# Diatom based transfer function for estimating the chemical composition of fossil water. Calibration based on salt lakes of the Lipez area in the southwestern Bolivian Altiplano.

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**Abstract:** Diatom assemblages and water chemistry were studied in 13 shallow salt lakes in the southern part of the Bolivian Altiplano. At each locality bottom sediment and water samples were collected simultaneously. Relationships between the composition of the diatom assemblages and variations in water chemistry were collated in order to permit the estimation of ancient water chemistries based on changes in the make up of fossil diatom associations in older sediments. Weighted Averages treated by Partial Least Squares regression (WA and WA-PLS methods) allowed an estimation of optima and the relative tolerances of 61 species to variations in salinity and to the relative quantities of the 15 chemical elements studied, among them boron and lithium.

**Key Words:** Flora; diatom; Bolivia; Quaternary; water ionic content; water chemistry; transfer function; ecology

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Résumé : Fonction de transfert pour l'estimation de la composition chimique des eaux fossiles à partir des diatomées. Calibration sur des lacs salés du Lipez, SW de l'Altiplano bolivien.- L'étude des assemblages de diatomées et de la composition chimique des eaux a été effectuée dans 13 lacs salés peu profonds localisés dans le Sud de l'Altiplano Bolivien. Les points et les dates de prélèvement sont les mêmes pour les deux types d'étude. Les relations entre les assemblages de diatomées et les variables chimiques mesurées sont effectuées dans le but d'estimer ces variables dans le passé à partir des diatomées fossiles conservées dans les sédiments. La méthode des moyennes pondérées (WA et WA-PLS régression) a permis d'estimer les optima et les tolérances de 61 espèces à la salinité et aux différents éléments chimiques dont le bore et le lithium.

**Mots-Clefs :** Flore ; diatomée ; Bolivie ; Quaternaire ; composition ionique ; chimie des eaux ; fonction de transfert ; écologie

# Introduction

It is now well-known that during the last 30,000 years the water level of the lacustrine basins of the Bolivian Aliplano varied markedly. Organisms such as ostracods, diatoms and plant remains preserved in the sediments suggest that modifications in the balance between precipitation and evaporation were associated with drastic changes in salinity. In Lake Titicaca, the highest salinities occurred during the early and mid-Holocene when the level of the lake was below the spillway. In the Uyuni-Coipasa closed basin, salinities remained high even when the levels of the lake were highest. The processes involved in arriving at such high levels of ionic concentration in ancient deep lakes and the associated climatic conditions are still not well identified. To resolve this problem, future research will require estimations as accurate as possible of salinities in ancient lakes and their variations throughout time. Diatoms are the best tool for attaining this objective because they are always present in the cored sediments. Moreover, existing environments offer a large range of salinities ranging between the very low levels in the lakes and wetlands of the glacial valleys and the very high concentrations of the shallow lakes in the arid areas of the southern Altiplano of Bolivia.

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**Figure 1:** Map of Bolivia. Map showing the location of the western Lipez. From West to East, the area is divided into 4 main geomorphic units: the Western Cordillera, the Altiplano, the Eastern Cordillera and the Amazonian « llanos ».

The first work linking diatom assemblages with ionic composition in existing environments (SERVANT-VILDARY & ROUX, 1990) was carried out in the southwestern part of the Bolivian Altiplano (South-Lipez). It served as the basis for an estimate of statistical relationships used to reconstruct the paleosalinity during the last Glacial period of a paleolake in the same area (ROUX, SERVANT-VILDARY & SERVANT, 1991). Recently, 11 samples collected near the northern border of the Salar de Uyun permitted the addition of 11 modern samples to the preexisting data set of this time frame (SYLVESTRE, SERVANT-VILDARY & ROUX, 2001).

In this paper, we present a revision of the data from the Lipez area. Samples from the Salar de Uyuni were not used because measurements boron and lithium on concentrations are lacking. This revision is based on two regression methods: weighted averaging (WA) leave-one-out and weighted averages plus least squares (WA-PLS). Moreover, we present an extensive diatom iconography, not published previously.

# A. The studied area

The western Lipez area is located in the southernmost part of the Bolivian Altiplano (21° - 22° S, 67° - 68° W), near the boundary with Chile at around 4,500 m elevation (Figures 1 and 7).



**Figure 2:** Location of the lakes. Location of the lakes where modern diatoms have been studied in the Pastos Grandes area. See Figure 4 for the locations of Laguna Colorada, Puripica and Laguna Verde lakes, sited farther south (after BALLIVIÁN & RISACHER, 1981, modified).







Figure 4: Location of the lakes. Location of the lakes in the Lipez area where water chemistry was studied.

The climate is cold and dry; the lowest temperatures are on the order of - 30°C, precipitation is 50 mm annually and evaporation 1,000-1,500 mm annually. The daily range in temperature is as much as 20°C. In winter (June - August), the area is influenced by mid-latitude atmospheric currents from the

west, winds are strong (60 km/h), snow falls occasionally. In summer (December -February), precipitation is fed principally by water vapor from Amazonia.

Geological formations are predominantly volcanic: Mio-Pliocene ignimbrites and Quaternary volcanoes; a few are still active. These volcanic formations occupy very extensive tracts in the western Cordillera and in the southern part of the Bolivian Andes along the Argentina frontier.

The Lipez intravolcanic basins (Figures 2-4) are occupied by shallow endoreic lakes and evaporites (Figures 8-13). Calcareous crusts (Figure 14) and pisolites (Figure 15) are well developed at Pastos Grandes (RISACHER & EUGSTER, 1979; JONES & RENAUT, 1994).

These basins are fed mainly by groundwaters, at least in part, as in the Altiplano of the northern Chile (GEYH, GROSJEAN *et alii*, 1999), recharged during the Quaternary humid cycles, particularly in Late Glacial times. Seasonal and annual fluctuations in waterlevels are small.

The lacustrine terraces observed on the edges of the basins (Figures 10-11, 13 and 16-17) (FERNANDEZ, 1980; SERVANT & FONTES, 1978) show three main highstands. They are correlated respectively with the three lacustrine phases in the Uyuni-Coipasa basin (SERVANT, FOURNIER *et alii*, 1995; SYLVESTRE, 1997; SYLVESTRE, SERVANT-VILDARY *et alii*, 1999): Minchin (> 20,000 <sup>14</sup>C yrs BP), Tauca (15,500-12,000 <sup>14</sup>C yrs BP) and Coipasa (~ 9,000 <sup>14</sup>C yrs BP). Great changes in water-level and salinity have been inferred from diatom assemblages in the Ramaditas-Ballivián Basin (ROUX, SERVANT-VILDARY & SERVANT, 1991; SERVANT-VILDARY & MELLO E SOUZA, 1993).

### **B.** Water chemistry

The waters are characterized by a high ionic content. Essentially, they are sodium chlorides. Some are rich in boron and lithium (Table 1) (RISACHER, 1992a, 1992b; RISACHER & FRITZ, 1991a, 1991b, 1992, 1995).

# Methods of analysis

- Alkalinity: titration by automatic potentiometry

- Cations: Na<sup>+</sup>, K<sup>+</sup>, Li<sup>+</sup>, Ca<sup>++</sup>, Mg<sup>++</sup>: atomic absorption spectrometry (standard methods)

- Anions and neutral species: automatic colorimetry (Technicon autoanalizer)

- Cl<sup>-</sup>: mercuric thiocyanate method

- SO<sub>4</sub><sup>--</sup>: complexation by methythymol blue

- SiO<sub>2</sub>: complexation by ammonium molybdate and reduction with ferrous iron

- B: complexation by azomethane H



**Figure 5A:** WA method. Estimated optima and tolerances of 61 species to salinity (All with maximum abundance >3 and occurrence in three or more samples).



**Figure 5B:** WA method. Estimated optima and tolerances of 61 species to alkalinity (with maximum abundance > 3 and occurrence in three or more samples).



**Figure 5C:** WA method. Estimated optima and tolerances of 61 species to alkalinity (with maximum abundance > 3 and occurrence in three or more samples). In Figure 5C, the very high values of alkalinity were removed in order to show more clearly the optima and tolerances of species with low alkalinity values.

# C. The diatom flora

In thirteen of these lakes the existing diatom flora (SERVANT-VILDARY, 1984; SERVANT-VILDARY & ROUX, 1990) was studied at the water/sediment interface (Table 2, Figure 2). Throughout the summer of 1978 samples of both water and sediments were collected by F. RISACHER at the same sites and at the same time. At Pastos Grandes, samples were collected from the margins toward the center, order to relate changes in in diatom assemblages to increases in salinity (Figure 3).

Diatom frustules are partially dissolved in the sediments collected (BADAUT, RISACHER *et alii*, 1979; BADAUT & RISACHER, 1983). But a comparison between living diatoms in the water and those in the water/sediment interface showed that this diagenesis is slight (ILTIS, RISACHER & SERVANT-VILDARY, 1984).

The diatom flora is diversified. The image data base is being prepared: 107 species are presented here. The list of images is in Table 3. It includes the abundant species (used in the transfer function calculations) and some rare ones. In columns 5 to 7 species previously published are indicated (SERVANT-VILDARY, 1984; SERVANT-VILDARY & BLANCO, 1984; SERVANT-VILDARY & ROUX, 1990).

Species identifications were based on a considerable number of recent works, not possible to cite here. On the other hand we would like to direct attention to publications that, although less well-known, are fundamental to this study because they concern

areas close to southern Bolivia (FRENGUELLI, 1934, 1936, 1942).

# **D. Diatom ecology**

Optima and tolerance of the species are obtained by the Weighted Averaging [WA] method and the Weighted Averaging Partial Least Squares regression [WA-PLS] (TER BRAAK & JUGGINS, 1993; TER BRAAK, JUGGINS *et alii*, 1993), programmed by M. ROUX and introduced in « Biomeco » for this study. All the sites were used, environmental data were not transformed. The 61 species selected from the total of 104 are those present at least in 3 samples. The values R, R<sup>2</sup> and that of SEP from WA are listed in Table 4.

The number of components selected for use in the WA-PLS method are deduced from « r » (correlation coefficient between observed and predicted value by the leave-one-out method). Values of R and R2 deduced from WA-PLS are listed in Table 4. Optima and tolerances of the species in relation to the ionic composition of the waters (anions and cations), alkalinity, salinity and pH estimated by WA leave-one-out method are listed in Table 4. Alkalinity and silica content are the parameters that can be most accurately estimated from the diatom flora (R = 0.94,  $R^2$  = 0.88). Multiple correlation coefficients are up to 0.80 for sodium, sulfate, chlorine, salinity and pH. The accuracy of prediction for boron and lithium are relatively low, respectively 0.75 and 0.77. Figure 5A







Figures 6A and 6B: WA-PLS method. The salinity and alkalinity of the lakes as inferred from modern diatom assemblages (calibration).

### Fig. 6A



**Figure 7:** An example of the Lipez landscape: In the foreground a Quaternary glacis with a pebble cover. Note the absence of vegetation. In the background an Upper Cenozoic volcano.



**Figure 8:** Laguna Chiar Kkota in the foreground and Laguna Hedionda in the background. Salt deposits fringe the lakes.



Figure 9: Laguna Ballivián: Playa-type « salar », characterized by a very small watershed.



**Figure 10:** Laguna Ramaditas: In the background the threshold which separates Laguna Ramaditas from Laguna Ballivián. The two lakes were connected during the « Minchin » highstand phase.



**Figure 11:** Laguna Honda. 1: Past shorelines with bioherms, the top one is dated early Holocene (~ 11.800 cal yr BP) by U/Th, 2: Undated lacustrine deposits, 3: Diatomites representing the three main lacustrine phases (Minchin, Tauca and Coipasa).



Figure 12: Cachi Laguna salar: Unconfined aquifer salar.



**Figure 13:** Laguna Colorada: 1: Springs at the foot of the slope, 2: Quaternary diatomites, 3: Open surface salt water.



Figure 14: Pastos Grandes salar: Fossil calcareous crust (undated).



**Figure 15:** Pastos Grandes salar: Calcareous pisoliths in shallow ephemeral pools fed by hot springs. Diatomites are common in the outer layers.



**Figure 16:** Laguna Ballivián: 1: Diatomites and bioherms of the highest water level, probably of the Minchin phase (Middle Glacial), 2: Diatomites presumably of the Tauca phase. Formations 1 and 2 are separated by an erosion surface, 3: Modern colluvions, 4: Halite efflorescences.



**Figure 17:** Laguna Ramaditas: Northern border. 1: Quaternary diatomites eroded by the wind during a Holocene dry phase, 2: Present-day halite efflorescences.

## Appendices

**Table 1**: Location of the lakes and data regarding water chemistry.

**Table 2 :** List of species and their abundance in 30 samples.

**Table 3 :** List of diatom pictures.

## Table 4 :

WA method: Optima and tolerances of the species (in alphabetical order) to Na<sup>+</sup>, Mg<sup>++</sup>, SO4<sup>--</sup>, Si, Li<sup>+</sup>, salinity, pH, K<sup>+</sup>, Ca<sup>++</sup>, Cl<sup>-</sup>, B and alkalinity. Estimation of environmental variables for each sample. SEP values are indicated at the end of the list of estimations for all samples. Optima and tolerances of species to salinity and alkalinity are illustrated in Figures 5A, 5B and 5C.

WA-PLS method. Values of r, R,  $R^2$  and SEP listed in table 4 show that this method improves the predictions for all the environmental parameters. Calibration of salinity and alkalinity is illustrated in Figures 6A and 6B.

shows the ecological preferences of 61 species as regards salinity (g/l). Figures 5B and 5C show preferences of these species concerning alkalinity (meq/l) deduced from WA. Error bars represent the values the "tolerance" column of Table 4) above and below the optimum. Figures 6A and 6B show that the salinity and alkalinity of the 13 lakes can be estimated with reasonable accuracy from the diatom flora. Estimation of salinity is excellent except for PG43 and PG41 where measured salinity has mean values (28 and 13 g/l). Alkalinity is well estimated in all samples (except for Canapa and Laguna Colorada).

We cite here examples of the ecology of some species as deduced from these analyses:

- Optimum salinity for Nitzschia liebetruthii (NILI) est 28.4 ± 12 g/l. This species is very abundant at Ramaditas where the measured salinity is 27 g/l and the estimated salinity 30.8 g/l. This species seems to be a good indicator of average salinity in the range of salinities considered here.
- The optimum of *Navicula salinicola* (**NASA**) to lithium is  $0.6 \pm 0.5$  g/l. This species is very abundant in Pastos Grandes 47 (measured lithium concentration 1.64 g/l) and estimated lithium concentration from the diatom flora is 0.5 g/l. This species is a good indicator of high concentrations of lithium.
- Concerning sulfates, Surirella wetzeli (SUWE) of which the optimum is 13.6 ± 11 g/l, is very abundant in Chulluncani 4 where measured sulfate concentration is 26.6 g/l and the estimated value is 11.5 g/l. This species is a good indicator of a high concentration of sulfates. We might cite Mastoglia atacamae (MATA) as an indicator of very low concentration.
- As an indicator for high alkalinity we cite Stauroneis wislouchii (STAW), its optimum is 190 ± 167 meq/l. It is abundant in Cachi Laguna 20, where measured alkalinity is 355 meq/l and the estimated value 211 meq/l. An indicator for low alkalinity could be Amphora atacamana minor (AMPM), for its optimum is 8.7 ± 5.7 meq/l and the measured alkalinity in the sample Pastos Grandes 78, where it is abundant, is 9.4 meq/l and the inferred alkalinity is 8.6 meq/l.
- As regards silicon, we can cite Fragilaria zeilleri (FZ). Its optimum is 0.020 ± 0.008 g/l, the measured value of silicon concentration being 0.015 g/l in Pastos Grandes sample 82 where this species is abundant and the inferred value is 0.02 g/l. Stauroneis sp. (SSP) on the contrary is a good indicator for a high concentration of silicon, for its optimum is 1.57 ± 0.02 g/l, and the measured value of silicon in Cachi Laguna 20 is 1.6 g/l and the inferred value

1.08 g/l.

- Concerning potassium, the optimum of Nitzschia pusilla (NIPS) is 7.7 ± 4.3 g/l. In Pastos Grandes sample 116 where it is abundant the measured concentration is 7.3 g/l and the inferred concentration is 4.6 g/l.
- As regards chlorine, the optimum of Nitzschia accedens chilensis (NCHI) is 86.4 ± 70 g/l. The values measured in Pastos Grandes sample 78 where this species is abundant is 85.9 g/l and the inferred value is 57.3 g/l.
- For sodium, we may cite *Fallacia pygmaea* (**NPYG**) which although rare in Pastos Grandes sample 43 is a good indicator for, its optimum is 3.3 g/l, whereas the measured concentration in the sample is 4.5 g/l and the inferred concentration 3.7 g/l.

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# Bibliography

- BADAUT D., RISACHER F., PAQUET H., EBERHART J.P. & WEBER F. (1979).- Néoformation de minéraux argileux à partir de frustules de diatomées : le cas des lacs de l'Altiplano bolivien.- Comptes Rendus de l'Académie des Sciences, Paris, v. 289D, p. 1191-1193.
- BADAUT D. & RISACHER F. (1983).- Authigenic smectite on diatom frustules in Bolivian saline lakes.- *Geochimica Cosmochimica Acta*, Amsterdam, v. 47, p. 363-375.
- BALLIVIÁN O. & RISACHER F. (1981).- Los salares del Altiplano Boliviano. Métodos de estudio y estimación económica.-Universidad Mayor de San Andrès, La Paz ; ORSTOM (Office de la Recherche Scientifique et Technique Outre-Mer), Paris, 241 p.
- FERNANDEZ G. (1980).- Evolución cuaternaria de las cuencas lacustres del sud oeste boliviano en la region de Mina Corina (Sud Lipez).- Universidad Mayor de San Andrès, Thesis de Doctorado, La Paz, 102 p.
- FRENGUELLI J. (1934).- Diatomeas del Plioceno superior de las Guayquerias de San Carlos.-*Revista del Museo de La Plata*, La Plata, n° 34, p. 339-371.
- FRENGUELLI J. (1936).- Diatomeas de la caliza de la cuenca de Calama en el desierto de Atacama (Chile).- *Revista del Museo de La Plata*, La Plata, Paleontologia, nº 1, 141 p.
- FRENGUELLI J. (1942).- Diatomeas del Neuquen (Patagonia).- Revista del Museo de La Plata,

La Plata, Botanica, nº 20, p. 73-219.

- GEYH M.A., GROSJEAN M., NUNES L. & SCHOTTERER U. (1999).- Radiocarbon reservoir effect and the timing of the Late-Glacial/Early Holocene humid phase in the Atacama desert (Northern Chile).-Quaternary Research, San Diego, v. 52, p. 143-153.
- ILTIS A., RISACHER F. & SERVANT-VILDARY S. (1984).- Contribution à l'étude hydrobiologique des lacs salés du Sud de l'Altiplano bolivien.- *Revue d'Hydrobiologie tropicale*, Paris, v. 17, n° 3, p. 259-273.
- JONES B. & RENAUT R.W. (1994).- Crystal fabrics and microbiota in large pisoliths from Laguna Pastos Grandes, Bolivia.-*Sedimentology*, Oxford, v. 41, p. 1171-1202.
- RISACHER F. (1992a).- Géochimie des bassins à évaporites de l'Altiplano bolivien.- Thèse Université Louis Pasteur, Strasbourg, 233 p.
- RISACHER F. (1992b).- Géochimie des lacs salés et croûtes de sel de l'Altiplano bolivien.-*Sciences géologiques, Bulletin,* Strasbourg, v. 45, n° 3-4, 219 p.
- RISACHER F. & EUGSTER H.P. (1979).- Holocene pisoliths and encrustations associated with spring-fed surface pools, Pastos Grandes, Bolivia.- *Sedimentology*, Oxford, v. 26, p. 253-270.
- RISACHER F. & FRITZ B. (1991a).- Geochemistry of Bolivian salars, Lipez, southern Altiplano: origin of solutes and brine evolution.-*Geochimica Cosmochimica Acta*, Amsterdam, v. 55, p. 687-705.
- RISACHER F. & FRITZ B. (1991b).- Quaternary geochemical evolution of the salars of Uyuni and Coipasa, Central Altiplano, Bolivia.-*Chemical Geology*, Amsterdam, v. 90, p. 211-231.
- RISACHER F. & FRITZ B. (1992).- Mise en évidence d'une phase climatique holocène extrêmement aride dans l'Altiplano central, par la présence de la polyhalite dans le salar de Uyuni (Bolivie).- *Comptes Rendus de l'Académie des Sciences*, Paris, v. 314, n° II, p. 1371-1377.
- RISACHER F. & FRITZ B. (1995).- La genèse des lacs salés.- *La Recherche*, Paris, p. 516-522.
- ROUX M., SERVANT-VILDARY S. & SERVANT M. (1991).- Inferred ionic composition and salinity of a Bolivian quaternary lake, as estimated from fossil diatom flora in the sediments.- *Hydrobiologia*, Dordrecht, v. 210, p. 3-18.
- SERVANT M. & FONTES J.C. (1978).- Les lacs quaternaires des hauts plateaux des Andes Boliviennes. Premières interprétations paléoclimatiques.- *Cahiers ORSTOM*, Paris, Géologie, v. 10, n° 1, p. 9-23.
- SERVANT M., FOURNIER M., ARGOLLO J., SERVANT-VILDARY S., SYLVESTRE F.,

WIRRMANN D. & YBERT J.P. (1995).- La dernière transition glaciaire/interglaciaire des Andes tropicales sud (Bolivie) d'après l'étude des variations des niveaux lacustres et des fluctuations glaciaires.- *Comptes Rendus de l'Académie des Sciences*, Paris, v. 320, n° IIa, p. 729-736.

- SERVANT-VILDARY S. (1984).- Les diatomées des lacs sursalés boliviens. Sous-classe des Pennatophycidées. I- Famille des Nitzschiacées.- *Cahiers ORSTOM*, Paris, v. 14, n° 1, p. 35-53.
- SERVANT-VILDARY S. & BLANCO M. (1984).- Les diatomées fluvio-lacustres plio-pleistocènes de la Formation Charana (Cordillère occidentale des Andes de Bolivie).- *Cahiers ORSTOM*, Paris, v. 14, n° 1, p. 55-102.
- SERVANT-VILDARY S. & MELLO E SOUZA S.H. (1993).- Palaeohydrology of the Quaternary saline Lake Ballivian (southern Bolivian Altiplano) based on diatom studies.-*International Journal for Salt Lake Research*, Dordrecht, v. 2, n° 1, p. 69-85.
  SERVANT-VILDARY S. & ROUX M. (1990).-
- SERVANT-VILDARY S. & ROUX M. (1990).-Multivariate analysis of diatoms and water chemistry in Bolivian saline lakes.-*Hydrobiologia*, Dordrecht, v. 197, p. 267-290.
- SYLVESTRE F. (1997).- La dernière transition glaciaire-interglaciaire (18 000-8 000 <sup>14</sup>C ans BP) des Andes tropicales sud (Bolivie) d'après l'étude des diatomées.- Thèse Muséum National d'Histoire Naturelle, Paris, 243 p.
- SYLVESTRE F., SERVANT-VILDARY S., SERVANT M., CAUSSE C., FOURNIER M. & YBERT J.P. (1999).- Lake-level chronology on the Southern Bolivian Altiplano (18-23° S) during Late Glacial time and the Early Holocene.- *Quaternary Research*, San Diego, v. 51, p. 54-66.
- SYLVESTRE F., SERVANT-VILDARY S. & ROUX M. (2001).- Diatom-based ionic concentration and salinity models from the south Bolivian Altiplano (15-23° S).- Journal of Paleolimnology, Dordrecht, v. 25, p. 279-295.
- TER BRAAK C.J.F. & JUGGINS S. (1993).-Weighted averaging partial least square regression (WA-PLS): an improved method for reconstructing environmental variables from species assemblages.- *Hydrobiologia*, Dordrecht, v. 269/270, p. 485-502.
- TER BRAAK C.J.F., JUGGINS S., BIRKS H.J.B. & VAN DER VOET H. (1993).- Weighted averaging partial least squares (WA-PLS): definition and comparison with other methods for species-environmental calibration. *In:* PATIL G.P. & RAO C.R. (eds.), Multivariate Environmental Statistics.-Elsevier Science Publishers, Amsterdam, p. 525-560.

# TABLEAU 1 : Localisation des lacs et données chimiques des eaux

# TABLE 1: Lake locations andwater chemistry data

Lacs	Lakes		Ballivian	Ramaditas	Laguna Verde	Hedionda	Pujio	Puripica	Honda	Chiar Kkota	Canapa
N° Ech.	N° Ech.		BA67	RAM6	VER5	HED4	PJ30	PUR2	HON4	CHI5	CAN4
Altitude	Altitude	(m)	4130	4120	4310	4121	4110	4393	4110	4110	4140
Longitude	Longitude		68°05'	68°05'	67°48'	68°04'	68°04'	67°30'	68°04'	68°04'	68°01'
Latitude	Latitude		21°38'	31°38'	22°48'	21°34'	21°37'	22°31'	21°37'	21°35'	21°
Na	Na	(mg/l)	13600	7590	4510	20400	10000	9550	6740	20700	3590
К	К	(mg/l)	1700	1030	308	2100	1020	1720	989	2500	212
Mg	Mg	(mg/l)	605	326	262	649	210	275	140	1140	34.0
Ca	Ca	(mg/l)	1200	1370	218	521	400	465	200	1340	65.0
SO4	SO4	(mg/l)	5700	3070	2300	17900	4320	4660	2600	4080	5070
CI	CI	(mg/l)	22000	13900	6460	24600	14500	15300	10300	38700	2250
Si	Si	(mg/l)	25.2	41.4	28.6	27.5	26.1	20.6	31.6	34.4	31.4
В	В	(mg/l)	150	77.0	125	235	145	238	57.0	250	13.0
Li	Li	(mg/l)	25.5	11.8	36.5	122	37.0	109	47.0	176	19.5
Alcalinité	Alkalinity	(mg/l)	4.88	2.93	7.25	10	7.22	7.8	4.4	8.05	2.15
Salinité	Salinity	(mg/l)	45335	27658	14716	67099	31139	32785	21392	69439	11440
lons majeurs	Principal ions		NaCl	Na (Ca) Cl	NaCl (SO4)	NaCl (SO4)	NaCl (SO4)	NaCl (SO4)	NaCl	NaCl	NaCl (SO4)
рН	рН		8.18	8.15	8.72	8.5	8.85	8.52	9.05	8.28	9.18
Profondeur	Depth	(cm)	30	30	100	20	100	100	20	20	15
Température	Temperature	(°C)	5	1	2	8	1	4	6	8	6
Densité	Density		1.032	1.02	1.01	1.05	1.022	1.024	1.015	1.051	1.009

Chullunca	ini	Laguna	Colorada	Pastos	Grande	S								
CHU4	CHU9	CD24	CD16	PG70	PG23	PG41	PG43	PG45	PG47	PG72	PG73	PG76	PG74	PG78
4430	4430	4278	4278	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400
67°53'	67°53'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'	67°47'
21°32'	21°32'	22°11'	22°11'	21°39'	21°39'	21°39'	21°39'	21°39'	21°39'	21°39'	21°39'	21°39'	21°39'	21°39'
30100	2320	19900	40700	4000	451	9270	4510	34000	103000	80.0	3910	4510	350	46000
12800	1800	2110	4260	532	43.0	1020	500	3950	14200	16.5	399	579	48.1	5000
1900	53.0	382	914	89.9	11.0	265	132	110	3470	20.2	138	132	55.4	1200
730	200	103	260	200	24.5	360	200	1100	3100	50.9	190	200	32.7	1500
26600	4360	5980	6440	265	72.0	465	250	1270	2460	105	302	305	130	2920
44000	1970	29500	65000	7240	699	16700	8060	61400	194000	90.2	6750	8310	600	85900
21.9	18.7	32.5	45.6	36.4	38.4	31.6	17.3	20.5	31.4	37.2	58.8	32.2	30.2	34.2
959	147	263	612	29.9	3.49	60.0	28.4	290	944	0.995	25.5	32.0	2.92	320
22.5	2.75	86.8	196	42.5	4.80	117	52.5	500	1640	0.507	42.5	57.5	3.89	600
35	11.4	12.9	31.5	5.09	1.51	4.25	3.21	9.08	22.9	3.3	5.13	3.85	4.2	9.42
119261	11377	59166	120357	12787	1475	28564	13961	103267	324141	644	12189	14421	1542	144099
NaCl (SO4)	NaCl (SO4)	NaCl	NaCl	NaCl	NaCl	NaCl	NaCl	NaCl	NaCl	Na (Ca) CO3 (Cl)	NaCl	NaCl	Na (Ca) Cl (CO3)	NaCl
8.8	10.2	8.52	8.4	8.42	9.35	8.52	8.05	7.4	7.2	6.95	8.15	8.35	7.85	7.91
15	15	20	20	20	100	20	100	100	100	20	20	20	20	20
5	8	10	6	5	1	4	6	5	5	10	1	10	1	10
1.087	1.008	1.04	1.081	1.009	1.001	1.02	1.01	1.073	1.211	1	1.009	1.01	1.001	1.098
	Chullunca CHU4 4430 67°53' 21°32' 30100 12800 1900 730 26600 44000 21.9 959 22.5 35 119261 NaCl (SO4) 8.8 15 5 5 1.087	Chulluncani         CHU4       CHU9         4430       4430         67°53'       67°53'         21°32'       21°32'         30100       2320         12800       1800         1900       53.0         730       200         26600       4360         44000       1970         21.9       18.7         959       147         22.5       2.75         35       11.4         119261       11377         NaCl (SO4)       NaCl (SO4)         8.8       10.2         15       8         1.0087       1.008	Chulluncani         Laguna           CHU4         CHU9         CD24           4430         4430         4278           67°53'         67°53'         67°47'           21°32'         21°32'         22°11'           30100         2320         19900           12800         1800         2110           1900         53.0         382           730         200         103           26600         4360         5980           44000         1970         29500           21.9         18.7         32.5           959         147         263           22.5         2.75         86.8           35         11.4         12.9           119261         11377         59166           NaCl (SO4)         NaCl (SO4)         NaCl           8.8         10.2         8.52           15         15         20           5         8         10           1.087         1.008         1.04	Chulluncani         Laguna Colorada           CHU4         CHU9         CD24         CD16           4430         4430         4278         4278           67°53'         67°53'         67°47'         67°47'           21°32'         21°32'         22°11'         22°11'           30100         2320         19900         40700           12800         1800         2110         4260           1900         53.0         382         914           730         200         103         260           26600         4360         5980         6440           44000         1970         29500         65000           21.9         18.7         32.5         45.6           959         147         263         612           22.5         2.75         86.8         196           35         11.4         12.9         31.5           119261         11377         59166         120357           NaCl (SO4)         NaCl (SO4)         NaCl         NaCl           8.8         10.2         8.52         8.4           15         15         20         20           <	Chulluncani         Laguna Colorada         Pastos           CHU4         CHU9         CD24         CD16         PG70           4430         4430         4278         4278         4400           67°53'         67°53'         67°47'         67°47'         67°47'           21°32'         21°32'         22°11'         22°11'         21°39'           30100         2320         19900         40700         4000           12800         1800         2110         4260         532           1900         53.0         382         914         89.9           730         200         103         260         200           26600         4360         5980         6440         265           44000         1970         29500         65000         7240           21.9         18.7         32.5         45.6         36.4           959         147         263         612         29.9           22.5         2.75         86.8         196         42.5           35         11.4         12.9         31.5         5.09           119261         1377         59166         120357         12787 </td <td>Chulluncari         Laguna Colorada         Pastos Grande           CHU4         CHU9         CD24         CD16         PG70         PG23           4430         4430         4278         4278         4400         4400           67°53'         67°53'         67°47'         67°47'         67°47'         67°47'         67°47'           21°32'         21°32'         22°11'         22°11'         21°39'         21°39'           30100         2320         19900         40700         4000         451           12800         1800         2110         4260         532         43.0           1900         53.0         382         914         89.9         11.0           730         200         103         260         200         24.5           26600         4360         5980         6440         265         72.0           44000         1970         29500         65000         7240         699           21.9         18.7         32.5         45.6         36.4         38.4           959         147         263         612         29.9         3.49           22.5         2.75         86.8</td> <td>Chulluncaii         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41           4430         4430         4278         4278         4400         4400         4400           67°53'         67°53'         67°47'         67°47'         67°47'         67°47'         67°47'         67°47'         67°47'           21°32'         21°32'         22°11'         22°11'         21°39'         21°39'         21°39'         21°39'           30100         2320         19900         40700         4000         451         9270           12800         1800         2110         4260         532         43.0         1020           1900         53.0         382         914         89.9         11.0         265           730         200         103         260         200         24.5         360           26600         4360         5980         6440         265         72.0         465           44000         1970         29500         65000         7240         699         16700           21.9         18.7         32.5         45.6         &lt;</td> <td>Chulluncani         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43           4430         4430         4278         4278         4400         4400         4400         4400         4400           67°53'         67°53'         67°47'<td>Chulluncari         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45           4430         4430         4278         4278         4400         4000         4070'         67°47'         67°4</td><td>Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47           4430         4430         4278         4278         4400         4400         4400         4400         4400         4400         4400         4400         4400         4400         4400         4000         4000         21°39'<td>Chulluncair         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70           4430         4430         4430         4278         4278         4400         477         67*47         <t< td=""><td>Chulluncani         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47         PG72         PG73           4430         4430         4430         4278         4278         4400         4000         1030         1030         2010         1030         202         132         110         310         50.9         132         110         310         50.9         130         1400         14000         100</td></t<><td>Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CD49         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70         PG70         PG70         PG70         PG43         PG40         4400         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000</td><td>Chilluncari         Laguna C-brada         Pastos Grandes           Chillun         Chubs         CD43         CD16         PG70         PG23         PG41         PG40         400         400         400         400         400           4430         4430         4278         4278         4278         4400         400&lt;</td></td></td></td>	Chulluncari         Laguna Colorada         Pastos Grande           CHU4         CHU9         CD24         CD16         PG70         PG23           4430         4430         4278         4278         4400         4400           67°53'         67°53'         67°47'         67°47'         67°47'         67°47'         67°47'           21°32'         21°32'         22°11'         22°11'         21°39'         21°39'           30100         2320         19900         40700         4000         451           12800         1800         2110         4260         532         43.0           1900         53.0         382         914         89.9         11.0           730         200         103         260         200         24.5           26600         4360         5980         6440         265         72.0           44000         1970         29500         65000         7240         699           21.9         18.7         32.5         45.6         36.4         38.4           959         147         263         612         29.9         3.49           22.5         2.75         86.8	Chulluncaii         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41           4430         4430         4278         4278         4400         4400         4400           67°53'         67°53'         67°47'         67°47'         67°47'         67°47'         67°47'         67°47'         67°47'           21°32'         21°32'         22°11'         22°11'         21°39'         21°39'         21°39'         21°39'           30100         2320         19900         40700         4000         451         9270           12800         1800         2110         4260         532         43.0         1020           1900         53.0         382         914         89.9         11.0         265           730         200         103         260         200         24.5         360           26600         4360         5980         6440         265         72.0         465           44000         1970         29500         65000         7240         699         16700           21.9         18.7         32.5         45.6         <	Chulluncani         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43           4430         4430         4278         4278         4400         4400         4400         4400         4400           67°53'         67°53'         67°47' <td>Chulluncari         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45           4430         4430         4278         4278         4400         4000         4070'         67°47'         67°4</td> <td>Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47           4430         4430         4278         4278         4400         4400         4400         4400         4400         4400         4400         4400         4400         4400         4400         4000         4000         21°39'<td>Chulluncair         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70           4430         4430         4430         4278         4278         4400         477         67*47         <t< td=""><td>Chulluncani         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47         PG72         PG73           4430         4430         4430         4278         4278         4400         4000         1030         1030         2010         1030         202         132         110         310         50.9         132         110         310         50.9         130         1400         14000         100</td></t<><td>Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CD49         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70         PG70         PG70         PG70         PG43         PG40         4400         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000</td><td>Chilluncari         Laguna C-brada         Pastos Grandes           Chillun         Chubs         CD43         CD16         PG70         PG23         PG41         PG40         400         400         400         400         400           4430         4430         4278         4278         4278         4400         400&lt;</td></td></td>	Chulluncari         Laguna C-lorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45           4430         4430         4278         4278         4400         4000         4070'         67°47'         67°4	Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47           4430         4430         4278         4278         4400         4400         4400         4400         4400         4400         4400         4400         4400         4400         4400         4000         4000         21°39' <td>Chulluncair         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70           4430         4430         4430         4278         4278         4400         477         67*47         <t< td=""><td>Chulluncani         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47         PG72         PG73           4430         4430         4430         4278         4278         4400         4000         1030         1030         2010         1030         202         132         110         310         50.9         132         110         310         50.9         130         1400         14000         100</td></t<><td>Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CD49         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70         PG70         PG70         PG70         PG43         PG40         4400         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000</td><td>Chilluncari         Laguna C-brada         Pastos Grandes           Chillun         Chubs         CD43         CD16         PG70         PG23         PG41         PG40         400         400         400         400         400           4430         4430         4278         4278         4278         4400         400&lt;</td></td>	Chulluncair         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70           4430         4430         4430         4278         4278         4400         477         67*47 <t< td=""><td>Chulluncani         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47         PG72         PG73           4430         4430         4430         4278         4278         4400         4000         1030         1030         2010         1030         202         132         110         310         50.9         132         110         310         50.9         130         1400         14000         100</td></t<> <td>Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CD49         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70         PG70         PG70         PG70         PG43         PG40         4400         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000</td> <td>Chilluncari         Laguna C-brada         Pastos Grandes           Chillun         Chubs         CD43         CD16         PG70         PG23         PG41         PG40         400         400         400         400         400           4430         4430         4278         4278         4278         4400         400&lt;</td>	Chulluncani         Laguna Colorada         Pastos Grandes           CHU4         CHU9         CD24         CD16         PG70         PG23         PG41         PG43         PG45         PG47         PG72         PG73           4430         4430         4430         4278         4278         4400         4000         1030         1030         2010         1030         202         132         110         310         50.9         132         110         310         50.9         130         1400         14000         100	Chulluncari         Laguna Colorada         Pastos Grandes           CHU4         CD49         CD24         CD16         PG70         PG23         PG41         PG45         PG45         PG47         PG70         PG70         PG70         PG70         PG43         PG40         4400         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000         4000	Chilluncari         Laguna C-brada         Pastos Grandes           Chillun         Chubs         CD43         CD16         PG70         PG23         PG41         PG40         400         400         400         400         400           4430         4430         4278         4278         4278         4400         400<

Pastos Grandes				
PG82	PG84	PG97	P114	P116
4400	4400	4400	4400	4400
67°47'	67°47'	67°47'	67°47'	67°47'
21°39'	21°39'	21°39'	21°39'	21°39'
41.9	77100	85.1	81000	92000
4.42	6450	12.6	9810	7390
3.21	1250	7.41	2550	2080
6.10	1650	12.5	2380	2500
14.0	3370	4.99	3240	3180
63.2	134000	150	154000	158000
15.9	33.0	22.4	16.8	31.4
0.703	404	1.08	545	520
0.347	675	1.18	1160	861
0.523	9.7	1.36	7.68	13.1
195	225344	402	255230	267366
Na (Ca) Cl (CO3)	NaCl	Na (Ca) Cl (CO3)	NaCl	NaCl
9.62	7.46	8.92	6.95	7.5
20	100	20	100	100
10	15	10	10	7
1	1.147	1	1.167	1.171

# TABLEAU 2 : Liste des espèces et abondance dans 30 échantillons TABLE 2: List of species and

their abundance in 30 samples

Codes	Genres	Espèces	Ballivian	Ramaditas	Laguna Verde	Hedionda	Pujio	Puripica	Honda	Chiar kkota	Chull	uncani	Canapa
Codes	Genera	Species	BA67	RAM6	VER5	HED4	PJ30	PUR2	HON4	CHI5	CHU4	CHU9	CAN4
ACAR	Achnanthes	arenaria	2.29	0.50	0.50	0.00	0.00	0.00	12.52	0.00	0.00	0.00	0.00
AD	Achnanthes	delicatula	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00
ASPE	Achnanthes	speciosa	3.99	0.10	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
AMPA	Amphora	atacamana	0.00	0.00	0.00	0.73	3.41	1.89	0.99	0.00	0.00	0.00	1.71
AMPM	Amphora	atacamana minor	0.00	0.00	0.00	0.00	0.00	0.30	0.00	1.30	0.00	0.00	0.00
ABOL	Amphora	boliviana	1.00	0.00	0.40	0.00	0.00	0.00	0.20	0.00	0.00	0.98	0.00
ABEL	Amphora	boliviana elongata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.88	0.00
AMCJ	Amphora	carvajaliana	2.29	0.00	0.00	77.24	54.32	63.01	70.07	83.50	9.60	0.00	0.00
ANSA	Anomoeoneis	sphaerophora angusta	0.00	0.00	0.00	0.18	0.20	0.00	0.00	0.00	0.70	0.98	0.00
CSP	Caloneis	silicula minuta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.98	0.00
CAW	Caloneis	westii	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CP	Cocconeis	placentula	0.00	0.99	3.70	0.00	0.40	0.00	0.00	0.00	0.00	0.98	0.00
CYL	Cymbella	gracilis	4.39	0.50	0.00	0.00	11.85	0.00	2.49	1.30	0.00	0.00	0.00
DETH	Denticula	pusilla	0.30	0.50	0.00	0.00	0.00	0.00	0.80	0.00	0.90	0.00	0.00
DEIII	Denticula	elegans	4.69	2.29	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
DEV	Denticula	valida	0.00	0.70	14.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FB	Fragilaria	brevistriata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	4.01
FRCV	Fragilaria	construens venter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FE	Fragilaria	fasciculata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OM	Fragilaria	leptaustoron martyi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FP	Fragilaria	pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	1.71
FZ	Fragilaria	zeilleri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HA	Hantzschia	amphioxys	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HN	Hantzschia	novsp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00
MATA	Mastoglia	atacamae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NCA	Navicula	cariocincta	0.00	0.00	0.00	0.00	0.00	0.30	0.00	1.60	0.00	0.00	9.23
NCI	Navicula	cincta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
NC	Navicula	veneta	0.00	0.00	0.00	2.20	0.00	0.60	0.00	0.00	0.70	14.71	0.00
NHN	Navicula	nivalis	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
NPB	Navicula	paramutica binodis	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	2.30	2.50	0.00
NAO	Navicula	cryptotenelloïdes	1.60	0.50	0.20	0.36	1.20	8.87	1.19	0.10	0.00	0.00	6.32
NLA	Navicula	pseudolanceolata	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	49.40	9.75	26.08
NLI	Navicula	pseudolitoricola	0.30	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
NPYG	Fallacia	pygmeae	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
NDC	Navicula	erituga	0.00	0.30	0.40	0.00	5.82	1.88	3.78	0.00	0.00	0.00	0.00
INASA	Navicula	sainneona	0.30	0.00	0.00	0.00	0.00	1.00	1.49	0.00	0.00	0.00	0.00
NILI	Nitzschia	sp. liabatruthii	62 70	80.40	70.10	0.00	0.00 9.11	0.00	0.00	0.00	0.00	0.00	0.00
NCHI	Nitzschia	accedens chilensis	0.00	0.40	1.40	0.00	0.00	0.00	0.00	2.60	0.00	0.00	0.00
NIAL	Nitzschia	alnina	1 40	1 40	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ND	Nitzschia	amphibiodes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	2.31
NICC	Nitzschia	compressa compressa	0.00	0.50	0.20	0.00	1.61	0.00	0.00	0.00	0.00	0.00	0.00
NIEP	Nitzschia	epithemioides epithemioides	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71
NF	Nitzschia	frustulum	1.20	0.10	0.00	0.00	0.00	0.00	0.00	0.50	1.80	3.92	0.00
NGRU	Nitzschia	grunowii	0.60	0.60	0.20	0.00	2.41	0.00	0.00	0.10	0.00	0.80	0.00
NIH	Nitzschia	hantzschiana	1.30	1.39	0.00	0.00	1.91	6.58	0.70	0.00	1.50	0.00	0.00
NIHU	Nitzschia	hungarica	0.00	0.00	0.00	0.36	0.00	2.89	0.00	0.00	4.70	25.49	15.05
NPA	Nitzschia	palea	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
NIPS	Nitzschia	pusilla	0.00	0.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	5.50	0.00
NIVA	Nitzschia	valdecostata	0.00	0.00	0.00	0.00	0.80	1.89	0.00	0.00	0.00	0.00	8.02
PB	Pinnularia	bogotensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00
PIMI	Pinnularia	microstauron	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00
RHWE	Rhopalodia	wetzelii	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00
SCPE	Scoliopleura	peisonis	0.00	0.99	0.00	1.72	2.01	0.60	1.29	2.60	0.00	0.00	0.00
SG	Stauroneis	gregorii	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
SB	Stauroneis	bathurstensis	0.00	0.00	0.00	3.00	1.61	1.30	1.19	0.30	0.00	0.00	3.41
SSP	Stauroneis	species (obtusa?)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STAW	Stauroneis	wislouchii	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.30	0.70	0.00	12.34
SO	Surirella	oregonica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUSE	Surirella	sella	5.98	2.98	1.90	0.00	4.82	0.00	1.89	1.00	0.10	0.00	0.00
SUSP	Surirella	sp.	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUWE	Surirella	wetzelii	0.00	0.00	0.00	13.78	0.40	1.99	0.10	0.10	22.10	3.92	4.81

# TABLEAU 2 : Liste des espèces et abondance dans 30 échantillons TABLE 2: List of species and their abundance in 30 samples

Genres

Espèces

Cachi Laguna Laguna Colorada

Codes

Pastos Grandes

Codes	Genera	Species	CL20	CD24	CD16	PG70	PG23	PG41	PG43	PG45	PG47	PG72
		-										
ACAR	Achnanthes	arenaria	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AD	Achnanthes	delicatula	0.00	0.00	0.09	0.00	0.89	1.48	4.50	1.37	0.00	0.00
ΔΜΡΔ	Armhora	speciosa	0.00	0.00	2 94	0.72	0.00	5.43	6.70	0.00 8.40	4 94	0.00
AMPM	Amphora	atacamana minor	0.00	0.00	0.00	0.00	0.00	5 55	4 50	0.00	2.22	0.00
ABOL	Amphora	boliviana	0.00	0.00	2.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ABEL	Amphora	boliviana elongata	0.00	0.00	0.00	2.80	0.80	0.00	0.00	0.68	1.31	0.00
AMCJ	Amphora	carvajaliana	0.00	1.00	6.08	0.00	0.00	2.50	3.90	2.73	0.40	0.50
ANSA	Anomoeoneis	sphaerophora angusta	0.00	2.00	0.09	0.72	0.00	0.00	0.00	0.00	0.00	0.00
CSP	Caloneis	silicula minuta	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.50
CAW	Caloneis	westii	0.00	0.00	0.00	2.38	2.78	0.00	0.00	0.00	0.00	0.00
СР	Cocconeis	placentula	0.00	1.30	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
CYL	Cymbella	gracilis	0.00	0.00	0.09	1.04	0.20	0.00	0.00	0.68	0.00	0.00
CYMP	Cymbella	pusilla thomas lie	0.00	0.00	1.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
DETH	Denticula	elegans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DEV	Denticula	valida	0.00	0.00	0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00
FB	Fragilaria	brevistriata	0.00	0.00	0.00	35.82	73.06	10.23	7.30	10.00	9.49	0.00
FRCV	Fragilaria	construens venter	0.00	0.00	0.00	0.00	0.00	5.80	0.00	3.65	0.00	0.00
FE	Fragilaria	fasciculata	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	5.85	0.00
OM	Fragilaria	leptaustoron martyi	0.00	3.00	0.00	0.00	1.89	0.00	0.00	0.46	0.00	0.00
FP	Fragilaria	pinnata	0.00	0.00	0.00	0.72	0.00	1.85	0.00	2.73	1.31	0.00
FZ	Fragilaria	zeilleri	0.00	0.00	0.00	0.00	9.94	0.00	0.60	0.00	0.00	0.00
HA	Hantzschia	amphioxys	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
HN	Hantzschia	novsp	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.06
MAIA	Mastoglia	atacamae	0.00	0.00	0.00	1.97	0.50	0.00	0.00	1.37	0.00	0.00
NCI	Navicula	cincta	0.00	0.00	0.09	0.00	0.10	0.74	0.00	0.00	0.40	0.00
NC	Navicula	veneta	0.00	21.00	0.00	2.38	0.00	0.00	0.00	0.00	0.00	0.00
NHN	Navicula	nivalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
NPB	Navicula	paramutica binodis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.56
NAO	Navicula	cryptotenelloïdes	0.00	1.00	4.84	1.55	0.80	10.97	7.30	5.40	8.58	0.00
NLA	Navicula	pseudolanceolata	0.00	12.00	0.00	7.25	0.00	12.70	12.90	0.00	0.00	0.00
NLI	Navicula	pseudolitoricola	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NPYG	Fallacia	pygmeae	0.00	0.00	0.00	0.31	1.19	0.00	0.60	0.00	0.00	0.00
NDC	Navicula	erifuga	0.00	0.00	5.22	0.00	0.00	0.00	0.00	17.70	2.72	1.51
NASA	Navicula	salinicola	0.00	7.00	21.65	2.07	0.00	14.92	21.40	19.20	25.73	0.00
NS	Navicula	sp.	0.00	0.00	0.00	0.00	1.09	0.37	1.60	0.00	0.40	0.00
NILI	Nitzschia	liebetruthii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NCHI	Nitzschia	accedens chilensis	2.30	0.00	5.89	0.31	0.10	5.70	8.50	1.37	7.37	0.00
ND	Nitzschia	anpina	0.00	35.00	4.56	0.00	0.10	0.00	0.00	0.00	2.22	0.00
NICC	Nitzschia	compressa compressa	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.00	0.00	0.00
NIEP	Nitzschia	epithemioides epithemioides	0.00	0.00	1.61	0.00	0.00	3.45	10.10	6.60	5.45	0.00
NF	Nitzschia	frustulum	0.00	0.00	0.00	3.62	0.00	1.85	0.00	1.80	0.00	0.00
NGRU	Nitzschia	grunowii	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIH	Nitzschia	hantzschiana	0.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.59
NIHU	Nitzschia	hungarica	0.00	2.00	1.23	0.00	0.50	0.00	1.10	1.37	0.40	0.00
NPA	Nitzschia	palea	0.30	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00
NIPS	Nitzschia	pusilla	2.30	3.00	0.00	0.00	0.00	1.48	1.10	2.73	14.63	0.00
NIVA	Nitzschia	valdecostata	0.00	1.00	0.00	2.07	0.00	0.00	0.00	0.00	0.00	3.02
PB	Pinnularia	bogotensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIMI	Pinnularia	microstauron	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RHWE	Rhopalodia	wetzelii	0.00	0.00	0.00	1.55	0.00	0.74	2.20	4.10	0.40	0.00
SCPE	Sconopieura	peisonis	0.00	0.00	0.00	1.04	0.00	0.00	1.10	1.37	0.00	0.00
SB	Stauroneis	bathurstensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSP	Stauroneis	species (obtusa?)	19.60	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.00	0.00
STAW	Stauroneis	wislouchii	75.80	5.00	40.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO	Surirella	oregonica	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.40	0.00
SUSE	Surirella	sella	0.00	2.00	0.09	9.32	0.10	0.00	0.10	0.91	0.10	0.00
SUSP	Surirella	sp.	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.00	0.00
SUWE	Surirella	wetzelii	0.00	0.00	0.00	3.62	0.10	0.37	0.60	4.10	0.20	0.00

# TABLEAU 2 : Liste des espèces et abondance dans 30 échantillons TABLE 2: List of species and their abundance in 30 samples

Codes	Genres	Espèces					Pastos Grand	les			
Codes	Genera	Species	PG73	PG76	PG74	PG78	PG82	PG84	PG97	P114	P116
AGAD	A 7 .7		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACAR	Achnanthes	arenaria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
AD	Achnanthes	delicatula	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00
ASPE	Achnanthes	speciosa	1.46	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AMPA	Amphora	atacamana minor	0.00	2.90	0.00	5.24	0.00	0.00	0.00	5.70	1.79
ABOI	Amphora	boliviana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ABOL	Amphora	boliviana elongata	3 11	1.90	3.67	0.00	0.00	0.00	0.00	0.00	0.00
AMCI	Amphora	carvaialiana	0.00	0.00	0.00	1.31	1.07	1 25	0.00	0.00	0.00
ANSA	Anomoeoneis	sphaerophora angusta	0.29	0.00	0.00	0.00	0.19	0.00	0.56	0.00	0.00
CSP	Caloneis	silicula minuta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAW	Caloneis	westii	3.02	0.00	3.10	0.00	0.19	0.18	0.00	0.00	0.00
СР	Cocconeis	placentula	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00
CYL	Cymbella	gracilis	9.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CYMP	Cymbella	pusilla	0.00	3.53	7.53	2.62	0.20	0.00	0.00	0.00	0.00
DETH	Denticula	thermalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DE	Denticula	elegans	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DEV	Denticula	valida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FB	Fragilaria	brevistriata	6.42	0.00	5.27	1.31	0.00	0.00	0.00	11.26	5.18
FRCV	Fragilaria	construens venter	0.00	0.00	1.32	1.71	0.00	1.51	0.00	1.95	0.00
FE	Fragilaria	fasciculata	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OM	Fragilaria	leptaustoron martyi	0.00	0.00	0.00	0.00	0.00	1.07	0.74	0.32	0.30
FP	Fragilaria	pinnata	0.00	0.00	0.00	1.70	11.99	0.00	0.00	0.00	8.97
FZ	Fragilaria	zeilleri	0.00	0.00	1.69	0.00	41.52	0.00	0.00	0.00	0.00
HA	Hantzschia	amphioxys	0.00	0.00	0.00	0.00	0.19	0.00	0.56	0.43	0.00
HN	Hantzschia	novsp	0.00	0.00	0.56	0.00	0.19	0.00	13.30	0.43	0.00
MATA	Mastoglia	atacamae	15.18	7.40	16.65	1.30	0.19	0.71	1.12	0.00	0.60
NCA	Navicula	cariocincta	0.00	0.00	0.00	0.80	0.20	5.79	4.80	3.40	2.20
NCI	Navicula	cincia	2.00	0.00	0.00	0.00	4.30	1.00	0.00	6.90	0.00
NU	Navicula	veneta	7.50	5.90	17.78	0.81	19.10	1.07	3.72	3.68	2.19
NDD	Navicula	naramutica binadic	0.00	0.00	0.00	0.00	0.19	0.00	5.05 10.00	0.00	0.30
NAO	Navicula	paramutica binouis	0.00	0.00	1.12	11.40	2 10	2.40	20.50	0.43	6.70
NLA	Navicula	nsaudalancaalata	15.66	4.40 24 30	5.97	31.40	0.20	0.00	28.80	0.00	10.97
NLI	Navicula	pseudolitoricola	0.00	1 94	0.00	0.40	0.20	0.00	0.00	0.00	0.00
NPYG	Fallacia	nyamese	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NDC	Navicula	erifuga	0.00	0.00	0.00	0.00	0.10	0.00	5 59	6 49	0.00
NASA	Navicula	salinicola	0.00	2.90	0.00	12.30	1.85	35.65	0.00	30.40	22.90
NS	Navicula	sp.	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00
NILI	Nitzschia	liebetruthii	1.95	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00
NCHI	Nitzschia	accedens chilensis	0.00	0.42	0.00	2.22	0.88	6.32	0.00	1.95	8.18
NIAL	Nitzschia	alpina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ND	Nitzschia	amphibiodes	0.00	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NICC	Nitzschia	compressa compressa	5.84	2.40	0.38	0.40	0.19	0.89	0.00	0.00	0.60
NIEP	Nitzschia	epithemioides epithemioides	0.00	0.00	0.00	1.70	0.68	8.01	0.00	4.44	7.28
NF	Nitzschia	frustulum	5.00	10.90	0.38	1.31	1.56	1.25	0.00	1.41	0.00
NGRU	Nitzschia	grunowii	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIH	Nitzschia	hantzschiana	4.96	0.00	0.40	1.30	1.36	0.00	0.00	0.00	0.00
NIHU	Nitzschia	hungarica	2.24	3.90	0.56	1.31	3.31	0.53	4.66	0.43	0.60
NPA	Nitzschia	palea	0.00	0.00	0.00	0.00	0.00	6.23	0.00	0.00	0.30
NIPS	Nitzschia	pusilla	0.00	0.00	0.00	0.00	0.00	9.70	0.00	11.47	13.86
NIVA	Nitzschia	valdecostata	0.00	0.00	0.40	0.00	1.17	0.00	0.00	0.00	0.00
PB	Pinnularia	bogotensis	1.07	0.00	1.69	0.00	0.39	0.18	0.56	0.00	0.00
PIMI	Pinnularia	microstauron	0.00	0.00	1.89	0.00	0.40	0.00	0.60	0.00	0.30
RHWE	Rhopalodia	wetzelii	0.00	3.20	0.00	0.40	0.19	0.98	0.56	0.43	0.30
SCPE	Scoliopleura	peisonis	1.75	2.90	0.00	1.71	0.19	0.00	0.00	0.00	0.00
SG	Stauroneis	gregorii bathurstansis	0.00	0.00	0.40	0.00	0.88	0.36	0.00	0.00	0.00
SB	Stauroneis		0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00
SSP	Stauroneis	species (obtusa?)	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STAW	Stauroneis Seminal	wislouchii	0.00	4.90	0.00	0.00	0.00	3.74	0.56	0.87	1.50
SO	Surirella	oregonica	0.70	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SUSE	Surirella	sella	0.00	1.46	9.78	0.40	0.10	0.00	0.56	0.00	0.00
SUSP	Surirella	sp.	1.90	1.20	0.40	0.00	0.00	0.00	0.00	0.00	0.00
SUWE	Surirella	wetzelii	3.79	1.56	3.29	0.10	0.10	0.18	0.00	0.43	0.00

### TABLEAU 3 : Liste des images de diatomées

### TABLE 3: List of diatom pictures

Genres	Espèces		Images		SERVANT-VILDARY & ROUX	SERVANT-VILDARY & BLANCO	SERVANT-VILDARY (1984)
Genera	Species		Pictures		(1990)	(1984)	
			CG2001_M01_SSV-FR-MR_Photo_001	d2-80			
Acnnanthes	arenaria	Amosse	CG2001 M01 SSV-FR-MR Photo 002	d1-73	Fig. 42-43		
Achnanthes	brevipes intermedia	Kützing					
Achnanthes	chilensis	Hustedt			Fig. 31-32		
Achnanthes	delicatula	(Kütz) Grunow			Fig. 33	Pl. IV, fig. 1-2	
			CG2001_M01_SSV-FR-MR_Photo_003	d2-101			
Achnanthes	speciosa	Hustedt	CC2001 M01 SSV ED MD Dhote 004	d1.00o		Pl. I, fig. 19; Pl. VIII, fig. 4	
Amphora	atacamana	Frenguelli	CG2001_M01_SSV-FR-MR_Photo_005	d2-29	Fig. 11		
Amphora Amphora	boliviana	Patrick	CG2001_M01_SSV-FR-MR_Photo_006, CG2001_M01_SSV-FR-MR_Photo_007	d2-53, d2-17	Fig. 10		
Amphora	boliviana elongata		CG2001_M01_SSV-FR-MR_Photo_008	d2-12	Fia. 13		
Amphora	carvajaliana	Patrick	CG2001_M01_SSV-FR-MR_Photo_009	d1-71	Fig. 9, 14		
Amphora	coffaeformis	Agardh	CG2001_M01_SSV-FR-MR_Photo_010	d2-99		Pl. IV, fig. 9	
Amphora	lineolata	Ehrenberg	CG2001_M01_SSV-FR-MR_Photo_011	d2-52a	Fig. 47-48		
			CG2001_M01_SSV-FR-MR_Photo_012	d1-06			
Amphora	lybica	Ehrenberg	CG2001 M01 SSV.ER.MR Photo 013	d2.65	Fig. 44		
Amphora	platensis	Frenquelli		02.00		Pl. II. fia. 25	
	<i>,</i>		CG2001_M01_SSV-FR-MR_Photo_014	d2-11			
Anomoeoneis	sphaerophora angusta	Frenguelli				Pl. II , fig. 16-17	
			CG2001_M01_SSV-FR-MR_Photo_015	d4-05			
Anomoeoneis	sphaerophora navicularis	(Ehr.) O. Muller				Pl. II , fig. 12-13	
			CG2001_M01_SSV-FR-MR_Photo_016	d2-09			
Anomoeoneis	sphaeroprophora platensis	Frenguelli	CG2001 M01 SSV-ER-MR Photo 017	d2-23	Fig. 49		
Brachysira	anonina	Kutzina		01 10	Fig. 25		
bidenysiid	apornia	Rotting	CG2001_M01_SSV-FR-MR_Photo_018	d1-57	1.9.20		
Caloneis	silicula minuta	(Grun) Mills					
			CG2001_M01_SSV-FR-MR_Photo_019	d1-02			
Caloneis	westii	(W. Smith) Hendey			Fig. 50	Pl. I, fig. 7	
			CG2001_M01_SSV-FR-MR_Photo_020	d1-37			
Cocconeis	placentula euglypta	(Ehr) Cleve	CG2001 M01 SSV.ER.MR Photo 021	42.83			
Cymholla	cymbiformis	(Agardh Kütz) Van Heurck					
-,	-,	(	CG2001_M01_SSV-FR-MR_Photo_022	d1-81			
Cymbella	pusilla	Grunow			Fig. 14		
			CG2001_M01_SSV-FR-MR_Photo_023	d2-24			
Denticula	elegans	Kützing	CORDER MOD. COVIED MD. Diversion	40.57	Fig. 51		
			CG2001_M01_SSV-FR-MR_Photo_024	d2-57			
Denticula	eximia	Krammer & Lange-Bertalot	CG2001 M01 SSV-FR-MR Photo 025	d2-43			
Denticula	kuetzinaii	Grunow					
			CG2001_M01_SSV-FR-MR_Photo_026	d1-18			
Denticula	subtilis	Grunow					
			CG2001_M01_SSV-FR-MR_Photo_027	d2-22			
Denticula	tenuis var.?	Kützing	CC2001 M01 SSV EP MP Photo 029	42.60	Fig. 36		
Donticula	thormalic	Kützing	CG2001_M01_3344 K4MK_P1005_020	43-00			
Denticula	mermans	Kuizing	CG2001_M01_SSV-FR-MR_Photo_029	d2-60			
Denticula	valida	(Pedicino) Grunow			Fig. 35		
			CG2001_M01_SSV-FR-MR_Photo_030	d3-75			
Entomoneis	paludosa	(W. Smith) Reimer				Pl. IV, fig. 10	
			CG2001_M01_SSV-FR-MR_Photo_031	d2-100			
Fallacia	pygmeae	Kützing	CC2001 M01 SSV EP MP Photo 022	42 09 (DAC 70)	Fig. 38	Pl. II, fig. 23	
Fragilaria	hrovistriata		CG2001_M01_33V-1 K-MIK_P11010_032	02-70 (FAG 70)			
Traynana	brevisulata		CG2001_M01_SSV-FR-MR_Photo_033	d2-07a (PAG 73)			
Fragilaria	brevistriata				Fig. 27		
			CG2001_M01_SSV-FR-MR_Photo_034	d1-41 (PAG 23)			
Fragilaria	brevistriata						
			CG2001_M01_SSV-FR-MR_Photo_035	d1-45 (PAG 41)			
Fragilaria	brevistriata elliptica	Héribaud	CG2001 M01 SSV.EP.MR Photo 026	d2.86			
Franilaria	construons hinodis	(Ebrophora) Hustod	002001_W01_00v+rk-Wk_F1000_036	G2 00			
raynaild	construens binouis	(Emenory/ Husten	CG2001_M01_SSV-FR-MR_Photo_037	d1-43			
Fragilaria	construens f. subsalina	Hustedt					
			CG2001_M01_SSV-FR-MR_Photo_038	d1-44			
Fragilaria	fasciculata	(Agardh) Lange-Bertalot					
Fragilaria	pinnata	Ehrenberg				PL III, fig. 2	

### TABLEAU 3 : Liste des images de diatomées

### TABLE 3: List of diatom pictures

Genres	Espèces		Images		SERVANT-VILDARY & ROUX (1990)	SERVANT-VILDARY & BLANCO (1984)	SERVANT-VILDARY (1984)
Fragilaria	zeilleri	Héribaud	Fictures		Fig. 29	(	
magnana	Lunch		CG2001_M01_SSV-FR-MR_Photo_039	d4-08	119.27		
Hantzschia	amphioxys	(Ehrenberg) Grunow	CG2001_M01_SSV-FR-MR_Photo_040	d1-10		Pl. V, fig. 12-13	
Hantzschia	amphioxys var. maior	Grunow	CG2001_M01_SSV-FR-MR_Photo_041	d2-93		Pl. V, fig. 1-11	
Hantzschia	sp.		CG2001_M01_SSV-FR-MR_Photo_042	d2-89			
Hippodonta	hungarica	(Grun) Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_043	d2-06			
Mastoglia Mastoglia	atacamae smithii lacustris	Frenguelli Grunow	CG2001_M01_SSV-FR-MR_Photo_044,	d2-25, d2-47	Fig. 53		
			CG2001_M01_SSV-FR-MR_Photo_045 CG2001_M01_SSV-FR-MR_Photo_046	d2-14			
Navicula	arctotenelloïdes	Lange-Bertalot & Metzeltin	CG2001_M01_SSV-FR-MR_Photo_047	d2-95 (Pag 72)			
Navicula	cariocincta	Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_048	d2-103			
Navicula	cf. muticopsis	Van Heurck	CG2001_M01_SSV-FR-MR_Photo_049	d2-103			
Navicula	cf. paramutica binodis	Bock	CG2001_M01_SSV-FR-MR_Photo_050	d2-04 (ag 116 )	Fig. 39	PI. II, fig. 20	
Navicula	cincta	Ehrenberg	CG2001_M01_SSV-FR-MR_Photo_051	d2-37			
Navicula	cryptotenelloides	Hustedt	CG2001_M01_SSV-FR-MR_Photo_052	d1-09c			
Navicula Navicula	digitoradiata minor erifuga	Krasske Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_053,	d1-36, d1-27	Fig. 54 Fig. 34		
			CG2001_M01_SSV-FR-MR_Photo_054 CG2001_M01_SSV-FR-MR_Photo_055	d2-05 (Pag 73)			
Navicula	incertata	Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_056	d4-11			
Navicula	nivalis	Ehrenberg	CG2001_M01_SSV-FR-MR_Photo_057	d1-35		PI. II, fig. 21	
Navicula	novadecipiens	Hustedt	CG2001_M01_SSV-FR-MR_Photo_058	d2-18 (Can 4)			
Navicula	phyllepta	Kützing	CG2001_M01_SSV-FR-MR_Photo_059	d1-31			
Navicula	podzorskii	Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_060	d2-55 (Bal 67)			
Navicula	pseudolitoricola	Häkansson	CG2001_M01_SSV-FR-MR_Photo_061	d2-15 (Pag 84)			
Navicula	salinicola		CG2001_M01_SSV-FR-MR_Photo_062	d2-32	Fig. 22, 23		
Navicula	sp.		CG2001_M01_SSV-FR-MR_Photo_063	d1-98			
Navicula	tripunctata	(O.F. Muller) Bory	CG2001_M01_SSV-FR-MR_Photo_064	d2-07b (Pag 73)			
Navicula	veneta	Kützing	CG2001_M01_SSV-FR-MR_Photo_065	d2-85	Fig. 45		
Neidium	bisulcatum subampliatum	Krammer	CG2001_M01_SSV-FR-MR_Photo_066	d2-84			
Neidium	koslowii	Mereschkowski	CG2001_M01_SSV-FR-MR_Photo_067	d3-72			
Nitzschia	accedens chilensis	Patrick	CG2001_M01_SSV-FR-MR_Photo_068	d1-08			Pl. I, Fig. 1-5
Nitzschia	aff. valdecostata		CG2001_M01_SSV-FR-MR_Photo_069	d2-59 (Cl20)			Pl. IV, Fig. 4-11
Nitzschia	amphibia	Grunow	CG2001_M01_SSV-FR-MR_Photo_070	d2-21 (Can 4)			
Nitzschia	cf. amphibioides	Hustedt	CG2001_M01_SSV-FR-MR_Photo_071	d3-62			
Nitzschia Nitzschia	compressa compressa epithemioides epithemioides	Lange-Bertalot Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_072, CG2001_M01_SSV-FR-MR_Photo_073	d2-13, d1-89			Pl. I, Fig. 26 Pl. I, Fig. 12-15
Nitzechia	frustulum (modosta)	(Kitzing) Grupow	CG2001_M01_SSV-FR-MR_Photo_074	d1-86 (Pag 84)			PL I Eig 16 17
Nitzschia	arunowii	(Cleve) Hasle	CG2001_M01_SSV-FR-MR_Photo_075	d2-46 (Bal)			PL II Fig. 13.16
Nitzechia	hantachiana (modocta)	Cieve naste	CG2001_M01_SSV-FR-MR_Photo_076	d2-94 (Pag 72)			ri, ii, rig. 13-16

### TABLEAU 3 : Liste des images de diatomées

### TABLE 3: List of diatom pictures

Genres Genera	Espèces Species		Images Pictures		SERVANT-VILDARY & ROUX (1990)	SERVANT-VILDARY & BLANCO (1984)	SERVANT-VILDARY (1984)
Nitzechio	hungariaa	Cruppur	CG2001_M01_SSV-FR-MR_Photo_077	d1-49			
Nitzschia	liebetruthii	Lange-Bertalot	CG2001_M01_SSV-FR-MR_Photo_078, CG2001_M01_SSV-FR-MR_Photo_079	d2-20, d2-58			Pl. IV, Fig. 19-25
			CG2001_M01_SSV-FR-MR_Photo_080	d1-40 (CLD 16)			
Nitzschia	alpina	Husteat	CG2001_M01_SSV-FR-MR_Photo_081	d2-36 (Can)			Pl. I, Fig. 6-9
Nitzschia	palea	(Kützing) W. Smith	CG2001_M01_SSV-FR-MR_Photo_082	d1-48 (Pag 23)			Pl. III, Fig. 6-7
Nitzschia	palea	(Kützing) W. Smith	CG2001_M01_SSV-FR-MR_Photo_083	d4-16			
Nitzschia	pusilla	Grunow	CG2001_M01_SSV-FR-MR_Photo_084	d1-54			
Nitzschia	valdecostata	Lange-Bertalot & Simonsen	CG2001_M01_SSV-FR-MR_Photo_085	d2-38			PI. IV, Fig. 1-3
Nitzschia	valdestriata	Aleem & Hustedt	CODDA NOT COULD ND DEVE DOL	42.02			
Pinnularia	borealis f. ovalis	Boye Petersen	CG2001_M01_SSV-FR-MR_Photo_086	02-92			
			CG2001_M01_SSV-FR-MR_Photo_087	d2-90			
Pinnularia	microstauron	Ehrenberg Cleve	CG2001_M01_SSV-FR-MR_Photo_088	d2-48 (Pur 2)			
Placoneis	aff. elginensis	(Greg) Cox var elginensis					
Dhonaladia	sculota	Krammor	CG2001_M01_SSV-FR-MR_Photo_089	d4-10			
Rhopaloula	sculpta	KLATTITUEL	CG2001_M01_SSV-FR-MR_Photo_090	d2-34			
Rhopalodia	wetzelii	Hustedt	CC2001 M01 SSV EP MP Photo 001	d2.64	Fig. 15-17		
Scoliopleura	peisonis	Grunow	CG2001_M01_5544 K4MK_F1005_071	03-04	Fig. 52		
·			CG2001_M01_SSV-FR-MR_Photo_092	d2-16			
Stauroneis	anceps	Ehrenberg	CG2001_M01_SSV-FR-MR_Photo_093	d2-50			
Stauroneis	bathurstensis	Giffen			Fig. 34		
Stauronois	olata	Husterit	CG2001_M01_SSV-FR-MR_Photo_094	d2-68,			
Stationers	Ciuto	hosed	CG2001_M01_SSV-FR-MR_Photo_095	d1-46			
Stauroneis	gregorii	Ralfs	CG2001 M01 SSV-ER-MR Photo 096	d3-76	Fig. 55		
Stauroneis	gregorii densestriata	Hustedt					
			CG2001_M01_SSV-FR-MR_Photo_097	d2-19			
Stauroneis	gregorii var linearis	Hustedt	CG2001_M01_SSV-FR-MR_Photo_098	d1-26			
Stauroneis	legleri	Hustedt			Fig. 40		
Stauroneis	sp. (obtusa?)		CG2001_M01_SSA-EK-WK_buot0_044	d2-40	Fig. 37		
Stauroneis	wislouchii	Poretsky & Anisimova	CG2001_M01_SSV-FR-MR_Photo_100, CG2001_M01_SSV-FR-MR_Photo_101	d4-02, d2-49	Fig. 41		
Curley II.	-h111-	lastek.	CG2001_M01_SSV-FR-MR_Photo_102	d1-05	FI- F/		
Surrena	cniiensis	Janish	CG2001_M01_SSV-FR-MR_Photo_103	d1-12	Fig. 56		
Surirella	dubia	Frenguelli	CODDA NOT COULD ND DEVE 404	41.70			
Surirella	oregonica	Ebrenberg	CG2001_M01_SSV-FR-MR_Photo_104	d1-70		PL I, fig. 17: PL VIII, fig. 1-2	
Juniona	oregonica	Lincipuly	CG2001_M01_SSV-FR-MR_Photo_105	d2-27		11. 1, 11g. 17, 11. Vill, 11g. 12	
Surirella	ovata utahensis	Grunow			Fig. 26	PI. VIII, fig. 8-9; PI. II, fig. 6	
Surirella	sella	Hustedt	CG2001_M01_SSV-FR-MR_Photo_106	d1-13	Fig. 19	Pl. II, fig. 7; Pl. VII, fig. 3-7	
Surirella	wetzelii	Hustedt	CC2001 M01 SSV ED MD Deste 107	d1 72a	Fig. 20		
Chiar Kkota			002001_W01_00V-FR-WR_F1000_107	u. /Ja			
			CG2001_M01_SSV-FR-MR_Photo_038	d1-44			
Pastos Grandes 23 Pastos Grandes 84			CG2001_M01_SSV-FR-MR_Photo_063,	d1-98, d1-09			
			CG2001_M01_SSV-FR-MR_Photo_108				

# TABLEAU 4 : Optima et tolérances estimées des espèces

# **TABLE 4: Optima and tolerances of the species**

Weighted Averaging (WA) method. Results: R, R<sup>2</sup>, Standard error of prediction (SEP). Weighted Averaging Plus Least Squares regression (WA-PLS). Results: number of components, r, R, R<sup>2</sup> and S

CenersSpeciesSamplesorderOPTIMUTOLERAUCPERCURNERAdmanthesadvantheADAR9440.0211850.676AdmanthesADAR13127.3717287.347AmphereadvantheADAR9410.121703.547AmphereadvantheAMPA9410.103888.547AmphereadvantheAMPA9410.102898.1075AmphereadvantheADR9410.102898.1017053.505AmpherebehrinnABDL11927.811190.83921AmpherebehrinnADR11927.811190.83921AmpherebehrinnCCAN11927.141098.82921AmpherebehrinnCCAN11927.141098.82921AmpherebehrinnCCAN11927.141098.82710ConstructsplacembraCCN3200.021018.221313314AmberepadrisCCAN3200.221018.221351515151515151515151615161516161516161516<	Genres	Espèces	Codes	Na+ (mg/l)			
Achanathes         arcrark         ACAR         9440.02         1188.07         8           Admanthes         defactula         AD         13217.75         1737.34         7           Admanthes         attamana         AMP         40413.13         3284.07         17           Amphana         attamana         AMP         40413.13         3284.07         16           Amphana         attamana         AMP         40413.13         3284.07         16           Consta         systemphora matrix         AMP         1442.07         1644.08         11           Consta         systemphora matrix         CP         3382.06         949.02         8           Consta         systemphora matrix         CP         3382.06         949.02         11           Consta         systemphora matrix	Genera	Species	Samples	codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE
Admanthe         Admanthe         AD         1317.75         1737.34         7           Anbanthe         AND         AND         407.04         6           Amphen         atacaman and         AMPA         4018.13         3888.07         17           Amphen         hobitsin and         AMPA         4018.09         3669.35         7           Amphen         hobitsin and         AMPA         4018.09         3669.35         7           Amphen         hobitsin angara         AMCI         13297.04         1989.35         5           Amphen         caloristic         AMPA         4019.09         3669.35         7           Amphen         caloristic         AMPA         4019.00         3669.35         7           Amphen         caloristic         AMPA         4019.00         3669.35         7           Caloristic         subtrainic         CAV         3330.00         1319.25         1           Caloristic         subtrainic         CAV         3330.00         1319.25         1           Caloristic         subtrainic         CAV         3330.80         1         1           Caloristic         prenthin         CAV         2985.10         <	Achnanthes	arenaria	ACAR		9440.02	11850.67	6
Admanthes         specima         ASE         9437.31         947.91         94.90.90         6           Amphorn         atteamma         AMPA         4418.13         3084.07         17           Amphorn         atteamma         AMPA         4418.13         3084.07         17           Amphorn         babitsma         ABOI         2396.10.3         1708.5.3         5           Amphorn         babitsma         ABOI         2396.10.3         1708.5.3         5           Amphorn         babitsma dragan         ABC         1392.07.08         1510.05         21           Amphorn         babitsma dragan         AMSA         1347.04         1098.92         8           Calmats         splace/plors angusta         AMSA         1347.04         1098.92         8           Calmats         westi         CAV         3332.06         948.92         8         7           Calmats         plactina         CAV         3332.06         948.92         8         7           Calmats         plactina         CAV         3332.04         948.92         9         7           Calmats         pactina         FBC         377.15         3375.98         8         9 </td <td>Achnanthes</td> <td>delicatula</td> <td>AD</td> <td></td> <td>13217.75</td> <td>17837.34</td> <td>7</td>	Achnanthes	delicatula	AD		13217.75	17837.34	7
Amplone         accurants minore         AMPA         40443 13         20846.07         7           Amplone         bolksane         AMPA         40490.09         366653.5         7           Amplone         bolksane selengte         ABRI.         20894.03         7065.50         5           Amplone         carangianus         ABRI.         15877.68         1587.68         9           Amplone         carangianus         ABRI.         15877.68         10105.22         1           Amplone         sphareophera argenta         ANSA         1387.741         1008.82         4           Calouts         westfi         C.N.         338.88         69.343.62         13.1           Calouts         westfi         C.N.         338.88         60.33.62         13.1           Calouts         graduta         C.P.         338.88         136.12.2         1           Calouts         predita         1234.427         13.1         136.12.2         1           Calouts         predita         1234.427         13.1         136.12.2         1           Calouts         predita         1234.427         13.1         136.12.2         1           Predita         predita	Achnanthes	speciosa	ASPE		9437.31	4670.60	6
Amplem         sequence         90098.35         7           Amplem         belvisme conguta         ABCL         2994.03         705.50         5           Amplema         belvisme conguta         ABCL         10797.01         2580.84         9           Amplema         carcajaliza         ANSA         13427.04         1088.83         9           Calonets         splaceruphure angutas         ANSA         13427.04         1088.83         9           Calonets         splaceruphure angutas         CN         3332.06         9349.22         8           Calonets         patternitura         CN         9820.02         10816.22         13           Cymbolit         garciks         CVI         9920.02         10816.22         15           Cymbolit         garciks         CVI         9820.02         10816.22         15           Dentroital         threstratura         FR         172.56         3302.53         16           Splatinit         facturatas         FR         172.56         3305.63         16           Splatinit         facturatas         FR         172.15         3437.68         16           Splatinit         facturatas         FR         1	Amphora	atacamana	AMPA		40443.13	32684.07	17
Ampbane         boltvane         ABOL         23994.03         1795.50         5           Ampbane         carapilation         ABEL         (1777.01)         2580.44         9           Ampbane         carabies         Spherophore angola         ANSA         13427.04         1088.53         9           Calaneis         stheraphore angola         ANSA         13427.04         1088.52         4           Calaneis         westli         CAW         3332.06         9348.22         8           Cacconeis         glaccifia         CP         7358.88         0313.96         7           Cymbella         gracifia         CYMP         21344.87         13054.82         7           Cymbella         gracifia         CYMP         21344.87         13054.82         7           Proglaria         norstruss water         FE         3772.56         4411.52         7           Proglaria         construss water         FE         3772.56         4147.35.43         9           Proglaria         inparatom mary 1         OM         2282.23         988.54         4           Proglaria         inparatom mary 1         OM         27347.08         98222.20         4	Amphora	atacamana minor	AMPM		40196.09	36663.85	7
Amplore         botican elongen         ABRT.         10737.01         2538.34         9           Anumexorité         spherophere angiosia         ANSA         13427.04         10883.83         9           Calorité         spherophere angiosia         ANSA         13427.04         10883.83         9           Calorité         spherophere angiosia         ANSA         13427.04         10883.83         9           Calorité         spherophere angiosia         CAW         3332.06         943.22         8           Connorté         palecentrala         CP         735.84         6013.356         7           Cymbelle         genétis         CYNP         21344.47         1504.82         7           Denticula         threshrintan         FB         1725.64         3332.63         5           Frightari         constranse worter         FEC         3723.53         1441.74.84         9           Frightaria         infacticulata         EP         3735.53         4         4         171.16         4835.52         14           Frightaria         infacticulata         EP         3735.53         4         14         18         18           Frightaria         infacticulata	Amphora	holiviana	ABOL.		23994.03	17053.50	5
Amphorn anyshering/ar anysharANC11527/881510.6521Caloncisspherelytar anysharANSA13427041098.359Caloncisspherelytar anysharCAW332.366940.228CaloncisphereluliaCP735.88904.3967ConsolisphereluliaCP953.88904.3967ConsolisphereluliaCYMP921.44.87150.54.827ConsolisphereluliaCYMP921.44.8755FagilariahrestriatFB1723.564411.55.85Fragilariaconstruers verterFK927.21.56333.02.2311FragilarianontatFF377.21.56440.72.849Fragilariapherates verterFK377.21.56340.72.844Fragilariapherates verterFF177.47.13488.554HantzschiaanplatoysHA27.347.08382.22.204HantzschiaanplatoysHA27.347.08382.22.204HantzschiaandexaneMATA697.38128.4411NavialacarrieticatNCA207.34343.534NavialacarrieticatNCA207.3520.55NavialacarrieticataNCA207.3520.55NavialacarrieticataNCA207.3520.55NavialacarrieticataNCA207.3520.55N	Amphora	boliviana elongata	ABEL		10787.01	25830.84	9
Automonomics         spheraphers argusts         ANSA         11427/14         10983/83         9           Calorets         victal mituta         CSP         10067/21         10089/82         4           Calorets         yestin         CAW         3332.06         9349.22         8           Concorts         placettala         CP         7358.88         0013.66         7           Cymbella         practits         CYL         952.002         1081.62         13           Cymbella         practits         CYL         952.002         1081.62         13           Cymbella         practits         CYL         952.002         114         147.35         147.35         147.35         147.35         117.35         147.35	Amphora	carvaialiana	AMCI		15297.68	11510.65	21
Calonesis         vesti         1007.21         1408.92         4           Calonesis         vesti         1302.04         9492.2         8           Cacconesis         pikertrula         CP         7358.88         6013.96         7           Cymbella         pakertrula         CP         7358.88         6013.96         7           Cymbella         pakertrula         CP         7358.88         6013.96         7           Cymbella         pasertrula         CP         7358.88         6013.96         7           Cymbella         pasertrula         CP         7358.84         6013.96         7           Derrula         pasertrula         FB         1723.54         3302.23         11           Proglanta         prostores writer         FB         7731.54         4475.84         9           Proglanta         prostores writer         FP         7305.34         44497.84         9           Proglanta         prostores writer         FP         7305.34         44497.84         9           Proglanta         prostores many /         OK         2737.18         4845.92         14           Harrockia         aredia         NATA         6873.97         <	Anomoeoneis	sphaerophora angusta	ANSA		13427.04	10983.83	9
Caluers         vesti         CAW         333.0 (P         934.2 (P)         8           Corcorets         plecttalin         CP         7358.8 (P)         913.6 (P)         7           Cymbelic         pavelic         CYL         952.0 (P)         131.6 (P)         7           Cymbelic         pavelic         CYL         952.0 (P)         131.6 (P)         7           Denticulu         dermalis         DETTI         (P)         913.6 (P)         7           Denticulu         dervisital         FB         (P)         913.6 (P)         918.6 (P)         5           Frightaria         construmers writter         FRC         2917.2 (P)         918.6 (P)         7         7           Frightaria         pitrutaria         FR         2736.5 (P)         7	Caloneis	silicula minuta	CSP		16067.21	14089.92	4
Coroneirs         pheentrula         CP         7358.88         0013.86         7           Cymbelin         parolla         CYVL         923.08         1013.96         7           Cymbelin         parolla         CYVLP         1213.48.77         1505.48.2         7           Cymbelin         parolla         CYVLP         1213.44.87         1505.48.2         7           Dentrula         Dentrula         FB         1723.51.4         3302.23         11           Eregilaria         parostress varier         EB         1723.54.4         3302.23         12           Fregilaria         parostress varier         FB         3725.26         2475.18         14           Fregilaria         parostress varier         FD         3736.34         41497.84         9           Fregilaria         parostress varier         FD         3736.34         41497.84         9           Haitschia         anphays         FD         3736.34         41497.84         9           Ibaraschia         anphays         HA         2737.18         488.35         4           Ibaraschia         anphays         FD         2734.3         34459.92         14           Navivala         anpa	Caloneis	westii	CAW		3332.06	9349.22	8
Cymbella         persits         CVL         9320         10816.82         13           Cymbella         proteina         Proteina         10545.82         7           Dorriscula         Ibrevalis         PI         17235.64         3330.23         11           Figglaria         Invivolation         PE         37721.58         3473.58         5           Figglaria         Invisoritanos venter         PE         37721.58         3473.58         5           Figglaria         Invisoritana         PE         3785.53         4407.55         4           Figglaria         andinory         PI         3785.53         4407.55         4           Hanzschia         andinory         PI         3785.53         1845.98         7           Hanzschia         andinory         PI         3785.53         440         11           Navicula         andreva         MATA         873.53         1846.44         11           Navicula         andreva         NC         2007.73         3445.99         4           Navicula         andreva         NC         3035.73         38608.3         5           Navicula         araditarichande         NC         3037.33	Cocconeis	nlacentula	CP		7358.88	6013.96	7
Openable         pentitalis         CVMP         1344.87         1405.482         7           Deristula         thermalis         DETH         6791.96         4115.52         5           Pragilaria         constructs venite         FRCV         2862.52         29188.60         5           Pragilaria         fragilaria         fragilaria         fragilaria         1712.15         3135.23         11           Pragilaria         fastendata         FE         37781.15         3435.44         4147.14         9           Fragilaria         atherat         FP         37385.34         4147.14         9         167.13         488.35         4           Hanzschia         amphoxys         HA         27347.08         3822.20         4         11         140.85.08         7           Masteglia         atteamae         MATA         6873.38         1868.44         11           Navicula         atteamae         NC1         5035.67         3808.34         4           Navicula         invicula         niculas         NL1         190.03         5           Navicula         invicula         NL1         190.03         5         7           Navicula         pseudol	Cymbella	gracilis	CYL		9520.02	10816.22	13
Derivative         DETH         TP16         TP36         441.5.2         5           Pragilaria         constrames viviter         PEC         2982.54         3302.23         11           Pragilaria         constrames viviter         PEC         2972.15         3302.23         12           Pragilaria         factuation         PEC         2972.15         2985.71.0         7           Pragilaria         phmata         PT         3726.53.1         4147.84         9           Pragilaria         phmata         PT         3728.53.31         4147.84         9           Pragilaria         ardiferi         FZ         177.13         4895.93         4           Hantzochia         mphonys         HA         27347.08         3822.20         4           Hantzochia         nov.sp.         HA         2805.23         10485.98         7           Mixital         caronencica         NCA         2807.73         3800.33         4           Nixital         caronencica         NCA         2807.73         3800.35         5           Nixital         pragilaria         nixital         1307.34         4145.90         5           Nixital         pratematica bindis	Cymbella	nusilla	CYMP		21344.87	15054.82	7
Paglarin         Presistrata         PE         17.23.84         33.98.23         11           Paglarin         construms writer         FE         297.1.56         947.83.08         5           Praglarin         fasciculata         FE         277.1.56         947.83.08         5           Praglarin         pluntis         FP         37.83.5.34         44.897.44         9           Praglarin         pluntis         FP         37.83.5.34         44.897.44         9           Praglarin         authiboys         11.4         27.47.08         3822.2.0         4           Intrascila         anglinoys         11.4         27.47.08         3822.2.0         4           Marcial         anglinoys         11.4         27.47.08         3822.2.0         4           Hantschia         anglinoys         11.4         27.47.08         3822.2.0         4           Marcial         atacamae         NATA         687.3.58         1586.4.4         11           Navicula         atacamae         NCI         2005.5.07         3808.3.4         4           Navicula         paramutica bindis         NPB         695.5.49         19702.86         9           Navicula	Denticula	thermalis	DETH		6761.96	4415.52	5
margin         margin         FRCV         20282-29         29188.00         1           FrigBarin         kosculata         FE         37721.56         39733.88         5           FrigBarin         leptassroom maryi         OM         27283.28         29857.10         7           FrigBarin         planta         FP         37731.56         39733.88         5           FrigBarin         partat         FP         37731.56         39733.88         5           FrigBarin         partat         FP         37731.56         39733.88         5           FrigBarin         partat         FP         37731.56         39733.88         5           FrigBarin         actionica         NCA         22097.43         4459.22         4           Hattisschin         novischin         NCA         22097.43         34459.22         14           Navischin         carcinica         NCA         22097.43         34459.23         14           Navischin         paramitica bindis         NFB         6053.49         19702.86         9           Navischin         paratica bindis         NFB         6053.49         19702.86         9           Navischin         pseudofforticola	Fragilaria	hrevistriata	FB		17235 64	33302 23	11
Partial         Fee         37721.56         37721.56         3793.88         5           Pragilaria         Janschum         FP         37721.56         3473.88         5           Pragilaria         pinnta         FP         37761.53         41897.84         9           Fragilaria         zelleri         FZ         17.71.3         488.35         4           Hantschia         anphiosys         HA         27.47.08         38222.0         4           Hantschia         anphiosys         HA         27.47.08         38222.0         4           Mastoglia         attacmae         MA         287.47.08         38222.0         4           Mastoglia         attacmae         MA         267.47.08         3822.2         4           Navicula         caricintra         NCA         2207.43         34459.92         14           Navicula         caricintra         NCI         3053.07         3890.83         5           Navicula         paramitricintra         NCI         3053.07         3890.83         5           Navicula         paramitricintra         NCI         393.75         480.81.70         25           Navicula         paramitricintra         N	Fragilaria	construens venter	FRCV		26823 29	29188 60	5
non-start         Ippensitanon maryi         OM         27283.28         29857.10         7           Prigilaria         pinnta         PP         37395.34         41497.84         9           Prigilaria         zalleri         FZ         177.13         483.35         4           Haurschia         amphaxys         11A         27347.08         38222.20         4           Haurschia         nov. sp.         11N         2085.29         10485.08         7           Mastegila         atcanne         MATA         6875.58         15804.44         11           Navicula         cardocincta         NCA         2007.3         34459.92         144           Navicula         cardocincta         NCA         907.83         2057.95.8         20           Navicula         paramitic bindix         NFN         4398.02         1893.03         5           Navicula         paradoliuricola         NIA         1881.41         7         1893.03         5           Navicula         paradoliuricola         NIA         1882.14         17         18         30.93         5           Navicula         paradoliuricola         NIA         1823.14         180.14         17	Fragilaria	fasciculata	FE		37721.56	34753.68	5
Argentian         primata         PP         37365.34         41497.84         9           Prigilaria         zelleri         FZ         177.13         488.35         4           Intraschia         anphixoys         IIA         27347.06         3822.20         4           Hantzschia         anov. sp.         IIN         2085.29         10485.98         7           Mastoglia         atacamee         MATA         0875.28         15844.44         11           Navicula         centeria         NCA         2097.43         34459.92         14           Navicula         centeria         NCI         5035.67         38808.34         4           Navicula         nivalis         NHN         4360.02         1893.03         5           Navicula         paramutica hinofis         NPB         6335.49         19702.86         9           Navicula         pseudolanceolata         NLA         18821.11         12651.41         7           Navicula         pseudolitricola         NLI         1303.47         460.02         7           Navicula         sepaudolitricola         NLI         18821.11         14550.41         7           Navicula         sepaudolitricol	Fragilaria	lentaustoron martvi	OM		27283 28	29857 10	7
Instruct	Fragilaria	ninnata	FP		37365 34	41497 84	9
Ingran         India         Instruction         Instruction <thinstruction< th="">         Instruction         <thinstru< td=""><td>Fragilaria</td><td>zeilleri</td><td>FZ</td><td></td><td>177 13</td><td>488 35</td><td>4</td></thinstru<></thinstruction<>	Fragilaria	zeilleri	FZ		177 13	488 35	4
Initiationinput by intervalinv interval $10 \times 10^{-1}$ $10 \times 10^{-1}$ $10^{-1} \times 10^{-1} \times 10^{-1} \times 10^{-1}$ $10^{-1} \times 10^{-1} $	Hantzschia	amphiovys	ΗΔ		27347.08	38222 20	4
Intrastanti         Div Ap.         Div         Div         Div         Div         Div         Div           Mastaglia         atazame         MATA         6873.38         1584.44         11           Navicula         carlocincta         NCA         22097.43         34459.92         14           Navicula         veneta         NCI         50355.07         38808.34         4           Navicula         indifis         NHN         4366.02         18936.03         5           Navicula         cargotinelloides         NHN         4366.02         18936.03         5           Navicula         cargotinelloides         NHN         4366.02         18936.03         5           Navicula         cargotinelloides         NHN         4366.02         18936.03         5           Navicula         pseudolitoricola         NLA         16821.11         12631.41         7           Navicula         spinode         NDC         2339.75         4500.82         7           Navicula         saliticola         NASA         5112.24         34786.00         18           Navicula         salpina         NIL         4807.35         3633.29         6           Nitzs	Hantzschia	nov sp	HN		2085.20	10/85 98	7
Interspin         andotation         NTA         0.07.03         1.0001-01         1.0001-01           Navicula         cincta         NCA         22097.43         3.4459.92         14           Navicula         vincta         NCA         5035.07         38808.34         4           Navicula         vincta         NC         9779.83         200           Navicula         pramutico binedis         NL         4366.02         18936.03         5           Navicula         cryptotenelloides         NAO         28421.04         34981.70         25           Navicula         cryptotenelloides         NAO         28421.04         34981.70         25           Navicula         pseudolanceolata         NL1         12031.11         12651.41         7           Navicula         pseudolanceolata         NL1         12031.41         14550.63         5           Navicula         salinicola         NL1         12031.41         1450.63         5           Navicula         spinola         NLA         13124.38         30099.34         5           Nitzschia         alpinola         NLH         4895.66         38497.14         17           Nitzschia         alpinola	Mastaglia	atacamaa	ΜΑΤΑ		6873 58	15864 44	11
Anticulu         Loss A         Loss A         Jatuability         I           Navicula         Circla         NCI         5035.507         38808.34         4           Navicula         nvaita         NCI         5075.38         20579.58         20           Navicula         paramutica binodis         NHN         4366.02         18936.03         5           Navicula         paramutica binodis         NPB         6935.49         19702.86         9           Navicula         pseudolancoolata         NLA         16821.11         12651.41         7           Navicula         pseudolancoolata         NLA         16821.11         12651.41         7           Navicula         pseudolancolata         NLA         16821.11         12651.41         7           Navicula         pseudolancolata         NLI         12031.41         1450.03         5           Navicula         salinicola         NDC         23247.65         28971.50         19           Navicula         salinicola         NDC         23247.65         28971.50         13           Nitzschia         anphibiodes         NCH         4825.66         34497.14         17           Nitzschia         anophibio	Navicula	cariocincta	NCA		22007 13	34450 02	11
Antruda         Chr.a         30300, 3000, 30         3000, 30         4           Navicula         vetela         NC         9779, 83         20579, 358         20           Navicula         paranutica binodis         NPB         6935, 49         1970, 286         9           Navicula         pseudolanceolata         NLA         16821, 11         12851, 41         7           Navicula         pseudolanceolata         NLI         12031, 41         14330, 63         5           Navicula         pseudolanceolata         NLI         12031, 41         14330, 63         5           Navicula         pseudolanceolata         NLI         12031, 41         14330, 63         5           Navicula         effiga         NDC         28247, 65         28971, 50         19           Navicula         sp.         NS         13124, 38         30099, 34         5           Nitzschia         leiberuthii         NIL         8007, 35         3635, 29         6           Nitzschia         apithenioides         ND         8500, 04         7345, 89         4           Nitzschia         epithenioides         NIEP         52051, 10         3754, 32         12           Nitzschia	Navicula	cincta	NCI		50355 07	34433.32	14
Anticula         Inc.         311.53         2.05.1.53         2.5           Navicula         paramutica binodis         NHN         4366.02         18936.03         5           Navicula         cryptotenelioides         NAO         28421.04         34981.70         25           Navicula         pseudolanceolata         NLA         16821.11         12651.41         7           Navicula         pseudolitoricola         NLI         12031.41         14330.63         5           Navicula         pseudolitoricola         NLI         12031.41         14330.63         5           Navicula         silinicola         NDC         28247.65         28971.50         19           Navicula         salinicola         NAS         13124.38         30099.34         5           Nitzschia         alpina         NLL         8307.35         3835.29         6           Nitzschia         alpina         NLL<	Navicula	vanata	NC		9779 83	20570 58	20
Arricula         Infras         Yulk         House         House         Job           Navicula         cryptotenelloides         NAO         28421.04         34981.70         25           Navicula         pseudolitoricola         NLA         16821.11         12651.41         7           Navicula         pseudolitoricola         NLI         12031.41         14350.63         5           Navicula         pseudolitoricola         NLI         12031.41         14350.63         5           Vavicula         salinicola         NDC         28247.65         28971.50         19           Navicula         salinicola         NASA         53122.24         34786.00         18           Navicula         salinicola         NASA         53122.24         34786.00         18           Navicula         salinicola         NDC         28247.65         28971.50         19           Nitzschia         alpina         NL1         8307.35         36332.9         6           Nitzschia         alpina         NCHI         48925.66         38497.14         17           Nitzschia         alpina         NIA         2505.10         37543.23         12           Nitzschia	Navicula	nivalic	NHN		1366 02	18036 03	5
Arriculaparaminina manadaNTD $000545$ $1500200$ $35$ NaviculacryptorenelloidesNAO $28421.04$ $498170$ $25$ NaviculapseudolanceolataNLA $16821.11$ $12051.41$ $7$ NaviculapseudolanceolataNLA $16821.11$ $12051.41$ $7$ NaviculapseudolanceolataNLA $16821.11$ $12051.41$ $7$ NaviculaspinicolaNDC $28421.05$ $28971.50$ $19$ NaviculaspinicolaNASA $55122.24$ $3786.00$ $88$ Naviculasp.NS $13124.38$ $30099.34$ $5$ NitzschiaiebetruthiiNLL $807.35$ $3335.29$ $6$ NitzschiaalpinaNIAL $2531.24$ $3786.00$ $88$ NitzschiaalpinaNIAL $2531.24$ $3978.87$ $7$ NitzschiaalpinaNIAL $2531.24$ $9047.58$ $7$ NitzschiaaphibidotsNID $8500.04$ $7345.89$ $4$ Nitzschiaepithemioides epithemioidesNIEP $2051.10$ $3754.32$ $12$ NitzschiafurunwaitNF $1206.83$ $5819.79$ $8$ NitzschiafurunwaitNF $1205.83$ $581.97$ $8$ NitzschiafurunwaitNF $1205.83$ $581.97$ $8$ NitzschiapaleaNPA $64909.73$ $28127.99$ $6$ NitzschiapaleaNPA $64909.73$ $28127.99$ $6$ </td <td>Navicula</td> <td>naramutica hinodis</td> <td>NPR</td> <td></td> <td>6935 49</td> <td>10330.03</td> <td>9</td>	Navicula	naramutica hinodis	NPR		6935 49	10330.03	9
Narkula         Organization         NARS         Dela 1.93         Abole 1.03	Navicula	cryntotenelloïdes	NAO		28421 04	3/981 70	25
NarkulapseudolitoricolaNLA1001.111001.111001.111001.111FallaciapygmeaeNPYG3339.754620.827NaviculaselfingaNDC28247.6528971.5019NaviculasalinicolaNASA5122.2434786.0018Naviculasp.NS13124.3830099.345NitzschialiebetruthiNIL18307.353635.296Nitzschiaacedens chilensisNCH48925.6638497.1417NitzschiaalpinaNIAL25431.2419047.587NitzschiaaphibiodesND8500.047345.894Nitzschiaompresa compresaNICC14066.1824500.7313NitzschiaepithemioidesNIF13205.3420836.7916NitzschiagrunowiiNGRU9150.835819.798NitzschiahantzschianaNIHU9519.9417046.4520NitzschiapaleaNPA64909.7321827.996NitzschiapaleaNIVA542.214662.807PinnulariamicrostauronPIM6836.5317258.046NitzschiapaleaNIVA542.214662.807PinnulariamicrostauronPIM6836.5317258.046NitzschiapaleaSCPE1480.9913101.8813StauroneisgegoriiSG26378.8530284.68 <t< td=""><td>Navicula</td><td>nseudolanceolata</td><td>NLA</td><td></td><td>16821 11</td><td>12651 /1</td><td>7</td></t<>	Navicula	nseudolanceolata	NLA		16821 11	12651 /1	7
National pertonnumber pertonnumb	Navicula	nseudolitoricola	NLI		12021.11	1/350.63	5
ParticulaprigrateFAT PG $30.3.7.3$ $402.0.0.2$ $1$ NaviculasalinicolaNASA $55122.24$ $34786.00$ $18$ NaviculasalinicolaNASA $55122.24$ $34786.00$ $18$ Naviculasp.NS $13124.38$ $30099.34$ $5$ NitzschialebetruthiiNILI $807.35$ $3335.29$ $6$ Nitzschiaaccedens chilensisNCHI $48925.66$ $38497.14$ $17$ NitzschiaaphinaNIAL $25431.24$ $19047.58$ $7$ NitzschiaaphibiodesND $8500.04$ $7345.89$ $4$ Nitzschiacompress compressaNICC $14086.18$ $24500.73$ $13$ Nitzschiacompress compressaNICC $14086.18$ $24500.73$ $13$ NitzschiafurtstulumNF $13205.34$ $20836.79$ $16$ NitzschiagrunowiNGRU $9150.83$ $5819.79$ $8$ NitzschiahantzschianaNIH $6869.44$ $10104.02$ $12$ NitzschiahantzschianaNIHU $9151.94$ $17046.45$ $200$ NitzschiapaleaNPA $64909.73$ $28127.99$ $6$ NitzschiapaleaNIVA $5422.61$ $4662.80$ $7$ PinnulariabogotensisPB $8636.53$ $17258.04$ $6$ PinnulariamicrostauronPIM $6689.21$ $22072.75$ $5$ ScalopleurapeisonisSCPE $14800.99$ $13101$	Fallacia	pygmaaa	NEVC		2220 75	4620 82	7
NarkulaEnergyNBC $26241.03$ $2631.30$ $13$ Naviculasp.NS $5122.24$ $34786.00$ $18$ Naviculasp.NS $13124.38$ $30099.34$ $5$ NitzschiailebetruthiiNILI $8307.35$ $3635.29$ $6$ Nitzschiaaccedens chilensisNCH $48925.66$ $38497.14$ $17$ NitzschiaalpinaNIAL $25431.24$ $19047.58$ $7$ NitzschiaamphibiodesND $8500.04$ $7345.89$ $4$ Nitzschiaepithemioides epithemioidesNICC $14086.18$ $24500.73$ $13$ Nitzschiaepithemioides epithemioidesNIEP $52051.10$ $37543.32$ $12$ NitzschiafrustulumNF $13205.34$ $20836.79$ $16$ NitzschiagrunowiiNGRU $9150.83$ $5819.79$ $8$ NitzschiahungaricaNIH $6869.44$ $10104.02$ $12$ NitzschiahungaricaNIPS $69579.49$ $3585.78$ $11$ NitzschiapusilhNIPS $69579.49$ $3585.78$ $11$ NitzschiapusilhNIPS $69579.49$ $3585.78$ $11$ NitzschiapusilhNIPS $69579.49$ $3585.78$ $11$ NitzschiapusilhNIPS $69579.49$ $3585.78$ $11$ NitzschiapusilhaNIPS $69579.49$ $3585.78$ $11$ NitzschiapusilhaNIPS $69579.49$ $3585.78$	Navicula	orifuga	NDC		28247 65	98071 50	10
NaticularSaturitolaNext $3124.38$ $3010.50$ 10Navicularsp.NS $3124.38$ $30099.34$ 5NitzschialiebetruthiiNILI $8307.35$ $3635.29$ 6Nitzschiaaccedens chilensisNCHI $48925.66$ $38497.14$ $17$ NitzschiaalpinaNIAL $25431.24$ $19047.58$ 7NitzschiaamphibiodesND $8500.04$ $7345.89$ 4Nitzschiacompressa compressaNICC $14086.18$ $24500.73$ 13Nitzschiacompressa compressaNICC $14086.18$ $24500.73$ 13NitzschiagrunowilNF $3205.34$ $20836.79$ 16NitzschiagrunowilNGRU $9150.83$ $5819.79$ 8NitzschiagrunowilNGRU $9150.83$ $5819.79$ 8NitzschiapaleaNHU $9150.83$ $5819.79$ 8NitzschiapaleaNPA $69979.49$ $3585.78$ 11NitzschiapaleaNPA $69979.49$ $3588.78$ 11NitzschiapaleaNIVA $5422.61$ $4662.80$ 7PinnulariabogotensisPB $8636.53$ $17258.04$ 6PinnulariamicrostauronPIM $689274.99$ $13101.88$ 13StauroneisgregoriiSC $26378.85$ $30284.68$ 13StauroneisgregoriiSG $26378.85$ $30284.68$ 13Stauroneisgrego	Navicula	ciliuga	NASA		55199 94	24786.00	19
Narkulasp.1010 + 10 + 305005.543Nitzschiaaccedens chilensisNILI $8307.35$ $3635.29$ 6NitzschiaalpinaNIAL $25431.24$ $19047.58$ 7NitzschiaamphibiodesND $8500.04$ $7345.89$ 4NitzschiaamphibiodesND $8500.04$ $7345.89$ 4Nitzschiacompressa compressaNICC $14086.18$ $24500.73$ 13Nitzschiapithemioides epithemioidesNIEP $52051.10$ $37543.32$ 12NitzschiagrunowiiNGRU $9150.83$ $5819.79$ 8NitzschiagrunowiiNGRU $9150.83$ $5819.79$ 8NitzschiahantzschianaNIH $6869.44$ $10104.02$ 12NitzschiahantzschianaNIH $64909.73$ $28127.99$ 6NitzschiapaleaNPA $64909.73$ $28127.99$ 6NitzschiapusillaNIPS $69579.49$ $35585.78$ 11NitzschiapusillaNIPS $69579.49$ $35585.78$ 11NitzschiagotensisSC $2072.75$ $5$ Rhopalodiawetzelii <td>Navicula</td> <td>sp</td> <td>NS</td> <td></td> <td>13124 38</td> <td>30000 31</td> <td>10</td>	Navicula	sp	NS		13124 38	30000 31	10
Nitzschia         noch dam         NEH         000.05         000.05         000.05         0           Nitzschia         alpina         NIAL         25431.24         19047.58         7           Nitzschia         anphibiodes         ND         8500.04         7345.89         4           Nitzschia         oppressa compressa         NICC         14086.18         24500.73         13           Nitzschia         opithemioides epithemioides         NIEP         52051.10         37543.32         12           Nitzschia         frustulum         NF         13205.34         20836.79         16           Nitzschia         grunowii         NGRU         9150.83         5819.79         8           Nitzschia         hungarica         NIHU         9150.83         5819.79         8           Nitzschia         hungarica         NIHU         9151.94         17046.45         20           Nitzschia         palea         NPA         64909.73         28127.99         6           Nitzschia         pusilla         NIPS         93585.78         11           Nitzschia         valdeostata         NIPA         5422.61         4662.80         7           Pinnularia <td< td=""><td>Nitzschia</td><td>sp. liehetruthii</td><td>NILI</td><td></td><td>8307 35</td><td>3635 29</td><td>6</td></td<>	Nitzschia	sp. liehetruthii	NILI		8307 35	3635 29	6
Nitzschia         alpina         NIAL         4052.50         597.14         17           Nitzschia         alpina         NIAL         25431.24         19047.58         7           Nitzschia         amphibiodes         NID         8500.04         7345.89         4           Nitzschia         compressa compressa         NICC         14086.18         24500.73         13           Nitzschia         epithemioides epithemioides         NIEP         52051.10         37543.32         12           Nitzschia         frustulum         NF         13205.34         20836.79         16           Nitzschia         grunowii         NGRU         9150.83         5819.79         8           Nitzschia         hantzschiana         NIH         6869.44         10104.02         12           Nitzschia         palea         NPA         64909.73         28127.99         6           Nitzschia         pusilla         NIPS         69579.49         3585.78         11           Nitzschia         pusilla         NIVA         5422.61         4662.80         7           Pinnularia         microstauron         PIM         6689.21         22072.75         5           Ropalodia	Nitzschia	accedens chilensis	NCHI		48025 66	3033.23	17
NutschiaappliaNRL2441.241904.357NitzschiaamphibiodesND8500.047345.894Nitzschiaepithemioides epithemioidesNIEP52051.1037543.3212NitzschiafrustulumNF13205.3420836.7916NitzschiagrunowiiNGRU9150.835819.798NitzschiagrunowiiNIH6869.4410104.0212NitzschiahantzschianaNIH6869.4410104.0212NitzschiapaleaNPA64909.7328127.996NitzschiapaleaNIPS69579.4935585.7811NitzschiapaleaNIPS69579.4935585.7811NitzschiapusillaNIPS69579.4935585.7811NitzschiapusillaNIPS69579.4935585.7811NitzschiapusillaNIPS69579.4935585.7811NitzschiapusillaNIPS69579.4935585.7811NitzschiavaldecostataNIVA5422.614662.807PinnulariamicrostauronPIM6689.2122072.755RhopalodiawetzeliiSC26378.8530284.6813StauroneisgregoriiSG26378.8530284.6813StauroneisgregoriiSTAW2128.9518691.3213StauroneisshthurstensisSB10397.726982.387	Nitzschia	aluina	NIAI		4052J.00 25421 24	100/7 59	7
Nitzschia         anipinuous         ND         500.04         134.53         4           Nitzschia         compressa compressa         NICC         14086.18         24500.73         13           Nitzschia         epithemioides epithemioides         NIEP         52051.10         37543.32         12           Nitzschia         frustulum         NF         13205.34         20836.79         16           Nitzschia         grunowii         NGRU         9150.83         5819.79         8           Nitzschia         hantzschiana         NIH         6869.44         10104.02         12           Nitzschia         hungarica         NIHU         9519.94         17046.45         20           Nitzschia         palea         NPA         64909.73         28127.99         6           Nitzschia         pusilla         NIPS         69579.49         35585.78         11           Nitzschia         valdecostata         NIVA         542.261         4662.80         7           Pinnularia         microstauron         PIM         6689.21         2027.75         5           Rhopalodia         wetzelii         RHWE         24527.57         27391.25         14           Stauroneis<	Nitzschia	amphibiodos	ND		25451.24 8500.04	7345.80	1
Nitzschia         Compression Compression         Nucc         14000-10         24000-13         15           Nitzschia         epithemioides pithemioides         NIEP         52051.10         37543.32         12           Nitzschia         frustulum         NF         13205.34         20836.79         16           Nitzschia         grunowii         NGRU         9150.83         5819.79         8           Nitzschia         hantzschiana         NIH         6869.44         10104.02         12           Nitzschia         hantzschiana         NIHU         9519.94         17046.45         20           Nitzschia         palea         NPA         64909.73         28127.99         6           Nitzschia         pusilla         NIPS         69579.49         35585.78         11           Nitzschia         pusilla         NIVA         5422.61         4662.80         7           Pinnularia         bogtensis         PB         8636.53         17258.04         6           Pinnularia         bicrostauron         PIM         6689.21         2072.75         5           Rhopalodia         wetzeli         RHWE         24527.57         27391.25         14           Staurone	Nitzschia	compressa compressa	NICC		1/086 18	24500 73	12
Nitzschia         Epithemiolides epintemiolides         NE         35,031,10         37,353,22         12           Nitzschia         frustulum         NF         13205,34         2083,679         16           Nitzschia         grunowii         NGRU         9150,83         5819,79         8           Nitzschia         hantzschiana         NIH         6869,44         10104,02         12           Nitzschia         hungarica         NIHU         9519,94         17046,45         20           Nitzschia         palea         NPA         64909,73         28127,99         6           Nitzschia         pusilla         NIPS         69579,49         35585,78         11           Nitzschia         valdecostata         NIVA         5422,61         4662,80         7           Pinnularia         bogotensis         PB         8636,53         17258,04         6           Pinnularia         microstauron         PIMI         6689,21         22072,75         5           Rhopalodia         wetzelii         RHWE         24527,57         27391,25         14           Scaliopleura         peisonis         SG         26378,85         30284,68         13           Stauroneis <td>Nitzschia</td> <td>opithomioidos opithomioidos</td> <td>NIED</td> <td></td> <td>52051 10</td> <td>24500.75</td> <td>13</td>	Nitzschia	opithomioidos opithomioidos	NIED		52051 10	24500.75	13
Intestina         Internation         Intestina         Intestina         Description         Description <thdescription< th=""> <thdescription< th=""> <thde< td=""><td>Nitzschia</td><td>frustulum</td><td>NE</td><td></td><td>12205 24</td><td>20836 70</td><td>16</td></thde<></thdescription<></thdescription<>	Nitzschia	frustulum	NE		12205 24	20836 70	16
MitschiagrunownNetwork3130-333013.733NitzschiahantzschianaNIH689.4410104.0212NitzschiahungaricaNIHU9519.9417046.4520NitzschiapaleaNPA64909.7328127.996NitzschiapusillaNIPS69579.4935585.7811NitzschiavaldecostataNIVA5422.614662.807PinnulariabogotensisPB8636.5317258.046PinnulariamicrostauronPIMI6689.2122072.755RhopalodiawetzeliiRHWE24527.5727391.2514ScoliopleurapeisonisSCPE14800.9913101.8813StauroneisgregoriiSG26378.8530284.6813Stauroneisspecies (obtusa?)SSP10391.231275.464SurirellaoregonicaSO18356.9535103.414SurirellawetzeliiSUSP1010.541994.346	Nitzschia	arunowii	NCPU		0150 82	5810 70	10
NitzschiaInitizeInitizeInitizeInitizeInitizeNitzschiapaleaNIHU $9519.94$ 17046.4520NitzschiapaleaNPA $64909.73$ $28127.99$ 6NitzschiapusillaNIPS $69579.49$ $3585.78$ 11NitzschiavaldecostataNIVA $5422.61$ $4662.80$ 7PinnulariabogotensisPB $8636.53$ 17258.046PinnulariamicrostauronPIMI $6689.21$ $22072.75$ 5RhopalodiawetzeliiRHWE $24527.57$ $27391.25$ 14ScoliopleurapeisonisSCPE14800.9913101.8813StauroneisgregoriiSG $26378.85$ $30284.68$ 13Stauroneisspecies (obtusa?)SSP10391.231275.464StauroneisvislouchiiSTAW $21298.95$ 18691.3213SurirellaoregonicaSO18356.9535103.414SurirellawetzeliiSUSP4010.541994.346	Nitzschia	hantzschiana	NIH		6869 11	1010/ 02	12
NitzschiaInfiguraNife $5313.54$ $11040.43$ $20$ NitzschiapaleaNPA $64909.73$ $28127.99$ $6$ NitzschiapusillaNIPS $69579.49$ $35585.78$ $11$ NitzschiavaldecostataNIVA $5422.61$ $4662.80$ $7$ PinnulariabogotensisPB $8636.53$ $17258.04$ $6$ PinnulariamicrostauronPIMI $6689.21$ $22072.75$ $5$ RhopalodiawetzeliiRHWE $24527.57$ $27391.25$ $14$ ScoliopleurapeisonisSCPE $14800.99$ $13101.88$ $13$ StauroneisgregoriiSG $26378.85$ $30284.68$ $13$ Stauroneisspecies (obtusa?)SSP $10391.23$ $1275.46$ $4$ StauroneiswislouchiiSTAW $21298.95$ $18691.32$ $13$ SurirellaoregonicaSO $18356.95$ $35103.41$ $4$ SurirellasellaSUSE $7995.52$ $9242.72$ $19$ SurirellawetzeliiSUWE $4010.54$ $1994.34$ $6$	Nitzschia	hungarica	NIHU		0510.04	17046 45	20
NitzschiaparaNTA04505.7.32012.7.530NitzschiapusillaNIPS69579.4935585.7811NitzschiavaldecostataNIVA5422.614662.807PinnulariabogotensisPB8636.5317258.046PinnulariamicrostauronPIMI6689.2122072.755RhopalodiawetzeliiRHWE24527.5727391.2514ScoliopleurapeisonisSCPE14800.9913101.8813StauroneisgregoriiSG26378.8530284.6813StauroneisbathurstensisSB10397.726982.387Stauroneisspecies (obtusa?)SSP10391.231275.464SurirellaoregonicaSO18356.9535103.414SurirellasellaSUSP4010.541994.346SurirellawetzeliiSUWE19125.0214219.4621	Nitzschia	nalia	NDA		6/000 73	28127.00	6
NitzschiaplasmaNITS0537134335363.7611NitzschiavaldecostataNIVA5422.614662.807PinnulariabogotensisPB8636.5317258.046PinnulariamicrostauronPIMI6689.2122072.755RhopalodiawetzeliiRHWE24527.5727391.2514ScoliopleurapeisonisSCPE14800.9913101.8813StauroneisgregoriiSG26378.8530284.6813StauroneisbathurstensisSB10397.726982.387Stauroneisspecies (obtusa?)SSP10391.231275.464StauroneiswislouchiiSTAW21298.9518691.3213SurirellaoregonicaSUSE7995.529242.7219Surirellasp.SUSP4010.54194.346SurirellawetzeliiSUWE19125.0214219.4621	Nitzschia	pucilla	NIDS		60570 40	25585 78	11
NutzolnaValuetostataNUVA9422.019402.007PinnulariabogotensisPB8636.5317258.046PinnulariamicrostauronPIMI6689.2122072.755RhopalodiawetzeliiRHWE24527.5727391.2514ScoliopleurapeisonisSCPE14800.9913101.8813StauroneisgregoriiSG26378.8530284.6813StauroneisbathurstensisSB10397.726982.387Stauroneisspecies (obtusa?)SSP10391.231275.464StauroneiswislouchiiSTAW21298.9518691.3213SurirellaoregonicaSO18356.9535103.414Surirellasp.SUSP4010.541994.346SurirellawetzeliiSUWE19125.0214219.4621	Nitzschia	valdacostata	NIVA		5499 61	1662 80	7
Initiality         bigotensis         FB         6030.33         17230.04         6           Pinnularia         microstauron         PIMI         6689.21         22072.75         5           Rhopalodia         wetzelii         RHWE         24527.57         27391.25         14           Scoliopleura         peisonis         SCPE         14800.99         13101.88         13           Stauroneis         gregorii         SG         26378.85         30284.68         13           Stauroneis         bathurstensis         SB         10397.72         6982.38         7           Stauroneis         species (obtusa?)         SSP         10391.23         1275.46         4           Stauroneis         wislouchii         STAW         21298.95         18691.32         13           Surirella         oregonica         SO         18356.95         35103.41         4           Surirella         sp.         SUSP         4010.54         1994.34         6           Surirella         wetzelii         SUWE         19125.02         14219.46         21	Dinnularia	bogotonsis	DR		8626 52	17258 0/	6
Initiality       Initiality <td>Dinnularia</td> <td>microstauron</td> <td></td> <td></td> <td>6680 21</td> <td>22072 75</td> <td>5</td>	Dinnularia	microstauron			6680 21	22072 75	5
Initial of the second secon	Phopalodia	wotzolii	DHW/F		94597 57	27301 25	14
Stauroneis         gregorii         SG         26378.85         30284.68         13           Stauroneis         gregorii         SG         26378.85         30284.68         13           Stauroneis         bathurstensis         SB         10397.72         6982.38         7           Stauroneis         species (obtusa?)         SSP         10391.23         1275.46         4           Stauroneis         wislouchii         STAW         21298.95         18691.32         13           Surirella         oregonica         SO         18356.95         35103.41         4           Surirella         sp.         SUSP         4010.54         1994.34         6           Surirella         wetzelii         SUWE         19125.02         14219.46         21	Scolionlaura	neisonis	SCPF		1/800.00	13101.20	13
Staturoneis	Stauroneis	gregorii	SG		26378.85	30284 68	13
Statustics         SD         10397.72         0362.38         7           Stauroneis         species (obtusa?)         SSP         10391.23         1275.46         4           Stauroneis         wislouchii         STAW         21298.95         18691.32         13           Surirella         oregonica         SO         18356.95         35103.41         4           Surirella         sella         SUSE         7995.52         9242.72         19           Surirella         wetzelii         SUWE         19125.02         14219.46         21	Stauroneis	bathurstansis	SR		10307 79	6029 22	7
Stationes     Species (ondsa:)     Str     10391.23     1273.40     4       Stauroneis     wislouchii     STAW     21298.95     18691.32     13       Surirella     oregonica     SO     18356.95     35103.41     4       Surirella     sella     SUSE     7995.52     9242.72     19       Surirella     sp.     SUSP     4010.54     1994.34     6       Surirella     wetzelii     SUWE     19125.02     14219.46     21	Stauroneis	spacias (abtuse?)	dec.		10301.72	1975 /6	Λ
Statistics         Stream         Str	Stauroneis	wislouchii	STAW/		21208 05	18601 22	12
Surirella         sella         SUSE         7995.52         9242.72         19           Surirella         sp.         SUSP         4010.54         1994.34         6           Surirella         wetzelii         SUWE         19125.02         14219.46         21	Surirolla	oregonica	SO		18356.05	35102 41	10
Surirella         sp.         SUSP         4010.54         1994.34         6           Surirella         wetzelii         SUWE         19125.02         14219.46         21	Surirella	salla	SUSE		7005 59	09/19 79	4
Surirella wetzelii SUWE 19125 02 14219 46 21	Surirella	sp	SUSP		1000.02	1004 24	15
	Surirella	wetzelii	SUWE		19125 02	14219.46	21

SERVANT-VILDARY S., RISACHER F., ROUX M. (2002)

RakeRake13600.000985.410774.550RAME7590.0009189.363-1599.363-1599.363WER54510.0001374.528-8604.528HED420400.00015766.8534633.147P33010000.00017438.639-7438.639PUR29550.0001774.068-8214.068HON46744.00015732.725-8992.725CH1520700.00015708.244129.176CAM43590.00017847.662-14257.662CH2420700.0001537.538-13057.588CL2010900.0002103.520-10435.520CL2419900.0002103.520-10435.520CL2419900.0002104.158-214.158PG419270.0003387.559-44557.559PG434510.0003388.2459610.176PG7430000.0003413.168-24557.559PG733910.0001282.317-352.317PG764510.000339.388-2559.88PG77851.001090.177-1548.775PG74350.0001198.148-1659.388PG7585.1001681.489-1659.388PG7485.1001682.377-15780.497PG7485.1001682.377-15780.497PG7585.1001681.489-1659.388PG7485.1001688.3844259.488PG7585.1001068.188.34443173.254PG76 </th <th>Samples</th> <th>Observed Estimated values</th> <th>Residus</th>	Samples	Observed Estimated values	Residus
BA67       13360.000       9850.410       3749.590         VER5       7590.000       9189.363       -1599.363         VER5       45100.000       1314.528       -5804.528         HED4       20400.000       1743.639       -7438.639         PUR2       9550.000       17744.068       -8214.068         BON4       6740.000       15732.725       -8992.725         CH15       20700.000       16336.339       13768.661         CH29       2320.000       15377.588       -14257.662         CH14       30100.000       16335.320       -10435.200         CH20       10600.000       2038.520       -10435.200         CH24       19900.000       22094.158       -2194.158         CH26       40700.000       3154.473       9105.527         PG70       4000.000       1707.711       -13107.711         PG23       451.000       15942.589       -455.559         PG43       4510.000       3791.148       -3401.148         PG72       80.000       3389.824       59610.176         PG73       3910.000       1384.275       -15452.375         PG74       13000.000       3389.824       5959.935		values	
RAM6       7980.000       9180.363       -1599.363         VER5       4510.000       1014.528       -5804.528         HED4       20400.000       1748.639       -7438.639         PUR2       9550.000       17764.068       -8214.068         HON4       6740.000       15732.725       -8992.725         CH15       20700.000       16570.824       4129.176         CAN4       3360.000       1747.662       -14257.662         CH19       2320.000       15377.588       -13057.588         CL20       10600.000       21038.520       -10438.520         CD24       1990.000       21041.85.20       -10438.520         CD24       1990.000       21041.85.20       -11310.711         PG70       4000.000       717.71       -13107.711         PG73       451.000       3327.559       -2457.559         PG43       451.000       338.824       -961.176         PG72       80.000       3339.884       -259.988         PG73       3510.000       12992.77       -1542.77.59         PG76       4100.000       3339.594       14060.406         PG82       77100.000       3339.594       14060.406      <	BA67	13600.000 9850.410	3749.590
VER5       4310.000       10314.528       -3804.328         HED4       2400.000       15768.53       4633.147         P030       10000.000       17438.639       -7438.639         PUR2       9550.000       17764.068       -8214.068         H0N4       6740.000       15732.72       -8992.725         CR15       20700.000       16570.824       4129.176         CAN4       3390.000       1784.682       -14257.662         CHU9       2320.000       15377.588       -13057.588         CL20       10600.000       21038.520       -10438.520         CD24       19900.000       22094.158       -2194.158         CD16       40700.000       3154.473       9105.527         PG70       4000.000       17107.711       -13107.711         PG23       451.000       3791.148       -33401.148         PG44       9270.000       3327.559       -2455.559         PG43       4510.000       3791.148       -33401.148         PG45       3400.000       8339.988       -8259.988         PG72       80.000       8339.984       -2435.168         PG74       350.000       1393.934       14060.406 <t< th=""><th>RAM6</th><th>7590.000 9189.363</th><th>-1599.363</th></t<>	RAM6	7590.000 9189.363	-1599.363
HED4       20400.000       15766.853       4633.47         PU72       9550.000       17743.639       -7438.639         PUR2       9550.000       17743.639       -7438.639         PUR2       9550.000       15702.725       -8992.725         CH15       20700.000       16570.824       4129.176         CAN4       3590.000       17847.662       -14257.662         CH14       30100.000       1536.339       1373.581         CL20       10600.000       21035.520       -10438.520         CD24       19900.000       22094.158       -2194.158         CD16       40700.000       31594.473       9105.527         PG70       4000.000       17107.711       -13107.711         PG23       451.000       1542.589       -15119.589         PG43       9270.000       3382.7559       -2455.755         PG72       80.000       4338.824       59610.176         PG72       80.000       3339.988       +8259.988         PG73       3910.000       1282.317       -8352.317         PG74       350.000       11990.775       -15482.775         PG74       350.000       13939.594       14060.046 <t< th=""><th>VER5</th><th>4510.000 10314.528</th><th>-5804.528</th></t<>	VER5	4510.000 10314.528	-5804.528
PJ30       10000.000       1/438.639       -4438.639         PUR2       9550.000       17764.068       -8214.068         H0N4       6740.000       15732.725       -8992.725         CH15       20700.000       16570.824       4129.176         CAN4       3590.000       17847.662       -14257.662         CH19       2320.000       15377.588       -13057.588         CL20       16600.000       21038.520       -10438.520         CD24       19900.000       2294.158       -2194.158         CD16       40700.000       1594.473       9105.527         PG70       4000.000       1594.473       9105.527         PG71       4000.000       1594.5759       -24557.559         PG43       451.000       3991.148       -33401.148         PG45       34000.000       3613.168       -2413.168         PG72       80.000       8339.988       -8259.988         PG73       3910.000       1262.317       -8352.317         PG74       46000.000       19392.75       -15482.775         PG74       450.000       31939.594       14060.406         PG82       41.900       15822.397       -15780.497	HED4	20400.000 15766.853	4633.147
PUR29550.00017/44.068-52/44.068HON46740.00015732.725-8992.725CH1520700.0001570.8244129.176CAN43590.00017847.662-14257.662CH1430100.00016336.33913763.661CH192320.00015377.588-13057.588CL2010600.00021038.520-10438.520CD241990.00022094.158-2194.158CD1640700.00031594.4739105.527PG704000.00017107.711-13107.711PG23451.00015642.589-15191.589PG419270.0003389.624-24557.559PG434510.00037911.148-33401.148PG449270.0003389.82459610.176PG7280.0008339.988-8259.988PG733910.00012262.317-3552.317PG764510.00031939.59414060.406PG8241.9001582.275-15780.497PG7846000.00031939.59414060.406PG8241.9001582.237-15780.497PG7885.10016881.498-16596.398P11692000.00043336.01648663.984WA: Coefficient de correlation multipleR = 0.68117PG7685.10016881.498-16596.398PG1492000.00043336.01648663.984WA: Coefficient de correlation multipleR = 0.68117PG762500.0004338.01648663.984W	PJ30	10000.000 17438.639	-7438.639
HOR4       6/40.000       15/32.723       -8992.723         CH15       20700.000       16570.824       4129.176         CAN4       3390.000       17847.662       -14257.662         CH04       30100.000       16336.339       13763.661         CH09       23220.000       21038.520       -10438.520         CL20       10660.000       21038.520       -10438.520         CD16       40700.000       31594.473       9105.527         PG70       4000.000       17107.711       -13107.711         PG23       451.000       3782.759       -2455.759         PG43       34000.003       3827.559       -2457.559         PG43       4510.000       37911.148       -33401.148         PG43       34000.000       43389.824       59610.176         PG72       80.000       8339.988       -8259.988         PG73       3910.000       12262.317       -8352.317         PG74       350.000       11990.177       -16740.177         PG78       46000.000       3193.934       14060.406         PG82       41.900       1582.237       -15780.497         PG74       350.000       16881.498       -16596.398 <th>PUR2</th> <th>9550.000 17764.068</th> <th>-8214.068</th>	PUR2	9550.000 17764.068	-8214.068
CH15 $20700.000$ $16370.824$ $4123,176$ CAN4 $3590.000$ $17847.662$ $-14257.662$ CHU4 $30100.000$ $16336.339$ $13763.661$ CHU9 $2220.000$ $15377.588$ $-10357.588$ CL20 $10600.000$ $21038.520$ $-10438.520$ CD24 $19900.000$ $22094.158$ $-2194.158$ CD16 $40700.000$ $11717.711$ $-10438.520$ PG70 $4000.000$ $17107.711$ $-13107.711$ PG23 $451.000$ $15642.589$ $-15191.589$ PG41 $9270.000$ $33827.559$ $-24557.559$ PG43 $4510.000$ $37911.148$ $-3410.148$ PG45 $34000.000$ $43389.824$ $5610.176$ PG70 $80.000$ $8339.988$ $-8259.988$ PG73 $3910.000$ $12202.317$ $-8352.317$ PG76 $4510.000$ $1999.775$ $-15482.775$ PG76 $4510.000$ $1999.775$ $-15482.775$ PG778 $46000.000$ $3139.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG84 $77100.000$ $4132.605$ $2967.395$ PG97 $85.100$ $16881.498$ $-16596.398$ P114 $81000.000$ $41336.016$ $4863.984$ WX: Coefficient de correlation multiple $R = 0.666$ Variance de la variable Na à expliquer $831E+08$ Variance de résidus $5EP$ $5tandard$ error of predictionVariance de résidus $5EP$ $5tandard$ error of prediction </th <th>HON4</th> <th>6740.000 15732.725</th> <th>-8992.725</th>	HON4	6740.000 15732.725	-8992.725
CRN4       3390.000       1744.7662       -14237.602         CHU4       330100.00       16336.339       13763.661         CHU9       2320.000       15377.588       -13057.588         CL20       10600.000       21038.520       -10438.520         CD24       19990.000       2094.158       -2194.158         CD16       40700.000       31594.473       9105.527         PG70       4000.000       17107.711       -13107.711         PG23       451.000       1544.289       -15191.589         PG41       9270.000       33827.559       -24557.559         PG43       451.000       37911.148       -3401.148         PG45       33000.000       43389.824       59610.176         PG72       80.000       3339.88       -8239.988         PG73       3910.000       1399.594       14060.406         PG74       350.000       1199.177       -10740.177         PG75       4510.000       1999.755       -15482.775         PG74       350.000       3139.594       14060.406         PG82       41.900       15822.397       -15780.497         PG76       4510.000       1999.755       15482.775	CHI5	20700.000 16570.824	4129.176
CHU4 $30100.000$ $16336.339$ $1370.568$ CHU9 $2230.000$ $15377.588$ $-10438.520$ CL20 $10600.000$ $21038.520$ $-10438.520$ CD24 $19900.000$ $22094.158$ $-2194.158$ CD16 $40700.000$ $31594.473$ $9105.527$ PG70 $4000.000$ $17107.711$ $-13107.711$ PG23 $451.000$ $15642.589$ $-15191.589$ PG41 $9270.000$ $33827.559$ $-24557.559$ PG43 $4510.000$ $37911.148$ $-33401.148$ PG45 $34000.000$ $4389.824$ $59610.176$ PG72 $80.000$ $8339.988$ $-8259.988$ PG73 $3910.000$ $12262.317$ $-8352.317$ PG76 $4510.000$ $19992.775$ $-15482.775$ PG774 $350.000$ $1090.177$ $-10740.177$ PG78 $46000.000$ $31939.594$ $4060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG77 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $4132.605$ $29967.395$ PG97 $85.100$ $16681.498$ $-16596.398$ P116 $92000.000$ $43336.016$ $48663.984$ P116 $92000.000$ $4336.016$ $83663.98$ Variance de la variable Na à expliquer $8.31E+08$ Variance de la variable Na à expliquer $8.31E+08$ Variance des résidus $5EP$ $5EP$ Variance des résidus $5EP$ $20614.64$ WA-PLS : 2 components, SEP = 19442	CAN4	3590.000 17847.662	-14257.662
CHU9       2320,000       13377.388       -1307.388         CL20       10600.000       21038.520       -10438.520         CD24       19900.000       22094.158       -2194.158         CD16       40700.000       31594.473       9105.527         PG70       4000.000       17107.711       -13107.711         PG23       451.000       3582.759       -24557.559         PG41       9270.000       33827.559       -24557.559         PG43       4510.000       37911.148       -33401.148         PG45       34000.000       4611.168       -2413.168         PG47       103000.000       4613.168       -2413.168         PG72       80.000       839.884       -59610.176         PG73       3910.000       1262.317       -8352.317         PG74       103000.000       4182.775       -15482.775         PG74       350.000       11090.177       -10740.177         PG78       46000.000       3139.3544       14060.406         PG82       41.900       15822.397       -15780.497         PG78       85100       16681.498       -16596.398         P116       92000.000       43336.016       48663.984 <th>CHU4</th> <th>30100.000 16336.339</th> <th>13/63.661</th>	CHU4	30100.000 16336.339	13/63.661
CL2010600.00021038.320-10438.320CD2419900.00022094.158-2194.158CD1640700.00031594.4739105.527PG704000.00017107.711-13107.711PG23451.00015642.589-15191.589PG419270.00033827.559-24557.559PG434510.00036413.168-2413.168PG4534000.00036413.168-2413.168PG47103000.00043389.82459610.176PG7280.0008339.988-8259.988PG733910.00012262.317-8352.317PG764510.00019992.775-15482.755PG74350.00011090.177-10740.177PG7846000.00031393.59414068.406PG8241.90015822.397-15780.497PG7846000.00041385.74639173.254P11481000.0004338.01648663.984P11481000.0004338.01648663.984WA: Coefficient de correlation multiple $\mathbf{R} = 0.8117$ $\mathbf{R}^2 = 0.66$ Kariance de la variable Na à expliquer8.31E+08Variance de la variable Na à expliquer8.31E+08Variance des résidus $\leq 25E + 508$ Ecart-type des résidus $\leq 25E + 508$ </th <th>CHU9</th> <th>2320.000 15377.588</th> <th>-13057.588</th>	CHU9	2320.000 15377.588	-13057.588
CD241990.00022094.138 $-2194.138$ CD1640700.00031594.4739105.527PG704000.00017107.711 $-13107.711$ PG23451.00015642.589 $-15191.589$ PG419270.00033827.559 $-24557.559$ PG434510.00037911.148 $-33401.148$ PG4534000.00043389.82459610.176PG7080.0008339.988 $-8259.988$ PG733910.00012262.317 $-8352.317$ PG764510.00019992.775 $-15482.775$ PG74350.00011090.177 $-10740.177$ PG7846000.0003193.59414060.406PG8241.90015822.397 $-15780.497$ PG7485.10016881.498 $-16596.398$ PI1692000.00043336.01648663.984WA: Coefficient de correlation multiple $R = 0.8117$ $R^2 = 0.66$ Variance de la variable Na à expliquer8.31E+08Variance des résidusSEP Standard error of prediction20614.64WA-PLS : 2 components, SEP = 19442 $R = 0.89$	CL20	10600.000 21038.520	-10438.520
CD16 $40/00.000$ $3194.473$ $9105.527$ PG70 $4000.000$ $17107.711$ $-13107.711$ PG23 $451.000$ $15642.589$ $-15191.589$ PG41 $9270.000$ $33827.559$ $-24557.559$ PG43 $4510.000$ $37911.148$ $-33401.148$ PG45 $34000.000$ $4388.824$ $59610.176$ PG72 $80.000$ $8339.988$ $-8259.988$ PG73 $3910.000$ $12262.317$ $-8352.317$ PG76 $4510.000$ $19992.775$ $-15482.775$ PG74 $350.000$ $11090.177$ $-10740.177$ PG78 $46000.000$ $31939.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG78 $46000.000$ $4132.605$ $29967.395$ PG97 $8.5100$ $16881.498$ $-16596.398$ P114 $81000.000$ $4132.6746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ WA: Coefficient de correlation multiple $\mathbf{R} = 0.8117$ $\mathbf{R}^2 = 0.666$ Variance des résidus $s SEP$ Standard error ofVariance des résidus $s SEP$ Standard error ofpredictionVariance des résidus $s SEP$ Standard error of $reficion$ Variance des résidus $s SEP$ Standard error of $reficion$ VAPLS : 2 components, SEP = 19442 $\mathbf{R} = 0.89$	CD24	19900.000 22094.158	-2194.158
$\begin{array}{ccccccc} & 4000.000 & 17107.711 & -13107.711 \\ & 4000.000 & 17107.711 & -13107.711 \\ & PG23 & 451.000 & 15642.589 & -15191.589 \\ & PG44 & 9270.000 & 33827.559 & -24557.559 \\ & PG43 & 4510.000 & 37911.148 & -33401.148 \\ & PG45 & 34000.000 & 36413.168 & -2413.168 \\ & PG47 & 103000.000 & 43389.824 & 59610.176 \\ & PG72 & 80.000 & 8339.988 & -8259.988 \\ & PG73 & 3910.000 & 12262.317 & -8352.317 \\ & PG76 & 4510.000 & 1992.775 & -15482.775 \\ & PG74 & 350.000 & 11090.177 & -10740.177 \\ & PG78 & 46000.000 & 31939.594 & 14060.406 \\ & PG82 & 41.900 & 15822.397 & -15780.497 \\ & PG78 & 46000.000 & 41326.65 & 29967.395 \\ & PG79 & 85.100 & 16681.498 & -16596.398 \\ & P114 & 81000.000 & 41326.746 & 39173.254 \\ & P116 & 92000.000 & 4336.016 & 48663.984 \\ & WA: Coefficient de correlation multiple & R = 0.8117 \\ & R^2 = 0.66 \\ & Variance des résidus & 4.23E+08 \\ & Ecart-type des résidus = SEP Standard error of \\ & prediction & 20614.64 \\ & WA-PLS : 2 components, SEP = 19442 & R = 0.89 \\ \end{array}$	CD16	40700.000 31594.473	9105.527
P223       431.000       15042.389       -15191.389         PG41       9270.000       33827.559       -24557.559         PG43       4510.000       37911.148       -33401.148         PG45       34000.000       36413.168       -2413.168         PG47       103000.000       4389.824       59610.176         PG72       80.000       8339.988       -8259.986         PG73       3910.000       12262.317       -8352.317         PG76       4510.000       19992.775       -15482.775         PG74       350.000       11090.177       -10740.177         PG78       46000.000       31939.594       14060.406         PG82       41.900       15822.397       -15780.497         PG84       77100.000       47132.605       29967.395         PG97       85.100       16681.498       -16596.398         P114       81000.000       41336.016       48663.984         P116       92000.000       43336.016       48663.984         Variance de résidus       425E+08       Ecart-type des résidus = SEP Standard error of prediction       20614.64         WA-PLS : 2 components, SEP = 19442       R = 0.89       20614.64	PG70	4000.000 1/10/./11	-13107.711
PG41 $9270.000$ $33827.559$ $-24357.559$ PG43 $4510.000$ $37911.148$ $-33401.148$ PG45 $34000.000$ $36413.168$ $-2413.168$ PG7 $103000.000$ $43389.824$ $59610.176$ PG72 $80.000$ $8339.988$ $-8259.988$ PG73 $3910.000$ $12262.317$ $-8352.317$ PG76 $4510.000$ $1999.775$ $-15482.775$ PG74 $350.000$ $11090.177$ $-10740.177$ PG78 $46000.000$ $3193.954$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG78 $46000.000$ $4132.605$ $299967.395$ PG97 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $41826.746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ WA: Coefficient de correlation multiple $R = 0.8117$ R <sup>2</sup> = 0.66Variance de la variable Na à expliquer $8.31E+08$ Variance des résidus $5EP$ Standard error ofprediction $20614.64$ $WA-PLS: 2$ components, $SEP = 19442$ $R = 0.89$	PG23	451.000 15642.589	-15191.589
PG434310.000 $3/911.148$ $-33401.148$ PG45 $34000.000$ $36413.168$ $-2413.168$ PG47 $103000.000$ $43389.824$ $59610.176$ PG72 $80.000$ $8339.988$ $-8259.988$ PG73 $3910.000$ $12262.317$ $-8352.317$ PG76 $4510.000$ $19992.775$ $-15482.775$ PG77PG74 $350.000$ $11999.2775$ $-15482.775$ PG74 $46000.000$ $31939.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG84 $77100.000$ $47132.605$ $29967.395$ PG97 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $41826.746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ Variance de la variable Na à expliquer $\mathbf{R}^2 = 0.66$ Variance des résidus $\mathbf{SEP}$ $\mathbf{Standard}$ Variance des résidus $\mathbf{SEP}$ $\mathbf{Standard}$ Variance des résidus $\mathbf{SEP}$ $\mathbf{SEP}$ Variance des résidus $\mathbf{SEP}$ $\mathbf{R} = 0.89$	PG41	9270.000 33827.559	-24557.559
PG45 $34000,000$ $36413.168$ $-2413.168$ PG47 $103000,000$ $43389.824$ $59610.176$ PG72 $80.000$ $8339.988$ $8259.988$ PG73 $3910.000$ $12262.317$ $-8352.317$ PG76 $4510.000$ $19992.775$ $-15482.775$ PG74 $350.000$ $11090.177$ $-10740.177$ PG78 $46000.000$ $31939.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG78 $85.100$ $16681.498$ $-16596.398$ PG97 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $41326.746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ WA: Coefficient de correlation multiple $\mathbf{R} = 0.8117$ $\mathbf{R}^2 = 0.66$ Variance de la variable Na à expliquer $\mathbf{8.31E+08}$ Variance des résidus $4.25E+08$ Ecart-type des résidus $4.25E+08$ Ecart-type des résidus $5.2P = 19442$ $\mathbf{R} = 0.89$	PG43	4510.000 37911.148	-33401.148
Pd47103000.00043388.824 $39610.176$ PG72 $80.000$ $8339.988$ $-8259.988$ PG73 $3910.000$ $12262.317$ $-8352.317$ PG76 $4510.000$ $19992.775$ $-15482.775$ PG74 $350.000$ $11090.177$ $-10740.177$ PG78 $46000.000$ $31939.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG84 $77100.000$ $47132.605$ $29967.395$ PG97 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $41826.746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ WA: Coefficient de correlation multiple $\mathbf{R} = 0.8117$ $\mathbf{R}^2 = 0.66$ Variance de la variable Na à expliquer $\mathbf{831E+08}$ Variance des résidus $4.25E+08$ Ecart-type des résidus = SEP Standard error of prediction $20614.64$ WA-PLS : 2 components, SEP = 19442 $\mathbf{R} = 0.89$	PG45	34000.000 36413.168	-2413.168
PG72 $80.000$ $8339.988$ $-8239.988$ PG73 $3910.000$ $12262.317$ $8332.317$ PG76 $4510.000$ $19992.775$ $-15482.775$ PG74 $350.000$ $11090.177$ $-10740.177$ PG78 $46000.000$ $31939.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG84 $77100.000$ $47132.605$ $29967.395$ PG97 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $41826.746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ WA: Coefficient de correlation multiple $R = 0.8117$ $R^2 = 0.66$ Variance de la variable Na à expliquer $8.31E+08$ Variance des résidus $4.25E+08$ Ecart-type des résidus = SEP Standard error of prediction $20614.64$ WA-PLS : 2 components, SEP = 19442 $R = 0.89$	PG47	103000.000 43389.824	59610.176
PG73 $3910.000$ $12262.317$ $-8352.317$ PG74 $4510.000$ $19992.775$ $-15482.775$ PG74 $350.000$ $11090.177$ $-10740.177$ PG78 $46000.000$ $31939.594$ $14060.406$ PG82 $41.900$ $15822.397$ $-15780.497$ PG97 $85.100$ $16681.498$ $-16596.398$ P114 $81000.000$ $41326.746$ $39173.254$ P116 $92000.000$ $43336.016$ $48663.984$ WA: Coefficient de correlation multiple $\mathbf{R} = 0.8117$ $\mathbf{R}^2 = 0.66$ Variance de la variable Na à expliquer $\mathbf{8.31E+08}$ Variance de la variable Na à expliquer $\mathbf{8.31E+08}$ Variance de s résidus $\mathbf{4.25E+068}$ Ecart-type des résidus = SEP Standard error ofprediction $20614.64$ WA-PLS : 2 components, SEP = 19442 $\mathbf{R} = 0.89$	PG72	80.000 8339.988	-8259.988
PG764310.00019992.775-13482.775PG74350.00011090.177-10740.177PG7846000.00031939.59414060.406PG8241.90015822.397-15780.497PG8477100.00047132.60529967.395PG9785.10016681.498-16596.398P11481000.00041826.74639173.254P11692000.00043336.01648663.984WA: Coefficient de correlation multiple $\mathbf{R} = 0.8117$ $\mathbf{R}^2 = 0.66$ Variance de la variable Na à expliquer8.31E+08Variance des résidus4.25E+08Ecart-type des résidus = SEP Standard error of prediction20614.64WA-PLS : 2 components, SEP = 19442 $\mathbf{R} = 0.89$	PG73	3910.000 12262.317	-8352.317
PG74       330.000       11090.177       -10740.177         PG78       46000.000       31939.594       14060.406         PG82       41.900       15822.397       -15780.497         PG84       77100.000       47132.605       29967.395         PG97       85.100       16681.498       -16596.398         P114       81000.000       41826.746       39173.254         P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117       R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08       Variance des résidus       4.25E+08         Ecart-type des résidus       = SEP       Standard error of prediction       20614.64         WA-PLS : 2 components, SEP = 19442       R = 0.89       1942       R = 0.89	PG76	4510.000 19992.775	-15482.775
PG78       40000.000       31933.394       14060.406         PG82       41.900       15822.397       -15780.497         PG84       77100.000       47132.605       29967.395         PG97       85.100       16681.498       -16596.398         P114       81000.000       41826.746       39173.254         P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117       R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08       Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64       WA-PLS : 2 components, SEP = 19442       R = 0.89	PG74	350.000 11090.177	-10/40.1//
PG82       41.900       13822.397       -15780.497         PG84       77100.000       47132.605       29967.395         PG97       85.100       16681.498       -16596.398         P114       81000.000       41826.746       39173.254         P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117       R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08       Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64       WA-PLS : 2 components, SEP = 19442       R = 0.89	PG78	46000.000 31939.594	14060.406
PG84       7/100.000       4/132.005       29967.395         PG97       85.100       16681.498       -16596.398         P114       81000.000       41826.746       39173.254         P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117       R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08       Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64       WA-PLS : 2 components, SEP = 19442       R = 0.89	PG82	41.900 15822.397	-15/80.49/
PG97       85.100       16681.498       -16396.398         P114       81000.000       41826.746       39173.254         P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117       R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08       Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64       WA-PLS : 2 components, SEP = 19442       R = 0.89	PG84	//100.000 4/132.605	29967.395
P114       81000.000       41826.746       39173.234         P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117       R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08         Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64         WA-PLS : 2 components, SEP = 19442       R = 0.89	PG97	85.100 16681.498	-16596.398
P116       92000.000       43336.016       48663.984         WA: Coefficient de correlation multiple       R = 0.8117         R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08         Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64         WA-PLS : 2 components, SEP = 19442       R = 0.89	P114	81000.000 41826.746	39173.254
WA: Coefficient de correlation multiple       R = 0.8117         R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer       8.31E+08         Variance des résidus       4.25E+08         Ecart-type des résidus = SEP Standard error of prediction       20614.64         WA-PLS : 2 components, SEP = 19442       R = 0.89	P116	92000.000 43336.016	48663.984
R <sup>2</sup> = 0.66         Variance de la variable Na à expliquer         8.31E+08         Variance des résidus         4.25E+08         Ecart-type des résidus = SEP Standard error of prediction         20614.64         WA-PLS : 2 components, SEP = 19442         R = 0.89		WA: Coefficient de correlation multiple	R = 0.8117
Variance de la variable Na à expliquer8.31E+08Variance des résidus4.25E+08Ecart-type des résidus = SEP Standard error of prediction20614.64WA-PLS : 2 components, SEP = 19442R = 0.89			$R^2 = 0.66$
Variance des résidus4.25E+08Ecart-type des résidus = SEP Standard error of prediction20614.64WA-PLS : 2 components, SEP = 19442R = 0.89		Variance de la variable Na à expliquer	8.31E+08
Ecart-type des résidus = SEP Standard error of prediction20614.64WA-PLS : 2 components, SEP = 19442R = 0.89		Variance des résidus	4.25E+08
prediction         20614.64           WA-PLS : 2 components, SEP = 19442         R = 0.89		Ecart-type des résidus = SEP Standard error o	f
WA-PLS : 2 components, SEP = 19442 <b>R</b> = 0.89		prediction	20614.64
		WA-PLS : 2 components, SEP = 19442	<b>R</b> = <b>0.89</b>
$R^2 = 0.80$			$R^2 = 0.80$
r = 0.7428			r = 0.7428

	K	+ (mg/l)		Salinity (mg/l)						
codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE	codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE			
	1207.12	925.77	6		29884.19	34429.63	6			
	1511 25	2143 75	7		40795 95	55567 99	7			
	1166 47	600 42	6		31176.80	15906 11	6			
	1100.47	38/15 / 8	17		193735 /1	99822 04	17			
	4957.00	4103 14	7		120700.41	110307 /1	7			
	2860.24	1447 47	5		79079 30	110557.41	5			
	1995 90	2406 20	0		24062 11	90209 52	0			
	1023.20	9147 55	9 91		50262.22	27055 72	9			
	2011.12	2147.33	21		JUJUJ.23 44776 91	20254 55	21			
	6951.01	5887 35	Э Л		64038.06	55436.06	5 1			
	350.89	795.83	8		10419 22	27379 88	8			
	923.81	743 64	7		23819 22	17230 23	7			
	1071.23	1196.17	13		30254.42	33905.07	13			
	4631.94	4764.32	7		71689.87	48995.69	7			
	1464.69	419.25	5		24453.56	13426.39	5			
	2142.83	4228.09	11		53828.97	103370.23	11			
	2866.36	3155.15	5		82480.13	89476.72	5			
	4810.78	4884.37	5		116897.13	109656.84	5			
	2635.38	2740.90	7		81122.17	88503.35	7			
	3477.70	3933.59	9		110897.58	122287.35	9			
	18.46	53.66	4		627.79	1512.63	4			
	3312.03	4629.13	4		86242.18	120386.45	4			
	288.91	1278.51	7		6799.33	32799.58	7			
	705.25	1446.05	11		21127.10	46977.82	11			
	2131.09	3435.69	14		66718.63	103268.48	14			
	5849.73	4612.14	4		157232.81	121336.81	4			
	1264.47	2378.74	20		30542.75	62613.84	20			
	369.78	1523.23	5		12920.90	54997.88	5			
	1541.78	3682.57	9		23503.87	61560.73	9			
	3238.18	4138.50	25		87662.23	107368.46	25			
	6070.26	5953.59	7		63646.28	50895.54	7			
	1407.68	1534.89	5		38474.49	44953.49	5			
	400.11	569.66	7		10917.80	15497.66	7			
	3065.24	3031.91	19		86752.94	87606.20	19			
	5914.08	4163.34	18		167355.16	106348.25	18			
	1732.16	4169.37	5		41231.30	94724.01	5			
	983.03	547.96	6		28432.38	12116.65	6			
	5219.24	4429.53	17		148070.84	116343.82	17			
	2867.35	2681.80	7		76748.71	59978.92	7			
	800.00	800.00	4		26391.02	22403.08	4			
	1313.00 5416.01	4292 07	10		42439.33	112644.00	15			
	20/0 82	4203.07	16		137143.11	64602 72	12			
	12/19/03	614 71	8		90077 37	17198 71	8			
	1199 49	2455.08	12		23025 32	33768 41	19			
	2176.01	3286.98	20		32533 97	53575.68	20			
	5508.15	2199.18	6		190057.30	81420.38	6			
	7761.39	4335.74	11		212075.11	108571.73	11			
	586.82	652.96	7		17276.65	14251.57	7			
	2315.01	4612.97	6		30407.47	57011.78	6			
	1085.02	1823.82	5		21220.58	63804.37	5			
	2710.03	3007.51	14		74965.75	82850.99	14			
	1708.77	1435.23	13		47373.04	40977.83	13			
	3107.44	3915.96	13		82300.65	94715.86	13			
	1148.16	801.92	7		33961.54	23164.52	7			
	2769.21	435.99	4		35521.27	4497.50	4			
	3094.82	1616.26	13		65771.20	53788.02	13			
	2472.09	4863.69	4		57857.84	110435.44	4			
	972.41	1242.84	19		25807.73	28999.84	19			
	461.16	249.10	6		12834.27	6515.62	6			
	5394.96	5449.09	21		69143.63	51302.73	21			

Observed	Fstimated values	RESIDUS	Observed	Fstimated values	RESIDUS
values	Listimated values	RESID CO	values	Listimated values	REDID CD
1700.000	1190.587	509.413	45335.000	32671.533	12663.467
1030.000	1100.207	-70.207	27658.000	30878.086	-3220.086
308.000	1204.500	-896.500	14716.000	34239.449	-19523.449
2100.000	2508.819	-408.819	67099.000	52600.191	14498.809
1020.000	2161.026	-1141.026	31139.000	55710.945	-24571.945
1720.000	2335.447	-615.447	32785.000	57165.410	-24380.410
989.000	2062.277	-1073.277	21392.000	50968.250	-29576.250
2500.000	2163.798	336.202	69439.000	53829.586	15609.414
212.000	3499.940	-3287.940	11440.000	59072.313	-47632.313
12800.000	4922.541	7877.459	119261.000	59508.641	59752.359
1800.000	2976.847	-1176.847	11377.000	50853.691	-39476.691
2850.000	3194.134	-344.134	36285.000	65473.848	-29188.848
2110.000	3085.000	-975.000	59166.000	68947.984	-9781.984
4260.000	3810.768	449.232	120357.000	96830.477	23526.523
532.000	2218.201	-1686.201	12787.000	54032.887	-41245.887
43.000	1913.913	-1870.913	1475.000	48721.523	-47246.523
1020.000	3764.239	-2744.239	28564.000	103717.336	-75153.336
500.000	4202.771	-3702.771	13961.000	115942.891	-101981.891
3950.000	4206.625	-256.625	103267.000	111875.195	-8608.195
14200.000	4819.732	9380.268	324141.000	132470.984	191670.016
16.500	1244.068	-1227.568	644.000	26697.957	-26053.957
399.000	2304.313	-1905.313	12189.000	40753.777	-28564.777
579.000	2433.364	-1854.364	14421.000	62155.457	-47734.457
48.100	1482.448	-1434.349	1542.000	35173.887	-33631.887
5000.000	3514.777	1485.223	144099.000	97949.422	46149.578
4.420	1703.133	-1698.713	195.000	48293.891	-48098.891
6450.000	5043.687	1406.313	225344.000	142971.688	82372.313
12.600	2056.703	-2044.103	402.000	51884.598	-51482.598
9810.000	4639.320	5170.680	255230.000	127894.984	127335.016
7390.000	4677.638	2712.362	267366.000	131722.109	135643.891
VA: Coefficient de correlatio	n multiple	R = 0.7559	WA: Coefficient de correlation	multiple	R = 0.8022
		$R^2 = 0.57$			$R^2 = 0.57$
/ariance de la variable K à e	xpliquer	1.37E+07	Variance de la variable Salinit	té à expliquer	7.69E+09
/ariance des résidus		8377185	Variance des résidus		4.07E+09
Ecart-type des résidus = Si	EP Standard error of	ſ	Ecart-type des résidus = SE	P Standard error o	of
prediction		2894.337	prediction		63814.21
VA-PLS : 1 component			WA-PLS : 2 components, SEP	<i>= 62130</i>	<b>R</b> = <b>0.8849</b>
					$R^2 = 0.78$
					r = 0.71

Alkalinity meq/l				Mg++ (mg/l)			
codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE	codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE
	1 92	9.49	6		955 59	202 62	ß
	4.65	2.42	0		200.00	302.83	0
	4.90	0.49	ß		202.67	450.00	6
	4.01	6.85	17		034 53	1001 13	17
	8 77	5 79	7		111/ 11	1001.15	7
	19.57	12 10	5		609 18	351.06	5
	7.83	5.10	9		310.19	837.84	9
	8.45	5.60	21		559.31	507.79	21
	12.83	9.73	9		436.95	583.08	9
	21.54	13.74	4		976.78	925.04	4
	4.00	1.65	8		96.89	159.22	8
	7.93	3.34	7		251.37	105.36	7
	5.76	2.04	13		279.62	315.07	13
	18.34	14.90	7		811.12	681.13	7
	7.05	3.65	5		267.74	218.89	5
	5.14	6.02	11		526.02	1045.61	11
	5.67	2.19	5		699.55	774.64	5
	9.92	6.88	5		787.64	1328.67	5
	8.16	5.01	7		515.12	666.24	7
	6.86	6.51	9		848.94	1063.83	9
	0.85	0.76	4		7.73	16.18	4
	3.37	3.08	4		863.02	1201.80	4
	3.0Z	2.67	11		67.10 170.09	310.00	/
	4.80	1.77	11		170.92	310.38	11
	5.02	4.47	14		519.20 1485.00	002.00 1200 18	14
	5.22 6.80	5.04	4 20		261 44	571 33	4 20
	2.24	2 49	5		105.26	426 55	5
	6.04	8.87	9		260.79	643.18	9
	7.45	7.39	25		759.29	1050.31	25
	18.84	14.61	7		901.39	884.16	7
	4.86	2.03	5		375.59	403.90	5
	2.69	1.74	7		126.12	239.36	7
	7.77	5.70	19		662.75	805.69	19
	12.08	8.31	18		1351.85	1118.83	18
	4.95	6.07	5		434.87	1015.02	5
	4.95	1.81	6		382.49	145.35	6
	26.48	68.77	17		1251.83	1133.28	17
	14.67	6.52	7		592.65	676.83	7
	5.26	4.32	4		203.84	283.87	4
	5.70	2.34	13		325.96	480.09	13
	9.98	7.00	12		1212.33	1150.28	12
	0.90	0.71	10		370.29	024.00	10
	6.25	4.09	0 19		274.00	214.97	0 19
	0.23	8 70	20		287.81	506 76	20
	21.86	66 12	6		1081 25	490 77	6
	24.73	62.45	11		1840.32	1214.60	11
	4.14	3.21	7		101.32	112.42	7
	8.67	11.32	6		392.05	680.48	6
	6.50	4.37	5		171.03	493.83	5
	6.55	3.88	14		451.37	747.87	14
	6.41	2.45	13		427.65	422.44	13
	7.24	5.49	13		703.45	958.14	13
	6.11	3.14	7		293.92	281.30	7
	343.05	63.68	4		4.85	30.72	4
	190.15	167.55	13		353.31	500.26	13
	6.71	6.78	4		609.79	1186.10	4
	5.62	3.01	19		253.96	304.65	19
	4.34	0.92	6		137.36	63.04	6
	16.68	13.32	21		854.15	817.65	21

	Observed values	<b>Estimated values</b>	RESIDUS	Observed values	Estimated values	RESIDUS
	4.880	5.629	-0.749	605.000	386.463	218.537
	2.930	5.367	-2.437	326.000	385.820	-59.820
	7.250	5.943	1.307	262.000	416.459	-154.459
	10.000	9.825	0.175	649.000	585.043	63.957
	7.220	7.909	-0.689	210.000	542.507	-332.507
	7.800	8.281	-0.481	275.000	568.564	-293.564
	4.400	7.968	-3.568	140.000	525.182	-385.182
	8.050	9.280	-1.230	1140.000	570.364	569.636
	2.150	33.674	-31.524	34.000	577.680	-543.680
	35.000	17.005	17.995	1900.000	772.366	1127.634
	11.400	11.218	0.182	53.000	506.815	-453.815
	355.000	211.978	143.022	0.146	342.099	-341.953
	12.900	21.075	-8.175	382.000	593.984	-211.984
	31.500	85.025	-53.525	914.000	721.933	192.067
	5.090	6.856	-1.766	89.900	506.458	-416.558
	1.510	5.726	-4.216	11.000	459.126	-448.126
	4.250	15.215	-10.965	265.000	856.742	-591.742
	3.210	10.760	-7.550	132.000	933.127	-801.127
	9.080	10.065	-0.985	110.000	883.374	-773.374
	22.900	12.948	9.952	3470.000	1097.798	2372.202
	3.300	6.202	-2.902	20.200	246.155	-225.955
	5.130	9.467	-4.337	138.000	427.681	-289.681
	3.850	17.223	-13.373	132.000	497.498	-365.498
	4.200	6.356	-2.156	55.400	320.698	-265.298
	9.420	8.664	0.756	1200.000	793.382	406.618
	0.523	4.055	-3.532	3.210	398.847	-395.637
	9.700	20.107	-10.407	1250.000	1129.245	120.755
	1.360	7.315	-5.955	7.410	446.102	-438.692
	7.680	12.414	-4.734	2550.000	1071.368	1478.632
	13.100	15.249	-2.149	2080.000	1080.861	999.139
WA: Coeff	icient de correlatio	n multiple	<b>R</b> = <b>0.9460</b>	WA: Coefficient de correlation	n multiple	R = 0.7260
			$R^2 = 0.89$			$R^2 = 0.53$
Variance d	e la variable Alcal	inité à expliquer	3929.396	Variance de la variable Mg à c	expliquer	724201.7
Variance d	les résidus		847.3527	Variance des résidus		478831.7
Ecart-type	des résidus = Si	EP Standard error o	f	Ecart-type des résidus = SE	P Standard error o	f
prediction			29.10932	prediction		691.9767
WA-PLS :	2 components, SE	P = 62.26	<b>R</b> = 0.9661	WA-PLS : 2 components, SEP	= <b>8</b> 57	<b>R</b> = <b>0.8437</b>
			$R^2 = 0.93$			$R^2 = 0.71$
			r = 0.29			r = 0.43

	Ca++ (mg/l)			рН			
codes	OPTIMUM	TOLERANCE	FREQUENCE	codes	OPTIMUM	TOLERANCE	FREQUENCE
	420.70	482.06	6		8.86	0.38	6
	450.58	515.59	7		8.20	0.59	7
	768.25	499.24	6		8.22	0.10	6
	1137.33	899.67	17		7.93	0.60	17
	1267.27	1008.59	7		7.98	0.42	7
	425 29	380.82	5		8 75	0.73	5
	391.49	746 98	9		8 70	1.04	g
	618.80	470.62	21		8 57	0.34	91
	224 58	917 98	0		8.02	0.63	0
	444.50	217.20	5		8.92	1.01	5 A
	140.26	253.17	1		8.49	0.50	1 Q
	247.14	401 10	8 7		0.42	0.59	7
	459 79	401.15	12		0.04	0.38	12
	452.72	430.30	13		0.34	0.42	15
	JJ9.39 794.69	447.41	/ F		0.07	0.41	1
	724.02	005.01	3 11		9.07	0.95	5
	533.64	965.21	11		8.63	0.81	11
	803.03	755.73	5		8.13	0.55	5
	1193.96	1020.58	5		7.62	0.40	5
	533.20	800.76	7		8.44	0.74	7
	1065.66	1146.64	9		8.50	1.00	9
	12.50	21.53	4		9.50	0.35	4
	809.48	1118.84	4		8.40	1.06	4
	73.82	289.37	7		8.06	1.02	7
	243.75	422.97	11		8.08	0.32	11
	591.31	906.16	14		8.80	0.93	14
	1428.50	1117.31	4		7.98	1.25	4
	244.79	552.35	20		7.94	1.02	20
	134.18	511.41	5		8.59	0.76	5
	211.87	503.34	9		8.12	1.12	9
	840.19	1005.36	25		8.27	0.70	25
	388.21	304.07	7		8.89	0.51	7
	570.76	548.83	5		8.26	0.16	5
	231.90	395.92	7		8.83	0.61	7
	871.76	823.57	19		8.05	0.51	19
	1445.32	1030.71	18		7.73	0.58	18
	434.01	895.48	5		8.33	0.69	5
	927.70	514.60	6		8.35	0.27	6
	1300.92	1111.42	17		7.97	0.74	17
	341.29	691.18	7		8.42	0.30	7
	185.37	311.36	4		8.80	0.39	4
	474.54	610.27	13		8.24	0.39	13
	1419.81	1033.84	12		7.71	0.56	12
	464.34	570.43	16		8.34	0.84	16
	573.43	428.60	8		8.84	0.66	8
	296.95	389.41	12		7.81	0.82	12
	292.24	448.64	20		9.25	0.84	20
	1428.95	617.70	6		7.80	0.79	6
	1917.29	1060.52	11		7.75	1.00	11
	147.19	147.26	7		8.93	0.41	7
	233.75	375.63	6		8.33	0.58	6
	238.36	590.28	5		8.89	1.08	5
	788.48	737.93	14		7.96	0.53	14
	648.31	518.15	13		8.32	0.41	13
	858.91	897.79	13		8.20	0.03	13
	329.35	257.23			8.79	0.35	1
	8.93	41.58	4		10.32	0.34	4
	181.14	400.04	13		9.44	1.01	13
	603.60	1030.00	4		8.24	0.55	4
	409.90	307.47	19		0.31	0.39	19
	200.00	200.30	0 21		0.20	0.29	0 91
	525.02	307.10	£1		0.01	0.00	£1

Observed	<b>Estimated values</b>	RESIDUS	Observed	<b>Estimated values</b>	RESIDUS
values			values		
1200.000	809.649	390.351	8.180	8.358	-0.178
1370.000	870.791	499.209	8.150	8.352	-0.202
218.000	903.878	-685.878	8.720	8.359	0.361
521.000	591.004	-70.004	8.500	8.563	-0.063
400.000	655.317	-255.317	8.850	8.416	0.434
465.000	636.018	-171.018	8.520	8.450	0.070
200.000	609.795	-409.795	9.050	8.548	0.502
1340.000	639.713	700.287	8.280	8.536	-0.256
65.000	430.164	-365.164	9.180	8.889	0.291
730.000	433.077	296.923	8.800	8.755	0.045
200.000	440.114	-240.114	10.200	8.663	1.537
2.490	216.707	-214.217	10.380	9.532	0.848
103.000	447.579	-344.579	8.520	8.380	0.140
260.000	684.664	-424.664	8.400	8.632	-0.232
200.000	569.280	-369.280	8.420	8.452	-0.032
24.500	479.207	-454.707	9.350	8.683	0.667
360.000	971.286	-611.286	8.520	8.138	0.382
200.000	1084.233	-884.233	8.050	7.988	0.062
1100.000	1053.445	46.555	7.400	7.983	-0.583
3100.000	1202.642	1897.358	7.200	7.991	-0.791
50.900	247.577	-196.677	6.950	7.984	-1.034
190.000	411.541	-221.541	8.150	8.374	-0.224
200.000	610.692	-410.692	8.350	8.269	0.081
32.700	383.106	-350.406	7.850	8.273	-0.423
1500.000	944.818	555.182	7.910	8.078	-0.168
6.100	451.328	-445.228	9.620	8.939	0.681
1650.000	1237.152	412.848	7.460	7.972	-0.512
12.500	489.792	-477.292	8.920	8.305	0.615
2380.000	1147.982	1232.018	6.950	8.025	-1.075
2500.000	1192.603	1307.397	7.500	8.033	-0.533
VA: Coefficient de correlation	n multiple	<b>R</b> = 0.7652	WA: Coefficient de correlation	n multiple	<b>R</b> = <b>0.8598</b>
	•	$R^2 = 0.58$		-	$R^2 = 0.74$
/ariance de la variable Ca à e	xpliquer	679352.3	Variance de la variable pH à c	expliquer	0.6853808
ariance des résidus		395522.8	Variance des résidus		0.3132309
Ccart-type des résidus = SE	P Standard error of	r	Ecart-type des résidus = SE	P Standard error o	f
orediction		628.906	prediction		0.5596703
VA-PLS : 2 components, SEP	= 723	<b>R</b> = <b>0.8873</b>	WA-PLS : 5 components. SEP	<i>P</i> = <b>0</b> .5	<b>R</b> = 0.9910
•		$R^2 = 0.78$	•		$R^2 = 0.98$
		r = 0.60			r = 0.71

V E P V

Water Depth (cm)				SO4 (mg/l)			
codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE	codes	OPTIMUM	TOLERANCE	FREQUENCE
	95.07	17.94	0		2070 09	1110.00	C
	25.67	17.34	0		3076.92	1110.96	6
	87.37	29.17			1080.00	1485.70	
	20.11	7.40	0		3344.37 9507.65	2000.90	0
	57 50	39.49	17		2397.03	1202 17	7
	97.91	21.68	5		5429.08	13/6 65	5
	30.23	28.93	9		1630 14	1850.29	9
	45.72	37.44	21		6809.94	6514.59	21
	21.36	15.29	9		7057.99	8108.55	9
	16.13	2.09	4		14551.30	12160.47	4
	40.15	34.56	8		305.49	687.34	8
	64.47	39.29	7		3305.58	1521.19	7
	43.53	35.40	13		2286.84	2091.15	13
	23.03	13.65	7		9398.68	9766.64	7
	26.08	16.73	5		4148.31	1100.49	5
	69.60	39.02	11		1008.27	2799.18	11
	36.56	32.41	5		12/6.23	12/6.24	5
	92.14 61 50	23.81	J 7		3118 10	2558 73	J 7
	53.22	39.57	9		1688.03	2099 76	9
	35.69	31.76	4		31.01	37.12	4
	53.12	39.40	4		1100.61	1524.19	4
	21.08	9.86	7		433.10	1332.44	7
	25.40	20.08	11		413.01	682.88	11
	39.88	35.71	14		1972.44	2097.02	14
	69.70	39.02	4		2235.71	1622.06	4
	24.70	20.03	20		2131.15	3533.38	20
	23.56	16.49	5		238.03	770.94	5
	23.35	18.01	9		2616.59	7012.43	9
	51.25 16.24	39.10 2.16	20 7		2074.23	2103.08 11252 57	20 7
	21 40	2.10	5		1473 46	1854 03	5
	75.99	35.93	7		616.91	1375.98	7
	51.35	39.00	19		1853.26	1681.74	19
	77.21	36.07	18		2854.64	1770.38	18
	81.46	33.76	5		425.92	687.68	5
	53.12	33.05	6		3561.97	1428.39	6
	71.78	37.41	17		2617.36	1841.58	17
	25.12	18.42	7		5723.60	986.38	7
	17.46	2.50	4		4223.57	2051.06	4
	39.06	33.72	13		1241.51	1528.40	13
	28.60	25 54	16		249.00	5523 68	12
	62.55	38.67	8		4066.46	1230.23	8
	36.40	31.84	12		2703.45	5066.40	12
	25.50	25.97	20		5042.76	6079.36	20
	96.22	14.93	6		3008.68	1053.60	6
	85.99	30.13	11		3096.90	1026.16	11
	31.44	31.72	7		3878.28	2092.21	7
	22.34	15.71	6		4307.58	9477.35	6
	23.34	19.95	5		1708.62	2017.53	5
	62.35	39.77	14		1219.75	1320.91	14
	41.56	34.99	13		3528.86	4783.96	13
	40.42	36.04	7		7900.61	6144.01	7
	49.76	6.80	4		3593.35	622.02	4
	38.05	19.86	13		4569.58	2230.61	13
	40.39	34.87	4		594.93	776.31	4
	36.60	30.16	19		2281.74	2523.52	19
	24.39	17.26	6		417.85	605.88	6
	27.40	27.15	21		13693.55	11044.40	21

	Observed values	<b>Estimated values</b>	RESIDUS	Observed values	<b>Estimated values</b>	RESIDUS
	30.000	48.048	-18.048	5700.000	3467.345	2232.655
	30.000	51.388	-21.388	3070.000	3516.977	-446.977
	100.000	53.718	46.282	2300.000	3491.296	-1191.296
	20.000	42.499	-22.499	17900.000	7575.381	10324.619
	100.000	48.317	51.683	4320.000	5001.739	-681.739
	100.000	45.509	54,491	4660.000	5550.414	-890.414
	20.000	43.393	-23.393	2600.000	5734.399	-3134.399
	20.000	46.190	-26.190	4080.000	6263.509	-2183.509
	15.000	32.839	-17.839	5070.000	6937.772	-1867.772
	15.000	23.971	-8.971	26600.000	11548.886	15051.114
	15.000	29.545	-14.545	4360.000	5405.575	-1045.575
	50.000	42.387	7.613	3710.000	4295.603	-585.603
	20.000	32.489	-12.489	5980.000	5253.148	726.852
	20.000	50.686	-30.686	6440.000	3957.202	2482.798
	20.000	51.707	-31.707	265.000	2787.123	-2522.123
	100.000	63.598	36.402	72.000	1061.000	-989.000
	20.000	58.745	-38.745	465.000	2484.437	-2019.437
	100.000	67.860	32.140	250.000	2533.728	-2283.728
	100.000	64.911	35.089	1270.000	2736.314	-1466.314
	100.000	70.009	29.991	2460.000	2559.531	-99.531
	20.000	26.840	-6.840	105.000	2165.341	-2060.341
	20.000	33.344	-13.344	302.000	4186.065	-3884.065
	20.000	41.007	-21.007	305.000	2404.631	-2099.631
	20.000	34.938	-14.938	130.000	2193.485	-2063.485
	20.000	55.110	-35.110	2920.000	2207.240	712.760
	20.000	41.971	-21.971	14.000	1402.441	-1388.441
	100.000	70.063	29.937	3370.000	2777.558	592.442
	20.000	36.766	-16.766	4.990	1957.775	-1952.785
	100.000	66.741	33.259	3240.000	2404.016	835.984
	100.000	66.259	33.741	3180.000	2383.299	796.701
WA: Coefficien	nt de correlatio	n multiple	<b>R</b> = 0.7413	WA: Coefficient de correlat	ion multiple	<b>R</b> = <b>0.8500</b>
		-	$R^2 = 0.55$		•	$R^2 = 0.72$
Variance de la	variable Tran	che d'eau à expliquer	1397.806	Variance de la variable SO	4 à expliquer	2.94E+07
Variance des r	ésidus		836.4213	Variance des résidus		1.41E+07
Ecart-type des	s résidus = Sl	EP Standard error of	f	Ecart-type des résidus = S	EP Standard error o	f
prediction			28.92095	prediction		3750.238
WA-PLS : 2 co	mponents, SEl	P = 41	<b>R = 0.8648</b>	WA-PLS : 5 components, S	<b>EP</b> = 3537	R = 0.9917
			$R^2 = 0.74$			$R^2 = 0.98$
			r = 0.41			r = 0.76

CI- (mg/l)				Lithium (mg/l)			
codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE	codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE
	14000 11	00451.01	0		50.45	111.05	0
	14993.11	20451.81	6		58.45	111.05	6
	23639.56	33514.01	7		166.63	262.07	7
	15569.22	7225.07	6		34.52	11.72	6
	72787.46	60379.97	17		490.04	456.92	17
	72700.10	65890.75	7		489.38	481.26	7
	37967.34	27712.32	5		107.90	88.53	5
	19267.58	48614.77	9		147.96	406.09	9
	24130.00	20875.09	21		117.22	153.79	21
	19628.20	16419.76	9		48.22	42.67	9
	23215.80	20889.64	4		15.76	12.78	4
	5807.30	16248.26	8		31.95	81.62	8
	10938.92	9193.09	7		36.21	26.45	7
	16042.57	20076.66	13		77.18	144.18	13
	33282.25	23423.09	7		70.51	76.11	7
	10540.70	8016.47	5		15.35	13.76	5
	31637.72	61943.40	11		231.40	479.69	11
	49128.13	53852.89	5		329.55	366.88	5
	69660.26	65760.14	5		574.26	562.33	5
	46050.76	53391.00	7		238.19	328.66	7
	65349.60	72704.67	9		403.86	455.04	9
	286.94	864.62	4		1.86	5.67	4
	51973.35	72683.44	4		391.45	547.51	4
	3568.51	19498.65	7		21.70	142.62	7
	12221.71	27972.67	11		78.36	169.18	11
	38783.57	62138.53	14		234.57	392.79	14
	94506.10	73370.53	4		684.15	545.30	4
	16210.28	37029.64	20		87.80	254.26	20
	7456.06	32517.56	5		40.63	177.12	5
	11373.54	34209.47	9		48.48	199.27	9
	51249.82	64592.64	25		354.27	488.55	25
	23962.93	19259.33	7		29.68	21.89	7
	22025.46	26822.35	5		133.68	191.39	5
	5919.56	8371.95	7		27.65	36.36	7
	50956.84	52497.13	19		343.67	366.05	19
	98857.86	64366.08	18		643.94	510.25	18
	24428.40	56771.34	5		197.62	482.28	5
	13756.07	6121.92	6		24.21	10.55	6
	86499.48	70530.56	17		549.66	537.87	17
	40356.13	36909.32	7		170.07	337.54	7
	11904.31	12867.56	4		52.48	42.71	4
	24349.91	42594.55	13		131.35	230.65	13
	93201.18	68176.38	12		613.43	500.96	12
	23300.64	38014.12	16		139.97	261.14	16
	13999.22	9801.08	8		33.29	33.36	8
	11111.16	17226.60	12		50.05	105.49	12
	14437.85	30423.25	20		70.78	201.00	20
	112249.90	49845.83	6		568.25	252.74	6
	125270.74	67082.82	11		860.92	551.53	11
	6736.76	7800.39	7		37.07	33.10	7
	13728.14	28535.13	6		41.14	128.41	6
	10814.46	38052.54	5		56.56	207.94	5
	44325.84	49602.85	14		309.45	356.24	14
	25510.28	24406.43	13		152.19	183.42	13
	48898.94	56756.38	13		362.75	457.35	13
	13299.95	9791.01	7		66.50	48.26	7
	4654.01	1288.13	4		54.07	8.05	4
	27943.74	35632.36	13		122.35	156.06	13
	34312.12	66225.71	4		279.98	563.92	4
	13291.57	16382.25	19		52.33	118.69	19
	7145.56	3654.46	6		43.42	24.42	6
	28007.31	24131.16	21		92.79	173.32	21

Observed values	<b>Estimated values</b>	RESIDUS	Observed values	<b>ESTIMATIONS</b>	and <b>RESIDUS</b>
22000.000	16382.306	5617.694	25,500	49.242	-23.742
13900.000	15258.410	-1358.410	11.800	37.755	-25.955
6460.000	17306.295	-10846.295	36.500	52.718	-16.218
24600.000	24605.609	-5.609	122.000	115.566	6.434
14500.000	29036.055	-14536.055	37.000	158.964	-121.964
15300.000	29399.520	-14099.520	109.000	164.771	-55.771
10300.000	25460.934	-15160.934	47.000	129.877	-82.877
38700.000	26699.959	12000.041	176.000	137.293	38.707
2250.000	27770.922	-25520.922	19.500	130.516	-111.016
44000.000	24015.320	19984.680	22.500	61.906	-39.406
1970.000	25116.932	-23146.932	2.750	130.094	-127.344
4540.000	27219.348	-22679.348	54.100	137.076	-82.976
29500.000	35892.352	-6392.352	86.800	175.138	-88.338
65000.000	51764.414	13235.586	196.000	301.824	-105.824
7240.000	30018.563	-22778.563	42.500	192.471	-149.971
699.000	28448.877	-27749.877	4.800	202.218	-197.418
16700.000	60321.617	-43621.617	117.000	399.189	-282.189
8060.000	67867.867	-59807.867	52.500	453.979	-401.479
61400.000	65206.918	-3806.918	500.000	442.065	57.935
194000.000	77789.156	116210.844	1640.000	522.698	1117.302
90.200	13854.553	-13764.353	0.507	72.611	-72.104
6750.000	20275.330	-13525.330	42.500	101.736	-59.236
8310.000	34917.531	-26607.531	57.500	221.704	-164.204
600.000	19036.701	-18436.701	3.890	111.431	-107.541
85900.000	57354.555	28545.445	600.000	381.853	218.147
63.200	27945.895	-27882.695	0.347	176.855	-176.508
134000.000	83734.867	50265.133	675.000	536.504	138.496
150.000	29453.436	-29303.436	1.180	190.823	-189.643
154000.000	75271.078	78728.922	1160.000	503.956	656.044
158000.000	77381.148	80618.852	861.000	509.584	351.416
VA: Coefficient de correlatio	n multiple	<b>R= 0.8132</b>	WA: Coefficient de correlation	n multiple	<b>R</b> = <b>0.77</b>
		$R^2 = 0.66$			$R^2 = 0.59$
ariance de la variable Cl à e	expliquer	2.80E+09	Variance de la variable Li à e	xpliquer	149337.2
/ariance des résidus		1.42E+09	Variance des résidus		79096.27
Ccart-type des résidus = Sl	EP Standard error o	f	Ecart-type des résidus = SE	EP Standard error	of
prediction		37698.6	prediction		281.2406
VA-PLS : 2 components, SEI	P = 35726	<b>R</b> = <b>0.8823</b>	WA-PLS : 2 components, SEP	<b>P</b> = 266	<b>R</b> = <b>0.8739</b>
		$R^2 = 0.79$			$R^2 = 0.76$
					r = 0.68

V H P V

Boron (mg/l)				Si (mg/l)			
codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE	codes	<b>OPTIMUM</b>	TOLERANCE	FREQUENCE
	84.66	79.84	6		30.98	3.13	6
	108 74	139.96	7		23.06	7 45	7
	96.98	59.88	6		34 23	13.01	6
	309.41	252 11	17		28.32	7 54	17
	900 97	276 56	7		20.32	6.99	7
	200.37	270.30	7 E		20.07	11.25	F
	374.34	237.73	5		34.03	11.55	5
	128.41	227.70	9		32.39	13.05	9
	208.90	166.22	21		28.86	5.78	21
	265.04	285.04	9		27.54	7.02	9
	523.20	439.22	4		24.42	6.88	4
	22.06	50.54	8		40.50	11.41	8
	141.29	62.67	7		29.33	6.44	7
	96.48	92.71	13		35.18	12.38	13
	422.29	375.90	7		33.12	10.08	7
	122.73	35.56	5		27.18	8.94	5
	135.42	272.93	11		35.71	7.47	11
	169.76	182.32	5		30.16	4.95	5
	330.69	324.31	5		23.93	8.64	5
	217.52	171.69	7		31.63	6.02	7
	241.04	271.12	9		24.72	7.73	9
	1.60	3.06	4		20.53	8.87	4
	184.32	256.95	4		20.77	5.84	4
	22.74	84.07	7		28.97	7.48	7
	45.66	97.59	11		39.74	13.48	11
	136.34	213.21	14		23.63	7.74	14
	328.98	256.78	4		18.42	5.28	4
	107.12	171.49	20		33.42	9.42	20
	25.78	107.02	5		25.09	5.73	5
	111.57	268.04	9		28.51	7.73	9
	231.93	275.46	25		26.87	7.25	25
	465.68	440.31	7		30.04	12.48	7
	94.53	105.20	5		32.15	2.98	5
	30.12	53.74	7		31.05	9.75	7
	218.55	207.91	19		28.89	7.11	19
	416.32	267.21	18		28.74	8.61	18
	112.65	277.83	5		27.55	8.81	5
	113.56	31.92	6		32.60	7.49	6
	382.55	300.96	17		35.51	27.28	17
	321.62	183.27	7		33.82	4.47	7
	87.60	109.44	4		32.01	0.79	4
	94.87	135.43	13		42.62	13.73	13
	363.02	282.07	12		26.53	7.73	12
	139.56	222.38	16		32.68	11.94	16
	141.03	75.15	8		29.13	9.85	8
	114.33	193.31	12		34.67	11.24	12
	174.68	247.15	20		25.35	8.96	20
	347.25	140.06	6		38.52	24.37	6
	509.18	272.62	11		31.86	25.16	11
	65.00	92.58	7		29.33	5.77	7
	169.14	343.71	6		33.55	14.67	6
	83.02	131.40	5		24.26	5.81	5
	183.99	198.35	14		26.58	7.08	14
	144.36	111.20	13		32.49	10.28	13
	203.25	259.98	13		35.19	11.17	13
	128.32	100.06	7		28.40	3.60	7
	139.13	21.03	4		157.05	21.14	4
	275.44	228.50	13		100.98	61.14	13
	160.96	324.66	4		39.52	11.43	4
	90.54	104.74	19		31.12	5.17	19
	28.32	16.29	6		45.05	13.00	6
	421.25	397.04	21		27.18	9.22	21

Observed	E-thursday I and I are	DECIDIC	Observed	F-thursday I and have	DECIDUC
UDSERVEA values	Estimated values	RESIDUS	UDServed values	Estimated values	RESIDUS
150 000	123 807	26 193	25 200	32 419	-7 219
77 000	120.656	-43 656	41 400	32.550	8 850
125 000	128 298	-3 298	28 600	32.431	-3 831
235 000	233 375	1 625	27 500	28 893	-1 393
145 000	194 662	-49 662	26 100	30.078	-3.978
238 000	209 196	28 804	20,600	28 957	-8.357
57.000	192.644	-135.644	31,600	29.424	2,176
250.000	208.042	41.958	34,400	29.419	4.981
13.000	271.104	-258.104	31.400	37.281	-5.881
959.000	384.899	574.101	21.900	29.686	-7.786
147.000	228,941	-81.941	18,700	29,181	-10.481
143.000	256.833	-113.833	161.000	108.663	52.337
263.000	274.761	-11.761	32.500	35.529	-3.029
612.000	307.855	304.145	45.600	58.906	-13.306
29.900	164.081	-134.181	36.400	32.689	3.711
3.490	123.997	-120.507	38.400	34.046	4.354
60.000	265.911	-205.911	31.600	31.744	-0.144
28.400	298.557	-270.157	17.300	28.375	-11.075
290.000	297.368	-7.368	20.500	28.086	-7.586
944.000	336.567	607.433	31.400	30.057	1.343
0.995	103.283	-102.288	37.200	32.256	4.944
25.500	175.538	-150.038	58.800	34.981	23.819
32.000	179.071	-147.071	32.200	35.390	-3.190
2.920	114.049	-111.129	30.200	33.632	-3.432
320.000	248.693	71.307	34.200	29.630	4.570
0.703	115.891	-115.188	15.900	23.444	-7.544
404.000	349.545	54.455	33.000	32.587	0.413
1.080	149.260	-148.180	22.400	28.209	-5.809
545.000	314.913	230.087	16.800	29.672	-12.872
520.000	324.056	195.944	31.400	30.689	0.711
WA: Coefficient de correlation	on multiple	<b>R</b> = <b>0</b> .7577	WA: Coefficient de correlatio	n multiple	<b>R</b> = 0.9411
	-	$R^2 = 0.57$		•	$R^2 = 0.88$
Variance de la variable B à c	expliquer	66730.07	Variance de la variable Si à e	xpliquer	633.5131
Variance des résidus		41769.64	Variance des résidus		149.972
Ecart-type des résidus = S	EP Standard error o	f	Ecart-type des résidus = S	EP Standard error o	of
prediction		204.3762	prediction		12.24631
WA-PLS : 1 component			WA-PLS : 3 components, SE	P = 16.95	R = 0.9812
-					$R^2 = 0.96$
					r = 0.75

Density							
codes	OPTIMUM	TOLERANCE	FREQUENCE				
	1.02	0.02	6				
	1.03	0.04	7				
	1.02	0.01	6				
	1.08	0.06	17				
	1.08	0.07	7				
	1.05	0.03	5				
	1.02	0.05	9				
	1.04	0.03	21				
	1.05	0.03	9 4				
	1.00	0.02	8				
	1.02	0.01	7				
	1.02	0.02	13				
	1.05	0.03	7				
	1.02	0.01	5				
	1.04	0.07	11				
	1.06	0.06	5				
	1.08	0.07	5				
	1.05	0.06	7				
	1.07	0.08	9				
	1.00	0.00	4				
	1.00	0.08	4 7				
	1.00	0.02	11				
	1.04	0.07	14				
	1.10	0.08	4				
	1.02	0.04	20				
	1.01	0.04	5				
	1.02	0.04	9				
	1.06	0.07	25				
	1.05	0.04	7				
	1.03	0.03	5				
	1.01	0.01	7				
	1.06	0.06	19				
	1.11	0.07	18				
	1.03	0.00	5				
	1.02	0.01	17				
	1.05	0.04	7				
	1.02	0.02	4				
	1.03	0.05	13				
	1.10	0.07	12				
	1.03	0.04	16				
	1.02	0.01	8				
	1.02	0.02	12				
	1.02	0.04	20				
	1.12	0.05	6				
	1.14	0.07	11				
	1.01	0.01	/ 6				
	1.02	0.04	5				
	1.05	0.05	14				
	1.03	0.03	13				
	1.06	0.06	13				
	1.03	0.02	7				
	1.03	0.00	4				
	1.05	0.03	13				
	1.04	0.07	4				
	1.02	0.02	19				
	1.01	0.00	6				

Observed	Estimated values	RESIDUS
values		
1.032	1.023	0.009
1.020	1.022	-0.002
1.010	1.024	-0.014
1.050	1.038	0.012
1.022	1.039	-0.017
1.024	1.040	-0.016
1.015	1.036	-0.021
1.051	1.038	0.013
1.009	1.041	-0.032
1.087	1.043	0.044
1.008	1.035	-0.027
1.029	1.046	-0.017
1.040	1.047	-0.007
1.081	1.065	0.016
1.009	1.037	-0.028
1.001	1.032	-0.031
1.020	1.069	-0.049
1.010	1.077	-0.067
1.073	1.075	-0.002
1.211	1.087	0.124
1.000	1.018	-0.018
1.009	1.028	-0.019
1.010	1.042	-0.032
1.001	1.024	-0.023
1.098	1.065	0.033
1.000	1.032	-0.032
1.147	1.094	0.053
1.000	1.035	-0.035
1.167	1.084	0.083
1.171	1.087	0.084
WA: Coefficient de correlation multiple		<b>R</b> = <b>0.8003</b>
		$R^2 = 0.64$
Variance de la variable Densité à expliquer		3.25E+00
Variance des résidus		1.7
Ecart-type des résidus = S	SEP Standard error o	f
prediction		4.1
WA-PLS : 2 components, SEP = 0.04		R = 0.8827
		$R^2 = 0.78$
		r = 0.70