



Centre de Recherche Public  
**Gabriel Lippmann**

*Freshwater benthic Bacillariophyceae*  
*Norrtälje, Sweden, 29.07-06.08.2004*

**Taxonomical and ecological studies on  
epilithic diatom communities of watercourses  
from Guadeloupe (French Antilles)**

**Luc Ector, Viola Huck & Loïc Tudesque**

**Public Research Center – Gabriel Lippmann, Luxembourg**



DIRECTION REGIONALE DE  
**L'ENVIRONNEMENT**  
GUADELOUPE

# Outline

## Introduction:

Background and objectives

Guadeloupe: Geography and Climatology



## Methods:

Study sites, river sampling

## Results:

Water quality assessment

Floristic inventory of benthic diatom communities

## Prospects:

Clarification of unknown taxa and their autecology

Implementation of a biological indication system  
for watercourses of Guadeloupe

# Background and objectives

## DIREN Guadeloupe

(Regional Environmental Protection Authority):

better knowledge on aquatic ecosystems  
of the islands

water quality surveillance (diatoms  
and macro invertebrates)



2000-2003:

- Bi-annual sampling = **6 campaigns**
- Physical and chemical data

## CREBS Luxembourg

(Environmental and Biotechnologies  
Research Unit):

taxonomic and ecological studies of  
benthic diatom communities



- Biological water quality maps of  
each campaign
  - Diatom Flora Guadeloupe
  - Calibration of autecology of taxa
- ...



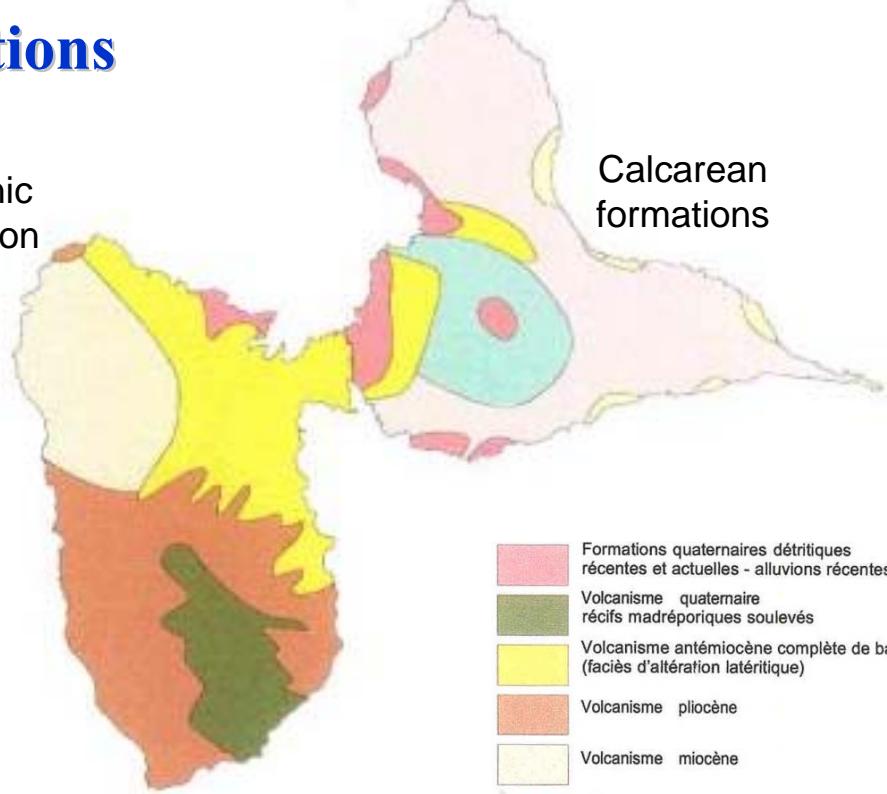
Biological Indication System

# Guadeloupe: Natural Conditions

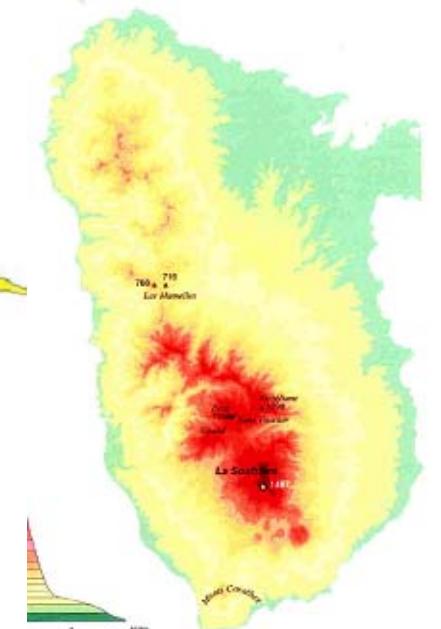
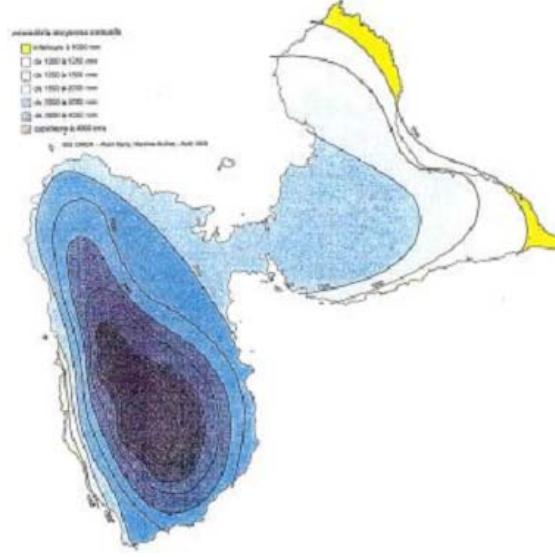
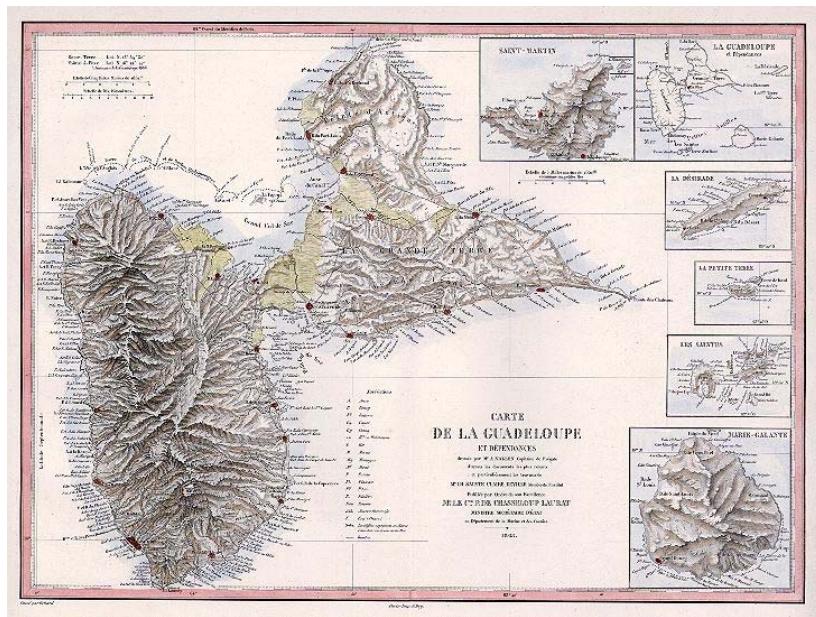


## Volcanic formation

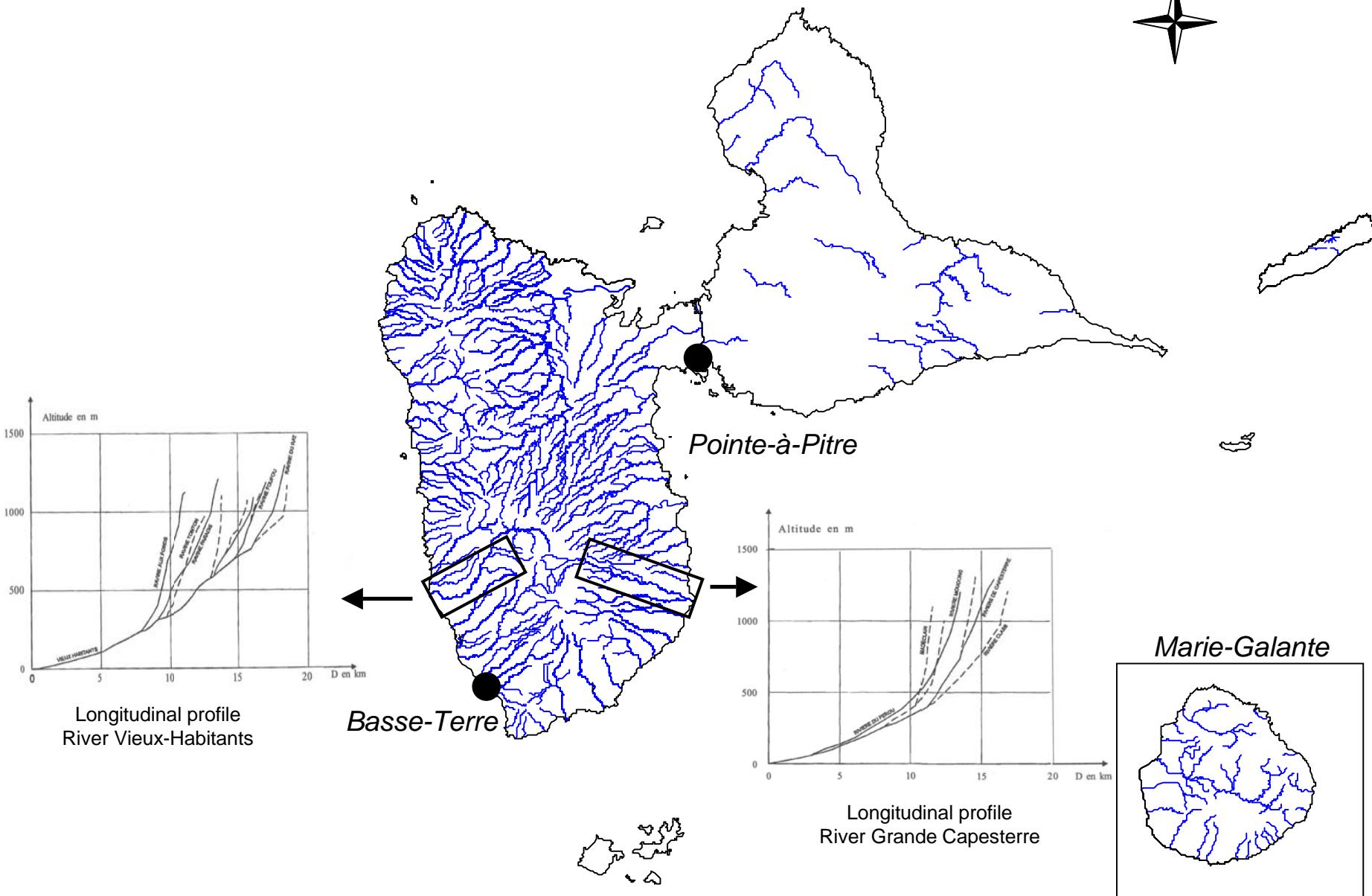
9



## Calcarean formations



# Guadeloupe: Hydrography

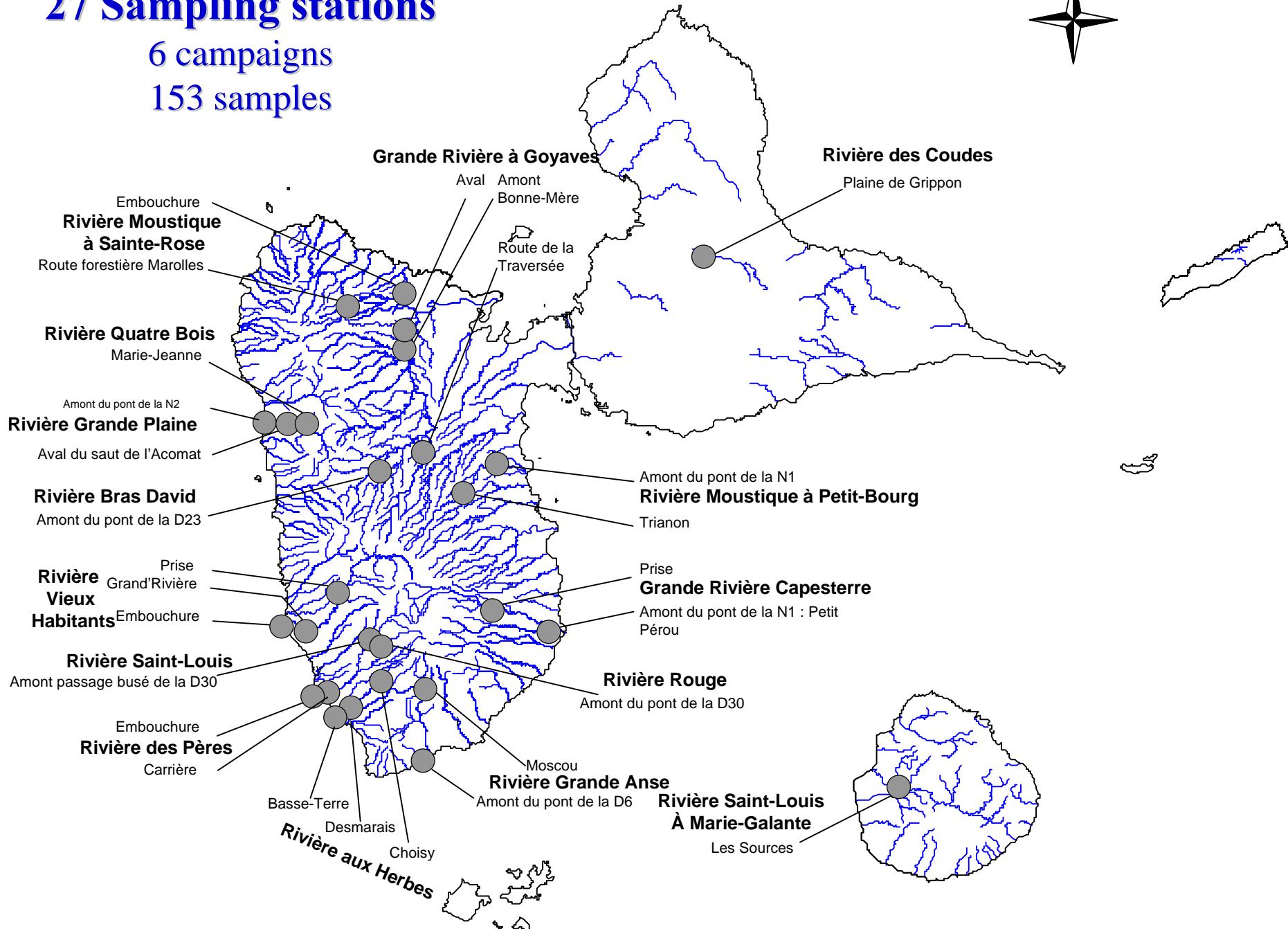


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# 27 Sampling stations

6 campaigns

153 samples



# Floristic Inventory

**153 epilithic samples in rivers**

**262 taxa in 54 genera**  
(all taxa in 46 samples)

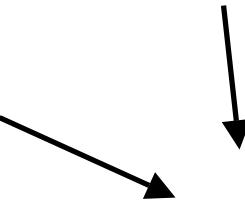
relatively low species richness:  
**7-54** taxa per sample

samples dominated by **1-6** taxa

*Navicula* 39  
*Nitzschia* 38  
*Eunotia* 18  
*Gomphonema* 16  
*Pinnularia* 12

**Bourrelly & Manguin 1952:**

**430 Taxa (100 new):**  
**124** taxa from rivers and cascades  
**306** taxa from lakes, ponds,  
mangroves, on *Sphagnum*, hot  
springs..



**~ 100 taxa in common**

# Water quality

7 OMNIDIA 3

Fichier Edition Menu Aide Inventaires Fenêtres

Analys

N° préparation 39613260803

Date 26/08/2003

Bassin GUADELOUPE 2003

Rivière RIV. DES PÈRES

Site EMBOUCHURE

Code Hydrologique

PK

Température

Code prélèvement

Particularités

NB espèc 42

Effectif 421

Diversité 4.50

Equitabilit 0.83

	Autécologie	Calcul des indices					
IDA	6.2	SH	12.7	IPS	13.9	L&	10.9
EPI-	9.7	RO	13.2	SL	13.2	ID	11.4
IBD	15.9	WA	11.7	DE	14.2	CE	10.7
TDI/10		60.5	%P	15.7			

Trouver <> >>

Graphe IBD

Sommer 2 préparations

Lire un fichier de comptage

Simulation

Créer Modifier

ADCT	11
ADMI	9
AEXG	1
AMMO	2
AMUS	5
ARPT	3
ASHU	12
CBAC	1
CMLF	2
CPLI	37
CTR0	1
DCOT	4
DESP	43
DPCT	1
EEXI	4
EOLI	22
EOMI	13
EOVE	1
FGOU	25
GDEC	61

N° PREP DATE BASSIN GUADELOUPE 2003  
39613260803 26/08/2003 RIVIERE/SITE RIV. DES PÈRES/EMBOUCHURE

Indéterminé Indéterminé R.A.S. Indéterminé ou non précisé  
CODE HYDROLOGIQUE PK  
CODE PRELEVEMENT TEMPERATURE  
PARTICULARITES

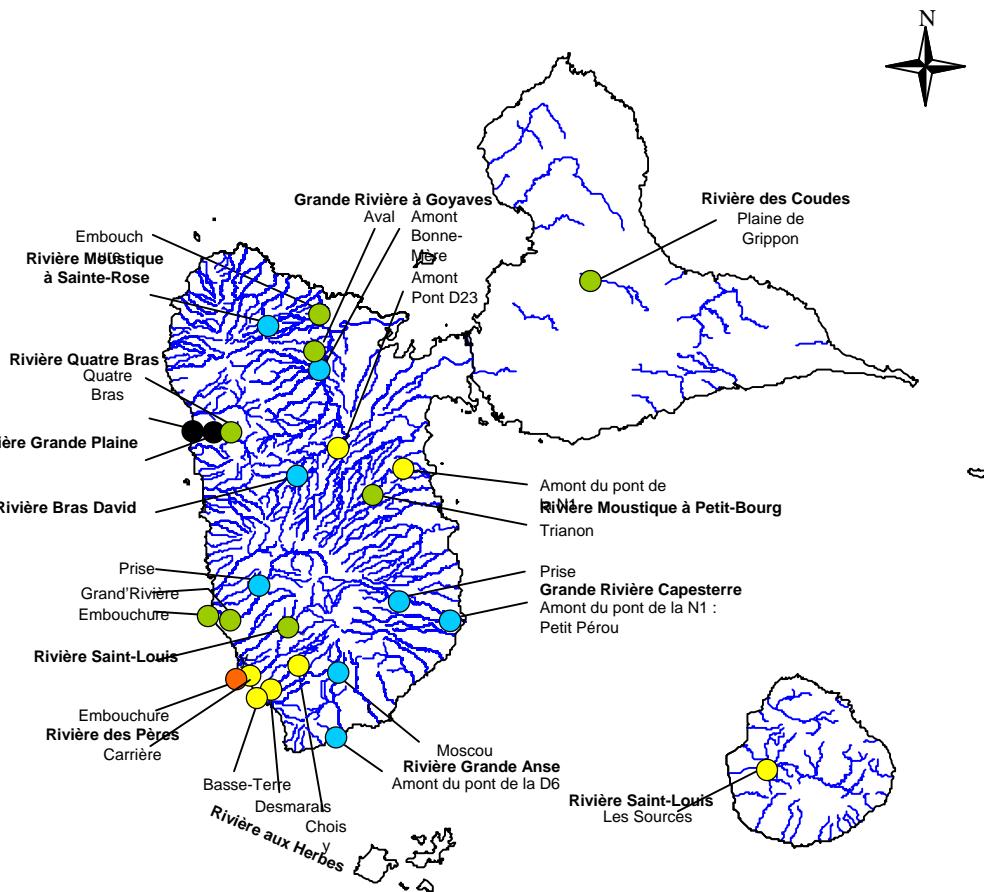
IPS	SLA.	DESCY	L&M	GENRE	CEE	SHE	WAT	IDAP	TDI	IBD	ROTT	EPI-D
13.9	13.2	14.2	10.9	11.4	10.7	12.7	11.7	6.2	60.5	15.9	13.2	9.7
NB d'espèces		42		Diversité		4.50						
Effectif		421		Equitabilité		0.83						

\* : espèce retenue pour le calcul de l'IBD

Nombre	%	Abrév.	Désignation	IPS S	IPS V
61	14.49	GDEC	* Geissleria decussis(Ostrup) Lange-Bertalot & Metzeltin	5.0	2.0
43	10.21	DESP	Denticula sp.	0.0	0.0
37	8.79	CPLI	* Cocconeis placentula Ehrenberg var.lineata(Ehr.)Van Heurck	5.0	1.0
35	8.31	NINC	* Nitzschia inconspicua Grunow	2.8	1.0
25	5.94	FGOU	Fragilaria goulardii (Brébisson) Lange-Bertalot	3.0	2.0
22	5.23	EOLI	EOLIMNA Lange-Bertalot & Schiller	0.0	0.0
18	3.80	UULN	* Ulnaria ulna (Nitzsch) Compère	3.0	1.0
14	3.33	PLFR	* Planothidium frequentissimum(Lange-Bertalot)Round & Bukhtiyarova	3.4	1.0
14	3.33	GDES	Gomphonema designatum E. Reichardt	5.0	1.0
14	3.33	NZSS	Nitzschia species	1.0	2.0
13	3.09	EOMI	* Eolimna minima(Grunow) Lange-Bertalot	2.2	1.0
13	3.09	NIFR	* Nitzschia frustulum(Kützing)Grunow var.frustulum	2.0	1.0
12	2.85	ASHU	Achnanthes subhudsonis Hustedt	5.0	2.0
11	2.61	ADCT	Achnanthes catenatum (Bily & Marvan) Lange-Bertalot	0.0	0.0
10	2.38	NACD	* Nitzschia acidoclinata Lange-Bertalot	5.0	2.0
9	2.14	ADMI	* Achnanthes minutissimum (Kütz.) Czarnecki	5.0	1.0
8	1.90	NNGO	Naviculadicta nanogomphonema Lange-Bertalot & Rumrich	0.0	0.0
6	1.43	MAPE	* Mayamaea atomus var. permittis (Hustedt) Lange-Bertalot	2.3	1.0
6	1.43	NUPR	Nupela praecipua(Reichardt) Reichardt	0.0	0.0
5	1.19	NPAD	* Nitzschia palea (Kützing) W.Smith var.debilis(Kützing)Grunow in Cl. & Gru	1.0	3.0
5	1.19	AMUS	Adlaia muscora (Kociolek & Reviers) Moser Lange-Bertalot & Metzeltin	0.0	0.0
4	0.95	DCOT	* Diadesmis contenta (Grunow ex V. Heurck) Mann	4.0	1.0
4	0.95	NROS	Navicula rostellata Kützing	3.0	3.0
4	0.95	NGRE	Navicula gregaria Donkin	3.4	1.0
4	0.95	EEXI	* Eunotia exigua (Brébisson ex Kützing) Rabenhorst	5.0	2.0
4	0.95	NSEM	Navicula seminulum Grunow	1.5	2.0
3	0.71	ARPT	Achnanthes rupestoides Hohn	3.8	1.0
2	0.48	CMLF	* Craticula molestiformis (Hustedt) Lange-Bertalot	2.0	1.0
2	0.48	AMMO	Amphora montana Krasske	2.8	1.0
2	0.48	NSYM	Navicula symmetrica Patrick	2.0	3.0
2	0.48	NZSU	Nitzschia supralitoraea Lange-Bertalot	1.5	2.0
1	0.24	NDEB	* Nitzschia debilis(Arnott)Grunow	2.0	2.0
1	0.24	CTRO	Cymbella tropica Krammer	0.0	0.0
1	0.24	AEXG	Achnanthes exigua Grunow in Cl. & Grun.var. exigua	4.0	1.0
1	0.24	NLGC	Navicula longicephala Hustedt var.longicephala	4.5	2.0
1	0.24	NTER	Nitzschia terrestris (Petersen) Hustedt	3.0	1.0
1	0.24	EOVE	Eolimna verecundaeformis(Mang.) Moser, Lange-Bertalot & Metzeltin	0.0	0.0
1	0.24	CBAC	* Caloneis bacillum (Grunow) Cleve	4.0	2.0
1	0.24	NCLA	Nitzschia clausii Hantzsch	2.8	3.0
1	0.24	LACD	Luticola acidoclinata Lange-Bertalot	5.0	1.0
1	0.24	SELL	SELLAPHORA C. Mereschkowsky	0.0	0.0
1	0.24	DPCT	Diadesmis paracontenta Lange-Bertalot & Werum	0.0	0.0

# Water quality

Biological water quality of the rivers of Guadeloupe 2002  
(Rain season)

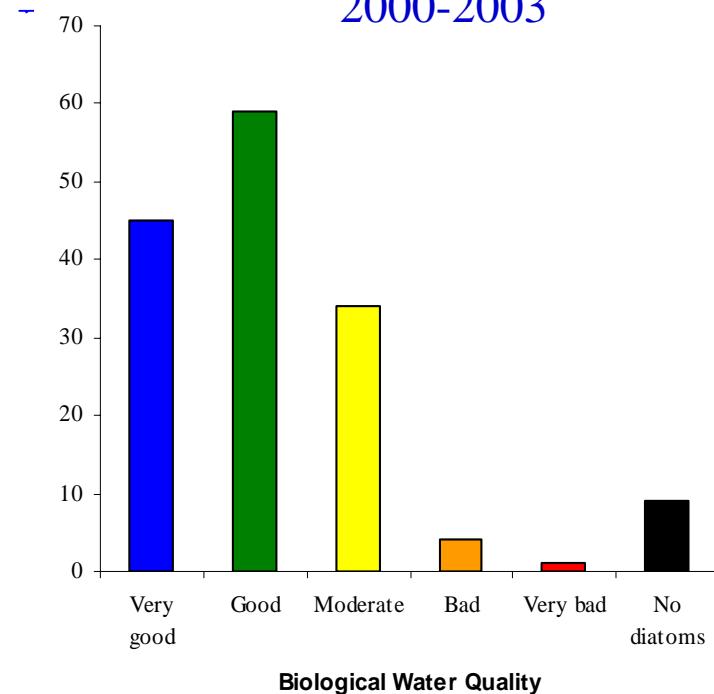


## Biological Water Quality

- 17 ≤ IPS ≤ 20 Very good
- 13 ≤ IPS < 17 Good
- 9 ≤ IPS < 13 Moderate
- 5 ≤ IPS < 9 Bad
- 1 ≤ IPS < 5 Very bad
- No diatoms

IPS : Specific Polluosensitivity Index

6 campaigns  
2000-2003



N° PREP	DATE	BASSIN	GUADELOUPE 1ERE 2002
39415060602	06/06/2002	RIVIERE/SITE	RIVIERE DES PERES/EMBOUCHURE

Indéterminé Indéterminé R.A.S. Indéterminé ou non précisé

CODE HYDROLOGIQUE

PK

CODE PRELEVEMENT

TEMPERATURE

PARTICULARITES

IPS	SLA.	DESCY	L&M	GENRE	CEE	SHE	WAT	IDAP	TDI	IBD	ROTT	EPI-D
6.6	12.8	12.7	7.8	6.7	6.1	4.8	6.4	5.6	79.2	9.9	7.7	2.7

NB d'espèces	34	Diversité	3.13
Effectif	417	Equitabilité	0.62

\* : espèce retenue pour le calcul de l'IBD

Nombre	%	Abrév.	Désignation	IPS S	IPS V
190	45.56	FSAP	* <i>Fistulifera saprophila</i> (Lange-Bertalot & Bonik) Lange-Bertalot	2.0	1.0
73	17.51	NIFR	* <i>Nitzschia frustulum</i> (Kützing)Grunow var. <i>frustulum</i>	2.0	1.0
18	4.32	NPAL	* <i>Nitzschia palea</i> (Kützing) W.Smith	1.0	3.0
16	3.84	DESP	<i>Denticula</i> sp.	0.0	0.0
12	2.88	EOLI	<i>EOLIMNA</i> Lange-Bertalot & Schiller	0.0	0.0
11	2.64	GPAR	* <i>Gomphonema parvulum</i> (Kützing) Kützing var. <i>parvulum</i> f. <i>parvulum</i>	2.0	1.0
11	2.64	ADCT	<i>Achnanthidium catenatum</i> (Billy & Marvan) Lange-Bertalot	0.0	0.0
9	2.16	NSYM	* <i>Navicula symmetrica</i> Patrick	2.0	3.0
9	2.16	AMMO	* <i>Amphora montana</i> Krasske	2.8	1.0
7	1.68	ADMI	* <i>Achnanthidium minutissimum</i> (Kütz.) Czarnecki	5.0	1.0
6	1.44	NSEM	<i>Navicula seminulum</i> Grunow	1.5	2.0
5	1.20	NGRE	* <i>Navicula gregaria</i> Donkin	3.4	1.0

In general:

Cosmopolitan species dominating in waters of moderate to bad quality

N° PREP	DATE	BASSIN	GUADELOUPE 2IEME 2002
39523251102	25/11/2002	RIVIERE/SITE	RIV. MOUSTIQUE-PETIT BOURG/TRIANON

Indéterminé Indéterminé R.A.S. Indéterminé ou non précisé

CODE HYDROLOGIQUE

PK

CODE PRELEVEMENT

TEMPERATURE

PARTICULARITES

IPS	SLA.	DESCY	L&M	GENRE	CEE	SHE	WAT	IDAP	TDI	IBD	ROTT	EPI-D
18.3	13.1	13.8	14.0	14.0	17.3	14.9	14.4	5.7	45.9	19.5	17.1	10.6

NB d'espèces	31	Diversité	3.82
Effectif	425	Equitabilité	0.77

\* : espèce retenue pour le calcul de l'IBD

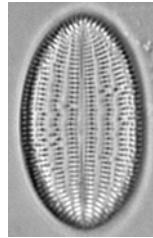
Nombre	%	Abrév.	Désignation	IPS S	IPS V
77	18.12	ASHU	<i>Achnanthes subhudsonis</i> Hustedt	5.0	2.0
57	13.41	GENT	<i>Gomphonema entolegium</i> Ostrup	5.0	3.0
50	11.76	CPLI	* <i>Cocconeis placenta</i> Ehrenberg var. <i>lineata</i> (Ehr.)Van Heurck	5.0	1.0
47	11.06	GDES	<i>Gomphonema designatum</i> E. Reichardt	5.0	1.0
35	8.24	DESP	<i>Denticula</i> sp.	0.0	0.0
33	7.76	GAGN	<i>Gomphonema agnatum</i> Hustedt	0.0	0.0
21	4.94	EOLI	<i>EOLIMNA</i> Lange-Bertalot & Schiller	0.0	0.0
18	4.24	PRBU	<i>Planothidium robustius</i> (Hustedt) Lange-Bertalot	4.6	1.0
15	3.53	FGOU	<i>Fragilaria goulardii</i> (Brébisson) Lange-Bertalot	3.0	2.0
11	2.59	EOMI	* <i>Eolimna minima</i> (Grunow) Lange-Bertalot	2.2	1.0
10	2.35	EADN	<i>Epithemia adnata</i> (Kützing) Brebisson	4.0	3.0
9	2.12	ROPE	<i>Rhopalodia operculata</i> (Agardh) Hakansson	5.0	2.0
4	0.94	ARPT	<i>Achnanthes rupestris</i> Hohn	3.8	1.0

Waters of good to excellent quality dominated by taxa with preferences to tropical latitudes

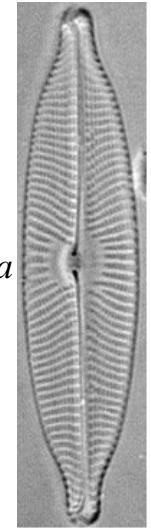
# Floristic Inventory: Cosmopolitan taxa



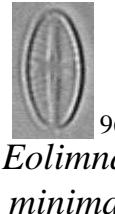
*Achnanthes exigua*



*Cocconeis placentula*  
var. *lineata*



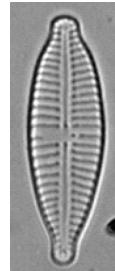
*Navicula rostellata*



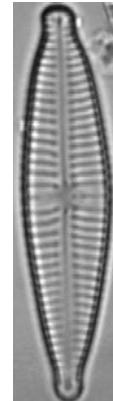
*Eolimna minima*



*Encyonema silesiacum*



*Gomphonema parvulum*



*Gomphonema exilissimum*



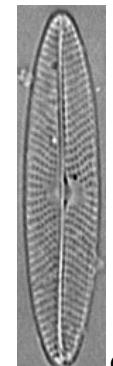
*Nitzschia palea*



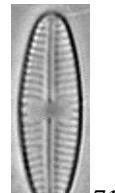
*Achnanthidium minutissimum*



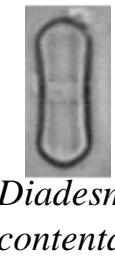
*Planothidium frequentissimum*



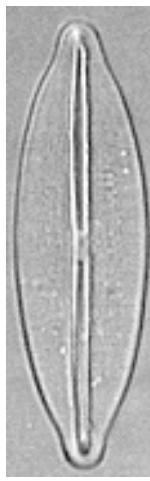
*Navicula symmetrica*



*Navicula seminulum*



*Diadesmis contenta*



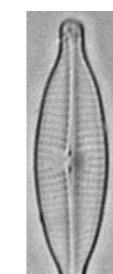
*Frustulia crassinervia*



*Epithemia adnata*



*Eunotia exigua*



*Navicula gregaria*



*Eolimna subminuscula*



*Nitzschia frustulum*

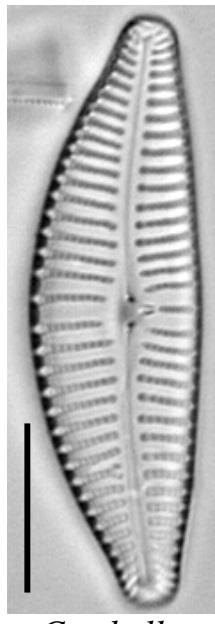


*Nitzschia amphibia*

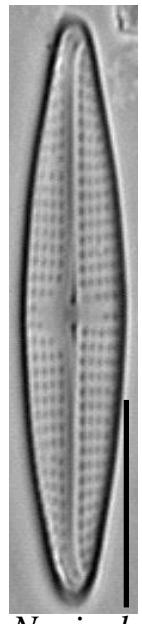


*Nitzschia inconspicua*

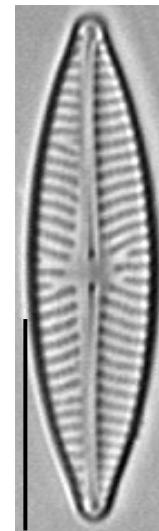
# **Floristic Inventory: Tropical taxa**



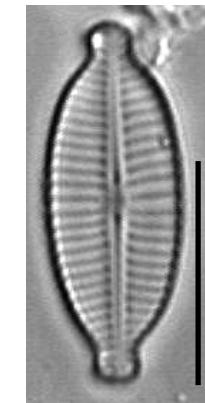
*Cymbella*  
*tropica*



*Navicula*  
*incarum*



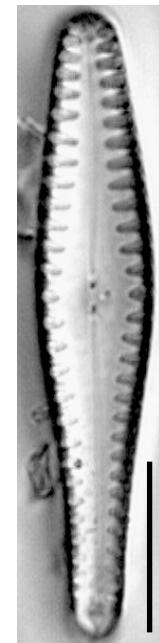
*Navicula*  
*quasidisjuncta*



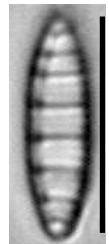
*Naviculadicta Gomphonema brasiliense*  
*nanogomphonema* ssp. *pacificum*



*nonema brasiliense*  
sp. *pacificum*



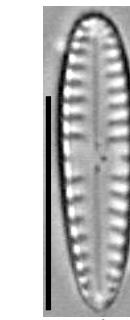
# *Gomphonema agnatum*



*Denticula  
sundayensis*



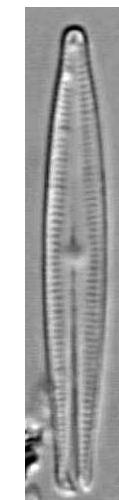
*Eolimna  
verecundaeformis*



*Gomphonema  
bourbonense*



*Brachysira  
neoexilis*



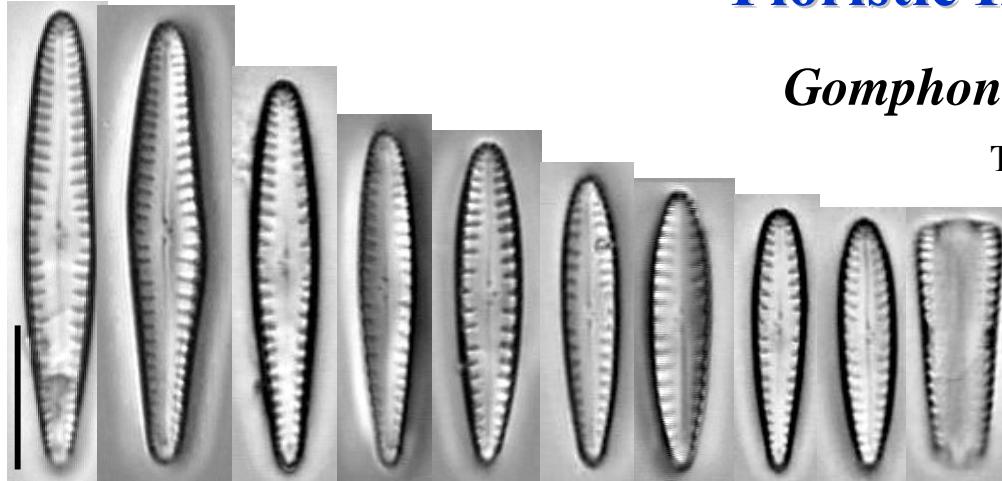
## *Gomphosphenia oahuensis*

# Floristic Inventory: Dominant taxa

*Gomphonema cf. designatum* Reichardt

Type locality: Guadeloupe?

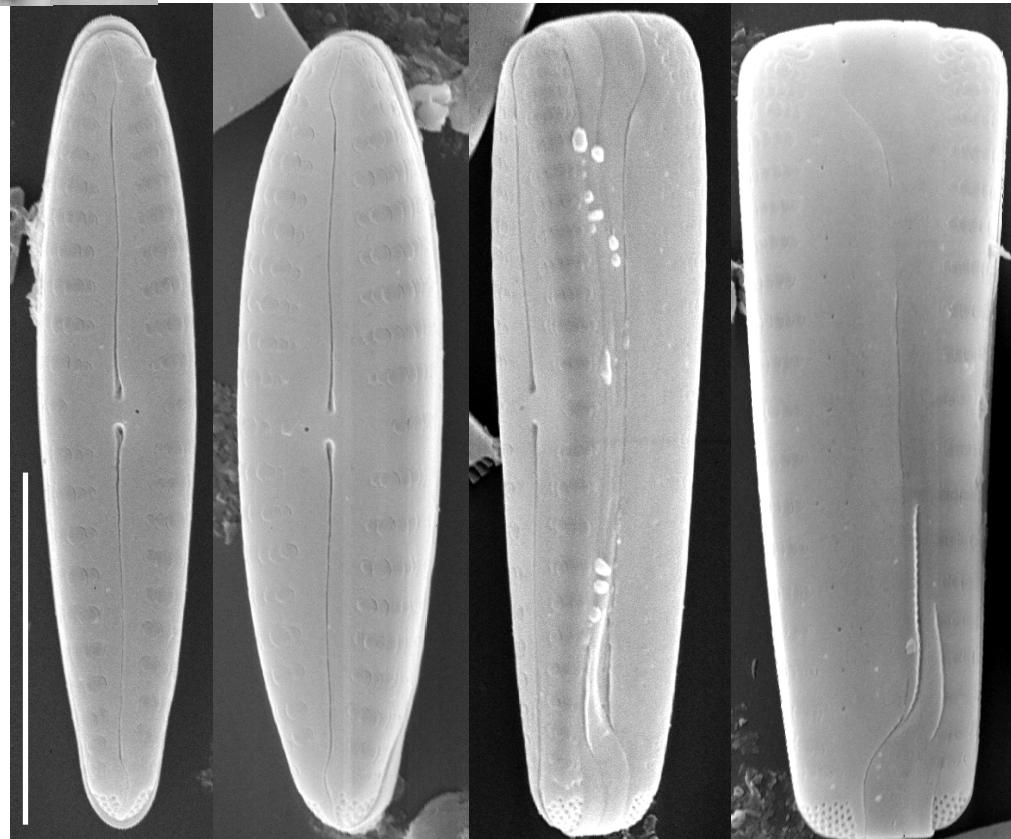
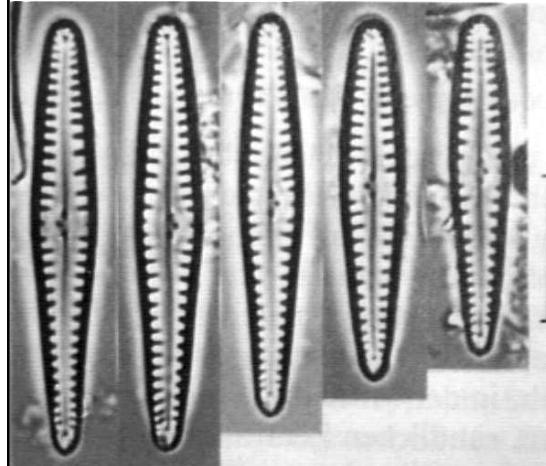
125 samples (40 samples  $\geq 10\%$ )



*Gomphonema designatum* Reichardt

Type population

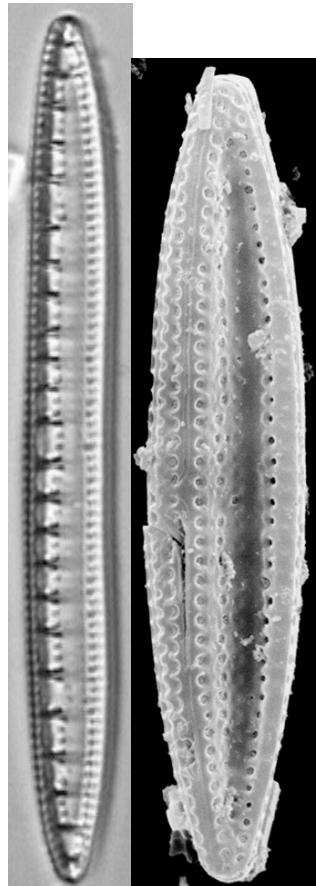
Thailand/"mud of streambank"



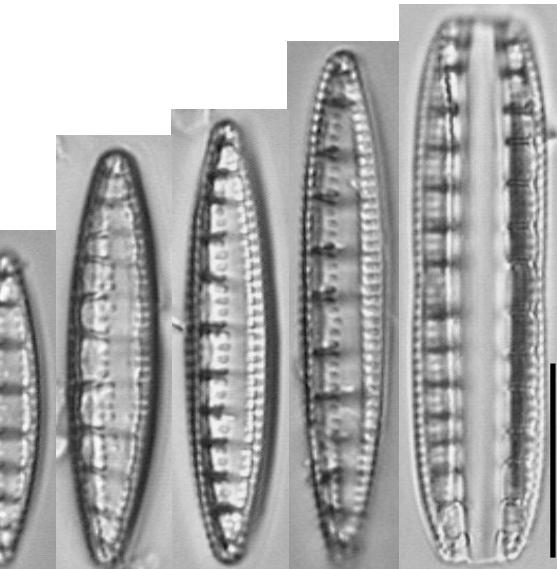
# Floristic Inventory: Dominant taxa

*Denticula* sp.

Type locality: Guadeloupe?

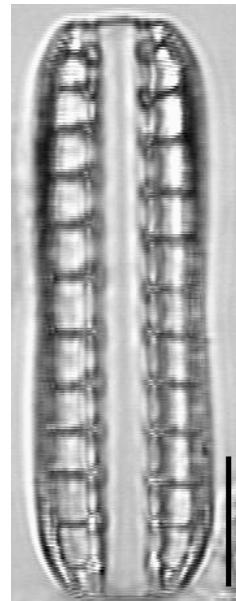


112 samples (22 samples  $\geq 10\%$ )



*Denticula parva* Hustedt  
sensu Manguin

Bourrelly &  
Manguin 1952:  
Hot source  
“Bouillante”, high  
salinity,  
50-60°C

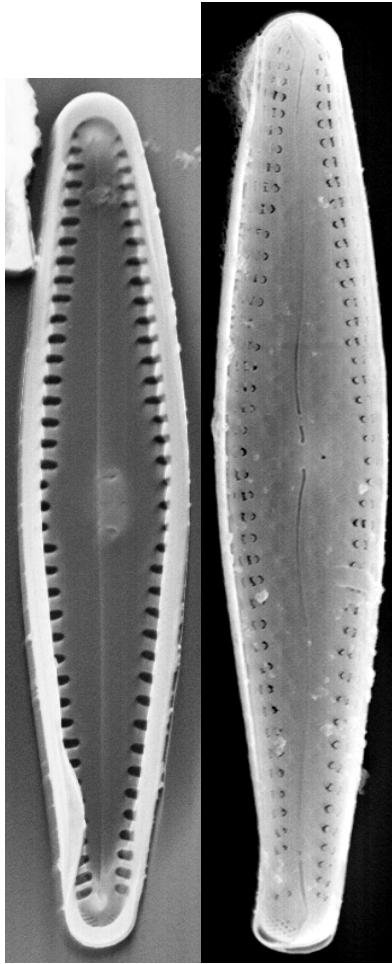
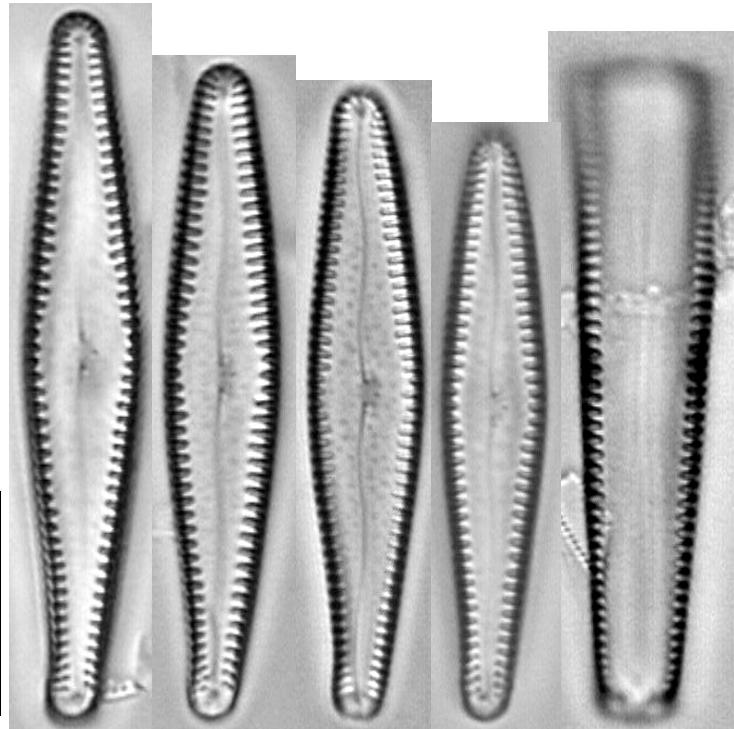


# Floristic Inventory: Dominant taxa

*Gomphonema* aff. *entolejum* Østrup

Type locality: Guadeloupe?

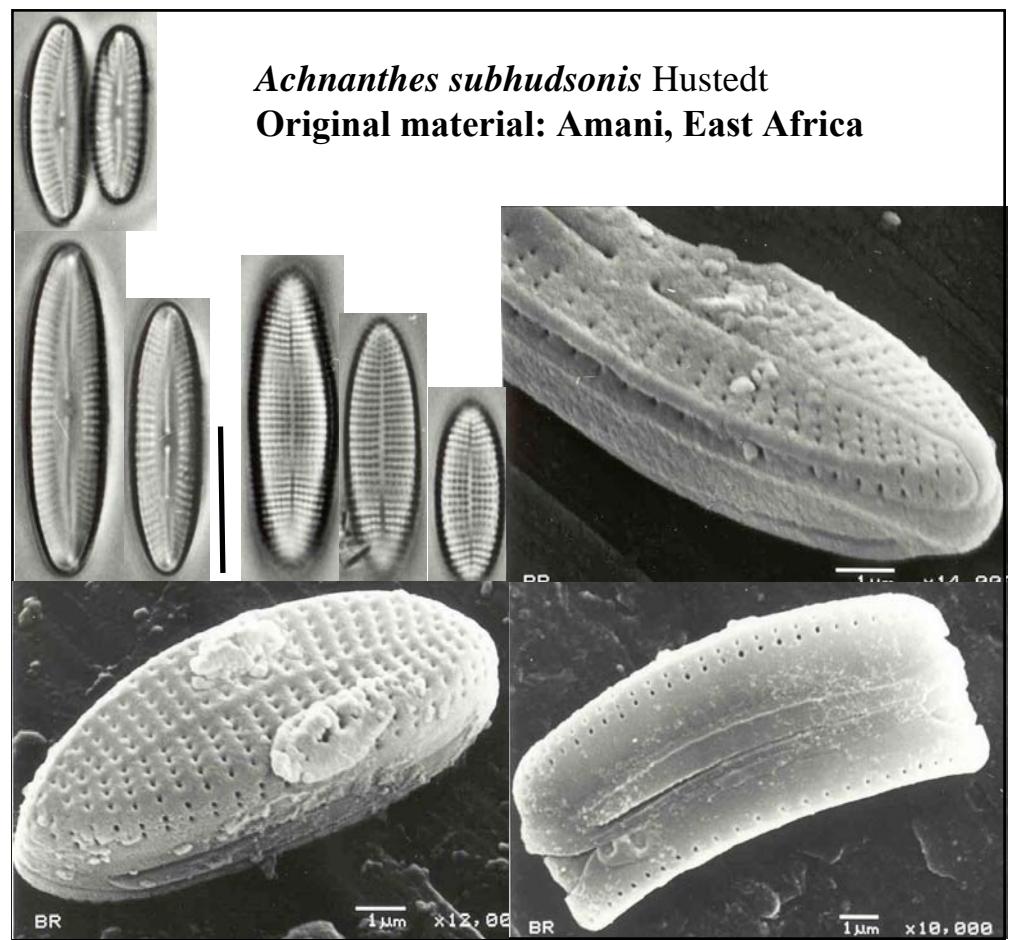
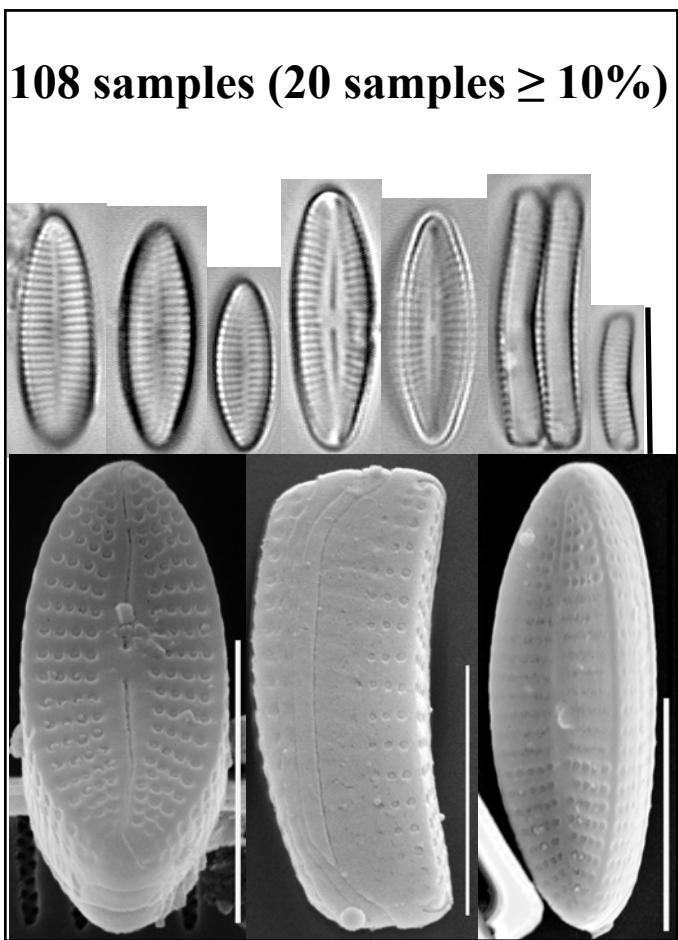
58 samples (10 samples  $\geq$  10%)



# Floristic Inventory: Dominant taxa

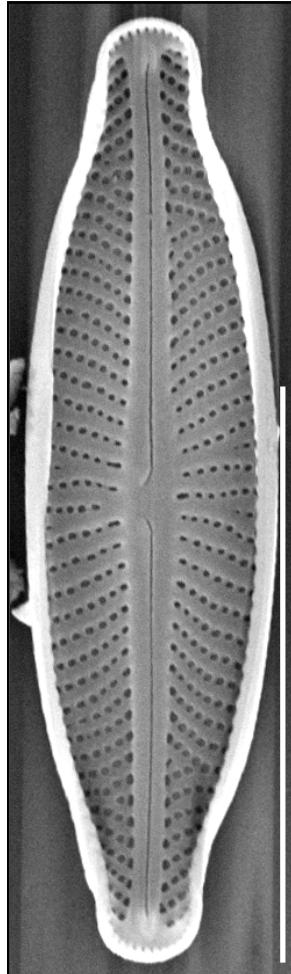
*Achnanthes* aff. *subhudsonis* Hustedt

Type locality: Guadeloupe?

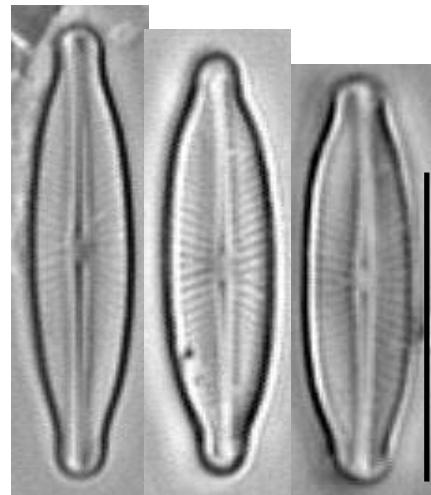


## Floristic Inventory: Dominant taxa

*Adlafia muscora* (Kociolek & Reviers) Moser, Lange-Bertalot & Metzeltin

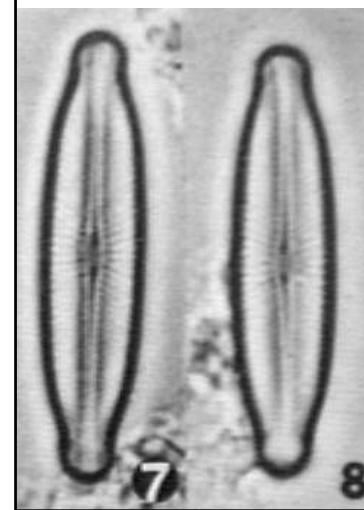


**87 samples  
(12 samples  $\geq 5\%$ )**



**Manguin 1962**

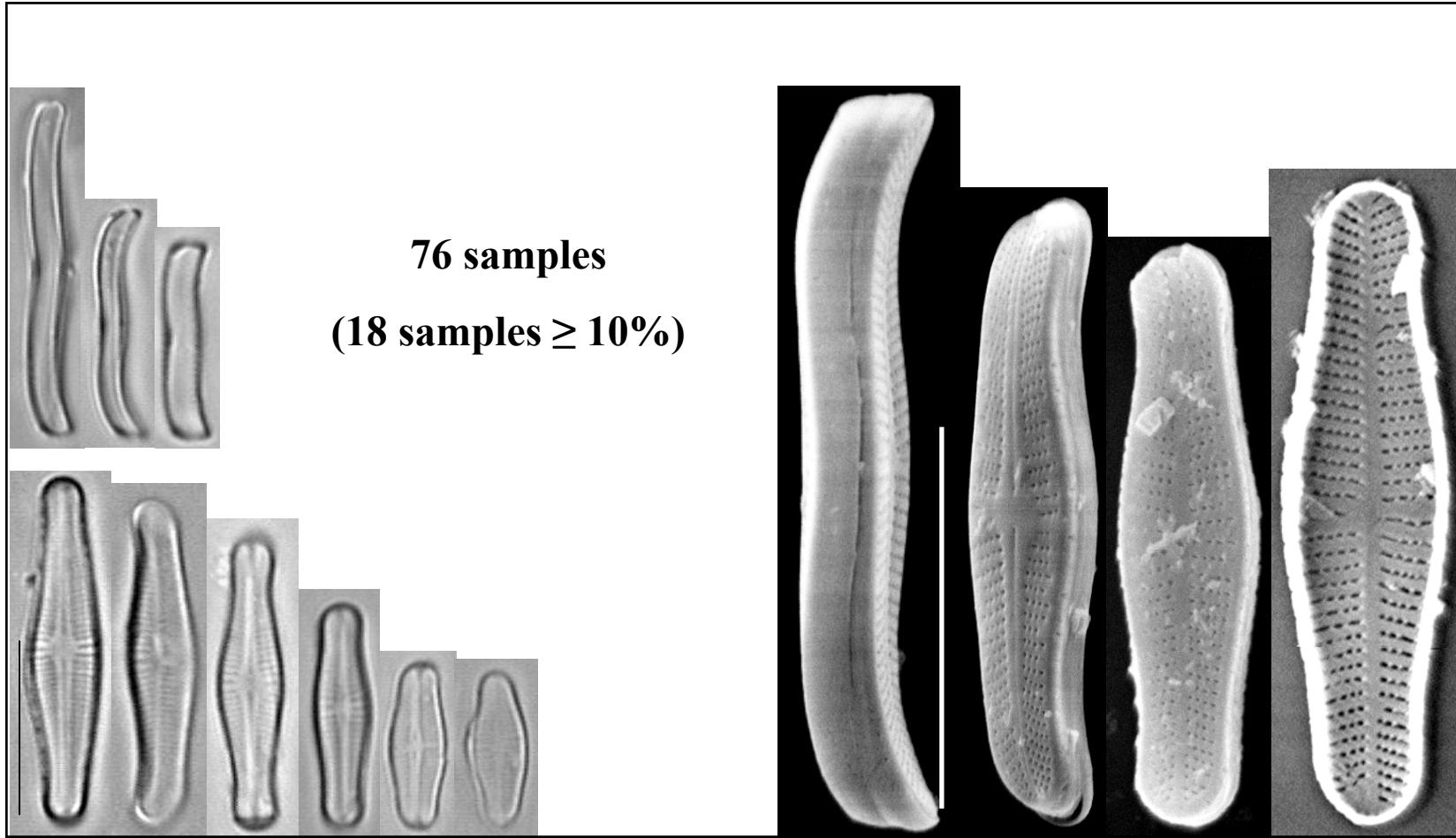
**Type locality:  
New Caledonia**



# Floristic Inventory: Dominant taxa

*Achnanthidium catenatum* (Bílý & Marvan) Lange-Bertalot

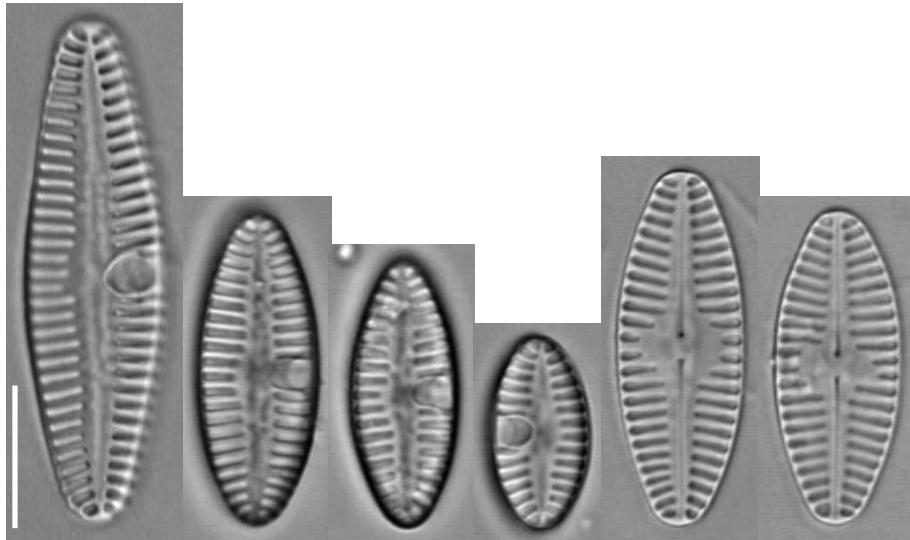
Type locality: Artificial lake, Sedlice (CZ)



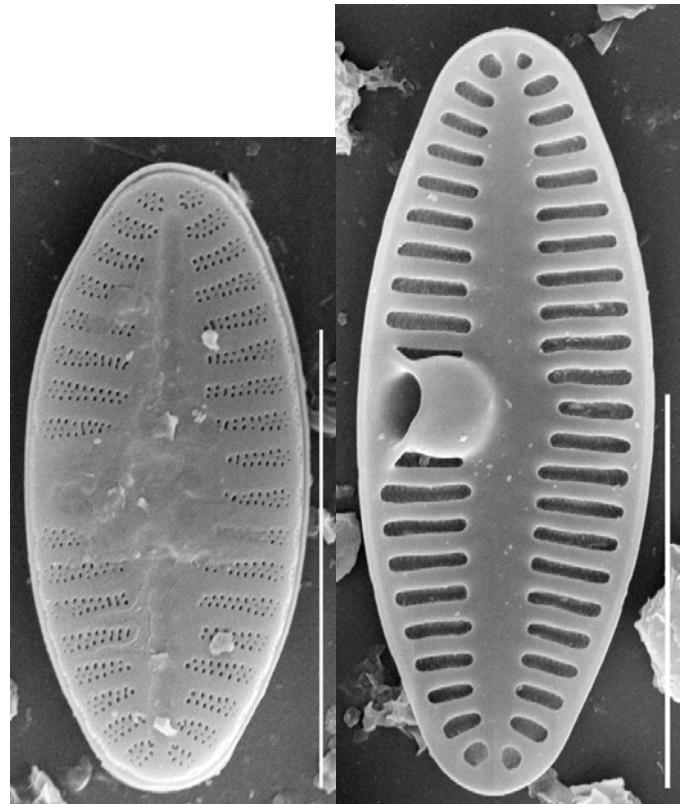
# Floristic Inventory: Dominant taxa

*Planothidium robustius* (Hustedt) Lange-Bertalot

Type locality: Java, Waterfall



119 samples (23 samples  $\geq 10\%$ )

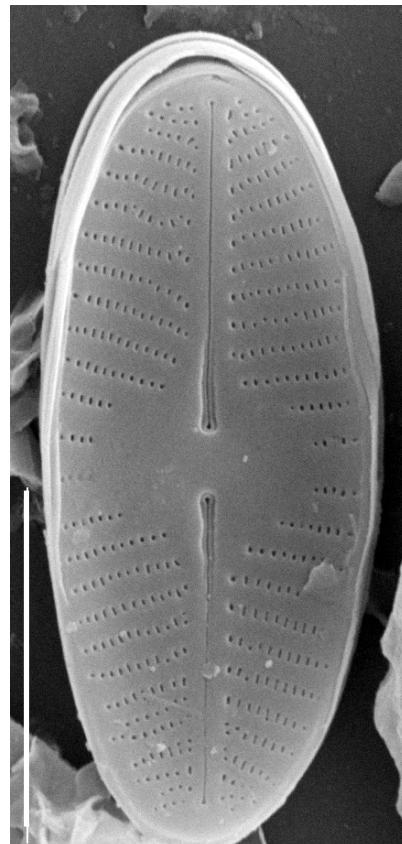
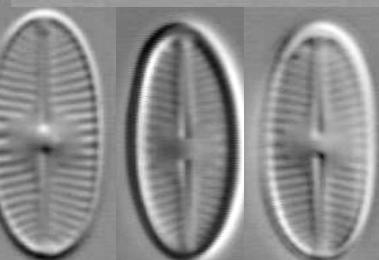
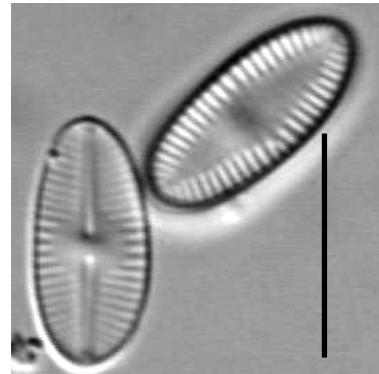


# Floristic Inventory: Dominant taxa

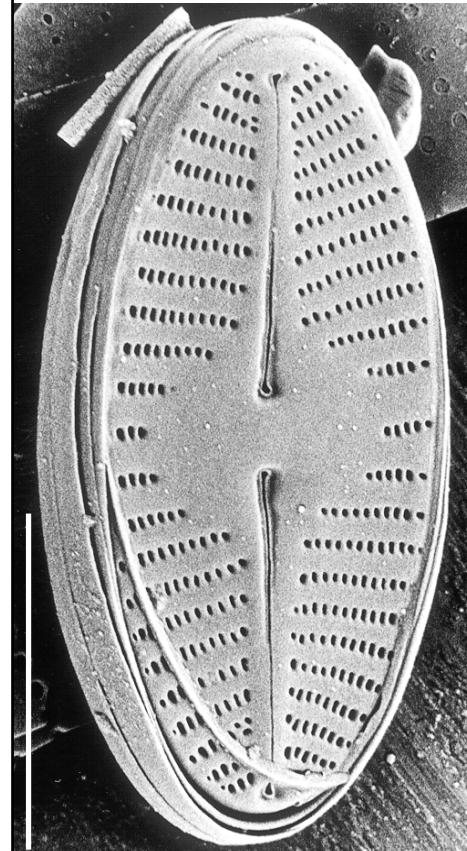
*Achnanthes rupestris* Hohn var. *uniseriata*

Lange-Bertalot et Monnier

60 samples ( $1 \geq 10\%$ )



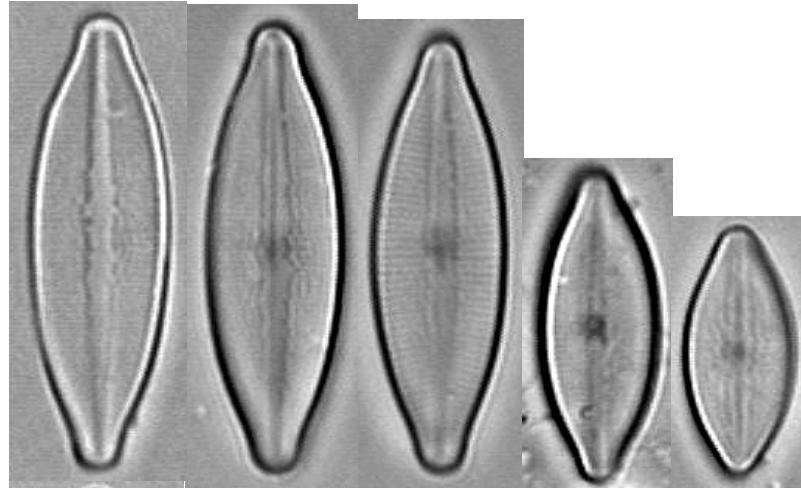
Type locality:  
Tropical aquarium  
France



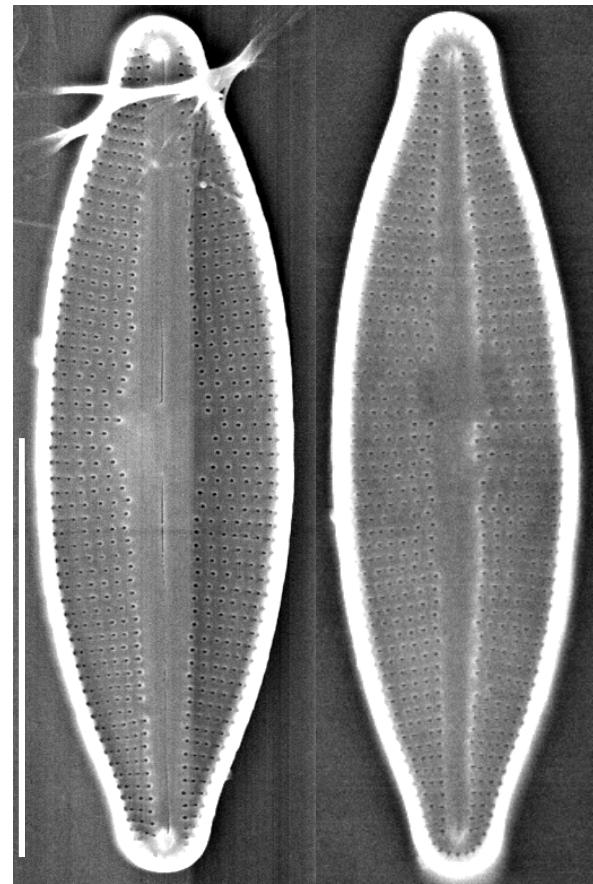
# Floristic Inventory: Dominant taxa

*Nupela* aff. *praecipua* (Reichardt) Reichardt

Type locality: Guadeloupe?



42 samples  
(13 samples  $\geq 5\%$ )



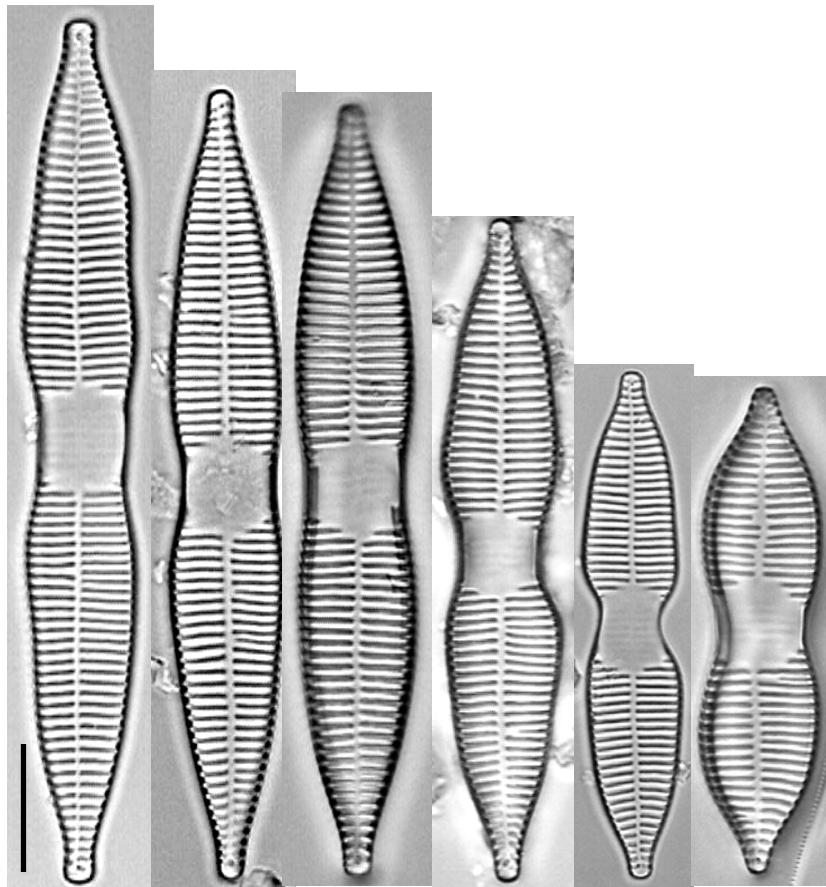
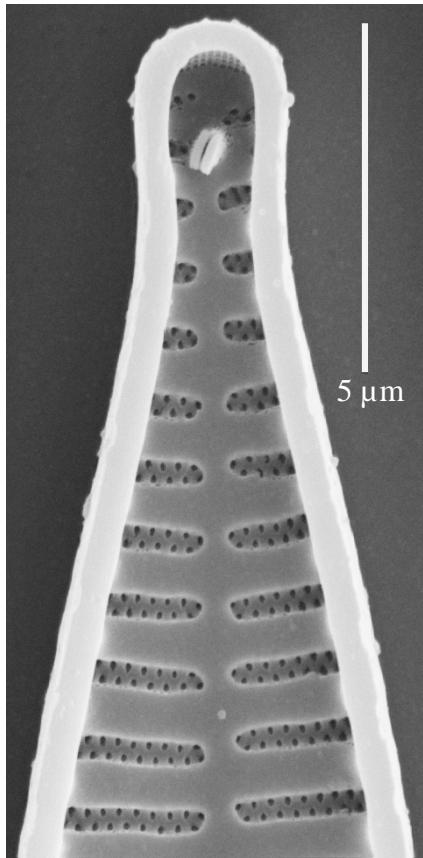


# Floristic Inventory: Dominant taxa

*Fragilaria goulardii* (Brébisson) Lange-Bertalot

Type locality: Buenos Aires, Portorico, Kamtschatka, Jenissey (?)

110 samples (19 samples  $\geq 10\%$ )



# Floristic Inventory

*Gomphosphenia* sp.

Type locality: Guadeloupe?

