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The diatom flora in Conceição Lagoon, Florianópolis, SC, Brazil

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Abstract

"Lagoa da Conceição" is a small lagoon located at Santa Catarina Island, Santa Catarina State, Brazil (27º 34`S; 48º 27`W). In recent decades, their characteristics have been changed mainly due to the increase in average salinity caused by permanent opening of the canal, in 1982, that connects the lagoon to the sea and the growing urbanization impact of the surrounding areas. The only study on the lagoon phytoplankton was conducted in 1988, showing that diatoms were the most diverse group and were dominant at some periods. This study aimed to make a floristic survey of the Conceição Lagoon diatom community, analyzing its variation over a sampled period. The samples were obtained in 1979, 1980, 1982, and 1994 at six stations and in 2002 at ten stations with a phytoplankton net. One hundred and eight specific and infraspecific taxa were identified belonging to Coscinodiscophyceae, (32), Fragilariophyceae (14) and Bacillariophyceae (62). Six taxa were present in all sampling periods and fifteen at 80% sampled years. The Conceição lagoon diatom flora showed 41% of taxa in common with the Santa Catarina Southern Lagoon Complex. Scanning electron microscopy studies confirmed the presence of the *Cyclotella litoralis* Lange et Syvertsen and *Paralia fenestrata* Sawai et Naguno in the

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lagoon which probably had been misidentified as *Cyclotella striata* (Kützing) Grunow and *Paralia sulcata* (Ehrenberg) Cleve respectively in a former survey. Available data are insufficient to explain the distribution of diatom species related to salinity at the Conceição lagoon.
Key words: Estuarine diatoms, Bacillariophyceae, Coastal lagoon.

Resumo

(A flora de diatomáceas na Lagoa da Conceição, Florianópolis, Santa Catarina, Brasil) A Lagoa da Conceição é uma pequena lagoa costeira, localizada na Ilha de Santa Catarina, Estado de Santa Catarina, Brasil (27º 34`S; 48º 27`W). Nas ultimas décadas, suas características têm sido modificadas principalmente em decorrência do aumento da salinidade média causada pela abertura permanente do canal que a conecta com o mar, em 1982 e pelo crescente impacto causado pela urbanização do entorno. O único estudo realizado, em 1988, sobre o fitoplâncton da lagoa mostrou que as diatomáceas foram o grupo mais diverso e dominaram em alternância com a fração do fitoplâncton menor que 8µm. O presente trabalho teve como objetivo fazer um levantamento florístico da comunidade de diatomáceas da lagoa da Conceição, analisando sua variação ao longo do período amostrado. As amostras foram obtidas em 1979,1980,1982, 1994 em 6 estações e em 10 estações, em 2002, com uma rede de fitoplâncton. Foram identificados cento e oito táxons específicos e infra-específicos pertencentes a Coscinodiscophyceae, (32), Fragilariophyceae (14) e Bacillariophyceae (62). Seis táxons foram constantes em todos os anos e quinze táxons em 80% dos anos amostrados. A comunidade de diatomáceas da lagoa da Conceição, apresentou 40% de táxons em comum com a do Complexo Estuarino do Sul do Estado de Santa Catarina.Estudos de microscopia eletrônica de varredura confirmaram a presença na lagoa de *Cyclotella litoralis* Lange et Syvertsen e de *Paralia fenestrata* Sawai et Naguno que provavelmente haviam sido mal identificadas como *Cyclotella striata* (Kutzing) Grunow e *Paralia sulcata* (Ehrenberg) Cleve respectivamente, em estudos prévios.
Palavras-chave: Diatomáceas estuarinas, Bacillariophyceae, Lagoa costeira.

Introduction

Conceição Lagoon is a small lagoon located at Santa Catarina Island, Florianópolis (27º34'S; 48º 27'W). It has an approximate area of 19 km^2 and connects with the sea through a channel. It receives the drainage of small freshwater flows, and the Capivara river to the north, is the biggest one. In Conceição Lagoon we can distinguish three regions, south, center and north, which were characterized by Knoppers *et al.* (1984).

After 1982 the Conceição Lagoon characteristics have been modified mainly due to increasing salinity average caused by permanent opening of the canal that

connects it with the sea and the growing urbanization impact of the surrounding areas (Assumpção *et al.* 1981; Souza-Sierra *et al.* 1999; Fonseca 2006).

An annual study conducted in phytoplankton during 1983 -1984 (Odebrecht 1988 and 1999) covering the whole lagoon, showed that diatom community was the most important in diversity alternated in dominance with the phytoplankton fraction <8μm.

This study aimed to study the diatom flora present at Conceição Lagoon and to describe its variation along the period sampled.

Material and Methods

Between 1979 and 2002 diatoms were colected at Conceição lagoon. The samples were obtained in November,1979, November,1980, May and November, 1982, August,1994 at 6 sites (E1, E3, E7, E8, E10, E14) and in March, 2002 at 10 sites (E2, E4, E5, E6, E8, E9 E11, E12, E13, E14) (Figure 1, Table 1) by dragging with phytoplankton net The samples were fixed in 4% formaldehyde solution, oxidized following the Muller-Melchers & Ferrando (1956) and Hasle & Fryxell (1970) techniques and the slides prepared with Permount. The samples and permanent slides were deposited in the FLOR Herbarium of the Department of Botany, University Federal of Santa Catarina, Florianópolis, Brazil, under the numbers FLOR 943 to 979. Permanent slides were examined using a Olympus BX 50 light microscope and the specimens were photographed using a COPEX ISO 25 (AGFA) film.

Table 1. Geografical position of sites sampled in Conceição lagoon.

Sites	Latitude	Longitude
1	27^{0}30'43"S	48^{0}25'31"W
2	27^{0}31'09"S	48^{0}25'47"W
3	27^{0}31'50"S	48^{0}26'20"W
4	27^{0}31'40"S	48^{0}26'32"W
5	27^{0}31'18"S	48^{0}26'33"W
6	27^{0}31'16"S	48^{0}26'41"W
7	27^{0}31'38"S	48^{0}27'01"W
8	27^{0}32'41"S	48^{0}27'33"W
9	27^{0}34'57"S	48^{0}27'25"W
10	27^{0}35'49"S	48^{0}26'55"W
11	27^{0}35'19"S	48^{0}26'13"W
12	27^{0}36'21"S	48^{0}27'40"W
13	27^{0}36'59"S	48^{0}27'54"W
14	27^{0}37'12"S	48^{0}28'26"W

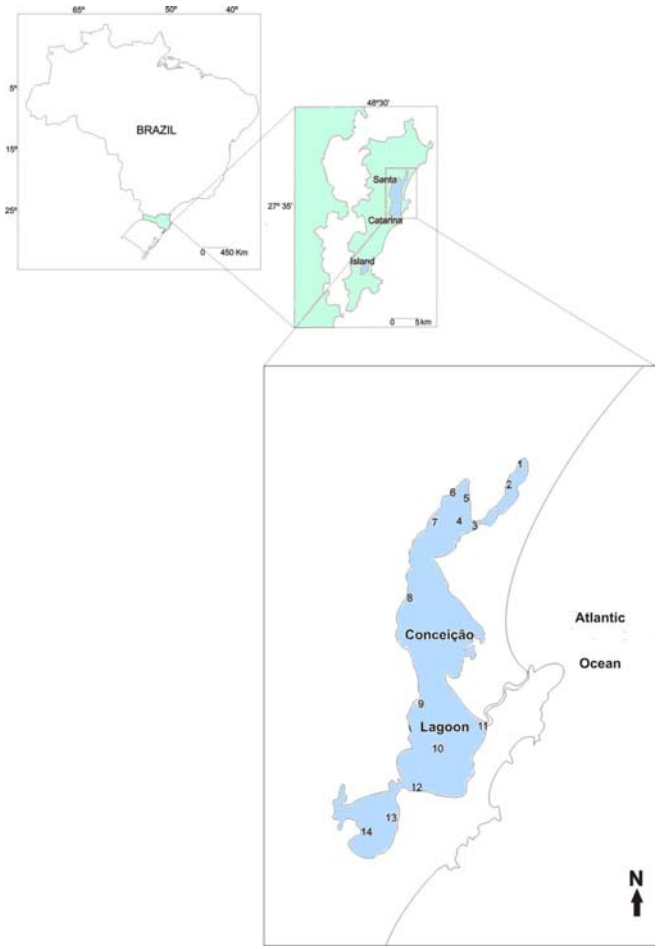

Figure 1. Localization of Conceição Lagoon and sampling sites.

For scaning electron microscopy (SEM), cleaned frustules were dried and deposited over a stub, coated with gold at 1kV for 4 minutes, and examined with JEOL 6390LV at an accelerating voltage of 20kV, and spot size between 25 to 30 in the Central Laboratory of Electron Microscopy at the Federal University of Santa Catarina.

For taxonomic purposes, we used the system of Round *et al.* (1990).

Results and Discussion

Salinity mean values obtained during sampling procedures (Table 2) with standard deviation were 12.7(±1.9), before the official canal opening. After the canal opening the salinity has changed to 16.7(±6).

Table 2. Water temperature and salinity of Conceição lagoon during studied period.

	nov/79		nov/80		May/82		nov/82		Aug/94	
	S	^{0}C	S	^{0}C	S	^{0}C	S	^{0}C	S	^{0}C
E1	10,5	25	14,1	25	10,7	20	15,7	25	24	20
E2										
E3	11,1	25	12,8	25	12,9	21	16,4	24,5	25	19
E4										
E5										
E6										
E7	11,5	25	14,7	25	13,3	20	9,7	27	25	19
E8	12	25	15,3	25	12,8	19	16	23	26	19,5
E9										
E10	12,7	25	15,7	25	13	21	10,5	22	26	20
E11										
E12										
E13										
E14	9,9	25	12,5	25	10,7	22	12,5	22	21	19

One hundred and eight specific and infraspecific taxa were identified belonging to Coscinodiscophyceae (32), Fragilariophyceae (14) and Bacillariophyceae (62).

The taxa distribution along the sampled years appears in Table 3.

Table 3. The taxa distribution along the sampled years.

Taxa	1979	1980	1982	1994	2002
Achnanthes brevipes	x				x
A. brevipes var. *intermedia*					x
A.inflata	x				
Actinella brasiliensis			x	x	
Actinocyclus ehrenbergii			x	x	x
Actinoptychus senarius	x		x	x	x
Actinoptychus splendens	x				
Amphora acuta					x
A. arenaria					x
A. obtusa					x
A. ostrearia					x
A. ovalis					x
A. proteus	x		x	x	x
A. tumida				x	
Aulacoseira granulata					x
A. italica					x
Bacteriatrum hyalinum				x	
Brackysira serians	x		x		
Caloneis sp			x		
Capartogramma cricucula		x			
Chaetoceros affinis				x	
C. curvisetum				x	
C.lorenzianum				x	
C. peruvianum				x	
Cocconeis heteroidea			x		
C. placentula var. *euglypta*		x	x	x	
C. scutellum			x	x	x
Corethron criophylum				x	
Coscinodiscus gigas				x	
C. granii				x	
C. jonesianus			x	x	x
C. oculus-iridis	x		x	x	x
Cyclotella striata		x	x	x	x
C. stylorum	x	x	x	x	x
Cymatotheca weisflogii					x
Dimerogramma minor				x	
Diploneis bombus			x	x	x
D. crabro					x

Table 3. Continued…

Taxa	1979	1980	1982	1994	2002
D.dydima		x	x		
D. finnica	x	x	x		
D. ovalis	x	x	x		
D. smithii	x	x	x		x
D. weisflogii	x				x
Ditylum brightwelii				x	
Entomoneis alata	x	x	x	x	x
E. alata var. pulchra	x	x	x	x	x
Eunotia camelus	x				x
E. flexuosa	x		x		
E. lineolata		x	x		
E. monodon	x				
E. (trigibba) paucistriata	x				
E. pectinales	x				x
E. pseudoindica	x				
E. zigodon	x			x	
Frustulia rhomboides		x			x
Gomphonema parvulum		x			x
Grammatophora marina				x	x
G. oceanica					x
Gyrosigma balticum	x		x	x	x
Hemidiscus cuneiformis					x
Licmophora eherenbergii var. *angustata*	x				x
L. remulus				x	x
Lithodesmium undulatum				x	
Lyrella aproximata	x			x	
Martyana marthyi	x		x	x	x
M. schwartzii			x		x
Mastogloia angulata	x		x	x	x
M. apiculata		x	x	x	x
M. brauini	x		x	x	
M. decussata					x
M. elegans	x	x	x	x	
M. elliptica var. dansei	x	x	x	x	
M. pumilla	x	x			x

Table 3. Continued…

Taxa	1979	1980	1982	1994	2002
N. distans				x	
N. pennatae	x	x	x	x	x
N. viridula					x
N. yarrensis	x		x		x
Nitzschia scalaris	x		x		
N. sigma	x		x		
Odontella sinensis			x	x	
Paralia sulcata			x	x	
Perissonoë cruciata	x		x	x	x
Petroneis marina			x		
Pinnularia borealis	x				
P. maior	x				x
Plagiogramma staurophorum			x	x	x
P. lepidoptera	x	x	x	x	x
Pleurosigma diverse-striatum				x	
Psammodactyon pandurifomre		x	x	x	
Pseudosolenia calcar-avis				x	
Raphoneis amphiceros	x				x
R. castracanei	x		x	x	x
Rhizosolenia hebetata var. hiemalis				x	
Rhopalodia gibberula	x		x	x	x
R. musculus	x	x	x	x	x
Roperia tesselata				x	
Stauroneis phoenicenteron	x				
Surirella guatimalensis			x		
Synedra crystalina					x
S. formosa	x			x	
Terpsinoë americana	x		x	x	x
T. musica				x	x
Thalassiosira eccentrica	x		x	x	
T. oestrupii	x				x
Thlassionema frauenfeldii			x		
Triceratium favus				x	

The following specific and infra-specific taxa were recorded:

Achnanthes brevipes Agardh **PLATE V, FIGS. 54 - 55**
Giffen, 1970, p.263.
Apical axis 29-56 µm; transapical axis 11-21,6 µm.

Achnanthes brevipes var. *intermedia* (Kutzing) Cleve
Foged, 1984, p.12; Hustedt, 1927-1966, p.425.
Apical axis: 30-62 µm; transapical axis: 6-15 µm; 10-15 transversal striae/10 µm.

Achnanthes inflata (Kutzing) Grunow **PLATE VI, FIG. 56**
Patrick & Reimer, 1966, p. 279
Apical axis: 30-70 µm; transapical axis: 12-15 µm; striae 9/10 µm.

Actinella brasiliensis Grunow **PLATE IV, FIG. 41**
Van Heurck, 1880-1885:est.35, fig.19
Apical axis 75-85µm; transapical axis 2,5-8µm; 12 striae/10µm.

Actinocyclus octonarius Ehrenberg **PLATE I, FIG. 10**
Hustedt, 1927-1966, p. 525.
Diameter: 46-90 µm.

Actinoptychus senarius Ehrenbergt **PLATE II, FIG. 13 and PLATE, FIG. 3**
Hendey, 1964, p. 95.
Diameter: 20-50 µm.

Actinoptychus splendens (Shadboldt) Ralfs. **PLATE II, FIG. 14**
Hustedt, 1927-1966, p. 478.
Diameter: 30-55 µm.

Amphora acuta Gregory
Schoeman & Archibald, 1986, p.116; Schmidt *et al*, 1874: pr.26, fig.20
Apical axis: 40-50 µm; transapical axis: 10-20 striae/10 µm.

Amphora obtusa Gregory.
Peragallo & Peragallo, 1908, p. 216; Hendey, 1964, p.268.
Apical axis: 75-90 µm; transapical axis: 10-15 µm; 30 striae/10 µm

Amphora ostrearia Brebisson
Hendey, 1964, p. 266.
Apical axis: 35-53 µm; transapical axis: 8-15 µm; 10-20 striae/10 µm.

Amphora ovalis (Kutzing) Kutzing **PLATE VII, FIG. 75**
Patrick & Reimer, 1975, p.68.
Apical axis: 30-50 µm; transapical axis: 8-12 µm 10-20 striae/10 µm

Amphora proteus Gregory **PLATE VII, FIG. 76**
Navarro, 1982b, p. 33.
Apical axis 40-50 µm; transapical axis 9-15 µm; 10-20 striae/10 µm.

Amphora tumida Hustedt **PLATE X, FIGS. 20 - 21**
Sar *et al*., 2004, p.74; Garcia, 2008, p. 141.
Apical axis: 35, 25 µm; transapical axis: 6,47 µm; 20 striae/10 µm.

Ardissonea formosa (Hantzsch) Grunow **PLATE IV, FIG. 34**
Hustedt, 1927-1966, p. 233, (like *Synedra formosa* Hantzsch); Navarro, 1982a, p.260

Apical axis: 232µm; transapical axis: 20µm.

Aulacoseira granulata (Ehrenberg) Simonsen **PLATE I, FIG. 5**
Krammer & Lange-Bertalot, 1991. **2**: 22
Diameter: 5-6 µm.

Bacteriastrum hyalinum Lauder **PLATE III, FIG. 28**
Hendey, 1964, p.139.

Brackysira serians (Brebisson) Round & Mann **PLATE VI, FIG. 59**
Patrick & Reimer, 1966, p. 378 (like *Anomoeoneis serians* Brebisson)
Apical axis 20-40 µm; transapical axis 5-8 µm µm; 30-40 striae: 10 µm.

Caloneis westii (Wm.Smith) Hendey. **PLATE VI, FIG. 62**
Hendey, 1964, p.230.
Apical axis 135 µm; transapical axis 35 µm;

Capartogramma crucicola (Grunow) Ross
Patrick & Reimer, 1966, p.372.
Apical axis:20-40 µm; transapical axis:20-30 µm; 20-25 striae/10 µm.

Chaetoceros affinis Lauder
Cupp, 1943, p.125.
Diameter: 7-27µm.

Chaetoceros curvisetum Cleve
Hustedt, 1927-1966, p.737.
Diameter: 10-20µm.

Chaetoceros lorenzianum Grunow **PLATE III, FIG. 26**
Cupp, 1943, p.117.
Diameter: 12-20µm.

Chaetoceros peruvianum Brightweli **PLATE III, FIG. 27**
Hendey, 1964, p. 123.
Diameter: 23-26µm.

Cocconeis heteroidea Hantzsch **PLATE VI, FIG. 57**
Hustedt, 1927-1966, p.356.
Apical axis 28 µm; transapical axis 21 µm.

Cocconeis placentula Ehrenberg var. *euglypta* (Ehrenberg) Grunow**PLATE IX, FIG. 10**
Hustedt, 1930, p. 190.
Apical axis 18-40 µm; transapical axis 10-20 µm; 18 striae/10 µm.

Cocconeis scutellum Ehrenberg
Hustedt, 1927-1966, p.337.
Apical axis 21-24 µm; transapical axis 17-25 µm.

Corethron criophylum Castracane **PLATE III, FIG.24**
Hendey, 1964, p.144.
Diameter: 30-50µm

Coscinodiscus gigas Ehrenberg P**LATE I, FIG. 6.**
Hustedt, 1927-1966, p.456.

Diameter: 120-400 µm.
Coscinodiscus granii Gough.
Cupp, 1943, p. 56. ; Hustedt, 1927-1966, p.436.
Diameter: 150-260 µm; 10-15 areolae/10 µm.
Coscinodiscus jonesianus (Greville) Ostenfeld **PLATE I, FIG.7**
Hustedt, 1927-1966, p.438.
Diameter: 90-150 µm.
Coscinodiscus oculus-iridis Ehrenberg **PLATE I, FIG. 8**
Hendey, 1964, p.78.
Diameter: 70-200 µm.
Cyclotella litoralis Lange-Bertalot & Syvertsen **PLATE VIII, FIG. 1**
Nova Hedwigia, 1989. **48** (3-4): 341 – 356.
Diameter: 18-25 µm; 10-15 striae/10 µm.
Cyclotella stylorum Brightwel **PLATE I, FIG. 3**
Hustedt, 1927-1966: 348.
Diameter: 30-40µm; 10-15 striae/10 µm; 3-8 chambers.
Cymatotheca weissflogii (Grunow) Hendey **PLATE II, FIG.12**
Hendey, 1958, p.41.
Apical axis: 18-19 µm; transapical axis 16-18µm.
Dimerogramma minor (Gregoy) Ralfs **PLATE III, FIG.21**
Hustedt, 1985, p.113.
Apical axis: 20-60 µm; transapical axis: 6-20 µm; 8-10 striae/10.
Diploneis bombus Ehrenbeg **PLATE VI, FIG. 63**
Hustedt, 1927-1966, p.704.
Apical axis 40-60 µm; transapical axis 10-20 µm; 5-10 costae/10 µm.
Diploneis crabro (Ehrenberg)Ehrenberg **PLATE VI, FIG. 64**
Hendey, 1964, p.225.
Apical axis: 35-100 µm; transapical axis: 13-25 µm; 5-10 costae/10 µm.
Diploneis didyma (Ehrenberg) Ehrenberg **PLATE VI, FIG. 65**
Hustedt, 1927-1966, p.685.
Apical axis: 37,5-46 µm; transapical axis: 15-17 µm; 9-10 costae/10 µm.
Diploneis finnica (Ehrenberg) Ehrenberg
Patrick & Reimer, 1966, p.410. ; Hustedt, 1927-1966, p. 669.
Apical axis 35-48 µm; transapical axis 25-30 µm; 7-8 costae/10 µm.
Diploneis interrupta Cleve **PLATE IX, FIG. 12**
Navarro, 1982b, p.34.
Apical axis 31 µm; transapical axis 11,5µm;striae 13/10 µm.
Diploneis ovalis (Hilse) Cleve **PLATE VI, FIG. 66**
Hustedt, 1927-1966, p.671.
Apical axis 40-53 µm; transapical axis 20-25 µm; 10-12 striae/10 µm.
Diploneis smithii (Brebisson) Cleve **PLATE VI, FIG. 67 and PLATE X, 13**
Hendey, 1964, p.225.

Apical axis 20-55 µm; transapical axis 10-30 µm; 5-11 costae/10 µm.

Diploneis weissflogii (Hustedt) Grunow **PLATE VI, FIG. 68**
Hustedt, 1927-1966, p.703.
Apical axis: 27-85 µm; transapical axis: 5-19 µm: 7-10 costae/10 µm

Entomoneis alata (Ehrenberg) Kutzing. P**LATE VII, FIG. 82**
Patrick & Reimer, 1975, p.3; Hendey, 1964, p.253
Apical axis 100 µm; pervalvar axis 20-40 µm; 10 striae/10 µm.

Entomoneis. pulchra (J.Bailey) Reimer
Patrick & Reimer, 1975, p.5.
Apical axis 200-270 µm; 7 striae/10 µm

Eunotia camelus Ehrenberg **PLATE IV, FIG. 36**
Frenguelli, 1933, p.451.
Apical axis 16-32µm; transapical axis 5-6µm; 9-10 striae⁄10µm.

Eunotia flexuosa (Brebisson) Kutzing **PLATE IV, FIG. 37**
Patrick & Reimer, 1966, p.187.
Apical axis 85-250µm; transapical axis 2-5µm; 14-19 striae⁄10µm.

Eunotia lineolata Hustedt **PLATE IV, FIG. 38**
Silva, 1987, p.48.
Apical axis: 99µm; transapical axis 6,5µm; 17-19 striae⁄10µm; 7-8 espinhos⁄10µm.

Eunotia monodon Ehrenberg **PLATE IV, FIG. 39**
Hustedt, 1930, p.185.
Apical axis 66-76µm; transapical axis 10-14µm; 11 striae⁄10µm.

Eunotia trigibba var. *paucistriata* Hustedt
Silva, 1987, p. 37.
Apical axis 24,5-43µm; transapical axis 11,5-12µm; striae 10-13⁄10µm.

Eunotia pectinalis (O.Muller) Rabenhorst
Patrick & Reimer, 1966, p.204
Apical axis: 73-90 µm; transapical axis: 5,5-10 µm; 10 striae/10 µm.

Eunotia pseudoindica Frenguelli
Silva, 1987, p.41.
Apical axis 45-100µm; transapical axis 7,5-13µm; 10,5-15 striae⁄10µm.

Eunotia zigodon Ehrenberg **PLATE IV, FIG. 40**
Patrick & Reimer, 1966, p.199.
Apical axis 62,5-115µm; transapical axis 20-24,5µm; 12-14 striae⁄10µm.

Eupodiscus radiatus Bailey **PLATE II, FIG. 17 and PLATE VIII, FIG. 4**
Hendey, 1964, p.97.
Diameter: 60-280 µm.

Fallacia pseudony (Hustedt) Mann. **PLATE VI, FIG. 60**
Hustedt, 1927-1966, p.370.
Apical axis: 12-20 µm; transapical axis: 9,5-15 µm; striae: 20-25/10 µm.

Fragilaria fasciculata (Agardh) Lange-Bertalot. **PLATE VII, FIG. 5**
Krammer & Langue-Bertalot, 1991, p.500.

Fragilaria cf. robusta (Fusey) Manguin **PLATE VIII, FIG. 6**
Krammer & Lange-Bertalot, 1991, p.164.
Diameter: 2,85 µm.
Frustulia rhomboides (Ehrenberg) De Toni **PLATE VI, FIG. 58**
Patrick & Reimer, 1966, p.306.
Apical axis 60-70 µm; transapical axis 14-15 µm.
Gomphonema parvulum (Kutzing) Kutzing
Silva, 1987, p.125.
Apical axis: 12-26 µm; transapical axis: 5-7 µm; striae: 14-18/10µm.
Grammatophora marina (Lyngbye) Kutzing **PLATE IV, FIG. 35 and PLATE IX, 9**
Hustedt, 1985, p.41.
Apical axis: 20-60µm; pervalvar axis: 8-18µm; 18-20 striae⁄10µm.
Grammatophora oceanica (Ehrenberg) Grunow
Hustedt, 1927-1966, p.45.
Apical axis: 48 µm; transapical axis: 6 µm.
Gyrosigma balticum (Ehrenberg) Rabenhorst **PLATE VI, FIG. 72**
Patrick & Reimer, 1966, p.324.
Apical axis 200-400µm; transapical axis 20-50µm; 13-15 striae/10µm.
Hemidiscus cuneiformis Wallich **PLATE I, FIG. 9**
Hendey, 1964, p.94.
Apical axis: 35-63µm; transapical axis 35-40µm.
Licmophora ehrenbergii (Kützing) Grunow var. *angustata* Grunow **PLATE III, FIG.31**
Hustedt, 1927-1966, p.70.
Apical axis: 100-105µm; transapical axis: 7,5-10µm.
Licmophora remulus Grunow
Hustedt, 1927-1966, p.57.
Apical axis: 50-300 µm; striae: 33-36/10 µm.
Lithodesmium undulatum Ehrenberg **PLATE III, FIG.22**
Hendey, 1964, p.111.
Length between two corners: 30-40 µm; 15-20 lines of areolae⁄10µm.
Lyrella approximata (Greville) D.G.Mann **PLATE V, FIG. 42**
Hustedt, 1927-1966, p.416.; Hendey, 1958, p.63. (like *Navicula approximate* Grev.)
Apical axis: 55-60 µm; transapical axis: 20-30 µm; striae: 10-15/10 µm.
Martyana martyi Heribaud
Hustedt, 1930, p.132. (like *Opephora martyi* Herib)
Apical axis: 70-91µm; transapical axis: 10,5-14µm.
Martyana schwartzii (Grunow) Petit. **PLATE III, FIG. 29**
Patrick & Reimer, 1966, p.116. (like *Opephora schwartzii* (Grun.)Petit)
Apical axis: 40-70µm; transapical axis: 10-20µm; 3-5 striae⁄10⁄10µm.
Mastogloia angulata Lewis **PLATE V, FIGS. 44 - 45**
Stephens & Gibson, 1980, p.355.

Apical axis 50-70µm; transapical axis 25-30µm; 10-12 striae/10µm; 3-4 loculi/ 10µm.

Mastogloia apiculata Wm. Schmith **PLATE V, FIG. 46 and PLATE IX, 11**

Peragallo & Peragallo, 1897-1908, p.33. ; Hustedt,1985, p.439.

Apical axis:50-58 µm; transapical axis: 20-21µm; 15-7 striae/10 µm; 7-8 partecta/ 10µm.

Mastogloia braunii Grunow **PLATE V, FIGS. 47 - 48**

Hustedt, 1985, p.468.

Apical axis 40-56µm; transapical axis 16-20µm; 15-20 loculi/10µm.

Mastogloia elegans Lewis **PLATE V, FIGS. 49 - 50**

Hustedt, 1985, p.426.

Apical axis 50-72µm; transapical axis 18-24µm; 14-15 loculi/10µm.

Mastogloia elliptica (Agard) Cleve var *dansei* (Thwaits) Cleve **PLATE V, FIG. 51**

Hustedt, 1985, p.428.

Apical axis 30-45µm; transapical axis 10-15; 25-30 striae/10µm; 3-4 loculi.

Mastogloia pumilla (Grunow) Cleve **PLATE V, FIGS. 52 - 53**

Stephens & Gibson, 1980, p.22.; Patrick& Reimer, 1966, p.301.

Apical axis 30-45µm; transapical axis 10-15µm; 25-30 striae/10 µm; 3-4 partectos/ 10 µm.

Navicula cryptocephala (Kutzing) **PLATE X, 14 – 16, FIG. 14 - 16**

Patrick & Reimer, 1966, p.503.

Apical axis; 11µm; transapical axis 8,5 µm 12 striae/10 µm.

Navicula distans (Wm. Smith) Ralfs

Hendey, 1964, p.203.

Apical axis 100-120 µm; transapical axis 19-22 µm.

Navicula pennatae A. Schmidt **PLATE VI, FIG. 70**

Hendey, 1964, p.203.

Apical axis 50-100 µm; transapical axis 7-18 µm; 4-13 striae/10 µm.

Navicula viridula (Kutzing) Ehrenberg

Hendey, 1964, p.200.

Apical axis: 70-75 µm; transapical axis: 15-20 µm; 5-10 striae/10 µm.

Nitzschia scalaris (Ehrenberg) Wm. Smith **PLATE VII, FIG. 78**

Hustedt, 1985, p.861.

Apical axis 230-240µm; transapical axis 10-13µm; 10-15 striae/10µm; 4-6 fibula/10µm.

Nitzschia sigma (Kutzing) Wm. Smith **PLATE VII, FIG. 79**

Hustedt, 1985, p.873.

Apical axis 80-400µm; transapical axis 5-11,5µm; 10-15 striae/10µm; 4-8 fibula/ 10µm.

Odontella sinensis (Greville) Simonsen **PLATE II, FIG. 16**

Hendey, 1964, p.105. ; Hustedt, 1927-1966, p.837.

Apical axis: 50-100 µm; transapical axis 45-50 µm.

Paralia fenestrata Sawai & Nagumo. **PLATE I , FIG. 4 and PLATE VIII, FIG. 2**

Sawai *et al.* (2005). Phycologia, **44**: 517-529.
Diameter: 20 – 27,5 µm

Perissonöe cruciata (Janisch &Rabenhorst.) Andrews et Stoelzel **PLATE IV, FIG. 33**
Andrews & Stoelzel, 1982, p.226.; Fenandes *et alii*, 1990, p.69.
Length between two sides: 27 µm; length between opposit corners 32 µm.

Petroneis marina (Ralfs in Pritchard) Mann **PLATE V, FIG. 43**
Hustedt, 1927-1966, p.705. ; Hendey, 1964, p.207.
Apical axis 60-100 µm; transapical axis 25-40 µm; 9-15 striae/10µm.

Plagiogramma staurophorum (Gregory) Ehrenberg **PLATE III, FIG.20**
Hendey, 1964, p.166.
Apical axis: 30-70 µm; transapical axis: 10-15 µm; 8-10 striae/10 µm.

Plagiotropis lepdoptera (Gregory) Cleve **PLATE VII, FIG. 73**
Hendey, 1964, p.256. (like *Tropidoneis lepdoptera* Greg.)
Apical axis: 90-120 µm; transapical axis: 10-21 µm; 20-26 striae/10 µm.

Pleurosigma diverse-striatum Meister **PLATE VI, FIG.71**
Hendey, 1970, p.152.
Apical axis 130 µm; transapical axis 20-29 µm; 20 striae/10µm.

Psammodictyon panduriformis (Gregory) Mann **PLATE VII, FIG. 77**
Navarro, 1982b, p.55.
Apical axis 120-170µm; transapical axis 40-50µm; 16striae/10µm; 6-8 fibula/ 10 µm.

Pseudosolenia calcar-avis (Schultz) Sünds
Cupp, 1943, p.89.
Apical axis: 600-630µm; transapical axis: 22µm.

Rhaphoneis amphiceros (Ehrenberg) Ehrenberg
Navarro, 1982b, p.24. ; Hendey, 1964, p.154.
Length between two corners: 20-30µm.

Rhaphoneis castracanei Grunow. **PLATE III, FIG. 32**
Andrews, 1975, p.206.
Apical axis 20-60µm; transapical axis 10-30µm.

Rhizosolenia hebetata Bailey var. *hiemalis* Gran. **PLATE III, FIG.25**
Cupp, 1943, p.88.
Diameter: 18-20µm.
Apical axis: 26,5 µm; transapical axis: 4 µm; striae 18/10 µm

Rhopalodia gibberula (Ehrenberg) O. Muller **PLATE VII, FIG. 80**
Hustedt, 1930, p. 391.
Apical axis 25-30µm; transapical axis 8-11µm.

Rhopalodia musculus (Kutzing) O. Muller **PLATE VII, FIG. 81**
Rivera, 1974, p.75.; Hustedt, 1930, p.392.
Apical axis 30-80µm; transapical axis 12-16µm; 12-16 lines of costae/10 µm.

Roperia tesselata (Roper) Grunow **PLATE II, FIG. 11**
Hendey, 1964:85, pl.22, fig.3; Hustedt, 1927-1966:523, fig.297 a.

Diameter: 67,5µm.

Seminavis atlântica Garcia **PLATE X, FIGS. 17 - 19**

Garcia, 2007, p.765-769.

Apical axis 65,54 µm; transapical axis 8,8 µm; 15 striae/10 µm.

Stauroneis phoenicenteron (Nitzsch) Ehrenberg **PLATE VII, FIG. 74**

Patrick & Reimer, 1966, p.359.

Apical axis 120-155µm; transapical axis 22-30µm; 13 costae/10µm.

Surirella guatimalensis Ehrenberg **PLATE VII, FIG. 83**

Hustedt, 1962, p.516.

Apical axis: 110-157 µm; transapical axis: 55-70 µm; 27 fibula/10 µm.

Synedra crystalina Lyngb-Peragallo **PLATE III, FIG. 30 and PLATE IX, FIGS. 7 - 8**

Hustedt, 1927-1966, p.232.

Apical axis: 220 - 320µm; transapical axis -12-16µm; striae 11-13/10µm

Terpsinoë americana (Bailey) Ralfs **PLATE II, FIG.18**

Hustedt, 1927-1966, p.900.

Apical axis: 30-100 µm, transapical axis: 20-45 µm.

Terpsinoë musica Ehrenberg **PLATE II, FIG.19**

Peragallo & Peragallo, 1897-1908, p.370.

Apical axis: 80-150 µm.

Thalassiosira eccentrica (Ehrenberg) Cleve **PLATE I, FIG. 1**

Fryxel & Hasle, 1972, p.300.

Diameter: 30-50 µm; 5-10 areolae/10 µm.

Thalassiosira oestrupii var. *venrickae* Fryxell & Hasle **PLATE, FIG. 2**

Fryxell & Hasle, 1980, p.810-813.

Diameter: 15-30 µm; 5-10 areolae/10 µm.

Thalassionema frauenfeldii (Grunow) Grunow

Cupp, 1943, p.184.

Apical axis: 90-200µm; transapical axis 2-4µm.

Triceratium favus Ehrenberg **PLATE II, FIG. 15**

Hustedt, 1927-1966, p.798.

Length between two corners: 90-150 µm.

Discussion

Cyclotella stylorum, *Entomoneis alata*, *Entomoneis pulchra*, *Navicula pennata*, *Plagiotropis lepidoptera* and *Rhopalodia musculus* were the most constant species in Lagoa da Conceição, occurring in all sampled periods.

Actinoptychus senarius, *Amphora proteus*, *Coscinodiscus oculus-iridis*, *Cyclotella litoralis*, *Diploneis smith*, *Gyrosigma balticum*, *Martyana marthy*, *Mastogloia angulata*, *Mastogloia apiculata*, *Mastogloia elegans*, *Mastogloia elliptica var. dansei*, *Perissonoe cruciata*, *Rhaphoneis castracanei*, *Rhopalodia gibberula and*

Terpsinoe americana were also well representative, occurring in 80% of the sampled periods.

Conceição lagoon showed diatom flora typical of coastal lagoons and estuaries, with low percentage of freshwater species (21%) and euplanktonic species (10%) as same as the Santa Catarina Southern Lagoon Complex (Souza-Mosimann and Laudares-Silva 2005), The two systems presented approximated taxa richness but, nevertheless, it was found only 41% of similarity between its diatom flora (Souza-Mosimann and Laudares-Silva 2005).

The freshwater species of the genus *Eunotia, Actinella, Brackysira, Stauroneis and Surirella* (Table 1) that had been restricted to the northern area of Conceição lagoon were not recorded in 2002. The marine neritic euplanktonic species of the genus *Bacteriastrum, Chaetoceros, Corethron, Lithodesmium, Skeletonema* were found only in the Conceição Lagoon southern area and at the entrance of the channel that communicates the lagoon with the sea. However, more data is necessary to explain the influence of salinity on diatoms species distribution.

The estuarine and very common species Asterionellopsis glacialis (Castracane) Round, Bacilliaria paxillifera Gmelin, and *Melosira moniliformis* (Muller) Agardh recorded by Odebrecht, (1985) to Conceição lagoon were not recorded in this analysis.

Odebrecht (1988), highlights the importance of the diatom *Cyclotella striata* by its high densities throughout the lagoon and *Nitiszchia aff. closterium* at the central area. This study confirmed the high density of *Cyclotella litoralis* in May and November 1982 at central area and May 1980 at northern area. Scanning electron microscopy studies did not confirm the presence of *Cyclotella striata* in Conceição lagoon but *Cyclotella litoralis* were confirmed. It was probably misidentified at the optical microscope and confused with the first. Likewise, it was confirmed in the lagoon the presence of *Paralia fenestrata* Sawai & Nagumo that probably had been misidentified by Odebrecht (1988) as *Paralia sulcata* (Ehrenberg) Cleve. Only in (2005) Sawai *et al.* observed that *Paralia sulcata* comprised a complex of species, among them *P. fenestrata*,

Available data are insufficient to explain the distribution of diatom species related to salinity at the Conceição lagoon. More intensive and systematic studies are needed concerning this community.

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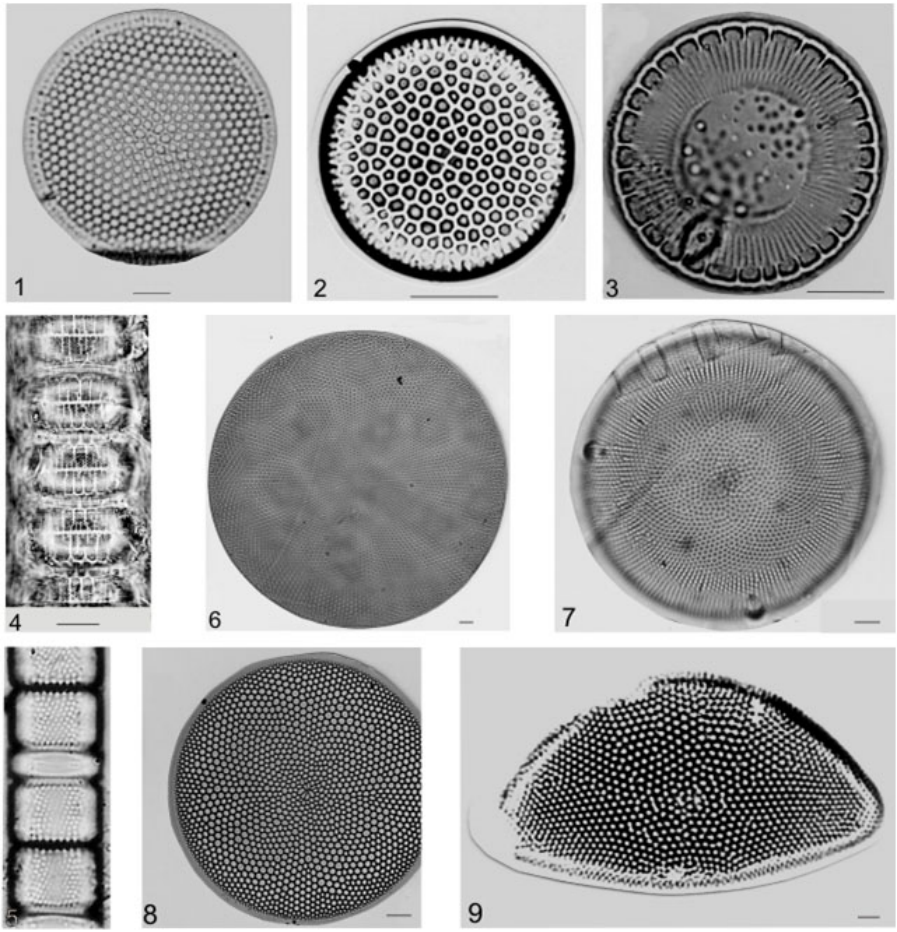

Plate I. Light Microscopy. Fig. 1.*Thalassiosira eccentrica*; 2. *T. oestrupii* var. *venrickae*; 3. *Cyclotella stylorum*; 4. *Paralia fenestrata*; 5. *Aulacoseira granulata*; 6 *Coscinodiscus gigas*; 7.*C. jonesianus*; 8.*C. oculus-iridis*; 9.*Hemidiscus cuneiformis.* Scale (bars): 10 µm.

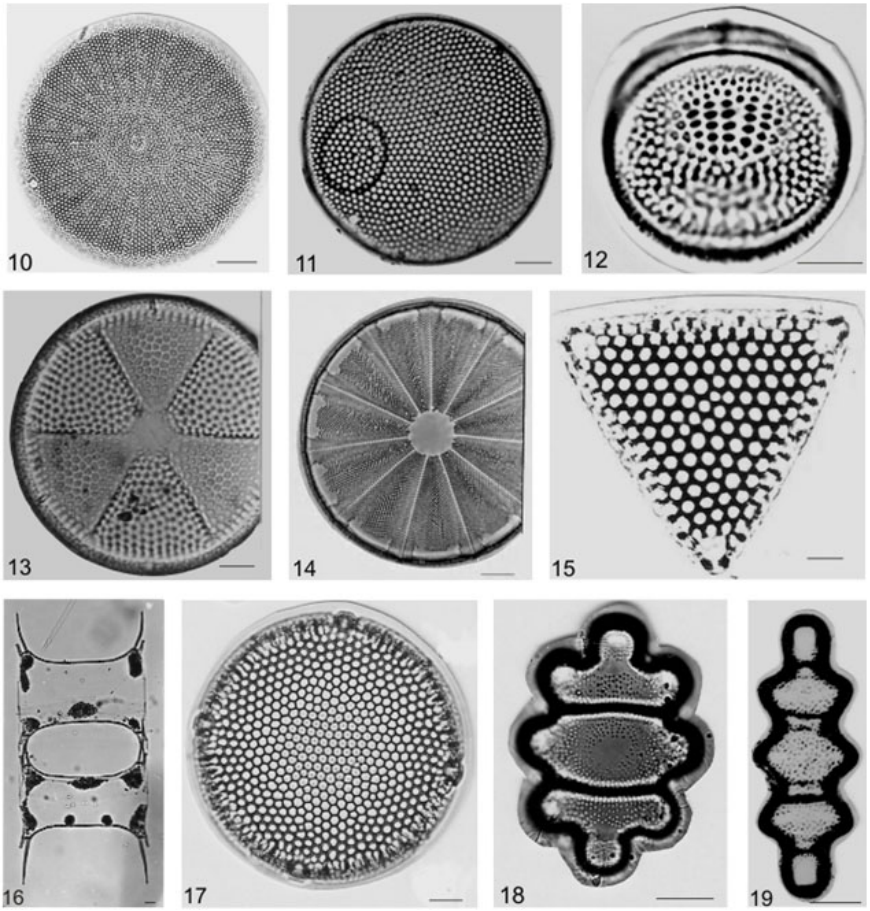

Plate II. Light Microscopy. Fig. 10.*Actinocyclus octonarius*; 11. *Roperia tesselata*; 12. *Cymatotheca weissflogii*; 13. *Actinoptychus senarius*; 14. *A. splendens*; 15. *Triceratium favus*; 16. *Odontella sinensis*; 17. *Eupodiscus radiatus*; 18. *Terpisinöe americana*; 19. *T. musica. Scale: (bars):* 10 µm.

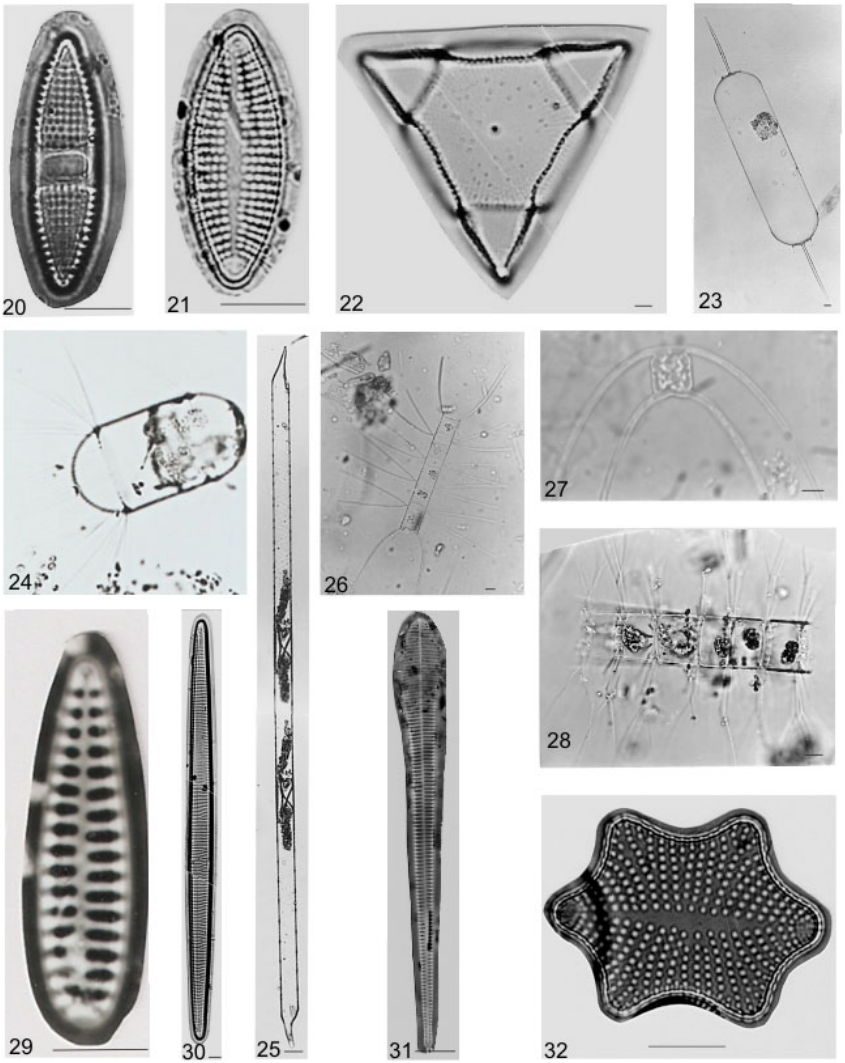

Plate III. Light Microscopy. Fig.20. *Plagiogramma staurophorum*; 21. *Dimerogramma minor*; 22. *Lithodesmium undulatum*; 23. *Ditylum brightwellii*; 24. *Corethron criophylum*; 25. *Rhizosolenia hebetata*; 26. *Chaetoceros lorenzianum*; 27. *C. peruvianum*; 28. *Bacteriastrum hyalinum*; 29. *Martyana shcwartzii*; 30. *Synedra crystalina*; 31. *Licmophora ehrenbergii*; 32. *Rhaphoneis castracanei.* Scale (bars): 10 µm.

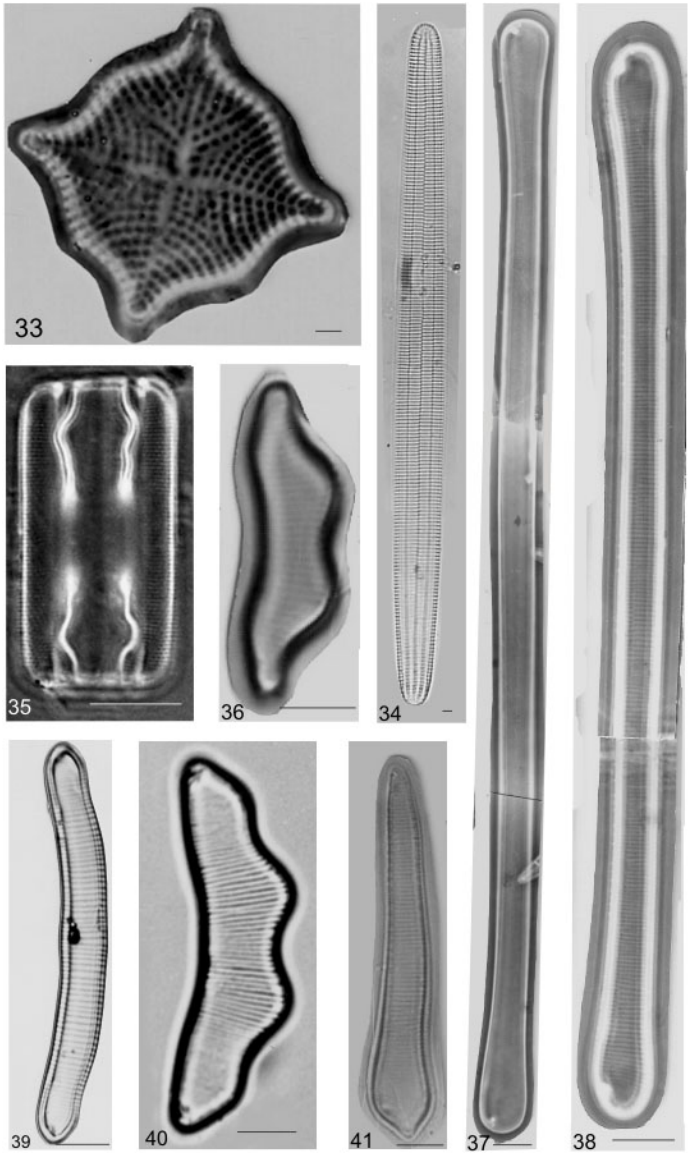

Plate IV. Light Microscopy. Fig. 33. *Perissonöe cruciata*; 34. *Ardissonea formosa*; 35. *Grammatophora marina*; 36. *Eunotia camelus*; 37. *Eunotia flexuosa*; 38. *Eunotia lineolata*; 39. *E. monodon*; 40. *E. zygodon*; 41. *Actinella brasiliensis*.Scale (bars): 10 µm.

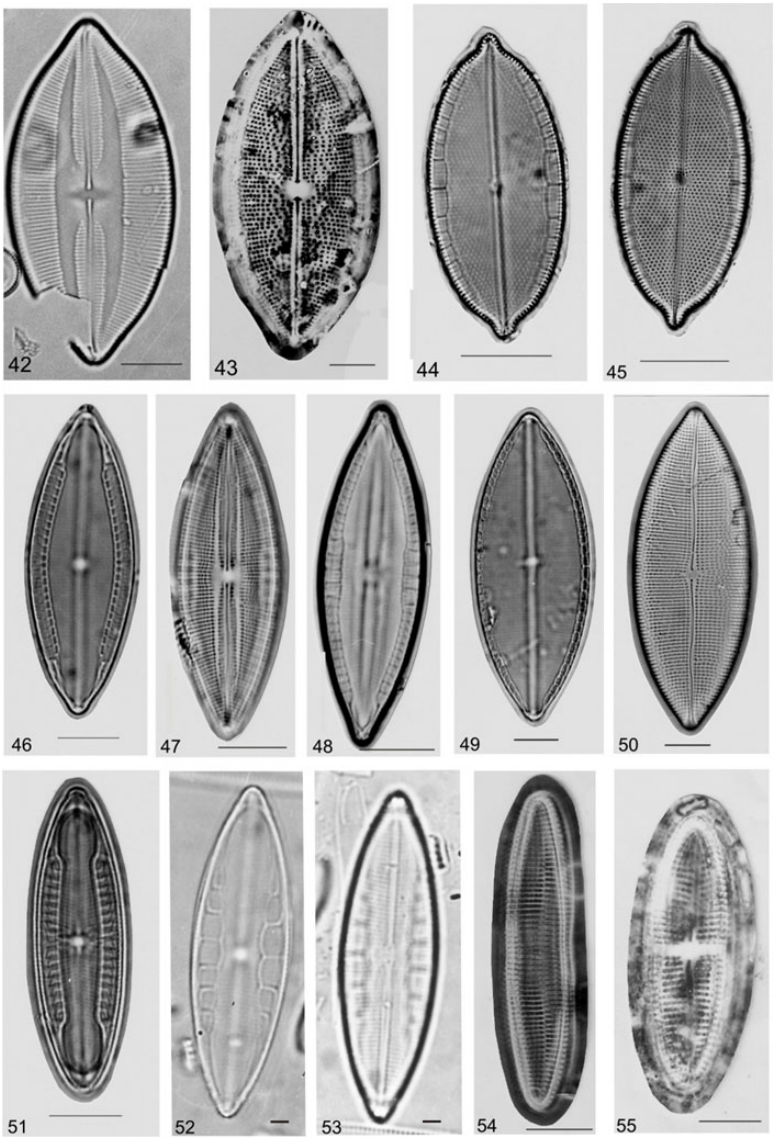

Plate V. Light Microscopy. Fig. 42. *Lyrella approximata*; 43. *Petroneis marina*; 44 - 45. *Mastogloia angulata*; 46. *M. apiculata*; 47- 48. *M. braunii;* 49 - 50. *M. elegans*; 51. *M. elliptica* var. *dansei;* 52 - 53. *M. pumilla.*54 - 55.*Achnanthes brevipes.* Scale (bars):10 µm.

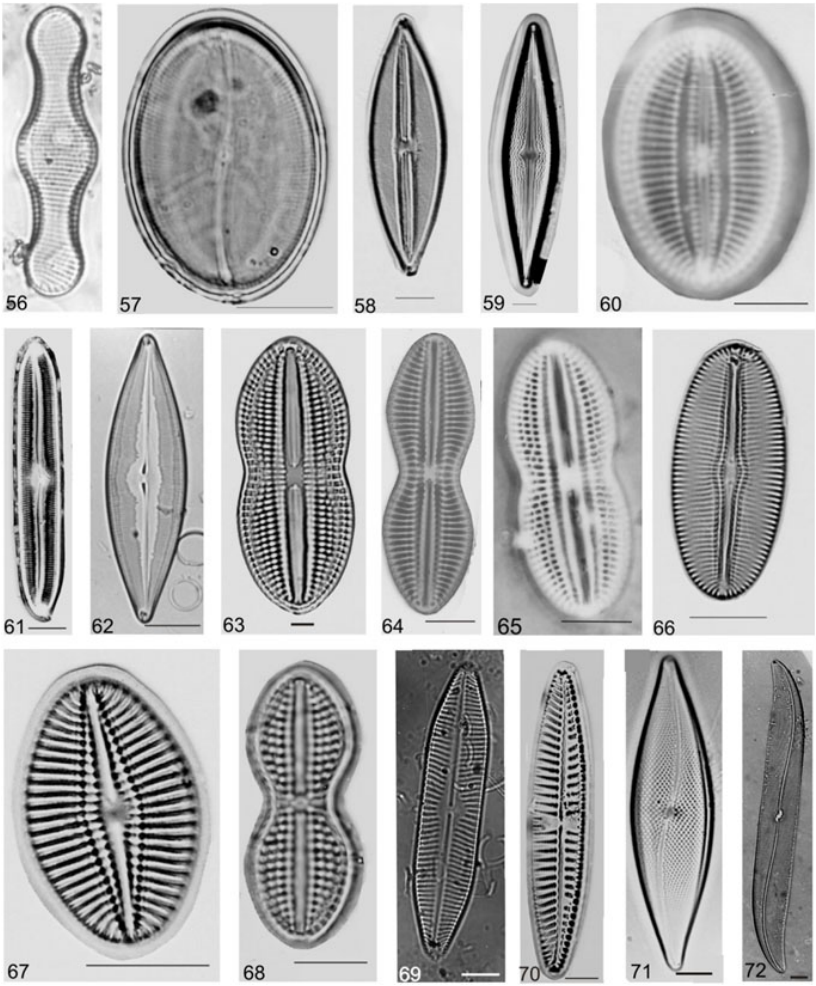

Plate VI. Light Microscopy.Fig.56.*Achnanthes inflata*; 57.*Cocconeis heteroidea*; 58.*Frustulia rhomboides*;59.*Brackysira serians*; 60. *Fallacia pseudony;* 61.*Pinnularia maior*;62. *Caloneis westii*; 63.*Diploneis bombus*; 64. *D. crabro*; 65.*D. didyma*; 66.*D. ovalis*; 67.*D. smithii*; 68. *D. weissflogii*; 69. *Pinnularia yarrensis* var. *americana*; 70. *N. pennatae*; 71. *Pleurosigma diverse-striatum*; 72. *Gyrosigma balticum*. Scale (bars): 10 µm. Exception Fig. 62: 15 µm.

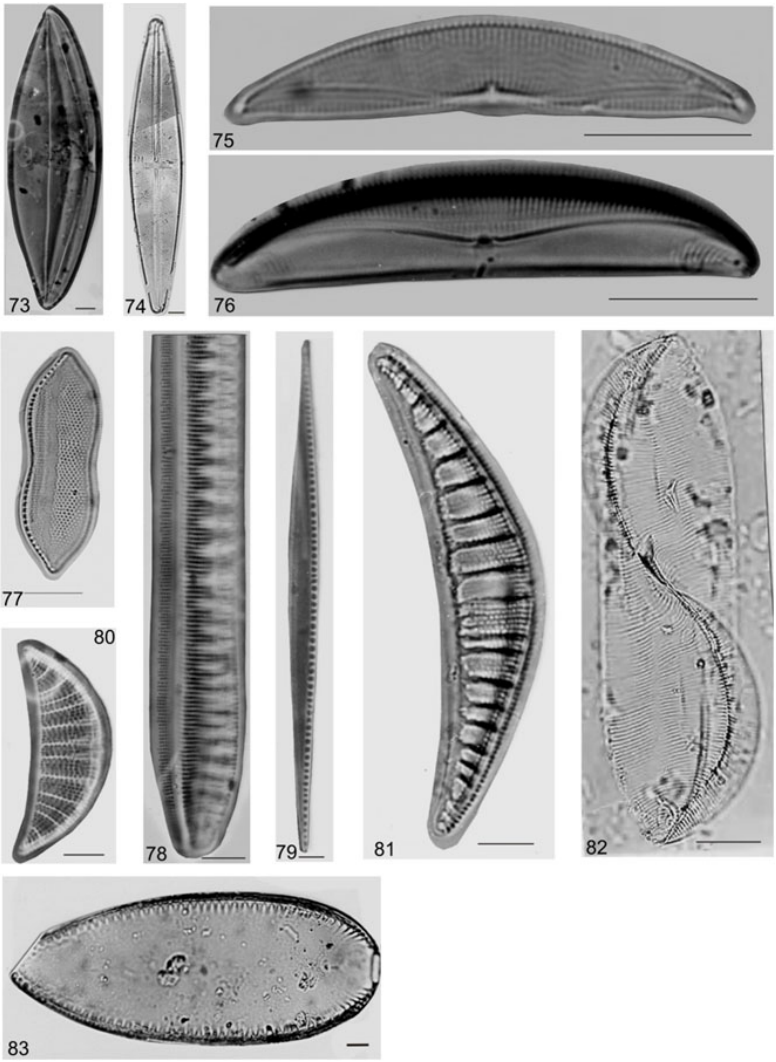

Plate VII. Light Microscopy. Fig. 73.*Plagiotropis lepdoptera*;74. *Stauroneisphoenicenteron*; 75. *Amphora ovalis*; 76. *A. proteus*;77. *Psammodictyon panduriformis*; 78. *Nitzschia scalaris*; 79. *N. sigma*; 80. *Rhopalodia gibberula*; 81. *R. musculus*; 82. *Entomoneis alata*; 83. *Surirella guatimalensis.* Scale (bars.): 10 µm. Exception: Figs.75 and 76: 5 µm.

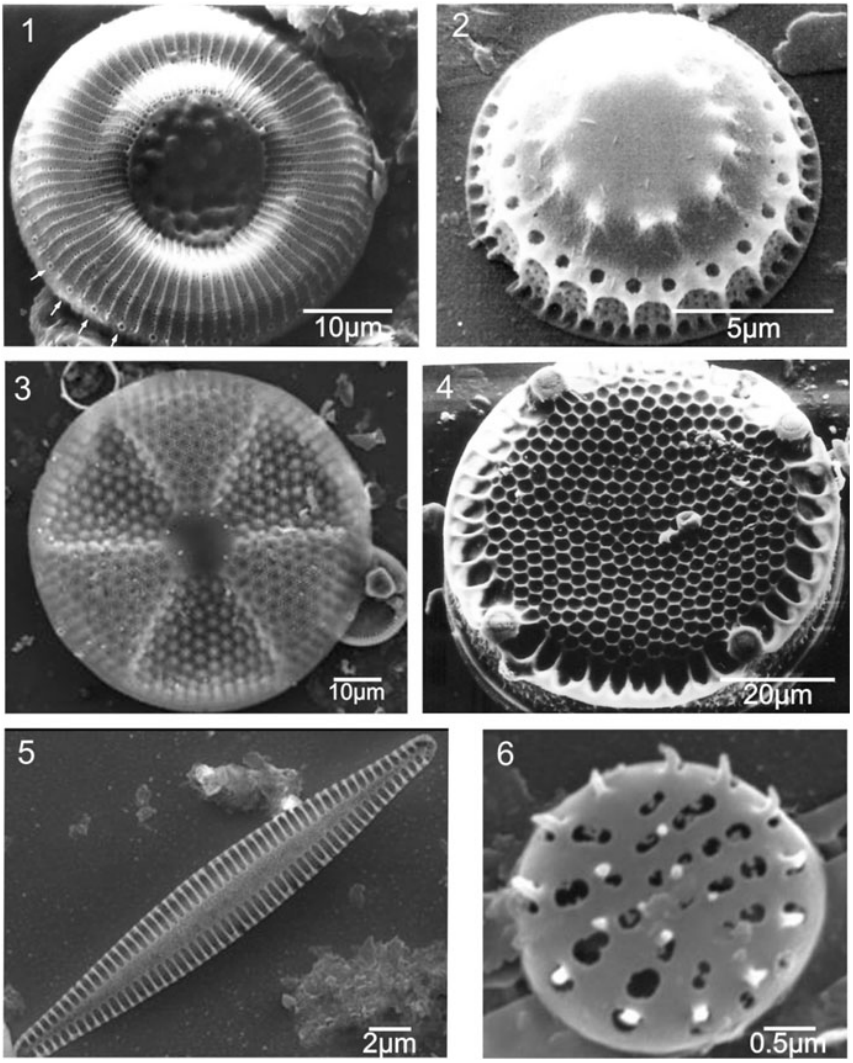

Plate VIII. Scanning Electron Microscopy. Fig. 1. *Cyclotella litoralis;* Fig. 2. *Paralia fenestrata*; Fig. 3. *Actinoptychus senarius;* Fig. 4. *Eupodiscus radiatus;* Fig.5. *Fragilaria fasciculata;* Fig. 6. *Fragilaria* cf. *robusta.*

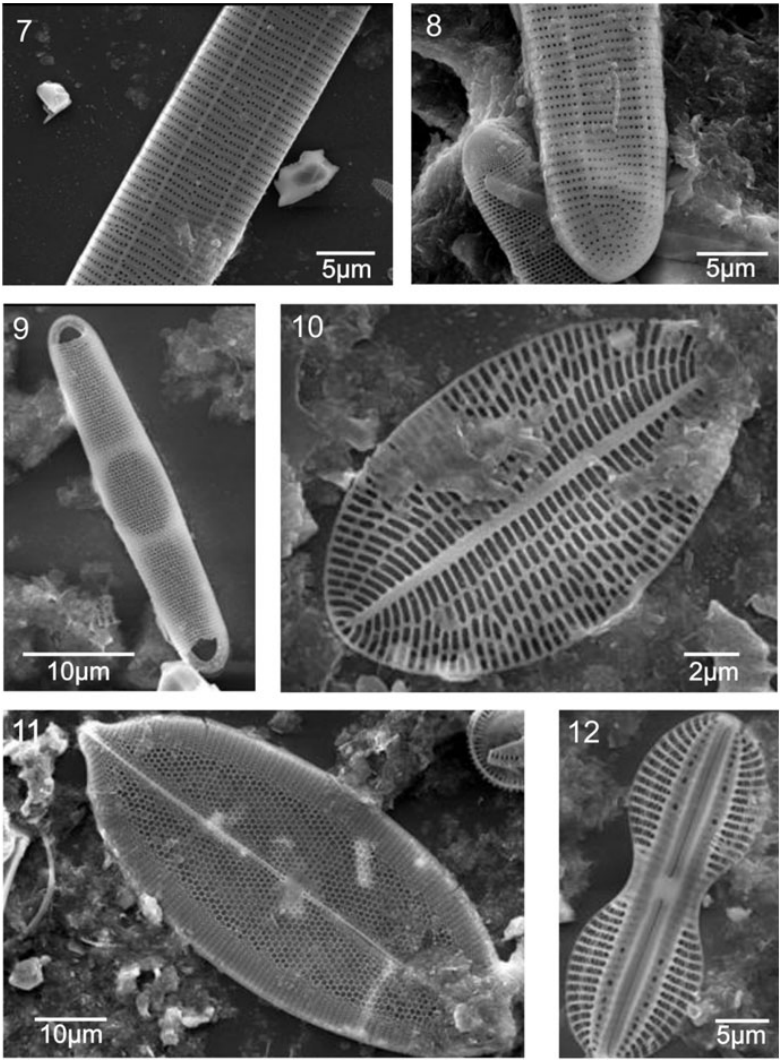

Plate IX. Scanning Electron Microscopy. Fig.7 - 8. *Synedra crystalina;* Fig. 9. *Grammatophora marina*; Fig. 10. *Cocconeis placentula;* Fig. 11. *Mastogloia apiculata;* Fig. 12. *Diploneis interrupta.*

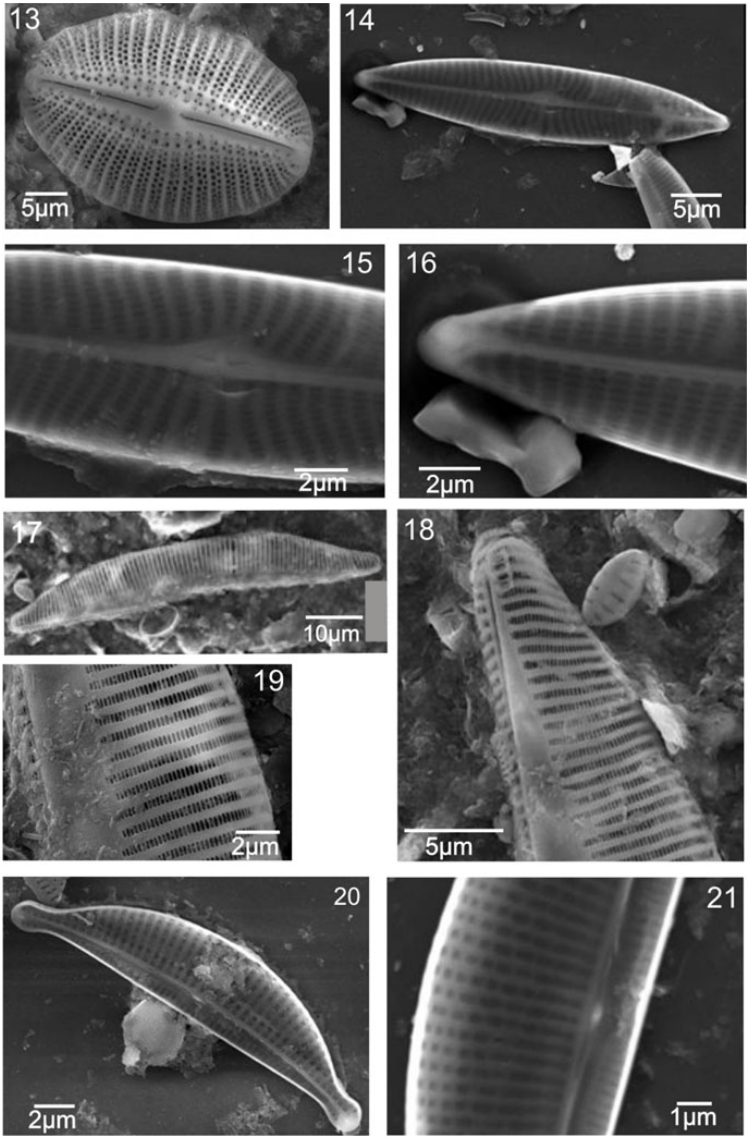

Plate X. Scanning Electron Microscopy. Fig. 13. *Diploneis smithii;* Figs. 14 - 16. *Navicula cryptocephala*; Figs. 17 - 19. *Seminavis atlantica;* Figs. 20 - 21. *Amphora tumida*.