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Ecological composition and distribution of the diatoms from the Laguna Superior, Oaxaca, Mexico

Author Details

José Luis Moreno-Ruiz (*Corresponding author*)	Universidad Autónoma Metropolitana-Xochimilco, Calzada Del Hueso 1100, Col. Villa Quietud, C.P. 04960, México, D.F. e-mail: jlmoreno@correo.xoc.uam.mx; jlmr08@yahoo.com.mx; jlmr64@yahoo.com.mx
Margarito Tapia-Garcia	Universidad Autonoma Metropolitana-Iztapalapa, Av. Michoacan y Av. La Purisima, Col. Vicentina, Iztapalapa, C.P. 09340, A.P. 55-535
Sergio Licea	Instituto De Ciencias Del Mar y Limnología, Universidad Nacional Autónoma de México, C.P. 04510, A.P. 70-305
María Guadalupe Figueroa-Torres	Universidad Autónoma Metropolitana-Xochimilco, Calzada Del Hueso 1100, Col. Villa Quietud, C.P. 04960, Mexico, D.F.
Alfonso Esquivel	Universidad Autónoma Metropolitana-Xochimilco, Calzada Del Hueso 1100, Col. Villa Quietud, C.P. 04960, Mexico, D.F.
Jorge Eduardo Herrera-Galindo	Universidad Del Mar, Puerto Ángel, Oax., C.P. 70902
José Manuel González-Fernández	Universidad Autonoma Metropolitana-Xochimilco, Calzada Del Hueso 1100, Col. Villa Quietud, C.P. 04960, México, D.F.
María Del Carmen González-Macias	Instituto Mexicano Del Petróleo, Subdirección De Protección Ambiental, Laboratorio De Estudios Ecológicos, C.P. 07730, A.P. 14-805

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Abstract

A taxonomic study of diatoms was carried out in a tropical coastal lagoon. Material for this study consists of water samples obtained from February-March 1992 to November-December 2000. Qualitative and quantitative analyses showed the presence of 373 taxa of which the families Bacillariaceae (67 species) and Chaetocerotaceae (37 species) were the most abundant groups. The species *Skeletonema costatum, Chaetoceros curvisetus, Coscinodiscus radiatus* var. radiatus, *Ditylum brightwellii, Thalassiosira eccentrica* and *Entomoneis alata* were found associated with moderate water quality and forming blooms. In addition, a regional comparison between Mexico and South America of the identified species is given. For practical handling, indicative values obtained from their ecological composition are incorporated as well as a code of the floristic list. A checklist of the species and their occurrence are given.

Key words

Phytoplanktic, Indicator values, Neotropical, Blooms, Water quality

Introduction

Studies of diatoms in coastal lagoons and estuaries in the southern portion of the Mexican Pacific have been scanty and records for fresh water species, few. However, since more than a century ago there have been sporadic studies on this subject (cf. Moreno *et al.*, 1996, Figueroa-Torres *et al.*, 2008; Figueroa-Torres, 2009). There have been some studies that provide check lists and indicator values (Ortega *et al.*, 1995; Moreno-Ruiz, 2000, 2005; Moreno, 2003); however a great number of species have been excluded. For this reason it is necessary to study their ecological dynamics. Because of the extension of the Mexican territory, however, it is necessary to apply a regional approach to determine the ecological characteristics in such a magnitude that a greater precision in the studies that are here developed is provided (Moreno *et al.*, 1996).

The study area has social problems with ecological repercussions that have produced demographic growth, industrial activities and natural disasters in the lagoon. The problem is even larger since it corresponds to an area poorly studied in relation to its biotic resources (Tapia-García *et al.*, 1998). In this investigation our main goal is to contribute to the current knowledge of the composition and distribution of diatom species through indicator values of their ecological composition and habitat characteristics.

Materials and Methods

The study area is located between the geographical coordinates 16° 14' at 16° 26' N and the 94° 47' at 95° 05' W in the Isthmus of Tehuantepec (Fig. 1) at the South-east Coastal Plain Province (Rzedowsky, 1978). The climate is warm and sub-humid with an average temperature of 27.3°C and the annual oscillation < to 5°C (García, 1981). Two climatic seasons exist: the dry season (November to April-May) and the rainy season (May-June to October). Between January to March, strong winds from the north called "Tehuantepecos" or "Tehuantepecanos" occur (Monreal-Gómez and Salas de León, 1998).

For this study, 14 excursions were undertaken. Sampling was carried out on a boat with an overboard motor at 16 stations (Fig. 1). A Total of 224 water samples were gathered at variable depths (0.4-2.0 m) in February-March, May-June and November-December (1992, 1996, 1998-1999 and 2000). Material was collected at the surface level with a Van-Dorn bottle of a two-liter capacity and preserved in Lugol's solution for analysis on an inverted microscope (Olympus CK40). Later on, qualitative and quantitative analyses were carried out, 100 ml of each sample being settled in a sedimentation chamber (Utermöhl, 1958). In addition, net samples were taken for each station and preserved in neutralized formalin. This material was used mainly for detailed identification following the methods referred to by Moreno (2003). In some cases sub-samples rinsed of salt were mounted directly on aluminium stubs for Electron Microscopy for detailed identification. Electron microscopy was carried out using a SEM model JEOL JSM-5410LV, and a Transmission Electron microscope being used (JEOL JEM-1200EX2). Species with their nomenclatural authorities (Table 2) are arranged alphabetically in each order according to the classification of Round *et al.* (1990).

Table 1 shows the species identification, systematic ordination, and indicator values (pH, salinity, thermic preference, nitrite, nitrate, ammonium and phosphate concentrations; total nitrogen:total phosphorus ratio; trophic preferences, frequency or distribution, importance or dominance, blooms, species richness, Shannon-Wiener diversity and form of life) were elaborated with original data according to the approaches of Caljon (1983), Contreras-Espinosa *et al.* (1994), Van Dam *et al.* (1994), Moreno *et al.* (1996), Moreno-Ruiz (2000, 2005 and 2008), Reguera (2002), Siqueiros-Beltrones (2002), Moreno (2003) and Smith (2006).

Ecological composition or indicator values: The classification of indicator values is illustrated in Table 1. The individual pondered indicator value was obtained by using 15 mean values of the variables referred to in Table 2 for each taxon. The average of the highest values that the variables used can have produced the highest indicator value of water quality). 33.3% of this value defined the upper limit of the high water quality while the 66.9% of the largest value defined the upper limit of the moderate water quality. Intervals for this study are shown in Table 1. The average of the pondered indicator values represented the indicator value of water quality of the analyzed taxa (Table 2).

Floristic list and distribution: The obtained species list of this lagoon was compared with species previously reported in the country by 70 authors between 1838 and 2003, the ones that were also summarised by Moreno-Ruiz (2005, 2008), data of Mora-Navarro *et al.* (2004) and Oliva-Martínez *et al.* (2005) being included. This information was upgraded with the addition of new data through the analysis of materials collected by the authors of this study in different sites of the country. The fossil material studied, coming from Late-Miocene (Moreno-Ruiz and Carreño, 1994), was collected by colleagues of the Instituto de Geología of the Universidad Nacional Autónoma de México, The Universidad Autónoma de Baja California, CICESE and of the first author. Morphometry and illustration of important species is shown in Moreno-Ruiz (2000).

Data related to the presence of diatoms species in South America were obtained from the information referred by Navarro (1981, 1982a, 1982b, 1983), González de Infante (1988), Spiniello (1996), Huszar *et al.* (1998), Díaz-Ramos (2000), Soler *et al.* (1993), Soler (1993) Donato-Rondón (2001), Riofrío *et al.* (2003) and Lacerda *et al.* (2004).

For the analysis of the species of this lagoon, a matrix was built with the indicative pondered values for each taxon (Table 2), which was standardized according to Lepistö and Rosenström (1998). For the biogeographic analysis, a binary matrix was integrated using data of the presence and absence of the taxa shared between the lagoon and those of the rest of the country. With both data, the sampling sites and of the country locations were classified through the cluster of minimum variance (Ward, 1963).The statistical analysis was carried out with the "PAST" package (Hammer *et al.*, 2001).

Results and Discussion

Floristic list: A total of 373 taxa belonging to 50 families of diatoms were determined, of which 89 genera, 328 species, 71 varieties, 17 forms and 2 morphotypes were found.

Communities: A total of 373 taxa were determined for the first time. Among these diatoms, 36.6% belong to phytoplankton, 59.8% are benthic and 2.7% are periphytic. There was also a group of species whose form of life was uncertain (0.9%). The composition of planktic diatoms had a moderate species richness (120), being dominated by the family Chaetocerotaceae: *Chaetoceros curvisetus*, *Chaetoceros laciniosus* and *Chaetoceros socialis*; Skeletonemaceae: *Skeletonema costatum* and *Skeletonema pseudocostatum*;

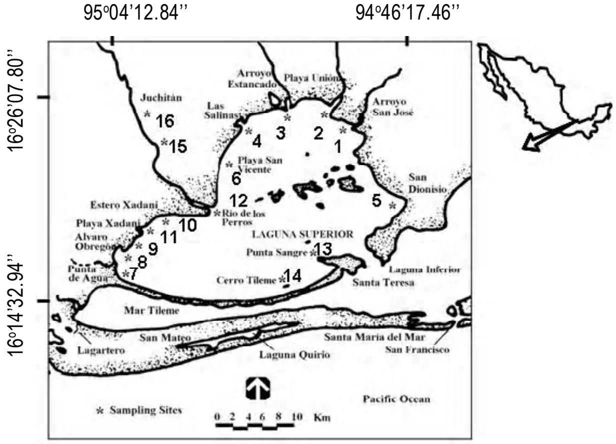

Fig. 1: Study area and sampling sites

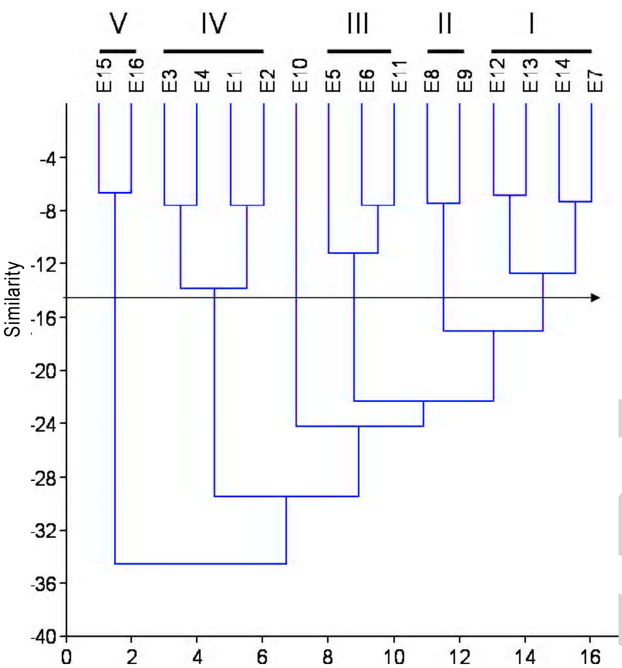

Fig. 2: Dendrogram of similarity of sites (E1-16) in five collecting periods based on species composition and mean ponderate values (pH, H, T, NO_2, NO_3, NH_4, PO_4, NT:Pt, Tp, Freq, Dom, B, R, H´n and Lf) indicated in Table 2. Arrow shows arbitrary division line that defines identified habitats (I-V)

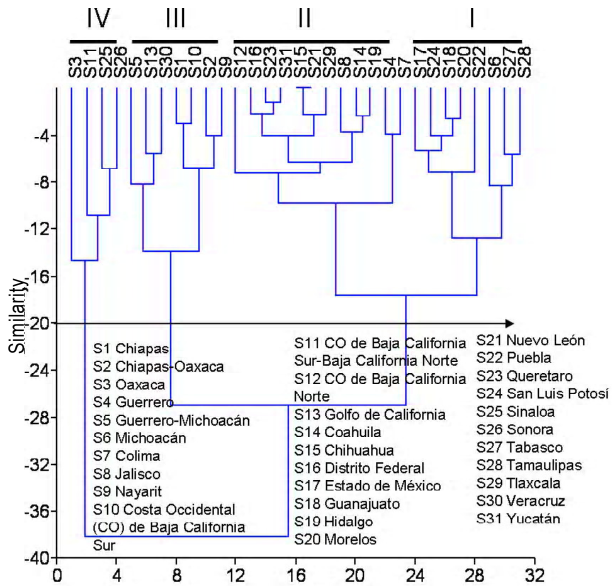

Fig. 3: Dendrogram of similarity of the taxonomic composition recorded in four sites (S10-13), 27 localities of Mexico and the Laguna Superior (see Table 2). Arrow shows arbitrary division line that defines identified habitats (I-IV)

Leptocylindraceae: *Leptocylindrus minimus*; Bacillariaceae: *Pseudo-nitzschia pseudodelicatissima*; Rhizosoleniaceae: *Dactyliosolen fragilissimus* and *Guinardia striata*, as well as Hemiaulaceae: *Hemiaulus sinensis*. It is important to mention the presence of the 11 periphitic species with the dominance of *Licmophora* cf. *ehrenbergii* f. *angustata* (Table 2). Besides this species and according to the criterion of Caljon (1983) diatoms belonging to the benthic community stood out. This outstanding group had a slight increment of species richness (196) with the prominent *Cylindrotheca closterium*, *Navicula cincta* and *Entomoneis alata*.

Between the plankton flora another microscopic algae group whose form of life was uncertain showed a low species richness (3) and among them *Cyclotella* sp. 1, *Mastogloia delicatissima* and *Terpsinoë americana*. For this reason it is advisable to incorporate other techniques to study these organisms in the communities and sub-communities defined by Round (1981) and Moreno-Ruiz *et al.* (2008) more precisely; in any case, with the identified components it was possible to discern part of their ecological composition.

The marine influence manifested by the five species *Cyclotella striata*, *Amphora terroris*, *Plagiotropis lepidoptera, Cerataulina pelagica* and *Thalassionema nitzschioides* var. *nitzschioides* that were distributed as far as the interior of the lagoon was remarcable.

In the marine and coastal zone, lagoons and adjacent rivers some phytoplanktic works were done, but these concerning taxonomy and ecology of marine species (Tapia-García *et al.*, 1998). Recently, Moreno-Ruiz *et al.* (2008) found in the adjacent coast of the study area that *Chaetoceros seiracanthus* and *C. subtilis* var. *subtilis* f. *knipowitzschii* grow in big chains several times a year (3-8 cells); however, in this study they were found only in single cells at stations 9 at 11. Rines and Hargraves (1988) explain this change when some species of *Chaetoceros* live under special environmental conditions or in cultures. In our case the stations referred to are sites with strong changes in salinity by which these morphological variations could probably take place.

The presence in the lagoon of 33 diatoms: *Synedra delicatissima* var. *delicatissima* to *Nitzschia sicula* var. *sicula* (Table 2) provided a guide in the detection of considerable concentrations of organic matter that is frequently deposited through the discharge of the water coming from the river Juchitan and of the garbage that is thrown into this aquatic enclosure, which rebounded in the

Table - 1: Classification of ecological composition or indicator values accordingly with Wilhm and Dorris (1968, WD), Caljon (1983, Ca), Contreras-Espinosa *et al.* (1994, CE), Van Dam *et al.* (1994, VD), Abel (2002, A), Moreno-Ruiz (2000, 2005, 2008 MR), Reguera (2002, Re), Siqueiros -Beltrones (2002, SB), Moreno (2003, Mo) and Smith (2006, Sm)

pH (Ca, A)
1 acidobiontic, optimal presence to pH <5.5
2 acidophyll, principal presence to pH <7
3 circumneutral, principal presence at pH around 7
4 alkaliphyll, principal presence at pH >7
5 alkalibiontic, exclusive presence at pH >7
6 indiferent, no optimum apparent

(H) salinity (Ca, MR)
1 limnobiont stenohaline <0.5 psu
2 limnobiont eurihaline 0.5-8 psu
3 limnobiont slightly eurihaline 0.5-3 psu
4 limnobiont eurihaline 3-8 psu
5 hifalmirobiont, brackiswater occasional at the sea and freshwater
6 brackiswater eurihaline 2-20 psu
7 lower brackiswater 2-10 psu
8 upper brackiswater 8-20 psu
9 marine eurihaline, in marine biotopes
10 holeurihaline, marine water, brackiswater and freshwater

(T) thermic preference (Ca)
1 oligothermic (-3°C)
2 oligo-mesothermic
3 meso-oligothermic
4 mesothermic (18 a - 3°C)
5 meso-polythermic (>18-35°C)
6 poly-mesothermic
7 eurithermic (high temperature)

(NO_2) nitrite (mg l^{-1}, A)
1 low <1.74
2 moderate, between 1.74 and 5.21
3 high $\geq$ 5.43 (toxic)

(NO_3) nitrate (mg l^{-1}, A)
1 low <488.4
2 moderate, between 488.4 and 1433.1
3 high $\geq$ 1462.3 (toxic)

(NH_4) ammonium (mg l^{-1}, A)
1 low <6.1
2 moderate, between 6.1 and 11.9
3 high $\geq$12.2 (toxic to pH 8.5 and 20°C)

(PO_4) phosphates (mg l^{-1}, A)
1 low <3.2
2 moderate, between 3.2 and 10.5
3 high >10.5 (polluted waters)

(tN:tP) total nitrogen:total phosphorous ratio (Sm)
1 low <7 (nitrogen limitation)
2 moderate, between 15 and 7
3 high >15 (phosphorous limitation)

(Tp) trophic preference, mg m^{-3} chl *a* (CE, MR)
Oligotrophic species, in biotopes poor in nutrients:
1 ultra-oligotrophic (0.000-0.122)
2 α-oligotrophic (0.123-0.340)
3 β-oligotrophic (0.350-0.940)
4 γ-oligotrophic (0.950-2.600)
mesotrophic, equivalent to:
oligo-mesotrophic, with
5 α-mesotrophic (2.700-7.200)
meso-eutrophic, with
6 β-mesotrophic (7.300-20.000)
eutrophic species, in biotopes rich in nutrients:
7 α-eutrophic (21.000-55.000)
8 β-eutrophic (56.000-155.000)
9 γ-eutrophic (156.000-425.000)
10 hiper-eutrophic ($\geq$ 426.000)
11 euritrophic, in biotopes rich or poor in nutrients

(Freq) frequency or distribution (MR)
1 very low (about 10%)
2 low (11-30%)
3 moderate (31-50%)
4 sligtly high (51-75%)
5 high (76-100%)

(Dom) dominance (Mo, MR)
1 non dominant <1
2 dominant $\geq$ 1

(B) blooms (MR)
1 associate (<1,000 cells ml^{-1})
2 non massive ($\geq$ 1,000 cells ml^{-1})
3 massive ($\geq$ 10,000 cells ml^{-1})
4 hipermassive ($\geq$ 50,000 cells ml^{-1})

(R) species richness (MR)
1 high $\geq$10.7
2 moderate, between 3.6 and 10.6
3 low $\leq$3.5

(H'n) Shannon-Wiener diversity (WD, MR)
1 clean waters (>3 bits/ind.)
2 moderate polluted (1-3 bits/ind.)
3 high polluted (<1 bits/ind.)

(Lf) life form (SB, MR)
1 benthic
2 periphitic
3 planktic

(IVICA) Intervals of the indicator value of water quality (MR)
high water quality ($\leq$1.533)
moderate water quality (1.534-3.067)
low water quality (3.068-4.600)

development of the mentioned diatoms (Morales & Manoylov, 2009; Yoshida *et al.*, 2009).

Biogeography: In the lagoon the genera: *Giffenia* (0.3%), the 17 species *Thalassiosira minima* to *Giffenia cocconeiformis* (4.6%), three varieties: *Actinocyclus curvatulus* var. *kariana*, *Synedra affinis* var. *fasciculata* and *Synedra rumpens* var. *scotica* (0.8%), as well as *Licmophora ehrenbergii* f. *angustata* were outstanding. All these taxa are considered as new records for this water body (Table 2, column NR).

The distribution of *Cyclotella meneghiniana* and *Cylindrotheca closterium* (slightly high) is outstanding because of their constant abundance in the lagoon produced by the ecological dynamics of this aquatic body and their small size and highly competitive character as Nielsen and Kiørboe (1991) have pointed

Table - 2: Taxonomic composition and ecological indicator value of diatoms from Laguna Superior, Oaxaca (see Table 1 for explanation). No.=key of taxon, VIP=pondered indicator value, M%F=Mexican percentage frequency (before this study), SA%F=South American percentage frequency, NR=new register, b=genus, c=species, d=variety, f=form, VICA=indicator value of water quality, MVIP=maximum pondered indicator value

No.	Taxa	pH	H	T	NO_2	NO_3	NH_4	PO_4	tN:tP	Tp	Freq	Dom	B	R	H'n	Lf	VIP	M%F	SA%F	NR
1	DIVISIÓN: BACILLARIOPHYTA																			
3	Familia Thalassiosiraceae Lebour																			
5	*Thalassiosira aestivalis* Gran	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7		
6	*Thalassiosira decipiens* (Grunow) Jørgensen	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	45.2	10.0	
7	*Thalassiosira eccentrica* (Ehrenberg) Cleve	4	9	5	1	1	2	2	1	4	1	1	2	3	1	3	2.667	45.2	20.0	
8	*Thalassiosira lineata* Jousé	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5		
9	*Thalassiosira minima* Gaarder	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600			c
10	*Thalassiosira pseudonana* Hasle et Heimdal	4	9	5	4	4	2	2	4	4	4	1	1	3	1	3	3.400	3.2		
11	*Thalassiosira subtilis* (Ostenfeld) Gran	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5	10.0	
12	*Planktoniella sol* (Wallich) Schütt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0	
14	Familia Skeletonemaceae Lebour, *sensu em.* Round *et al.*																			
16	*Skeletonema costatum* (Greville) Cleve	4	9	5	3	3	2	2	3	4	3	2	3	3	1	3	3.333	38.7	30.0	
17	*Skeletonema tropicum* Cleve	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	3.2		
18	*Skeletonema pseudocostatum* Medlin *in* Medlin *et al.*	4	5	5	3	3	2	2	3	4	3	2	2	3	1	3	3.000	19.4		
19	*Skeletonema subsalsum* (A. Cleve) Bethge	4	8	5	1	1	2	2	1	4	1	1	1	3	1	3	2.533	16.1		
20	*Detonula pumila* (Castracane) Gran Schütt	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5	20.0	
22	Familia Stephanodiscaceae Glezer *et* Makarova																			
24	*Cyclotella atomus* Hustedt	4		5	1	1	2	2	1	4	1	1	1	3	1	3	2.143		10.0	
25	*Cyclotella litoralis* Lange *et* Syvertsen	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533	25.8		
26	*Cyclotella meneghiniana* Kützing	4	2	5	2	2	2	2	2	4	2	2	1	3	1	3	2.467	61.3	60.0	
27	*Cyclotella stelligera* Cleve *et* Grunow	4	2	5	1	1	2	2	1	4	1	1	1	3	1	3	2.133	29.0	40.0	
28	*Cyclotella striata* (Kützing) Grunow *in* Cleve *et* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	38.7	10.0	
29	*Cyclotella* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1		2.143	22.6		
31	Familia Lauderiaceae (Schütt) Lemmermann, *em.* Round *et* Crawford																			
33	*Lauderia annulata* Cleve	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	32.3	10.0	
35	Familia Melosiraceae Kützing sensu *em.* Round *et al.*																			
37	*Melosira moniliformis* (O. F. Müller) Agardh	4	7	5	1	1	2	2	1	4	1	1	1	3	1	1	2.333	19.4	10.0	
39	Familia Stephanopyxidaceae Nikolaev																			
41	*Stephanopyxis turris* (Arnott *in* Greville) Ralfs *in* Pritchard	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7		
43	Familia Paraliaceae Crawford																			
45	*Paralia sulacata* (Ehrenberg) Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	20.0	
47	Familia Aulacoseiraceae Crawford *in* Round *et al.*																			
49	*Aulacoseira granulata* (Ehrenberg) Simonsen var. *granulata* f. *granulata*	4	3	5	1	1	2	2	1	4	1	1	2	3	1	3	2.267	61.3	70.0	
50	*Aulacoseira granulata* var. *angustissima* (O. Müller) Simonsen f. *angustissima*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	3	2.200	25.8	40.0	
51	*Aulacoseira granulata* var. *angustissima* f. *curvata* (Grunow) Simonsen	4	3	5	1	1	2	2	1	4	1	1	1	3	1	3	2.200	9.7	10.0	
53	Familia Coscinodiscaceae Kützing																			
55	*Coscinodiscus centralis* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	20.0	
56	*Coscinodiscus granii* Gough	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	12.9	10.0	

57	*Coscinodiscus oculus-iridis* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0	
58	*Coscinodiscus radiatus* Ehrenberg *ex* Moreno *in* Moreno *et* licea var. *radiatus*	4	9	5	2	2	2	2	2	4	2	1	2	3	1	3	2.933	38.7	20.0	
59	*Coscinodiscus radiatus* var. 1	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7		
60	*Coscinodiscus radiatus* var. 2	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7		
61	*Coscinodiscus rothii* (Ehrenberg) Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	20.0	
63	Familia Hemidiscaceae Hendey *ex* Simonsen																			
65	*Actinocyclus curvatulus* Janish *in* Schmidt *et al.* var. *curvatulus*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	32.3		
66	*Actinocyclus curvatulus* var. *kariana* (Cleve et Grunow) Días-Ramos	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600			cd
67	*Roperia tesselata* (Roper) Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5		
69	Familia Asterolampraceae H. L. Smith																			
71	*Asteromphalus heptactis* (Brébisson) Ralfs *in* Pritchard	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0	
73	Familia Triceratiaceae (Schütt) Lemmermann																			
75	*Odontella mobiliensis* (Bailey) Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	38.7	20.0	
76	*Eupodiscus argus* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2		
78	Familia Biddulphiaceae Kützing																			
80	*Biddulphia alternans* (Bailey) Van Heurck (Biddulphiopsis sp. 1)	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	32.3		
81	*Terpsinoë americana* Ehrenberg	4	5	5	1	1	2	2	1	4	1	1	1	3	1		2.286		10.0	
83	Familia Hemiaulaceae Heiberg																			
85	*Hemiaulus hauckii* Grunow *in* Van Heurck	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5	20.0	
86	*Hemiaulus membranaceus* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	20.0	
87	*Hemiaulus sinensis* Greville	4	9	5	4	4	2	2	4	4	4	2	2	3	1	3	3.533	41.9	20.0	
88	*Eucampia cornuta* (Cleve) Grunow *in* Van Heurck	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	38.7	30.0	
89	*Climacodium frauenfeldianum* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	25.8		
90	*Cerataulina pelagica* (Cleve) Hendey	4	9	5	3	3	2	2	3	4	3	1	1	3	1	3	3.133	38.7	40.0	
92	Familia Streptothecaceae Crawford *in* Round *et al.*																			
94	*Helicotheca thamesis* (Shrubsole) Ricard	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	25.8	10.0	
96	Familia Anaulaceae (Schütt) Lemmermann																			
98	*Eunotogramma laeve* Grunow *in* Cleve *et* Möller	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	25.8		
100	Familia Lithodesmiaceae Round *in* Round *et al.*																			
102	*Lithodesmium undulatum* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	25.8	10.0	
103	*Ditylum brightwellii* (T. West) Grunow *in* Van Heurck	4	9	5	1	1	2	2	1	4	1	1	2	3	1	3	2.667	6.5	10.0	
105	Familia Corethraceae Lebour																			
107	*Corethron hystrix* Hensen	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	9.7	20.0	
109	Familia Cymatosiraceae Hasle, von Stosch *et* Syvertsen																			
111	*Cymatosira lorenziana* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533	3.2		
113	Familia Rhizosoleniaceae De Toni																			
115	*Rhizosolenia bergonii* H. Peragallo	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0	
116	*Rhizosolenia clevei* var. *comunis* Sundström	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	32.3		
117	*Rhizosolenia hebetata Bailey* f. *semispina* (Hensen) Gran				1	1	2	2	1	4	1	1	1	3	1	3	1.750	6.5	20.0	
118	*Rhizosolenia pungens* Cleve-Euler	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5		
119	*Rhizosolenia setigera* Brightwell	4	9	5	3	3	2	2	3	4	3	1	1	3	1	3	3.133	41.9	30.0	
120	*Rhizosolenia styliformis* Brightwell				1	1	2	2	1	4	1	1	1	3	1	3	1.750	6.5	20.0	
121	*Proboscia alata* f. *alata* (Brightwell) Sundström	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	38.7	20.0	
122	*Proboscia alata* f. *gracillima* (Cleve *in* Cleve *et* Möller)	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5	10.0	

123	*Proboscia alata* f. *indica* (H. Peragallo) Gran	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	
124	*Pseudosolenia calcar-avis* Schulze	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	20.0
125	*Guinardia cylindrus* (Cleve) Hasle	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	10.0
126	*Guinardia delicatula* (Cleve) Hasle	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0
127	*Guinardia flaccida* (Castracane) Peragallo	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	9.7	20.0
128	*Guinardia striata* (Stolterfoth) Hasle *in* Hasle *et* Syvertsen	4	9	5	3	3	2	2	3	4	3	2	2	3	1	3	3.267	41.9	30.0
129	*Dactyliosolen fragilissimus* (Bergon) Hasle *et* Syvertsen	4	9	5	4	4	2	2	4	4	4	2	2	3	1	3	3.533	35.5	20.0
130	*Dactyliosolen phuketensis* (Sundströn) Hasle	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
132	Familia Chaetocerotaceae Ralfs *in* Pritchard																		
134	*Chaetoceros aequatorialis* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	3.2	
135	*Chaetoceros affinis* Lauder var. *affinis*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	38.7	30.0
136	*Chaetoceros affinis* var. *willei* (Gran) Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
137	*Chaetoceros anastomosans* Grunow	4	9	5	2	2	2	2	2	4	2	1	2	3	1	3	2.933	6.5	20.0
138	*Chaetoceros atlanticus* var. *neapolitana* (Shröder) Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
139	*Chaetoceros borealis* Bailey	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	12.9	
140	*Chaetoceros brevis* Schütt	4	9	5	2	2	2	2	2	4	2	2	2	3	1	3	3.000	9.7	20.0
141	*Chaetoceros coarctatus* Lauder	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	12.9	20.0
142	*Chaetoceros compressus* Lauder	4	9	5	2	2	2	2	2	4	2	2	2	3	1	3	3.000	9.7	20.0
143	*Chaetoceros costatus* Pavillard	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	20.0
144	*Chaetoceros curvisetus* Cleve	4	9	5	3	3	2	2	3	4	3	2	3	3	1	3	3.333	38.7	30.0
145	*Chaetoceros debilis* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	32.3	20.0
146	*Chaetoceros decipiens* Cleve	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	38.7	30.0
147	*Chaetoceros* af. *decipiens* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600		
148	*Chaetoceros densus* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
149	*Chaetoceros dichaeta* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0
150	*Chaetoceros didymus* Ehrenberg var. *didymus*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	12.9	20.0
151	*Chaetoceros didymus* var. *protuberans* (Lauder) Gran *et* Yendo	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
152	*Chaetoceros difficilis* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	35.5	
153	*Chaetoceros diversus* Cleve morfotipo *diversus*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	29.0	20.0
154	*Chaetoceros diversus* morfotipo 1	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	3.2	
155	*Chaetoceros gracilis* Schütt	4	8	5	2	2	2	2	2	4	2	1	2	3	1	3	2.867	32.3	10.0
156	*Chaetoceros laciniosus* Schütt	4	9	5	2	2	2	2	2	4	2	2	2	3	1	3	3.000	16.1	20.0
157	*Chaetoceros lorenzianus* Grunow f. *lorenzianus*	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	48.4	30.0
158	*Chaetoceros lorenzianus* f. *forceps* Meunier	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	19.4	10.0
159	*Chaetoceros messanensis* Castracane	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0
160	*Chaetoceros pelagicus* Cleve	4	9	5	2	2	2	2	2	4	2	2	2	3	1	3	3.000	32.3	20.0
161	*Chaetoceros pendulus* Karsten	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
162	*Chaetoceros peruvianus* Brightwell f. *peruvianus*	4	9	5	2	2	2	2	2	4	2	1	2	3	1	3	2.933	32.3	20.0
163	*Chaetoceros peruvianus* f. *gracilis* (Schröder) Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	
164	*Chaetoceros peruvianus* f. *robusta* (Cleve) Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	12.9	
165	*Chaetoceros pseudocurvisetus* Mangin	4	9	5	2	2	2	2	2	4	2	2	2	3	1	3	3.000	9.7	20.0
166	*Chaetoceros radicans* Schütt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
167	*Chaetoceros rostratus* Lauder	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	20.0
168	*Chaetoceros seiracanthus* Gran	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	22.6	10.0

169	*Chaetoceros socialis* Lauder	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	9.7	10.0	
170	*Chaetoceros subtilis* var. *abnormis* (Proshkina-Lavrenko) Poshkina-Lavrenko	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	3.2		
171	*Chaetoceros subtilis* var. *subtilis* f. *knipowitzschii* (Henckel) Proschkina-Lavrenko	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	12.9		
172	*Chaetoceros teres* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	10.0	
173	*Chaetoceros tortissimus* Gran	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	10.0	
174	*Chaetoceros* af. *vistulae* Apstein	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	3.2		
175	*Bacteriastrum delicatulum* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	35.5		
176	*Bacteriastrum elongatum* Cleve	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	9.7		
177	*Bacteriastrum hyalinum* Lauder	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5	30.0	
179	Familia Leptocylindraceae Lebour																			
181	*Leptocylindrus danicus* Cleve	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	38.7	30.0	
182	*Leptocylindrus minimus* Gran	4	9	5	4	4	2	2	4	4	4	2	1	3	1	3	3.467	32.3		
184	Familia Fragilariaceae Greville																			
186	*Pseudostaurosira brevistriata* (Grunow) Williams *et* Round var. *brevistriata*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	35.5	10.0	
187	*Fragilaria leptostauron* (Ehrenberg) Hustedt var. *leptostauron*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5	10.0	
188	*Fragilaria striatula* Lyngbye	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467			c
189	*Fragilaria* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5		
190	*Synedra affinis* var. *fasciculata* (Agardh) Grunow *in* Van Heurck	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467			cd
191	*Synedra delicatissima* W. Smith var. *delicatissima*	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	12.9		
192	*Synedra filiformis* var. *exilis* Cleve-Euler	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	6.5		
193	*Synedra goulardii* Brébisson *ex* Cleve *et* Grunow	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	32.3	10.0	
194	*Tabularia investiens* (W. Smith) Williams *et* Round	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533			c
195	*Synedra parasitica* (W. Smith) Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2		
196	*Synedra rumpens* var. *scotica* Grunow	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133			cd
197	*Synedra ulna* (Nitzsch) Ehrenberg var. *ulna*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	71.0	60.0	
198	*Synedra ulna* var. *aequalis* (Kützing) Hustedt	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	3.2		
199	*Synedra ulna* var. *amphirhynchus* (Ehrenberg) Grunow	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	19.4		
200	*Synedra* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	9.7		
201	*Synedra* sp. 2	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2		
202	*Asterionella formosa* Hassal	4	1	5	1	1	2	2	1	4	1	1	1	3	1	3	2.067	6.5		
203	*Opephora marina* (Gregory) Petit.	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5		
204	*Asterionellopsis glacialis* (Castracane) Round *in* Round *et al.*	4	9	5	2	2	2	2	2	4	2	1	2	3	1	3	2.933	45.2	30.0	
205	*Bleakeleya notata* (Grunow) Round *in* Round *et al.*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	20.0	
207	Familia Licmophoraceae Kützing																			
209	*Licmophora abbreviata* Agardh	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533	22.6	10.0	
210	*Licmophora ehrenbergii* f. *angustata* (Grunow) Grunow	4	9	5	2	2	2	2	2	4	2	1	1	3	1	2	2.800			cf
211	*Licmophora* sp. 1	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533			c
213	Familia Rhaphoneidaceae Forti																			
215	*Delphineis surirella* (Ehrenberg) Andrews	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5		
216	*Neodelphineis pelagica* Takano	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	29.0		
218	Familia Psammodiscaceae Round *et* D.G. Mann																			
220	*Psammodiscus nitidus* (Gregory) Round *et* Mann	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	10.0	
222	Familia Thalassionemataceae Round *in* Round *et al.*																			
224	*Thalassionema bacillaris* Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5		

225	*Thalassionema frauenfeldii* (Grunow) Tempère *et* Peragallo *ex* Hallegraeff	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	41.9	30.0
226	*Thalassionema nitzschioides* (Grunow) Hustedt var. *nitzschioides*	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	45.2	30.0
227	*Thalassionema nitzschioides* var. *capitulata* (Castracane) Moreno-Ruiz *in* Moreno-Ruiz *et* Licea	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	35.5	
228	*Thalassionema nitzschioides* var. *claviformis* (Schrader) Moreno-Ruiz *in* Moreno-Ruiz et Carreño	4	9	5	2	2	2	2	2	4	2	1	2	3	1	3	2.933	45.2	
229	*Thalassionema nitzschioides* var. *inflata* Heiden in Heiden *et* Kolbe	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
230	*Thalassionema nitzschioides* var. *lanceolata* (Grunow) Peragallo *et* Peragallo	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	38.7	
231	*Thalassiothrix longissima* Cleve & Grunow *in* Cleve *et* Möller	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	38.7	10.0
232	*Lioloma elongatum* (Grunow) Hasle	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	6.5	
234	Familia Rhabdonemataceae Round *et* Crawford																		
236	*Rhabdonema adriaticum* Kützing	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533	9.7	10.0
237	*Rhabdonema cf. minutum* Kützing	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	
239	Familia Striatellaceae Kützing																		
241	*Striatella unipunctata* (Lyngbye) C. Agardh	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	3.2	20.0
243	Familia Mastogloiaceae Mereschkowsky																		
245	*Mastogloia delicatissima* Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1		2.571	3.2	
247	Familia Rhoicospheniaceae Chen *et* Zhu																		
249	*Gomphonemopsis pseudexigua* (Simonsen) Medlin	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	
251	Familia Cymbellaceae Greville																		
253	*Cymbella mexicana* (Ehrenberg) Cleve	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5	
254	*Cymbella amphicephala* Nägeli *in* Kützing	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	12.9	
255	*Cymbella minuta* Hilse ex Rabenhorst var. *minuta*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	12.9	30.0
256	*Cymbella lanceolata* (Agardh) Agardh	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	12.9	
257	*Cymbella* cf. *pusilla* Grunow	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	6.5	
258	*Cymbella tumidula* Grunow	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	6.5	
259	*Cymbella affinis* Kützing	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	16.1	20.0
260	*Cymbella tumida* var. *tumida* (Brébisson) Van Heurck	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	16.1	
261	*Cymbella* sp. 1	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133		
263	Familia Gomphonemataceae Kützing																		
265	*Gomphonema affine* Kützing	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	29.0	10.0
266	*Gomphonema parvulum* (Kützing) Kützing var. *parvulum*	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	35.5	30.0
267	*Gomphonema parvulum* var. *lagenula* (Kützing) Frenguelli	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	12.9	10.0
268	*Gomphonema gracile* var. *gracile* Ehrenberg	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	45.2	50.0
269	*Gomphonema gracile* var. *naviculoides* (W. Smith) Grunow	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	3.2	
270	*Gomphonema* af. *grunowii* Patrick	4		5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	3.2	
271	*Gomphonema olivaceum* (Lyngbye) Kützing	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	9.7	
273	Familia Achnanthaceae Kützing, *sensu em.* Round *et al.*																		
275	*Achnanthes curvirostrum* Brun	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	19.4	10.0
276	*Achnanthes exigua* var. *heterovalvata* Krasske	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	19.4	10.0
277	*Achnanthes lanceolata* ssp. *dubia* (Grunow) Lange-Bertalot	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	12.9	20.0
278	*Achnanthes lanceolata* (Brébisson *in* Kützing) Grunow *in* Cleve et Grunow var *lanceolata*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467		10.0
279	*Achnanthes* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	19.4	

280	*Achnanthes* sp. 2	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	9.7		
281	*Achnanthes* sp. 3	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	9.7		
282	*Planothidium hauckianum* (Grunow *in* Cleve et Grunow) Round et Buktiyarova	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	12.9	10.0	
284	Familia Cocconeidaceae Kützing																			
286	*Cocconeis costata* Gregory	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5		
287	*Cocconeis placentula* var. *euglypta* (Ehrenberg) Cleve	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	41.9	40.0	
288	*Cocconeis scutellum* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	20.0	
289	*Cocconeis* sp. 1	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	19.4		
291	Familia Amphipleuraceae Grunow																			
293	*Amphipleura pellucida* Kützing	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	12.9		
295	Familia Sellaphoraceae Mereschkowsky																			
297	*Sellaphora pupula* var. *pupula* (Kützing) D.G. Mann	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	32.3	30.0	
298	*Sellaphora pupula* var. *capitata* (Skvortzow *et* Meyer)	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5		
299	*Sellaphora pupula* var. *elliptica* (Hustedt)	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2		
300	*Sellaphora rostrata* (Hustedt) Johansen	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933			c
301	*Fallacia forcipata* (Greville) Stikle *et* D.A. Mann	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	20.0	
302	*Fallacia pygmaea* (Kützing) Stickle et D. G. Mann *in* Round *et al.*	4	7	5	1	1	2	2	1	4	1	1	1	3	1	1	2.333	22.6		
304	Familia Pinnulariaceae D.G. Mann *in* Round *et al.*																			
306	*Pinnularia abaujensis* var. *subundulata* (A. Mayer *ex* Hustedt) Patrick *in* Patrick *et* Reimer	3	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000		20.0	
307	*Pinnularia acrosphaeria* W. Smith	3	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	6.5		
308	*Pinnularia cardinalis* (Ehrenberg) W. Smith	2	3	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2		
309	*Pinnularia interrupta* W. Smith	2	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.800	16.1		
310	*Pinnularia microstauron* (Ehrenberg) Cleve	2	2	5	1	1	2	2	1	4	1	1	1	3	1	1	1.867	16.1		
311	*Pinnularia* af. *viridis* (Nitzsch) Ehrenberg	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933			
312	*Pinnularia* sp. 1				1	1	2	2	1	4	1	1	1	3	1	1	1.583	9.7		
313	*Caloneis alpestris* (Grunow) Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7		
314	*Caloneis amphisbaena* (Bory) Cleve	4	3	5	1	1	2	2	1	4	1	1	1	3	1	3	2.200	25.8		
315	*Caloneis permagna* (Bailey) Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	16.1		
316	*Caloneis* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1	3	2.200	9.7		
317	*Caloneis* sp. 2	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5		
318	*Caloneis* sp. 3				1	1	2	2	1	4	1	1	1	3	1	1	1.583	3.2		
320	Familia Diploneidaceae D.G. Mann i*n* Round *et al.*																			
322	*Diploneis decipiens* Cleve var. *decipiens*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	12.9		
323	*Diploneis decipiens* var. *parallela* Cleve-Euler	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	19.4		
324	*Diploneis elliptica* (Kützing) Cleve	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	16.1		
325	*Diploneis ovalis* (Hilse) Cleve	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	16.1		
326	*Diploneis smithii* (Brébisson *ex* W. Smith) Cleve	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	19.4	40.0	
327	*Diploneis vacillans* (A. Schmidt) P.T. Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7		
328	*Diploneis weissflogii* (A. Schmidt) Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	32.3	20.0	
329	*Diploneis* sp. 1	4		5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	9.7		
330	*Diploneis* sp. 2				1	1	2	2	1	4	1	1	1	3	1	1	1.583	9.7		
332	Familia Naviculaceae Kützing																			
334	*Navicula abunda* Hustedt	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	22.6		

335	*Navicula* af. *accomoda* Hustedt	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2	
336	*Navicula capitata* (Grunow) Ross var. *hungarica*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	29.0	
337	*Navicula capitoradiata* (Grunow) Germain	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	9.7	
338	*Navicula cincta* (Ehrenberg) Ralfs *in* Pritchard	4	9	5	3	3	2	2	3	4	3	2	1	3	1	1	3.067	35.5	10.0
339	*Navicula crucicula* (W. Smith) Donkin	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	6.5	
340	*Navicula cryptocephala* Kützing var. *cryptocephala*	4	3	5	2	2	2	2	2	4	2	1	1	3	1	1	2.333	19.4	20.0
341	*Navicula cryptocephala* var. *subsalina* Hustedt	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	9.7	
342	*Navicula* af. *directa* (Wm. Smith) Ralfs var. *directa*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467		
343	*Navicula* af. *directa* var. *subtilis* (Gregory) Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467		
344	*Navicula distans* (Wm. Smith) Ralfs *in* Pritchard	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	12.9	
345	*Navicula halophila* (Grunow *in* Van Heurck) Cleve	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	29.0	10.0
346	*Navicula lanceolata* (Agardt) Kützing	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	9.7	
347	*Navicula menisculus* Shuman	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	9.7	
348	*Navicula* af. *pelagica* (nana) Cleve				1	1	2	2	1	4	1	1	1	3	1	3	1.750	3.2	
349	*Navicula* af. *radiosa* Kützing	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067		
350	*Navicula salinarum Grunow*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	
351	*Navicula* af. *vixvisibilis Hustedt*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067		
352	*Navicula* sp. 1	4	3	5	2	2	2	2	2	4	2	1	1	3	1	1	2.333	12.9	
353	*Navicula* sp. 2	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	12.9	
354	*Navicula* sp. 3	4	7	5	1	1	2	2	1	4	1	1	1	3	1	1	2.333	12.9	
355	*Navicula* sp. 4	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5	
356	*Navicula* sp. 5	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5	
357	*Navicula* sp. 6	4	7	5	1	1	2	2	1	4	1	1	1	3	1	1	2.333	3.2	
358	*Navicula* sp. 7				1	1	2	2	1	4	1	1	1	3	1	1	1.583	3.2	
359	*Navicula* sp. 8	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2	
360	*Navicula* sp. 9				1	1	2	2	1	4	1	1	1	3	1	1	1.583	3.2	
361	*Navicula* sp. 10	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	3.2	
362	*Navicula* sp. 11	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067		
363	*Navicula* sp. 12	4	7	5	1	1	2	2	1	4	1	1	1	3	1	1	2.333		
364	*Haslea frauenfeldii* (Hustedt) Simonsen	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	
365	*Haslea wawrikae* (Hustedt) Simonsen	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	10.0
367	Familia Stauroneidaceae D.G. Mann																		
369	*Craticula ambigua* (Ehrenberg) D.G. Mann	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	12.9	
370	*Craticula cuspidata* (Kützing) Kützing var. *cuspidata*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	25.8	
372	Familia Pleurosigmataceae Mereschkowsky																		
374	*Pleurosigma acutum* Norman ex Ralfs	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	
375	*Pleurosigma angulatum* (Quekett) W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	20.0
376	*Pleurosigma australe* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	
377	*Pleurosigma decorum* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	10.0
378	*Pleurosigma diverse-striatum* Meister	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	25.8	20.0
379	*Pleurosigma elongatum* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	
380	*Pleurosigma exsul* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2	
381	*Pleurosigma formosum* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	10.0
382	*Pleurosigma ibericum* Peragallo	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	

383	*Pleurosigma normanii* Ralfs	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	10.0
384	*Pleurosigma* af. *pulcrum* var. *mediterranea*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	
385	*Pleurosigma salinarum* (Grunow) Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2	
386	*Pleurosigma* sp. 1				1	1	2	2	1	4	1	1	1	3	1	1	1.583		
387	*Pleurosigma* sp. 2				1	1	2	2	1	4	1	1	1	3	1	1	1.583		
388	*Pleurosigma* sp. 3				1	1	2	2	1	4	1	1	1	3	1	1	1.583	3.2	
389	*Donkinia recta* var. *minuta* Peragallo *et* M. Peragallo	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	
390	*Gyrosigma* cf. *acuminatum* (Kützing) Rabenhorst	5	8	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	29.0	
391	*Gyrosigma balticum* (Ehrenberg) Rabenhorst	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	22.6	20.0
392	*Gyrosigma macrum* (W. Smith) Cleve	4	7	5	1	1	2	2	1	4	1	1	1	3	1	3	2.467	22.6	
393	*Gyrosigma spencerii* (Quekett) Griffith *et* Henfrey	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	35.5	
394	*Gyrosigma tenuissimum* Griffith *et* Henfrey	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	6.5	
396	Familia Plagiotropidaceae D.G. Mann *in* Round *et al.*																		
398	*Plagiotropis lepidoptera* (Gregory) Reimer var. *lepidoptera*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	22.6	30.0
399	*Plagiotropis lepidoptera* var. *minor* (Cleve) Reimer	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	25.8	
400	*Plagiotropis lepidoptera* var. *proboscidea* (Cleve) Reimer	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2	
401	*Plagiotropis* sp. 1	4	9	5	2	2	2	2	2	4	2	1	1	3	1	1	2.733	6.5	
402	*Meuniera membranaceus* (Cleve) P.C. Silva *in* Hasle *et* Syvertsen	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	25.8	20.0
404	Familia Stauroneidaceae D.G. Mann																		
406	*Stauroneis phoenicenteron* Ehrenberg	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	12.9	
408	Familia Catenulaceae Mereschkowsky																		
410	*Amphora angusta* Gregory var. *angusta*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	10.0
411	*Amphora arenaria* Donkin	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	9.7	
412	*Amphora coffeaeformis* (Agardh) Kützing var. *coffeaeformis*	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	32.3	10.0
413	*Amphora coffeaeformis* var. *acutiuscula* (Kützing) Hustedt	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	12.9	
414	*Amphora costata* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2	10.0
415	*Amphora exigua* Gregory	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	10.0
416	*Amphora laevis* Gregory	4	9	5	2	2	2	2	2	4	2	1	1	3	1	1	2.733	3.2	
417	*Amphora ostrearia* Brébisson *ex* Kützing var. *ostrearia*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5	
418	*Amphora ovalis* (Kützing) Kützing var. *ovalis*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	45.2	40.0
419	*Amphora ovalis* var. *affinis* (Kützing) Van Heurck *ex* DeTony	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	12.9	10.0
420	*Amphora ovalis* var. *pediculus* (Kützing) Van Heurck	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	16.1	
421	*Amphora salina* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	
422	*Amphora terroris* Ehrenberg	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	25.8	
423	*Amphora truncata* Gregory	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2	
424	*Amphora wisei* (Salah) Simonsen	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	12.9	
425	*Amphora* sp. 1	4	3	5	2	2	2	2	2	4	2	2	2	3	1	1	2.467	22.6	
426	*Amphora* sp. 2	4	3	5	1	1	2	2	1	4	1	1	2	3	1	1	2.133	16.1	
427	*Amphora* sp. 3	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	6.5	
428	*Amphora* sp. 4	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	9.7	
429	*Amphora* sp. 5				1	1	2	2	1	4	1	1	1	3	1	1	1.583	3.2	
430	*Amphora* sp. 6				1	1	2	2	1	4	1	1	1	3	1	1	1.583	6.5	
431	*Amphora* sp. 7	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2	
432	*Amphora* sp. 8	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	3.2	

434	Familia Bacillariaceae Ehrenberg																			
436	*Bacillaria paxillifer* (O. F. Müller) Hendey	4	10	5	1	1	2	2	1	4	1	1	1	3	1	3	2.667	35.5	60.0	
437	*Hantzschia amphioxys* (Ehrenberg) Grunow var. *amphioxys*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	48.4	30.0	
438	*Hantzschia amphioxys* var. *vivax* (Hantzsch) Grunow *in* Cleve *et* Grunow	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	6.5		
439	*Tryblionella calida* (Grunow in Cleve et Grunow) D.G. Mann *in* Round *et al.*	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933			c
440	*Tryblionella hungarica* (Grunow) D.G. Mann *in* Round *et al.*	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	25.8		
441	*Tryblionella levidensis* Wm. Smith	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	16.1		
442	*Tryblionella* cf. *litoralis* (Grunow in Cleve *et* Grunow) D.G. Mann *in* Round *et al.*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5		
443	*Tryblionella punctata* Wm. Smith f. *punctata*	4	7	5	1	1	2	2	1	4	1	1	1	3	1	1	2.333	22.6	20.0	
444	*Tryblionella punctata* f. *minor* (Hustedt)	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5		
445	*Tryblionella umbilicata* (Hustedt) D.G. Mann *in* Round *et al.*	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067			c
446	*Tryblionella* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5		
447	*Tryblionella* sp. 2	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2		
448	*Nitzschia acicularis* (Kützing) W. Smith	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	22.6		
449	*Tryblionella acuta* (Cleve) D.G. Mann in Round, Crawford et Mann	4	5	5	1	1	2	2	1	4	1	1	1	3	1	3	2.333		10.0	
450	*Nitzschia amphibia* Grunow	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	6.5		
451	*Nitzschia angularis* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533	6.5		
452	*Nitzschia bicapitata* Cleve	4	9	5	2	2	2	2	2	4	2	1	1	3	1	1	2.733	41.9		
453	*Nitzschia bilobata* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	2	2.533	6.5		
454	*Nitzschia braarudii* Hasle	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600			c
455	*Nitzschia clausii* Hantzsch	4	4	5	2	2	2	2	2	4	2	1	1	3	1	1	2.400	19.4		
456	*Nitzschia* af. *dissipata* var. *maewensis* de Lange-Bertalot *et* Krammer	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	3.2		
457	*Nitzschia* af. *fasciculata* Grunow	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	3.2		
458	*Nitzschia frustulum* (Kützing) Grunow *in* Cleve *et* Grunow	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	41.9	20.0	
459	*Nitzschia gandersheimiensis* Krasske	4	8	5	2	2	2	2	2	4	2	1	1	3	1	1	2.667	32.3		
460	*Nitzschia gracilis* Hantzsch	3	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	16.1		
461	*Nitzschia* af. *harrisonii* Cholnoky	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067			
462	*Nitzschia* cf. *holsatica* Hustedt	4	5	5	1	1	2	2	1	4	1	1	1	3	1	2	2.267			c
463	*Nitzschia* af. *hybrida* Grunow	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	16.1		
464	*Nitzschia* cf. *intermedia* Hantzsch	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200			c
465	*Nitzschia laevissima* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5		
466	*Nitzschia lanceolata* W. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	12.9	10.0	
467	*Nitzschia* af. *Longa* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467			
468	*Nitzschia longissima* (Brebisson in Kützing) Ralfs	4	9	5	2	2	2	2	2	4	2	1	1	3	1	1	2.733	9.7	10.0	
469	*Nitzschia lorenziana* Grunow	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5	10.0	
470	*Nitzschia* cf. *macilenta* W. Gregory	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5		
471	*Nitzschia media* Hantzsch	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	6.5		
472	*Nitzschia obtusa* Wm. Smith	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	22.6	20.0	
473	*Nitzschia ovalis* Arnott *in* Cleve *et* Grunow	4	4	5	1	1	2	2	1	4	1	1	1	3	1	1	2.133	22.6		
474	*Nitzschia* af. *pacifica* Cupp	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	3.2		
475	*Nitzschia palea* (Kützing) Wm. Smith var. *palea*	3	2	5	2	2	2	2	2	4	2	2	1	3	1	1	2.267	45.2	30.0	
476	*Nitzschia palea* var. *debilis* (Kützing) Grunow *in* Cleve *et* Grunow	3	2	5	2	2	2	2	2	4	2	1	1	3	1	1	2.200	22.6		
477	*Nitzschia* cf. *paleacea* Grunow *in* Van Heurck	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	12.9	10.0	
478	*Nitzschia* cf. *parvuloides* Cholnoky Lange-Bertalot and Krammer	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933			c

479	*Nitzschia* af. *recta* Hantzsch *in* Rabenhorst	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933			
480	*Nitzschia scalpelliformis* (Grunow) Grunow *in* Cleve *et* Grunow	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	9.7		
481	*Nitzschia semirobusta* Lange-Bertalot	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	25.8		
482	*Nitzschia seriata* Cleve	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600	9.7	20.0	
483	*Nitzschia sicula* (Castracane) Hustedt var. *sicula*	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	25.8	10.0	
484	*Nitzschia sigma* (Kützing) Wm. Smith	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	41.9	30.0	
485	*Nitzschia socialis* var. *massiliensis* Grunow *in* Cleve *et* Grunow	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	32.3		
486	*Nitzschia spathulata* Brébisson *in* Wm. Smith	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	19.4	10.0	
487	*Nitzschia* sp. 1	4	4	5	2	2	2	2	2	4	2	1	1	3	1	1	2.400	16.1		
488	*Nitzschia* sp. 2				1	1	2	2	1	4	1	1	1	3	1	1	1.583	16.1		
489	*Nitzschia* sp. 3	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	6.5		
490	*Nitzschia* sp. 4				1	1	2	2	1	4	1	1	1	3	1	1	1.583	12.9		
491	*Nitzschia* sp. 5	4	1	5	1	1	2	2	1	4	1	1	1	3	1	1	1.933	12.9		
492	*Nitzschia* sp. 6	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	3.2		
493	*Nitzschia* sp. 7	4		5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	3.2		
494	*Nitzschia* sp. 8				1	1	2	2	1	4	1	1	1	3	1	1	1.583	9.7		
495	*Nitzschia* sp. 9	4	1	5	2	2	2	2	2	4	2	1	1	3	1	1	2.200	3.2		
496	*Psammodyction panduriforme* var. *minor*	4	9	5	1	1	2	2	1	4	1	1	1	3	1	1	2.467	3.2	10.0	
497	*Pseudo-nitzschia delicatissima* (Cleve) Heiden	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	3.2	10.0	
498	*Pseudo-nitzschia fraudulenta* (Cleve) Hasle	4	9	5	1	1	2	2	1	4	1	1	1	3	1	3	2.600			c
499	*Pseudo-nitzschia pseudodelicatissima* (Hasle) Hasle *in* Hasle *et* Syvertsen	4	9	5	4	4	2	2	4	4	4	2	2	3	1	3	3.533	35.5		
500	*Pseudo-nitzchia pungens* (Grunow *ex* P.T. Cleve) Hasle	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	3.2		
501	*Pseudo-nitzschia subfraudulenta* (Hasle) Hasle	4	9	5	2	2	2	2	2	4	2	1	1	3	1	3	2.867	25.8		
502	*Pseudonitzschia subpacifica* (Hasle) Hasle	4	9	5	3	3	2	2	3	4	3	2	1	3	1	3	3.200	6.5		
503	*Denticula* sp. 1	4	3	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	3.2		
504	*Cylindrotheca closterium* (Ehrenberg) Reimann *et* Lewis	4	8	5	4	4	2	2	4	4	4	2	1	3	1	1	3.267	51.6	30.0	
505	*Cylindrotheca gracilis* (Brébisson) Grunow	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	6.5		
507	Familia Giffeniaceae Round *et* Basson																			
509	*Giffenia cocconeiformis* (Grunow) Round & Basson	4	5	5	1	1	2	2	1	4	1	1	1	3	1	2	2.267			bc
511	Familia Rhopalodiaceae (Karsten) Topachevs'kyj *et* Oksiyuk																			
513	*Rhopalodia gibba* (Ehrenberg) O. Müller	5	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.067	41.9	20.0	
514	*Rhopalodia gibberula* (Ehrenberg) O.F. Müller	4	2	5	1	1	2	2	1	4	1	1	1	3	1	1	2.000	41.9	30.0	
516	Familia Entomoneidaceae Reimer *in* Patrick *et* Reimer																			
518	*Entomoneis alata* (Ehrenberg) Ehrenberg	4	8	5	2	2	2	2	2	4	2	2	2	3	1	1	2.800	35.5	50.0	
519	*Entomoneis alata* var. *pulchra* (Bailey) Cleve	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	9.7		
520	*Entomoneis paludosa* (W. Smith) Reimer	4	8	5	1	1	2	2	1	4	1	1	1	3	1	1	2.400	9.7	10.0	
522	Familia Surirellaceae Kützing																			
524	*Surirella tenera* Gregory	4	5	5	1	1	2	2	1	4	1	1	1	3	1	1	2.200	19.4	10.0	
	VICA																2.396			
	MVIP	6	10	7	3	3	3	3	3	11	5	2	4	3	3	3				

out. This excludes, as a result, larger species (Oviat *et al.*, 1989). In addition, turbulence events were recognized in 14 sampling stations in those in which the presence of the species of larger size *Entomoneis alata* stood out. This species, together with other phytoplanktic and phytobenthic species, showed a mixture process through the discharge of the stream toward the lagoon, the tide movements and "tehuantepecanos" winds.

The species of the genera *Coscinodiscus*, *Chaetoceros, Thalassionema* and *Thalassiosira* are important components in the marine phytoplankton, in particular for their indicative role of upwelling (Koning *et al.*, 2001; Berges *et al.*, 2004); because of this, their presence and abundance in February-March indirectly showed the blooming of these species in the adjacent marine area associated with the increment of salinity, a bigger concentration of nutriments and an increase in the productivity, as has been postulated for the north of Gulf of Tehuantepec (Roden, 1961; Stumpf, 1975; Monreal-Gómez and Salas de León, 1998).

With the data referred to in Tables 1 and 2 the 16 sampling sites (stations) were classified. Results showed the formation of five distinctive groups denominated in this study habitats (Fig. 2). Among the five habitats, there were predominantly stood 51 species (15.5%) with a wide distribution, 41 species (12.5%) with a fairly wide distribution, 64 species (19.5%) with a moderate distribution, 109 species (33.2%) with a low distribution and 91 species (27.7%) with a very low distribution.

The first habitat (stations 7, 12-14) was distinguished for its high salinity (marine euhaline) the dominance of *Thalassiosira subtilis* with low tN:tP ratios, a decrease of biomass to α-mesotrophic, low species richness with marine eurihaline taxa (*Chaetoceros affinis* var. *affinis-Thalassiosira subtilis*) the brackish-water eurihaline taxa *Skeletonema subsalsum* and the limnobionts *Navicula* sp 2 and *Cocconeis* sp. 1.

The second habitat (stations 8-9), showed a decrease of salinity (mixo-polyhaline) where these stood out the upper brackish eurihaline *Amphora coffeaeformis* var. *coffeaeformis* with a decrease of the tN:tP ratios, a decrease of the biomass to γ-oligotrophic and an increase of species richness among those the marine eurihaline *Planktoniella sol-Navicula pelagica,* the upper brackish *Entomoneis alata* var. *pulchra* and the limnobionts *Amphora* sp. 6, *Navicula* sp. 7 and *Nitzschia recta*.

The third habitat (stations 5-6, 11) is characterised by a slight increase in salinity (mixo-polihaline), the dominance of the limnobiont slightly eurihaline *Amphora* sp 1 with a decrease in the tN:tP ratios, a decrease in the biomass to γ-oligotrophic and low species richness. The distribution of the species marine-eurihaline *Actinocyclus curvatulus* var. *curvatulus-Pleurosigma* sp. 1, the lower-upper brackish *Tryblionella punctata* f. *punctata-Nitzschia sigma*, the hifalmirobiont *Achnanthes curvirostrum* and the limnobiont eurihalines of second degree *Navicula distans* to *Navicula halophila*.

The fourth habitat (stations 1-4) is characterized by a decrease in salinity (mixo-polihaline), the dominance of *Ditylum brightwellii* (marine-eurihaline) with the smallest tN:tP ratios, decrease in biomass to β-oligotrophic and an increase in species richness. It is composed of the marine-eurihaline species *Thalassiosira decipiens-Pleurosigma* sp. 2, and the limnobiont slightly eurihaline *Achnanthes* sp. 1. Thus, the integraded species in the previous habitats showed the brackish tendency of this ecosystem.

The fifth habitat (stations 15-16), limnetic in nature, characterised by the dominance of *Navicula cryptocephala* var. *cryptocephala* (limnobiont-eurihaline) with low tN:tP ratio, a decrease in biomass to β-oligotrophic and an increase of species richness. Among them *Navicula* sp. 3-*Navicula* sp. 6 (lower brackish), *Aulacoseira granulata* var. *angustissima* f. *angustissima-Amphora ovalis* var. *ovalis*, (limnobionts slightly eurihaline), *Cyclotella stelligera-Amphora ovalis* var. *affinis* (limnobionts eurihaline) and *Achnanthes lanceolata-Nitzschia* sp. 4 (limnobiont stenohalines).

The line dot of station 10 (Fig. 2) was characterised by a slight decrease in salinity (mixo polihaline) and the non dominance of 17 taxa. Among them were *Cymatosira lorenziana* (marine eurihaline) to *Synedra filiformis* var. *exilis* (limnobiont) with decrease in the tN:tP ratio, an increase of biomass to α-mesotrophic and an increment in species richness. Besides *Synedra affinis* var. *fasciculata-Nitzschia media* (marine eurihalines), *Giffenia cocconeiformis* (hifalmirobiont), *Amphora ostrearia* var. *ostrearia* (limnobiont slightly eurihaline) and *Synedra delicatissima* var. *delicatissima* (limnobiont) were non dominants as well.

The frequent changes of the dominant species in the lagoon showed part of the succession of the diatoms (Padisák and Reynolds, 1998). This demonstrates the high tension of the ecosystem caused by the waste that spills into their waters and by the strong oscillations of salinity. In this respect, the tN:tP ratios registered in the rainy season toward the interior of the lagoon was indicative of the probable transport of organic matter that is discarded constantly from the urban area to its waters (Tapia-García *et al.*, 1998). Another aspect related to this is the gradual increment of the salinity from the innermost part in the lagoon toward its mouth. This showed the circulation of organic matter because of hydrological dynamics which is characteristic of the lagoon generated by water the displacement of the adjacent coastal area through tide movements.

It can be concluded that the five habitats found by an analysis of environmental characteristics synthesized in the pondered value of importance show the moderate water quality that was generated by the human different activities carried out in the lagoon or in their immediacy.

The diatoms of the lagoon and those of the 31 Mexican localities were similar (Table 2) [Ehrenberg, 1838; Moreno-Ruiz, 2000, 2005; Siqueiros-Beltrones, 2002; Moreno, 2003] shared 98% families, 88.8% genera and 87.5% species.

Banderas-Tarabay (1997) found a similarity of 40.4% when comparing species distribution between his study and the one of Ortega (1984), both in Mexico. In contrast, in our study the similarity is only 5.8% of the shared species. This is probably due to the exhaustive analysis of the literature referred to in Moreno-Ruiz (2005 and 2008).

Four groups stood out in the classification of the Mexican localities with 373 identified taxa (Fig. 3): the first one was formed with 8 localities located in the north-east region to central northeast-southwest (Tamaulipas-Estado de México). The second habitat was structured with 11 localities of the central region (Colima-Distrito Federal) as well as a northwest locality (west coast of Lower California). The third habitat was integrated by 3 localities in the northwest to the sub-central east region (Nayarit to Veracruz) and 4 localities south to central west (Chiapas-Oaxaca to Guerrero-Michoacán). The fourth habitat was structured with 3 localities at the northwest to southwest region (Sonora to Oaxaca) and a northwest locality (West of Lower California). In these four habitats 4 species (1.1%) stood out with a slightly high distribution, 61 species (16.4%) showed a moderate distribution, 144 species (38.6%) presented a low distribution and 152 species (40.8%) had a very low distribution.

Concerning the four habitats established in Fig. 3, the second that included the regions central west-east to north-west of the country exhibited the lowest species richness that together with the drop of species richness of the regions south-west to northwest (habitat I) is indicative of faulty information; this means that further research on the composition abundance and distribution of microalgae in the country must be undertaken to obtain a bigger phycofloristic relationship. Even so, the classification of the all states of the country (Fig. 3) exhibited the widest distribution of the three taxa limnobiont eurihalines: *Synedra ulna* var. *ulna*, *Cyclotella meneghiniana* and *Aulacoseira granulata* var. *granulata* f. *granulata* and the lower-upper brackish eurihaline *Cylindrotheca closterium.*

The similarity among the microscopic algae of South-America and those of the lagoon (Table 2) of 78% families, 73% genera, 41.8% species, 40.9% varieties and 58.8 % forms was obtained. In these algae the Chaetoceraceae showed a great species richness (25) and in second place, the Bacillariaceae (18).

When comparing the diatoms present in South America with those of Mexico, among six species, the limnobiont weakly eurihaline *Aulacoseira granulata* var. *granulata* f. *granulata* up to the brackish eurihaline *Entomoneis alata* with a lightly high distribution were prominent. 27 species among the limnobiont estenohalines *Cyclotella stelligera* to *Rhopalodia gibberula* exhibited a moderate distribution, and 104 species consisted of the marine eurihaline *Thalassiosira eccentrica* up to hifalmirobiont S*urirella tenera* having a low distribution.

Banderas-Tarabay (1997), talks about the common origin and wide dispersion of the microscopic algae between South America and North America with the recognition of a diatom species similarity of 2.13%. However, this contrasts with the increase of 41.8% registered in this study. For this reason it cannot be conclude that the diatoms of Mexico are richer than those of South America, since a distribution of diatoms in the little studied neotropical region was outstanding, the registration of taxa depending mainly on the temporal and spatial intensity of research (van Dam *et al.,* 1994). It thus is urgent to carry out more research in South America and Mexico; this will probably rebound in the increment of species richness and shared species, a better understanding of floristic relationships and recognition of highly productive areas.

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References

Banderas-Tarabay, A.: Phycoflora of the tropical high-mountain lake El Sol, Central Mexico and some biogeographical relationships. *Hydrobiol*., **354**, 17-40 (1997).

Abel, P.D.: Water pollution biology. Taylor and Francis EDS. UK. pp. 1-286 (2000).

Berges, J.A., E. Christopher, E. Gibson and B.M. Stewart: Physiological responses of phytoplankton communities in the Irish Sea to simulated upwelling. *Hydrobiol.*, **517**, 121-132 (2004).

Caljon, A.: Brackish-water phytoplankton of the Flemish lowland. *Develop. Hidrobiol.,* **18**, 1-272 (1983).

Contreras-Espinosa, F., O. Castañeda-López and A. García-Nagaya: La clorofila *a* como base para un índice trófico en lagunas costeras mexicanas (Chlorophyll-*a* as a base for a trophic index in Mexican coastal lagoons). *An. Inst. Cienc. Del Mar y Limnol. Univ. Nal. Autón. Méx*., **21**, 55-66 (1994).

Díaz-Ramos, J.R.: Índice de la microflora marina de Venezuela: Diatomeas, dinoflagelados y cocolitofóridos (Index of marine microflora from Venezuela: Diatoms, dinoflagellates and cocoliteophorids). *Rev. Biol. Trop*., **48**, 897-918 (2000).

Donato-Rondón, J.C.: Fitoplancton de los Lagos Andinos del Norte de Sudamérica (Colombia): Composición y factores de distribución (Phytoplankton from Andean lakes from the North of South America (Colombia): Composition and distribution factors). Acad. Col. Cienc. Exactas, Fís. y Nat. Ed. Guadalupe LTDA. Colombia. pp. 1-232 (2001).

Ehrenberg, C.G.: Die Infusionsthierchen als vollkommene Organisme. Ein Blick in das tiefere organische Leben der Natur (The infusoria as perfect organisms. A deeper view into the organic life of the nature). Leopold. Leipzig. (1838).

Figueroa-Torres, M.G.: Algas de la Cuenca de México (Algae from the Mexico valley). Universidad Autónoma Metropolitana, Unidad Xochimilco, México. pp. 1-81 (2009).

Figueroa-Torres, M.G., D. Santos-Zafra and A.A. Velasco-González: Ficoflora de Xochimilco, Parte 1: Diatomeas y Clorofitas (Algal flora of Xochimilco, Part 1: Diatoms and chlorophytes). Universidad Autónoma Metropolitana, Unidad Xochimilco, México. pp. 1-122 (2008).

García, E.: Modificaciones al sistema de clasificación climática de Köppen (para adaptarlo a las condiciones de la República Mexicana)

[Modifications to the Koppen climate system clasification(adapted to Mexican conditions)]. Larios, México D.F. (1981).

González De Infante, A.: El Plancton de las Aguas Continentales (Plankton of Inland waters). OEA, Washington. pp. 1-130 (1988).

Hammer, Ø., Harper, D.A.T. and P.D. Ryan: PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeont. Electronica*, **4**, 1-9 (2001).

Huszar, V.L.M., L.H.S. Silva, P. Domingos, M. Marinho and S. Melo: Phytoplankton species composition is more sensitive than OECD criteria to the trophic status of three Brazilian tropical lakes. *Hidrobiol.,* **369/370**, 59-71 (1998).

Koning, E., J.M. van Iperen, W. van Raaphorst, W. Helder, G.J.A. Brummer, and T.C.E. van Weering: Selective preservation of upwelling-indicating diatoms in sediments off Somalia, NW Indian Ocean. *Deep Sea Res.*, **48**, 2473-3495 (2001).

Lacerda, S.R., M.L. Koening, O.S. Neuman-Leita and M.J. Flores-Montes: Phytoplankton nyctemeral variation at a tropical river estuary (Itamaracá-Pernambuco-Brazil). *Braz. J. Biol.*, **64**, 81-94 (2004).

Lepistö, L. and U. Rosenstrom: The most typical phytoplankton taxa in four types of boreal lakes. *Hydrobiol.,* **369/370**, 89-97 (1998).

Monreal-Gómez, M.A. and D.A. Salas De León: Dinámica y estructura termohalina (Dynamics and Thermohalyne structure). *In*: El Golfo de Tehuantepec: El Ecosistema y sus Recursos (The Gulf of Tehuantepec: The ecosystem and its resources). (*Ed.*: M. Tapia), Univ. Autón. Metropol. México. pp. 13-26 (1998).

Mora-Navarro, M.R., J.A. Vázquez-García and Y.L. Vargas-Rodríguez: Ordenación de comunidades de fitoplancton en el lago de Chapala, (Ordination of phytoplankton communities in the Chapala Lake). Jalisco-Michoacán, México. *Hidrobiológica*, **14**, 91-103 (2004).

Morales, E.A. and K.M. Manoylov: Mayamaea cahabaensis sp. Nov. (Bacillariophyceae), a new freshwater diatom from streams in the southern United Status. *Proc. Aca. Natural Sci. Philadelphia*, **158**, 49-59 (2009).

Moreno, J.L.: Fitoplancton. *In*: Manual Para la Colecta, el Manejo y las Observaciones de Campo para Bioindicadores de Calidad del Agua (Manual for the collection, management and field observations for water quality bioindicators). (*Eds.*: G. De La Lanza-Espino and S. Hernández-Pulido) CNA/AGT ED. S.A. México. Pp. 13-45 (2003).

Moreno, J.L., S. Licea and H. Santoyo: Diatomeas del Golfo de California (Diatoms from the gulf of California). Universidad Autónoma de Baja California Sur, SEP-FOMES/PROMARCO. pp. 1-273 (1996).

Moreno-Ruiz, J.L.: Fitoplancton. *In*: Organismos Indicadores De La Calidad Del Agua y De La Contaminación (Phytoplankton. *In:* Organism indicators of water quality and pollution). (*Eds.*: G. De La Lanza Espino, S. Hernández-Pulido and J.L. Carbajal-Pérez). SEMARNAP, CNA, UNAM, INST. BIOL. UNAM, PLAZA & VALDEZ EDS. pp. 43-108 (2000).

Moreno-Ruiz, J.L.: Fitoplancton. *In:* Biodiversidad de Tabasco (Phytoplankton. *In*: Tabasco biodiversity).(*Eds.*: J.S. Bueno-Soria and F. Álvarez-Noguera). Inst. Biol., UNAM/CONABIO, México. Pp. 33-64 (2005).

Moreno-Ruiz, J.L. and A.L. Carreño: Diatom biostratigraphy of Bahía Asunción, Baja California Sur, México. *Rev. Mex. Cienc. Geol.*, **11**, 243-252 (1994).

Moreno-Ruiz, J.L., M. Tapia-García, M.C. González-Macias and M.G. Figueroa-Torres: Fitoplancton del río Tehuantepec, Oaxaca, México y algunas relaciones biogeográficas (Phytoplankton from Tehuantepec river, Oaxaca, Mexico and some biogeographical relationships). *Rev. Biol Trop.*, **56**, 27-54 (2008).

Navarro, J.N.: A survey of the marine diatoms of Puerto Rico. I. Suborders Coscinodiscineae and Rhizosoleniiaeae. *Bot. Mar.,* **24**, 427-439 (1981).

Navarro, J.N.: A survey of the marine diatoms of Puerto Rico. III. Suborder Biddulphiineae: Family Chaetoceraceae. *Bot. Mar.,* **25**, 305-319 (1982a).

Navarro, J.N.: A survey of the marine diatoms of Puerto Rico. V. Suborder Rhapidineae: Families Achnanthaceae and Naviculaceae (Excluding *Navicula* and *Mastogloia*). *Bot. Mar.,* **25**, 321-338 (1982b).

Navarro, J.N.: A survey of the marine diatoms of Puerto Rico. VII. Suborder Rhapidineae: FamiliesAuriculaceae, Epithemiaceae, Nitzschiaceae and Surirellaceae. *Bot. Mar.,* **26**, 393-408 (1983).

Nielsen, J.G. and T. Kiørboe: Effects of a storm event on the structure of the pelagic food web with special emphasis on planktonic ciliates. *J. Plankton Res.*, **13**, 35-51 (1991).

Oliva-Martínez, M.G., J.G. Ramírez-Martínez, G. Garduño-Solórzano, J. Cañetas-Ortega and M.M. Ortega: Caracterización diatomológica en tres cuerpos de agua de los humedales de Jilotepec-Ixtlahuaca, Estado de México (Diatoms characterization of three wetlands bodies of water from jilotepeclxtlahuaca, State of Mexico). *Hidrobiol.*, **15**, 1-26 (2005).

Ortega, M.M.: Catálogo de Algas Continentales Recientes de México (Catalogue of recent continental algae from Mexico). Univ. Nal. Autón. México. México. pp. 1-565 (1984).

Ortega, M.M., J.L. Godinez, G. Garduño-Solorzano and M.G. Oliva: Ficología de México: Algas Continentales (Phycology of Mexico: Continental algae). AGT Editor, S.A., México. pp. 1-236 (1995).

Oviat, C., P. Lane, I.F. French and P. Donaghay: Phytoplankton species and abundance in response to eutrophication in coastal marine mesocosms. *J. Plankton Res*., **11**, 1223-1244 (1989).

Padisák, J., and C.S. Reynolds: Selection of phytoplankton associations in lake Balaton, Hungary, in response to eutrophication and restoration measures, with special reference to the cyanoprokaryotes. *Hydrobiol.*, **384**, 41-53 (1998).

Reguera, B.: Establecimiento de un programa de seguimiento de microalgas tóxicas. *In*: Floraciones Algales Nocivas en el Cono Sur Americano (Establishment of a monitoring program for toxic algae. *In*: Harmful algal blooms in theamerican Southern cone). (*Eds.*: E.A. Sar, M.E. Ferrario and B. Reguera,) Instituto Español de Oceanografía. pp. 21-52 (2002).

Rines, J.E.B. and P.E. Hargraves: The *Chaetoceros* Ehrenberg (Bacillariophyceae) flora of Narragansett Bay, Rhode Island, U.S.A. *Bibliotheca Phycol.*, **79**, 1-196 (1988).

Riofrío, J., I. Samanez, F. Carrasco and M. Clavo: Limnological characteristics of the Amazonic Cashibococha Lake (Ucayali-Peru) at 2001. *Rev. Peru Biol.*, **10**, 183-194 (2003).

Roden, G.I.: Sobre la circulación producida por el viento en el Golfo de Tehuantepec y sus efectos sobre las temperaturas superficiales (On the wind-briven circulation in the Gulf of Tehuantepec and its effects upon surface temperatures). *Geofis. Inter*., **1**, 55-76 (1961).

Round, F.E.: The ecology of algae. Cambridge. Great Britain. pp. 1-653 (1981).

Round, F.E., R.M. Crawford and D.G. Mann: The diatoms, biology and morphology of the genera. Cambridge University Press, Cambridge. pp. 1-728 (1990).

Rzedowsky, J.: La Vegetación de México. Limusa, México. Pp. 1-432 (1978).

Siqueiros-Beltrones, D.A.: Diatomeas Bentónicas de la Península de Baja California; Diversidad y Potencial Ecológico (Benthic diatoms of Baja California Peninsula, diversity and ecological potential, Marine Science Books. CICIMAR, Libros de Ciencias Marinas, IPN-UABCS. pp. 1-102 (2002).

Smith, A.: Responses of estuarine and coastal marine phytoplankton to nitrogen and phosphorus enrichment. *Limnol. Oceanogr*., **51**, 377-384 (2006).

Soler, A.: Contribuciones al conocimiento de las diatomeas (Bacillariophyceae) de Panamá. II. Epifitismo en *Hydrilla verticillata* (Contributions to the knowledge of diatoms (Bacillariophyceae) in panama.II. Epiphytism on *Hydrilla verticillata*). *Rev. Universidad*, **48**, 106-168 (1993).

Soler, A., M.Y. Castillo and E.V. Robles: Contribuciones al conocimiento de las diatomeas (Bacillariophyceae) de Panamá. I. Diatomeas del Lago Gatún (Contributions to the knowledge of diatoms (Bacillariophyceae) in panama. I. diatoms from lake Gatun). *Rev. Universidad*, **47**, 161-227 (1993).

Spiniello, P.: Las diatomeas marino-costeras de Venezuela (Coastal marine diatoms from Venezuela). Caribbean Journal of Science, **32**, 331-347 (1996).

Stumpf, H.G.: Satelite detection of upwelling in the Gulf of Tehuantepec, Mexico. *J. Phys. Oceanogr*., **5**, 383-388 (1975).

Tapia-García, M., E. Ramos-Santiago and A. Ayala-Cortés: La Actividad Humana y su Impacto en la Zona Costera con Énfasis en el Istmo de Tehuantepec. In Tapia, M. (ed.). El Golfo de Tehuantepec: el Ecosistema y sus Recursos (Human activity and its impacts at the costal zone with Emphasis on the Isthmus of Tehuantepes. *In:* The Gulf of Tehuantepec: The ecosystem and its resources). Univ. Autón. Metropol. México. pp. 209-228 (1998).

Utermöhl, H.: Zur Vervollkommung der quantitativen Phytoplankton-Methodik (Improving the quantitative phytoplankton method). *Mitt. Int. Ver. Theor. Angew. Limnol.*, **9**, pp. 1-38 (1958).

Van Dam, H., A. Mertens and J.A. Sinkeldam: Coded checklist and ecological indicador values of freshwater diatoms from the Netherlands. *Neth. J. Aquatic Ecol.*, **28**, 117-133 (1994).

Ward, J.: Hierarchical grouping to optimise an objetive function. *J. Amer. Statist. Ass.*, **58**, 236-244 (1963).

Wilhm, J.L. and T.C. Dorris: Biological parameters for water quality criteria. *Bio. Sci.*, **18**, 477-481 (1968).

Yoshida, M., Y. Yoshiuchi and K. Hoyanagi: Occurence conditions of hyperpycnal flows, and their significance for organic-matter sedimentation in a Holocene estuary, Nigata Plain, Central Japan. *The Island Arc.*, **18**, 320-332 (2009).