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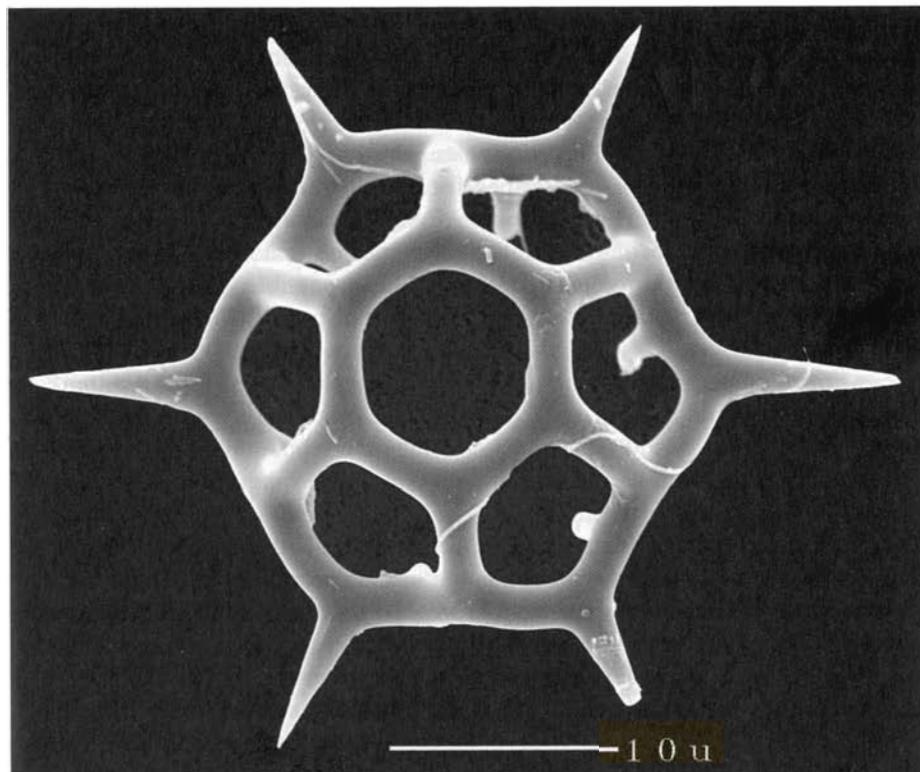
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Part 1

Phytoplankton

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Dictyocha speculum, a silicoflagellate, from the Golfo de Nicoya, Pacific Costa Rica. (Photo: Paul E. Hargraves)

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Abstract Phytoplankton are a complex group, composed of several taxonomic classes of unicellular or colonial species with great morphological and color variation, generally drifting with water movement. Some have one or several benthic life stages. They are mostly photosynthetic but some require organic nutrients. Color is important for taxonomic classification and depends on the chloroplast pigment composition. Studies on the biodiversity of marine phytoplankton in Costa Rican coasts are sparse and mostly confined to the Pacific coast, more specifically to the Golfo de Nicoya. New records presented here come from the three most important embayments in the Pacific coast. We report 268 species, 258 for the Pacific coast, 53 for the Caribbean coast, and 43 species common to both coasts. There are no reports of coccolithophorids, and only few species of flagellates other than dinoflagellates have been identified. Some taxonomic classes possibly occurring in local waters have never been examined. Phytoplankton listed for both Caribbean and Pacific coasts is basically neritic and cosmopolitan. When compared to the floras described for other parts of the world it is evident that much more work is needed on both Costa Rican coasts. It is important to monitor the occurrence of potentially toxic species that have proven to be a danger to human health in Costa Rica, to evaluate possible extinction events of local endemic flora, and to intensify the search of potentially valuable marine pharmaceuticals.

Introduction

The great majority of phytoplankton are eukaryotic cells that spend all or most of their life stages drifting in the water column of the oceans (and lakes). Some may have a resting stage that sink to the bottom where they await favorable environmental conditions to restart vegetative growth; some of these, so-called meroplanktonic species, can have complex life cycles with several bottom-dwelling and/or free-floating stages. The main components of phytoplankton are diatoms (*Bacillariophyceae*), dinoflagellates (*Dinophyceae*), coccolithophores (*Prymnesiophyceae*), and some flagellates (*Chlorophyceae*, *Rhaphydophyceae*, *Cryptophyceae*, *Dictyochophyceae*). Some ciliates (*Myrionecta*) or flagellates (*Hermesinum*) are regarded as heterotrophic but are autotrophic because they have endosymbiotic algae. Most of them are mixotrophic, i.e., they can photosynthesize but also require organic matter (mostly vitamins and amino acids) which they get by absorption from the surrounding water or by consuming entire cells, as some dinoflagellates do. There are some planktonic photosynthetic prokaryotes: purple and green sulfur bacteria and the blue green algae (*Cyanophyceae*) (Raymond 1980).

Perhaps the most striking feature of phytoplankton is the variability in shape and cell wall constitution (Raymond 1980): cellulose in many dinoflagellates, opal-like glass in diatoms, calcium carbonate in coccolithophores, organic or silicon scales in some flagellates. Some show elaborated cell wall projections, such as spines, horns, or wings; some can live as solitary cells, other can form long chains or colonies. Color depends on the chloroplast pigments. The pigment composition, along with cell wall

composition and structure, type of nucleus, chloroplast envelope, thylakoid organization, and type of flagella are taxonomic criteria used for class separation.

Studies of phytoplankton species richness on the Pacific coast of Costa Rica started with the collections of Allen (1925, 1939) and Cupp (1934). In a study of the annual cycle of potentially toxic dinoflagellates, Víquez & Hargraves (1995) documented the occurrence of species that were reported as toxic in other areas such as *Gymnodinium catenatum* and *Pyrodinium bahamense* var. *compressum*. Brugnoli (1998) and Brugnoli Olivera & Morales Ramírez (2001) studied the dynamics and structure of the phytoplankton community but did not consider species, only higher taxa levels such as genus and family. Vega (1999) records 151 taxa, including 73 species of diatoms, 18 species of dinoflagellates, and 2 other flagellates that were identified to the species level. Records of single species are provided by Morales *et al.* (2001) who reported a red tide by *Lingulodinium polyedrum*, and Mata *et al.* (1990) documented the occurrence of human poisoning due to *Pyrodinium bahamense* var. *compressum*. Vargas (2001) included descriptions, ultrastructure, and electron microscope photographs of 38 taxa of dinoflagellates, some of them identified to genus. More recently, Vargas-Montero & Freer (2004a) provided information on the presence of dinoflagellates of the genus *Ceratium* spp. in the Golfo de Nicoya, and they reported also on recent toxic algal bloom in the Golfo de Nicoya (Vargas-Montero & Freer 2004b, c).

Studies on the phytoplankton in the Costa Rican Caribbean are even sparser, and limited information exists on the flora. The only published annual cycle analysis of the phytoplankton assemblage of the Caribbean coast of Costa Rica was provided by Vargas (1991), and this information is included in Species List 1.1 (on CD-Rom). Another study (Silva 1986) on the photosynthesis and standing crop of phytoplankton in Cahuita identified phytoplankton to the genus level.

Most of the phytoplankton records for the Pacific coast (Species List 1.2 is included on the CD-Rom) come from Bahía Culebra (Golfo de Papagayo) in the north, Golfo de Nicoya in the central part of the country (Fig. 1.1), and Golfo Dulce in the south. Species reported by us as new records (indicated as NR in the first column in Species Lists 1.1 and 1.2, both on CD-Rom) are from bottle samples and net tow collections obtained from 1980 to 2001 (projects UNA-921002, UNA-021066 and UNA-023433 granted to R. Víquez). These samples were preserved with Lugol's solution. Dinoflagellates were identified from water mounts and diatoms from permanent resin mounts (Hyrax, Aroclor, or Melmount). All samples and resin mounts on duplicate glass slides were catalogued and deposited in the Plankton Collection at Estación de Biología Marina, Universidad Nacional, Puntarenas (R. Víquez collection), or at the Graduate School of Oceanography, URI (PEH collection). Here we report 268 species, 258 species for the Pacific coast, 53 species for the Caribbean coast, and 43 species occurring along both coasts (Table 1.1).

As in most compilations of species lists and surveys, the accuracy of identifications depends on the individual skills of the surveyor, which is unfortunately variable, and the adequacy of available literature. This compilation is no exception, and we have chosen not to judge the accuracy of the identifications of others. In addition, advances in taxonomic opinion may change rapidly, and the names in this list are always subject to modification.

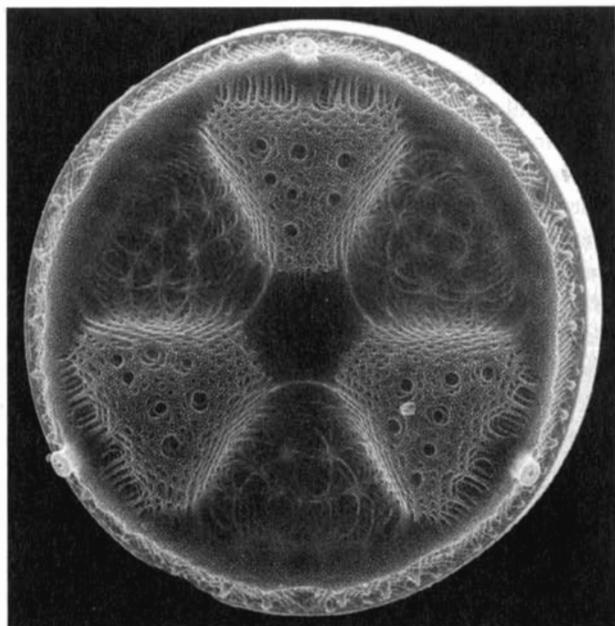


Fig. 1.1 *Actinopytchus senarius*, a diatom, from the Golfo de Nicoya, Costa Rica. Photo: Paul E. Hargraves

Table 1.1 Summary of phytoplankton species reported for each coast of Costa Rica

	Pacific	Caribbean	Pacific	Caribbean
Bacillariophyceae	151	46	Gymnodiniales	14
Coscinodiscales	40	6	Noctilucales	2
Rhizosoleniales	14	6	Peridiniales	30
Bidduphiales	56 plus 2 subspecies	14	Cyanobacteria	4 genera, 2 species
Fragilariales	11 plus 1 subspecies	2	Ebridea	2
Bacillariales	27	18	Ciliata	1
Dinophyceae	96	3	Prymnesiophyceae	1
Prorocentrales	11	1	Raphyophyceae	1
Dinophysiales	10	1	Dictyochophyceae	2
Gonyaulacales	29	1	TOTAL N° OF TAXA	258
Species reported only from the Pacific coast	215	Species reported only from the Caribbean coast		10
Number of species occurring along both coasts				43
TOTAL NUMBER OF SPECIES				268

Discussion

None of the above mentioned publications considered coccolithophorids, although these carbonate-secreting species are known to be diverse in other tropical coastal areas. When any local area is examined in detail for microalgae, species richness increases dramatically. In Florida, for example, an intensive survey of protists by one of us (PEH) tripled the number of reported species (www.sms.si.edu/irlspec/Species_Rpts.htm) based on a 3-month survey. Likewise, entire taxonomic groups of microalgae (Prymnesiophyceae, Cryptophyceae, Prasinophyceae, and several other classes) have never been examined in Costa Rican waters, and only occasional anecdotal observations are available. In other temperate and tropical coastal regions these (mostly) nanoplankton-sized organisms frequently make significant contributions to primary productivity and can form harmful algal blooms. They are neglected mostly because they are destroyed in common preservatives, their study requires electron microscopy, molecular techniques or both, and competent taxonomists for these difficult groups are scarce. Most species listed in this part are either easily preservable, identifiable by light microscopy, or both.

Phytoplankton so far reported for the Caribbean and Pacific coasts of Costa Rica can be defined as basically neritic and cosmopolitan. Communities of microplankton-sized cells (i.e., 20–200 µm) were dominated by diatoms, and *Skeletonema costatum* was repeatedly identified as an abundant and ubiquitous species (although this name may represent a complex of several species; Sarno *et al.* 2007, J. Phycol. 43:156–170). The species-rich genus *Chaetoceros* played a prominent role in determining the diversity of the Costa Rican flora (Víquez 1983; Brugnoli 1998; Vega 1999; Brugnoli Olivera & Morales Ramírez 2001).

The phytoplankton in the Golfo de Nicoya shared around 50% of species with the Gulf of Panama, the Gulf of California, the Gulf of Guayaquil in Ecuador, and the summer flora of Narragansett Bay in the east coast of the United States (Hargraves & Víquez 1985). Although this suggests a high degree of cosmopolitan species, it is also true that five centuries of interoceanic ship travel makes it difficult to decide which species are truly cosmopolitan, and which are invasive species on a century-long time scale. In other words, many cosmopolitan species could be more accurately described as cryptogenic.

When compared to the floras described for other parts of the world it is evident that much more work is needed on both Costa Rican coasts. As an example, here we report only 13 species of the genus *Ceratium* for the Pacific coast and two species for the Caribbean; however, in the Gulf of California 83 taxa have been described, close to the total number of species reported worldwide (120 spp.) (Cortés-Altamirano & Nuñez 2000).

Knowledge of phytoplankton species richness for the Caribbean coast of Costa Rica (Species List 1.1: 53 spp.) is rather incomplete, probably because the single study (Vargas 1991) was carried out at the mouth of two estuaries with strong freshwater influence, thus excluding many oceanic stenohaline species. It is also note-

worthy that for some of the species listed, few or no references from other tropical areas were found, whereas other taxa were ubiquitous and common according to a survey of published records from other areas. In Venezuela, Díaz-Ramos (2000) compiled a total of 461 species (275 species of diatoms, 162 species of dinoflagellates, and 24 species of coccolithophores) based on 40 years of studies by several authors.

Since harmful algal blooms have an impact on public health and economy of Costa Rica (Mata *et al.* 1990; Morales *et al.* 2001), it is necessary to monitor more closely the occurrence of those species known to be toxic to both humans and marine animals of economic importance. Moreover, it has been estimated that hundreds or thousands of species become extinct before they are discovered (which is a non-verifiable statement). It is likely that extinctions and biodiversity loss also take place at some level in coastal marine environments. Before evaluations of such extinction events can be made, it is necessary to know the number of endemic species in marine areas of Costa Rica. Widespread species may be in danger of local extinction, but not necessarily global eradication; in contrast, endemic species are much more susceptible. Given the common occurrence of allelopathy (i.e., biochemical warfare) amongst microscopic organisms, it is likely that potentially valuable marine pharmaceuticals may be found in phytoplankton species, waiting to be discovered. The first step is the establishment of biotic inventories, and there is much to be done. This is contribution # 1695 from Harbor Branch Oceanographic Institution of Florida Atlantic University, and contribution #728 from Smithsonian Marine Station/Ft Pierce, FL. PEH acknowledges support from both institutions.

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Species List 1.1 List of phytoplankton species from the Caribbean coast of Costa Rica. For diatoms, grouping of genera into Orders follows Hasle & Syvertsen (1996), dinoflagellates are grouped according to Steidinger & Tangen (1996)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
Phylum CHRYSOPHYTA			
Class BACILLARIOPHYCEAE			
Order COSCINODISCALES			
<i>Actinocyclus curvatus</i> Janisch	[98]	CTPIO	[36, 90]
Syn. <i>Coseinodiscus curvatus</i> Grunow			
<i>Coscinodiscus centralis</i> Gran & Angst.	[98]	Car, IO, GM, Med, NEA	[19, 20, 21, 41, 77, 90]
<i>Cyclotella meneghiniana</i> Kuizing	[98]	Car, EC, GM, IO, Med	[20, 21, 33, 72, 96]
<i>Glossierella tropica</i> Schütt	[98]	Ca, Car, IO, SEP	[3, 21, 32, 72, 96]
<i>Melosira moniliformis</i> (O. Müller) Agardh	[98]	EC, GM, NEP, SEP	[3, 33, 72]
<i>Skeletonema costatum</i> (Greville) cleve	[98]	Ca, Car, ETP, GM, IO, NEA NWA, SEP	[3, 8, 10, 18, 19, 72, 77, 90, 96]
Order RHIZOSOLENALES			
<i>Guinardia striata</i> (Stolterfoth) Hasle	[98]	Car, EC, ETP, GM, NEA, NWA, SA	[8, 9, 10, 18, 19, 21, 37, 72, 77, 88]
Syn. <i>Rhizosolenia stolterfothii</i> Peragallo			
<i>Proboscia alata</i> (Brightwell) Sundström	[98]	Car, CTP, ETP, GM, IO, Med, NEA, NWA, SEP	[3, 8, 10, 18, 19, 21, 41, 77, 90]
Syn. <i>Rhizosolenia alata</i> Brightwell			
<i>Pseudosolenia calcar-avis</i> (Schulze) Sundström	[98]	Ca, EC, ETP, GM, IO, NEA, NWA	[8, 18, 19, 72, 73, 90]
<i>Rhizosolenia imbricata</i> Brightwell	[98]	Ca, Car, ETP, GM, IO, NEA, SA, SEP	[3, 9, 10, 18, 19, 21, 72, 90, 96]
<i>Rhizosolenia setigera</i> Brightwell	[98]	Car, EC, ETP, GM, IO, NEA	[10, 18, 19, 72, 77, 90, 96]
Order BIDULPHIALES			
<i>Bacteriastrum delicatulum</i> Cleve	[98]	Ca, Car, ETP, GM, IO, Med, NWP	[18, 19, 20, 21, 45, 72, 96]
<i>Bacteriastrum hyalinum</i> Lauder	[98]	Ca, Car, IO, Med	[20, 21, 72, 79, 96]
<i>Ceratulina dentata</i> Hasle	[98]	Ca, TP	[43, 72]
<i>Chaetoceros affinis</i> Lauder	[98]	Ca, Car, EC, ETP, GM, IO, NEA, NWA, SEP	[3, 10, 18, 19, 72, 79, 85, 96]
<i>Chaetoceros brevis</i> Schütt	[98]		[3, 20, 79, 85, 88]
<i>Chaetoceros coarcatus</i> Lauder	[98]		[19, 20, 72, 79, 85, 90, 96]
<i>Chaetoceros curviseus</i> Cleve	[98]		[3, 18, 19, 21, 79, 85, 90, 96]
<i>Chaetoceros dianicus</i> Cleve	[98]		[10, 18, 19, 85]
<i>Chaetoceros diversus</i> Cleve	[98]		[18, 19, 79, 90, 96]

(continued)

Species List 1.1 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
<i>Chaenoceros gracilis</i> Schiltt	[98]	Ca,GM,SEP	[3,19,72]
<i>Chaenoceros peruvianus</i> Brightwell	[98]	Car,CTP,ETP,GM,IO,NWA	[18,19,41,79,85,90,96]
<i>Chaenoceros socialis</i> Lauder	[98]	EC,ETPPGM,IO,NEA,NWA,SEP	[3,10,18,72,85,88,96]
<i>Ditylum brightwellii</i> (West) Grunow	[98]	Car,EC,ETP,IO,SA,NEA	[9,10,18,21,72,96]
<i>Hemiaulus hauckii</i> Grunow	[98]	Car,EC,ETP,GM,IO,Med	[7,18,19,20,65,72,78]
<i>Lithodesmium undulatum</i> Ehrenberg	[98]	GM,IO,NEA	[19,65,88,96]
Order FRAGILARIALES			
<i>Asterionellopsis glacialis</i> (Catascane) Round Syn.	[98]	Car,EC,ETP,GM,IO,NEA,SA,SEP	[3,8,9,18,19,72,80,90,96]
<i>Asterionella japonica</i> Gran.	[98]	Car,EC,GM,IO,SEP	[3,19,21,29,72,80,90,96]
<i>Thalassionema frauenfeldii</i> (Grunow) Haelgaeff	[98]		
<i>Syn. Thalassiothrix frauenfeldii</i> Grunow			
Order BACILLARIALES			
<i>Achnanthes longipes</i> Agardh	[98]	Car,EP,NEA	[65,72,81]
<i>Amphora granulata</i> Greg.	[98]	IO	[90]
<i>Bacillaria paixillifera</i> (Müller) Hendey	[98]	Car,GM,IO,NEA,NWP	[19,21,65,72,88,90,96]
<i>Syn. Nitzschia paradoxaa</i> (Gmel.) Grun.			
<i>Syn. Bacillaria paradoxaa</i> Gmel.			
<i>Cylindrotheca closterium</i> (Ehrenberg) Reimann & Lewin.	[98]	Car,EC,CNP,ETP,GM,IO,Med,NEA,NWA,SA,SEP	[3,8,9,10,18,19,20,21,72,90,96,101]
<i>Syn. Nitzschia closterium</i> (Ehrenberg) W. Smith	[98]	Car	[21,82]
<i>Mastogloia bipiculata</i> Schmith	[98]	Car	[21,82]
<i>Mastogloia bifornis</i> Grun.	[98]	n.a.	n.a.
<i>Navicula disparata</i> Hustedt	[98]	GM	[88]
<i>Navicula distans</i> Cleve	[98]	n.a.	n.a.
<i>Navicula hustedtii</i> Krasske	[98]	Car,GM	[21,82,88]
<i>Navicula irrorata</i> Grev.	[98]	Car	[21]
<i>Nitzschia bilobata</i> Wm. Smith	[98]	Car,ETP,GM,IO,SEP	[3,18,19,21,96]
<i>Nitzschia longissima</i> (Brebisson) Ralfs	[98]	IO	[96]
<i>Pleurosigma elongatum</i> Wm. Smith	[98]	Ant,NEA,SA,SEP	[9,10,45,86]
<i>Pseudo-nitzschia delicatissima</i> (Cleve) Heiden. Syn.	[98]		
<i>Nitzschia delicatissima</i> Cleve			

<i>Pseudo-nitzschia pungens</i> (Grunow ex Cleve) Hasle.	[98]	Au,Ca,CTP,EC,GM,SA,SEP	[9, 19, 21, 30, 40, 41, 72, 86, 88]
Syn. <i>Nitzschia pungens</i> Grunow ex Cleve			
<i>Surirella lemmermanni</i> Hustedt	[98]	n.a.	n.a.
<i>Surirella angustifcostata</i> Hustedt	[98]	n.a.	n.a.
DINOPHYTA			
Class DINOPHYCEAE			
Order PROTOCENTRALES			
<i>Protoxanthum gracile</i> Schütt	[98]	Ca,Car,Med,NEA,NWA,SWA,TP	[5, 21, 22, 23, 52, 53, 66]
Order DINOPHYSTIALES			
<i>Dinophysis caudata</i> Saville-Kent. Syn. <i>Dinophysis homunculus</i> Stein	[98]	Ca,Car,GM,GM,Med,NEA,NEA, SWA,TA	[5, 6, 19, 20, 21, 51, 52, 52, 64, 66]
Order GONYAULACALES			
<i>Ceratium furca</i> Claparede & Lachmann	[98]	Au,Ca,Car,GM,JO,Med, NWA,SA,SEA,SWA	[5, 9, 19, 20, 21, 46, 52, 66]
CYANOBACTERIA			
<i>Spirulina subsalsaria</i> Ørsted ex Gomont	[35]	EC,Med	[34, 62, 73]
<i>Johannesbaptista pellicula</i> (Dickie) Taylor & Drouet	[NR]	NWA	[73]
<i>Trichodesmium</i> sp.	[NR]	GM	[19, 53]
DINOPHYTA			
Class DICTYOCHOPHYCEAE (Silicoflagellates)			
<i>Dictyocha fibula</i> Ehrenberg	[98]	Au,CNP,EC,Med	[7, 26, 71, 101]

^a CR = Costa Rica, NR = New record^b Ant = Antarctic, Au = Australia, BI = British Isles, Ca = Gulf of California and Pacific coast of México, Car = Caribbean, EC = East coast of USA, CNP = Central North Pacific, CTP = Central Tropical Pacific, ETP = Eastern Tropical Pacific, GP = Gulf of Panamá, IO = Indian Ocean, GM = Gulf of México, Med = Mediterranean and adjacent seas, NEA = North Eastern Atlantic, NEP = North Eastern Pacific, NWP = North Western Atlantic, NWPA = North Western Pacific, SA = South Africa, SEP = South Eastern Pacific, SWA = South Western Pacific, SWP = South Western Atlantic, TA = Tropical Atlantic, TP = Tropical Pacific^c References are indicated by numbers according to the references list.

Species List 1.2 Phytoplankton species from the Pacific coast of Costa Rica. For diatoms, grouping of genera into Orders follows Hasle & Syvertsen (1996), dinoflagellates are grouped according to Steidinger & Tangen (1996), Ebriidae as in Hargraves (2002)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
Phylum CHRYSTOSOPHYTA			
Class BACILLARIOPHYCEAE			
Order COSCINODISCALES			
<i>Actinocyclus curvatus</i> Janisch Syn. <i>Coscinodiscus curvatus</i> Grunow			
<i>Actinocyclus octonarius</i> Ehrenberg. Syn. <i>Actinocyclus erhenbergii</i> Ralfs			
<i>Actinopithecus senarius</i> (Ehrenberg) Ehrenb. Syn. <i>Actinopithecus undulatus</i> (Bailey) Ralfs			
<i>Actinopithecus splendens</i> (Shadbold) Ralfs			
<i>Asterolampra marylandica</i> Ehrenberg			
<i>Asteromphalus cleveanus</i> Grunow			
<i>Asteromphalus heptactis</i> (Breb.) Ralfs			
<i>Corethron hystrix</i> Cleve			
<i>Coscinodiscus centralis</i> Gran & Angst.			
<i>Coscinodiscus granii</i> Gough			
<i>Coscinodiscus perforatus</i> Ehrenberg			
<i>Coscinodiscus wailesii</i> Gran & Angst.			
<i>Cyclotella meneghiniana</i> Kutzing			
<i>Cyclotella striata</i> (Kutzing) Grun.			
<i>Detonula pumila</i> (Catrascan) Schütt.			
Syn: <i>Schroederella delicatula</i> (Perragallo) Pavillard			
<i>Gossleriella tropica</i> Schütt			
<i>Lauderia annulata</i> Cleve.			
<i>Syn. Lauderia borealis</i> Gran			
<i>Lepicylindrus danicus</i> Cleve			
<i>Lepicylindrus mediterraneus</i> (Perragallo) Hasle.			

Syn. <i>Dactyliosolen mediterraneus</i> (Peragallo) Peragallo <i>Lepiolyndrus minimus</i> Gran	[103]	Ca,EC,ETP,GM,IO EC,GM,NEP,SEP Ca,Car,GM,IO,NEA,NWA	[20, 72, 88, 96] [3, 33, 72] [8, 21, 65, 72, 77, 88, 96]
<i>Melosira moniliformis</i> (O. Müller) Agardh	[NR]		
<i>Paralia sulcata</i> (Ehrenberg) Cleve.	[NR]		
Syn. <i>Melosira sulcata</i> (Ehrenberg) Kützing			
<i>Planktoniella muriformis</i> (Loeblich, Wight & Darley)	[100,103]	GM,NEA,	[18, 68]
Round.			
Syn. <i>Coenobiodiscus muriformis</i> Loeblich, Wight & Darley	[103]		
<i>Planktoniella sol</i> (Wallich) Schütt	[100,103]	Car,ETP,GM,IO,CTP,Med,NEA, NWA,SEP	[3, 8, 18, 20, 21, 33, 41, 90, 96]
<i>Skeletonema costatum</i> (Greville) cleve	[100,103]	Ca,Car,ETP,GM,IO,NEA,NWA, SEP	[3, 8, 10, 19, 20, 72, 77, 90, 96]
<i>Skeletonema tropicum</i> Cleve	[NR]	Ca,GM EC,ETP,IO,Med,SA,SEP	[15, 33] [3, 9, 20, 20, 72, 96]
<i>Stephanopyxis turris</i> (Greville & Arnott) Ralfs	[100,103]	Ca,GM,NWP	[25, 33, 72]
<i>Thalassiosira binata</i> Fryxell	[103]	Ca,NEA,NWA	[65, 72]
<i>Thalassiosira bioculata</i> (Grun.) Ostenfeld	[NR]	NWP	[25]
<i>Thalassiosira conferta</i> Hasle	[NR]	Ca,Car,CTP,GM,IO,NEA,Med, SA,SEP	[3, 9, 10, 19, 20, 21, 41, 72, 88, 96]
<i>Thalassiosira decipiens</i> (Grun.) Jorg.	[103]	Car,EC,GM,IO,Med,NWP,SA Ca,GM Ca,Car,CTP Ca,NWP NEA	[1, 9, 20, 21, 25, 72, 88, 90] [1, 33, 72] [1, 21, 41, 72] [1, 25, 72] [25, 38] [39]
<i>Thalassiosira eccentrica</i> (Ehrenberg) Cleve	[103]	Ca,CTP,IO,NWP	[1, 25, 41, 72, 90]
<i>Thalassiosira exigua</i> Fryx. & Hasle	[103]	Ca,EC,GM,Med	[7, 33, 72, 75]
<i>Thalassiosira leptopus</i> (Grun.) Hasle & Fryxell	[NR]	Ca,ETP,GM,IO,Med,SEP	[3, 20, 21, 41, 75, 90, 96]
<i>Thalassiosira mala</i> Tak.	[103]		
<i>Thalassiosira minima</i> Gaarder	[NR]		
<i>Thalassiosira oceanica</i> Hasle	[PNR]		
<i>Thalassiosira oestrupii</i> (Ostenfeld) Proshkina-Lavrenko	[NR]		
<i>Thalassiosira rotula</i> Meunier	[NR]		
<i>Thalassiosira subtilis</i> (ostenfeld) Gran	[NR]		
Order RHIZOSOLENALES			
<i>Dactyliosolen fragilissimus</i> (Bergon) Hasle	[35,103]	Ca,EC,ETP,GM,Med,NEA,NWA	[8, 10, 20, 37, 72, 88]

(continued)

Species List 1.2 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
Syn. <i>Rhizosolenia stolterfothii</i> Pergalio <i>Guinardia delicatula</i> (Cleve) Hasle	[35,100,103]	Car,EC,ETP,NEA,NWA,SA,SEP	[8,9,20,21,72,75]
Syn. <i>Rhizosolenia delicatula</i> Cleve	[100,103]	Car,EC,ETP,GM,IO,Med,NEA, NWA	[8,19,20,21,37,77,90,96]
Syn. <i>Rhizosolenia flaccida</i> Catrascane <i>Guinardia striata</i> (Stolterfoth) Hasle	[35,100,103]	Car,EC,ETP,GM,NEA,NWA,SA	[8,9,10,18,19,21,37,72,77, 88]
Syn. <i>Rhizosolenia stolterfothii</i> Pergalio <i>Proboscia alata</i> (Brightwell) Sundström.	[35,100,103]	Car,CTP,ETP,GM,IO,Med,NEA, SEP	[3,10,18,20,21,41,77,90]
Syn. <i>Rhizosolenia alata</i> Brightwell <i>Pseudosolenia calcar-avis</i> (Schulze) Sundström	[35,100,103] [NR]	Ca,EC,ETP,GM,IO,NEA,NWA Ca,ETP,GM,NEA, NWA	[8,19,20,72,75,90] [8,19,20,75]
<i>Rhizosolenia acuminata</i> (Perag.) Pav.	[35,100,103]	Ca,CTP,Car,ETP,GM,IO,NEA, NWA	[8,19,20,41,75,88,90]
<i>Rhizosolenia bergenii</i> Perag.			
<i>Rhizosolenia hebetata</i> van. <i>hebetata</i> Bailey	[35,100,103]	Ca,Car,GM,IO,NEA,SA, SEP	[3,9,10,19,21,75,90,96]
<i>Rhizosolenia imbricata</i> Brightwell	[100]	Ca,Car,ETP,GM,IO,NEA,SA,SEP	[3,9,10,19,20,21,75,90,96]
<i>Rhizosolenia robusta</i> Norman	[35,100,103]	Ca,Car,EC,GM,IO, Med	[19,20,72,75,77,90,96]
<i>Rhizosolenia senigera</i> Brightwell	[100,103]	Car,EC,ETP,GM,IO, NEA	[10,19,20,72,77,90,96]
<i>Rhizosolenia styliformis</i> Brightwell	[NR]	Ca,Car,CTP,ETP,GM,IO,NEA, NWA,SEP	[3,8,19,20,21,41,75,77,90, 96]
Order BIDDULPHIALES			
<i>Aulacodiscus kitttonii</i> Arnott ex Ralfs in Pritchard	[NR]	BI	[91]
<i>Bacteriastrum conosum</i> Pavillard	[100,103]	Ca,Car,ETP,IO	[20,21,75,79,96]
<i>Bacteriastrum delicatulum</i> Cleve	[100,103]	Ca,Car,ETP,GM,IO,Med,NWP Med	[19,20,21,45,72,75,96] [26]
<i>Bacteriastrum elegans</i> Pavillard		Ca,Car,IO,Med	[20,21,75,79,96]
<i>Bacteriastrum hyalinum</i> Lauder		BI,Ca,Car,EC,IO	[21,72,75,78,90,91]
<i>Biddulphia biddulphiana</i> (J.e. Smith) Boyer Syn.			
<i>Biddulphia puchella</i> Gray			
<i>Cerataulina pelagica</i> (Cleve) Hendey 1937. Syn.	[100,103]	Car,ETP,GM,IO,Med,NEA,NWP, SEP	[3,8,10,19,20,21,72,78,90, 96]
<i>Cerataulina bergenii</i> (H. Pergallo) Schütt			

<i>Cerataulina bicornis</i> (Ehrenberg) Hasle.	[100,103]	Ca,TP	[42, 43, 75]
Syn. <i>Cerataulina daemon</i> (Greville)Hasle			
<i>Cerataulina dentata</i> Hasle	[100,103]	Ca,TP	[43, 75]
<i>Chaetoceros affinis</i> Lauder	[35,100,103]	Ca,Car,EC,ETP,GM,IO,NEA, NWA,SEP	[3,10,19,20,75,79,85,96]
<i>Chaetoceros affinis</i> var. <i>circinalis</i> (Meunier) Hustadt	[103]	Ca	[75]
<i>Chaetoceros anastomosans</i> Grunow	[35,103]	Ca,Car,GM,Med	[20, 21, 33, 75, 79]
<i>Chaetoceros brevis</i> Schütt	[35,100,103]	Car,GM,Med,NWA,SEP	[3,20,79,85,88]
<i>Chaetoceros coarctatus</i> Lauder	[35,100,103]	Ca,Car,GM,IO,Med,NWA	[19,20,75,79,85,90,96]
<i>Chaetoceros compressus</i> Lauder	[35,100,103]	Car,ETP,GM,IO,Med,NEA,NWA, SEP	[3,19,20,21,75,79,85,90,96]
<i>Chaetoceros concavicornis</i> Mang.	[35,103]	Ca	[75]
<i>Chaetoceros constrictus</i> Gran	[35,103]	Car,ETP,GM,NEA,NWA,SA,SEP	[3,9,10,19,20,79,85]
<i>Chaetoceros curviseptus</i> Cleve	[35,103]	Car,ETP,GM,IO,NWA,SEP	[3,19,20,21,79,85,90,96]
<i>Chaetoceros decipiens</i> Cleve	[35,100,103]	Car,ETP,GM,IO,NEA,NWA,SEP	[3,10,19,20,21,85,90]
<i>Chaetoceros danicus</i> Cleve	[100]	ETPGM,NEA,NWA	[10,19,20,85]
<i>Chaetoceros didymus</i> Ehrenberg	[35,100,103]	ETPGM,NEA,NWA,SA,SEP	[3,9,19,20,21,85,90,96]
<i>Chaetoceros diversus</i> Cleve	[35,100,103]	ETP,Car,GM,IO,NWA	[19,20,65,79,90,96]
<i>Chaetoceros diversus</i> f. <i>laevis</i> (Leuduger-Fortmole)	[103]	Car,EP,ETP	[18,20,21,75]
Moreno-Ruiz et al.			
<i>Chaetoceros eibenii</i> (Grunow) Meunier	[35,100,103]	Ca,Car,IO,NWA	[75, 79, 85, 96]
<i>Chaetoceros gracilis</i> Schütt	[NR]	Ca,GM,SEP	[3, 19, 75]
<i>Chaetoceros laciniatus</i> Schütt	[35,100,103]	Ca,Car,IO,NEA,NWA,SEP	[3,10,21,75,79,85,96]
<i>Chaetoceros lauderii</i> Ralfs	[35,103]	Ca,Car,GM,IO,NWA	[75,79,85,88,96]
<i>Chaetoceros lorenzianus</i> Grunow	[35,100,103]	Ca,Car,CTP,ETPGM,IO,SA,NWA	[9,19,20,21,41,75,79,85,90, 96]
<i>Chaetoceros messanensis</i> Catrascane	[NR]	GM,IO	[19, 90, 96]
<i>Chaetoceros pelagicus</i> Cleve	[NR]	Car,IO,GM	[19, 79, 88, 96]
<i>Chaetoceros pendulus</i> Karsten	[103]	Car,EC,ETP	[20, 21, 72]
<i>Chaetoceros perpusillus</i> Cleve	[35,103]	Ca,NWA	[75, 85]
<i>Chaetoceros peruvianus</i> Brightwell	[35,100,103]	Car,CTP,ETP,GM,IO,NWA	[19, 20, 41, 79, 85, 90, 96]
<i>Chaetoceros radicans</i> Schütt	[35,100,103]	Ca,ETP,IO,NEA,NWA,SEP	[3,10,20,75,85,90]

(continued)

Species List 1.2 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
<i>Chaetoceros rostratus</i> Lauder	[100,103]	Ca,Car,IO,NWA NEA,NWA	[75,79,85,90] [10,85]
<i>Chaetoceros simplex</i> Ostendorf	[35,103]	EC,ETP,GM,IO,NEA,NWA,SEP	[3,10,20,72,85,88,96]
<i>Chaetoceros socialis</i> Lauder	[35,100,103]	EC,NEA,NWA	[10,65,72,85]
<i>Chaetoceros subtilis</i> Cleve	[100,103]	IO,NWA,SEP	[3,85,96]
<i>Chaetoceros wighamii</i> Brightwell	[NR]	ETPGM,IO	[20,88,90,96]
<i>Climacodiumium frauenfeldianum</i> Grunow	[100]	Car,EC,ETPIO,NEA,SA	[9,10,20,21,72,96]
<i>Ditylum brightwellii</i> (West) Grunow	[100]	Car,ETP,GM,IO,SEP	[20,21,78,90,96]
<i>Eucampia cornuta</i> (Cleve) Grunow	[100]	Car,ETP,GM,IO,SA,SEP	[3,9,19,20,21,90,96]
<i>Eucampia zodiaca</i> Ehrenberg	[NR]	Car	[77]
<i>Eupodiscus radiatus</i> Bailey	[103]	Car,GM	[19,21,37,77,88]
<i>Helicotheeca tamesis</i> (Shrubsole) Ricard	[NR]		
Syn. <i>Streptotheca tamexis</i> Shrubsole		Car,EC,ETP,GM,IO,Med	[7,19,20,65,72,78]
<i>Hemiaulus hauckii</i> Grunow	[100,103]	Car,EC,ETP,GM,IO	[19,72,78,88]
<i>Hemiaulus membranaceus</i> Cleve	[100,103]	Car,GM,IO,Med	[19,20,20,21,78,90,96]
<i>Hemiaulus sinensis</i> Greville	[100,103]	CTP,GM,IO,Med,SA	[9,19,21,41,90]
<i>Hamidiscus cuneiformis</i> Wallich	[NR]	EC,IO	[18,96]
<i>Isthmia nervosa</i> Kützing	[NR]	GM,JO,NEA	[19,65,88,96]
<i>Lithodesmium undulatum</i> Ehrenberg	[NR]	Car,GM,IO,NEA,SEP	[3,10,19,21,78,88,90]
<i>Odontella aurita</i> Agardh	[NR]		
Syn. <i>Biadulphia aurita</i> (Lyngbye) Brevisson & Godøy		EC,JO,SEP	[3,72,96]
<i>Odontella longicurvis</i> (Greville) Hoan	[103]	Ca,Car,EC,GM,IO,Med,NEA	[8,19,20,36,72,78,90,96]
<i>Odontella mobilensis</i> Grunow	[100,103]	GM,IO,NEA	[19,65,90,96]
Syn. <i>Biadulphia mobilensis</i> Bailey	[NR]		
<i>Odontella rhombus</i> (Ehrenberg) Kützing	[NR]	Car,IO	[21,90]
Syn. <i>Biadulphia rhombus</i> (Ehrenberg) Smith	[NR]	Car,EC,GM,IO,NEA	[8,19,21,72,96]
<i>Roperia tessellata</i> (Roper) Grunow	[NR]	GM	[19]
Syn. <i>Trigonium alternans</i> (Bailey) Mann	[NR]		
Syn. <i>Biadulphia alternans</i> (Bail.) VH.	[NR]		
<i>Terpsinoe musica</i> Ehrenberg			
Order FRAGILLARIALES			
<i>Asterionellopsis glacialis</i> (Catrascane) Round Syn.	[100,103]	Car,EC,ETP,GM,IO,NEA,SA,SEP	[3,8,9,19,20,72,80,90,96]
<i>Asterionella japonica</i> Gran.			

<i>Asterionellopsis kariana</i> (Grunow) Round	[NR]	Ca,Car,NEA	[21, 65]
<i>Bleakeleya notata</i> (Grunow) Round	[NR]	Ca,Med,NEA	[20, 75, 91]
Syn. <i>Asterionella bleakeleyi</i> Van Heurck			
<i>Clinacosphenia moniligera</i> Ehrenberg	[NR]	Car,GM,IO	[21, 80, 88, 96]
<i>Grammatophora marina</i> (Lyngb) Kützing	[NR]	Car,GM,IO,SEP	[3, 80, 90]
<i>Liolaem pacificum</i> (Cupp) Hasle	[100,103]	Car,EC,GM,IO,Med	[19, 20, 72, 80, 88, 90]
Syn. <i>Thalassiothrix mediterranea</i> Pavillard			
<i>Rhabdonema adriaticum</i> Kützing	[NR]	Car,GM,IO,Med,NEA,NEP	[65, 80, 88, 90]
<i>Striatella unipunctata</i> (Lyngbye) Agardh	[NR]	Car,GM,SA	[9, 19, 80]
<i>Thalassionema frauenfeldii</i> (Grunow) Haelgaeff	[100,103]	Car,EC,GM,IO,NEA,SEP	[3, 19, 21, 29, 65, 72, 80, 90, 96]
Syn. <i>Thalassiothrix frauenfeldii</i> Grunow			
<i>Thalassionema nitzschioides</i> (Grunow)	[100,103]	Car,CNP,CTP,ETP,GM,IO,Med, NEA,SA,SEP	[3, 9, 10, 19, 20, 21, 41, 80, 90, 96, 101]
Mereschkowsky.		n.a.	
Syn. <i>Thalassiothrix nitzschioides</i> Grunow			
<i>Thalassionema nitzschioides</i> var. <i>parva</i> Heiden	[100,103]	n.a.	
& Kolbe			
<i>Thalassionema pseudonitzschioides</i> (Schuette	[NR]	TP	[44]
& Schradet) Hasle			
Class BACILLARIOPHYCEAE			
Order BACILLARIALES			
<i>Achnanthes longipes</i> Agardh	[103]	Car,EP,GM,NEA	[8, 65, 72, 88]
<i>Amphora</i> spp.	[NR]	n.a.	[90]
<i>Bacillaria pavillifer</i> (Müller) Hendey	[100,103]	Car,GM,IO,NEA,NWP	[19, 21, 65, 72, 87, 90, 96]
Syn. <i>Nitzschia paradoxa</i> (Gmel.) Grun.			
<i>Syn. Bacillaria placenta</i> Ehrenberg	[NR]	Car,EC,IO	[21, 72, 90]
<i>Cocconeis placenta</i> Ehrenberg	[100,103]	Car,EC,CNP,ETP,GM,IO,Med, NEA,SA,SEP	[3, 9, 10, 19, 20, 21, 72, 90, 96, 101]
& Lewin.			
Syn. <i>Nitzschia closterium</i> (Ehrenberg) W. Smith	[NR]	Car	[8]
<i>Entomoneis alata</i> (Ehrenberg) Ehrenberg	[103]	IO	[90]
<i>Haslea grettham</i> Simonsen			

(continued)

Species List 1.2 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
<i>Hastea wawrikiae</i> (Hustedt) Simonsen. Syn. <i>Navicula wawrikiae</i> Hustedt	[100,103]	Car,GM,IO	[82,87,90]
<i>Navicula membranacea</i> Cleve	[100,103]	ETP,GM,NEA	[20,65,87]
<i>Nitzschia bicapitata</i> Cleve	[100,103]	CNP,CTP,IO	[41,90,101]
<i>Nitzschia bilobata</i> Wm. Smith	[100]	Car	[21]
<i>Nitzschia longissima</i> (Brebisson) Ralfs	[100,103]	Car,ETP,GM,IO,SEP	[3,19,20,21,96]
<i>Nitzschia pacifica</i> Cupp	[100]	CTP	[41]
<i>Nitzschia panduriformis</i> Greg.	[NR]	GM,IO	[87,96]
<i>Nitzschia plana</i> Wm. Smith	[NR]	n.a.	
<i>Pachyneis gerlachii</i> Simonsen	[103]	IO	[90]
<i>Plagiotropis subalata</i> (Cleve) Paddock	[NR]	IO	[90]
Syn. <i>Tropidoneis maxima</i> var. <i>subalsata</i> Cleve		Car,EC,GM	[8,21,72,88]
<i>Pleurosigma angulatum</i> Wm. Smith	[103]	IO	[96]
<i>Pleurosigma elongatum</i> Wm. Smith	[100,103]	EC	[18]
<i>Pleurosigma nicobaricum</i> Grunow	[103]	Car	[21]
<i>Psammodictyon panduriforme</i> (Gregory) Mann Syn.	[103]		
<i>Nitzschia panduriformis</i> Gregory		Ant,NEA,SA,SEP	[9,10,45,64,86]
<i>Pseudo-nitzschia delicatissima</i> (Cleve) Heiden. Syn.	[100]		
<i>Nitzschia delicatissima</i> Cleve		SE	[86]
<i>Pseudo-nitzschia fraudulenta</i> Cleve.	[100,103]	Ant,SEP	[39,86]
Syn. <i>Nitzschia fraudulenta</i> Cleve			
<i>Pseudo-nitzschia lineola</i> (Cleve) Hasle.	[NR]		
Syn. <i>Nitzschia lineola</i> Cleve			
<i>Pseudo-nitzschia pungens</i> (Grunow ex Cleve) Hasle.	[NR]	Au,Car,CTP,EC,GM,SA,SEP	[9,19,21,30,40,41,72,86,88]
Syn. <i>Nitzschia pungens</i> Grunow ex Cleve			
<i>Pseudo-nitzschia subraudulenta</i> (Hasle) Hasle. Syn.	[103]	GM,IO	[90,39]
<i>Nitzschia subraudulenta</i> Hasle			
<i>Surirella fastiosa</i> (Ehrenberg) Kützing	[100,103]	Car,GM,IO	[19,21,88,90]

DINOPHYTA			
Class DINOPHYCEAE			
Order PROROCENTRALES			
<i>Procentrum aporum</i> (Schiller) Dodge	[NR]	[99,100,104]	[23]
<i>Procentrum balicum</i> (Lohmann) Loeblich III Syn.			
<i>Exuviaella baltica</i> Lohmann			
<i>Procentrum compressum</i> (Bailey) Abé ex Dodge	[NR]		Car,Med,NEA,TA,TP Ca,EP,GM,NEA,NWA,SWA, NWP,NPEP
<i>Procentrum dentatum</i> Stein	[NR]		Au,Ca,Med,NEA,NWA,NWP,SWA [5,23,47,48,52,66] Bi,Ca,Med,TA,TP,NWA,NWP [22,23,52,53,66]
<i>Procentrum gracile</i> Schütt	[35,99,100]		Ca,Car,Med,NEA,NWA,SWA,TP [5,21,22,23,48,52,53,66]
<i>Procentrum lima</i> (Ehrenberg) Dodge	[NR]		Au,Ca,Car,EC,GM,NEA [21,23,30,48,52,63,66,72]
<i>Procentrum maximum</i> (Gourret) Schiller	[99]		Ca,Car,EP,IO,Med,GP,TP [21,22,23,36,41,52,53,66]
Syn. <i>Procentrum mexicanum</i> Osorio-Tafall			
<i>Procentrum micans</i> Ehrenberg	[35,99,100]		Ca,Car,Med,SA,SEP,SWA,TP [2,5,9,20,21,52,53,66,76]
<i>Procentrum minimum</i> (Pavillard) Schiller	[NR]		Au,Ca,Car,Med,NEP,NWP,NWA,S [6,21,22,23,27,30,53,61,63]
<i>Procentrum rostratum</i> Stein	[NR]		Au,Ca,Car,IO,Med,TA,TP,SWA [5,21,22,23,48,52,53,66]
<i>Procentrum triestinum</i> Schiller	[NR]		BI,Med,NWA,NWP,SEA,TP [21,22,23,53,69]
Order DINOPHYSTIALES			
<i>Amphisolenia bidentata</i> Schröder	[NR]		Ca,Car,TP,TA,TP [21,48,52,66]
<i>Dinophysis acuta</i> Ehrenberg	[NR]		Au,Ca,Car,GM,Med,NEA,SWP [10,12,21,23,30,63,84]
<i>Dinophysis canadensis</i> Saville-Kent.	[35,99,100]		Ca,Car,GM,Med,NEA,SWA,TA [5,6,19,20,21,51,52,64,66]
Syn. <i>Dinophysis homunculus</i> Stein			
<i>Dinophysis fortii</i> Pavillard	[NR]		Ca,Med,SA,SWA,SWP,TA,TP [5,9,12,48,52,66]
<i>Dinophysis hastata</i> Stein	[NR]		Ca,Car,BI,GM,TA,TP,NEA,SWA [5,21,52,66,84]
<i>Dinophysis ovum</i> Schütt	[99]		Ca,Car,NEA,NWA,SWA,SWP [12,21,23,52,66]
<i>Dinophysis tripos</i> Gourret	[NR]		Ca,Car,GM,NWA,SWA,SWP [5,6,12,19,21,51,52,66]
<i>Ornithocercus magnificus</i> Stein	[NR]		Ca,Car,Med,GM,TA,TP [21,48,52,66,83]
<i>Phalacroma mitra</i> Schütt	[NR]		Car,SWA [5,21]
<i>Phalacroma rotundatum</i> (Claparède & Lachmann)	[99]		Au,Car,NEA,NWP,NWA,SA, SWA,SWP [5,9,10,12,13,21,30]
Kofoid & Michener			
Syn. <i>Dinophysis roundata</i> Claparède & Lachmann			
Order GONYAULACALES			
<i>Alexandrium catenella</i> (Whedon & Kofoid) Balech	[100,104]		Au,Ca,NEP,NEA,NWA,NWP, NWA,SA,SEP,TP [6,9,23,30,52,106]

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Species List 1.2 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
<i>Syn. Gonyaulax catenella</i> Whedon & Kofoid	[99,100,104]	Ca,Car,GM,NWA,SEP	[6,21,52,54,66,105]
<i>Alexandrium monilatum</i> (Howell) Balech	[NR]	Ca,Car,NEA	[10,21,23,52,66]
<i>Syn. Gessnerium monilatum</i> (Howell) Loeblich			
<i>Amylax triacantha</i> (Jørgensen) Sournia			
<i>Syn. Gonyaulax triacantha</i> Jørgensen			
<i>Ceratium azoricum</i> Cleve	[NR]	Ca,Car,IO,Med,NEA,SEP,SWA, SWP,TP	[5,8,20,21,23,46,48,52,66]
<i>Ceratium candelabrum</i> (Ehrenberg) Stein	[100]	Ca,Car,EP,Med,NEA,TA,SWA	[5,20,21,23,41,48,52,66]
<i>Ceratium dens</i> Ostendorf & Schmidt	[NR]	Au,Ca,SA,SWA,TP	[5,9,16,47,48,108]
<i>Ceratium furca</i> Claparede & Lachmann	[35,100]	Au,Ca,Car,GM,IO,Med,NWA,SA, SEA,SWA	[5,9,19,20,21,46,52,66]
<i>Ceratium furca</i> var. <i>hircus</i> (Schöderer) Margaleff ex Sournia	[NR]	Ca,Car,GM,SWA	[5,52]
<i>Ceratium fusus</i> (Ehrenberg) Dujardin	[35,100]	Ca,Car,EP,GM,Med,NEA,TA,TP, SWA	[5,10,19,20,21,41,52,66]
<i>Ceratium kofoidii</i> Jørgensen	[NR]	Ca,Car,TP,SWA	[5,21,52,66]
<i>Ceratium lineatum</i> (Ehrenberg) Cleve	[100]	Au,Ca,Car,BI,NEA,NWA,SA, SEA,SEP,SWA	[5,9,21,23,46,48,52,66]
<i>Ceratium macroceros</i> (Ehrenberg) Vanhöffen	[100]	Ca,Car,BI,GM,NEA,SWA,TA,TP	[5,19,21,23,48,52,66.]
<i>Ceratium massiliense</i> (Gourret) Jørgensen	[NR]	Ca,Car,GM,IO,Med,NEA,SEP, SEA,SWA,SWP	[5,19,20,21,23,46,48,52,66]
<i>Ceratium minutum</i> Jørgensen	[NR]	Au,Ca,Med,NEA,NWA	[7,23,52,66]
<i>Ceratium pentagonum</i> Gourret	[NR]	Ca,Car,EP,GM,Med,SWA	[5,19,20,21,41,48,52,66]
<i>Ceratium tripos</i> (Müller) Nitzsch	[100]	Ca,Car,GM,Md,NEA,SEP,SWA	[5,19,20,21,46,48,52,66]
<i>Ceratocorys horrida</i> Stein	[NR]	Ca,Car,Med,SWA,TA	[5,20,21,52,66]
<i>Gonyaulax digitale</i> (Pouch.) Kofoid	[35,99]	Au,Ca,Car,Med,NEA	[10,20,21,23,52,66,108]
<i>Gonyaulax grindleyi</i> Reincke	[99]	Ca,Med,NEA,SEA,SWA	[5,7,23,52,66]
<i>Syn. Protoceratium reticulatum</i> (Claparedé & Lachmann) Butschi.			
<i>Gonyaulax polygramma</i> Stein	[99]	Au,Ca,Car,EP,GM,IO,Med,NEA, TA,TP,SWA	[5,20,21,30,41,46,52,66,94]

<i>Gonyaulax spinifera</i> (Clapared & Lachmann) Diesing	[99]	Ca,EC,NEA,Sa,SWA,TP,TA	[5, 9, 10, 23, 52, 66, 72]
<i>Gonyaulax turbynei</i> Murray & Whiting	[NR]	Au,NEA,SWA	[5, 23, 108]
<i>Lingulodinium polyedrum</i> (Stein) Dodge	[99]	Ca,Car,Med,NEA,SA,SWA,TP	[2, 5, 7, 9, 10, 20, 23, 27, 47, 52, 66]
Syn. <i>Gonyaulax polyedra</i> Stein			
<i>Oxytormum scolopax</i> Stein	[NR]	EP,GM,NEA,SWA,SWP	[5, 19, 23, 41, 82]
<i>Pyrocystis lunula</i> (Schütt) Schütt	[NR]	Ca,Med,SWA	[5, 20, 23, 52, 66]
<i>Pyrocystis noctiluca</i> Murray ex Schütt	[NR]	Ca,Med,NEA,SWA,SEA	[5, 20, 23, 52, 65, 66]
Syn. <i>Pyrocystis pseudonociliuca</i> Wyville-Thompson			
<i>Pyrodinium bahamense</i> var. <i>compressum</i> (Böhm)	[35,72,99,100]	Au,Ca,Car,IO,SWP,TP	[4, 30, 52, 66, 70]
Steidinger Tester & Taylor			
<i>Pyrodinium bahamense</i> var. <i>bahamense</i> (Plate)	[NR]	Car	[4, 21]
<i>Pyrophacus horologium</i> Stein	[NR]	Au,BI,Ca,Car,GM,Med,NEA, SEA,SWA	[5, 20, 21, 23, 46, 52, 53, 66]
Order GYMNOdiniales			
<i>Akashiwo sanguinea</i> (Hiratsaka) Hansen & Moestrup	[NR]	Au,BI,Ca,Car,GM,Med,NEA,	[7, 23, 27, 30, 48, 52]
Syn. <i>Gymnodinium sanguineum</i> Hiratsaka			
<i>Gymnodinium splendens</i> Lebour			
<i>Cochlodinium catenatum</i> Okamura	[35,100]	NWP,NEP	[59]
<i>Gymnodinium catenatum</i> Graham	[100,104]	Au,Ca,Car,NEA,TP,NEP,NWP, SEP,SWA	[5, 21, 27, 30, 52, 62, 63, 66]
<i>Gymnodinium biconicum</i> Schiller	[NR]	Au	[31]
<i>Gymnodinium micrum</i> (Leadbeater & Dodge) Loeblich	[99]	NEA	[23]
<i>Gymnodinium paulseni</i> Pavillard	[NR]	Med	[7]
<i>Gymnodinium sanguineum</i> Hiratsaka	[NR]	Au,BI,Ca,Car,GM,NEA	[7, 23, 31, 66]
Syn. <i>Gymnodinium splendens</i> Lebour			
<i>Gymnodinium simplex</i> (Lohman) Kofoid & Swezy	[NR]	Ca,Med,NEA	[7, 23, 52]
<i>Gymnodinium veneficium</i> Ballantine	[99]	NEA,NWA,SWA	[6, 23]
<i>Gyrodinium fusiforme</i> Kofoid & Swezy	[NR]	Car,NEA	[21, 23]
<i>Gyrodinium instriatum</i> freudenthal & Lee	[99]	NEA,NWA,NWP	[25, 97]
<i>Gyrodinium spirale</i> (Bergh) Kofoid & Swezy Syn.	[NR]	Ca,Car,GM,Med,NEA,NEP	[21, 52, 59, 66]
<i>Gyrodinium estuariale</i> Hulbert	[NR]	EC,NEA,NWA	[55, 72, 95]
<i>Polykrikos kofoidii</i> Chatton	[NR]	NEA,NWA,SEP	[11, 23, 76]

(continued)

Species List 1.2 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
Order NOCTILUCALES			
<i>Nociluca scintillans</i> (Macartney) Ehrenberg	[35]	Au,Ca,Car,Med,NEA,SA,SEP, SWA,SWP NEA,SA	[5, 9, 20, 21, 23, 30, 52, 63] [9, 23]
<i>Spatulodinium pseudonociluca</i> (Pouchet) Cachon & Cachon	[NR]		
Order PERDINIALES			
<i>Blepharocysta splendormaris</i> (Ehrenberg) Ehrenberg	[99]	Car,NEA	[21, 23]
<i>Diplopsalis lenticula</i> Bergh	[NR]	Au,EC,Med,NEA	[7, 23, 72, 108]
<i>Diplopelta asymmerica</i> (Manguin) Lebour	[99]	Ca,Car,EC,SWA	[5, 21, 47, 52, 66, 72]
<i>Syn. Dissodinium assimetricum</i> (Manguin) Loeblich			
<i>Heterocapsa niei</i> (Loeblich) Morrill	[NR]	Ca,GM	[24, 49, 67]
<i>Syn. Cachionima niei</i> Loeblich			
<i>Heterocapsa rotundata</i> (Lohmann) Hansen	[NR]	Car,NEA	[23, 109]
<i>Syn. Katodinium rotundatum</i> (Lohmann) Fott			
<i>Heterocapsa triquetra</i> (Ehrenberg) Balech	[NR]	Ca,EC,Med,NEA,SWA	[5, 7, 10, 23, 25, 52, 72]
<i>Syn. Peridinium triquetrum</i> (Ehrenberg) Lebour			
<i>Oxytixum scolopax</i> Stein	[NR]	Ca,EP	[41, 52, 66]
<i>Podolampsis palmipes</i> Stein	[NR]	Ca,Car,EP,Med,NEA,SWA	[5, 10, 20, 21, 23, 41, 48, 52, 66]
<i>Protoperidinium abei</i> (Paulsen) Balech	[NR]	Ca,Car,TP	[21, 48, 52, 66]
<i>Protoperidinium bispinum</i> (Schiller) Balech	[NR]	NEA,SWA	[5, 92]
<i>Protoperidinium cassum</i> (Balech) Balech	[NR]	GM,Med,SWA	[5]
<i>Protoperidinium claudicans</i> (Paulsen) Balech	[NR]	Ca,Car,IO,Med,NEA,NWA,SEPS	[5, 20, 21, 23, 48, 52, 66]
<i>Protoperidinium conicum</i> (Gran) Balech	[99]	WA AU,Ca,Car,Med,NEP,NEA,NWA, SWA	[5, 10, 20, 21, 46, 49, 52, 66]
<i>Syn. Protoperidinium biconicum</i> Dangeard & Balech	[99]	Ca,Car,GM,IO,Med,NEA,SA, SWA	[5, 7, 9, 10, 19, 21, 46, 49]
<i>Protoperidinium depressum</i> (Bailey) Balech	[NR]	Ca,Car,Med,NEA,SWA	[5, 10, 20, 21, 23, 48, 49]
<i>Protoperidinium divergens</i> (Ehrenberg) Balech			

<i>Protoperidinium elegans</i> (Cleve) Balech	[NR]	Ca,Car,TA,TP,SWA	[5, 21, 48, 49, 52, 66]
<i>Protoperidinium excentricum</i> (Paulsen) Balech	[100]	Ca,IO,NEA,SA,SEP,SWA,SWP	[5, 23, 46, 49]
<i>Protoperidinium leonis</i> (Pavillard) Balech	[NR]	Ca,Car,IO,Med,NEA,SEP	[21, 46, 48, 52, 66]
<i>Protoperidinium mediterraneum</i> (Kofoid) Balech	[99]	Ca	[49]
<i>Protoperidinium ovum</i> (Schiller) Balech	[NR]	Au,Ca,Med,SWA	[5, 20, 52, 66, 108]
<i>Protoperidinium pellucidum</i> Bergh	[99]	Ca,Med,NEA,SWA	[5, 7, 10, 23, 48, 49, 66]
<i>Protoperidinium pentagonum</i> (Gran) Balech	[99]	AU,Ca,Cat,Med,NEA,SA,SWA	[5, 9, 20, 21, 46, 49]
<i>Protoperidinium punctulatum</i> (Paulsen) Balech	[99]	Ca	[49]
<i>Protoperidinium pyriforme</i> (Paulsen) Balech	[99]	Ca,Car,Med,NEA,SA,SWA	[5, 7, 9, 21, 23, 49]
<i>Protoperidinium quarnerense</i> (Schröder) (Ballech) Syn. <i>Peridinium globulum</i> (Stein) Ballech	[99]	Ca,Car,NEA,SWA	[5, 21, 23, 48, 49, 66]
<i>Protoperidinium quinquecornae</i> Abé	[99]	Car,NEA,NWP	[21, 23, 92]
<i>Protoperidinium solidicorne</i> (Manguin) Balech	[NR]	Car,IO,SWA,TA,TP	[5, 21]
<i>Protoperidinium steinii</i> (Jørgensen) Balech	[NR]	Ca,IO,Med,NEA,NWP	[10, 21, 46, 48]
<i>Protoperidinium venustum</i> (Matzenauer) Balech	[99]	Ca	[49, 66]
<i>Scripsiella trochidea</i> (Stein) Loeblich III	[100]	Au,Ca,Car,Med,NEA,SA,SEP, SWA	[5, 9, 10, 20, 21, 30, 46, 52, 76]
CYANOBACTERIA			
<i>Anabaena</i> sp.	[NR]	NWP	[25]
<i>Johanneschitziella pellucida</i> (Dickie) Taylor & Drouet	[NR]	NWA	[73]
<i>Merismopedia</i> sp. colonies	[NR]	n.a.	n.a.
<i>Trichodesmium erythraeum</i> (Ehrenberg) Gomont	[NR]	GM	[19]
Class PRYMNESIOPHYCEAE	[NR]	Ant,Au,NA,NEA,NWA,NWPTA	[8, 25, 28, 30, 57, 63]
<i>Phaeocystis pouchetti</i> (Hariot) Lagerheim	[NR]	NWP	[25]
Class RAPHIDOPHYCEAE (Chloromonadophyceae)	[NR]	Au,EC,CNP,Med	[7, 26, 71, 101]
<i>Chattonella marina</i> (Subrahmanyam) Hara & Chibara	[NR]	Au,Med	[7, 63, 69]
Class DICTYOCHOPHYCEAE (Silicoflagellates)	[NR]		
<i>Dicyospha fibula</i> Ehrenberg	[100,104]		
<i>Syn. Distephanus speculum</i> (Ehrenberg) Haeckel	[NR]		

(continued)

Species List 1.2 (continued)

Species and common synonyms	Reports for C.R. ^a	World reports ^b	References for world reports ^c
Phylum NEOMONADA			
Class EBRIDEA			
<i>Ebria tripartita</i> (Schumann) Lemmermann	[NR]	EC,GM,Med,NWP,TP,NWP	[25, 33, 60, 72]
<i>Hermesinum adriaticum</i> Zacharias	[NR]	EC,GM,NWP,TP	[33]
Phylum PROTOZOA			
Class CILIATA			
Order GYMNOSTOMATIDA			
<i>Myrionecta nubra</i> (Lohmann) Jankowski	[100,104]	Au,Ca,NEA,NWA,SEP,SWP	[14, 30, 56, 58, 74, 93, 107]
Syn. <i>Mesodinium rubrum</i> (Lohmann) Jankowski			
Syn. <i>Halteria pulex</i> Claparéde & Lachmann			

^a NR = New record.^b Ant = Antarctic, Au = Australia, BI = British Isles, Ca = Gulf of California and Pacific coast of México, Car = Caribbean, EC = East coast of USA, CNP = Central North Pacific, CTIP = Central Tropical Pacific, ETP = Eastern Tropical Pacific, GP = Gulf of Panamá, GM = Gulf of México, Med = Mediterranean and adjacent seas, NEA = North Eastern Atlantic, NEP = North Eastern Pacific, NWP = North Western Pacific, SA = South Africa, SWA = South Western Atlantic, SEP = South Eastern Pacific, SWP = South Western Pacific, TA = Tropical Atlantic, TP = Tropical Pacific.^c References are indicated by numbers according to the reference list.