



**MSFD Guiding  
Improvements in the Black  
Sea  
Integrated Monitoring  
System**



# **List of NON-NATIVE PHYTOPLANKTON Species from the Black Sea**

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### Abbreviations used:

Black Sea countries	
BG	BULGARIA
GE	GEORGIA
RO	ROMANIA
RU	RUSSIAN FEDERATION
TR	TURKEY
UA	UKRAINE

### Acknowledgements:

Special thanks are given to each of the author, for their participation in establishing the list of non-native phytoplankton species for the Black Sea.

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**For each species, the following informations are provided:**

- full scientific name according to World Registered of Marine Species site – WORMS (<http://www.marinespecies.org>).
- year of the first occurrence in national waters
- place of the first occurrence in national waters
- native range (the origin of species)
- establishment success

## Black Sea non-native phytoplankton species

In the 20th century, especially in its second half, under the influence of climatic and anthropogenic factors, significant changes have occurred in the diversity of the flora and fauna of the Black Sea. One of the most pronounced anthropogenic factors is the invasion of non-native species, some of which negatively affected the communities in which they introduced or replaced native species. As a result, the Black Sea became a basin-recipient for many non-native species of different origins both marine and brackish water species. In addition the temperature increased both in the surface mixed and the cold intermediate layers facilitated the increase population of thermophilic species and their northward expansion from the Mediterranean. Until recently new Mediterranean species have been recorded temporarily or permanently mainly in the near- Bosphorus region. Therefore, they are usually not regarded as established non-native species (Shiganova, Ozturk, 2010).

The toxic microscopic algae represent a particularly important case of incidental immigration. Their mass development produce so-called toxic blooms, because of their biotoxins produced inside the cells (i.e. domoic, okaidic, yessatoxine or azaspiracids acids), with toxic effects on other organisms, even on humans.

This present checklist with the non-native phytoplankton species contains a number of 52 species, most of them occurred in the Bulgarian waters (35); only 9 and 6 species respectively were identified in the Romanian and Turkish waters.

We have to remark that the majority of these species entered the Black Sea waters very recently, after 2000, even 2010 (i.e. *Dinophysis odiosa* and *Gyrodinium aureolum* in the Russian waters). Generally the place of the first occurrence in national waters is the coastal and shelf waters.

# Black Sea non-native phytoplankton species list

Name of Species	Year of the First Occurrence in National Waters						Place of the first occurrence in national waters						Cited in
	BG	GE	RO	RU	TR	UA	BG	GE	RO	RU	TR	UA	
<i>Alexandrium acatenella</i> (Whedon & Kofoid) Balech, 1985 <i>Gessnerium acatenellum</i> (Whedon & Kofoid) L.Loeblich & Loeblich III <i>Gonyaulax acatenella</i> Whedon & Kofoid, 1936 <i>Protogonyaulax acatenella</i> (Whedon & Kofoid) Taylor, 1979	2008*		2001			2001	Coastal and shelf waters		Coastal area			Odessa port area	Aleksandrov et. al., 2007; TDA, 2007; Robino et al, 2010.
<i>Alexandrium affine</i> (H.Inoue & Y.Fukuyo) Balech, 1995 <i>Alexandrium fukuyoi</i> Balech, 1985; <i>Protogonyaulax affine</i> Inoue et Fukuyo, 1985	2008*				2010	2001	Coastal and shelf waters				Samsun area	Odessa port area	Aleksandrov et. al., 2007; TDA, 2007; Robino et al, 2010.
<i>Alexandrium minutum</i> Halim, 1960 <i>Alexandrium angustitabulatum</i> F.J.R.Taylor, 1995 <i>Alexandrium ibericum</i> Balech, 1985 <i>Alexandrium lusitanicum</i> Balech, 1985 <i>Pyrodinium minutum</i> (Halim) Taylor, 1976	2008	2010	2010	2001	2002-2003		Coastal and shelf waters		Coastal and shelf waters	Caucasian coast	Samsun area		Baytut, 2004; Robino et al, 2010; Gvarishvili, 2010; Vershinin&Orlova, 2008.
<i>Alexandrium monilatum</i> (Howell) (F.J.R. Taylor 1979) <i>Gonyaulax monilata</i> J.F. Howell, 1953; <i>Gessnerium mochimaense</i> Halim, 1967	1991					2001	Coastal area Varna					Odessa port area	Zaitsev & Ozturk, 2001; TDA, 2007; Moncheva et. al., 2001.
<i>Alexandrium pseudogonyaulax</i> (Biecheler) Horiguchi ex Yuki et Fukuyo, 1992 <i>Goniodoma pseudogoniaulax</i> Biecheler, 1952; <i>Alexandrium pseudogonyaulax</i> (Biecheler) Horiguchi, 1983						2002						Odessa port area	Terenko L., 2005; Aleksandrov et. al., 2007; TDA, 2007.
<i>Alexandrium tamarense</i> (Lebour, 1925) Balech, 1985 <i>Alexandrium excavatum</i> (Braarud) Balech et Tangen, 1985; <i>Gonyaulax exavata</i> (Braarud) Balech, 1971; <i>Gonyaulax tamarensis</i> Lebour, 1925; <i>Gonyaulax tamarensis</i> var. <i>excavata</i> Braarud, 1945; <i>Gessnerium tamarensis</i> (Lebour) Loeblich et Loeblich, 1979; <i>Protogonyaulax tamarensis</i> (Lebour) Taylor, 1979	2008		2004	2001		2001	Coastal and shelf waters		Coastal area	coastal		Odessa port area	Aleksandrov et. al., 2007; TDA, 2007; Vershinin et al., 2005; Robino et al, 2010; Nesterova et al., 2006.
<i>Apedinella radians</i> (Lohmann) Campbell 1973 <i>Apedinella spinifera</i> (Throndsen) Throndsen, 1971; <i>Pseudopedinella spinifera</i> Throndsen, 1969	1987		1991			1999	Coastal area		Coastal area			Odessa Bay	Aleksandrov et. al., 2007; TDA, 2007; Moncheva et. al., 2001.
<i>Chaetoceros tortissimus</i> Gran, 1900				2001	2002-2003	2001				Caucasian coast	Samsun area	Crimea coast: Sevastopol Bay area	Baytut, 2004; Vershinin et al., 2005; Senicheva, 2002.
<i>Cochlodinium polykrikoides</i> Margelef, 1961 <i>Cochlodinium heterolobatum</i> Silva, 1967	2008			2001		2001	Coastal and shelf waters			Caucasian coast		Odessa Bay	Aleksandrov et. al., 2007; Vershinin. et al., 2005; TDA, 2007; Terenko., 2005.; Robino et al., 2010.
<i>Detonula pumila</i> (Castracane) Gran 1900 <i>Lauderia delicatula</i> H.Peragallo, 1888 <i>Lauderia pumila</i> Castracane, 1886 <i>Schroederella delicatula</i> (H.Peragallo) Pavillard, 1913	1999	2010			2002-2003		Coastal area				Samsun area		Prodanov et al., 2001; TDA, 2007; Gvarishvili, 2010; Tas&Okus, 2006.
<i>Dinophysis odiosa</i> (Pav.) Tai & Scogsberg, 1934 <i>Phalacroma odiosum</i> Pav., 1930; <i>Protodinophysis odiosa</i> Pavillard Loeblich III				2010		2001				Novorossiysk		Crimea coast: Sevastopol Bay	Senicheva, 2002; Yasakova, 2010.
<i>Gyrodinium aureolum</i> Hulburt, 1957 <i>Gymnodinium aureolum</i> (Hulburt) Hansen, 2000	2008		2008	2010		2001	Coastal area		Coastal area	Novorossiysk		Odessa Bay	Aleksandrov et. al., 2007; TDA, 2007; Robino et al, 2010; Yasakova, 2010.
<i>Gymnodinium radiatum</i> Kofoid et Swezy, 1921						1998						Odessa Bay	Aleksandrov et. al., 2007; TDA, 2007; Krakhmalny, 2001.

Name of Species	Year of the First Occurrence in National Waters						Place of the first occurrence in national waters						Cited in	
	BG	GE	RO	RU	TR	UA	BG	GE	RO	RU	TR	UA		
<i>Gymnodinium uberrimum</i> (Allmann) Kofoid et Swezy, 1921 <i>Gymnodinium bogoriense</i> Klebs, 1912; <i>Gymnodinium irregulare</i> Christen, 1959; <i>Gymnodinium limitatum</i> Skuja, 1956; <i>Gymnodinium limneticum</i> Woloszynska, 1935; <i>Gymnodinium mirabile</i> Penard, 1891	1991		1989		1998	1999	Varna Bay		Coastal area				Odessa Bay	Zaitsev & Ozturk, 2001; Aleksandrov et. al., 2007; TDA, 2007; Moncheva et al., 1995; Skolka&Roban, 1989; Ozturk, 1998; Sukhanova &Belyaeva, 1980.
<i>Gyrodinium impudicum</i> Fraga et Bravo,1995 <i>Gymnodinium catenatum</i> Graham in Carrada et al.,1991	2008					2001	Coastal and shelf waters						Odessa port area	Aleksandrov et. al., 2007; TDA, 2007; Robino et al., 2010; Nesterova et al, 2006.
<i>Gymnodinium instriatum</i> (Freudenthal & Lee) Coats, 2002 <i>Gyrodinium instriatum</i> Freudental et Lee, 1963						2003							Odessa Bay	Aleksandrov et. al., 2007.
<i>Lioloma pacificum</i> (Cupp) Hasle, 1996 <i>Thalassiotrix mediterraneae</i> var. <i>pacifica</i> Cupp, 1943	2008		2001			1999	Coastal and shelf waters		Shelf area				Odessa Bay	Zaitsev et al., 2004; Aleksandrov et. al., 2007; TDA, 2007; Terenko, 2007; Moncheva in CBD Report, 2009.
<i>Mantoniella squamata</i> Manton & Parke (1960) <i>Micromonas squamata</i> I.Manton & M.Parke, 1960 <i>Oxyphysis oxytoxoides</i> Kofoid, 1926			1980s						Coastal area					Zaitsev & Ozturk, 2001; TDA, 2007. Petrova-Karadjova&Moncheva, 1998; TDA, 2007.
<i>Pentapharsodinium dalei</i> Idelicato et Loeblich, 1986	2008*			2001		2001	Coastal and shelf waters				Caucasian coast		Odessa port area	Vershinin&Velikova, 2008; Robino et al., 2010, Nesterova et al., 2006.
<i>Pentapharsodinium tyrrhenicum</i> (Balech, 1990) Montresor, Zingone & Marino, 1993	2008*			2001		2001	Coastal and shelf waters				Caucasian coast		Odessa port area	Vershinin&Velikova, 2008; Robino et al., 2010, Nesterova et al., 2006.
<i>Petalodinium porcelio</i> J.and M. Cachon 1968	1995						Shelf area							Stoyanova, 1999; TDA, 2007.
<i>Phaeocystis pouchettii</i> (Hariot) (Lagerheim, 1893)	1989-1990					1990	Coastal area							Zaitsev & Ozturk, 2001; TDA, 2007; Petrova-Karadjova, 1990; Moncheva et al., 1995; Yasakova, 2010; Ryabushko, 2003.
<i>Pseudo-nitzschia calliantha</i> Lundholm, Moestrup & Hasle, 2003					2000	2006						Sinop area	Sevastopol Bay	Bargu et al., 2002; Ryabushko et al., 2008.
<i>Pseudo-nitzschia inflatula</i> G.R.Hasle, 1993 <i>Nitzschia inflatula</i> Hasle, 1974						2002							Crimea: Sevastopol Bay area	Senicheva, 2002.
<i>Scaphodinium mirabile</i> Margalef, 1963 <i>Leptospathium navicula</i> (J. Cachon & Cachon-Enjumet, 1964)	1995						Shelf area							Stoyanova, 1999; TDA, 2007; Gavrilova, 2012.
<i>Spatulodinium pseudonociluca</i> (Pouchet, 1885) J. Cachon & Cachon ex Loeblich & Loeblich III, 1969 <i>Gymnodinium pseudonociluca</i> Pouchet, 1885; <i>Gymnodinium lebourii</i> Pavillard; <i>Gymnodinium fulgens</i> Kofoid et Swezy, 1921	1995					2001	Coastal area						Odessa port area	Stoyanova, 1999; Aleksandrov et. al., 2007; TDA, 2007; Terenko, 2005; Eker, 1998.
<i>Oxytoxum gladiolus</i> Stein, 1883						1989							Coastal area	Senichkina et al., 2001.
<i>Syracolithus dalmaticus</i> (Kamptner, 1927) Loeblich & Tappan, 1963; <i>Syracosphaera dalmatica</i> Kamptner, 1927														Bryantseva, 2000; Polikarpov et al., 2003.
<i>Attheya decora</i> T. West, 1860						2000							Odessa Bay	Terenko, 2006.
<i>Prorocentrum dentatum</i> Stein, 1883						1998							Odessa Bay	Krakhmalniy, 2005; Gvarishvili, 2010; Ozturk. 1998.
<i>Peridinium quinquecorne</i> Abé, 1927	2000		2009				Coastal and shelf waters		Coastal and shelf waters		Gelendjik			Moncheva (SESAME data base); Vershinin et al., 2005.
<i>Warnowia schuettii</i> (Kofoid et Swezy, 1921) Schiller, 1933						2001					Gelendjik		Odessa Bay	Terenko, 2005; Vershinin et al., 2005.
<i>Azadinium spinosum</i> Elbrächter & Tillmann, 2009	2005						Sozopol Bay							Mavrodiava, 2012.
<i>Lessardia elongata</i> Saldarriaga & F.J.R.Taylor, 2003	2008		2004				Coastal and shelf waters		Coastal and shelf waters					Eker-Develi&Velikova, 2009; Moncheva et al., 2010.

Name of Species	Year of the First Occurrence in National Waters						Place of the first occurrence in national waters						Cited in
	BG	GE	RO	RU	TR	UA	BG	GE	RO	RU	TR	UA	
<i>Gyrodinium cochlea</i> Lebour, 1925	2008						Coastal and shelf waters						Moncheva et al., 2009.
<i>Gyrodinium flagellare</i> Schiller, 1928	2008						Coastal and shelf waters						Moncheva et al., 2009; Yasakova, 2010.
<i>Gyrodinium varians</i> (Wulff, 1916) Schiller, 1933	2008						Coastal and shelf waters						Moncheva et al., 2009.
<i>Gymnodinium nanum</i> Schiller, 1928	2008						Coastal and shelf waters						Moncheva et al., 2009.
<i>Gymnodinium pulchrum</i> Schiller, 1928	1999						Coastal						Moncheva, 1999.
<i>Peridiniopsis polonicum</i> (Woloszynska) Bourrelly, 1968 <i>Glenodinium gymnodinium</i> Pénard, 1891	2008						Coastal and shelf waters						Moncheva et al., 2009.
<i>Gymnodinium nolleri</i> M.Ellegaard & Ø.Moestrup, 1999	2008*						Coastal and shelf waters						Robino et al., 2010.
<i>Scrippsiella lachrymosa</i> J.Lewis, 1991	2008*						Coastal and shelf waters						Robino et al., 2010.
<i>Scrippsiella ramonii</i> M.Montresor, 1995	2008*						Coastal and shelf waters						Robino et al., 2010.
<i>Scrippsiella spinifera</i> G.Honsell & M.Cabrini, 1991	2008*						Coastal and shelf waters						Robino et al., 2010.
<i>Scrippsiella trifida</i> J.Lewis, 1991	2008*						Coastal and shelf waters						Robino et al., 2010.
<i>Scrippsiella operosa</i> (Deflandre) Montresor, 2003 <i>Calciodinellum operosum</i> Deflandre, 1947	2008						Coastal and shelf waters						Robino et al., 2010.
<i>Dinophysis islandica</i> Paulsen, 1949						2001						Coastal area	Terenko, 2011.
<i>Dinophysis nasuta</i> (Stein) Parke & Dixon 1968 <i>Phalacroma nasutum</i> Stein 1883						2008						Coastal area	Terenko, 2011.
<i>Dinophysis recurva</i> Kofoed & Skogsberg, 1928						2001						Coastal area	Terenko, 2011.
<i>Dinophysis schilleri</i> Sournia, 1973						2001						Coastal area	Nesterova et al., 2006; Terenko, 2011.
<i>Chaetoceros aequatorialis</i> Cleve, 1873	2011			2004			Coastal and shelf waters						Mikaelyan et al., 2008; Slabakova N. (unpublished).

# Pictures of Black Sea non-native phytoplankton species



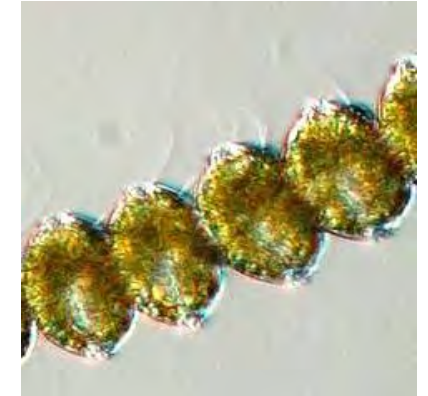
***Alexandrium acatenella*** (Whedon & Kofoid) Balech, 1985  
(<http://dinos.anesc.u-tokyo.ac.jp>)



***Alexandrium affine*** (H.Inoue & Y.Fukuyo) Balech, 1995  
(<http://planktonnet.awi.de>)



***Alexandrium minutum*** Halim, 1960  
(<http://adl.brs.gov.au/marinepests>)



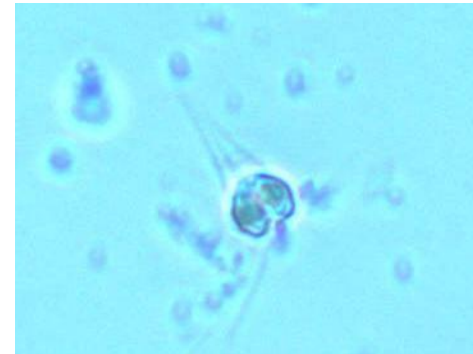
***Alexandrium monilatum*** (Howell) (F.J.R. Taylor 1979)  
(<http://adl.brs.gov.au/marinepests>)



***Alexandrium pseudogonyaulax*** (Biecheler) Horiguchi ex Yuki et Fukuyo, 1992  
(<http://dinos.anesc.u-tokyo.ac.jp>)



***Alexandrium tamarense*** (Lebour, 1925) Balech, 1985  
(<http://eol.org/pages910083>)



***Apedinella radians*** (Lohmann) Campbell 1973  
(NIMRD photo)

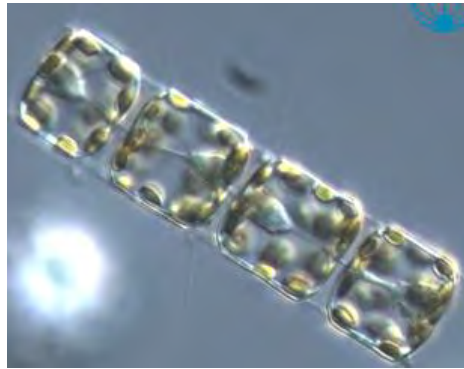


***Chaetoceros tortissimus*** Gran, 1900  
(<http://planktonnet.awi.de>)

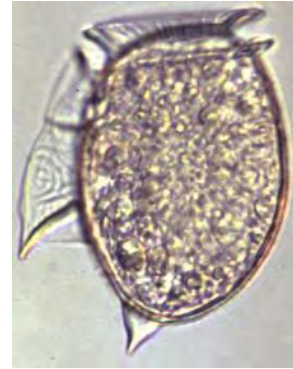




***Cochlodinium polykrikoides*** Margelef, 1961 ([www.flickr.com/photos/myfwc5842186713](http://www.flickr.com/photos/myfwc5842186713))



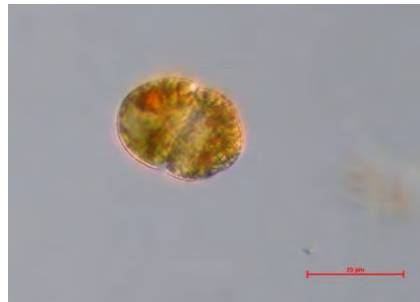
***Detonula pumila*** (Castracane) Gran 1900 (<http://planktonnet.awi.de>)



***Dinophysis odiosa*** (Pav.) Tai & Scogsberg, 1934 (<http://dinos.anesc.u-tokyo.ac.jp>)



***Gymnodinium aureolum*** Hulbert, 1957 (<http://adl.brs.gov.au/marinepests>)



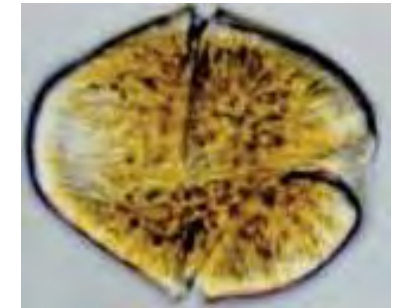
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***Gymnodinium radiatum*** Kofoid et Swezy, 1921

***Gymnodinium uberrimum*** (Allmann) Kofoid et Swezy, 1921 (<http://www.planktonforum.eu/>)



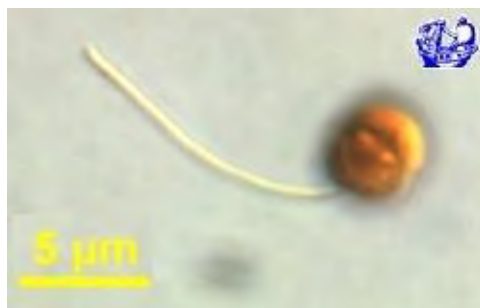
***Gyrodinium impudicum*** Fraga et Bravo, 1995 (<http://dinos.anesc.u-tokyo.ac.jp>)



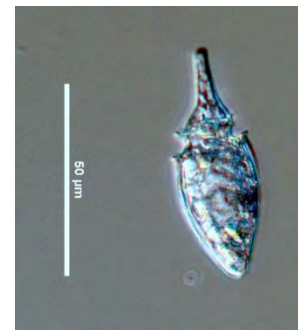
***Gymnodinium instriatum*** (Freudenthal & Lee) Coats, 2002 (<http://dinos.anesc.u-tokyo.ac.jp>)



***Lioloma pacificum*** (Cupp) Hasle, 1996 (<http://cimt.ucsc.edu>)



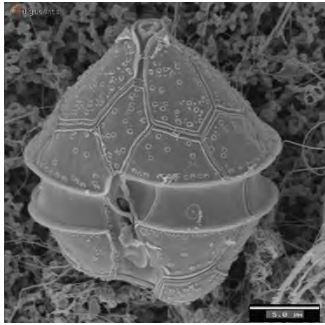
***Mantiella squamata*** Manton & Parke (1960) (<http://planktonnet.awi.de>)



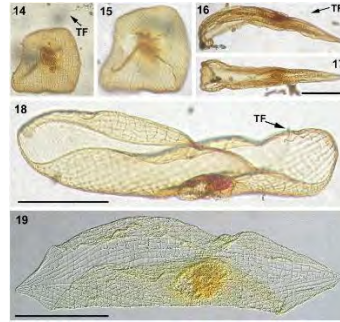
***Oxyphysis oxytoxoides*** Kofoid, 1926 ([www.eos.ubc.ca/research](http://www.eos.ubc.ca/research))



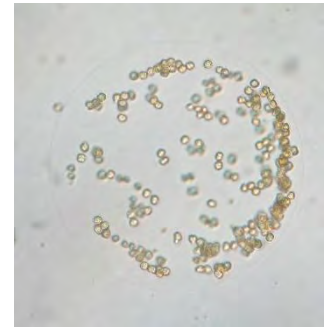
***Pentapharsodinium dalei*** Idelicato et Loeblich, 1986 (<http://nordicmicroalgae.org>)



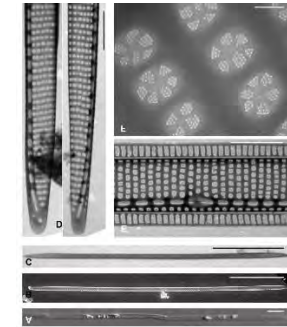
***Pentapharsodinium tyrrenicum*** (Balech, 1990) Montresor, Zingone & Marino, 1993  
(<http://seaweedafrica.org/>)



***Petalodinium porcelio*** J. and M. Cachon 1968  
(<http://www.sciencedirect.com>)



***Phaeocystis pouchettii*** (Hariot) (Lagerheim, 1893)  
(<http://nordicmicroalgae.org>)



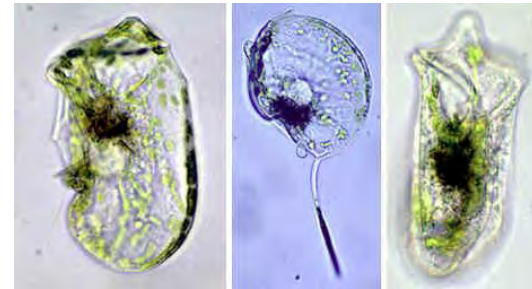
***Pseudo-nitzschia calliantha*** Lundholm, Moestrup & Hasle, 2003  
(<http://nordicmicroalgae.org/>)

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***Pseudo-nitzschia inflatula*** G.R. Hasle, 1993



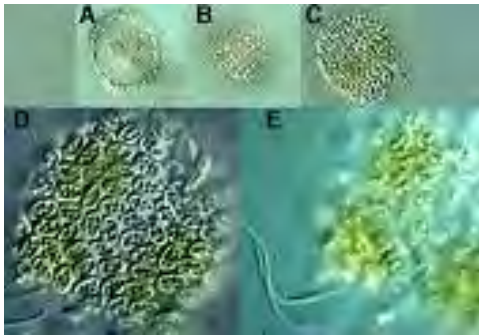
***Scaphodinium mirabile*** Margalef, 1963  
(NIMRD)



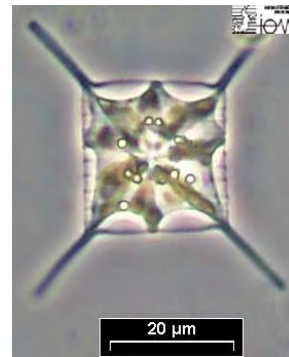
***Spatulodinium pseudonociluca*** (Pouchet, 1885) J. Cachon & Cachon ex Loeblich & Loeblich III, 1969  
(<http://nordicmicroalgae.org>)

Not found

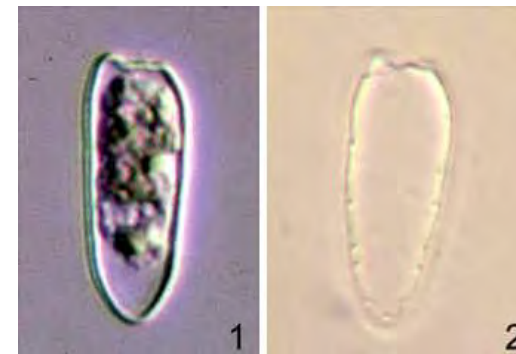
***Oxytoxum gladiolus*** Stein, 1883  
([http://www.scielo.cl/scielo.php?script=sci\\_arttext&pid=S0718-19572008000100004](http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0718-19572008000100004))



***Syracolithus dalmaticus*** (Kamptner, 1927) Loeblich & Tappan, 1963  
([www.smhi.se](http://www.smhi.se))



***Attheya decora*** T. West, 1860  
(<http://dinos.anesc.u-tokyo.ac.jp>)

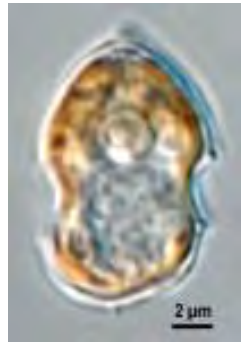


***Prorocentrum dentatum*** Stein, 1883  
([www.marinespecies.org](http://www.marinespecies.org))



***Peridinium quinquecorne*** Abé, 1927  
(NIMRD)

Not found  
*Warnowia schuettii* (Kofoid et Swezy,  
1921) Schiller, 1933

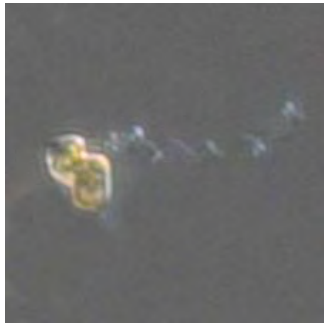


*Azadinium spinosum* Elbrächter &  
Tillmann, 2009 ([www.marinespecies.org](http://www.marinespecies.org))



*Lessardia elongata* Saldarriaga &  
F.J.R.Taylor, 2003  
(NIMRD picture)

*Gyrodinium cochlea* Lebour, 1925



*Gyrodinium flagellare* Schiller, 1928  
(<http://nordicmicroalgae.org>)

Not found  
*Gyrodinium varians* (Wulff, 1916)  
Schiller, 1933

Not found  
*Gymnodinium nanum* Schiller, 1928

Not found  
*Gymnodinium pulchrum* Schiller, 1928



*Peridiniopsis polonicum* (Woloszynska)  
Bourrelly, 1968  
(<http://planktonnet.awi.de>)



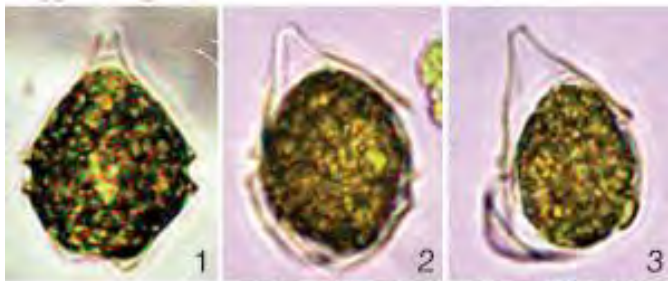
*Gymnodinium nolleri* M.Ellegaard &  
Ø.Moestrup, 1999  
(<http://www.sciencedirect.com>)



*Scripsiella lachrymosa* J.Lewis, 1991  
(<http://www.sciencedirect.com>)

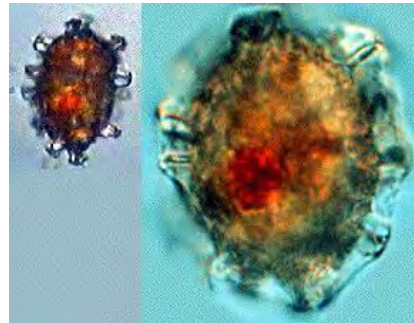


*Scripsiella ramonii* M.Montresor,  
1995  
(<http://dinos.anesc.u-tokyo.ac.jp>)



1: Ventral view, 2,3: Lateral view. Width: 21-36 µm

***Scrippsiella spinifera*** G.Honsell & M.Cabrini, 1991  
([tokyo.ac.jp/plankton/figure/Scrippsiella\\_spinifera.jpg](http://tokyo.ac.jp/plankton/figure/Scrippsiella_spinifera.jpg))



***Scrippsiella trifida*** J.Lewis, 1991  
(<http://www.smhi.se/oceanografi> this are the cysts)

Not found  
***Scrippsiella operosa*** (Deflandre)  
Montresor, 2003

Not found  
***Dinophysis islandica*** Paulsen,  
1949



***Dinophysis nasuta*** (Stein) Parke & Dixon 1968  
(<http://www.seaweedafrica.org>)



***Dinophysis recurva*** Kofoid & Skogsberg,  
1928  
(1928 <http://www.sciencedirect.com>)

Not found  
***Dinophysis schilleri*** Sournia, 1973

Not found  
***Chaetoceros aequatorialis***  
Cleve, 1873

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