NCEA | Natural Capital and Ecosystem Assessment

Realigning the UK's Plankton Species Lists under the mixoplankton paradigm with recommendations for field sampling of mixoplankton

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Acknowledgements

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1. Executive summary

- Mixoplankton, protist plankton that combine photosynthesis and feeding in the one cell, are now recognised as important components of marine food webs. Many organisms originally labelled as phytoplankton or as protist (micro-) zooplankton are now recognised as mixoplankton. This change in the conceptual core of marine ecology is termed the *mixoplankton paradigm*.
- While many (most) mixoplankton are important, valuable, contributors to ecological health and fisheries, an important minority are harmful algal bloom (HAB) species. Any loss of 'good' mixoplankton, through climate change or anthropogenic activity, is arguably as detrimental as proliferation of HAB mixoplankton. To track such events requires active monitoring and identifications of microbial plankton types.
- The *Master Plankton Species List*, used to guide UK analyses of plankton ecology, has been updated to better align it with the conceptual basis of the mixoplankton paradigm. The *Reduced Taxon List*, and the *EA Nuisance and Harmful Phytoplankton Species List*, have also been explored with attention drawn to mixoplankton.
- However, while the mixoplankton species have been identified within the lists, during this activity many existing points of error have been identified in the *Master Plankton Species List* that serves as the core reference for UK plankton monitoring. Aside from the issue of mixoplankton, these errors affect the use of the current list to identify phytoplankton and protist zooplankton.
- The *Reduced Taxon List* requires additional attention and updating (which was outside of the current contract scope).
- The *EA Nuisance and Harmful Phytoplankton Species List*, which can be seen to be dominated (82%) by mixoplankton with few real phytoplankton, is now successfully updated. The latter may be better termed the *EA Nuisance and Harmful Microalgae Species List* to reflect the mix of mixoplankton and phytoplankton.
- Given the significance of mixoplankton within these lists, the importance of mixoplankton amongst UK plankton communities, as indicators of biodiversity, is undisputable.
- Methods are described for the improved sampling of microbial plankton to better evaluate the contributions of mixoplankton biomass, biodiversity and production.
- The most important steps to be taken revolve around overcoming the inherent fragility of mixoplankton that results in damage and loss of cells during sampling and analysis.
- The main recommendations centre on enhancing the processing of microbial plankton data collection and exploitation to recognise that many of the organisms and processes traditionally attributed to 'phytoplankton', and ca. 1/3rd attributed to 'protist (micro) zooplankton', are actually attributed to various mixoplankton groups. The implications of the ecology and physiology of these organisms thus warrants due recognition in UK management and governance of marine waters.

2. Preamble – the mixoplankton paradigm

For context the following has been reproduced, with stylistic modifications, from a report previously presented to DEFRA by the author (Mitra, 2024).

Over the last decade, there has been a fundamental change in our understanding of the structure and functioning of coastal and open-water marine ecosystems. The traditional interpretation of the base of the marine food web assumes a plant-animal like dichotomy, based on phytoplankton-zooplankton, analogous to that of terrestrial systems where plants produce food and animals are the consumers. However, this traditional view is at best incomplete, if not arguably flawed (Flynn *et al.,* 2013; Mitra *et al.,* 2016; Mitra & Leles, 2023). The reason for this is that we now know that many of the single-celled planktonic organisms, hitherto labelled either as 'phytoplankton' or as single-celled 'zooplankton', are actually capable of both photosynthesising (like plants) and also hunting and consuming prey (like animals). They engage in both these producer and consumer processes synergistically (Flynn & Mitra, 2009; 2023). They thus simultaneously, with their dual nutritional modes, defy the traditional interpretations of what limits plankton growth (Mitra *et al.,* 2024). These organisms are the 'mixoplankton' (Flynn *et al.,* 2019).

Over decades, the importance of the role of mixoplankton in marine ecology has been ignored due to a fixation with the established plant-animal dichotomy. Our research methods, our conceptual and mathematical models, and our ecosystem management approaches, have all been dominated by this assumed dichotomy. However, over the last two decades, various studies have shown how mixoplankton play an important role in functioning and provisioning in coastal and marine waters. This has led to the emergence of a new paradigm in marine ecology – the *mixoplankton paradigm* (Glibert & Mitra, 2022), which sees a restructuring of the plankton food web (**Figure 1**).

The *mixoplankton paradigm* represents the third major change in the conceptual understanding of marine plankton ecology, coming after the *microbial loop* (which acknowledged the role of bacteria and other pico- and nano- sized plankton in marine ecology; Pomeroy, 1974; Azam *et al.,* 1983), and the *viral shunt* (acknowledging the role of viruses in the dynamics of marine plankton; Wilhelm & Suttle, 1999; Jiao *et al.,* 2010). The *mixoplankton paradigm* not only overlaps and reinforces the importance of the *microbial loop* and the *viral shunt*, but it fundamentally denies the acceptability of the phytoplankton-zooplankton concept which has been the bedrock of marine biology and ecology.

Of critical importance, the *mixoplankton paradigm* sees the explicit labelling and thus the identification of the dual and synergistic nutritional mechanisms of phototrophy (photosynthesis) and phagotrophy (consumption of prey) in many single-celled marine plankton (Mitra *et al.,* 2023). In the past these single-celled marine plankton have typically been considered to be either plant-like phytoplankton or animal-like zooplankton. The mixoplankton paradigm thus overturns our understanding of the physiology, ecological functioning and role of various planktonic organisms that we thought we understood (**Figure 1**). We now know that various marine plankton which had been previously mislabelled as phytoplankton or zooplankton are in fact **mixoplankton**.

Mixoplankton are single-celled plankton that employ photosynthesis and predation synergistically to obtain nourishment. They can also engage in osmotrophy. These organisms are not new discoveries (Pringsheim, 1958; Sanders, 1991; Stoecker, 1998; Stoecker *et al.,* 2009). However, as descriptions of marine food webs have always emphasized the plant-animal, 'phytoplankton-zooplankton', dichotomy, mixoplankton species have previously been labelled as either 'phytoplankton (akin to plants) that eat' or 'microzooplankton (akin to animals) that photosynthesize'. Both labels are wrong. **Protists are neither plants nor animals, and mixoplankton are not a subset of phytoplankton or microzooplankton** (Mitra *et al.,* 2024)**.**

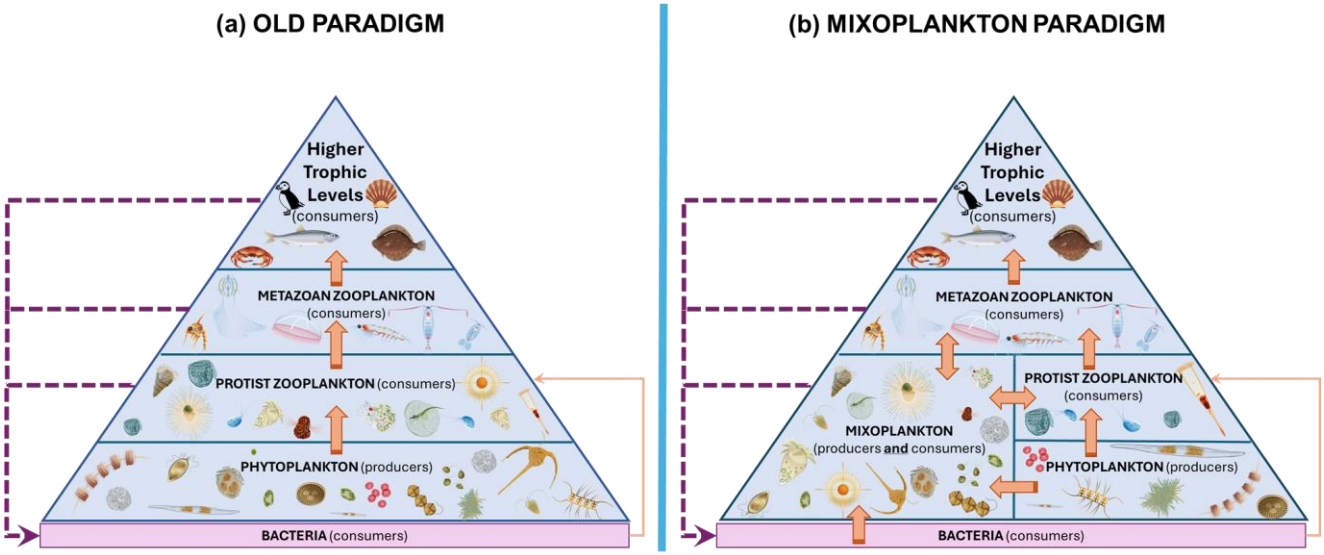


Figure 1. Restructuring of the marine food web under the new mixoplankton paradigm. Panel (a): Old paradigm where phytoplankton are the only producers of food with rest of the trophic levels including only consumers. **Panel (b)** Mixoplankton paradigm where the base of the food web comprises phytoplankton and mixoplankton. In this revised food web, mixoplankton occupying the base of the marine food webs are producers as well as consumers. Mixoplankton are single-celled plankton that photosynthesize and consume prey for their nourishment. Mixoplankton can consume microbial plankton as well as metazoan grazers. Plankton images not to scale. Figure adapted from Mitra & Leles (2023).

BOX 1 ORGANISMS

Mixoplankton are chlorophyll-containing protist microbes that are capable of predation. They are mixotrophs by combining photosynthesis, an ability to use dissolved organic nutrients (e.g., amino acids, sugars), and also by grazing. They are not 'plants-that-eat'; they are not 'animals-that-photosynthesize'; they are not a subset of 'phytoplankton'; they are not a subset of protist-zooplankton; they are not hybrids of phytoplankton and zooplankton. Examples include many photoflagellates (including Chl-containing dinoflagellates) and many ciliates.

Phytoplankton are chlorophyll-containing microbes (prokaryote or protist) that are not capable of consumption of other organisms. They are mixotrophs by combining photosynthesis and an ability to use dissolved organic nutrients (e.g., amino acids, sugars). They are not 'plants'. Examples include cyanobacteria and diatoms.

Protists are single celled eukaryote microbes. They have a higher level of cellular complexity than do the prokaryote bacteria, archaea and cyanobacteria.

Zooplankton are planktonic predators. Most are protists (i.e., protist-zooplankton, sometimes termed, microzooplankton), while the other are recognisably animals (metazoa-zooplankton). The former are single-celled microbes while the latter include multi-cellular animals of many mm (e.g., copepods), cm (e.g., krill), or even m dimension (jellies).

Mixoplankton comprise a diverse sub-group (functional types) of protist plankton. **Figure 2** shows the revised classification key for marine microbial plankton under the mixoplankton paradigm (Mitra *et al.,* 2023). Mixoplankton can be functionally divided broadly into two groups:

(i) **Constitutive Mixoplankton (CM)**: these possess an innate, constitutive ability to perform photosynthesis. Various globally ubiquitous cryptophytes, dinoflagellates and haptophytes such as *Teleaulax amphioxeia*, *Alexandrium tamarense*, *Tripos furca*, *Emiliania huxleyi*, *Phaeocystis globosa* are now recognised to be CMs. These would have traditionally been mislabelled as phytoplankton (i.e., considered as only producers in the food web).

(ii) **Non-Constitutive Mixoplankton (NCM)**: these need to acquire photosynthetic capabilities from consumption of photosynthetic prey. The NCM can be further sub-divided into three types according to how they acquire their phototrophic potential:

- **Generalist NCM (GNCM):** these acquire photosynthetic capability by using the chloroplasts from a range of different prey items. Various ciliates such as *Laboea strobila*, *Strombidium reticulatum*, *Tontonia ovalis* are now recognised as GNCMs. Traditionally these would have

been mislabelled as microzooplankton or protist-zooplankton (i.e., considered as only consumers in the food web).

- **plastidic Specialist NCM (pSNCM):** these acquire their photosynthetic machinery (including nuclear material) from specific prey taxonomic groups. Examples include the ubiquitous ciliate *Mesodinium rubrum* and various species from the harmful bloom forming *Dinophysis* genus; these species have previously been incorrectly assigned to microzooplankton (i.e., consumers in the food web).
- **endosymbiotic specialist NCM (eSNCM):** these NCM mixoplankton harbour prey symbionts for photosynthesis within their single cell. The dinoflagellate *Noctiluca scintillans*, various species belonging to the ubiquitous Rhizarians (i.e., foraminiferans, radiolarians) are now recognised to be eSNCMs. These species have previously been incorrectly assigned to microzooplankton or protist-zooplankton (i.e., consumers in the food web).

BOX 2 MIXOPLANKTON TYPES

Constitutive Mixoplankton [**CM**]: innate ability to photosynthesize

Non-Constitutive Mixoplankton [**NCM**]: acquires phototrophic ability from prey

Generalist Non-Constitutive Mixoplankton [**GNCM**]: gained ability to photosynthesize by keeping chloroplasts from diverse (generic) prey

Specialist Non-Constitutive Mixoplankton [**SNCM**]: gained photosynthetic ability from specific prey taxonomic groups

plastidic Specialist Non-Constitutive Mixoplankton [**pSNCM**]: gained ability to photosynthesize by keeping chloroplasts from specific prey

endosymbiotic Specialist Non-Constitutive Mixoplankton [**eSNCM**]: gained ability to photosynthesize by keeping specific prey as symbionts

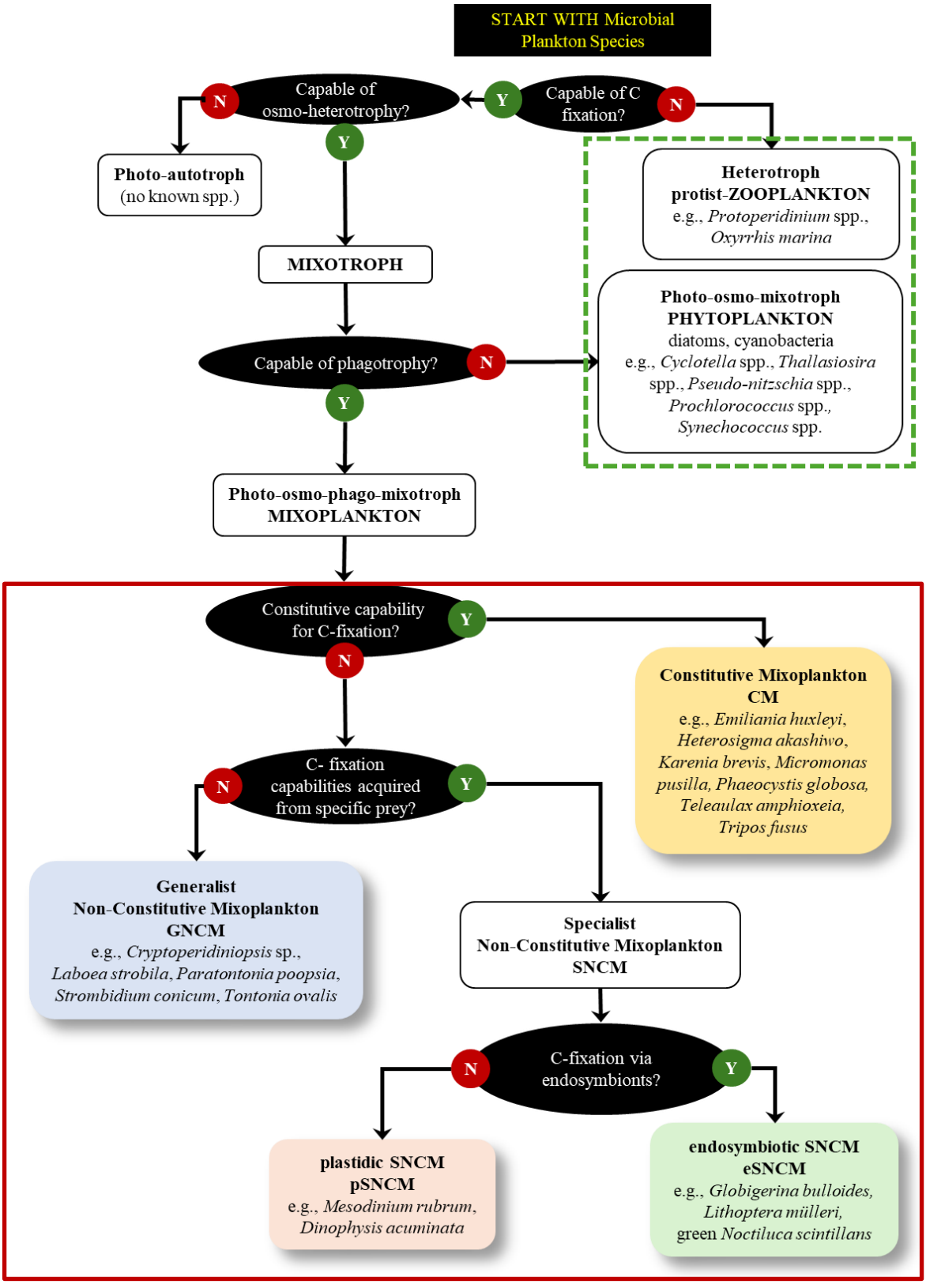


Figure 2. Functional group classification for marine microbial plankton. In marine environmental monitoring and management, the traditional classification based on the 'plant-animal' dichotomy of phytoplankton-zooplankton is employed (indicated by green dashed line). Additional classification associated with the new mixoplankton paradigm are shown within the red box. Figure from Mitra *et al.* (2023). See also **Boxes 1 & 2**.

3. Realigning the '*Master Plankton Species List*' under the mixoplankton paradigm

3.1 Introduction

The traditional phytoplankton-zooplankton plant-animal dichotomy is still assumed as the conceptual core for the majority of marine ecosystem monitoring and management research. For example, a few years ago a 'Plankton Lifeform Extraction Tool' was proposed with an aspiration "*to make complex plankton datasets accessible and meaningful for policy, public interest, and scientific discovery*" (Ostle *et al.,* 2021). This particular tool assumed the old 'phytoplankton-zooplankton' paradigm typified by inclusion of diatoms as the primary producers, consumed mainly by metazoan copepods. The copepods are consumed by fish and thus are considered to be the main link between the primary producers and ecosystem services such as fisheries.

The information for this 'Plankton Lifeform Extraction Tool' is obtained from a **master plankton species list** which "*has been designed to capture taxonomic and assigned trait information from pelagic datasets in one central location. Most of the datasets and therefore taxa and associated traits* {within this list} *are from UK waters.*"

The aims of this project were as follows:

- to review the protist plankton taxa within this *master plankton species list* against the revised protist functional groups and identifying mixoplankton species (**Figure 2**);
- to consider whether the current methods used for routine phytoplankton monitoring could capture the functional diversity in protist species;
- to provide suggestions for improvements in light of the mixoplankton focussed new paradigm in marine ecology.

The project was to be completed in reference to documents provided by the Environment Agency.

3.2 Methods

The project commenced in November 2024, making use of the (then) most recent version of the master plankton species list.

3.2.1 Information provided

The following documents were provided:

- The master plankton species list (version 7) was provided at the start of the project. An updated list (version 8) was made available on 17 February 2025.
- Annex 2_WER Reduced Taxon List
- Annex 3_EA Nuisance and Harmful Phytoplankton Species List

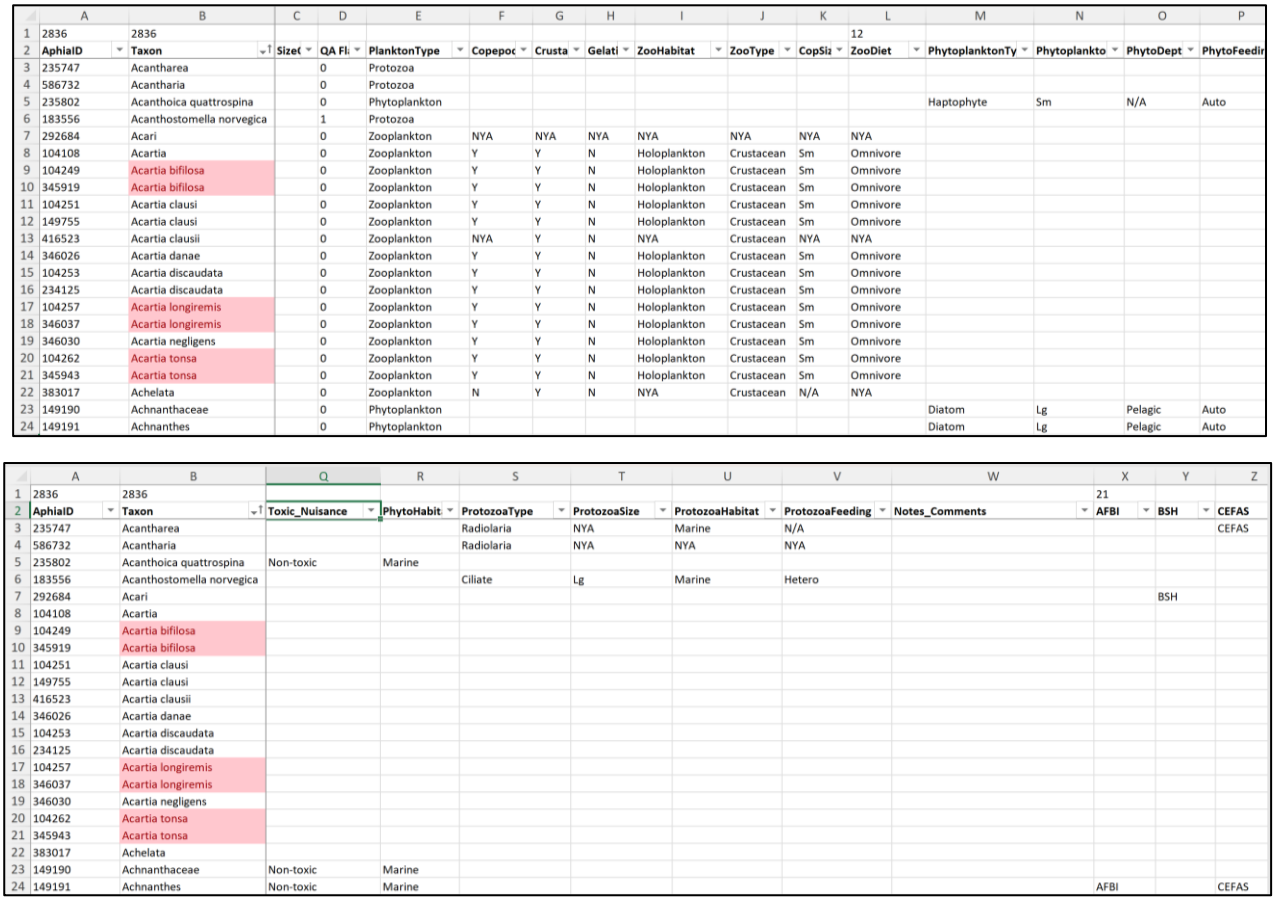
- APEM Method Statement PY-01

3.2.2 *Master Plankton Species List*

The '*Master Plankton Species List* version 7', as an Excel spreadsheet, comprised 2836 rows and 44 columns of data. The first two columns (**A** & **B**) provided the identification code (AphiaID) from the World Register of Marine Species (WoRMS) and a taxonomic identifier (including order, family, genus, species etc.), respectively (**Figure 3**).

Each of the entries in Column **B** were classified broadly into four functional groups within Column E – (i) phytoplankton, (ii) protozoa, (iii) zooplankton and (iv) fish.

Taxonomic information about phytoplankton and protozoa were provided in Columns **M** and **S**, respectively. Habitat information for phytoplankton and protist zooplankton were provided in Columns **R** and **U**, respectively.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	2836	2836										12				
2	AphiaID	Taxon	Size(	QA Fl	PlanktonType	Copepoc	Crusta	Gelati	ZooHabitat	ZooType	CopSiz	ZooDiet	PhytoplanktonTy	Phytoplankto	PhytoDept	PhytoFeedir
3	235747	Acantharea		0	Protozoa											
4	586732	Acantharia		0	Protozoa											
5	235802	Acanthoica quattrospina		0	Phytoplankton								Haptophyte	Sm	N/A	Auto
6	183556	Acanthostomella norvegica		1	Protozoa											
7	292684	Acari		0	Zooplankton	NYA	NYA	NYA	NYA	NYA	NYA	NYA				
8	104108	Acartia		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
9	104249	Acartia bifilosa		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
10	345919	Acartia bifilosa		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
11	104251	Acartia clausi		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
12	149755	Acartia clausi		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
13	416523	Acartia clausii		0	Zooplankton	NYA	Y	N	NYA	Crustacean	NYA	NYA				
14	346026	Acartia danae		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
15	104253	Acartia discaudata		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
16	234125	Acartia discaudata		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
17	104257	Acartia longiremis		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
18	346037	Acartia longiremis		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
19	346030	Acartia negligens		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
20	104262	Acartia tonsa		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
21	345943	Acartia tonsa		0	Zooplankton	Y	Y	N	Holoplankton	Crustacean	Sm	Omnivore				
22	383017	Achelata		0	Zooplankton	N	Y	N	NYA	Crustacean	N/A	NYA				
23	149190	Achnanthaceae		0	Phytoplankton								Diatom	Lg	Pelagic	Auto
24	149191	Achnanthes		0	Phytoplankton								Diatom	Lg	Pelagic	Auto

	A	B	Q	R	S	T	U	V	W	X	Y	Z
1	2836	2836								21		
2	AphiaID	Taxon	Toxic_Nuisance	PhytoHabit	ProtozoaType	ProtozoaSize	ProtozoaHabitat	ProtozoaFeeding	Notes_Comments	AFBI	BSH	CEFAS
3	235747	Acantharea			Radiolaria	NYA	Marine	N/A				CEFAS
4	586732	Acantharia			Radiolaria	NYA	NYA	NYA				
5	235802	Acanthoica quattrospina	Non-toxic	Marine								
6	183556	Acanthostomella norvegica			Ciliate	Lg	Marine	Hetero				
7	292684	Acari									BSH	
8	104108	Acartia										
9	104249	Acartia bifilosa										
10	345919	Acartia bifilosa										
11	104251	Acartia clausi										
12	149755	Acartia clausi										
13	416523	Acartia clausii										
14	346026	Acartia danae										
15	104253	Acartia discaudata										
16	234125	Acartia discaudata										
17	104257	Acartia longiremis										
18	346037	Acartia longiremis										
19	346030	Acartia negligens										
20	104262	Acartia tonsa										
21	345943	Acartia tonsa										
22	383017	Achelata										
23	149190	Achnanthaceae	Non-toxic	Marine								
24	149191	Achnanthes	Non-toxic	Marine						AFBI		CEFAS

Figure 3. **Screenshots of the *Master Plankton Species List*.** Column **A** lists the AphiaID from the World Register of Marine Species (WoRMS) for each entry in Column **B**. A broad functional group classification of these entries are provided in Column **E**. Columns **F**-**L**, provides information about metazoan grazers; Columns M-V, lists information about habitat, diet and taxonomic grouping; Columns **X**-**AR**, indicate the data source.

The updated *Master Plankton Species List* version 8 was similar in structure but comprised 2866 rows of data.

3.2.3 *Reduced Taxon List*

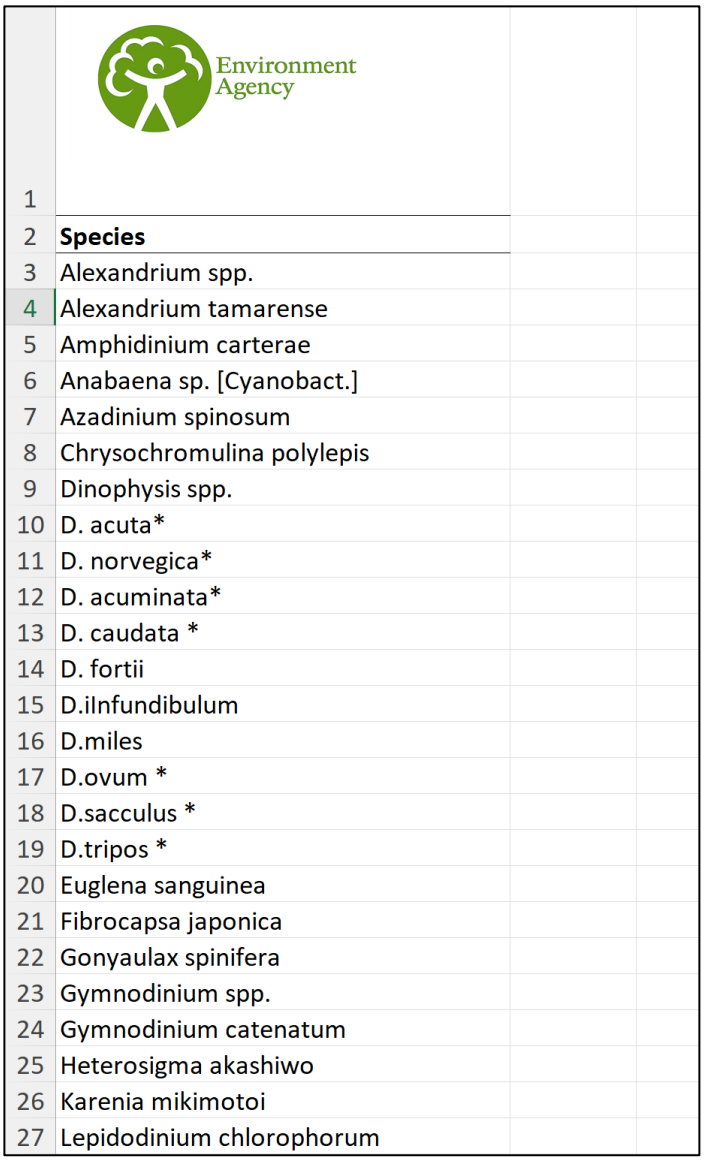
This list was developed for the Water Environment Regulations (WER) and Water Framework Directive (WFD) and includes taxa associated with specific requirements for the WER and WFD. This list including 233 entries was curated by Eileen Bresnan and was last updated in 2014. The entries in this list have been logged according to genus/assembly and species/groups; information about sizes of some these have been recorded (**Figure 4**). The primary objective of this list is to enable cost effective and timely identification of samples. The list is typically used by the main contractors of the Environment Agency.

	A	B	C
1	**Genus/Assembly**	**Species/Group**	**Size (um)**
2	Achnanthes	longipes	
3	Actinoptychus	sp	
4	Akashiwo	sanguinea	
5	Alexandrium	species	
6	Alexandrium	species	<20
7	Alexandrium	species	20-50
8	Alexandrium	species	>50
9	Amphidinium	species	
10	Amphidinium	cartarae	
11	Amylax	buxus	
12	Amylax	triacantha	
13	Asterionella	formosa	
14	Asterionellopsis	glacialis	
15	Asteromphalus	species	
16	Asteroplanus	karianus	
17	Attheya	Attheya	
18	Bacillaria	paxillifera	
19	Bacteriastrum	species	
20	Bellerochea	species	
21	Corataulina	pelagica	
22	Ceratium	species	
23	Ceratium	species	<20
24	Ceratium	species	20-50
25	Ceratium	species	>50
26	Ceratium	tripos	
27	Ceratium	arietinum	
28	Ceratium	azoricum	
29	Ceratium	hexacanthum	
30	Ceratium	setaceum	
31	Ceratium	furca	
32	Ceratium	fusus	
33	Ceratium	macroceros	

Figure 4. **Screenshot of the *Reduced Taxon List* developed for the Water Environment Regulations and Water Framework Directive**. This list is typically used by the main contractors of the Environment Agency.

3.2.4 *EA Nuisance and Harmful Phytoplankton Species List*

This file includes a list of 39 nuisance and harmful phytoplankton species maintained by the Environment Agency (**Figure 5**). This is a simple list of names either at genus or species levels; species belonging to cyanobacteria have been identified as seen in the screenshot below.



	Species
1	
2	**Species**
3	Alexandrium spp.
4	Alexandrium tamarense
5	Amphidinium carterae
6	Anabaena sp. [Cyanobact.]
7	Azadinium spinosum
8	Chrysochromulina polylepis
9	Dinophysis spp.
10	D. acuta*
11	D. norvegica*
12	D. acuminata*
13	D. caudata *
14	D. fortii
15	D.ilnfundibulum
16	D.miles
17	D.ovum *
18	D.sacculus *
19	D.tripos *
20	Euglena sanguinea
21	Fibrocapsa japonica
22	Gonyaulax spinifera
23	Gymnodinium spp.
24	Gymnodinium catenatum
25	Heterosigma akashiwo
26	Karenia mikimotoi
27	Lepidodinium chlorophorum

Figure 5. **Screenshot of the Environment Agency's Nuisance and Harmful Phytoplankton Species List**.

3.2.5 APEM Method Statement PY-01

This document provides the methodologies used for regular monitoring of phytoplankton.

3.2.6 Alignment process

The aspiration was to work on a copy of the *Master Plankton Species List*, applying the revised functional group classification (**Figure 2**). As noted below, however, this was much complicated by various errors in the provided database.

3.3 Review of *Master Plankton Species List*

Appendix 1 details the Excel file names of the lists (originals and revised), with a brief commentary on each.

In order to implement the functional group classification as per the marine Mixoplankton Database (**Figure 2**; Mitra *et al.,* 2023), it was essential to identify the marine protist plankton within the master list. This was done by filtering the data in Column **E** of the *Master Plankton Species List* for *phytoplankton* and *protozoa* and Columns **R** and **U** for *marine*.

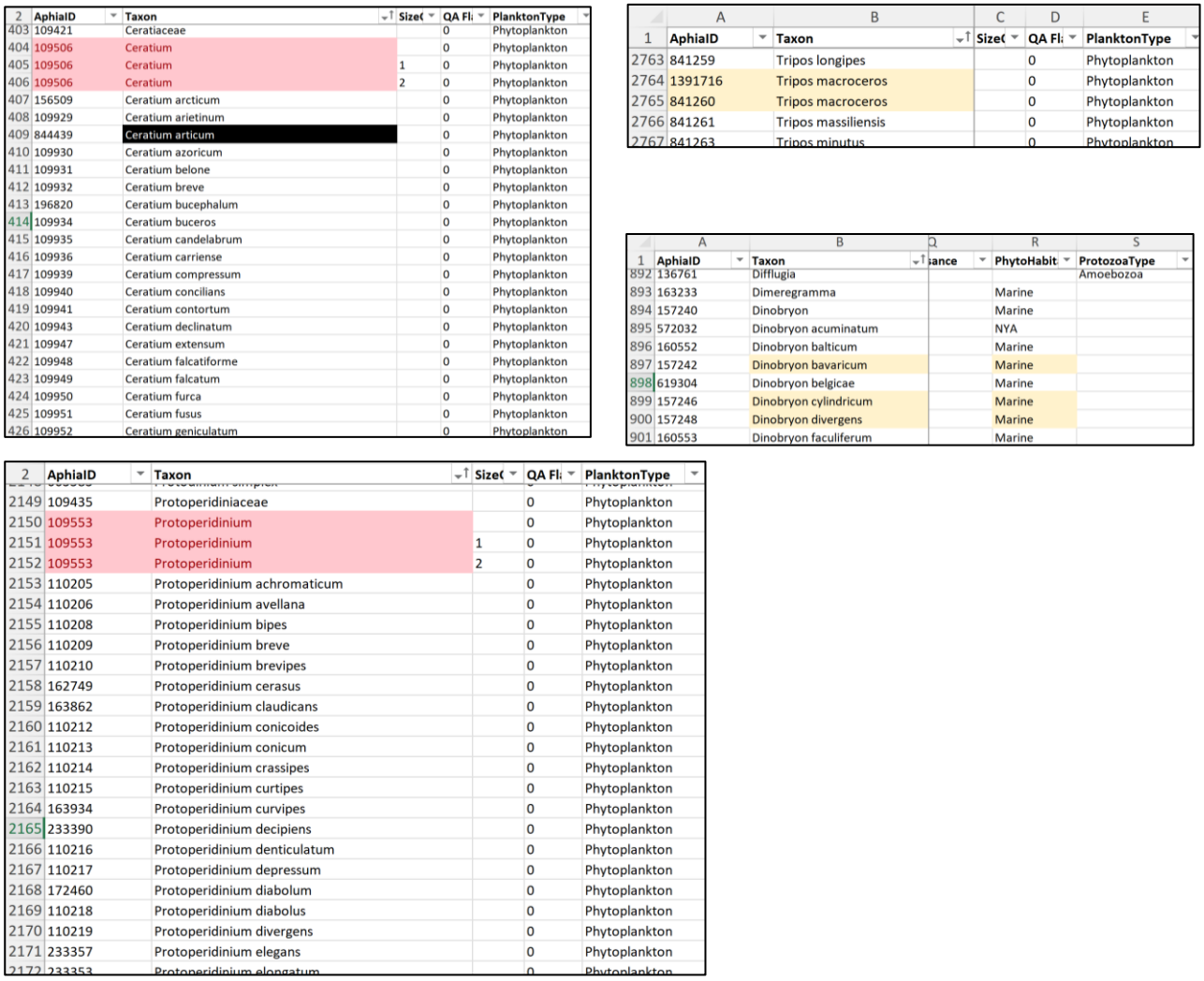
The original aspiration was to work on a copy of the *Master Plankton Species List* with revised classification data inserted within a new column and changes noted within Column **W** (notes). This work plan was based on the assumption that the entries in Column **B** defined as phytoplankton (Column **E**) would, under the mixoplankton paradigm, be categorised as either phytoplankton or constitutive mixoplankton. Those entries defined as protozoa (Column **E**) would belong to the non-constitutive mixoplankton functional groups or protist zooplankton group.

3.3.1 Problems with the extant database

Aligning the database proved to be an extremely challenging task as interrogation of the *Master Plankton Species List* files revealed to have a range of inaccuracies; a few examples are shown in **Figure 6**.

As examples of these errors:

- There are multiple entries of various 'taxon' data within Column **B**. In some instances, the AphiaIDs for the repeat entries do not match (e.g., *Tripos macroceros* is entered twice with two different AphiaIDs of 1391716 and 841260).
- The original classification of various protist plankton into phytoplankton and protozoa (i.e., protist zooplankton) using the traditional paradigm (**Figure 1**) were found to be erroneous (e.g., there is no evidence of any species within the *Protoperidinium* genus to possess any photosynthetic apparatus, yet these have been classified as phytoplankton).
- The list also uses inaccurate genus and species names for various entries. For example, various species listed within the genus *Ceratium* in *Master Plankton Species List* versions 7 and 8 actually belong to the genus *Tripos*.
- Some freshwater species have been inaccurately listed as marine (e.g., several species belonging to the genus *Dinobryon*).
- There are various spelling mistakes; in some instances as the AphiaID for the correctly spelt taxon entry does not match that of the incorrectly spelt entry, it is difficult to ascertain which species the entry is representing (e.g., *Ceratium arcticum* vs. *C. articum*).



2	AphiaID	Taxon	Size(	QA Fl	PlanktonType
403	109421	Ceratiaceae		0	Phytoplankton
404	109506	Ceratium		0	Phytoplankton
405	109506	Ceratium	1	0	Phytoplankton
406	109506	Ceratium	2	0	Phytoplankton
407	156509	Ceratium arcticum		0	Phytoplankton
408	109929	Ceratium arietinum		0	Phytoplankton
409	844439	Ceratium articum		0	Phytoplankton
410	109930	Ceratium azoricum		0	Phytoplankton
411	109931	Ceratium belone		0	Phytoplankton
412	109932	Ceratium breve		0	Phytoplankton
413	196820	Ceratium bucephalum		0	Phytoplankton
414	109934	Ceratium buceros		0	Phytoplankton
415	109935	Ceratium candelabrum		0	Phytoplankton
416	109936	Ceratium carriense		0	Phytoplankton
417	109939	Ceratium compressum		0	Phytoplankton
418	109940	Ceratium concilians		0	Phytoplankton
419	109941	Ceratium contortum		0	Phytoplankton
420	109943	Ceratium declinatum		0	Phytoplankton
421	109947	Ceratium extensum		0	Phytoplankton
422	109948	Ceratium falcatiforme		0	Phytoplankton
423	109949	Ceratium falcatum		0	Phytoplankton
424	109950	Ceratium furca		0	Phytoplankton
425	109951	Ceratium fusus		0	Phytoplankton
426	109952	Ceratium geniculatum		0	Phytoplankton

	A	B	C	D	E
1	AphiaID	Taxon	Size(	QA Fl	PlanktonType
2763	841259	Tripos longipes		0	Phytoplankton
2764	1391716	Tripos macroceros		0	Phytoplankton
2765	841260	Tripos macroceros		0	Phytoplankton
2766	841261	Tripos massiliensis		0	Phytoplankton
2767	841263	Tripos minutus		0	Phytoplankton

	A	B	Q	R	S
1	AphiaID	Taxon	ance	PhytoHabit	ProtozoaType
892	136761	Difflugia			Amoebozoa
893	163233	Dimeregramma		Marine	
894	157240	Dinobryon		Marine	
895	572032	Dinobryon acuminatum		NYA	
896	160552	Dinobryon balticum		Marine	
897	157242	Dinobryon bavaricum		Marine	
898	619304	Dinobryon belgicae		Marine	
899	157246	Dinobryon cylindricum		Marine	
900	157248	Dinobryon divergens		Marine	
901	160553	Dinobryon faculiferum		Marine	

2	AphiaID	Taxon	Size(	QA Fl	PlanktonType
2149	109435	Protoperidiniaceae		0	Phytoplankton
2150	109553	Protoperidinium		0	Phytoplankton
2151	109553	Protoperidinium	1	0	Phytoplankton
2152	109553	Protoperidinium	2	0	Phytoplankton
2153	110205	Protoperidinium achromaticum		0	Phytoplankton
2154	110206	Protoperidinium avellana		0	Phytoplankton
2155	110208	Protoperidinium bipes		0	Phytoplankton
2156	110209	Protoperidinium breve		0	Phytoplankton
2157	110210	Protoperidinium brevipes		0	Phytoplankton
2158	162749	Protoperidinium cerasus		0	Phytoplankton
2159	163862	Protoperidinium claudicans		0	Phytoplankton
2160	110212	Protoperidinium conicoides		0	Phytoplankton
2161	110213	Protoperidinium conicum		0	Phytoplankton
2162	110214	Protoperidinium crassipes		0	Phytoplankton
2163	110215	Protoperidinium curtipes		0	Phytoplankton
2164	163934	Protoperidinium curvipes		0	Phytoplankton
2165	233390	Protoperidinium decipiens		0	Phytoplankton
2166	110216	Protoperidinium denticulatum		0	Phytoplankton
2167	110217	Protoperidinium depressum		0	Phytoplankton
2168	172460	Protoperidinium diabolum		0	Phytoplankton
2169	110218	Protoperidinium diabolus		0	Phytoplankton
2170	110219	Protoperidinium divergens		0	Phytoplankton
2171	233357	Protoperidinium elegans		0	Phytoplankton

Figure 6. Screenshots of the *Master Plankton Species List* showing examples of errors noted in the text.

3.3.2 Alignment of mixoplankton

Given the substantial inaccuracies noted in **Section 2.3.1**, the pragmatic approach was to extract all the entries identified as 'phytoplankton', 'protozoa' and 'marine' from the *Master Plankton Species List* into a separate Excel sheet (**Appendix 2**).

The new sheet details the following:

- Columns **A** and **B** listed the AphiaIDs and the taxon entries from the *Master Plankton Species List*.
- The data in Column **B** were separated into two columns where Column **C** listed the genus and higher taxonomic categories (i.e., order, family etc.) and Column **D** recorded the species names. Both these columns (**C** and **D**) included corrections where appropriate. Corrections to genus and species names were undertaken with reference to the WoRMS and AlgaeBase databases.
- The original functional descriptions for the entries were included within Columns **E** and **F** entitled 'Old Plankton Type' and 'Old Phytoplankton & Protozoa groups', respectively.

- The revised plankton type according to the mixoplankton paradigm were documented in Column **G** with reference to the Mixoplankton Database (MDB; Mitra *et al.,* 2023).
- The current taxonomic descriptors of the phytoplankton and protozoa groups (Column **F**) were obtained from Adl *et al.* (2019) and documented in Column **H**.
- Columns **I, J, K** provided data on size class of known mixoplankton species, taxonomic group of the mixoplankton prey and prey size class from the MDB.

In instances where there were discrepancies in the AphiaIDs (including absence in WoRMS), the accuracy of the 'taxon' entries in Column **B** were checked with reference to the AlgaeBase (https://www.algaebase.org/). In some instances, it was found that freshwater species had been incorrectly labelled as 'marine' in the *Master Plankton Species List*. Using prior knowledge, the author also identified inaccuracies in Column **E** where various protist zooplankton had been labelled as phytoplankton. The current taxonomic descriptors of these entries were updated with reference to Adl *et al.* (2019).

3.3.3 Mixoplankton in UK waters

Appendix 2 provides a list of non-diatom marine protist plankton 'Taxon' entries from the *Master Plankton Species List* v7 and v8 aligned to the revised protist plankton functional group classification (**Figure 2**). Column **G** also listed all the functional groups encompassed within the higher level taxon entries; for example, Protozoa (Column **B**) includes all the functional groups (pZ, GNCM, pSNCM and CM). Likewise, for taxon entries with only genus names (e.g., *Alexandrium*), in Column **G**, the different functional groups associated with these were indicated.

A comparison of the *Master Plankton Species List* species with the twenty most frequently recorded mixoplankton species from UK waters within the UNESCO's Ocean Biodiversity Information System (OBIS) meta-database (**Table 1**) highlights a clear bias towards dinoflagellates especially HAB species and an absence of endosymbiotic Rhizarians within the *Master Plankton Species List*.

Appendix 1 details the Excel file names of the lists, and a brief commentary on each.

Table 1. Twenty most frequently recorded mixoplankton species in OBIS database from UK waters. These species were all categorised as 'phytoplankton' or 'microzooplankton' or 'protist-zooplankton' under the old 'phytoplankton-zooplankton' paradigm. MFT, mixoplankton functional type. NR, not recorded. * indicates Harmful bloom species (HABs). ** indicates species not listed in the current *Master Plankton Species List*. The order (top to bottom) reflects the frequency of reports. Data obtained from Mitra (2024).

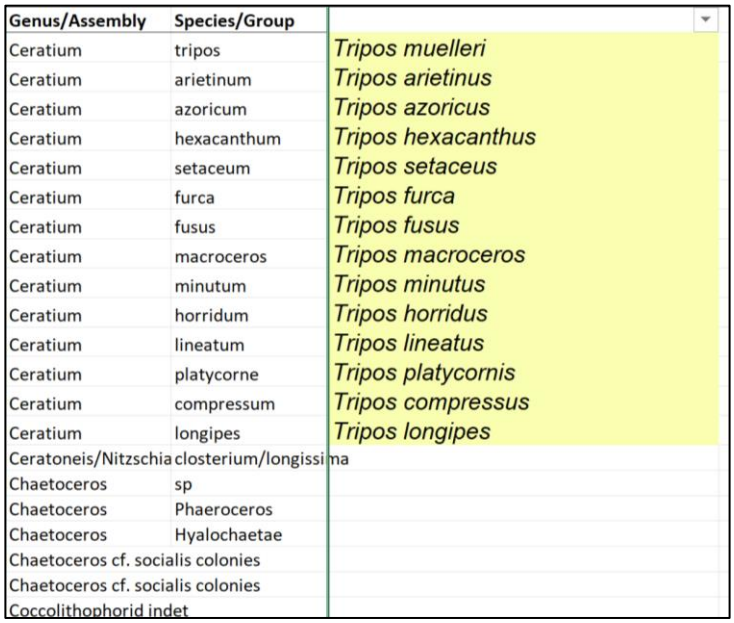
Species name	MFT	MFT taxonomy	MFT size class	OBIS records	prey size class	prey taxonomy
Tripos fusus	CM	Dinoflagellata	micro	80719	NR	NR
Tripos furca	CM	Dinoflagellata	micro	56318	nano-micro	NR
Tripos muelleri	CM	Dinoflagellata	micro	53352	NR	NR
Mesodinium rubrum	pSNCM	Ciliophora	nano-micro	42031	nano	Cryptophyceae
*Dinophysis acuminata**	pSNCM	Dinoflagellata	micro	23474	micro	Ciliophora
Prorocentrum micans	CM	Dinoflagellata	micro	23010	nano	Cryptophyceae Cyanobacteria Diatomea Dinoflagellata Haptophyta Ochrophyta
Heterocapsa rotundata	CM	Dinoflagellata	nano	21246	nano	Bacteria Diatomeae
Tripos longipes	CM	Dinoflagellata	micro	19779	NR	NR
*Dinophysis norvegica**	pSNCM	Dinoflagellata	micro	11815	micro	Ciliophora
*Globigerina bulloides***	eSNCM	Foraminifera	micro-meso	11492	micro-meso	Bacteria Copepoda Sarsostraca (Artemia)
*Globigerinita glutinata***	eSNCM	Foraminifera	micro-meso	8300	micro-meso	NR
*Prorocentrum cordatum**	CM	Dinoflagellata	nano	7340	nano	Cryptophyceae Cyanobacteria Dinoflagellata Haptophyta Ochrophyta
*Dinophysis acuta**	pSNCM	Dinoflagellata	micro	6941	micro	Ciliophora
*Karenia mikimotoi**	CM	Dinoflagellata	micro	6680	pico-nano	Haptophyta
Dinobryon faculiferum	CM	Ochrophyta	nano	5373	pico	Bacteria
*Globigerinoides ruber***	eSNCM	Foraminifera	micro-meso	5694	micro-meso	Ciliophora Copepoda
*Globigerinella siphonifera***	eSNCM	Foraminifera	micro-meso	4797	micro-meso	Bacteria, Copepoda Sarsostraca (Artemia)
*Lingulodinium polyedra**	CM	Dinoflagellata	micro	4606	nano-micro	Cyanobacteria Diatomeae
*Orbulina universa***	eSNCM	Foraminifera	micro-meso	4500	micro-meso	Ciliophora Copepoda
*Globigerina falconensis***	eSNCM	Foraminifera	micro-meso	4152	micro-meso	Bacteria, Copepoda Sarsostraca (Artemia)

3.3.4 Remaining issues

Due to contractual time constraints, it was not possible to check all the AphiaIDs and species names of entries labelled as diatoms, bacillariophyta and cyanobacteria in the *Master Plankton Species List*. There is no known evidence that diatoms are capable of consuming prey, therefore, at present the assumption is that all diatoms are photo-osmo-mixotrophic phytoplankton (**Figure 2**). However, as a few taxon entries (Column **B**) belonging to Diatomea were found to be incorrectly categorised as dinoflagellate, it is likely that similar errors may exists in categorisation of the non-diatoms. Given the aim of this project was to revise the protist plankton functional grouping according to the mixoplankton paradigm, the prokaryotic cyanobacteria were considered as out of scope.

3.4 Review of the *Reduced Taxon List*

Out of the 233 entries within this list, 105 are recorded to species level, 58 (i.e., 25%) are repeat entries. Similar to the *Master Plankton Species List*, there are various errors in this list. For example, the taxonomic names of various species do not reflect the current name (e.g., **Figure 7**). However, this is to be expected as this list has not apparently been updated since 2014.



Genus/Assembly	Species/Group	
Ceratium	tripos	*Tripos muelleri*
Ceratium	arietinum	*Tripos arietinus*
Ceratium	azoricum	*Tripos azoricus*
Ceratium	hexacanthum	*Tripos hexacanthus*
Ceratium	setaceum	*Tripos setaceus*
Ceratium	furca	*Tripos furca*
Ceratium	fusus	*Tripos fusus*
Ceratium	macroceros	*Tripos macroceros*
Ceratium	minutum	*Tripos minutus*
Ceratium	horridum	*Tripos horridus*
Ceratium	lineatum	*Tripos lineatus*
Ceratium	platycorne	*Tripos platycornis*
Ceratium	compressum	*Tripos compressus*
Ceratium	longipes	*Tripos longipes*
Ceratoneis/Nitzschia	closterium/longissima	
Chaetoceros	sp	
Chaetoceros	Phaeroceros	
Chaetoceros	Hyalochaetae	
Chaetoceros cf. socialis colonies		
Chaetoceros cf. socialis colonies		
Coccolithophorid indet		

Figure 7. Screenshots of the *Reduced Taxon List* showing examples of the errors noted in the text.

3.5 Review of *EA Nuisance and Harmful Phytoplankton Species List*

This list (**Table 2**) has been revised as follows:

- Column **A** is the original list of species maintained by the Environment Agency.
- The data in Column **A** were separated into two columns where Column **B** listed the genus and Column **C** recorded the species names.

- The current taxonomic descriptors of the species were obtained from Adl *et al.* (2019) and documented in Column **D**.
- The plankton functional group according to the mixoplankton paradigm were documented in Column **E** with reference to the Mixoplankton Database (MDB; Mitra *et al.,* 2023).
- Column **F** provides additional notes as required.

Within this list, 29 out of the 39 entries are recorded to species level with only one species name requiring updating; *Chrysochromulina polylepsis* is currently recognised as *Prymnesium polylepsis*. Of the 29 species, 66% belong to the constitutive mixoplankton (CM) functional group, 45% to the pSNCM, 14% to phytoplankton and 3% to protist zooplankton functional groups. Traditionally all the CM species would have been classified as 'phytoplankton' and all the pSNCM species as 'protist zooplankton'.

Table 2. Realignment of the Environment Agency's Nuisance and Harmful Phytoplankton Species List according to the mixoplankton paradigm. CM, constitutive mixoplankton; pSNCM, plastidic specialist non-constitutive mixoplankton; P, phytoplankton; pZ, protist zooplankton.

Species	Genus	Species	Taxonomy	Functional group	Additional information
Alexandrium spp.	*Alexandrium*		Dinoflagellata	CM*	* various CM species within this genus
Alexandrium tamarense	*Alexandrium*	*tamarense*	Dinoflagellata	CM	
Amphidinium carterae	*Amphidinium*	*carterae*	Dinoflagellata	CM	
Anabaena sp. [Cyanobact.]	*Anabaena*		Cyanobacteria	P	
Azadinium spinosum	*Azadinium*	*spinosum*	Dinoflagellata	TBC	not yet checked for phagotrophic capability
Chrysochromulina polylepis	*Chrysochromulina*	*polylepis*	Haptophyta	CM	corrected name: *Prymnesium polylepis*
Dinophysis spp.	*Dinophysis*		Dinoflagellata	pSNCM*	* various pSNCM species within this genus
D. acuta*	*Dinophysis*	*acuta*	Dinoflagellata	pSNCM	
D. norvegica*	*Dinophysis*	*norvegica*	Dinoflagellata	pSNCM	
D. acuminata*	*Dinophysis*	*acuminata*	Dinoflagellata	pSNCM	
D. caudata *	*Dinophysis*	*caudata*	Dinoflagellata	pSNCM	
D. fortii	*Dinophysis*	*fortii*	Dinoflagellata	pSNCM	
D.iInfundibulum	*Dinophysis*	*infundibulum*	Dinoflagellata	pSNCM	
D.miles	*Dinophysis*	*miles*	Dinoflagellata	pSNCM	
D.ovum *	*Dinophysis*	*ovum*	Dinoflagellata	pSNCM	
D.sacculus *	*Dinophysis*	*sacculus*	Dinoflagellata	pSNCM	
D.tripos *	*Dinophysis*	*tripos*	Dinoflagellata	pSNCM	
Euglena sanguinea	*Euglena*	*sanguinea*	Euglenozoa	CM	
Fibrocapsa japonica	*Fibrocapsa*	*japonica*	Ochrophyta	CM	
Gonyaulax spinifera	*Gonyaulax*	*spinifera*	Dinoflagellata	CM	
Gymnodinium spp.	*Gymnodinium*		Dinoflagellata	CM*	* various CM species within this genus
Gymnodinium catenatum	*Gymnodinium*	*catenatum*	Dinoflagellata	CM	
Heterosigma akashiwo	*Heterosigma*	*akashiwo*	Ochrophyta	CM	
Karenia mikimotoi	*Karenia*	*mikimotoi*	Dinoflagellata	CM	
Lepidodinium chlorophorum	*Lepidodinium*	*chlorophorum*	Dinoflagellata	CM	

Lingulodinium polyedrum	*Lingulodinium*	*polyedrum*	Dinoflagellata	CM	
Nodularia spumigena [Cyanobact.]	*Nodularia*	*spumigena*	Cyanobacteria	P	
Oscillatoria spp [Cyanobact.]	*Oscillatoria*		Cyanobacteria	P	
Pfiesteria spp.	*Pfiesteria*		Dinoflagellata	pSNCM*	*includes pSNCM species *Pfiesteria piscicida*
Phaeocystis spp.	*Phaeocystis*		Haptophyta	CM*	* various CM species within this genus
Phaeocystis globosa	*Phaeocystis*	*globosa*	Haptophyta	CM	
Phalacroma mitra	*Phalacroma*	*mitra*	Dinoflagellata	pSNCM	
Phalacroma rotundata*	*Phalacroma*	*rotundata*	Dinoflagellata	pZ	
Prorocentrum spp.	*Prorocentrum*		Dinoflagellata	CM*	* various CM species within this genus
Prorocentrum lima	*Prorocentrum*	*lima*	Dinoflagellata	CM	
Protoceratium reticulatum	*Protoceratium*	*reticulatum*	Dinoflagellata	CM	
Prymnesium parvum	*Prymnesium*	*parvum*	Haptophyta	CM	
Pseudo-nitzschia spp.	*Pseudo-nitzschia*		Diatomea	P	
Pyrodinium spp.	*Pyrodinium*		Dinoflagellata	TBC	not yet checked for phagotrophic capability

3.6 Conclusions

- The contracted task has been completed, with an alignment of plankton species in the *Master Plankton Species List* to mixoplankton functional types.
- From **Table 1**, and other data sources, it is apparent that mixoplankton are not well sampled/recorded from UK waters. Thus, **Table 1** emphasises certain large robust and enigmatic species (e.g., *Tripos*), HAB species (*Dinophysis*, *Karenia*), but also the forams that are not routinely recorded unless appropriate methods are deployed.
- At the other end of the size spectrum, various small CM species are poorly recorded. This, for example, includes *Teleaulax*, which must be present as these provide the plastids for *Mesodinium* and *Dinophysis*, both of which are recorded frequently.

3.7 Recommendations

- There is a clear need for the *Master Plankton Species List* to be updated in a systematic fashion to remove the remaining errors and inconsistencies.
- Until the update has been undertaken, the *Master Plankton Species List* database (both the previous versions, v7 and v8, and the new version including the mixoplankton entries – see **Appendix 1**) should be used with caution.
- Implications from the structuring of the database, and the data in **Table 1**, are that plankton sampling and identification protocols used in survey and monitoring of UK waters are suboptimal for mixoplankton (and thence likely other microbial plankton).
- The *EA Nuisance and Harmful Phytoplankton Species List* is relatively free from errors; these have been updated to align with the mixoplankton paradigm and may be used as they are.

4. Review of Monitoring methods

4.1 Introduction

This section contains methods on how to sample, preserve and analyse mixoplankton abundance and diversity directly from natural environments.

As mixoplankton are fully integrated constituents of the protist community, many of the sampling strategies and techniques described here are applicable also to phytoplankton and protist-zooplankton. Continuous and autonomous methods of sampling and identification of environmental parameters required to contextualise drivers of changes in diversity are not described here.

To draw explicit attention to any special recommendations to handle mixoplankton, in comparison with other plankton, each protocol carries a text box alerting the reader to any specific aspects.

Key amongst these is that, as a group, mixoplankton are relatively fragile and are easily damaged so complicating identification and counting.

4.2 Sample collection

Various studies have highlighted the importance of establishing effective protocols for field sampling of mixoplankton (Mitra *et al.,* 2021 and references therein). For biodiversity studies, it is crucial to properly define the sampling effort in order to correctly interpret the final data (Leles *et al.,* 2017, 2019). The plankton communities show different degree of sensitivity to sampling procedures, with some organisms being more robust than others. As a result, data (qualitative and quantitative) on the more fragile species are jeopardised. Special care should therefore be taken when sampling, both with respect to the logistics of sampling the water (spatial scales aspects over the water column) and subsampling for species identification and enumeration.

4.2.1 Sampling methods

Recommendations for mixoplankton: Mixoplankton are often fragile members of the plankton, and their cells are easily disrupted. Sampling methods should account for the fragility of these organisms. Hydrostatic shock, turbulence and shear stress are particularly problematic.

According to the current protocols, discrete samples are taken at ca. 1 m depth at set locations. However, such an approach can over- or under- estimate the plankton biomass and diversity as plankton communities are not homogenously distributed in the water column (Kamykowski *et al.,* 1998). Various mixoplankton (notably larger dinoflagellates and species such as *Heterosigma*) may undergo diel vertical migration, while others may also alter their

location in response to changing light and nutrient/prey conditions. Sampling at different times of the day at single depths can thus be problematic.

Recommendations for all protist plankton including mixoplankton: Sample at multiple depths according to the physical, chemical and biological characteristics of the water column.

Additional steps required includes being particularly careful not to subject the samples to hydrodynamic, light and/or temperature shock/s. Accordingly, the following should be considered:

- minimise flow rates and maximise orifice diameters (pipes, pipettes) when pouring or transferring samples;
- shield samples taken from the field from exposure to high light or elevated temperatures;
- transfer samples in bottles that have a minimal free air space;
- do not shake bottles to mix contents prior to subsampling; gently invert or roll them, or gently swirl if in a flask;
- transfer samples gently with a pipette (both filling and dispensing), using a wide-orifice tip; plastic tips should be cut to double the orifice diameter.

4.2.2 Sampling tools and equipment

According to the current protocols, water samples are taken by means of bottles and stored for further analysis. The following considers each of the main mixoplankton groups.

Recommendations for mixoplankton: Mixoplankton include fragile and cryptic species. Routine sampling with bottles at fixed depths may be inappropriate. Collect samples into dark (not clear) bottles, or otherwise shield the same from bright light.

Amber glass or polypropylene bottles are often used.

As with all plankton sampling, bottles should be gently filled and emptied with the local seawater, immediately prior to filling with the actual sample.

Statistically, it is preferable to take many smaller sample volumes than one large volume (e.g., 5x 200 mL rather than 1x 1L).

4.2.2.1 Generalist Non-Constitutive Mixoplankton (GNCM)

If water samples are collected with bottles, it is preferable for those to be equipped with a silicon tube by which subsamples may be siphoned off to decrease organism loss due to hydro-mechanical disturbance (**Figure 8**). The outlet of the tube should be such that splashing and similar disturbance generating shear stress is minimised.

Figure 8. Silicon tube used to decrease organism loss and damage when water samples are collected into amber glass bottles from Niskin bottles.

4.2.2.2 Specialist Non-Constitutive Mixoplankton (SNCM)

The absence of Rhizarians (mixoplankton and protist zooplankton), especially the foraminiferans (**Table 1**), within the current *Plankton Species Master List* is suggestive of an inadequacy in current monitoring techniques. For these endosymbiotic mixoplankton and protist zooplankton (e.g., Foraminiferans, Radiolarians), sampling using slow horizontal plankton net tows (**Figure 9**) have been shown to be the best compromise between ease of sampling and preserving cell quality (Graham *et al.,* 1976; Mansour *et al.,* 2020). Slow vertical net hauls may also be used.

Figure 9. Field sampling for Rhizaria using plankton nets. Rhizaria include important climate indicator species belonging to Acantharia, Collodaria, Foraminifera.

4.2.2.3 Constitutive Mixoplankton (CM)

Constitutive mixoplankton for the most part equate to non-diatom protist phytoplankton. The greatest challenge is presented in handling the relatively delicate larger flagellates (notably dinoflagellates), and in identification of the smaller flagellates (ca. <3 µm). In general, it is best to use similar protocols to those described below for GNCM and SNCM species in order to minimize physical damage to the cells.

Accordingly, sampling and samples should be handled with care to keep hydrodynamic forces (turbulence, shear) at a minimum, and to avoid exposure to high light and elevated temperature.

4.2.3 Filter fractionation

Recommendations for mixoplankton: Handle with care to minimise turbulence, shear stress and exposure to air.

Any water sample collected by bottle should be preserved or fractionated immediately. This is because the presence of predators (especially in samples concentrated in a plankton net) will rapidly negatively impact the plankton community structure.

Filter fractionation should be undertaken using a reverse flow method in which the filtration tower is floated in a beaker of the sample, and the filtered water then gently removed from within the tower as the tower sinks through the sample. On no account should fractionation be undertaken by pouring the water through the filter mesh in such a way that gravity and exposure to the air will further subject the plankton to physical stress.

4.3 Sample preservation

Recommendations for mixoplankton: In general, the minimum amount of preservative to fix material should be used as mixoplankton are fragile and their shape and internal contents are key defining characteristics for identification. The situation is particularly acute for the smallest, and also the largest forms (e.g., eSNCM colonial Radiolaria). Identification should be performed as soon as practically possible.

Samples should be preserved immediately for further analyses.

- Fixatives: acid Lugol´s solution, formaldehyde or glutaraldehyde solution; final concentration 2% v/v. Add Borax to the formaldehyde in excess (1-2% w/v) to keep stable at pH 7.
- Stains: Calcofluor (for polysaccharide; can be used to stain thecal plates in armoured dinoflagellates), DAPI (for nucleic acids), LysoTracker Green (acidotropic probe for food vacuoles).

The preservative used must guarantee a good recognition of taxa at least during the storage period of the samples. The most frequently used preservatives in phytoplankton research are Lugol's solution (basic Lugol if intact coccolithophorids are examined, otherwise acid Lugol and adaptations of it) and formaldehyde-based solutions.

According to Stoecker *et al.* (1994), formaldehyde fixation may underestimate the total ciliate abundance by up to 65%. Acid Lugol's solution is considered the most effective fixative in terms of ciliate cell loss (Gifford 1985; Leakey *et al.,* 1996) but does not allow observation of chloroplast autofluorescence.

Particularly for eSNCM Radiolaria ethanol alcohol fixation would work up to some degree but some loss is expected. Borax formaldehyde would also work for single celled but not for colonial Radiolaria.

Recommendations for mixoplankton: Since both fixative methods have advantages and disadvantages, it is recommended to count duplicate samples fixed by both methods (Lugol's and formaldehyde).

For identification and enumeration of organisms under microscope, duplicate water samples (200-1000 mL, depending on trophic status of the environment and depth) are collected from the desired depth into different amber glass or polypropylene bottles as follows:

- one containing Lugol´s solution (1-2% v/v final concentration), and,
- the other containing borax-buffered formalin or glutaraldehyde (final borax concentration 1-2% w/v, pH 7).

4.4 Sample storage

Recommendations for mixoplankton: No additional steps required; handle as per preserved phytoplankton and/or protist zooplankton.

Samples preserved with Lugol's solution should always be stored in darkness and ideally refrigerated (4-5°C; not higher than 10°C). Aldehyde samples should be stored frozen, preferably at -80°C, until staining. It is best to filter the environmental samples onto filters used for enumeration as soon as possible after sampling, unless the samples are quantified using a flow cytometer.

4.5 Identification & quantification of mixoplankton diversity and biomass

Recommendations for mixoplankton: Most mixoplankton are motile. If possible, observing (and filming) water immediately after sampling can provide a useful overview of what plankton are present. Motile plankton are especially obvious, although they can rapidly swim away from the bright light of a microscope and hide in the corners of a counting chamber.

4.5.1 Equipment

Recommendations for mixoplankton: Mixoplankton are members of the protist plankton that have hitherto been characterised as "phytoplankton" or "protist zooplankton". Typically, the same equipment used for standard plankton analyses can be deployed. However, as mixoplankton combine both phototrophy and phagotrophy in the same cell, protocols used for "phytoplankton" and for "protist zooplankton" are required together.

- Inverted light microscope equipped with camera (and, ideally, also equipped for epifluorescence), with software for measurement of an organisms' linear dimensions.

- Epifluorescence microscope
- Glass trays
- Counting and sedimentation chambers (Utermöhl and Sedgewick Rafter)
- Flow cytometer
- FlowCam or similar flow-image-analysis

4.5.2 Light microscopy methods for mixoplankton >10 µm in diameter

Mixoplankton >15µm can be enumerated from the Lugol's preserved samples using plate counting chambers in accordance with Utermöhl (1958) on an inverted light microscope at 200x magnification. The volume of sample to be settled in the counting chamber is adjusted depending on the biomass richness of the water sample, so that a representative number of organisms can be enumerated (ideally, for statistical reasons, at least 200 cells).

The microscope should ideally be equipped with a camera to acquire images of the organisms to aid in the measurement of linear dimensions. Cellular linear dimension can be measured with image software such as CellSense or ImageJ, provided that the images are calibrated with appropriate reference scales. Cellular biovolumes can then be calculated based on linear cellular dimensions using geometric formulas according to Hillebrand *et al.* (1999). This serves to convert cell counts (cells L^{-1}) into carbon mass (µg C L^{-1}) according to carbon to volume relationship recorded in the literature (e.g., Menden-Deuer & Lessard 2000; Mansour *et al.,* 2020).

The ability to identify members of the plankton relates directly to the experience of the operator and is, thus, typically not accurate beyond the genus level. It is strongly recommended that analyses are processed by the same person.

Further analysis of the glutaraldehyde preserved samples can be carried out. Glutaraldehyde preserved organisms can be collected on polycarbonate filters of 2 µm pore size and stained with Calcofluor (Andersen & Kristensen 1995) and DAPI (Porter & Feig 1980). These are then inspected with epifluorescence microscopy with light sources and filters of appropriate wavelengths to detect the fluorophores (UV light for DAPI and Calcoflour: excitation wavelength 350nm - emission 450 nm; blue or red light for chlorophyll: excitation wavelength 400nm or 700nm - emission 750 nm). This allows for a deeper characterization of the organisms morphotype than when observed in the Lugol's samples. Calcoflour stains thecal plates of armoured dinoflagellates helping in the morphological identification; DAPI stains cell nuclei helping the count of colonial organisms.

Recommendations for mixoplankton: Chlorophyll emission would reveal the presence of chloroplasts in either Constitutive Mixoplankton, which are not identifiable only based on morphology, or in Non-Constitutive Mixoplankton, which are rarely distinguishable from their purely heterotrophic counterpart if only based on morphology (especially ciliates).

Samples on filters can be frozen (-20°C) and stored for several years without losing their quality, though storage at 4°C suffices if examined within few days. Samples preserved samples with Lugol's have to be examined within months to avoid cell loss. Lugol's fixation is preferable because of handling (less toxic for the operator and the environment) and the broad effectiveness on the different organism types in the population.

Another approach, mainly for NCM (especially ciliates), is to examine formaldehyde fixed samples under an inverted epifluorescence microscope (in a similar way as for Lugol's fixed samples, see above), because formaldehyde allows for the observation of the autofluorescence of chloroplasts.

Since both fixative methods have advantages and disadvantages, it is recommended to counter duplicate samples fixed with both fixatives (Karayanni *et al.,* 2004; Romano *et al.,* 2021).

4.5.3 Flowcytometry methods for mixoplankton <5 µm in diameter

Mixoplankton of these sizes are more reliably enumerated with automated cell counters (e.g., flow cytometry), and are generally identified at class level, based on the pigments content detected via fluorescent emission under different excitation wavelengths (Anderson & Hansen 2020).

Samples for flow cytometry have to be preserved with transparent fixatives (like glutaraldehyde) and can be treated with LysoTracker Green (*a posteriori*) to stain acidic intracellular compartments, to detect the presence of (acidic) food vacuoles according to the protocol from Sintes & del Giorgio (2010). This allow the enumeration of organisms which were presumably actively feeding at the moment of sampling/fixation. Combining the chlorophyll fluorescent signal and the fluorescent signal of LysoTracker it is possible to enumerate CM species within the phytoflagellates population. If a flow cytometer is not available, samples fixed in glutaraldehyde or formaldehyde can be filtered onto Nuclepore filters and cells <15 µm enumerated using epifluorescence microscopy.

4.5.4 FlowCam or similar flow-image-analysis methods for mixoplankton >5 µm in diameter

These instruments can be used on un-preserved (fresh) samples or on preserved samples. They can provide rapid identification (using AI-assisted image analysis taught using suitable image libraries) and enumeration. Sample invariably require size fractionation to minimize the risks of clogging flow cells. This step must be undertaken using the precautions mentioned above.

4.6 Mixoplankton physiology

Mixoplankton engage in C-fixation (contributing to primary production) and predation. These processes operate in unison, synergistically, most obviously through the internal recycling of nutrients that would otherwise be regenerated during prey digestion in support of phototrophy (Mitra & Flynn 2023).

To track mixoplankton physiology is complex, and as yet no single approach is available, leaving the scientist with the option to measure primary production and predation through methods developed for phytoplankton and protist zooplankton.

4.6.1 Primary production

Size fractioning can be employed to estimate primary production in the different mixoplankton compartments: photosynthetic nanoplankton (bacterivorous CM) and photosynthetic microplankton (which include both CM and NCM species). Numerous techniques are generally employed to estimate primary production rates. Rough estimates can be derived from interpolation of chlorophyll a concentration and irradiance level in the water sample (Ryther & Yentsch 1957). However, rates are better estimated by measuring the development of the oxygen concentration in the illuminated water sample via O_2 sensors (Walker 1987) or the incorporation of carbon isotopes (^{14}C) into the biomass of the organisms (Steemann Nielsen 1952).

Warning: None of these methods can distinguish primary production associated with CM or NCM species from primary production of strict photo-autotrophic phytoplankton within the same population. However, if the measurements of such rates are associated with the identification and quantification of the organism functional types in the sample, then the specific contribution of mixoplankton to primary production may be roughly deducted from laboratory determined photosynthetic rates of known species. A similar approach may be used to partition rates of predation.

4.6.2 Fluorometric analysis

The last two decades has seen the development, and increasingly common, deployment of instruments that exploit the fact that the *in vivo* fluorescence signature of chloroplasts, when conducted in a certain fashion, yields information about the photo-physiological status of the organisms, and can give a handle on primary production as well (e.g., Suggett *et al.,* 2009; Robinson *et al.,* 2014; Aardema *et al.,* 2019). How these signatures vary in mixoplankton of different functional types, feeding in different ways in response to different environmental clues, is unknown. At present, it is assumed (and instruments tested against the assumption) that the methods are interrogating “phytoplankton” only. The same problem applies, of course, to measurements using ^{14}C or O_2 protocols. With the sensitivity of fluorometric methods, however, there is scope to deploy protocols at much higher spatial and temporal scales.

Warning: It is important to refer to production rates estimated using fluorometric analysis (and indeed O_2 and ^{14}C methods) as primary production rates of phytoplankton **and** mixoplankton, and not to attribute them to ‘phytoplankton’ only (e.g., ‘phytoplankton production’).

There is an urgent need to conduct laboratory and then field trials using fluorometric methods both to attempt to disentangle “phytoplankton” versus “mixoplankton” signals, and because of the potential of the methods to actually usefully separate those signals to get a better handle on the balance of photo- and phago- trophy.

4.6.3 Specific recommendations for different mixoplankton functional groups

4.6.3.1 Constitutive Mixoplankton (CM)

CM species are invariably classified traditionally as phytoplankton, and emphasis will be placed on phototrophy, using the usual suite of methodologies directed at C-fixation (^{14}C, O_2, PAM, etc.).

4.6.3.2 Generalist Non-Constitutive Mixoplankton (GNCM)

Photosynthetic rates of GNCM ciliates can be measured on single cells, that have been manually isolated from natural sea water samples with a drawn Pasteur pipette, applying the ^{14}C technique by Rivkin & Seliger (1981). Ciliate cells would have to be first rinsed in filtered sea water (FSW) and then incubated for some hours in the light in small volume of filtered seawater (2 mL) spiked with $NaH^{14}CO_3$. At the end of the incubation, samples have to be acidified and dried so that only organic carbon would remain in the incubation vial. This allows measurement of the amount of isotope which has been incorporated into the ciliate biomass, and thus calculation of carbon incorporation rates as pgC $cell^{-1}$ h^{-1}.

4.6.3.3 Specialist Non-Constitutive Mixoplankton (SNCM)

As for GNCM, photosynthetic rates can be measured on manually isolated single cells. It is generally not possible to establish cultures of eSNCM species (such as Radiolaria) and maintain them in the laboratory; this makes the ^{14}C technique more difficult to implement due to regulations on conducting experiments using radioisotopes on small boats often used to sample these organisms.

Alternatively, though less sensitive (more cells needed), stable isotopes (^{13}C, ^{15}N) can be employed. This has the added benefit of also allowing the simultaneous measurement of nitrogen uptake rates in addition to carbon uptake rates. Similar to the ^{14}C methodology, cells are incubated in FSW spiked with $NaH^{13}CO_3$. After which the specimens are deposited individually (or filtered) on pre-combusted GF/F filters. Controls are needed of an unlabelled spike and dark incubation. Specimens on filters are dried at 60°C and kept in the dark for EA-IRMS analysis.

4.7 Conclusion

Determining the contribution of mixoplankton to plankton ecology is complex. The most important first step is simply to appreciate that organisms formally termed ‘phytoplankton’ include a very different set of organisms. The term ‘phytoplankton’ must be reserved specifically for those microalgae that are unable to feed. A challenge here is that many organisms that we did not realise can feed can in fact do so. It is likely that the more we look for feeding in ‘phytoplankton’, the more we shall find can do it and are thus truly mixoplankton.

As a group, mixoplankton are more fragile than the prokaryote cyanobacteria and diatoms that comprise most of the phytoplankton. The mixoplankton are also motile (cyanobacteria and diatoms are not). To determine the contribution of mixoplankton to total microbial

plankton biomass, biodiversity and ecology is non trivial. However, as most of these organisms are important in trophic webs leading to fisheries, or conversely are noxious/harmful species (HAB), it is important to track their presence and activities.

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6. Appendix 1

This appendix lists the Excel files names for each list, together with a brief commentary. The source files were provided by the contractor.

New file name	Source file name	Comment
Masterlist_V7&V8 - Mixoplankton alignment Format: MS Excel	• Masterlist-V7_working • Masterlist_V8 Format: Excel	Updated *Master Plankton Species List*; note this contains various errors affecting non-mixoplankton species.
-	Annex 2_WER Reduced Taxon List Format: Excel	The *Reduced Taxon List was* last updated in 2014. It has various errors and requires significant effort for revision.
EA Nuisance and Harmful Microalgae Species List Format: MS Excel	Annex 3_EA Nuisance and Harmful Phytoplankton Species List Format: Excel	Updated *EA Nuisance and Harmful Phytoplankton Species List*

7. Appendix 2

The following pages provide a table documenting salient components from the Excel file entitled:

Masterlist_V7&V8 - Mixoplankton alignment

This file represents the modified *Master Plankton Species List* identifying mixoplankton.

COLOUR CODE KEY
alignment to functional groups under the mixoplankton paradigm
incorrect information in Masterlist
repeat entries
new entry in *Master Plankton Species List version 8*
corrected information

PLANKTON TYPE KEY	
pZ:	protist zooplankton
GNCM:	generalist non-constitutive mixoplankton
pSNCM:	plastidic specialist non-constitutive mixoplankton
eSNCM:	endosymbiotic specialist non-constitutive mixoplankton
CM:	constitutive mixoplankton
P:	phytoplankton
TBC:	to be confirmed

FROM Master Plankton List V7 & v8		Species names (incl. corrections)	FROM Master List V7 & v8		REVISED plankton type	REVISED Plankton group
Aphia ID	Taxon		OLD Plankton Type	OLD Phytoplankton & Protozoa groups		
235747	Acantharea		Protozoa	Radiolaria		
586732	Acantharia		Protozoa	Radiolaria	eSNCM*	Radiolaria
183556	*Acanthostomella norvegica*	*Acanthostomella norvegica*	Protozoa	Ciliate	TBC	Ciliophora
369319	*Actinomonas*		Protozoa	-	CM*	Ochrophyta
231787	*Akashiwo*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232546	*Akashiwo sanguinea*	*Akashiwo sanguinea*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109470	*Alexandrium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109470	*Alexandrium*		Phytoplankton	Dinoflagellate	CM*	
109470	*Alexandrium*		Phytoplankton	Dinoflagellate	CM*	
109707	*Alexandrium affine*	*Alexandrium affine*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
246835	*Alexandrium andersonii*	*Alexandrium andersonii*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
231873	*Alexandrium catenella*	*Alexandrium catenella*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109710	*Alexandrium leei*	*Alexandrium leei*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233447	*Alexandrium margalefii*	*Alexandrium margalefii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109711	*Alexandrium minutum*	*Alexandrium minutum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109712	*Alexandrium ostenfeldii*	*Alexandrium ostenfeldii*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata

233469	*Alexandrium pseudogoniaulax*	*Alexandrium pseudogoniaulax*	Phytoplankton	Dinoflagellate	CM	
109713	*Alexandrium pseudogonyaulax*	*Alexandrium pseudogonyaulax*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109714	*Alexandrium tamarense*	*Alexandrium tamarense*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
388924	*Alexandrium tamutum*	*Alexandrium tamutum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
605376	Amoeba		Protozoa	Protozoa	pZ	TBC
109473	*Amphidinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109718	*Amphidinium acutissimum*	*Amphidinium acutissimum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109723	*Amphidinium carterae*	*Amphidinium carterae*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109726	*Amphidinium crassum*	*Oxytoxum lohmannii*	Phytoplankton	Dinoflagellate	pZ	
232584	*Amphidinium glaucum*	*Amphidinium glaucum*	Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
109731	*Amphidinium herdmanii*	*Amphidinium herdmanii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109740	*Amphidinium latum*	*Amphidinium latum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109741	*Amphidinium longum*	*Amphidinium longum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109754	*Amphidinium sphenoides*	*Amphidinium sphenoides*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109517	*Amphidoma*		Phytoplankton	Dinoflagellate	TBC	TBC
233194	*Amphidoma acuminata*	*Amphidoma acuminata*	Phytoplankton	Dinoflagellate	TBC	TBC
110005	*Amphidoma caudata*	*Amphidoma caudata*	Phytoplankton	Dinoflagellate	TBC	TBC
231796	Amphidomataceae		Phytoplankton	Dinoflagellate	TBC	TBC
109459	*Amphisolenia*		Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
425527	Amphorellopsis		Protozoa	Ciliate	TBC	Ciliophora
109518	*Amylax*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233480	*Amylax buxus*	*Amylax triacantha var. buxus*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110007	*Amylax triacantha*	*Amylax triacantha*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
846758	*Amylax triacantha var. buxus*	*Amylax triacantha var. buxus*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
2	Animalia_Radiolaria		Phytoplankton	Protozoa	pZ*/eSNCM*	Radiolaria
248096	*Apedinella*		Phytoplankton	Silicoflagellate	TBC	Ochrophyta
248097	*Apedinella radians*	*Apedinella radians*	Phytoplankton	Silicoflagellate	TBC	Ochrophyta

248098	*Apedinella spinifera*	*Apedinella spinifera*	Phytoplankton	Silicoflagellate	TBC	Ochrophyta
836528	*Apicoporus*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
604918	*Archaeperidinium*		Phytoplankton	Dinoflagellate	TBC	TBC
624607	*Archaeperidinium minutum*	*Archaeperidinium minutum*	Phytoplankton	Dinoflagellate	TBC	TBC
415082	Ascampbelliella		Protozoa	Ciliate	TBC	Ciliophora
292898	*Askenasia stellaris*	*Askenasia stellaris*	Protozoa	Ciliate	TBC	Ciliophora
391508	*Azadinium*		Phytoplankton	Dinoflagellate	TBC	TBC
837075	*Azadinium caudatum*	*Azadinium caudatum*	Phytoplankton	Dinoflagellate	TBC	TBC
391509	*Azadinium spinosum*	*Azadinium spinosum*	Phytoplankton	Dinoflagellate	TBC	TBC
292899	Balanion		Protozoa	Ciliate	TBC	Ciliophora
427290	*Balanion comatum*	*Balanion comatum*	Protozoa	Ciliate	TBC	Ciliophora
1371463	*Barrufeta resplendens*	*Barrufeta resplendens*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
105557	*Bicosta minor*	*Bicosta minor*	Protozoa	Choanoflagellate	TBC	Choanoflagellata
105558	*Bicosta spinifera*	*Bicosta spinifera*	Protozoa	Choanoflagellate	TBC	Choanoflagellata
626298	*Biecheleria halophila*	Biecheleria halophila	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109548	Blepharocysta		Phytoplankton	Dinoflagellate	TBC	TBC
110178	Blepharocysta paulsenii	*Blepharocysta paulsenii*	Phytoplankton	Dinoflagellate	TBC	TBC
231802	*Bysmatrum*		Phytoplankton	Dinoflagellate	CM	Dinoflagellata
493993	Calciodinelloideae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
105506	Calliacantha		Protozoa	Protozoa	TBC	TBC
105559	*Calliacantha longicaudata*	*Calliacantha longicaudata*	Protozoa	Protozoa	TBC	TBC
105561	*Calliacantha natans*	*Calliacantha natans*	Protozoa	Protozoa	TBC	TBC
109526	*Centrodinium*		Phytoplankton	Dinoflagellate	TBC	TBC
109421	Ceratiaceae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109506	*Ceratium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109506	*Ceratium*		Phytoplankton	Dinoflagellate		
109506	*Ceratium*		Phytoplankton	Dinoflagellate		
156509	*Ceratium arcticum*	*Tripos longipes*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata

109929	*Ceratium arietinum*	*Tripos arietinus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
844439	*Ceratium articum*		Phytoplankton	Dinoflagellate		
109930	*Ceratium azoricum*	*Tripos azoricus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109931	*Ceratium belone*	*Tripos belone*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109932	*Ceratium breve*	*Tripos brevis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
196820	*Ceratium bucephalum*	*Tripos bucephalus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109934	*Ceratium buceros*	*Tripos buceros*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109935	*Ceratium candelabrum*	*Tripos candelabrum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109936	*Ceratium carriense*	*Tripos carriensis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109939	*Ceratium compressum*	*Tripos compressus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109940	*Ceratium concilians*	*Tripos concilians*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109941	*Ceratium contortum*	*Tripos contortus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109943	*Ceratium declinatum*	*Tripos declinatus*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109947	*Ceratium extensum*	*Tripos extensus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109948	*Ceratium falcatiforme*	*Tripos falcatiformis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109949	*Ceratium falcatum*	*Tripos falcatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109950	*Ceratium furca*	*Tripos furca*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109951	*Ceratium fusus*	*Tripos fusus*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109952	*Ceratium geniculatum*	*Tripos geniculatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109953	*Ceratium gibberum*	*Tripos gibberus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109955	*Ceratium hexacanthum*	*Tripos hexacanthus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
156511	*Ceratium hirundinella*	*Ceratium hirundinella*	Phytoplankton	Dinoflagellate	NYA	Dinoflagellata
109956	*Ceratium horridum*	*Tripos horridus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
422708	*Ceratium horridum var. buceros*	*Ceratium horridum var. buceros*	Phytoplankton	Dinoflagellate	NYA	Dinoflagellata
109958	*Ceratium inflatum*	*Tripos inflatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109960	*Ceratium karstenii*	*Tripos karstenii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109961	*Ceratium kofoidii*	*Tripos kofoidii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109962	*Ceratium limulus*	*Tripos limulus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

109963	*Ceratium lineatum*	*Tripos lineatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109964	*Ceratium longipes*	*Tripos longipes*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109965	*Ceratium longirostrum*	*Tripos longirostrum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
196822	*Ceratium lunula*	*Tripos lunula*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109967	*Ceratium macroceros*	*Tripos macroceros*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109968	*Ceratium massiliense*	*Tripos massiliensis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109969	*Ceratium minutum*	*Tripos minutus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109971	*Ceratium pavillardii*	*Tripos pavillardii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109972	*Ceratium pentagonum*	*Tripos pentagonus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
196824	*Ceratium platycorne*	*Tripos platycornis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109974	*Ceratium pulchellum*	*Tripos pulchellus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109975	*Ceratium ranipes*	*Tripos ranipes*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109977	*Ceratium setaceum*	*Tripos setaceus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109979	*Ceratium symmetricum*	*Tripos symmetricus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109980	*Ceratium teres*	*Tripos teres*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109981	*Ceratium trichoceros*	*Tripos trichoceros*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109982	*Ceratium tripos*	*Tripos muelleri*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109983	*Ceratium vultur*	*Tripos vultur*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109507	*Ceratocorys spp.*		Phytoplankton	Dinoflagellate	TBC	TBC
109508	Ceratoperidinium		Phytoplankton	Dinoflagellate	TBC	TBC
577493	Cercomonas		Protozoa	Euglenozoa	TBC	TBC
233776	*Chattonella*		Phytoplankton	Raphidophyte	CM*	Ochrophyta
233778	*Chattonella antiqua*	*Chattonella marina var. antiqua*	Phytoplankton	Raphidophyte	CM	Ochrophyta
547444	*Chattonella marina var. antiqua*	*Chattonella marina var. antiqua*	Phytoplankton	Raphidophyte	CM	Ochrophyta
160583	Chattonellaceae		Phytoplankton	Raphidophyte	CM*	Ochrophyta
160582	Chattonellales		Phytoplankton	Raphidophyte	CM*	Ochrophyta
562871	Choanofila		Protozoa	Protozoa	TBC	TBC

1444150	Choanoflagellata		Protozoa	Protozoa	TBC	TBC
580116	Choanoflagellatea		Protozoa	Protozoa	TBC	TBC
25	Choanoflagellida		Protozoa	Protozoa	TBC	TBC
562870	Choanozoa		Protozoa	Protozoa	TBC	TBC
7	Chromista		Phytoplankton	Phytoplankton	P	various
115090	*Chrysochromulina*		Phytoplankton	Haptophyte	CM*	Haptophyta
615467	*Chrysochromulina birgeri*	*Chrysochromulina birgeri*	Phytoplankton	Haptophyte	CM*	Haptophyta
573836	*Chrysochromulina camella*	*Chrysochromulina camella*	Phytoplankton	Haptophyte	CM	Haptophyta
115116	*Chrysochromulina ericina*	*Haptolina ericina*	Phytoplankton	Haptophyte	CM	Haptophyta
115119	*Chrysochromulina hirta*	*Haptolina hirta*	Phytoplankton	Haptophyte	CM	Haptophyta
115126	*Chrysochromulina parkeae*	*Chrysochromulina parkeae*	Phytoplankton	Haptophyte	CM*	Haptophyta
571998	*Chrysochromulina parva*	*Chrysochromulina parva*	Phytoplankton	Haptophyte	CM*	Haptophyta
115127	*Chrysochromulina polylepis*	*Prymnesium polylepis*	Phytoplankton	Haptophyte	CM	Haptophyta
115128	*Chrysochromulina pringsheimii*	*Chrysochromulina pringsheimii*	Phytoplankton	Haptophyte	CM	Haptophyta
115129	*Chrysochromulina spinifera*	*Chrysochromulina spinifera*	Phytoplankton	Haptophyte	CM*	Haptophyta
146192	Chrysomonada		Protozoa	Chrysomonad	P	
837255	*Chrysotila carterae*	*Chrysotila carterae*	Phytoplankton	Haptophyte	TBC	Haptophyta
125741	Ciliata		Protozoa	Ciliate	GNCM*/pSNCM*/pZ*	Ciliophora
11	Ciliophora		Protozoa	Ciliate	GNCM*/pSNCM*/pZ*	Ciliophora
375958	*Ciliophrys infusionum*	*Ciliophrys infusionum*	Phytoplankton	Silicoflagellate	TBC	TBC
109509	*Cladopyxis*		Phytoplankton	Dinoflagellate	TBC	TBC
233351	*Cladopyxis claytonii*	*Cladopyxis claytonii*	Phytoplankton	Dinoflagellate	TBC	TBC
233352	*Cladopyxis setifera*	*Cladopyxis setifera*	Phytoplankton	Dinoflagellate	TBC	TBC
178597	Coccolithaceae		Phytoplankton	Haptophyte	CM*	Haptophyta
493821	Coccolithales		Phytoplankton	Haptophyte	CM*	Haptophyta
235993	Coccolithophorid		Phytoplankton	Haptophyte	CM*	Haptophyta
592906	Coccolithophyceae		Phytoplankton	Haptophyte	CM*	Haptophyta

178598	*Coccolithus*		Phytoplankton	Haptophyte	CM*	Haptophyta
843999	*Coccolithus braarudii*	*Coccolithus braarudii*	Phytoplankton	Haptophyte	CM	Haptophyta
178600	*Coccolithus pelagicus*	*Coccolithus pelagicus*	Phytoplankton	Haptophyte	CM*	Haptophyta
555900	*Coccolithus pelagicus f. hyalinus*	*Coccolithus pelagicus f. hyalinus*	Phytoplankton	Haptophyte	CM*	Haptophyta
109474	*Cochlodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109766	*Cochlodinium helicoides*	*Cochlodinium helicoides*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
663581	*Cochlodinium helix*	*Cochlodinium helix*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232650	*Cochlodinium polykrikoides*	*Cochlodinium polykrikoides*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109773	*Cochlodinium pupa*	*Cochlodinium pupa*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
204197	Codonellopsis		Protozoa	Ciliate	CM*	Ciliophora
109534	*Coolia*	*Coolia sp.*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110130	*Coolia monotis*	*Coolia monotis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109527	*Corythodinium*		Phytoplankton	Dinoflagellate	TBC	TBC
233754	*Corythodinium curvicaudatum*	*Corythodinium curvicaudatum*	Phytoplankton	Dinoflagellate	TBC	TBC
149110	*Corythron criophilum*	*Corythron criophilum*	Phytoplankton	Dinoflagellate	TBC	TBC
148915	Coscinodiscales		Phytoplankton	Dinoflagellate	P	Diatomeae
235759	*Coxliella helix*	*Coxliella helix*	Protozoa	Ciliate	TBC	Ciliophora
109998	*Crypthecodinium cohnii*	*Crypthecodinium cohnii*	Phytoplankton	Dinoflagellate	TBC	TBC
17644	Cryptomonadaceae		Phytoplankton	Cryptophyte	TBC	Cryptophyta
17640	Cryptomonadales		Phytoplankton	Cryptophyte	TBC	Cryptophyta
106282	*Cryptomonas*		Phytoplankton	Cryptophyte	TBC	Cryptophyta
106297	*Cryptomonas baltica*	*Cryptomonas baltica*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
155555	*Cryptomonas erosa*	*Cryptomonas erosa*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
248112	*Cryptomonas marssonii*	*Cryptomonas marssonii*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
155554	*Cryptomonas ovata*	*Cryptomonas ovata*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
572025	*Cryptomonas rostrata*	*Cryptomonas rostrata*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
1369826	*Cucumeridinium coeruleum*	*Cucumeridinium coeruleum*	Phytoplankton	Dinoflagellate	TBC	TBC

341295	Cyclotrichium		Protozoa	Ciliate	TBC	Ciliophora
134527	*Cymbomonas*		Phytoplankton	Chlorophyte	CM*	Chlorophyta
134545	*Cymbomonas tetramitiformis*	*Cymbomonas tetramitiformis*	Phytoplankton	Chlorophyte	CM	Chlorophyta
393573	*Cyrtostrombidium*	*Cyrtostrombidium*	Phytoplankton	Ciliate	GNCM*	Ciliophora
196830	*Cystodinium*	*Cystodinium*	Phytoplankton	Dinoflagellate	TBC	TBC
105513	Diaphanoeca		Protozoa	Protozoa	TBC	TBC
105571	*Diaphanoeca grandis*	*Diaphanoeca grandis*	Protozoa	Choanoflagellate	TBC	Choanoflagellata
105574	*Diaphanoeca sphaerica*	*Diaphanoeca sphaerica*	Protozoa	Choanoflagellate	TBC	Choanoflagellata
157258	*Dictyocha*		Phytoplankton	Silicoflagellate	TBC	Ochrophyta
375788	*Dictyocha crux*	*Dictyocha crux*	Phytoplankton	Silicoflagellate	TBC	Ochrophyta
157463	*Dictyocha fibula*	*Dictyocha fibula*	Phytoplankton	Silicoflagellate	TBC	Ochrophyta
157260	*Dictyocha speculum*	*Dictyocha speculum*	Phytoplankton	Silicoflagellate	TBC	Ochrophyta
157257	Dictyochaceae		Phytoplankton	Silicoflagellate	TBC	Ochrophyta
157256	Dictyochales		Phytoplankton	Silicoflagellate	TBC	Ochrophyta
146232	Dictyochophyceae		Phytoplankton	Silicoflagellate	TBC	Ochrophyta
341301	Didinium		Protozoa	Ciliate	TBC	Ciliophora
417328	*Didinium nasutum*	*Didinium nasutum*	Protozoa	Ciliate	TBC	Ciliophora
136761	Difflugia		Protozoa	Amoebozoa	pZ	TBC
157240	*Dinobryon*		Phytoplankton	Chrysophyte	CM*	Ochrophyta
160552	*Dinobryon balticum*	*Dinobryon balticum*	Phytoplankton	Chrysophyte	CM	Ochrophyta
157242	*Dinobryon bavaricum*	*Dinobryon bavaricum*	Phytoplankton	Chrysophyte		
619304	*Dinobryon belgicae*	*Dinobryon belgicae*	Phytoplankton	Chrysophyte	CM*	Ochrophyta
157246	*Dinobryon cylindricum*	*Dinobryon cylindricum*	Phytoplankton	Chrysophyte		
157248	*Dinobryon divergens*	*Dinobryon divergens*	Phytoplankton	Chrysophyte		
160553	*Dinobryon faculiferum*	*Dinobryon faculiferum*	Phytoplankton	Chrysophyte	CM	Ochrophyta
157254	*Dinobryon sociale*	*Dinobryon sociale*	Phytoplankton	Chrysophyte		
146203	Dinoflagellata		Phytoplankton	Dinoflagellate	pZ*/ pSNCM*/ eSNCM*/CM*	Dinoflagellata

146203	Dinoflagellata		Phytoplankton	Dinoflagellate		
19542	Dinophyceae		Phytoplankton	Dinoflagellate	pZ*/ pSNCM*/ eSNCM*/CM*	Dinoflagellata
19542	Dinophyceae		Phytoplankton	Dinoflagellate		
19542	Dinophyceae		Phytoplankton	Dinoflagellate		
19542	Dinophyceae		Phytoplankton	Dinoflagellate		
19542	Dinophyceae		Phytoplankton	Dinoflagellate		
19542	Dinophyceae		Phytoplankton	Dinoflagellate		
109406	Dinophysiaceae		Phytoplankton	Dinoflagellate	pZ*/ pSNCM*/ eSNCM*/CM*/P*	Dinoflagellata
109406	Dinophysiaceae		Phytoplankton	Dinoflagellate		
109406	Dinophysiaceae		Phytoplankton	Dinoflagellate		
109406	Dinophysiaceae		Phytoplankton	Dinoflagellate		
109406	Dinophysiaceae		Phytoplankton	Dinoflagellate		
109406	Dinophysiaceae		Phytoplankton	Dinoflagellate		
109390	Dinophysiales		Phytoplankton	Dinoflagellate	pZ*/ pSNCM*/ eSNCM*/CM*/P*	Dinoflagellata
109390	Dinophysiales		Phytoplankton	Dinoflagellate		
109462	*Dinophysis*		Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
109462	*Dinophysis*		Phytoplankton	Dinoflagellate		
109462	*Dinophysis*		Phytoplankton	Dinoflagellate		
109603	*Dinophysis acuminata*	*Dinophysis acuminata*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109604	*Dinophysis acuta*	*Dinophysis acuta*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
232155	*Dinophysis borealis*	*Dinophysis acuminata*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109612	*Dinophysis caudata*	*Dinophysis caudata*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109616	*Dinophysis dens*	*Dinophysis acuta*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109624	*Dinophysis fortii*	*Dinophysis fortii*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109627	*Dinophysis hastata*	*Dinophysis hastata*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
232496	*Dinophysis nasuta*	*Dinophysis nasuta*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
109637	*Dinophysis norvegica*	*Dinophysis norvegica*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata

109638	*Dinophysis odiosa*	*Dinophysis odiosa*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
646201	*Dinophysis ovum*	*Dinophysis ovum*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
581938	*Dinophysis ovum*	*Dinophysis fortii*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109649	*Dinophysis pulchella*	*Dinophysis pulchella*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
109651	*Dinophysis punctata*	*Dinophysis punctata*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
162793	*Dinophysis rotundata*	*Phalacroma rotundatum*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
232261	*Dinophysis sacculus*	*Dinophysis sacculus*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109659	*Dinophysis skagii*	*Dinophysis acuminata*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
109662	*Dinophysis tripos*	*Dinophysis tripos*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
110131	*Diplopelta asymmetrica*	*Diplopelta asymmetrica*	Phytoplankton	Dinoflagellate	TBC	TBC
109515	*Diplopsalis*		Phytoplankton	Dinoflagellate	TBC	TBC
110001	*Diplopsalis lenticula*	*Diplopsalis lenticula*	Phytoplankton	Dinoflagellate	TBC	TBC
109537	*Diplopsalopsis*		Phytoplankton	Dinoflagellate	TBC	TBC
155560	*Diplopsalopsis bomba*	*Diplopsalopsis bomba*	Phytoplankton	Dinoflagellate	TBC	TBC
110138	*Diplopsalopsis latipeltata*	*Diplopsalopsis latipeltata*	Phytoplankton	Dinoflagellate	TBC	TBC
110139	*Diplopsalopsis orbicularis*	*Diplopsalopsis orbicularis*	Phytoplankton	Dinoflagellate	TBC	TBC
109516	*Diplosalsis*		Phytoplankton	Dinoflagellate	TBC	TBC
146221	Discomitochondria		Protozoa	Protozoa	TBC	TBC
109569	*Dissodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110324	*Dissodinium pseudocalani*	*Dissodinium pseudocalani*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110325	*Dissodinium pseudolunula*	*Dissodinium pseudolunula*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110326	*Dissodium asymmetricum*	*Diplopsalopsis bomba*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
626979	*Distephanopsis staurodon*	*Distephanopsis staurodon*	Phytoplankton	Silicoflagellate	TBC	TBC
134530	*Dolichomastix*		Phytoplankton	Chlorophyte	CM*	Chlorophyta
178589	*Dunaliella*		Phytoplankton	Chlorophyte	P	Chlorophyta
248118	*Durinskia baltica*	*Durinskia baltica*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
118014	*Ebria*		Protozoa	Protozoa	TBC	TBC
118051	*Ebria tripartita*	*Ebria tripartita*	Protozoa	Protozoa	TBC	TBC

146208	Ebriaceae		Protozoa	Protozoa	TBC	TBC
115086	*Emiliania*		Phytoplankton	Haptophyte	CM*	Haptophyta
115104	*Emiliania huxleyi*	*Emiliania huxleyi*	Phytoplankton	Haptophyte	CM	Haptophyta
231803	*Ensiculifera*		Phytoplankton	Dinoflagellate	TBC	TBC
233835	*Ensiculifera carinata*	*Ensiculifera carinata*	Phytoplankton	Dinoflagellate	TBC	TBC
658366	*Entomosigma peridinioides*	*Entomosigma peridinioides*	Phytoplankton	Dinoflagellate	TBC	TBC
341668	*Epiplocylis undella*	*Epiplocylis undella*	Protozoa	Ciliate	TBC	Ciliophora
8012	Euglena		Protozoa	Protozoa	CM*	Euglenozoa
163399	*Euglena acus*	*Euglena acus*	Protozoa	Protozoa	CM	Euglenozoa
163466	*Euglena proxima*	*Euglena proxima*	Protozoa	Protozoa	CM	Euglenozoa
615660	*Euglena stellata*	*Euglena stellata*	Protozoa	Protozoa	CM	Euglenozoa
163458	*Euglena tripteris*	*Euglena tripteris*	Protozoa	Protozoa	CM	Euglenozoa
163246	*Euglena viridis*	*Euglena viridis*	Protozoa	Protozoa	CM	Euglenozoa
21001	Euglenaceae		Protozoa	Protozoa	CM*	Euglenozoa
21000	Euglenales		Protozoa	Protozoa	CM*	Euglenozoa
582200	Euglenia		Protozoa	Protozoa	CM*	Euglenozoa
582209	Euglenida		Protozoa	Protozoa	CM*	Euglenozoa
582177	Euglenoidea		Protozoa	Protozoa	CM*	Euglenozoa
19539	Euglenophyceae		Protozoa	Protozoa	CM*	Euglenozoa
183543	*Eutintinnus*		Protozoa	Ciliate	TBC	Ciliophora
183557	*Eutintinnus elongatus*	*Eutintinnus elongatus*	Protozoa	Ciliate	TBC	Ciliophora
178582	Eutreptia		Protozoa	Protozoa	CM*	Euglenozoa
17655	Eutreptiaceae		Protozoa	Protozoa	CM*	Euglenozoa
17657	*Eutreptiella*		Protozoa	Protozoa	CM*	Euglenozoa
248121	*Eutreptiella braarudii*	*Eutreptiella braarudii*	Protozoa	Protozoa	CM*	Euglenozoa
573868	*Eutreptiella cornubiense*	*Eutreptiella cornubiense*	Protozoa	Protozoa	CM*	Euglenozoa
573871	*Eutreptiella eupharyngea*	*Eutreptiella eupharyngea*	Protozoa	Protozoa	CM*	Euglenozoa
110652	*Eutreptiella gymnastica*	*Eutreptiella gymnastica*	Protozoa	Protozoa	CM*	Euglenozoa

172264	*Eutreptiella hirudoidea*	*Eutreptiella hirudoidea*	Protozoa	Protozoa	CM*	Euglenozoa
160556	*Eutreptiella marina*	*Eutreptiella marina*	Phytoplankton	Protozoa	CM*	Euglenozoa
582210	Eutreptiida		Protozoa	Protozoa	TBC	Euglenozoa
160577	*Exuviaella*	*Prorocentrum spp.*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
231851	***Exuviella***		**Phytoplankton**	**Dinoflagellate**		
172431	Favella		Protozoa	Ciliate	TBC	Ciliophora
235761	*Favella ehrenbergii*	*Favella ehrenbergii*	Protozoa	Ciliate	TBC	Ciliophora
292923	*Favella helgolandica*	*Favella helgolandica*	Protozoa	Ciliate	TBC	Ciliophora
233759	*Fibrocapsa*		Phytoplankton	Raphidophyte	CM*	Ochrophyta
233761	*Fibrocapsa japonica*	*Fibrocapsa japonica*	Phytoplankton	Raphidophyte	CM	Ochrophyta
1410	Foraminifera		Protozoa	Foraminifera	eSNCM*	Foraminifera
22528	Foraminiferida		Protozoa	Foraminifera	eSNCM*	Foraminifera
232601	*Fragilidinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109468	*Fragilidium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109705	*Fragilidium subglobosum*	*Fragilidium subglobosum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
178847	Fusopsis incertae sedis		Protozoa	Protozoa	TBC	TBC
231798	*Gambierdiscus*		Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109538	*Glenodinium*		Phytoplankton	Dinoflagellate	TBC	TBC
110146	*Glenodinium danicum*	*Glenodinium danicum*	Phytoplankton	Dinoflagellate	TBC	TBC
571649	*Glenodinium pilula*	*Glenodinium pilula*	Phytoplankton	Dinoflagellate	TBC	TBC
109559	*Goniodoma*		Phytoplankton	Dinoflagellate	TBC	TBC
233386	*Goniodoma polyedricum*	*Goniodoma polyedricum*	Phytoplankton	Dinoflagellate	TBC	TBC
109408	Goniodomataceae		Phytoplankton	Dinoflagellate	TBC	TBC
109428	Gonyaulacaceae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109391	Gonyaulacales		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109519	*Gonyaulax*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109519	*Gonyaulax*		Phytoplankton	Dinoflagellate		
109519	*Gonyaulax*		Phytoplankton	Dinoflagellate		

110009	*Gonyaulax alaskenses*	*Gonyaulax alaskenses*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110014	*Gonyaulax diegensis*	*Gonyaulax diegensis*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110015	*Gonyaulax digitale*	*Gonyaulax digitale*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
418136	*Gonyaulax digitalis*	*Gonyaulax digitalis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110023	*Gonyaulax grindleyi*	*Protoceratium reticulatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110035	*Gonyaulax polygramma*	*Gonyaulax polygramma*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110038	*Gonyaulax rugosum*	*Gonyaulax rugosum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110039	*Gonyaulax scrippsae*	*Gonyaulax scrippsae*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
845296	*Gonyaulax spinifera*	*Gonyaulax ceratocoroides*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110041	*Gonyaulax spinifera*	*Gonyaulax spinifera*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110043	*Gonyaulax turbynei*	*Gonyaulax turbynei*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110045	*Gonyaulax verior*	*Gonyaulax verior*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109410	Gymnodiniaceae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109392	Gymnodiniales		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109475	Gymnodinium		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109475	Gymnodinium		Phytoplankton	-		
109475	Gymnodinium		Phytoplankton	-		
109777	*Gymnodinium abbreviatum*	*Gymnodinium abbreviatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232716	*Gymnodinium aureolum*	*Gymnodinium aureolum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109784	*Gymnodinium catenatum*	*Gymnodinium catenatum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109785	*Gymnodinium chlorophorum*	*Lepidodinium chlorophorum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
623645	*Gymnodinium corollarium*	*Gymnodinium corollarium*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109790	*Gymnodinium diploconus*	*Gymnodinium diploconus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109791	*Gymnodinium elongatum*	*Gymnodinium elongatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
621576	*Gymnodinium fusiforme*	*Gymnodinium fusiforme*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232765	*Gymnodinium galeatum*	*Gymnodinium galeatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109800	*Gymnodinium gracile*	*Balechina gracilis*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109802	*Gymnodinium halophilum*	*Biecheleria halophia*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

232778	*Gymnodinium heterostriatum*	*Gymnodinium heterostriatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232785	*Gymnodinium impudicum*	*Gymnodinium impudicum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
232792	*Gymnodinium irregulare*	*Gymnodinium irregulare*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
707830	*Gymnodinium litoralis*	*Gymnodinium litoralis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109809	*Gymnodinium lohmannii*	*Gymnodinium gracile*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109819	*Gymnodinium ostenfeldii*	*Gymnodinium ostenfeldii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
503615	*Gymnodinium parvum*	*Gymnodinium parvum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109825	*Gymnodinium pygmaeum*	*Gymnodinium pygmaeum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109826	*Gymnodinium rhomboides*	*Gymnodinium rhomboides*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232859	*Gymnodinium roseostigma*	*Gymnodinium roseostigma*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
162544	*Gymnodinium sanguineum*	*Akashiwo sanguinea*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109831	*Gymnodinium simplex*	*Protodinium simplex*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109835	*Gymnodinium variabile*	*Gymnodinium variabile*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232880	*Gymnodinium verruculosum*	*Gymnodinium verruculosum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109837	*Gymnodinium vestificii*	*Kapelodinium vestifici*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109476	*Gyrodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109476	*Gyrodinium*		Phytoplankton	Dinoflagellate		
109476	*Gyrodinium*		Phytoplankton	Dinoflagellate		
232901	*Gyrodinium aciculatum*	*Gyrodinium aciculatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109843	*Gyrodinium britannicum*	*Karlodinium corsicum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109844	*Gyrodinium calyptoglyphe*	*Gyrodinium calyptoglyphe*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
663610	*Gyrodinium calyptroglyphe*	*Sclerodinium calyptroglyphe*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109851	*Gyrodinium dominans*	*Gyrodinium dominans*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109852	*Gyrodinium estuariale*	*Gyrodinium estuariale*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232931	*Gyrodinium falcatum*	*Pseliodinium fusus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109854	*Gyrodinium flagellare*	*Gyrodinium flagellare*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109856	*Gyrodinium fusiforme*	*Gyrodinium fusiforme*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

232943	*Gyrodinium fusus*	*Gyrodinium fusus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109859	*Gyrodinium lachryma*	*Gyrodinium lachryma*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109870	*Gyrodinium pellucidum*	*Gyrodinium pellucidum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109876	*Gyrodinium spirale*	*Gyrodinium spirale*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
134528	*Halosphaera*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
134546	*Halosphaera viridis*	*Halosphaera viridis*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
100145	*Halosphaeria*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
624976	*Haptolina ericina*	*Haptolina ericina*	Phytoplankton	Haptophyte	CM	Haptophyta
699623	*Haptolina hirta*	*Haptolina hirta*	Phytoplankton	Haptophyte	CM	Haptophyta
369190	Haptophyta		Phytoplankton	Haptophyte	CM*	Haptophyta
172434	*Helicostomella*		Protozoa	Ciliate	TBC	Ciliophora
417184	*Helicostomella fusiformis*	*Helicostomella fusiformis*	Protozoa	Ciliate	TBC	Ciliophora
240437	*Helicostomella subulata*	*Helicostomella subulata*	Protozoa	Ciliate	TBC	Ciliophora
106287	*Hemiselmis*		Phytoplankton	Cryptophyte	TBC	Cryptophyta
106310	*Hemiselmis virescens*	*Hemiselmis virescens*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
109894	*Herdmania litoralis*	*Herdmania litoralis*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
478559	*Hermesinum*		Protozoa	Protozoa	TBC	TBC
109540	*Heterocapsa*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233615	*Heterocapsa lanceolata*	*Heterocapsa lanceolata*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233619	*Heterocapsa minima*	*Heterocapsa minima*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233620	*Heterocapsa niei*	*Heterocapsa niei*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233625	*Heterocapsa pygmaea*	*Heterocapsa pygmaea*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110152	*Heterocapsa rotundata*	*Heterocapsa rotundata*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110153	*Heterocapsa triquetra*	*Kryptoperidinium triquetrum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
160584	*Heterosigma*		Phytoplankton	Raphidophyte	CM*	Ochrophyta
160585	*Heterosigma akashiwo*	*Heterosigma akashiwo*	Phytoplankton	Raphidophyte	CM	Ochrophyta
425519	*Heterotrichea*		Phytoplankton	Ciliate	eSNCM*	Ciliophora
172815	*Hexasterias problematica*	*Polyasterias problematica*	Phytoplankton	Chlorophyte	TBC	Chlorophyta

109463	*Histioneis*		Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
163096	*Imantonia rotunda*	*Dicrateria rotunda*	Phytoplankton	Haptophyte	NYA	Haptophyta
839791	*Islandinium tricingulatum*	*Islandinium tricingulatum*	Phytoplankton	Dinoflagellate	NYA	Dinoflagellata
115060	Isochrysidales		Phytoplankton	Haptophyte	CM*	Haptophyta
573884	*Isochrysis galbana*	*Isochrysis galbana*	Phytoplankton	Haptophyte	CM	Haptophyta
231788	*Karenia*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
707679	*Karenia aureola*	*Gymnodinium aureolum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
233015	*Karenia brevis*	*Karenia brevis*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
246593	*Karenia cf. papilionacea*	*Karenia papilionacea*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
233024	*Karenia mikimotoi*	*Karenia mikimotoi*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
599664	Kareniaceae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
231789	*Karlodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233027	*Karlodinium micrum*	*Karlodinium veneficum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
233037	*Karlodinium veneficum*	*Karlodinium veneficum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
620842	*Katablepharis ovalis*	*Katablepharis ovalis*	Protozoa	Protozoa	TBC	TBC
109477	*Katodinium*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109885	*Katodinium glaucum*	*Katodinium glaucum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109499	*Kofoidinium*		Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233165	*Kofoidinium lebourae*	*Kofoidinium lebourae*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109918	*Kofoidinium pavillardii*	*Kofoidinium pavillardii*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
495390	*Kofoidinium velelloides*	*Kofoidinium velelloides*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109920	*Kofoidinium velleloides*	*Kofoidinium velleloides*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
231845	Kolkwitziellaceae		Phytoplankton	Dinoflagellate	TBC	TBC
109541	*Kryptoperidinium*		Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
110154	*Kryptoperidinium foliaceum*	*Kryptoperidinium foliaceum*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
1346683	*Kryptoperidinium triquetrum*	*Kryptoperidinium triquetrum*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
101190	*Laboea*		Protozoa	-	GNCM*	Ciliophora
101264	*Laboea strobila*	*Laboea strobila*	Protozoa	-	GNCM	Ciliophora

179314	Lacrymaria		Protozoa	Ciliate	TBC	Ciliophora
110204	*Lebouraia minuta*	*Lebouraia minuta*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233635	*Lebouraia pusilla*	*Lebouraia pusilla*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
101179	*Leegaardiella*		Protozoa	Ciliate	TBC	Ciliophora
101206	*Leegaardiella ovalis*	*Leegaardiella ovalis*	Protozoa	Ciliate	TBC	Ciliophora
101207	*Leegaardiella sol*	*Leegaardiella sol*	Protozoa	Ciliate	TBC	Ciliophora
231790	*Lepidodinium*		Phytoplankton	Dinoflagellate	CM	Dinoflagellata
345481	*Lepidodinium chlorophorum*	*Lepidodinium chlorophorum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
163401	Lepocinclis		Protozoa	Protozoa	TBC	TBC
163408	*Lepocinclis ovum*	*Lepocinclis ovum*	Protozoa	Protozoa	TBC	TBC
109914	*Leptodiscus medusoides*	*Leptodiscus medusoides*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
578704	*Leptohalysis scotti*	*Leptohalysis scotti*	Protozoa	Foraminifera	eSNCM*	Foraminifera
17651	*Leucocryptos*		Phytoplankton	Cryptophyte	TBC	Cryptophyta
119077	*Leucocryptos marina*	*Leucocryptos marina*	Phytoplankton	Cryptophyte	TBC	Cryptophyta
840689	*Levanderina fissa*	*Levanderina fissa*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
231799	*Lingulodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233592	*Lingulodinium polyedrum*	*Lingulodinium polyedrum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
101180	Lohmanniella		Protozoa	Ciliate	TBC	Ciliophora
101209	*Lohmanniella oviformis*	*Lohmanniella oviformis*	Protozoa	Ciliate	TBC	Ciliophora
134531	*Mamiella*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
134562	*Mamiella gilva*	*Mamiella gilva*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
134563	*Mantoniella squamata*	*Mantoniella squamata*	NYA	-	CM	Chlorophyta
990876	*Margalefidinium polykrikoides*	*Margalefidinium polykrikoides*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
115075	*Meringosphaera*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
248129	*Meringosphaera mediterranea*	*Meringosphaera mediterranea*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
179320	*Mesodinium*		Protozoa	-	pSNCM*	Ciliophora
179321	*Mesodinium pulex*	*Mesodinium pulex*	Phytoplankton	Ciliate	pSNCM*	Ciliophora

232069	*Mesodinium rubrum*	*Mesodinium rubrum*	Protozoa	-	pSNCM	Ciliophora
232516	*Mesoporos perforatus*	*Mesoporos perforatus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
231778	*Metaphalacroma*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109510	*Micracanthodinium*		Phytoplankton	Dinoflagellate	TBC	TBC
109992	*Micracanthodinium claytonii*	*Micracanthodinium claytonii*	Phytoplankton	Dinoflagellate	TBC	TBC
109993	*Micracanthodinium setiferum*	*Micracanthodinium setiferum*	Phytoplankton	Dinoflagellate	TBC	TBC
109511	*Micranthodinium*		Phytoplankton	Dinoflagellate	TBC	TBC
134533	*Micromonas*		Phytoplankton	Chlorophyte	CM*	Chlorophyta
134564	*Micromonas pusilla*	*Micromonas pusilla*	Phytoplankton	Chlorophyte	CM	Chlorophyta
663628	*Miniscula bipes*	*Miniscula bipes*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109585	*Minuscula bipes*	*Minuscula bipes*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
447753	*Monomorphina group*	*Monomorphina group*	Protozoa	Euglenozoa	TBC	TBC
447754	*Monomorphina pyrum*	*Monomorphina pyrum*	Protozoa	Protozoa	TBC	TBC
292896	*Myrionecta rubra*	*Mesodinium rubrum*	Protozoa	Ciliate	pSNCM	Ciliophora
109490	*Nematodinium*		Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109907	*Nematodinium armatum*	*Nematodinium armatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
233113	*Nematodinium torpedo*	*Nematodinium torpedo*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
494056	*Neoceratium*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495629	*Neoceratium arcticum*	*Neoceratium arcticum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495630	*Neoceratium arietinum*	*Neoceratium arietinum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495633	*Neoceratium azoricum*	*Neoceratium azoricum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495635	*Neoceratium belone*	*Neoceratium belone*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495637	*Neoceratium bigelowii*	*Neoceratium bigelowii*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495638	*Neoceratium breve*	*Neoceratium breve*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495640	*Neoceratium candelabrum*	*Neoceratium candelabrum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495641	*Neoceratium carnegiei*	*Neoceratium carnegiei*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495644	*Neoceratium compressum*	*Neoceratium compressum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495646	*Neoceratium contortum*	*Neoceratium contortum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata

495648	*Neoceratium declinatum*	*Neoceratium declinatum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495655	*Neoceratium extensum*	*Neoceratium extensum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495656	*Neoceratium falcatiforme*	*Neoceratium falcatiforme*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495659	*Neoceratium furca*	*Neoceratium furca*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495660	*Neoceratium fusus*	*Neoceratium fusus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495662	*Neoceratium gibberum*	*Neoceratium gibberum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495664	*Neoceratium hexacanthum*	*Neoceratium hexacanthum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495666	*Neoceratium horridum*	*Neoceratium horridum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495669	*Neoceratium inflatum*	*Neoceratium inflatum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495671	*Neoceratium kofoidii*	*Neoceratium kofoidii*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495674	*Neoceratium lineatum*	*Neoceratium lineatum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495675	*Neoceratium longipes*	*Neoceratium longipes*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495676	*Neoceratium longirostrum*	*Neoceratium longirostrum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495678	*Neoceratium macroceros*	*Neoceratium macroceros*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495679	*Neoceratium massiliense*	*Neoceratium massiliense*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495680	*Neoceratium minutum*	*Neoceratium minutum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495685	*Neoceratium pentagonum*	*Neoceratium pentagonum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495687	*Neoceratium platycorne*	*Neoceratium platycorne*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495690	*Neoceratium pulchellum*	*Neoceratium pulchellum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495691	*Neoceratium ranipes*	*Neoceratium ranipes*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495696	*Neoceratium setaceum*	*Neoceratium setaceum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495697	*Neoceratium symmetricum*	*Neoceratium symmetricum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495700	*Neoceratium teres*	*Neoceratium teres*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495701	*Neoceratium trichoceros*	*Neoceratium trichoceros*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495702	*Neoceratium tripos*	*Neoceratium tripos*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
495703	*Neoceratium uncinus*	*Neoceratium uncinus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
134524	*Nephroselmis*		Phytoplankton	Chlorophyte	CM*	Chlorophyta
134541	*Nephroselmis pyriformis*	*Nephroselmis pyriformis*	Phytoplankton	Chlorophyte	CM	Chlorophyta

134542	*Nephroselmis rotunda*	*Nephroselmis rotunda*	Phytoplankton	Chlorophyte	CM	Chlorophyta
109500	*Noctiluca*		Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109921	*Noctiluca scintillans*	*Noctiluca scintillans*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109418	Noctilucaceae		Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109393	Noctilucales		Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109542	*Oblea*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
656295	*Oblea acanthocysta*	*Oblea acanthocysta*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110155	*Oblea rotunda*	*Oblea rotunda*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
249725	*Ochromonas*		Phytoplankton	Chrysophyte	CM	Ochrophyta
345465	*Ochrophyta*		Phytoplankton	Phytoplankton	CM*	Ochrophyta
369960	*Octactis*		Phytoplankton	Silicoflagellate	TBC	TBC
375970	*Octactis octonaria*	*Octactis octonaria*	Phytoplankton	Silicoflagellate	TBC	TBC
1310442	*Octactis speculum*	*Octactis speculum*	Phytoplankton	Silicoflagellate	TBC	TBC
732974	Oligotrichea		Protozoa	Ciliate	TBC	Ciliophora
233763	*Olisthodiscus*		Phytoplankton	Raphidophyte	TBC	Ochrophyta
494102	*Oltmannsiellopsis*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
526636	*Oltmannsiellopsis viridis*	*Oltmannsiellopsis viridis*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
109464	*Ornithocercus*		Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
109693	*Ornithocercus magnificus*	*Ornithocercus magnificus*	Phytoplankton	Dinoflagellate	eSNCM	Dinoflagellata
109524	*Ostreopsis*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109902	*Oxyrrhis marina*	*Oxyrrhis marina*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109432	Oxytoxaceae		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109528	*Oxytoxum*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110079	*Oxytoxum adriaticum*	*Oxytoxum adriaticum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110082	*Oxytoxum caudatum*	*Oxytoxum caudatum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110087	*Oxytoxum crassum*	*Oxytoxum crassum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233857	*Oxytoxum criophilum*	*Oxytoxum criophilum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110090	*Oxytoxum curvatum*	*Oxytoxum curvatum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata

233870	*Oxytoxum gracile*	*Oxytoxum gracile*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110100	*Oxytoxum longum*	*Oxytoxum longum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110102	*Oxytoxum mediterraneum*	*Oxytoxum mediterraneum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110115	*Oxytoxum scolopax*	*Oxytoxum scolopax*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233871	*Oxytoxum turbo*	*Oxytoxum turbo*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233868	*Oxytoxum variabile*	*Oxytoxum variabile*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
160594	*Pachysphaera*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
196768	*Pacillina arctica*	*Pacillina arctica*	Protozoa	Protozoa	TBC	TBC
109512	*Palaeophalacroma*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
196836	Parafavella		Protozoa	Ciliate	TBC	Ciliophora
196837	*Parafavella gigantea*	*Parafavella gigantea*	Protozoa	Ciliate	TBC	Ciliophora
105518	Parvicorbicula		Protozoa	Choanoflagellate	TBC	Choanoflagellata
105588	*Parvicorbicula socialis*	*Parvicorbicula socialis*	Protozoa	Choanoflagellate	TBC	Choanoflagellata
109575	*Paulsenella chaetoceratis*	*Paulsenella chaetoceratis*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109529	*Pavillardinium*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
160561	*Pediastrum*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
160597	Pedinellales		Phytoplankton	Silicoflagellate	TBC	TBC
595197	*Pelagostrobilidium epacrum*	*Pelagostrobilidium epacrum*	Protozoa	Ciliate	TBC	Ciliophora
109504	*Pentapharsodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109925	*Pentapharsodinium dalei*	*Pentapharsodinium dalei*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109543	*Peridiniella*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110156	*Peridiniella catenata*	*Peridiniella catenata*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233369	*Peridiniella danica*	*Peridiniella danica*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
1305343	*Peridinium quadridentatum*	*Peridinium quadridentatum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233804	*Peridinium quinquecorne*	*Peridinium quinquecorne*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
163067	*Peritrichia*		Protozoa	Ciliate	TBC	Ciliophora
172321	*Peritromus*		Protozoa	Ciliate	TBC	Ciliophora
246598	*Pfiesteria piscicida*	*Pfiesteria piscicida*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata

115088	*Phaeocystis*		Phytoplankton	Haptophyte	CM*	Haptophyta
160538	*Phaeocystis globosa*	*Phaeocystis globosa*	Phytoplankton	Haptophyte	CM	Haptophyta
115106	*Phaeocystis pouchetii*	*Phaeocystis pouchetii*	Phytoplankton	Haptophyte	CM*	Haptophyta
109466	*Phalacroma*		Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
232491	*Phalacroma mitra*	*Phalacroma mitra*	Phytoplankton	Dinoflagellate	pSNCM	TBC
232492	*Phalacroma rapa*	*Phalacroma rapa*	Phytoplankton	Dinoflagellate	pSNCM	Dinoflagellata
156505	*Phalacroma rotundatum*	*Phalacroma rotundatum*	Phytoplankton	Dinoflagellate	pSNCM*	Dinoflagellata
109896	*Pheopolykrikos beauchampii*	*Pheopolykrikos beauchampii*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
106283	*Plagioselmis*		Phytoplankton	Cryptophyte	CM*	Cryptophyta
641580	*Plagioselmis lacustris*	*Plagioselmis lacustris*	Phytoplankton	Cryptophyte	CM*	Cryptophyta
370563	*Plagioselmis nannoplanctica*	*Plagioselmis nannoplanctica*	Phytoplankton	Cryptophyte	CM*	Cryptophyta
106303	*Plagioselmis prolonga*	*Plagioselmis prolonga*	Phytoplankton	Cryptophyte	CM*	Cryptophyta
105601	*Pleurasiga reynoldsii*	*Pleurasiga reynoldsii*	Protozoa	Choanoflagellate	TBC	Choanoflagellata
235825	*Pleurochrysis*		Phytoplankton	Haptophyte	TBC	Haptophyta
235969	*Pleurochrysis carterae*	*Pleurochrysis carterae*	Phytoplankton	Haptophyte	TBC	Haptophyta
109550	*Podolampas*		Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
110199	*Podolampas bipes*	*Podolampas bipes*	Phytoplankton	Dinoflagellate	eSNCM	Dinoflagellata
110201	*Podolampas elegans*	Podolampas elegans	Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
232625	*Podolampas palmipes*	*Podolampas palmipes*	Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
110202	*Podolampas spinifera*	*Podolampas spinifera*	Phytoplankton	Dinoflagellate	eSNCM*	Dinoflagellata
109413	Polykrikaceae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109485	*Polykrikos*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109898	*Polykrikos hartmannii*	*Polykrikos hartmannii*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
109899	*Polykrikos kofoidii*	*Polykrikos kofoidii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109901	*Polykrikos schwartzii*	*Polykrikos schwartzii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
663594	*Polykrikos schwarzii*	*Polykrikos schwarzii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109927	*Preperidinium meunierii*	*Preperidinium meunierii*	Phytoplankton	Dinoflagellate	TBC	TBC

109487	*Pronoctiluca*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233180	*Pronoctiluca acuta*	*Pronoctiluca acuta*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109903	*Pronoctiluca pelagica*	*Pronoctiluca pelagica*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109904	*Pronoctiluca spinifera*	*Pronoctiluca spinifera*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
292924	Proplectella		Protozoa	Ciliate	TBC	Ciliophora
109442	Prorocentraceae		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109396	Prorocentrales		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109566	*Prorocentrum*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109566	*Prorocentrum*		Phytoplankton	Dinoflagellate		
109566	*Prorocentrum*		Phytoplankton	Dinoflagellate		
110291	*Prorocentrum aporum*	*Prorocentrum aporum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110293	*Prorocentrum balticum*	*Prorocentrum balticum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
160578	*Prorocentrum cf. marinum*	*Prorocentrum lima*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110295	*Prorocentrum compressum*	*Prorocentrum compressum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
232376	*Prorocentrum cordatum*	*Prorocentrum cordatum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110298	*Prorocentrum dentatum*	*Prorocentrum dentatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110300	*Prorocentrum gracile*	*Prorocentrum gracile*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110301	*Prorocentrum lima*	*Prorocentrum lima*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110302	*Prorocentrum maximum*	*Prorocentrum maximum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
231885	*Prorocentrum mexicanum*	*Prorocentrum mexicanum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110303	*Prorocentrum micans*	*Prorocentrum micans*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110304	*Prorocentrum minimum*	*Prorocentrum cordatum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
110310	*Prorocentrum redfieldii*	*Prorocentrum redfieldii*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
232298	*Prorocentrum rhathymum*	*Prorocentrum rhathymum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110311	*Prorocentrum rostratum*	*Prorocentrum rostratum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110312	*Prorocentrum rotundatum*	*Prorocentrum rotundatum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110314	*Prorocentrum scutellum*	*Prorocentrum scutellum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110316	*Prorocentrum triestinum*	*Prorocentrum triestinum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

425488	Prorodontida		Protozoa	Ciliate	TBC	Ciliophora
425487	Prostomatea		Protozoa	Ciliate	TBC	Ciliophora
137294	*Protaspis glans*	*Protaspa glans*	Phytoplankton	Cercozoa	TBC	Rhizaria
105536	Proterospongia		Protozoa	Choanoflagellate	TBC	Choanoflagellata
109567	*Protoceratium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110321	*Protoceratium reticulatum*	*Protoceratium reticulatum*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
663583	*Protodinium simplex*	*Protodinium simplex*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109435	Protoperidiniaceae		Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109553	*Protoperidinium*		Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
109553	*Protoperidinium*		Phytoplankton	Dinoflagellate		
109553	*Protoperidinium*		Phytoplankton	Dinoflagellate		
110205	*Protoperidinium achromaticum*	*Protoperidinium achromaticum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110206	*Protoperidinium avellana*	*Protoperidinium avellana*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110208	*Protoperidinium bipes*	*Protoperidinium bipes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110209	*Protoperidinium breve*	*Protoperidinium breve*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110210	*Protoperidinium brevipes*	*Protoperidinium brevipes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
162749	*Protoperidinium cerasus*	*Protoperidinium cerasus*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
163862	*Protoperidinium claudicans*	*Protoperidinium claudicans*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110212	*Protoperidinium conicoides*	*Protoperidinium conicoides*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110213	*Protoperidinium conicum*	*Protoperidinium conicum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110214	*Protoperidinium crassipes*	*Protoperidinium crassipes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110215	*Protoperidinium curtipes*	*Protoperidinium curtipes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
163934	*Protoperidinium curvipes*	*Protoperidinium curvipes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233390	*Protoperidinium decipiens*	*Protoperidinium decipiens*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110216	*Protoperidinium denticulatum*	*Protoperidinium denticulatum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110217	*Protoperidinium depressum*	*Protoperidinium depressum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
172460	*Protoperidinium diabolum*	*Protoperidinium diabolum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata

110218	*Protoperidinium diabolus*	*Protoperidinium diabolus*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110219	*Protoperidinium divergens*	*Protoperidinium divergens*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233357	*Protoperidinium elegans*	*Protoperidinium elegans*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233353	*Protoperidinium elongatum*	*Protoperidinium elongatum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110220	*Protoperidinium excentricum*	*Protoperidinium excentricum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
232921	*Protoperidinium globulus*	*Protoperidinium globulus*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110223	*Protoperidinium granii*	*Protoperidinium granii*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233263	*Protoperidinium humile*	*Protoperidinium humile*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233257	*Protoperidinium incognitum*	*Protoperidinium incognitum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110228	*Protoperidinium laticeps*	*Protoperidinium laticeps*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233231	*Protoperidinium latidorsale*	*Protoperidinium latidorsale*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110229	*Protoperidinium leonis*	*Protoperidinium leonis*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110231	*Protoperidinium mariaelebouriae*	*Protoperidinium mariaelebouriae*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233176	*Protoperidinium marielebourae*	*Protoperidinium marielebourae*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
614620	*Protoperidinium marielebouriae*	*Protoperidinium marielebouriae*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110233	*Protoperidinium minutum*	*Protoperidinium minutum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110234	*Protoperidinium mite*	*Protoperidinium mite*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110237	*Protoperidinium nudum*	*Protoperidinium nudum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110238	*Protoperidinium oblongum*	*Protoperidinium oblongum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110239	*Protoperidinium obtusum*	*Protoperidinium obtusum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110240	*Protoperidinium oceanicum*	*Protoperidinium oceanicum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110241	*Protoperidinium ovatum*	*Protoperidinium ovatum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233061	*Protoperidinium pacificum*	*Protoperidinium pacificum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110244	*Protoperidinium pallidum*	*Protoperidinium pallidum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233050	*Protoperidinium parthenopes*	*Protoperidinium parthenopes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata

232837	*Protoperidinium paulsenii*	*Protoperidinium paulsenii*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110245	*Protoperidinium pellucidum*	*Protoperidinium pellucidum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110247	*Protoperidinium pentagonum*	*Protoperidinium pentagonum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110248	*Protoperidinium punctulatum*	*Protoperidinium punctulatum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110249	*Protoperidinium pyriforme*	*Protoperidinium pyriforme*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110250	*Protoperidinium quarense*	*Protoperidinium quarense*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
233805	*Protoperidinium quinquecorne*	*Protoperidinium quinquecorne*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110251	*Protoperidinium saltans*	*Protoperidinium saltans*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110257	*Protoperidinium steinii*	*Protoperidinium steinii*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
232897	*Protoperidinium stellatum*	*Protoperidinium stellatum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110258	*Protoperidinium subicurvipes*	*Protoperidinium subicurvipes*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110259	*Protoperidinium subinerme*	*Protoperidinium subinerme*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
110260	*Protoperidinium thorianum*	*Protoperidinium thorianum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
232861	*Protoperidinium thulense*	*Protoperidinium thulense*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
232824	*Protoperidinium tuba*	*Protoperidinium tuba*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
232777	*Protoperidinium venustum*	*Protoperidinium venustum*	Phytoplankton	Dinoflagellate	pZ	Dinoflagellata
5	Protozoa		Protozoa	Protozoa	pZ*/GNCM*/pSNCM*/eSNCM*/CM*/P*	TBC
115073	Prymnesiaceae		Phytoplankton	Haptophyte	CM*	Haptophyta
115061	Prymnesiales		Phytoplankton	Haptophyte	CM*	Haptophyta
115057	Prymnesiophyceae		Phytoplankton	Haptophyte	CM*	Haptophyta
160563	*Prymnesium*		Phytoplankton	Haptophyte	CM*	Haptophyta
160564	*Prymnesium parvum*	*Prymnesium parvum*	Phytoplankton	Haptophyte	CM	Haptophyta
670030	*Prymnesium polylepis*	*Prymnesium polylepis*	Phytoplankton	Haptophyte	CM	Haptophyta
1474876	*Pseliodinium fusus*	*Pseliodinium fusus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
520952	Pseudodifflugia		Protozoa	Foraminifera	eSNCM*	Foraminifera

160599	*Pseudopedinella*		Phytoplankton	Silicoflagellate	TBC	TBC
248149	*Pseudopedinella elastica*	*Pseudopedinella elastica*	Phytoplankton	Silicoflagellate	TBC	TBC
160600	*Pseudopedinella pyriformis*	*Pseudopedinella pyriformis*	Phytoplankton	Silicoflagellate	TBC	TBC
388485	*Pseudopedinella thomsenii*	*Pseudopedinella thomsenii*	Phytoplankton	Silicoflagellate	TBC	TBC
160601	*Pseudopedinella tricostata*	*Pseudopedinella tricostata*	Phytoplankton	Silicoflagellate	TBC	TBC
418160	*Pseudopfiesteria shumwayae*	*Pseudopfiesteria shumwayae*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
134534	*Pseudoscourfieldia*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
134566	*Pseudoscourfieldia marina*	*Pseudoscourfieldia marina*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
160595	*Pterosperma*		Phytoplankton	Chlorophyte	CM*	Chlorophyta
376081	*Pterosperma cristatum*	*Pterosperma cristatum*	Phytoplankton	Chlorophyte	CM	Chlorophyta
376690	*Pterosperma cuboides*	*Pterosperma cuboides*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
376082	*Pterosperma marginatum*	*Pterosperma marginatum*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
547730	*Pterosperma michaelsarsii*	*Pterosperma michaelsarsii*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
345882	*Pterosperma moebii*	*Pterosperma moebii*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
376083	*Pterosperma nationalis*	*Pterosperma nationalis*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
341609	*Pterosperma parallelum*	*Pterosperma parallelum*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
341610	*Pterosperma polygonum*	*Pterosperma polygonum*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
376084	*Pterosperma undulatum*	*Pterosperma undulatum*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
345881	*Pterosperma vanhoeffenii*	*Pterosperma vanhoeffenii*	Phytoplankton	Chlorophyte	CM*	Chlorophyta
172813	Pterospermataceae		Phytoplankton	Chlorophyte	CM*	Chlorophyta
345883	*Ptychocylis urnula*	*Ptychocylis urnula*	Protozoa	Ciliate	TBC	Ciliophora
109888	*Ptychodiscus noctiluca*	*Ptychodiscus noctiluca*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
603675	*Pyramidomonas*		Protozoa	Protozoa	TBC	TBC
134529	*Pyramimonas*		Phytoplankton	Chlorophyte	TBC	Chlorophyta
134550	*Pyramimonas (Trichocystis) grossii*	*Pyramimonas (Trichocystis) grossii*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
495333	*Pyramimonas disomata*	*Pyramimonas disomata*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
160513	*Pyramimonas longicauda*	*Pyramimonas longicauda*	Phytoplankton	Chlorophyte	TBC	Chlorophyta

134559	*Pyramimonas virginica*	*Pyramimonas virginica*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
109444	Pyrocystaceae		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109571	*Pyrocystis*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
232259	*Pyrocystis hamulus*	*Pyrocystis hamulus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
164053	*Pyrocystis lunula*	*Pyrocystis lunula*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
110332	*Pyrocystis noctiluca*	*Pyrocystis noctiluca*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
573782	*Pyrocystis pseudonoctiluca*	*Pyrocystis pseudonoctiluca*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109436	Pyrophacaceae		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109555	*Pyrophacus*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
232598	*Pyrophacus horologium*	*Pyrophacus horologium*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
196831	Radiolaria		Protozoa	Radiolaria	eSNCM*	Radiolaria
582421	Radiozoa		Protozoa	Radiolaria	eSNCM*	Radiolaria
450770	Radiozoa incertae sedis		Protozoa	Ciliate	eSNCM*	Ciliophora
375891	*Resultor mikron*	*Resultor mikron*	Phytoplankton	Chlorophyte	TBC	Chlorophyta
292925	Rhabdoaskenasia		Protozoa	Ciliate	TBC	Ciliophora
106289	*Rhodomonas*		Phytoplankton	Cryptophyte	P	Cryptophyta
106313	*Rhodomonas baltica*	*Rhodomonas baltica*	Phytoplankton	Cryptophyte	P	Cryptophyta
248153	*Rhodomonas lens*	*Rhodomonas lens*	Phytoplankton	Cryptophyte	P	Cryptophyta
106314	*Rhodomonas marina*	*Rhodomonas marina*	Phytoplankton	Cryptophyte	P	Cryptophyta
106316	*Rhodomonas salina*	*Rhodomonas salina*	Phytoplankton	Cryptophyte	P	Cryptophyta
110127	*Sabulodinium undulatum*	*Sabulodinium undulatum*	Phytoplankton	Dinoflagellate	TBC	TBC
183566	Salpingella		Protozoa	Ciliate	TBC	Ciliophora
417228	*Salpingella acuminata*	*Salpingella acuminata*	Protozoa	Ciliate	TBC	Ciliophora
105541	Salpingoeca		Protozoa	Choanoflagellate	TBC	Choanoflagellata
732868	*Schmidingerella serrata*	*Schmidingerella serrata*	Protozoa	Ciliate	TBC	Ciliophora
109545	*Scrippsiella*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
1321853	*Scrippsiella acuminata*	*Scrippsiella acuminata*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
163452	*Scrippsiella faeroense*	*Scrippsiella faeroense*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

233093	*Scrippsiella hangoei*	*Scrippsiella hangoei*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110168	*Scrippsiella lachrymosa*	*Scrippsiella lachrymosa*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
110172	*Scrippsiella trochoidea*	*Scrippsiella acuminata*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
414712	Scuticociliatia		Protozoa	Ciliate	TBC	Ciliophora
109467	*Sinophysis*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
663187	*Sinophysis ebriolus*	*Sinophysis ebriolus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
232532	*Sinophysis stenosoma*	*Sinophysis stenosoma*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109502	*Spatulodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109923	*Spatulodinium pseudonoctiluca*	*Spatulodinium pseudonoctiluca*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
101273	*Spirostrombidium sauerbreyae*	*Spirostrombidium sauerbreyae*	Phytoplankton	Ciliate	pZ*/GNCM*	Ciliophora
101185	Strobilidium		Protozoa	Ciliate	TBC	Ciliophora
578585	*Strobilidium sphaericum*	*Strobilidium sphaericum*	Protozoa	Ciliate	TBC	Ciliophora
101236	*Strobilidium spiralis*	*Strobilidium spiralis*	Protozoa	Ciliate	TBC	Ciliophora
101198	*Strombidinopsis*		Protozoa	-	GNCM*	Ciliophora
101195	*Strombidium*		Protozoa	-	GNCM*	Ciliophora
595215	*Strombidium chlorophilum*	*Strombidium chlorophilum*	Protozoa	-	GNCM	Ciliophora
101289	*Strombidium conicum*	*Strombidium conicum*	Phytoplankton	Ciliate	GNCM	Ciliophora
427725	*Strombidium cornucopiae*	*Strombidium cornucopiae*	Phytoplankton	Ciliate	GNCM*	Ciliophora
732820	*Strombidium emergens*	*Strombidium emergens*	Protozoa	-	GNCM*	Ciliophora
101325	*Strombidium reticulatum*	*Strombidium reticulatum*	Phytoplankton	Ciliate	GNCM	Ciliophora
101342	*Strombidium vestitum*	*Strombidium vestitum*	Protozoa	-	GNCM	Ciliophora
162681	Suctoria		Protozoa	Ciliate	TBC	Ciliophora
106285	*Teleaulax*		Phytoplankton	Cryptophyte	CM*	Cryptophyta
106305	*Teleaulax acuta*	*Teleaulax acuta*	Phytoplankton	Cryptophyte	CM*	Cryptophyta
106306	*Teleaulax amphioxeia*	*Teleaulax amphioxeia*	Phytoplankton	Cryptophyte	CM	Cryptophyta
389491	*Telonema antarcticum*	*Telonema antarcticum*	Protozoa	Cryptophyte	pZ	Cryptophyte
109557	*Thecadinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

110273	*Thecadinium kofoidii*	*Thecadinium kofoidii*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
376565	*Thecadinium yashimaense*	*Thecadinium yashimaense*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109438	Thoracosphaeraceae		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
247913	*Tiarina*		Protozoa	-	eSNCM	Ciliophora
247943	*Tiarina fusus*	*Tiarina fusus*	Protozoa	Ciliate	eSNCM*	Ciliophora
425497	Tintinnida		Protozoa	Ciliate	pZ	Ciliophora
183533	Tintinnidae		Protozoa	Ciliate	pZ	Ciliophora
247915	Tintinnidium		Protozoa	Ciliate	pZ	Ciliophora
410617	*Tintinnidium fluviatile*	*Tintinnidium fluviatile*	Phytoplankton	Ciliate	pZ	Ciliophora
247944	*Tintinnidium mucicola*	*Tintinnidium mucicola*	Protozoa	Ciliate	pZ	Ciliophora
732976	Tintinnina		Protozoa	Ciliate	pZ	Ciliophora
163780	Tintinnopsis		Protozoa	Ciliate	pZ	Ciliophora
163782	*Tintinnopsis beroidea*	*Tintinnopsis beroidea*	Protozoa	Ciliate	pZ	Ciliophora
163913	*Tintinnopsis campanula*	*Tintinnopsis campanula*	Protozoa	Ciliate	pZ	Ciliophora
345439	*Tintinnopsis cylindrica*	*Tintinnopsis cylindrica*	Phytoplankton	Ciliate	pZ	Ciliophora
427420	*Tintinnopsis magna*	*Tintinnopsis magna*	Phytoplankton	Ciliate	pZ	Ciliophora
232076	*Tintinnopsis minuta*	*Tintinnopsis minuta*	Phytoplankton	Ciliate	pZ	Ciliophora
163804	*Tintinnopsis nana*	*Tintinnopsis nana*	Protozoa	Ciliate	pZ	Ciliophora
427430	*Tintinnopsis rapa*	*Tintinnopsis rapa*	Phytoplankton	Ciliate	pZ	Ciliophora
101196	*Tontonia*		Protozoa	-	GNCM*	Ciliophora
427744	*Tontonia ovalis*	*Tontonia ovalis*	Protozoa	-	GNCM	Ciliophora
109479	*Torodinium*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109889	*Torodinium robustum*	*Torodinium robustum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
109890	*Torodinium teredo*	*Torodinium teredo*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
163247	Trachelomonas		Protozoa	Protozoa	TBC	TBC
163412	*Trachelomonas hispida*	*Trachelomonas hispida*	Protozoa	Protozoa	TBC	TBC
610196	*Trachelomonas rugulosa*	*Trachelomonas rugulosa*	Protozoa	Protozoa	TBC	TBC
109560	*Triadinium*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata

196828	*Triadinium polyedricum*	*Triadinium polyedricum*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
149049	Triceratiaceae		Phytoplankton	Dinoflagellate	P	Diatomeae
494057	*Tripos*		Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841182	*Tripos arietinus*	*Tripos arietinus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837310	*Tripos azoricus*	*Tripos azoricus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841188	*Tripos bigelowii*	*Tripos bigelowii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841189	*Tripos brevis*	*Tripos brevis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841190	*Tripos bucephalus*	*Tripos bucephalus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841193	*Tripos candelabrus*	*Tripos candelabrus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841199	*Tripos compressus*	*Tripos compressus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841211	*Tripos eugrammus*	*Tripos eugrammus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837220	*Tripos falcatus*	*Tripos falcatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
840627	*Tripos furca*	*Tripos furca*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
840626	*Tripos fusus*	*Tripos fusus*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
841248	*Tripos hexacanthum*	*Tripos hexacanthum*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837453	*Tripos horridus*	*Tripos horridus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841251	*Tripos incisus*	*Tripos incisus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837455	*Tripos inflatus*	*Tripos inflatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837456	*Tripos kofoidii*	*Tripos kofoidii*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837459	*Tripos lineatus*	*Tripos lineatus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841259	*Tripos longipes*	*Tripos longipes*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
841260	*Tripos macroceros*	*Tripos macroceros*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
1391716	*Tripos macroceros*	*Tripos macroceros*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841261	*Tripos massiliensis*	*Tripos massiliensis*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841263	*Tripos minutus*	*Tripos minutus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
495363	*Tripos muelleri*	*Tripos muelleri*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
841746	*Tripos pentagonus*	*Tripos pentagonus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
841751	*Tripos pulchellus*	*Tripos pulchellus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata

837234	*Tripos ranipes*	*Tripos ranipes*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
837446	*Tripos setaceus*	*Tripos setaceus*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
1381154	*Tripos teres*	*Tripos teres*	Phytoplankton	Dinoflagellate	CM	Dinoflagellata
842517	*Tripos trichoceros*	*Tripos trichoceros*	Phytoplankton	Dinoflagellate	CM*	Dinoflagellata
143943	Uronema		Protozoa	Ciliate	pZ	Ciliophora
707927	*Vicicitus globosus*	*Vicicitus globosus*	Phytoplankton	Raphidophyte	TBC	Ochrophyta
163573	*Vorticella*		Protozoa	Ciliate	pZ	Ciliophora
109491	*Warnowia*		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
233144	*Warnowia polyphemus*	*Warnowia polyphemus*	Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
109415	Warnowiaceae		Phytoplankton	Dinoflagellate	TBC	Dinoflagellata
183574	Xystonella		Protozoa	Ciliate	TBC	Ciliophora
196832	*Zoothamnium pelagicum*	*Zoothamnium pelagicum*	Protozoa	Ciliate	TBC	Ciliophora