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The Plankton Lifeform Extraction Tool: A digital tool to increase the discoverability and usability of plankton time-series data

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1 Abstract

Plankton form the base of the marine food web and are sensitive indicators of environmental change. Plankton time-series are therefore an essential part of monitoring progress towards global biodiversity goals, such as the Convention on Biological Diversity Aichi Targets, and for informing ecosystem-based policy, such as the EU Marine Strategy Framework Directive. Multiple plankton monitoring programmes exist in Europe, but differences in sampling and analysis methods prevent the integration of their data, constraining their utility over large spatio-temporal scales. The Plankton Lifeform Extraction Tool brings together disparate European plankton datasets into a central database from which it extracts abundance time-series of plankton functional groups, called 'lifeforms', according to shared biological traits. This tool has been designed to make complex plankton datasets accessible and meaningful for policy, public interest, and scientific discovery. It allows examination of large-scale shifts in lifeform abundance or distribution (for example, holoplankton being partially replaced by meroplankton), providing clues to how the marine environment is changing. The lifeform method enables datasets with different plankton sampling and taxonomic analysis methodologies to be used together to provide insights into the response to multiple stressors and robust policy evidence for decision making. Lifeform time-series generated with the Plankton Lifeform Extraction Tool currently inform plankton and food web indicators for the UK's Marine Strategy, the EU's Marine Strategy Framework Directive, and for the Convention for the Protection of the Marine Environment of the North- East Atlantic (OSPAR) biodiversity assessments. The Plankton Lifeform Extraction Tool currently integrates 155,000 samples, containing over 44 million plankton records, from 9 different plankton datasets within UK and European Seas, collected between 1924 and 2017. Additional datasets can be added, and time-series updated. The Plankton Lifeform Extraction Tool is hosted by The Archive for Marine Species and Habitats Data (DASSH) at https://www.dassh.ac.uk/lifeforms/. The lifeform outputs are linked to specific, doi-ed, versions of the Plankton Lifeform Traits Master List and each underlying dataset.

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2 Introduction

Plankton form the foundation of the marine food web, help to regulate ocean chemistry, and provide approximately half of the world's oxygen (Capuzzo et al., 2018; Falkowski, 2012). Globally, plankton communities are undergoing significant changes in distribution (Reid et al., 2016), community composition (Beaugrand et al., 2002), phenology (Edwards and Richardson, 2004), and productivity (Kulk et al., 2020). These changes vary in space and time, reflecting both direct and locally acute anthropogenic pressure on the marine environment, such as nutrient loading, and wider-scale climate-driven changes in ocean chemistry and temperature (Beaugrand et al., 2010; Bedford et al., 2020a).

Plankton have short life cycles, drift freely in the ocean and have wide distributions. For these reasons they are considered to be particularly sensitive indicators to climate change (Richardson, 2008). Changes in the composition and abundance of plankton can have negative impacts on industries such as fisheries and aquaculture (Richardson et al., 2009; Schmidt et al., 2020). As the base of the food web, they are a key element of the ecosystem approach to marine management (Morishita, 2008). Monitoring plankton communities over wide spatial and long temporal scales can help tease apart the prevailing footprint of climate change on marine ecosystems from other, more localised pressures, for example, pollution, nutrient loading and fishing (Bedford et al., 2020b). Consequently, plankton time-series play an increasingly important role in decision-making and provision of advice. Plankton indicators contribute to the delivery of global, regional and national policy drivers such as the Convention on Biological Diversity's Aichi targets (Chiba et al., 2018), the regional Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) (OSPAR, 2017), and biodiversity state in the European Union's Marine Strategy Framework Directive (MSFD) and the UK Marine Strategy (McQuatters-Gollop et al., 2019).

Although there are a number of programmes that monitor plankton in Northwest European waters, they operate at different spatial scales, from fixed-point sampling stations to long-distance continuously sampled ship transects (O'Brien et al., 2017). Furthermore, European plankton surveys employ different sampling methods, enumerate specimens at a variety of taxonomic levels and employ different counting regimes (Raybaud et al., 2011). These methodological differences and the lack of direct comparability

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between datasets has meant that the tools to use all available datasets together to produce a comprehensive assessment have only recently been developed (Bedford et al., 2020a; McQuatters-Gollop et al., 2019). While most datasets are regularly submitted to appropriate data repositories (e.g.: the Ocean Biodiversity Information System: OBIS; the British Oceanographic Data Centre: BODC, or the PANGAEA data publisher for earth and environmental science) and some are available through institutional websites or data centres, the aggregation of plankton data into functional groups (or 'lifeforms' e.g.: diatoms, dinoflagellates, holoplankton, meroplankton) has not yet been linked to traceable dataset versions or been possible to apply in an accessible, transparent and centralised way. Accordingly, understanding of plankton change across multiple spatial and temporal scales has been limited. The International Group of Marine Ecological Time Series IGMETS (https://igmets.net; O'Brien et al., 2017), represents valuable progress towards this goal: it provides a global-scale compilation of pelagic time series, with a tool to summarise visualisations of trends across a variety of temporal and spatial scales. However, this initiative summarises time trends of highly aggregated variables (e.g.: total zooplankton) for multiple sites. Trajectories of the key component plankton functional groups are not described, and the underlying data products are not made available to users for further analysis. Aggregating these disparate plankton datasets increases the spatial-temporal scope of analysis, increases their robustness and provides decision makers with more scientifically robust evidence.

Building on previous work (Gowen et al., 2011; Scherer et al., 2014; Tett et al., 2008, 2013) an indicator of shifts in plankton structure based on time-series of broad plankton functional groups, called 'lifeforms', has been developed for use in policy assessments (McQuatters-Gollop *et al*., 2019). The term 'lifeform' is derived from work carried out by Margalef (1978), to distinguish between diatoms and dinoflagellates based on traits related to survival in specific hydrodynamic conditions. Lifeforms differ slightly from the term 'Plankton Functional Type' (PFT), in that PFTs are often used to describe plankton based on their ecosystem function and not on their traits. This indicator enables plankton datasets with different sample collection and analysis routines to be used congruently to investigate changes in pelagic habitat functioning. By using these pre-defined lifeforms to group plankton taxa, the new Plankton Lifeform Extraction Tool (PLET), hosted by the Archive for Marine Species and Habitats

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Data (DASSH, https://www.dassh.ac.uk), brings together disparate plankton datasets, increasing their accessibility and promoting compliance with the FAIR data principles (Wilkinson et al., 2016). The PLET enables the user to investigate multiple datasets to assess changes in plankton ecology at multiple spatio-temporal scales using a consistent plankton indicator for the first time. As time-series grow in length and/or spatial distribution, and new plankton time-series are established, additional plankton taxa and datasets can be added to the PLET in order to improve future biodiversity assessments. The tool is a key step towards transparent and standardised assessment allowing the integration of information from multiple datasets at multiple spatial and temporal scales.

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3 Plankton datasets

In its current form, the PLET integrates 155 thousand samples containing over 44 million plankton records from 9 different data providers around the UK and European Seas, collected between 1924 and 2017 (**Table 1**). Flexibility of the PLET design allows existing time-series to be updated and new time-series to be added, continuing the expansion of integrated data sets beyond the UK, where policy reporting motivated its initial development. Plankton time-series have been collected both along transects and at fixed-point stations (**Figure 1**). These datasets, which underpin the PLET lifeform outputs, enumerate plankton in taxon groupings (see **Table A1**).

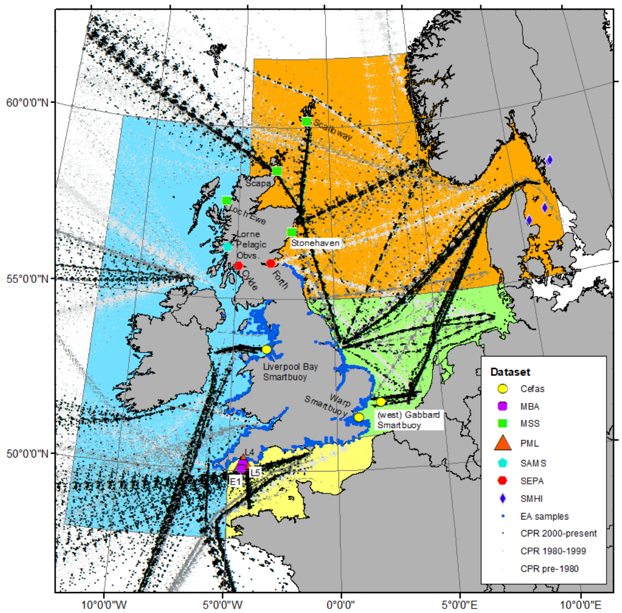

Figure 1. Spatial coverage of plankton measurements currently integrated with the PLET tool for lifeform extraction. See data provider and station information in **Table 1**, individual station names are given next to the symbols, while symbols designate data providers as shown in the legend. The sampling transects for the CPR are coloured by date sampled, with pre-1980 in light grey, 1980-1999 in darker grey, and the most recent 2000-onwards in black. Coloured regions indicate how data are summarised for presentation of Lifeform outputs in **Section 6**: blue: Celtic Seas; red: northern North Sea; green: southern North Sea; light yellow: Channel.

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Table 1. Plankton data currently held in PLET and used to produce the aggregated lifeform outputs. For un-aggregated plankton data, contact information and institute-specific data holdings (where available) are given for each data institute. Most of these time series are ongoing and many sample at higher temporal resolution than the monthly average data held in PLET. Prospective users for these higher resolution versions of the respective time series are encouraged to consult with the contact people listed below.

Institute, dataset name, *primary contact*; data web address, [PLET doi]	**Region or Station Name**	**Sampling Period**	
		Phytoplankton	**Zooplankton**
The Marine Biological Association (MBA), Continuous Plankton Recorder Survey, *David Johns (djoh@mba.ac.uk);* https://data.cprsurvey.org/datacatalog/ https://doi.org/10.17031/1629 (CPR and Johns, 2019)	UK and European Seas	1958-2017	1958-2017
The Marine Biological Association (MBA), Station sampling, *Rachel Brittain (racbri@mba.ac.uk)* https://doi.org/10.17031/1636 (MBA, 2019)	L5	not determined	1924 - 1940, 1945 - 1987, 2001 - 2013
	E1		
Plymouth Marine Laboratory (PML) *Angus Atkinson (aat@pml.ac.uk);* http://www.westernchannelobservatory.org.uk/ https://doi.org/10.17031/1632 (PML, 2019)	L4	1992-2015	1988-2017
Centre for Environment Fisheries and Aquaculture Science (Cefas), Smartbuoys, *Michelle Devlin (michelle.devlin@cefas.ac.uk);* https://www.cefas.co.uk/cefas-data-hub/smartbuoys/ https://doi.org/10.17031/1634 (CEFAS, 2019)	Dowsing	2000-2017	not determined
	Gabbard and West Gabbard	2001-2017	
	Liverpool Bay	2002-2017	
	Warp	2001-2012	
Environment Agency (EA) *Mike Best (mike.best@environment-agency.gov.uk)* https://doi.org/10.17031/1635 (EA, 2019)	UK coastal and transitional waters	2010-2017	not determined
Marine Scotland Science (MSS) *Eileen Bresnan & Margarita Machairopoulou* *(Eileen.Bresnan@gov.scot; Margarita.Machairopoulou@gov.scot)* https://data.marine.gov.scot/search/type/dataset https://doi.org/10.17031/1637 (MSS, 2019)	Stonehaven	1997-2017	1999-2017
	Loch Ewe	2002-2017	2002-2017
	Scapa (Orkney Islands)	2001-2017	not determined
	Scalloway (Shetland Islands)	2001-2017	
Swedish Meteorological and Hydrological Institute (SMHI) *Marie Johansen (marie.johansen@smhi.se)* https://sharkweb.smhi.se/ https://doi.org/10.17031/1633 (SMHI, 2019)	Swedish west coast	1986-2015	1998-2015
Scottish Environment Protection Agency (SEPA) *Malcolm Baptie (Malcolm.Baptie@sepa.org.uk)* https://doi.org/10.17031/b84a-7951 (SEPA, 2020)	Forth	2007-2017	2014 - 2017
	Clyde		
Scottish Association for Marine Science (SAMS) *Paul Tett (Paul.Tett@sams.ac.uk)* https://doi.org/10.17031/nz24-br35 (SAMS, 2020)	Lorne Pelagic Observatory	1970-2015	not determined

3.1 Plankton sampling and analysis methodology

All individual datasets that have been added to the PLET have been pre-processed to ensure suitability for extraction of monthly-aggregated lifeform data products. Pre-processing was the responsibility of the individual data providers. Examples of pre-processing required are (i) the exclusion of instances of 'double counting' where, for example, a taxon is included in both higher and lower taxonomic groupings within the same dataset and (ii) the removal of taxa that have not been looked for (recorded) over the entire time-period to avoid apparent changes in lifeform abundance due to methodological changes.

Existing datasets were gathered through a data call issued by OSPAR in 2016. The purpose of the data call was to gather plankton datasets to use for assessment and reporting for the European Union's and individual Member States' Marine Strategy Framework Directive initial biodiversity assessment in 2017 (https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/habitats/changes-phytoplankton-and-zooplankton-communities/). A simple data submission template was developed as part of this process and is now available on the PLET website for wider use. To make data submission as simple and easy as possible, the template allows data-holders to submit the datasets in either list (long) or matrix (wide) formats. A data archiving and access permission agreement form is also available from the PLET website, and allows data-holders to specify their preferred level of data access, such as full access to raw data or access to lifeform data products only.

All plankton records currently included have been identified using light microscopy. For simplicity we use the term "phytoplankton" to mean protist cells, mindful that these include a spectrum of auto-, mixo- and heterotrophic forms (Flynn et al., 2013). This terminology is used to differentiate from "zooplankton" which are the metazoans usually counted from net haul samples. For quality assurance, analysts participate in NMBAQC (the Northeast Atlantic Marine Biological Analytical Quality Control Scheme) and the International Phytoplankton Intercomparison external identification ring trials, although these do not cover the full length of some of the historical data sets. Field abundance, in individuals per unit volume, is calculated as sample abundance multiplied by subsample factor, divided by the sampled water volume. Concentrations of phytoplankton identified by light microscopy are

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typically expressed as numbers (cells) per mL, and those of zooplankton are typically expressed as numbers (individuals) per m^{-3}.

3.1.1 Continuous Plankton Recorder Survey (Marine Biological Association)

The Continuous Plankton Recorder (CPR) is a marine sampler that is towed behind volunteer ships of opportunity at speeds of up to ~20 knots and samples at a depth of ~7 m below the surface. Plankton have been sampled on routes crossing the North Atlantic and NW European shelf seas using a consistent methodology since 1958.

The CPR unit is a metal casing in the shape of a ~1 m torpedo that houses a roll of silk which automatically rotates using a geared propeller system. The seawater enters the front aperture where plankton and small particles are captured onto the rotating silk, which has a mesh size of 270 µm. This silk is stored in 4 % buffered formalin to preserve the sample until microscopic analysis at the laboratory in Plymouth. The silk is cut into pre-defined sections that represent one sample and equate to 10 nautical miles of tow. Phytoplankton and zooplankton are identified and counted at different stages of the microscopic analysis: semi-quantitative count of phytoplankton across 20 fields of view per sample, quantitative count of all zooplankton >= 2 mm (these are picked off the silk for identification), and semi-quantitative traverse count of all zooplankton < 2 mm.

For a more in-depth description of the sampling methodology please refer to Richardson et al. (2006). CPR monthly abundance counts from 1958 to 2017 are available from the following open access data portal: https://data.cprsurvey.org/datacatalog/.

3.1.2 Western Channel Observatory (Marine Biological Association and Plymouth Marine Laboratory)

The Marine Biological Association (MBA) and Plymouth Marine Laboratory (PML) jointly sample at three offshore stations in the western English Channel as part of their Western Channel Observatory (https://westernchannelobservatory.org.uk). These stations are termed: L4 (50.25˚N, 4.3˚W; approx. 55 m water depth) 13 km south-west of Plymouth, which can be regarded as a coastal station, albeit in transitionally stratified water; L5 (50.18˚N, 4.3˚W; approx. 58 m depth) is positioned between coastal and offshore waters, and E1 (50.03˚N, 4.37˚W; approx. 70 m depth) is 40 km offshore in seasonally

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stratified water. Sampling at these historical sites began in 1924 with interruptions between 1940-45 and 1987-2001. Sampling frequency has varied between weekly and fortnightly; current sampling is weekly at station L4 and, weather-permitting, fortnightly at L5 and E1.

The phytoplankton and zooplankton time-series at L4 are provided by PML. Sampling for phytoplankton began in 1992 and for mesozooplankton in 1988. Detailed phytoplankton taxonomic microscope counts are from water samples collected at 10 m depth. These samples are preserved in 2% acid Lugol's iodine solution and enumerated for all taxa larger than approximately 2 µm using the Utermöhl (1958) technique, usually settling 50 ml (Widdicombe et al., 2010). Mesozooplankton are collected each week in two replicate 0-50 m vertical hauls with a WP2 net (0.57 m diameter, 200 μm mesh-size). Each of these are analysed in two aliquots, the first being a stempel pipette – derived small subsample for enumeration of the more numerous taxa and the second larger fraction, often one-half to one-eighth, analysed for the larger or rarer taxa.

Weekly densities are calculated as the average of the two separate net hauls. Environmental conditions and the mesozooplankton sampling and analysis methods are described in detail in Atkinson et al. (2015).

Macroplankton and larval fish sampling at the WCO sites is carried out by the MBA. Although net design and methods of deployment have changed on several occasions, care has been taken to ensure that sampling characteristics have not altered appreciably. The 1 m^2 Young Fish Trawl (YFT), fitted with a 700 µm knitted mesh is hauled for 20 minutes in an oblique profile to an ideal depth ~5 m above the seabed. Depth and temperature profiles are occasionally recorded and the volume of water filtered calculated using flow data recorded by a flowmeter fitted across the net mouth. The samples are preserved in 4 % buffered formalin and analysed as soon as possible after collection using a WILD M5 binocular microscope. Results are standardized to number of individuals per 4000 m^3 in order to mitigate historical changes in sampling gear and deployment.

A comprehensive summary of these macroplankton sampling methods and analysis is given in Southward et al. (2004) and references therein.

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3.1.3 *Smartbuoys (Centre for Environment Fisheries and Aquaculture Science)*

Water samples for phytoplankton analysis are collected from several of the Centre of Environment Fisheries and Aquaculture Science (Cefas) 'Smartbuoy' moorings using automated water samplers mounted at 1 m below the surface. Time-series at approximately monthly resolution from four buoy stations are available: Dowsing off the Humber estuary (51.53˚N, 1.05˚E, sampled 2000-present), Gabbard/West Gabbard off the Thames estuary (51.95˚N, 2.11˚E, sampled 2001-present), Warp in the outer Thames estuary (51.52˚N, 1.028˚E, sampled 2001-2012), and Liverpool Bay (53.53 ˚N, 3.35˚W, sampled 2002-present).

Water samplers are pre-programmed to collect 150 mL samples on an approximately weekly cycle into sample bags pre-spiked with acidified Lugol's iodine solution. Phytoplankton samples are returned for analysis at Cefas every 1–3 months, where they are decanted into 175 mL glass jars and topped up with acidified Lugol's iodine. A minimum of one sample per month is selected for analysis from each deployment location where sample availability allows. Samples are analysed at Cefas using the Utermöhl (1958) technique under inverted Olympus microscopes within 1 year of collection. Species are identified and enumerated to the lowest possible taxonomic level and counts recorded in cells per litre.

More detailed methodology is available in Weston et al. (2008) and Greenwood (2019). Plankton and environmental parameters from the Smartbuoy monitoring programme are available from the Cefas Data Hub: https://www.cefas.co.uk/data-and-publications/smartbuoys/.

3.1.4 *England's Estuarine and Coastal Waters (Environment Agency)*

The Environment Agency (EA) and its predecessors have been collecting phytoplankton on targeted campaigns since the 1990's, however from the inception of EU Water Framework Directive (WFD; EU, 2000) monitoring in 2006, Environment Agency routine phytoplankton samples have been collected from sites in near-shore WFD waterbodies from boats, or occasionally, jetties or bridges in estuaries Devlin et al. (2012).

Sampling in WFD transitional and coastal waters typically consists of one sample per calendar month from 3 to 5 sites per water body. Ideally, samples should be 28-31 days apart throughout the year. There

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must be at least a 14-day interval between sampling occasions at each site. Phytoplankton samples are taken in the mixed surface layer usually between 1-2 m below the water surface using a standard NIO/Niskin-style water sampler, avoiding the surface film and without disturbing bottom sediments. In coastal or non-turbid waters >5m depth, the diurnal vertical migration of phytoplankton with light availability is accommodated by collection during daylight hours. However, for some samples, the use of integrated depth sampling using a Lund-type tube system negated the need to constrain the sampling window to daylight hours. Samples are collected in 250ml clear PET bottles filled to approximately 90%, leaving sufficient headspace to allow for preservation and homogenisation. Samples are preserved with acidified Lugol's iodine, and stored in the dark, ideally at a temperature of 3°C ±2°C for no longer than 6 months. Samples are analysed using the Utermöhl (1958) method under inverted microscopes. Analysis was conducted at Cefas until 2013, then at both Cefas and an external laboratory from 2013 onwards. Some samples are analysed by multiple analysts to check for comparability of results.

3.1.5 The Scottish Coastal Observatory (Marine Scotland Science)

Marine Scotland Science (MSS) routinely samples the plankton in Scottish waters as part of the Scottish Coastal Observatory. Weekly phytoplankton samples have been collected from Stonehaven (56.96˚N, 2.11 ˚W) since 1997, Scapa (Orkney Islands; 58.74 ˚N, 2.97 ˚W) since 2001, Loch Ewe (57.84 ˚N, 5.65 ˚W) since 2023 and Scalloway (Shetlands, 60.18 ˚N, 1.28 ˚W) since 2001. Meso-zooplankton have been sampled, also weekly at Stonehaven since 1999 and Loch Ewe since 2002.

Phytoplankton samples are collected using a 10 m integrated tube sampler. A 1 L subsample is preserved with 0.5% acidic Lugol's iodine and returned to the MSS Marine Laboratory. Phytoplankton samples are analysed using a modified Utermöhl (1958) technique. Phytoplankton samples are analysed using an inverted Zeiss Axiovert microscope. The presence/absence of all cells in the chamber are recorded and fields of view across a transect are counted at X200 magnification. Phytoplankton are identified to the lowest taxonomic level possible, however due to the limitations of light microscopy and the Lugol's fixative in some instances a genus level identification or 'unidentified' category is assigned.

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Zooplankton samples are collected using 40 cm diameter bongo nets fitted with 200 µm mesh and filtering cod ends. The nets are hauled vertically from near bottom (45 m at Stonehaven and 35 m at Loch Ewe) to surface at a speed of 1 m s^{-1}. The samples are immediately fixed in 4 % borax buffered formaldehyde for later analysis in the laboratory. Zooplankton samples are analysed in the laboratory using a Zeiss Stemi SV-11 stereomicroscope. Larger zooplankton categories (such as *Calanus* spp., chaetognaths, jellyfish, euphausiids etc.) are identified and enumerated from the whole sample. The remaining zooplankton categories are identified and enumerated from a series of subsamples (of variable volumes depending on concentration of animals but a minimum 2.5 % of the whole sample) so that at least 100 animals of the most common taxa are recorded. Most taxa are identified to the lowest taxonomic level possible, whilst other animals are recorded at Class or Phylum level.

More detailed methodology is available in Bresnan et al. (2016). Phytoplankton monthly densities from Stonehaven, Loch Ewe, Scapa and Scalloway, and zooplankton weekly densities from Stonehaven and Loch Ewe are available from: https://data.marine.gov.scot/search/type/dataset.

3.1.6 Scotland Coastal Stations (Scottish Environment Protection Agency)

The Scottish Environment Protection Agency (SEPA) collects plankton samples at two near-shore stations (Forth: 56.03˚N, 3.18˚W; Clyde: 55.95˚N, 4.89˚W). Monthly samples for phytoplankton have been collected since 2007 and zooplankton since 2014.

Phytoplankton samples are collected using an integrated tube column water sampler with foot valve and closure tap, which is lowered open to 10 m depth. The closure tap is then moved to the closed position and the sampler retrieved. The foot valve is opened and the contents of the sampler are emptied into a rinsed bucket. A 250 ml sample bottle prefilled with 2.5 ml of 5% w/v Lugol's iodine solution is gently submerged to fill with water from the bucket. The sample bottle is gently inverted to mix preservative and stored in the dark in a refrigerator at 4 °C. Samples of phytoplankton are removed from cold storage and left to acclimatise at room temperature for 24 hours after which they are gently inverted 100 times to re-suspend settled cells and a volume of sample, typically 50 ml, poured into a sample tube and left to settle for 24 hours. After this time, 40ml of supernatant is drawn off slowly and discarded. The remaining 10 ml of sample is then gently inverted 100 times before being carefully poured into a 10 ml

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Utermöhl (1958) counting chamber. This is then left to settle for a further 24 hours before being analysed on an inverted microscope (Leica DM IRB or Leica DMI4000B – Wetzlar, Germany or Zeiss Axiovert S100 – Jena, Germany). The chamber plate is scanned to assess rough composition of the sample and to determine if settled cells are randomly distributed. Depending on the cell type, size and density, cell counts are made of the whole counting chamber, a number of transects of the widest point, or a number of random fields of view. At least 400 cells are counted when employing transect or field of view counting strategies. Field abundance in cells L^{-1} is calculated by multiplying sample count by microscope subsample factor and 1000 divided by settled volume.

Zooplankton samples are taken with a 27 cm diameter net fitted with a 200 µm mesh with a non-filtering 1 litre cod end. A Hydro-bios (Kiel-Altenholz, Germany) digital flow meter with a back run stop is fitted to the mouth of the net in order to determine the volume hauled, and therefore abundance in individuals m^3. The net is deployed vertically from near-bottom to the surface at approximately 0.5 m s^{-1}. Upon recovery, the net is rinsed with seawater and the contents of the cod ends are transferred into a sample bottle and preserved in 4 % borax buffered formaldehyde. These samples are gently rinsed through a 63 µm wire mesh sieve for microscopic analysis using Leica (Wetzlar, Germany) M165C microscopes. Abundance is determined by counting in the full sample any zooplankton larger than stage IV *Calanus* (including and from copepodite stage V) and enumerating all other zooplankton in a subsample taken using a Folsom or Motoda splitter or a plunge sampler as appropriate to achieve an acceptable density of zooplankton, being no less than 100 of the most abundant taxa.

3.1.7 Lorne Pelagic Observatory (Scottish Association of Marine Science)

Phytoplankton samples have been collected weekly at the Lorne Pelagic Observatory (56.48 ˚N, 5.5˚W) since 1970 by the Scottish Association of Marine Science (SAMS). Water samples for microplankton (i.e.: phytoplankton and pelagic micro-heterotrophs) are taken with water bottles and in some cases with a 10 m integrating hose. They are preserved with 0.5% acidic Lugol's iodine and volumes of 10 to 50 mL sedimented for counting using the Utermöhl (1958) technique and Wild and Zeiss inverted microscopes equipped with phase contrast. Depending on abundance and organism size, a variety of counting patterns are used, ranging from examination of the whole base of the sedimentation chamber at low power to narrow transects or a few fields at high power.

3.1.8 Swedish West Coast (Swedish Meteorological and Hydrological Institute)

The Swedish Meteorological and Hydrological Institute (SMHI) samples both phytoplankton and zooplankton at four stations on the Swedish west coast. Phytoplankton are sampled as an integrated sample using a hose (0-10 m) and preserved in acidic Lugol's; alkaline Lugol's is used for counts of coccolithophores. Twenty-five ml of each sample is analysed using the Utermöhl (1958) method. The samples are stored in the dark and at room temperature prior to analyses. Zooplankton are sampled with a WP2 net (100 µm mesh size), and an integrated sample is taken from 0-25 m. Samples are preserved in formalin and stored in the dark prior to analyses. The subsample volume used when counting depends on the concentration of copepods in the sample to enable statistically sound data.

3.2 Spatio-temporal data distribution

The plankton datasets currently available for lifeform extraction by the PLET have variable spatial and temporal extents, summarised herein into the four regions shown in **Figure 1**. Within each region, the availability of plankton data over time differs between datasets (**Figure 2**). Due to their high spatial coverage the CPR and EA datasets contain the largest numbers of samples available for any month, within each region. The number of samples at fixed-point sampling stations shows variations in sampling frequency; in some cases this has changed over the course of the time-series (for example, in the Celtic Seas both Cefas Smartbuoy and the SAMS dataset).

While sampling is typically carried out weekly or monthly in order to capture the seasonal cycle of the plankton community structure and rapid changes associated with plankton bloom events, several datasets include sampling gaps and changes in sampling intensity for a variety of reasons (**Figure 3**). For example, the EA dataset sampling frequency (and spatial distribution of samples) increased alongside the implementation of the Water Framework Directive (EU, 2000) in 2007, while the SAMS time-series stopped between 1982 and 1999. Missing months in the Cefas Smartbuoy time-series largely indicate failures of the automated sampling system, or sample loss related to logistical delays in buoy servicing. Ongoing sampling of all time-series are at risk of additional reductions in sampling frequency and quality related to funding (McQuatters-Gollop et al., 2017; Zingone et al., 2015).

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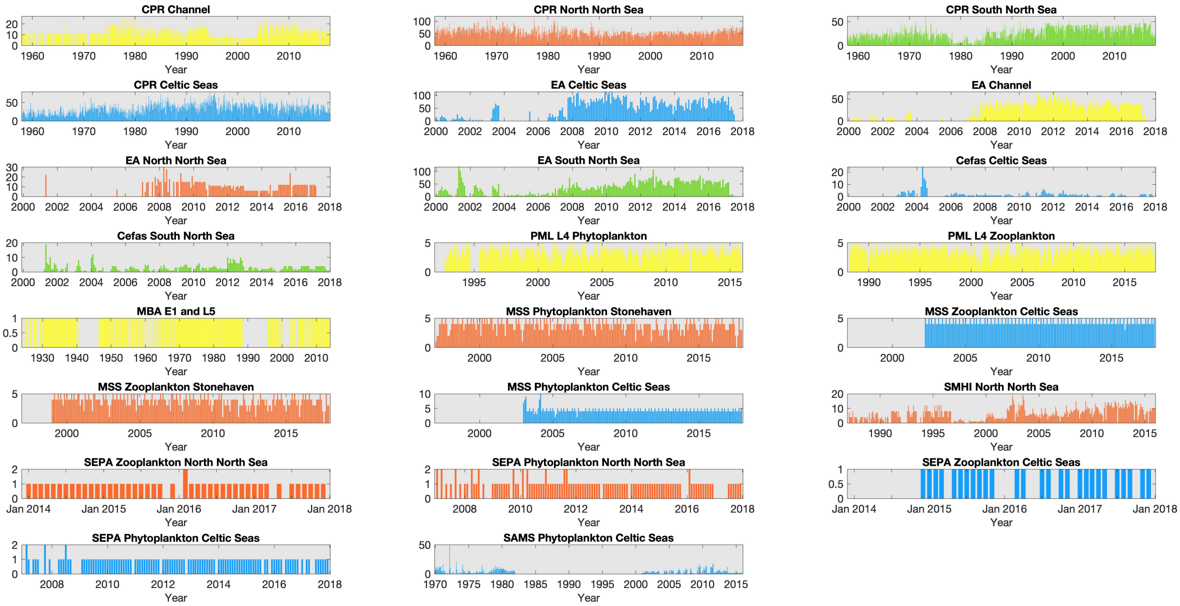

Figure 2. Sampling effort of each dataset within each region: number of sampling timepoints collected per month for each dataset within each of the regions defined in **Figure 1**, except for MSS stations in the northern North Sea where only Stonehaven is shown as an example of the three MSS stations in that region. Note that axis limits are not fixed between panels. Bar colour indicates spatial region (see **Figure 1**); blue: Celtic Seas; red: northern North Sea; green: southern North Sea; light yellow: Channel.

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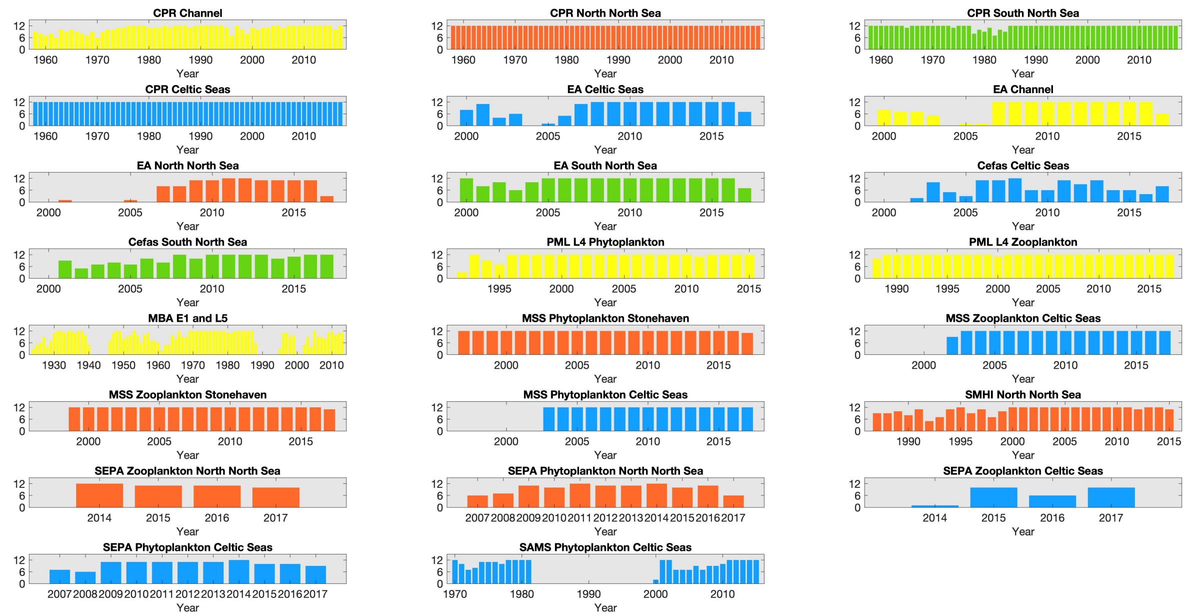

Figure 3. Number of months sampled per year for each dataset within each region: number of months sampled within each year, for each dataset within each of the regions defined in **Figure 1**, except for MSS stations in the northern North Sea where only Stonehaven is shown as an example of the three MSS stations in that region. Widths of the bars indicate the total time-series length. Bar colour indicates spatial region (see **Figure 1**); blue: Celtic Seas; red: northern North Sea; green: southern North Sea; light yellow: Channel.

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4 Plankton lifeforms

The PLET uses a trait look-up table to aggregate plankton taxa into lifeforms. The lifeforms have been pre-defined using biological traits to represent groups of plankton which perform similar ecological functional roles (McQuatters-Gollop et al., 2019; Scherer et al., 2014). Details of each lifeform, and lifeform pairings with ecological relevance for assessment, are given in **Table 2**. It should be noted that these traits have been developed for marine taxa only (see list of included taxon groups in **Table A1**, and traits in **Table B1**), with the goal of simplifying plankton datasets for use in assessments; they are not intended as a fully comprehensive list of plankton traits.

The trait look-up table (Plankton Lifeform Traits Master List (UK Pelagic Habitats Expert Group, 2020) was developed by using a combination of extensive literature synthesis and expert opinion. The World Register of Marine Species (WoRMS Editorial Board, 2020) Aphia IDs are used to link the taxa to their associated traits. Confidence in the lifeforms extracted is assigned based on a combination of the ability to identify each of the taxa it comprises reliably by light microscopy and the ability to assign traits to each taxon (**Table 3**). The confidence associated with each lifeform is described in **Table 4**. Only lifeforms with a 'high' confidence rating are provided in the PLET outputs. In some cases, confidence assignment reflects the limitations of identification by light microscopy by nature of the datasets around which the table was developed. Similarly, the size-based lifeforms (as currently defined and used) reflect the size limitations of sampling and identification of the currently included datasets. For example, the lifeform 'small phytoplankton', defined as phytoplankton with size < 20 µm, is more appropriately termed 'small micro-phytoplankton' because while the lower size limit of identification by routine light microscopy will include some large nanophytoplankton, it excludes pico-plankton and the smaller nano- phytoplankton.

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Table 2. List of lifeforms and their ecological importance. The definitions of the lifeforms (see also McQuatters-Gollop et al. (2019) based on the trait lookup table are given in **Table C1**.

Lifeform	Definition[1]	Ecological Importance
(micro)Phytoplankton (size range determined by possible enumeration by light microscopy)	Protista taxa that contribute to primary production	Encompasses key primary producers, with notable exclusion of pico-, small nano- and microphytoplankton Important for food web support, dynamics and biogeochemical cycling.
Large microphytoplankton	≥ 20 µm individual cell diameter	Changes in relative abundance provides a size-based indicator of the efficiency of energy flow to higher trophic levels. (Schmidt *et al.*, 2020).
Small microphytoplankton	< 20 µm individual cell diameter, with lower size limit determined by current enumeration by light microscopy.	
Diatoms	Taxa of the class Bacillariophyceae	Key groups of primary producers. Changes in abundance, and relative abundance in particular, are used to monitor changes in ecosystem functioning (Hinder et al., 2012; Wasmund et al., 2017). Dominance of dinoflagellates over diatoms may be an indicator of eutrophication or of change in water column stability, indicating changes in nutrient concentration or stratification (Devlin et al., 2009; Wasmund et al., 2017). When dinoflagellates are mainly heterotrophic, then they can account for a significant part of diatom grazing (as in the Eastern English Channel; Grattepanche et al. (2011)).
Dinoflagellates	Taxa of the phylum Dinoflagellata	
Autotrophic and mixotrophic dinoflagellates	Autotrophic: nutrition by photosynthesis; Mixotrophic: capable of obtaining nourishment via photo(auto)trophy and phago(hetero)trophy, as well as via osmo(hetero)trophy (see Flynn *et al.*, 2019)	Shift in primary producers may indicate eutrophication (Gowen et al., 2012).
Pelagic diatoms	Diatoms living in the water column.	Changes in relative abundance provides an indicator of benthic disturbance and frequency of resuspension events (Cibic et al., 2012).
Tychopelagic diatoms	Benthic diatoms which can become mixed into the water column.	
Potentially toxic or nuisance diatoms	Diatoms and dinoflagellates which are either 'toxic', defined as *capable of producing toxins which can cause illness or death in humans, animals and/or fish*, or 'nuisance' defined as taxa producing effects which are detrimental to aquaculture and benthos via physical harm or causing anoxia or produce water discolorations, scums or foams that can be aesthetically, socially, or economically negative.	These groups include species which have the potential for negative impacts on human health and provision of ecosystem services for people as well as other higher trophic levels of the system (Hallegraeff et al., 2021; Wells et al., 2020).
Potentially toxic or nuisance dinoflagellates		
Ciliates	Protozoans characterized by the presence of cilia.	Increases in abundance could indicate a shift from primarily autotrophic to a more heterotrophic system (Scherer, 2012).
Holoplankton	Zooplankton taxa which spend their entire lifecycle in the plankton.	Changes in relative abundance provides an indicator of change in pelagic-benthic food web structure (Bedford et al., 2020a; Kirby et al., 2008).
Meroplankton	Taxa which spend part of their lifecycle as zooplankton.	

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Lifeform	**Definition**[1]	**Ecological Importance**
Gelatinous zooplankton	Taxa of the phyla Cnidaria and Ctenophora only.	Changes in relative abundance indicate potential alternative energy flows through the food web of varying importance to fisheries, aquaculture, tourism etc. (Richardson *et al*., 2009).
Fish larvae and fish eggs	Includes fish eggs as well as larvae.	
Carnivorous zooplankton	Taxa which prey mainly on other zooplankton.	Non-carnivorous functionally refers to zooplankton that could be grazers on phytoplankton, at some point in their lifecycle. Changes in relative abundance of carnivorous and non-carnivorous zooplankton indicates a shift in energy flow and balance between primary consumers and secondary consumers.
Non-carnivorous zooplankton	Zooplankton with less-carnivorous feeding mechanisms, i.e.: predominately suspension or filter feeders, omnivores which can use both carnivorous and herbivorous feeding, or ambiguous (diet uncertain).	
Crustaceans	Taxa of the Subphylum Crustacea	Crustaceans are important for commercial fisheries, either directly or in food chains that fuel them. Changes in crustacean zooplankton abundance can reflect both bottom-up and top-down controls and may indicate changes in food availability for exploited fish stocks (Capuzzo et al., 2018).
Large copepod species (≥ 2 mm)	≥ 2 mm adult total body length	Changes in relative abundance provide a size-based indicator of food web structure and energy flow (Daufresne et al., 2009).
Small copepod species (< 2 mm)	< 2 mm adult total body length	

[1] Modified from McQuatters-Gollop et al. (2019)

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Table 3. Lifeform confidence assignment matrix, where 'High', 'Medium', or 'Low' are based on the ability to identify and assign traits for the constituent taxa groups of a lifeform.

	Can assign traits to constituent taxa	**Cannot assign traits to constituent taxa**
Can identify constituent taxa	high	medium
Cannot identify constituent taxa	medium	low

Table 4. Lifeform confidences based on ability to identify and assign traits, applying rationale in **Table 3**. Only lifeforms with a 'high' confidence rating are provided in the PLET outputs.

Lifeform	**Confidence**	**Reason for confidence (where not 'high')**
(micro)Phytoplankton	High	
Large microphytoplankton	Medium	Can reliably identify individual plankton species size class but cannot always reliably assign the size trait if the group counted spans taxa that are both larger and smaller than 20 microns.
Small microphytoplankton	Medium	
Diatoms	High	
Dinoflagellates	High	
Autotrophic and mixotrophic dinoflagellates	Medium	Can identify taxa, but assigning feeding mechanism trait is not always clear (see discussion in Flynn et al. (2019)
Pelagic diatoms	High	
Tychopelagic diatoms	High	
Potentially toxic and nuisance diatoms	Low	Designation of some algal blooms as "harmful" (i.e.: Harmful Algal Blooms, 'HABS'), relates more to societal assessment than plankton traits, these 'lifeforms' are therefore not currently recommended for use though they are defined in the traits list and will be the focus of future development work. Specific issues include: • The toxin producing diatom genus *Pseudo-nitzschia* contains both amnesic shellfish toxin-producers which can render shellfish unfit for human consumption and potentially negatively impact the health of marine mammals, and non toxin-producing species/individuals. It is not possible to identify these cells to species level using routine light microscopy; some toxin and non-toxin producing species are morphologically identical. • The genus *Alexandrium* contains both paralytic shellfish toxin- and non-toxin-producing species/strains and it is not possible to distinguish these using routine light microscopy; some toxin and non-toxin producing species are morphologically identical. • Currently it is unknown if the negative impact from *Karenia mikimotoi* in European waters is via toxin production or anoxia arising from high biomass blooms. • Not all datasets included in PLET reliably record key species (e.g.: CPR does not record *Alexandrium*)
Potentially toxic and nuisance dinoflagellates	Low	
Ciliates	Low	• Ecological function can be duplicated by heterotrophic and mixotrophic dinoflagellates. • Ciliates do not preserve well in the standard 0.5% Lugol's iodine preservative used to preserve phytoplankton samples and some (but not all) are too small and too fragile to be well sampled by many of the datasets currently in PLET.
Holoplankton	Medium	• May not identify taxa specifically enough to determine traits. • Some of the rarer species are resuspended from the seabed and definition of their holo- or meroplanktonic status is difficult
Meroplankton	Medium	
Gelatinous zooplankton	High	
Fish larvae	High	
Carnivorous zooplankton	Medium	Can identify taxa, but assigning diet trait is unclear, especially at different life stages.
Non-carnivorous zooplankton	Medium	
Crustaceans	High	
Small copepods	High	
Large copepods	High	

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5 Plankton lifeform extraction tool functionality

The PLET is accessed through a web-based user-interface (see **Figure 4**). To generate custom plankton lifeform outputs, users select: time-series start and end dates, a spatial area, and a data set. Because of methodological differences in sampling and analysis it is not appropriate to produce average lifeforms across the multiple datasets, as such all sample locations within the selected spatial area for any data set are aggregated into a single lifeform data product but stations from different datasets are never aggregated. The resulting data product, monthly averaged aggregated lifeform abundance, is generated either within the web-browser, or for download in *.csv* or *.json* format. The output data includes the number of individual samples from which each monthly average was derived, as well as a list of component taxon groupings. Blank output component taxon groupings indicate that the originally submitted sample data did not include information in the (optional) 'Taxon Name' field.

The PLET also has a simple API (Application Programming Interface), which provides the option of bypassing the webpage interface and sending queries to the tool using the URL only. The base URL is ' 'https://www.dassh.ac.uk/lifeforms/cgi-bin/get_form.py '. The parameters are: *startdate* (YYYY-MM-DD), *enddate* (YYYY-MM-DD), *north* (northern edge of bounding box, in decimal degrees), *south* (southern edge of bounding box, in decimal degrees), *east* (eastern edge of bounding box, in decimal degrees), *west* (western edge of bounding box, in decimal degrees), *dataset* (currently: CPR, L4_phyto, L4_zoo, SMHI, CEFAS_SmartBuoy, EA_PHYTO_2000-2017, MBA_E1_L5, MSS_phyto, MSS_zoo, SEPA_Zooplankton, SEPA_Phytoplankton or SAMS-LPO), *format* (csv, json or pretty). For example, to retrieve results from the CPR dataset for May 1975 between 50 and 60 degrees of Latitude and -5 and 5 degrees of Longitude, and return in CSV format, the URL request is: https://www.dassh.ac.uk/lifeforms/cgi-bin/get_form.py?startdate=1975-05-01&enddate=1975-05-30&north=60&south=50&east=5&west=-5&dataset=CPR&format=CSV. Sending such URL commands via Curl or similar tools allows the PLET to be used programmatically if desired.

There are a number of options for defining the spatial domain of the lifeform data product. A rectangular extent can be manually defined by the northern, southern, western, and eastern edges of a rectangular bounding box, by simply drawing a rectangle on the interactive map display which shows sample locations for each data set. Similarly, a polygon shaped extent can be manually defined in 'well-known text' (WKT) format or through the interactive map. A query specifying spatial extent by polygon instead of bounding box can be constructed for the API by designating the parameter *wkt* instead of *north*, *south*, *east* and *west*. A more complex area, for example a formal assessment region, can be used by uploading a shapefile to the tool.

All integrated datasets are listed within the web interface, with full metadata. The trait look-up table can also be accessed and downloaded. To facilitate submission of new and updated plankton data, templates for data submission are also provided.

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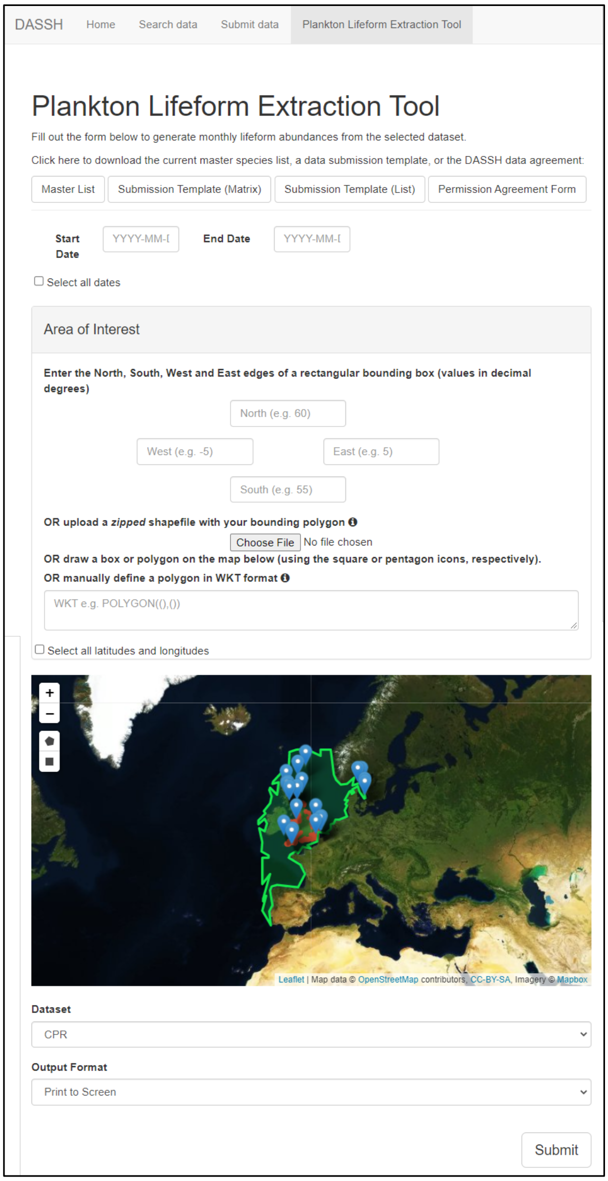

Figure 4. The Plankton Lifeform Extraction Tool. Screenshot of the Plankton Lifeform Extraction Tool (v1).

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6 Lifeform outputs

The spatial and temporal patterns of plankton lifeforms, based on the data currently held in PLET, are summarised to highlight seasonal patterns in **Figure 5** (phytoplankton) and **Figure 6** (zooplankton), and inter-annual patterns in **Figure 7** and **Figure 8**. In order to facilitate visualisation across the different lifeforms and datasets, where absolute lifeform abundances are extremely variable, within-lifeform and dataset changes are shown as standardised z-scores that indicate the difference from the overall time-series mean values (Glover et al., 2005).

Plankton abundance peaks in spring and summer are associated with nearly all plankton lifeforms, across all datasets. However, the timing, duration, and intensity of these peaks differ between lifeforms and datasets (see **Figure 5** and **Figure 6)**, in some cases partly because of spatial aggregation of the data. In the CPR dataset, which samples furthest offshore, seasonal zooplankton lifeform abundance peaks last longer than those of the phytoplankton lifeforms. The EA datasets, which represent estuarine and coastal waters, include much shorter seasonal phytoplankton lifeform abundance peaks than the CPR for the corresponding regions, and differences in bloom timing are also evident, highlighting the small-scale spatial variability in plankton abundance. This is further evidenced in the comparison between seasonal patterns in PML's L4 station in the Channel and both the EA and CPR data aggregation for the same larger region. This heterogeneity demonstrates the added value of integrating datasets to achieve a representative description of plankton community seasonal succession within even a relatively localised sea area, particularly where different programmes sample different subsets of the plankton community (in this case the fragile dinoflagellates being less well preserved by CPR compared to PML and EA sampling). Comparing across larger spatial scales, differences in seasonal patterns between English and Scottish waters are likely influenced by the latitudinal gradients (Fanjul et al., 2017, 2019; Uriarte et al., 2021) as well as local hydrographic conditions (e.g.: Atlantic inflow). The Swedish stations, located in the Kattegat, show the most divergent lifeform seasonality compared to the other datasets, notably in the timing of abundance peaks (e.g.: the absence of April plankton blooms) which likely reflect their distinct oceanographic setting and the influence of Baltic Sea outflow waters.

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Interannual trends in lifeform abundance can be related to changes in pressures within the marine system (Bedford et al. (2020a) and McQuatters-Gollop et al. (2019)). Given the strong seasonal variability, summarising plankton abundance to compare across years is non-trivial. Representative data coverage, typically at least monthly is needed to ensure that inter-annual differences are not due to missing samples. For example, the WFD eutrophication assessment procedure (Greenwood (2019)) requires phytoplankton data for at least 9 months of every year assessed. The Plankton Lifeform Index (Tett et al., 2007, 2008), by looking at changes from a reference envelope defined by 3-5 years of adequate data (i.e.: at least monthly sampling) is robust against missing samples (months) so long as these are not biased to particular times of the year. The Pelagic Habitat Expert Group has recommended at least monthly sampling to adequately take account of seasonal changes in the balance of plankton lifeforms, while noting that higher temporal resolution would provide greater confidence that all transient bloom events (which may last less than a month) were observed. Given the tool's robustness against data loss, annual assessments can be made reliably when one to three months have been lost, so long as there is no persistent bias in lost months over several years.

Despite missing months being an important consideration for annual aggregation (in some datasets in particular, see (**Figure 4)** the interannual trends in phytoplankton (**Figure 7**) and zooplankton (**Figure 8**) lifeforms show considerable changes in lifeform abundance among years in all datasets and regions. The longest time-series (MBA L5&E1 since 1924, CPR since 1960 and SAMS phytoplankton since 1970) capture decreases over several years followed by subsequent increases, which caution against over-interpretation of the shorter time-series. For example, there have been decreases in all zooplankton lifeforms at the MSS Celtic Seas station since 2013 that cannot be seen in the nearby SEPA Celtic Seas station which only has observations from 2014 onwards; while both in the Celtic Seas area, these two sites are characterised by very different hydrographical settings. The importance of considering both short- and long-term changes in plankton lifeforms is discussed in detail in (Bedford et al., 2020b).

Bringing diverse datasets together to extend both spatial and temporal coverage is a key tool for distinguishing small-scale, short-term fluctuations from larger-scale longer-term changes. For example, Bedford *et al.*, 2020a identified regional-scale trends in lifeform changes (increasing diatom abundance in the northern North Sea and increasing mesozooplankton abundance across almost the whole North-

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West European shelf) using timeseries data from 5 different UK plankton surveys and linked some of these changes to changing sea surface temperature. Assessment of the status of the marine pelagic habitat (McQuatters-Gollop et al., 2019) requires linking changes to pressures (Scherer et al., 2016), which relies on high temporal and spatial resolution good quality observations, such as climate (Bedford *et al.*, 2020a) and eutrophication (Gowen et al., 2015; Greenwood, 2019).

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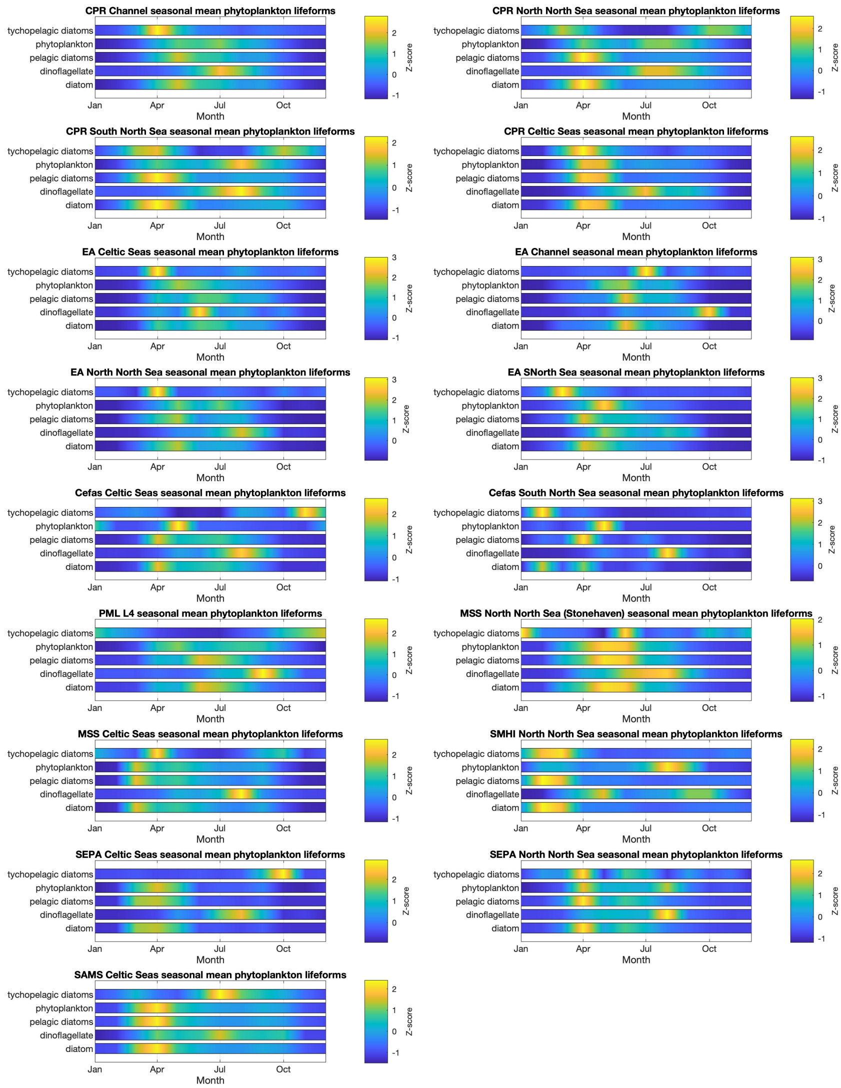

Figure 5. Phytoplankton lifeform monthly means, by data provider and region. Colour indicates lifeform abundance relative to the long-term mean of each lifeform within each region and dataset as standardised z-score (Glover et al., 2005): Scores of zero are equal to the long-term mean, positive scores (in green/yellow) signify values above the long-term mean and negative scores values below the long-term mean (in blue). Only those lifeforms that have been assigned a confidence level of 'high' are shown (see **Table 2** and **Table 3**). Regions are defined in **Figure 1**.

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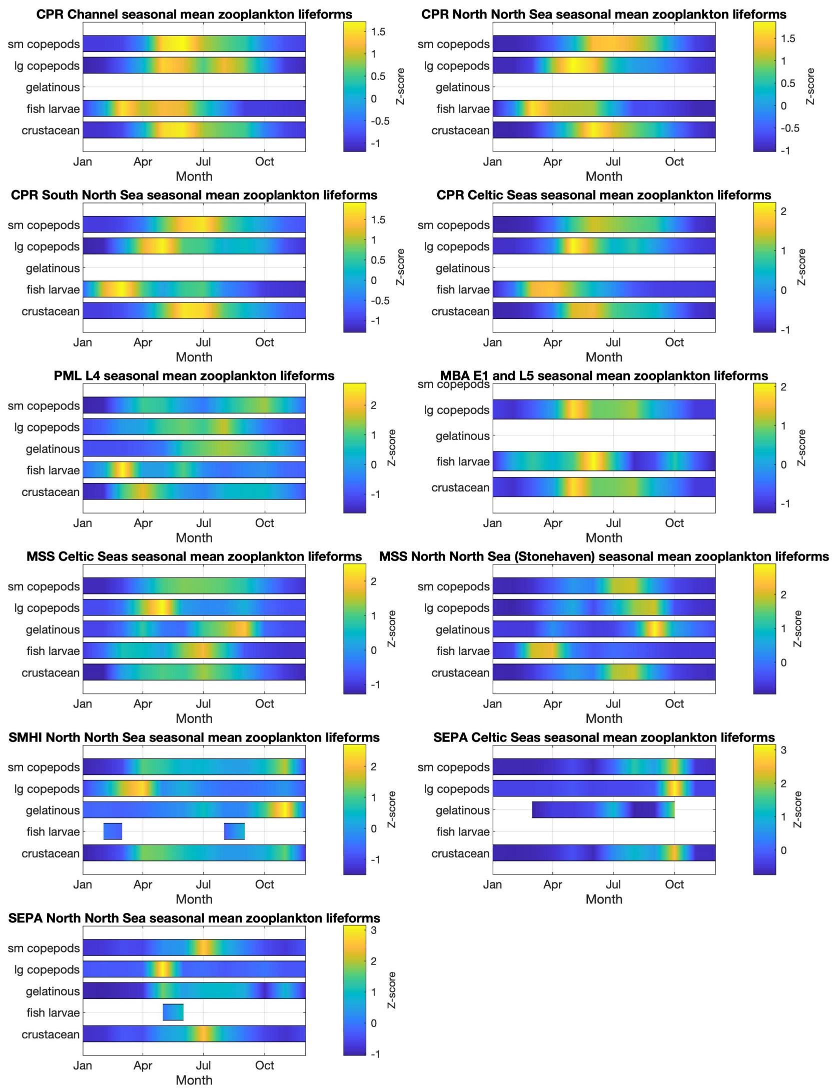

505 **Figure 6. Zooplankton lifeform monthly means, by data provider and region.** Colour indicates lifeform abundance relative to the long-term mean of each lifeform within each region and dataset as standardised z-score (Glover et al., 2005): Scores of zero are equal to the long-term mean, positive scores (in green/yellow) signify values above the long-term mean and negative scores values below the long-term mean (in blue). Only those lifeforms that have been assigned a confidence level of 'high' are shown (see **Table 2** and **Table 3**). Regions are defined in **Figure 1**.

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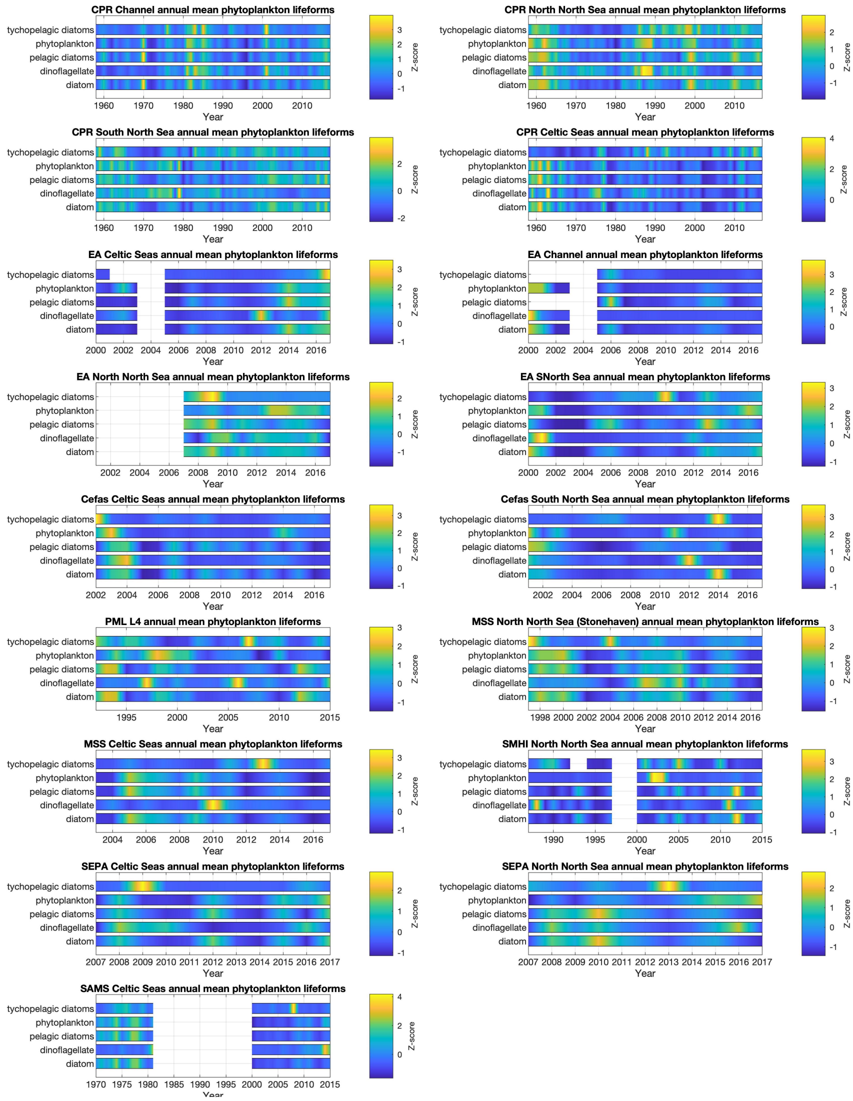

Figure 7. Phytoplankton lifeform annual means, by data provider and region. Colour indicates lifeform abundance relative to the long-term mean of each lifeform within each region and dataset as standardised z-score (Glover et al., 2005): Scores of zero are equal to the long-term mean, positive scores (in green/yellow) signify values above the long-term mean and negative scores values below the long-term mean (in blue). Only those lifeforms that have been assigned a confidence level of 'high' are shown (see **Table 2** and **Table 3**). Regions are defined in **Figure 1**.

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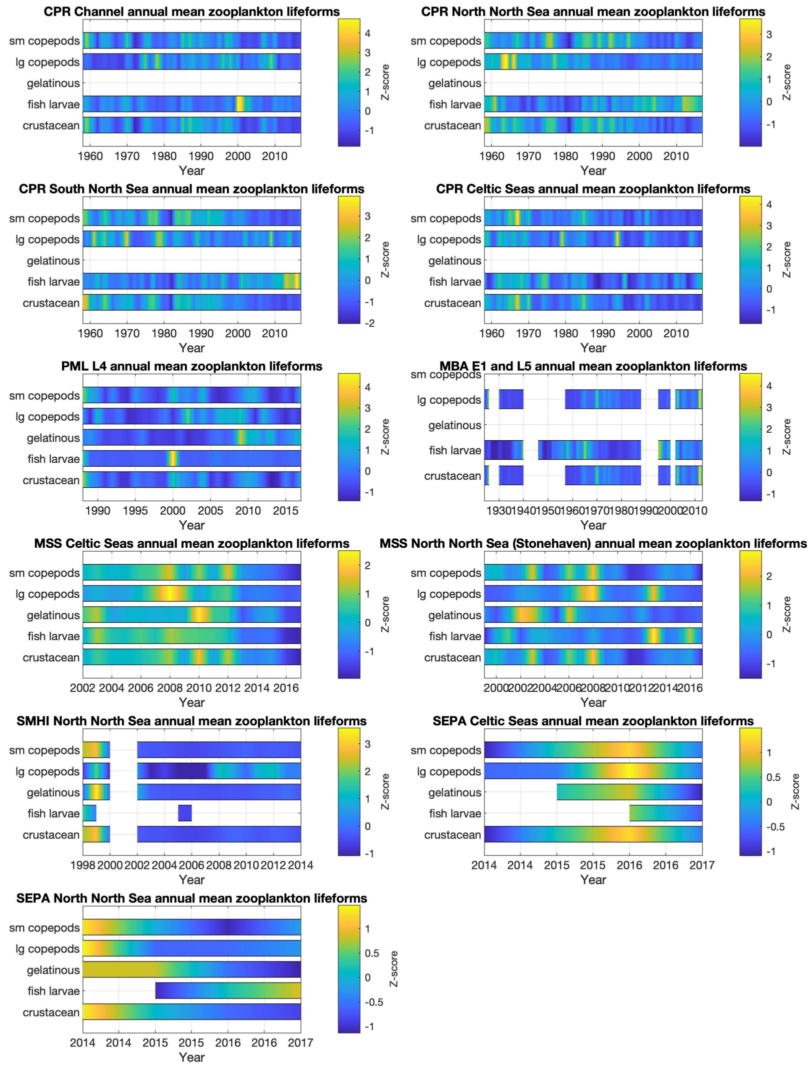

Figure 8. Zooplankton lifeform annual means, by data provider and region. Colour indicates lifeform abundance relative to the long-term mean of each lifeform within each region and dataset as standardised z-score (Glover et al., 2005): Scores of zero are equal to the long-term mean, positive scores (in green/yellow) signify values above the long-term mean and negative scores values below the long-term mean (in blue). Only those lifeforms that have been assigned a confidence level of 'high' are shown (see **Table 2** and **Table 3**). Regions are defined in **Figure 1**.

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7 Discussion

Large-scale trends in the abundance of individual species are challenging to compare across multiple time-series due to difficulties in sampling and in counting at the species level, particularly at the limits of the geographic range of a species. Conversely, trends in bulk indices such as total zooplankton biomass and abundance or total chlorophyll *a* concentration can miss important underlying details. Our method to aggregate at the level of functional groups (lifeforms) provides a tractable approach to reveal meaningful information at an intermediate level of organisation that is still ecologically relevant.

While the main available UK plankton time series are included here as well as Swedish data from the south eastern North Sea, further extending the geographical and temporal extent of plankton time-series held in the PLET will improve robustness of evidence underpinning pelagic habitat assessment. As a transparent and accessible source of diverse plankton datasets, the PLET also facilitates exploration of associated research questions in an integrated way. Observations of changes in size-based plankton lifeform abundances (Greenwood *et al.*, 2019; McQuatters-Gollop *et al*., 2019, Bedford *et al*., 2020), alongside methodological developments in measuring the complete plankton size spectrum (Atkinson et al., 2021), provide an improved ability to understand what is driving changes in plankton size and species composition across the full spatial-temporal scales of the component datasets (Schmidt *et al*., 2020). Data from different data sources are not aggregated within PLET in order to maintain the scientific robustness of the outputs, and incorporate a range of methodologies (units, scale, fixed-point, transect etc.). The data is outputted in a unified way from PLET to encourage comparison and interpretation of the changes in the plankton, if the user wishes to combine the outputs within a specified area and time period a normalisation technique can be applied, however care needs to be taken to ensure compatibility and coverage does not bias the combined results. There is also the flexibility to improve confidence in low confidence groupings, and to potentially incorporate new types of plankton data into the tool in the future, such as the use of flow cytometry data.

Time-series datasets are critical for identifying and assessing changes in the marine environment. Given the expense and effort which goes into producing and maintaining these invaluable datasets, tools which make them more widely available, transparent, and accessible to the broader user community are needed. The PLET provides a centralised, easily accessible, source for version-controlled time-series data and metadata and is an essential component of a robust assessment process as well as a tool to support the research which is needed to underpin assessment. This includes exploring new ecologically relevant lifeform groupings and improving the understanding of lifeforms currently designated as medium and low confidence, and which will in turn feed back into the process of assessing the health of the marine environment.

The PLET is not a static resource; it is designed to readily accept additional datasets and be updated to support future assessments as the assessment procedure continues to evolve. This is a critical step towards using multiple datasets collected with diverse methods to populate and assess a common indicator, allowing the assessment of pelagic biodiversity at a regional scale. As the tool is expanded with additional datasets, its ability to detect change in plankton communities will increase, and the policy evidence it provides will continue to become more robust, providing decision makers with critical information to inform management measures. As pelagic habitat assessments continue to improve and adapt to the changing policy landscape (Boyes and Elliott, 2016) and to evolving plankton data availability, the PLET's flexibility will allow it to continue to underpin assessment.

8 Data Availability and Citation

The Plankton Lifeform Extraction Tool is hosted by the Archive for Marine Species and Habitats Data (DASSH), which is accredited as the UK Node of the Ocean Biodiversity Information System (OBIS) and through the Marine Environmental Data and Information Network (MEDIN), the UK partnership of organisations committed to improving access to UK marine data, and core-funded by the Department for the Environment, Food and Rural Affairs (Defra) and the Scottish Government. Lifeform data products can be generated at: https://www.dassh.ac.uk/lifeforms/.

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The PLET's lifeform data products are generated by applying the Plankton Lifeform Traits Master List trait look-up table (UK Pelagic Habitats Expert Group, 2020; https://www.dassh.ac.uk/doitool/data/1709) to standardised-format versions of the integrated plankton datasets (see **Table 1** for details (CPR and Johns, 2019; MBA, 2019; PML, 2019; CEFAS, 2019; EA, 2019; MSS, 2019; SMHI, 2019; SEPA, 2020; SAMS, 2020)**)**. These time-series may be updated in the future to include ongoing plankton monitoring, and more datasets may be added. Versions of several of these datasets are also available through other data repositories (e.g.: institute-specific websites provided in **Table 1**, or the Ocean Biodiversity Information System: OBIS). However, PLET provides the first centralised database for all time-series feeding into UK Marine Strategy and OSPAR biodiversity lifeform-based assessments, and importantly: a format and structure compatible with extraction of lifeform time-series. By attaching doi's to the underlying dataset versions held within PLET and the traits list, the tool provides full transparency and reproducibility for the generated lifeform outputs. Users of these datasets are encouraged to appropriately cite the data sources by means of their doi's as well as this data paper, so that usage can be more easily traced. Doing so provides evidence of data uptake, enhancing the possibility of continued funding for valuable time series and for plankton indicator development.

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10 Author contribution

AMG co-ordinated the project. All authors developed the Plankton lifeform traits master list and provided input on the lifeform traits and groupings. CO and GG designed the Plankton Lifeform Extraction Tool (PLET) and wrote the initial code. KP developed the PLET and performed the maintenance of the site, with support from DL and DB. DGJ, CO, AA, CW, RB, MB, MD, CG, BB, EB, KC, MM, MJ, and PT provided datasets. CO, CG and AMG prepared the manuscript with contributions from all co-authors.

11 Competing interests

The authors declare that they have no conflict of interest.

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13 Appendices

Table A1: List of taxa groupings included in traits list, and datasets in which they appear. Institutes: AFBI: Agri-food and Biosciences Institute; CEFAS: Centre for Environment, Fisheries and Aquaculture Science; EA: Environment Agency; MBA: Marine Biological Association; MSS: Marine Scotland Science; PML: Plymouth Marine Laboratory; SEPA; Scottish Environment Protection Agency; SMHI: Swedish Meteorological and Hydrological Institute; SAMS: Scottish Association for Marine Science.

AphiaID	Taxon	Institutes
235747	*Acantharea*	CEFAS
235802	*Acanthoica quattrospina*	PML; SMHI
345919	*Acartia bifilosa*	MSS; SEPA; SMHI
149755	*Acartia clausi*	MSS; PML; SEPA; SMHI
346026	*Acartia danae*	MBA
234125	*Acartia discaudata*	MSS; SEPA; SMHI
346037	*Acartia longiremis*	MBA; MSS; SEPA; SMHI
346030	*Acartia negligens*	MBA
104108	*Acartia* spp.	MBA; SEPA; SMHI
345943	*Acartia tonsa*	SEPA; SMHI
149191	*Achnanthes*	AFBI; CEFAS; EA
149387	*Achnanthes brevipes*	AFBI
156533	*Achnanthes longipes*	CEFAS; EA; PML; SEPA
160542	*Actinastrum*	CEFAS; EA
160543	*Actinastrum hantzschii*	Unallocated
109717	*Actiniscus pentasterias*	AFBI; MBA
148944	*Actinocyclus*	AFBI; EA; PML
148945	*Actinocyclus normanii*	Unallocated
162770	*Actinocyclus octonarius var. octonarius*	SMHI
149654	*Actinocyclus octonarius var. ralfsii*	MBA
10194	*Actinopterygii*	MBA; SMHI
148947	*Actinoptychus*	AFBI; CEFAS; EA; MBA; MSS; SEPA
149163	*Actinoptychus octonarius*	AFBI
148948	*Actinoptychus senarius*	AFBI; CEFAS; PML; SMHI
148949	*Actinoptychus splendens*	AFBI
623576	*Acutodesmus acuminatus*	Unallocated
110069	*Adenoides eludens*	MSS
109525	*Adenoides* spp.	MSS
992758	*Aduncodinium glandula*	Unallocated
116998	*Aequorea* spp.	MSS; SEPA
104075	*Aetideidae*	SMHI
356886	*Aetideopsis armatus*	SEPA
104275	*Aetideus armatus*	MBA; MSS; SEPA
104276	*Aetideus giesbrechti*	MBA
104112	*Aetideus* spp	MBA; SEPA
135484	*Agalma elegans*	MSS; SEPA
117849	*Aglantha digitale*	MSS; SEPA
232546	*Akashiwo sanguinea*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109470	*Alexandrium*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109707	*Alexandrium affine*	Unallocated
109711	*Alexandrium minutum*	AFBI; CEFAS; SMHI
109712	*Alexandrium ostenfeldii*	AFBI; CEFAS; EA; SMHI
109713	*Alexandrium pseudogonyaulax*	SMHI
109714	*Alexandrium tamarense*	AFBI; CEFAS; PML; SMHI

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AphiaID	Taxon	Institutes
125516	*Ammodytidae larva*	MSS; SEPA
109556	*Amphidiniopsis*	MSS
109473	*Amphidinium*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109723	*Amphidinium carterae*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109726	*Amphidinium crassum*	AFBI; MSS; PML; SMHI
109741	*Amphidinium longum*	AFBI; CEFAS; SMHI
109754	*Amphidinium sphenoides*	AFBI; CEFAS; EA; MSS; PML; SMHI
109517	*Amphidoma*	AFBI; EA; MSS
110005	*Amphidoma caudata*	AFBI; EA; MBA; MSS; PML
117178	*Amphinema* spp.	MSS; SEPA
1135	*Amphipoda*	MBA; MSS; SEPA; SMHI
149140	*Amphiprora*	AFBI; CEFAS; EA
179174	*Amphiprora hyperborea*	MBA
163647	*Amphiprora paludosa var. paludosa*	SMHI
160671	*Amphiprora surirelloides*	PML
109459	*Amphisolenia*	AFBI; MBA
149200	*Amphora*	AFBI; CEFAS
109518	*Amylax*	AFBI; CEFAS; EA; MSS
233480	*Amylax buxus*	AFBI; CEFAS; MSS; SEPA
110007	*Amylax triacantha*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
146585	*Anabaena*	CEFAS; EA; SMHI
177635	*Anabaena baltica*	SMHI
163489	*Ankistrodesmus*	CEFAS; EA
163490	*Ankistrodesmus falcatus*	Unallocated
608578	*Ankistrodesmus fusiformis*	SMHI
104722	*Anomalocera patersoni*	MBA; MSS; PML; SEPA
106671	*Anomura*	SEPA; SMHI
13551	*Anthoathecata*	MSS; SEPA
1292	*Anthozoa*	PML; SEPA; SMHI
248096	*Apedinella*	AFBI; SMHI
248097	*Apedinella radians*	AFBI; CEFAS; SMHI
160567	*Aphanizomenon*	SMHI
248099	*Aphanizomenon flos-aquae*	SMHI
146562	*Aphanocapsa*	SMHI
162668	*Aphanocapsa incerta*	Unallocated
146715	*Aphanothece*	SMHI
162689	*Aphanothece minutissima*	SMHI
146421	*Appendicularia*	MSS; PML; SEPA; SMHI
624607	*Archaeperidinium minutum*	Unallocated
127126	*Arnoglossus laterna*	SMHI
415082	*Ascampbelliella*	AFBI
1839	*Ascidiacea larva*	MSS; PML; SEPA
292898	*Askenasia stellaris*	Unallocated
148953	*Asterionella*	AFBI; CEFAS; EA; MSS
148954	*Asterionella formosa*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
148955	*Asterionella glacialis*	MSS
149374	*Asterionella gracillima*	Unallocated
149138	*Asterionellopsis*	AFBI; EA
149139	*Asterionellopsis glacialis*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
149618	*Asterionellopsis kariana*	MBA; SEPA
123080	*Asteroidea*	SEPA; SMHI
162254	*Asteromphalus*	AFBI; CEFAS; EA; MBA; MSS; SEPA
162255	*Asteromphalus flabellatus*	PML
394598	*Asteromphalus sarcophagus*	PML
251745	*Asteroplanus karianus*	AFBI; CEFAS; EA

AphiaID	Taxon	Institutes
251744	*Asteroplanus species*	AFBI
394840	*Attheya armata*	AFBI
160520	*Attheya decora*	AFBI; CEFAS; SMHI
464444	*Attheya longicornis*	MSS; SMHI
162823	*Attheya septentrionalis*	AFBI; CEFAS; PML; SMHI
160519	*Attheya* spp.	AFBI; CEFAS; EA; MSS; SEPA
104137	*Augaptilus* spp.	MBA
149280	*Aulacodiscus argus*	AFBI; MBA
148959	*Aulacoseira*	AFBI; SMHI
148960	*Aulacoseira ambigua*	Unallocated
149096	*Aulacoseira distans*	Unallocated
148961	*Aulacoseira granulata*	Unallocated
162877	*Aulacoseira italica*	SMHI
611550	*Aulacoseira subborealis*	Unallocated
135306	*Aurelia aurita*	MSS; SEPA
135263	*Aurelia* spp. *ephyra*	MSS; SEPA
391508	*Azadinium*	AFBI; CEFAS; EA; MSS; SMHI
391509	*Azadinium spinosum*	AFBI; SMHI
149651	*Azpeitia nodulifera*	AFBI
558242	*Bacillaria paradoxa*	Unallocated
149149	*Bacillaria paxillifer*	SEPA
558243	*Bacillaria paxillifera*	AFBI; CEFAS; EA; MBA; MSS; PML
149148	*Bacillaria* spp.	AFBI; CEFAS; EA; MSS
149001	*Bacillariales*	PML
148899	*Bacillariophyceae*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
149118	*Bacteriastrum*	AFBI; CEFAS; EA; MBA; MSS; SEPA
248066	*Bacteriastrum comosum*	Unallocated
164108	*Bacteriastrum delicatulum*	AFBI; EA
164110	*Bacteriastrum furcatum*	AFBI; PML
149119	*Bacteriastrum hyalinum*	AFBI; CEFAS; EA; SMHI
162927	*Bacterosira bathyomphala*	AFBI; CEFAS
292899	*Balanion*	Unallocated
427290	*Balanion comatum*	SMHI
149305	*Bellerochea*	AFBI; CEFAS; EA; MSS; SEPA
447730	*Bellerochea horologicalis*	AFBI; CEFAS
149306	*Bellerochea malleus*	MBA
106331	*Beroe*	SEPA
106358	*Beroe cucumis*	MSS; SEPA
708294	*Bicosoeca campanulata*	Unallocated
104002	*Bicosoeca petiolata*	Unallocated
149655	*Biddulphia alternans*	EA; MBA
162952	*Biddulphia biddulphiana*	AFBI; MBA
149324	*Biddulphia rhombus*	AFBI; CEFAS
148967	*Biddulphia* spp.	AFBI; EA; MSS
148965	*Biddulphiales*	AFBI; CEFAS
105	*Bivalvia*	MBA; MSS; PML; SEPA; SMHI
163736	*Bleakeleya notata*	AFBI; MBA
110178	*Blepharocysta paulsenii*	AFBI; MBA
22556	*Bodonidae*	PML
110067	*Boreadinium pisiforme*	MSS
106265	*Bosmina*	MSS; SEPA; SMHI
106271	*Bosmina coregoni*	SMHI
248104	*Botryococcus braunii*	Unallocated
117328	*Bougainvillia muscus*	SEPA
117015	*Bougainvillia* spp.	MSS; SEPA

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AphiaID	Taxon	Institutes
235922	*Braarudosphaera bigelowii*	PML
106673	*Brachyura*	SEPA; SMHI
104115	*Bradyidius*	SEPA
104902	*Branchiostoma*	PML; SEPA; SMHI
104906	*Branchiostoma lanceolatum*	MBA; SEPA; SMHI
149136	*Brockmanniella*	AFBI; EA
149137	*Brockmanniella brockmannii*	AFBI; CEFAS; PML
231802	*Bysmatrum*	AFBI
1100	*Calanoida C1-6*	MBA; MSS; SEPA; SMHI
104462	*Calanoides carinatus*	MBA; PML; SEPA
104464	*Calanus finmarchicus*	MBA; MSS; SEPA; SMHI
104465	*Calanus glacialis*	MBA; SMHI
104466	*Calanus helgolandicus*	MBA; MSS; PML; SEPA
104467	*Calanus hyperboreus*	MBA; SEPA; SMHI
104152	*Calanus I-IV*	MBA; MSS; SEPA; SMHI
555889	*Calciosolenia brasiliensis*	PML
135513	*Caligidae C1-6*	MSS; SEPA
135566	*Caligus* spp. *C1-6*	MSS; SEPA
105559	*Calliacantha longicaudata*	SMHI
105561	*Calliacantha natans*	SMHI
125522	*Callionymidae*	SMHI
104193	*Calocalanus* spp.	MBA; MSS; PML; SEPA
149488	*Caloneis*	AFBI; MSS
235828	*Calyptrosphaera*	PML
149616	*Campylodiscus*	AFBI
178059	*Campyloneis*	AFBI
149357	*Campylosira cymbelliformis*	AFBI; MBA
104474	*Candacia armata*	MBA; MSS; PML; SEPA
104475	*Candacia bipinnata*	MBA
220915	*Candacia bispinosa*	MBA
104476	*Candacia curta*	MBA
104478	*Candacia ethiopica*	MBA
104479	*Candacia giesbrechti*	MBA
104481	*Candacia longimana*	MBA
104483	*Candacia pachydactyla*	MBA
220914	*Candacia simplex*	MBA
104157	*Candacia* spp.	MBA; SEPA; SMHI
104485	*Candacia tenuimana*	MBA
104486	*Candacia varicans*	MBA
101361	*Caprellidae*	SMHI
196121	*Caprellidea*	MBA
106674	*Caridea*	SMHI
341285	*Centrales*	AFBI; CEFAS
109526	*Centrodinium*	AFBI; MBA
104491	*Centropages bradyi*	MBA
104494	*Centropages chierchiae*	MBA; SEPA
104495	*Centropages furcatus*	MBA
104496	*Centropages hamatus*	MBA; MSS; SEPA; SMHI
104159	*Centropages* spp.	MBA; SEPA; SMHI
104499	*Centropages typicus*	MBA; MSS; SEPA; SMHI
104500	*Centropages violaceus*	MBA
416184	*Cephalobrachia* spp.	MBA
1824	*Cephalochordata*	MSS
11707	*Cephalopoda larvae*	MBA; PML; SEPA
149619	*Cerataulina pelagica*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI

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AphiaID	Taxon	Institutes
149236	*Årtaulina* spp.	AFBI; CEFAS; EA; MSS
109506	*Ceratium*	AFBI; CEFAS; EA; MSS; SMHI
156509	*Ceratium arcticum*	MBA; MSS
109929	*Ceratium arietinum*	EA; MBA; MSS; SEPA
844439	*Ceratium articum*	Unallocated
109930	*Ceratium azoricum*	CEFAS; MBA; MSS; SEPA
109931	*Ceratium belone*	AFBI; MBA
109932	*Ceratium breve*	AFBI; MBA
196820	*Ceratium bucephalum*	MBA; SMHI
109934	*Ceratium buceros*	MBA
109935	*Ceratium candelabrum*	AFBI; MBA
109936	*Ceratium carriense*	MBA
109939	*Ceratium compressum*	CEFAS; EA; MBA; MSS; SEPA
109940	*Ceratium concilians*	Unallocated
109941	*Ceratium contortum*	MBA
109943	*Ceratium declinatum*	MBA
109947	*Ceratium extensum*	AFBI; MBA
109948	*Ceratium falcatiforme*	MBA
109949	*Ceratium falcatum*	MBA
109950	*Ceratium furca*	EA; MBA; MSS; SEPA; SMHI
109951	*Ceratium fusus*	AFBI; EA; MBA; MSS; SEPA; SMHI
109952	*Ceratium geniculatum*	MBA
109953	*Ceratium gibberum*	AFBI; MBA
109955	*Ceratium hexacanthum*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA
109956	*Ceratium horridum*	AFBI; EA; MBA; MSS; SEPA; SMHI
422708	*Ceratium horridum var. buceros*	Unallocated
109958	*Ceratium inflatum*	MBA
109960	*Ceratium karstenii*	MBA
109961	*Ceratium kofoidii*	MBA
109962	*Ceratium limulus*	MBA
109963	*Ceratium lineatum*	EA; MBA; MSS; SEPA; SMHI
109964	*Ceratium longipes*	EA; MBA; MSS; PML; SEPA; SMHI
109965	*Ceratium longirostrum*	AFBI; MBA
196822	*Ceratium lunula*	MBA
109967	*Ceratium macroceros*	EA; MBA; MSS; SEPA; SMHI
109968	*Ceratium massiliense*	AFBI; MBA
109969	*Ceratium minutum*	CEFAS; EA; MBA; MSS; SEPA
109971	*Ceratium pavillardii*	MBA
109972	*Ceratium pentagonum*	MBA
196824	*Ceratium platycorne*	AFBI; CEFAS; MBA; MSS; SEPA
109974	*Ceratium pulchellum*	MBA
109975	*Ceratium ranipes*	MBA
109977	*Ceratium setaceum*	AFBI; CEFAS; EA; MBA; MSS; SEPA
109979	*Ceratium symmetricum*	AFBI; EA
109980	*Ceratium teres*	AFBI; MBA
109981	*Ceratium trichoceros*	AFBI; MBA
109982	*Ceratium tripos*	AFBI; EA; MBA; MSS; SEPA; SMHI
109983	*Ceratium vultur*	MBA
109507	*Ceratocorys* spp.	AFBI; MBA
163932	*Ceratoneis closterium*	Unallocated
1361	*Ceriantharia*	SEPA
100782	*Cerianthus* spp.	MSS; SEPA
148985	*Chaetoceros*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
370366	*Chaetoceros (Hyalochaete)*	AFBI; MBA; SEPA
370367	*Chaetoceros (Phaeoceros)*	AFBI; EA; SEPA

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AphiaID	Taxon	Institutes
149241	*Chaetoceros affinis*	AFBI; CEFAS; PML; SMHI
149292	*Chaetoceros anastomosans*	AFBI; PML; SMHI
162998	*Chaetoceros anastomosans var. externa*	SMHI
149288	*Chaetoceros atlanticus*	AFBI
149124	*Chaetoceros borealis*	AFBI; CEFAS; PML; SMHI
149291	*Chaetoceros brevis*	AFBI; CEFAS; PML
163013	*Chaetoceros calcitrans*	AFBI; SMHI
149297	*Chaetoceros ceratosporus*	AFBI; CEFAS
163016	*Chaetoceros ceratosporus var. ceratosporus*	SMHI
163019	*Chaetoceros circinalis*	AFBI; SMHI
149129	*Chaetoceros compressus*	AFBI; CEFAS; PML; SMHI
156607	*Chaetoceros concavicornis*	AFBI; CEFAS; PML; SMHI
156609	*Chaetoceros constrictus*	AFBI; CEFAS; SMHI
149623	*Chaetoceros contortus*	AFBI; SMHI
156611	*Chaetoceros convolutus*	AFBI; PML; SMHI
163026	*Chaetoceros coronatus*	AFBI; SMHI
149289	*Chaetoceros costatus*	AFBI; PML; SMHI
149171	*Chaetoceros crinitus*	AFBI; CEFAS; SMHI
465389	*Chaetoceros criophilus*	AFBI
149221	*Chaetoceros curvisetus*	AFBI; CEFAS; PML; SMHI
149120	*Chaetoceros danicus*	AFBI; CEFAS; EA; MSS; PML; SMHI
149219	*Chaetoceros debilis*	AFBI; CEFAS; PML; SMHI
149126	*Chaetoceros decipiens*	AFBI; CEFAS; PML; SMHI
149121	*Chaetoceros densus*	AFBI; CEFAS; PML; SMHI
149128	*Chaetoceros diadema*	AFBI; CEFAS; SMHI
149122	*Chaetoceros didymus*	AFBI; CEFAS; PML; SMHI
163048	*Chaetoceros didymus var. didymus*	SMHI
163054	*Chaetoceros didymus var. protuberans*	SMHI
163056	*Chaetoceros difficilis*	Unallocated
160521	*Chaetoceros eibenii*	AFBI; CEFAS; PML
160522	*Chaetoceros externus*	PML
178194	*Chaetoceros filiformis*	AFBI; PML
149173	*Chaetoceros fragilis*	AFBI; PML
465524	*Chaetoceros gracilis*	SMHI
163063	*Chaetoceros holsaticus*	Unallocated
163080	*Chaetoceros impressus*	SMHI
156613	*Chaetoceros ingolfianus*	SMHI
149228	*Chaetoceros laciniosus*	AFBI; CEFAS; PML; SMHI
160523	*Chaetoceros lauderi*	AFBI; PML
156617	*Chaetoceros lorenzianus*	AFBI; CEFAS; EA; SMHI
163089	*Chaetoceros minimus*	SMHI
148986	*Chaetoceros mitra*	Unallocated
163098	*Chaetoceros muelleri*	SMHI
418510	*Chaetoceros neogracile*	AFBI
178185	*Chaetoceros peruvianus*	AFBI; CEFAS; MSS; PML
163055	*Chaetoceros protuberans*	AFBI; PML
163109	*Chaetoceros pseudobrevis*	AFBI; SMHI
149222	*Chaetoceros pseudocrinitus*	AFBI; SMHI
178229	*Chaetoceros pseudocurvisetus*	AFBI
163112	*Chaetoceros radicans*	AFBI; PML
621740	*Chaetoceros salsugineum*	Unallocated
163118	*Chaetoceros seiracanthus*	AFBI; CEFAS; SMHI
149127	*Chaetoceros similis*	AFBI; CEFAS; PML; SMHI
149294	*Chaetoceros simplex*	AFBI; PML; SMHI
149123	*Chaetoceros socialis*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI

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AphiaID	Taxon	Institutes
163126	*Chaetoceros socialis f. radians*	SMHI
163124	*Chaetoceros socialis f. socialis*	SMHI
156621	*Chaetoceros subtilis*	AFBI; CEFAS; SMHI
163131	*Chaetoceros subtilis var. subtilis*	SMHI
156623	*Chaetoceros tenuissimus*	AFBI; CEFAS; SMHI
149125	*Chaetoceros teres*	AFBI; CEFAS; PML; SMHI
163137	*Chaetoceros throndsenii*	AFBI; CEFAS; SMHI
163150	*Chaetoceros throndsenii var. throndsenii*	SMHI
163161	*Chaetoceros tortissimus*	AFBI; PML
160524	*Chaetoceros wighamii*	AFBI; PML; SMHI
156625	*Chaetoceros willei*	PML
2081	*Chaetognatha*	MBA; PML; SEPA; SMHI
233776	*Chattonella*	AFBI; CEFAS; EA; SMHI
547444	*Chattonella marina var. antiqua*	Unallocated
178587	*Chlamydomonas coccoides*	Unallocated
573809	*Chlamydomonas quadrilobata*	Unallocated
160576	*Chlorella*	Unallocated
532029	*Chlorella vulgaris*	EA
17666	*Chlorodendrales*	SMHI
178734	*Chlorogonium*	MSS
600769	*Chloromonas*	Unallocated
802	*Chlorophyceae*	AFBI; EA
580116	*Choanoflagellatea*	AFBI; CEFAS; MSS; PML
25	*Choanoflagellida*	SMHI
341353	*Choreotrichida*	SEPA
249689	*Chromulina*	Unallocated
106281	*Chroomonas*	SMHI
115090	*Chrysochromulina*	CEFAS; MSS; SMHI
115116	*Chrysochromulina ericina*	SMHI
115119	*Chrysochromulina hirta*	SMHI
115126	*Chrysochromulina parkeae*	Unallocated
571998	*Chrysochromulina parva*	Unallocated
115127	*Chrysochromulina polylepis*	SMHI
146230	*Chrysophyceae*	AFBI; EA
125741	*Ciliata*	Unallocated
11	*Ciliophora*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
1082	*Cirripedia*	MBA; MSS; PML; SEPA; SMHI
1082	*Cirripede cyprid*	MBA; MSS; PML; SEPA; SMHI
1082	*Cirripede nauplii*	MBA; MSS; PML; SEPA; SMHI
1076	*Cladocera*	SEPA; SMHI
109509	*Cladopyxis*	AFBI; MBA
233351	*Cladopyxis claytonii*	SMHI
233352	*Cladopyxis setifera*	SMHI
128567	*Clausidiidae*	SEPA
104082	*Clausocalanidae*	SMHI
104502	*Clausocalanus arcuicornis*	SMHI
104161	*Clausocalanus* spp.	MBA; MSS; PML; SEPA; SMHI
196804	*Climacodium frauenfeldianum*	MBA
248081	*Climacosphenia*	CEFAS
137751	*Clio* spp.	MBA; SEPA
137793	*Clione*	MBA; PML; SEPA
139178	*Clione limacina*	MBA; MSS; SEPA
162725	*Closterium*	EA
577666	*Closterium moniliferum*	Unallocated
125464	*Clupeidae larva*	MSS; SEPA

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AphiaID	Taxon	Institutes
115273	*Clytemnestra*	SEPA
587514	*Clytemnestrinae*	SEPA
117368	*Clytia hemisphaerica*	MSS; SEPA
1267	*Cnidaria*	SEPA; SMHI
178597	*Coccolithaceae*	Unallocated
235993	*Coccolithophorid*	AFBI; EA
178600	*Coccolithus pelagicus*	PML
555900	*Coccolithus pelagicus f. hyalinus*	PML
148990	*Cocconeis placentula*	Unallocated
179573	*Cocconeis pseudomarginata*	Unallocated
149376	*Cocconeis scutellum*	CEFAS; SMHI
163880	*Cocconeis scutellum var. scutellum*	CEFAS; SMHI
148989	*Cocconeis* sp	AFBI; CEFAS; SMHI
626348	*Cochlearisigma falcatum*	Unallocated
109474	*Cochlodinium*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
232650	*Cochlodinium polykrikoides*	Unallocated
109773	*Cochlodinium pupa*	SMHI
565154	*Codonium proliferum*	SEPA
160550	*Coelastrum*	EA
163975	*Coelastrum microporum*	Unallocated
152230	*Coelenterata*	MSS
567048	*Commation*	SMHI
623754	*Conticribra weissflogii*	AFBI; CEFAS
109534	*Coolia*	AFBI; CEFAS; SEPA
1080	*Copepoda* C1-6	MSS; SEPA; SMHI
128721	*Copilia* spp.	MBA
149109	*Corethron*	AFBI; CEFAS; EA; MSS
957579	*Corethron criophilum*	AFBI
179596	*Corethron hystrix*	AFBI; CEFAS; EA; MBA; MSS
341496	*Corethron pennatum*	AFBI; CEFAS; EA; PML; SEPA
235934	*Coronosphaera*	PML
128569	*Corycaeidae*	MSS; SEPA; SMHI
128800	*Corycaeus speciosus*	MBA
128634	*Corycaeus* spp.	MBA; SEPA; SMHI
162519	*Corymbellus aureus*	CEFAS; PML
117452	*Corymorpha nutans*	MSS; SEPA
151860	*Coryne eximia*	SEPA
107277	*Corystes cassivelaunus*	SEPA
109527	*Corythodinium*	AFBI; MBA; MSS
110073	*Corythrodinium diploconus*	Unallocated
149110	*Corythron criophilum*	Unallocated
148900	*Coscinodiscophyceae*	MSS; SMHI
148917	*Coscinodiscus*	AFBI; CEFAS; EA; MBA; MSS; SEPA; SMHI
149274	*Coscinodiscus asteromphalus*	PML
149159	*Coscinodiscus centralis*	AFBI; CEFAS; PML; SMHI
148991	*Coscinodiscus commutatus*	AFBI; CEFAS; SMHI
148992	*Coscinodiscus concinnus*	AFBI; CEFAS; EA; MBA; PML; SMHI
149271	*Coscinodiscus granii*	AFBI; CEFAS; EA; PML; SMHI
149307	*Coscinodiscus pavillardii*	AFBI
149158	*Coscinodiscus radiatus*	AFBI; CEFAS; EA; PML; SMHI
156632	*Coscinodiscus wailesii*	AFBI; CEFAS; EA; MBA; PML; SMHI
478557	*Cosmarium*	Unallocated
117747	*Cosmetira pilosella*	SEPA
178617	*Crucigenia species*	CEFAS; EA; MSS; SEPA
178619	*Crucigenia tetrapedia*	EA

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AphiaID	Taxon	Institutes
1066	*Crustacea*	SEPA
118011	*Cryothecomonas*	SMHI
118047	*Cryothecomonas scybalophora*	SMHI
109998	*Crypthecodinium cohnii*	Unallocated
17644	*Cryptomonadaceae*	PML
17640	*Cryptomonadales*	CEFAS; SMHI
106282	*Cryptomonas*	CEFAS; EA; SMHI
238840	*Cryptomonas curvata*	Unallocated
155555	*Cryptomonas erosa*	Unallocated
248112	*Cryptomonas marssonii*	Unallocated
155554	*Cryptomonas ovata*	Unallocated
17639	*Cryptophyceae*	AFBI; CEFAS; EA; MSS; SMHI
17638	*Cryptophyta*	Unallocated
104162	*Ctenocalanus* spp.	MBA; SEPA
104510	*Ctenocalanus vanus*	MBA; MSS; PML; SEPA
1248	*Ctenophora*	MSS; SEPA
1137	*Cumacea*	MBA; MSS; PML; SEPA
135301	*Cyanea capillata*	SEPA
135302	*Cyanea lamarckii*	MSS; SEPA
135259	*Cyanea* spp.	MSS; SEPA
146537	*Cyanobacteria*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
177108	*Cyanodictyon*	SMHI
357973	*Cyclopinoides longicornis*	MBA
1101	*Cyclopoida*	MSS; SEPA; SMHI
148996	*Cyclostephanos dubius*	Unallocated
148905	*Cyclotella*	AFBI; CEFAS; EA; SMHI
148907	*Cyclotella atomus*	EA
148908	*Cyclotella choctawhatcheeana*	Unallocated
148998	*Cyclotella cryptica*	Unallocated
163197	*Cyclotella hakanssoniae*	SMHI
148909	*Cyclotella meneghiniana*	Unallocated
149000	*Cyclotella radiosa*	Unallocated
148906	*Cyclotella scaldensis*	Unallocated
148911	*Cyclotella striata*	Unallocated
292893	*Cyclotrichiida*	SEPA
149004	*Cylindrotheca closterium*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
149570	*Cylindrotheca gracilis*	AFBI; CEFAS; MSS; SEPA
149003	*Cylindrotheca* spp.	AFBI; CEFAS; EA; MSS
149008	*Cymatopleura solea*	Unallocated
149012	*Cymatosira belgica*	AFBI; CEFAS
179688	*Cymatosira lorenziana*	CEFAS; MSS
134527	*Cymbomonas*	SMHI
134545	*Cymbomonas tetramitiformis*	SMHI
146142	*Cyphonautes*	MBA; MSS; PML; SEPA; SMHI
196830	*Cystodinium*	AFBI; MBA
149309	*Dactyliosolen*	AFBI; CEFAS; EA; SEPA
179785	*Dactyliosolen antarcticus*	AFBI; CEFAS; EA; MBA; MSS; SEPA
179786	*Dactyliosolen blavyanus*	AFBI; CEFAS; EA; PML; SMHI
149310	*Dactyliosolen fragilissimus*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
248064	*Dactyliosolen phuketensis*	CEFAS; SMHI
771485	*Daphnia*	SMHI
341300	*Daturella*	SMHI
1130	*Decapoda larvae*	MBA; MSS; PML; SEPA; SMHI
149179	*Delphineis*	AFBI; CEFAS; EA; MSS; PML
621926	*Delphineis minutissima*	Unallocated

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AphiaID	Taxon	Institutes
149180	*Delphineis surirella*	AFBI
162724	*Desmidiaceae*	SEPA
886288	*Desmidiales*	CEFAS; EA
249711	*Desmodesmus*	CEFAS; EA; MSS; SEPA
612499	*Desmodesmus armatus*	Unallocated
576237	*Desmodesmus communis*	Unallocated
612502	*Desmodesmus dispar*	Unallocated
624737	*Desmodesmus granulatus*	Unallocated
149286	*Detonula confervacea*	AFBI; CEFAS; MBA; MSS; SEPA; SMHI
149647	*Detonula pumila*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
149285	*Detonula* spp.	AFBI; CEFAS; EA; MSS
104167	*Diaixis*	SEPA
104521	*Diaixis hibernica*	MBA; MSS; PML; SEPA
104522	*Diaixis pygmaea*	MBA; SEPA
247924	*Diaptomus* spp.	MSS
149013	*Diatoma*	Unallocated
160092	*Diatoma tenue*	CEFAS; EA
149014	*Diatoma tenuis*	AFBI; SMHI
149347	*Diatoma vulgare*	Unallocated
232110	*Dicroerisma psilonereiella*	SMHI
231762	*Dicroerisma* spp	MSS
157258	*Dictyocha*	AFBI; CEFAS; EA; SMHI
375788	*Dictyocha crux*	AFBI
157463	*Dictyocha fibula*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
157260	*Dictyocha speculum*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
157256	*Dictyochales*	CEFAS
146232	*Dictyochophyceae*	AFBI; EA; MSS; SEPA
178623	*Dictyosphaerium*	EA
178625	*Dictyosphaerium ehrenbergianum*	Unallocated
341301	*Didinium*	SMHI
163233	*Dimeregramma*	Unallocated
157240	*Dinobryon*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
160552	*Dinobryon balticum*	SMHI
157248	*Dinobryon divergens*	CEFAS; SMHI
160553	*Dinobryon faculiferum*	CEFAS; SMHI
157252	*Dinobryon sertularia*	EA
19542	*Dinophyceae*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109406	*Dinophysiaceae*	EA
109462	*Dinophysis*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109603	*Dinophysis acuminata*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
109604	*Dinophysis acuta*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
232155	*Dinophysis borealis*	MSS
109612	*Dinophysis caudata*	AFBI; CEFAS; EA; MSS; SEPA
109616	*Dinophysis dens*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109624	*Dinophysis fortii*	AFBI; CEFAS; MSS; SEPA
109627	*Dinophysis hastata*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
232496	*Dinophysis nasuta*	AFBI; CEFAS; MSS; PML; SEPA
109637	*Dinophysis norvegica*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109638	*Dinophysis odiosa*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
646201	*Dinophysis ovum*	AFBI; EA; MSS; SEPA
109649	*Dinophysis pulchella*	AFBI; CEFAS; EA; MSS; SEPA
109651	*Dinophysis punctata*	AFBI; CEFAS; EA; MSS; SEPA
162793	*Dinophysis rotundata*	AFBI; EA; MSS
232261	*Dinophysis sacculus*	AFBI; CEFAS; EA; MSS; PML; SEPA
109659	*Dinophysis skagii*	AFBI; MSS; SEPA

AphiaID	Taxon	Institutes
109662	*Dinophysis tripos*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
135338	*Diphyidae*	MSS; SEPA
149018	*Diploneis*	AFBI; CEFAS; EA; MBA; SMHI
149194	*Diploneis bombus*	Unallocated
149396	*Diploneis crabro*	PML
149195	*Diploneis didyma*	Unallocated
149019	*Diploneis interrupta*	Unallocated
149404	*Diploneis littoralis*	Unallocated
164085	*Diploneis stroemii*	Unallocated
109515	*Diplopsalis*	AFBI; CEFAS; EA; PML; SEPA; SMHI
110001	*Diplopsalis lenticula*	AFBI; SMHI
155560	*Diplopsalopsis bomba*	AFBI; SMHI
146221	*Discomitochondria*	AFBI
465546	*Discostella pseudostelligera*	Unallocated
109569	*Dissodinium*	AFBI; EA; SEPA
110325	*Dissodinium pseudolunula*	AFBI; SMHI
110326	*Dissodium asymmetricum*	AFBI; EA
128805	*Ditrichocorycaeus anglicus*	PML; SEPA
149023	*Ditylum brightwellii*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
134530	*Dolichomastix*	Unallocated
625374	*Dolichospermum lemmermannii*	SMHI
137212	*Doliolida*	PML; SEPA
137215	*Doliolidae*	MBA; MSS; SMHI
149510	*Donkinia*	Unallocated
178589	*Dunaliella*	Unallocated
106889	*Ebalia*	SEPA
118051	*Ebria tripartita*	CEFAS; SEPA; SMHI
1806	*Echinodermata*	MBA; MSS; PML; SEPA; SMHI
123082	*Echinoidea*	SEPA
558776	*Echinospira larvae*	MBA
117512	*Eirene viridula*	SEPA
115104	*Emiliania huxleyi*	AFBI; PML; SMHI
1820	*Enteropneusta*	SEPA
156598	*Entomoneis*	AFBI; SMHI
341375	*Entomoneis paludosa var. hyperborea*	Unallocated
1271	*Entoprocta*	SEPA
291403	*Ephemera*	AFBI
341542	*Ephemera planamembranacea*	MBA; PML
341668	*Epiplocylis undella*	Unallocated
149027	*Epithemia turgida*	Unallocated
231793	*Erythropsidinium*	PML
104085	*Eucalanidae*	SEPA
104171	*Eucalanus*	SEPA
149718	*Eucalanus elongatus*	Unallocated
847452	*Eucalanus elongatus elongatus*	MSS
345781	*Eucalanus hyalinus*	MBA
149130	*Eucampia*	AFBI; EA; MBA; MSS
248058	*Eucampia cornuta*	AFBI; CEFAS; EA; MSS; SEPA
157430	*Eucampia groenlandica*	AFBI; CEFAS; EA; MBA; MSS; SEPA; SMHI
149131	*Eucampia zodiacus*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
616809	*Eucampia zoodiacus*	MSS
104550	*Euchaeta acuta*	MBA
104552	*Euchaeta marina*	MBA
104553	*Euchaeta media*	MBA
104554	*Euchaeta pubera*	MBA

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AphiaID	Taxon	Institutes
104555	*Euchaeta spinosa*	MBA
104174	*Euchaeta* spp.	SEPA
104086	*Euchaetidae*	MBA; MSS; SEPA; SMHI
104296	*Euchirella amoena*	MBA
104299	*Euchirella curticauda*	MBA; SEPA
104300	*Euchirella maxima*	MBA
104301	*Euchirella messinensis*	MBA
104302	*Euchirella pulchra*	MBA
104303	*Euchirella rostrata*	MBA; SEPA
104120	*Euchirella* spp.	MBA; SEPA
390664	*Eudorina*	EA
8012	*Euglena*	EA; MSS; SMHI
163466	*Euglena proxima*	Unallocated
21000	*Euglenales*	SMHI
582177	*Euglenoidea*	AFBI; CEFAS
19539	*Euglenophyceae*	EA; SMHI
582161	*Euglenozoa*	SEPA
105416	*Eukrohnia hamata*	SEPA
1128	*Euphausiacea Total*	MBA; SMHI
110671	*Euphausiid*	MSS; PML; SEPA
117095	*Euphysa* spp.	MSS; SEPA
416226	*Euryarchaeota*	SMHI
104240	*Eurytemora*	SMHI
104872	*Eurytemora affinis*	SEPA
157670	*Eurytemora herdmani*	SEPA
115348	*Euterpina*	SMHI
116162	*Euterpina acutifrons*	PML; SEPA; SMHI
117515	*Eutima gracilis*	MSS; SEPA
183543	*Eutintinnus*	SMHI
183557	*Eutintinnus elongatus*	SMHI
178582	*Eutreptia*	SMHI
17657	*Eutreptiella*	AFBI; CEFAS; MSS; PML; SMHI
248121	*Eutreptiella braarudii*	SMHI
573868	*Eutreptiella cornubiense*	Unallocated
573871	*Eutreptiella eupharyngea*	Unallocated
110652	*Eutreptiella gymnastica*	SMHI
172264	*Eutreptiella hirudoidea*	Unallocated
160556	*Eutreptiella marina*	Unallocated
106273	*Evadne nordmanni*	MSS; SEPA; SMHI
106267	*Evadne* spp.	MBA; PML; SEPA; SMHI
172431	*Favella*	SMHI
235761	*Favella ehrenbergii*	SMHI
292923	*Favella helgolandica*	Unallocated
233761	*Fibrocapsa japonica*	AFBI
11676	*Fish larvae*	MSS; PML; SEPA; SMHI
146222	*Flagellates*	CEFAS; EA; PML; SEPA; SMHI
1410	*Foraminifera*	SMHI
149028	*Fragilaria*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA
157458	*Fragilaria striatula*	EA; SMHI
148952	*Fragilariaceae*	AFBI
149313	*Fragilariopsis*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA
232601	*Fragilidinium*	AFBI; MSS
109468	*Fragilidium*	AFBI; SMHI
109705	*Fragilidium subglobosum*	EA; SMHI
103358	*Fritillaria*	SMHI

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AphiaID	Taxon	Institutes
103375	*Fritillaria borealis*	SEPA
156946	*Frustulia*	Unallocated
178847	*Fusopsis incertae sedis*	MBA
10313	*Gadiformes larva*	MSS; SEPA
104312	*Gaetanus minor*	MBA
104121	*Gaetanus* spp.	MBA
237965	*Gaetanus tenuispinus*	MBA
231798	*Gambierdiscus* spp	AFBI; MSS
101383	*Gammaridae*	SMHI
1207	*Gammaridea*	MBA
236816	*Gammariida*	PML
101	*Gastropoda larva*	MSS; PML; SEPA; SMHI
235823	*Gephyrocapsa*	PML
115070	*Gephyrocapsaceae*	AFBI; EA
128775	*Giardella callianassae*	MBA
128776	*Giardella thompsoni*	MBA
109538	*Glenodinium*	AFBI; MBA; SMHI
233386	*Goniodoma polyedricum*	AFBI; MBA
346509	*Goniopsyllus clausi*	PML
577670	*Gonium*	EA
109519	*Gonyaulax*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109519	*Gonyaulax*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109519	*Gonyaulax*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
110009	*Gonyaulax alaskenses*	AFBI; MSS
110015	*Gonyaulax digitale*	AFBI; CEFAS; EA; MSS; PML; SMHI
110023	*Gonyaulax grindleyi*	MSS; PML; SEPA
110035	*Gonyaulax polygramma*	AFBI; MSS; SMHI
110039	*Gonyaulax scrippsae*	AFBI; MSS; SMHI
110041	*Gonyaulax spinifera*	AFBI; CEFAS; EA; MSS; PML; SEPA
110043	*Gonyaulax turbynei*	AFBI
110045	*Gonyaulax verior*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
149335	*Grammatophora*	AFBI; EA; MBA; MSS; PML
149338	*Grammatophora marina*	AFBI; CEFAS; EA; SEPA; SMHI
149339	*Grammatophora oceanica*	Unallocated
149340	*Grammatophora serpentina*	Unallocated
149111	*Guinardia*	AFBI; CEFAS; EA; MSS
163241	*Guinardia cylindrus*	AFBI; CEFAS; EA; MBA; MSS; SEPA
149112	*Guinardia delicatula*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
149132	*Guinardia flaccida*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
149113	*Guinardia striata*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
109392	*Gymnodiniales*	AFBI; CEFAS; EA; MSS; SMHI
109475	*Gymnodinium*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109475	*Gymnodinium*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109475	*Gymnodinium*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
232716	*Gymnodinium aureolum*	EA; SMHI
109784	*Gymnodinium catenatum*	AFBI
109785	*Gymnodinium chlorophorum*	SMHI
109791	*Gymnodinium elongatum*	SMHI
232765	*Gymnodinium galeatum*	MSS; SMHI
109802	*Gymnodinium halophilum*	SMHI
232778	*Gymnodinium heterostriatum*	SMHI
109819	*Gymnodinium ostenfeldii*	SMHI
109825	*Gymnodinium pygmaeum*	PML
109831	*Gymnodinium simplex*	AFBI; CEFAS; SMHI
232880	*Gymnodinium verruculosum*	SMHI

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AphiaID	Taxon	Institutes
109837	*Gymnodinium vestificii*	AFBI; CEFAS; SMHI
164	*Gymnosomata*	MSS; SEPA
109476	*Gyrodinium*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109844	*Gyrodinium calyptoglyphe*	AFBI
109851	*Gyrodinium dominans*	Unallocated
109852	*Gyrodinium estuariale*	AFBI; SMHI
109854	*Gyrodinium flagellare*	SMHI
109856	*Gyrodinium fusiforme*	AFBI; CEFAS; MSS; SMHI
232943	*Gyrodinium fusus*	Unallocated
109859	*Gyrodinium lachryma*	AFBI; MSS
109871	*Gyrodinium pepo*	MSS
109876	*Gyrodinium spirale*	AFBI; CEFAS; EA; MSS; PML; SMHI
109878	*Gyrodinium undulans*	MSS
149033	*Gyrosigma*	AFBI; CEFAS; EA; MBA; SEPA; SMHI
149035	*Gyrosigma acuminatum*	Unallocated
149034	*Gyrosigma arcticum*	Unallocated
661267	*Gyrosigma attenuatum*	AFBI; CEFAS
149494	*Gyrosigma fasciola*	AFBI; CEFAS; SMHI
1484	*Halacaridae*	SEPA
127482	*Halocyprididae*	MSS; SEPA
104422	*Haloptilus acutifrons*	MBA
104431	*Haloptilus longicornis*	MBA; SEPA
104437	*Haloptilus spiniceps*	MBA
134528	*Halosphaera*	SMHI
134546	*Halosphaera viridis*	SMHI
100145	*Halosphaeria*	PML
699623	*Haptolina hirta*	Unallocated
163057	*Haptorida*	SEPA
1102	*Harpacticoida*	MBA; MSS; PML; SEPA; SMHI
248063	*Haslea wawrikae*	AFBI; PML
172434	*Helicostomella*	SMHI
417184	*Helicostomella fusiformis*	SMHI
240437	*Helicostomella subulata*	SMHI
157438	*Helicotheca*	AFBI; EA
157440	*Helicotheca tamesis*	AFBI; CEFAS; EA; MBA; PML; SEPA
163248	*Hemiaulus*	AFBI; CEFAS; MBA; SEPA
1818	*Hemichordata larva*	MSS; PML
413311	*Hemicyclops aberdonensis*	MBA
180367	*Hemidiscus cuneiformis*	AFBI; MBA
106287	*Hemiselmis*	CEFAS; SMHI
106310	*Hemiselmis virescens*	CEFAS; SMHI
109540	*Heterocapsa*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
233619	*Heterocapsa minima*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
233620	*Heterocapsa niei*	AFBI; CEFAS; EA; MSS; PML
233625	*Heterocapsa pygmaea*	Unallocated
110152	*Heterocapsa rotundata*	AFBI; CEFAS; EA; MSS; SMHI
110153	*Heterocapsa triquetra*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
260629	*Heterophryxus appendiculatus*	MBA
104576	*Heterorhabdus abyssalis*	MBA
104577	*Heterorhabdus clausi*	MBA
104579	*Heterorhabdus norvegicus*	MBA; SEPA
104580	*Heterorhabdus papilliger*	MBA; SEPA
104582	*Heterorhabdus spinifer*	MBA
104178	*Heterorhabdus* spp.	MBA; SEPA
160584	*Heterosigma*	CEFAS; MSS; SMHI

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AphiaID	Taxon	Institutes
160585	*Heterosigma akashiwo*	AFBI; SEPA; SMHI
172815	*Hexasterias problematica*	MBA
447739	*Hippdonta capitata var. capitata*	SMHI
109463	*Histioneis*	AFBI; MBA
248178	*Holococcolithophorid*	PML
123083	*Holothuroidea*	SEPA
106903	*Hyas*	SEPA
117988	*Hybocodon prolifer*	MSS; SEPA
117117	*Hydractinia* spp.	MSS; SEPA
101796	*Hyperia* spp.	MSS; SEPA
101417	*Hyperiidae*	SEPA; SMHI
1205	*Hyperiidea*	MBA; PML
163096	*Imantonia rotunda*	Unallocated
104501	*Isias clavipes*	MBA; MSS; PML; SEPA
573884	*Isochrysis galbana*	Unallocated
1131	*Isopoda*	MBA; MSS; PML; SEPA; SMHI
163257	*Isthmia*	AFBI
107737	*Jaxea nocturna*	SEPA
707679	*Karenia aureola*	Unallocated
233015	*Karenia brevis*	AFBI
246593	*Karenia cf. papilionacea*	MSS
233024	*Karenia mikimotoi*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
231788	*Karenia* spp.	AFBI; CEFAS; EA; MSS; SEPA
233037	*Karlodinium veneficum*	AFBI; CEFAS; PML; SMHI
601744	*Katablepharis*	SMHI
119081	*Kathablepharis remigera*	SMHI
109477	*Katodinium*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
109882	*Katodinium asymmetricum*	Unallocated
109885	*Katodinium glaucum*	AFBI; CEFAS; MSS; PML; SMHI
178604	*Kephyrion spirale*	Unallocated
134992	*Keratella quadrata*	SMHI
163108	*Kirchneriella*	Unallocated
233165	*Kofoidinium lebourae*	AFBI; PML
109499	*Kofoidinium* spp.	AFBI; CEFAS; MSS; SEPA
495390	*Kofoidinium velelloides*	SMHI
109920	*Kofoidinium velleloides*	AFBI
451665	*Komma caudata*	CEFAS
110154	*Kryptoperidinium foliaceum*	AFBI; CEFAS; EA; MSS; SEPA
104727	*Labidocera acutifrons*	MBA
104728	*Labidocera aestiva*	MBA
104208	*Labidocera* spp.	MBA; SEPA
104736	*Labidocera wollastoni*	MBA; PML; SEPA
101190	*Laboea*	Unallocated
101264	*Laboea strobila*	CEFAS; SEPA; SMHI
178610	*Lagerheimia genevensis*	Unallocated
138101	*Lamellaria* spp. *larva*	MSS; SEPA
117725	*Laodicea undulata*	MSS; SEPA
149134	*Lauderia*	AFBI; CEFAS; EA; MSS; SMHI
149135	*Lauderia annulata*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
101179	*Leegaardiella*	SMHI
101206	*Leegaardiella ovalis*	SMHI
101207	*Leegaardiella sol*	SMHI
177138	*Lemmermanniella*	SMHI
549205	*Lennoxia faveolata*	SMHI
450723	*Lennoxia* spp.	AFBI; CEFAS; EA; MSS; SEPA

AphiaID	Taxon	Institutes
106087	*Lepas nauplii*	MBA
345481	*Lepidodinium chlorophorum*	AFBI
163401	*Lepocinclis*	Unallocated
624247	*Lepocinclis acus*	Unallocated
625430	*Leprotintinnus pellucidus*	SMHI
149038	*Leptocylindrus*	AFBI; CEFAS; EA; SMHI
573481	*Leptocylindrus curvatus*	Unallocated
149106	*Leptocylindrus danicus*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
149230	*Leptocylindrus mediterraneus*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
149039	*Leptocylindrus minimus*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
578704	*Leptohalysis scotti*	Unallocated
13552	*Leptothecata*	MSS; SEPA
232703	*Lessardia elongata*	CEFAS; PML; SMHI
117791	*Leuckartiara octona*	MSS; SEPA
119077	*Leucocryptos marina*	CEFAS; SMHI
149342	*Licmophora*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
157062	*Licmophora abbreviata*	AFBI; CEFAS; SMHI
138122	*Limacina*	SEPA
140227	*Limacina retroversa*	MSS; PML; SEPA
177508	*Limnothrix redekei*	Unallocated
233592	*Lingulodinium polyedrum*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
292726	*Lioloma*	AFBI
292728	*Lioloma delicatulum*	PML
573482	*Lioloma elongatum*	SMHI
117568	*Liriope tetraphylla*	SEPA
149321	*Lithodesmium* spp.	AFBI; EA; MSS
149322	*Lithodesmium undulatum*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
117345	*Lizzia blondina*	MSS; SEPA
101180	*Lohmanniella*	SMHI
101209	*Lohmanniella oviformis*	SMHI
115403	*Longipedia* spp.	SEPA; SMHI
104225	*Lophothrix* spp.	MBA
117736	*Lovenella clausa*	SEPA
128672	*Lubbockia* spp.	MBA
104183	*Lucicutia* spp.	MBA
106827	*Lucifer* spp.	MBA
146538	*Lyngbya*	Unallocated
418285	*Lyrella hennedyi*	AFBI
1071	*Malacostraca*	MSS
249721	*Mallomonas*	Unallocated
249722	*Mallomonas akrokomos*	Unallocated
134562	*Mamiella gilva*	Unallocated
134563	*Mantoniella squamata*	SMHI
619174	*Marvania coccoides*	Unallocated
157052	*Mastogloia*	AFBI
104616	*Mecynocera clausi*	MBA; SEPA
345485	*Mediopyxis helysia*	AFBI; CEFAS; EA; MBA; MSS; SEPA
1337	*Medusae*	PML; SEPA; SMHI
110690	*Meganyctiphanes norvegica*	SEPA
117743	*Melicertum octocostatum*	SEPA
149042	*Melosira*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
160537	*Melosira arctica*	SMHI
156636	*Melosira lineata*	MBA
418547	*Melosira moniliformis*	AFBI; CEFAS; EA; SMHI
149044	*Melosira nummuloides*	AFBI; SMHI

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AphiaID	Taxon	Institutes
149043	*Melosira varians*	Unallocated
341546	*Membraneis challengeri*	CEFAS
149345	*Meridion*	AFBI
149346	*Meridion circulare*	EA
115075	*Meringosphaera*	EA; PML; SMHI
248129	*Meringosphaera mediterranea*	CEFAS; SMHI
146545	*Merismopedia*	AFBI; EA; SMHI
177158	*Merismopedia elegans*	Unallocated
146578	*Merismopedia glauca*	Unallocated
146577	*Merismopedia punctata*	Unallocated
146576	*Merismopedia tenuissima*	Unallocated
146546	*Merismopedia warmingiana*	Unallocated
104468	*Mesocalanus tenuicornis*	MBA; SEPA
179320	*Mesodinium*	Unallocated
232069	*Mesodinium rubrum*	AFBI; CEFAS; EA; MSS; SMHI
109564	*Mesoporos*	AFBI; CEFAS; MSS
232516	*Mesoporos perforatus*	AFBI; EA; PML
104632	*Metridia longa*	MBA; SEPA
104633	*Metridia lucens*	MBA; PML; SEPA; SMHI
850801	*Metridia lucens lucens*	MSS
104190	*Metridia* spp. (V-VI)	MBA; SEPA; SMHI
104092	*Metridinidae*	MSS
149144	*Meuniera*	AFBI; CEFAS; EA
149145	*Meuniera membranacea*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
109510	*Micracanthodinium*	AFBI; EA; SMHI
109992	*Micracanthodinium claytonii*	AFBI
163479	*Micractinium pusillum*	Unallocated
109511	*Micranthodinium*	AFBI; PML
157675	*Microcalanus pusillus*	MSS; SEPA
104164	*Microcalanus* spp.	MBA; PML; SEPA; SMHI
146557	*Microcystis*	AFBI; EA
146558	*Microcystis aeruginosa*	Unallocated
177399	*Microcystis reinboldii*	Unallocated
134533	*Micromonas*	SMHI
134564	*Micromonas pusilla*	SMHI
116115	*Microsetella norvegica* C1-6	MSS; SEPA
116116	*Microsetella rosea* C1-6	MSS; SEPA
115341	*Microsetella* spp.	PML; SEPA; SMHI
148981	*Minidiscus*	AFBI
663628	*Miniscula bipes*	EA; MSS
109585	*Minuscula bipes*	AFBI; EA
116383	*Miracia efferata*	MBA
117754	*Mitrocomella brownei*	SEPA
117755	*Mitrocomella polydiademata*	MSS; SEPA
117970	*Modeeria rotunda*	SEPA
51	*Mollusca*	MBA; MSS; SEPA
621192	*Monactinus simplex*	Unallocated
447754	*Monomorphina pyrum*	Unallocated
160590	*Monoraphidium*	EA
160591	*Monoraphidium contortum*	Unallocated
160592	*Monoraphidium convolutum*	SMHI
163100	*Monoraphidium komarkovae*	Unallocated
163101	*Monoraphidium minutum*	Unallocated
105535	*Monosiga*	SMHI
119805	*Monstrilla longiremis*	MBA; SEPA

AphiaID	Taxon	Institutes
119777	*Monstrillidae* C1-6	MSS; SEPA
119816	*Mormonilla*	SEPA
135366	*Muggiaea*	SEPA
135441	*Muggiaea atlantica*	MSS; SEPA
135444	*Muggiaea kochii*	SEPA
292896	*Myrionecta rubra*	SEPA
149668	*Mysidacea*	MBA; MSS; PML; SEPA
104469	*Nannocalanus minor*	MBA; SEPA
135496	*Nanomia cara*	MSS; SEPA
248180	*Nanoneis hasleae*	PML
149142	*Navicula*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
149467	*Navicula directa*	Unallocated
149143	*Navicula distans*	PML
172797	*Navicula granii*	EA
172799	*Navicula gregaria*	SMHI
149320	*Navicula transitans*	AFBI; CEFAS; SMHI
175320	*Navicula transitans var. derasa*	CEFAS; SMHI
175321	*Navicula transitans var. derasa f. delicatula*	CEFAS; SMHI
175319	*Navicula transitans var. transitans*	SMHI
175335	*Navicula viridula var. rostellata*	Unallocated
149031	*Naviculaceae*	AFBI; EA
149015	*Naviculales*	AFBI; EA; MSS
106927	*Necora*	SEPA
604302	*Nematodinium*	AFBI; PML
109907	*Nematodinium armatum*	SMHI
547527	*Nematopsides vigilans*	SMHI
152391	*Nemertea*	SMHI
104471	*Neocalanus gracilis*	MBA; SEPA
104472	*Neocalanus robustior*	MBA
104155	*Neocalanus* spp.	MBA; SEPA
345491	*Neocalyptrella robusta*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
495629	*Neoceratium arcticum*	Unallocated
495630	*Neoceratium arietinum*	Unallocated
495633	*Neoceratium azoricum*	Unallocated
495635	*Neoceratium belone*	Unallocated
495637	*Neoceratium bigelowii*	Unallocated
495638	*Neoceratium breve*	Unallocated
495640	*Neoceratium candelabrum*	Unallocated
495641	*Neoceratium carnegiei*	Unallocated
495644	*Neoceratium compressum*	Unallocated
495646	*Neoceratium contortum*	Unallocated
495648	*Neoceratium declinatum*	Unallocated
495655	*Neoceratium extensum*	Unallocated
495656	*Neoceratium falcatiforme*	Unallocated
495659	*Neoceratium furca*	PML
495660	*Neoceratium fusus*	PML
495662	*Neoceratium gibberum*	Unallocated
495664	*Neoceratium hexacanthum*	Unallocated
495666	*Neoceratium horridum*	PML
495669	*Neoceratium inflatum*	Unallocated
495671	*Neoceratium kofoidii*	Unallocated
495674	*Neoceratium lineatum*	PML
495675	*Neoceratium longipes*	Unallocated
495676	*Neoceratium longirostrum*	Unallocated
495678	*Neoceratium macroceros*	PML

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AphiaID	Taxon	Institutes
495679	*Neoceratium massiliense*	PML
495680	*Neoceratium minutum*	Unallocated
495685	*Neoceratium pentagonum*	Unallocated
495687	*Neoceratium platycorne*	Unallocated
495690	*Neoceratium pulchellum*	Unallocated
495696	*Neoceratium setaceum*	Unallocated
495697	*Neoceratium symmetricum*	Unallocated
495700	*Neoceratium teres*	Unallocated
495701	*Neoceratium trichoceros*	Unallocated
495702	*Neoceratium tripos*	PML
495703	*Neoceratium uncinus*	Unallocated
196813	*Neodenticula seminae*	AFBI; MBA
450616	*Neostreptotheca*	Unallocated
107254	*Nephrops norvegicus larva*	MSS; SEPA
134524	*Nephroselmis*	SMHI
134541	*Nephroselmis pyriformis*	SMHI
149046	*Nitzschia acicularis*	Unallocated
341566	*Nitzschia bicapitata*	AFBI; MBA
149150	*Nitzschia longissima*	AFBI; CEFAS; EA; MBA; MSS; SMHI
609727	*Nitzschia paleacea*	Unallocated
149213	*Nitzschia sigma*	AFBI
196817	*Nitzschia sigma rigida*	MBA
149604	*Nitzschia sigmoidea*	AFBI; CEFAS; PML; SMHI
149045	*Nitzschia* spp.	AFBI; CEFAS; EA; MBA; MSS; SMHI
109500	*Noctiluca*	AFBI; EA; MSS; SEPA; SMHI
109921	*Noctiluca scintillans*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
109393	*Noctilucales*	AFBI; EA; SEPA
160566	*Nodularia spumigena*	SMHI
254316	*Nyctiphanes couchii*	MSS; SEPA
117034	*Obelia* spp.	MSS; SEPA; SMHI
109542	*Oblea*	AFBI; CEFAS; MSS
110155	*Oblea rotunda*	AFBI; CEFAS; EA; MSS; SMHI
249725	*Ochromonas*	Unallocated
375970	*Octactis octonaria*	AFBI; CEFAS; EA; MSS; SEPA
148963	*Odontella*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
149050	*Odontella aurita*	AFBI; CEFAS; EA; MBA; MSS; SEPA; SMHI
345492	*Odontella aurita var. minima*	Unallocated
702200	*Odontella aurita var. obtusa*	Unallocated
149156	*Odontella granulata*	AFBI; MBA; SEPA
345493	*Odontella minima*	Unallocated
164116	*Odontella mobiliensis*	AFBI; EA; MBA; PML; SEPA
162940	*Odontella obtusa*	MBA
149094	*Odontella regia*	AFBI; CEFAS; EA; MBA; SEPA
149157	*Odontella rhombus*	MBA; SEPA
149051	*Odontella rostrata*	Unallocated
149095	*Odontella sinensis*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
341487	*Odontella weissflogii*	MBA
103367	*Oikopleura*	SEPA; SMHI
106485	*Oithona* spp.	MBA; MSS; PML; SEPA
106422	*Oithonidae* C1-6	MSS; SEPA
595083	*Oligotrichida*	SEPA
162740	*Ollicola vangoorii*	SMHI
494102	*Oltmannsiellopsis*	SMHI
526636	*Oltmannsiellopsis viridis*	Unallocated
128690	*Oncaea* spp.	MBA; PML; SEPA; SMHI

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AphiaID	Taxon	Institutes
128586	*Oncaeidae* C1-6	MSS; SEPA; SMHI
178611	*Oocystis*	SMHI
178613	*Oocystis parva*	SMHI
248144	*Oocystis pelagica*	SMHI
178934	*Oocystis solitaria*	SMHI
123084	*Ophiuroidea*	SEPA; SMHI
109464	*Ornithocercus*	AFBI; MBA
146549	*Oscillatoria*	AFBI
146554	*Oscillatoria limosa*	Unallocated
1078	*Ostracoda*	MBA; SEPA; SMHI
109431	*Ostreopsidaceae*	AFBI; EA
110284	*Oxyphysis oxytoxoides*	MSS
109486	*Oxyrrhis*	AFBI; EA
109902	*Oxyrrhis marina*	AFBI; CEFAS; EA; MSS; SEPA
109528	*Oxytoxum*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
110087	*Oxytoxum crassum*	Unallocated
233857	*Oxytoxum criophilum*	SMHI
233870	*Oxytoxum gracile*	MSS; SMHI
110115	*Oxytoxum scolopax*	AFBI; EA
160594	*Pachysphaera* spp.	MBA; SMHI
196768	*Pacillina arctica incertae sedis*	Unallocated
106738	*Paguridae*	SEPA
623653	*Palatinus apiculatus*	Unallocated
178919	*Pandorina colony*	EA
104685	*Paracalanus parvus*	MSS; PML; SEPA; SMHI
104196	*Paracalanus* spp.	MBA; SEPA; SMHI
510916	*Paraeuchaeta acuta*	SEPA
104560	*Paraeuchaeta glacialis*	MBA
104561	*Paraeuchaeta gracilis*	MBA
104563	*Paraeuchaeta hebes*	MBA; PML; SEPA
104566	*Paraeuchaeta norvegica*	MBA; MSS; SEPA
196874	*Paraeuchaeta* spp.	MBA; SEPA
359879	*Paraeuchaeta tonsa*	MBA
196836	*Parafavella*	Unallocated
196837	*Parafavella gigantea*	Unallocated
149054	*Paralia*	SEPA
149055	*Paralia sulcata*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
345498	*Parapedinella*	EA
104686	*Parapontella brevicornis*	MBA; MSS; PML; SEPA
105408	*Parasagitta*	SEPA
105440	*Parasagitta elegans*	MSS; SEPA
105443	*Parasagitta setosa*	MSS; SEPA
799	*Parasitic Nematoda*	MBA; SEPA
724226	*Parathalestris croni*	Unallocated
116598	*Parathalestris cronii*	MBA
147082	*Parathemisto*	SEPA
237968	*Pareucalanus attenuatus*	SEPA
104175	*Pareuchaeta*	SMHI
136903	*Paulinella ovalis*	SMHI
109529	*Pavillardinium*	Unallocated
249731	*Pavlova*	SMHI
160561	*Pediastrum*	CEFAS; EA; MSS; SEPA
164061	*Pediastrum duplex*	AFBI
248148	*Pedinella*	Unallocated
135305	*Pelagia noctiluca*	MSS; SEPA

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AphiaID	Taxon	Institutes
106272	*Penilia avirostris*	MBA; SMHI
1304629	*Pennales*	AFBI
109504	*Pentapharsodinium*	AFBI
109925	*Pentapharsodinium dalei*	AFBI; MSS; SMHI
138327	*Peracle*	Unallocated
109394	*Peridiniales*	AFBI; CEFAS; EA; PML; SMHI
110156	*Peridiniella catenata*	SMHI
233369	*Peridiniella danica*	EA; SMHI
109549	*Peridinium*	AFBI; EA; MSS; SEPA
163858	*Peridinium achromaticum*	Unallocated
233804	*Peridinium quinquecorne*	AFBI; EA; MSS; SEPA; SMHI
172321	*Peritromus*	Unallocated
175560	*Petrodictyon gemma*	Unallocated
175573	*Petroneis humerosa*	Unallocated
246598	*Pfiesteria piscicida*	Unallocated
163375	*Phacus longicauda*	Unallocated
163354	*Phacus pleuronectes*	Unallocated
104698	*Phaenna spinifera*	MBA; SEPA
115088	*Phaeocystis*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
160538	*Phaeocystis globosa*	AFBI; CEFAS; EA; SMHI
115106	*Phaeocystis pouchetii*	AFBI; EA; PML; SMHI
175584	*Phaeodactylum tricornutum*	AFBI; MSS; SMHI
109466	*Phalacroma*	AFBI; MBA; SEPA
156505	*Phalacroma rotundatum*	AFBI; CEFAS; EA; MSS; PML; SMHI
117804	*Phialella quadrata*	MSS; SEPA
1789	*Phoronida larva*	MSS; SEPA; SMHI
148378	*Phoronidae*	SMHI
128545	*Phoronis*	SMHI
149208	*Pinnularia*	AFBI
107188	*Pisidia longicornis*	SEPA
149314	*Plagiogramma*	AFBI
149056	*Plagiogrammopsis*	AFBI; CEFAS; EA
149057	*Plagiogrammopsis vanheurckii*	EA
601957	*Plagiolemma distortum*	PML
370563	*Plagioselmis nannoplanctica*	Unallocated
106303	*Plagioselmis prolonga*	CEFAS; SMHI
106283	*Plagioselmis* sp.	EA; SMHI
149516	*Plagiotropis*	AFBI
162716	*Planctonema lauterbornii*	SMHI
196815	*Planktoniella sol*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
146552	*Planktothrix agardhii*	Unallocated
793	*Platyhelminthes*	SEPA; SMHI
247981	*Pleopis polyphemoides*	MSS; SEPA
106346	*Pleurobrachia*	SEPA
106386	*Pleurobrachia pileus*	MSS; SEPA
235825	*Pleurochrysis*	SMHI
235969	*Pleurochrysis carterae*	SMHI
104637	*Pleuromamma abdominalis*	MBA; SEPA
104638	*Pleuromamma borealis*	MBA; SEPA
104639	*Pleuromamma gracilis*	MBA; SEPA
104640	*Pleuromamma piseki*	MBA; SEPA
104642	*Pleuromamma robusta*	MBA; SEPA
104191	*Pleuromamma* spp.	MBA; SEPA
104643	*Pleuromamma xiphias*	MBA; SEPA
149181	*Pleurosigma*	AFBI; CEFAS; EA; PML; SEPA; SMHI

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AphiaID	Taxon	Institutes
577792	*Pleurosigma acutum*	Unallocated
149183	*Pleurosigma angulatum*	Unallocated
248088	*Pleurosigma directum*	Unallocated
149185	*Pleurosigma naviculaceum*	Unallocated
149182	*Pleurosigma normanii*	EA
231883	*Pleurosigma planctonicum*	AFBI; PML
231884	*Pleurosigma simonsenii*	Unallocated
156586	*Pleurosigma strigosum*	Unallocated
140825	*Pneumodermopsis ciliata*	SEPA
140826	*Pneumodermopsis paucidens*	SEPA
138366	*Pneumodermopsis* spp.	MBA; SEPA
117653	*Podocoryna aereolata*	SEPA
117654	*Podocoryna borealis*	SEPA
109550	*Podolampas*	AFBI; MBA
106276	*Podon intermedius*	MSS; SEPA; SMHI
106277	*Podon leuckartii*	MSS; SEPA; SMHI
106269	*Podon* spp.	MBA; MSS; PML; SEPA; SMHI
149059	*Podosira* spp.	AFBI; MSS
149060	*Podosira stelligera*	AFBI; CEFAS; EA; MBA; PML; SEPA
883	*Polychaeta*	MBA; MSS; PML; SEPA; SMHI
109485	*Polykrikos*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
109899	*Polykrikos kofoidii*	Unallocated
109901	*Polykrikos schwartzii*	AFBI; EA; MSS; PML; SMHI
104097	*Pontellidae*	MBA; MSS; SEPA; SMHI
104743	*Pontellina plumata*	MBA; SEPA
107190	*Porcellana platycheles*	SEPA
106734	*Porcellanidae*	SEPA
156689	*Porosira glacialis*	AFBI; CEFAS; MSS; SMHI
17329	*Prasinophyceae*	AFBI; SMHI
109505	*Preperidinium*	PML
614618	*Preperidinium meunieri*	MSS
109927	*Preperidinium meunierii*	AFBI
149167	*Proboscia*	AFBI; CEFAS; EA
149168	*Proboscia alata*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
613575	*Proboscia curvirostris*	MBA
345513	*Proboscia indica*	AFBI; EA; MBA; SMHI
341501	*Proboscia inermis*	AFBI; MBA
248181	*Proboscia truncata*	AFBI; CEFAS; PML
117836	*Proboscidactyla stellata*	MSS; SEPA
109487	*Pronoctiluca*	AFBI; CEFAS; EA; MSS; SEPA
233180	*Pronoctiluca acuta*	Unallocated
109903	*Pronoctiluca pelagica*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
292924	*Proplectella*	Unallocated
109396	*Prorocentrales*	AFBI; EA
109566	*Prorocentrum*	AFBI; CEFAS; EA; MBA; MSS; SEPA; SMHI
110291	*Prorocentrum aporum*	SMHI
110293	*Prorocentrum balticum*	AFBI; CEFAS; EA; PML; SEPA; SMHI
110295	*Prorocentrum compressum*	AFBI; EA; MSS
232376	*Prorocentrum cordatum*	AFBI; CEFAS; EA; PML; SEPA; SMHI
110298	*Prorocentrum dentatum*	AFBI; MSS; PML
110300	*Prorocentrum gracile*	AFBI; CEFAS; EA; MSS
110301	*Prorocentrum lima*	AFBI; CEFAS; EA; MSS; SEPA
110303	*Prorocentrum micans*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
110304	*Prorocentrum minimum*	EA; MSS
110310	*Prorocentrum redfieldii*	SMHI

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AphiaID	Taxon	Institutes
110314	*Prorocentrum scutellum*	AFBI; MSS
110316	*Prorocentrum triestinum*	AFBI; CEFAS; EA; MSS; PML; SEPA
425488	*Prorodontida*	Unallocated
110321	*Protoceratium reticulatum*	AFBI; CEFAS; EA; MSS; SMHI
109553	*Protoperidinium*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
110208	*Protoperidinium bipes*	AFBI; CEFAS; EA; MSS; PML; SEPA; SMHI
110209	*Protoperidinium breve*	AFBI; CEFAS; SMHI
110210	*Protoperidinium brevipes*	AFBI; CEFAS; EA; MSS; PML; SMHI
162749	*Protoperidinium cerasus*	AFBI; EA; MSS; SMHI
163862	*Protoperidinium claudicans*	AFBI; CEFAS; MSS; SMHI
110212	*Protoperidinium conicoides*	AFBI; CEFAS; MSS; SMHI
110213	*Protoperidinium conicum*	AFBI; CEFAS; EA; MSS; SMHI
110214	*Protoperidinium crassipes*	AFBI; CEFAS; MSS; SMHI
110215	*Protoperidinium curtipes*	AFBI; CEFAS; EA; MSS; PML; SMHI
163934	*Protoperidinium curvipes*	AFBI; EA
110216	*Protoperidinium denticulatum*	AFBI; MSS; SMHI
110217	*Protoperidinium depressum*	AFBI; CEFAS; EA; MSS; PML; SMHI
172460	*Protoperidinium diabolum*	AFBI; MSS
110219	*Protoperidinium divergens*	AFBI; CEFAS; EA; MSS; PML; SMHI
110220	*Protoperidinium excentricum*	AFBI; MSS
232921	*Protoperidinium globulus*	AFBI
110223	*Protoperidinium granii*	AFBI; CEFAS; MSS; SMHI
233257	*Protoperidinium incognitum*	Unallocated
110228	*Protoperidinium laticeps*	SMHI
110229	*Protoperidinium leonis*	AFBI; CEFAS; EA; MSS
110231	*Protoperidinium mariaelebouriae*	MSS
233176	*Protoperidinium marielebourae*	Unallocated
614620	*Protoperidinium marielebouriae*	AFBI; SMHI
110233	*Protoperidinium minutum*	AFBI; EA; MSS
110234	*Protoperidinium mite*	AFBI; CEFAS; EA; MSS
110237	*Protoperidinium nudum*	MSS
110238	*Protoperidinium oblongum*	AFBI; CEFAS; EA; MSS; SMHI
110239	*Protoperidinium obtusum*	AFBI; MSS; PML
110240	*Protoperidinium oceanicum*	AFBI; CEFAS; EA; MSS; PML
110241	*Protoperidinium ovatum*	AFBI; CEFAS; EA; MSS; PML
110244	*Protoperidinium pallidum*	AFBI; CEFAS; EA; MSS; SMHI
110245	*Protoperidinium pellucidum*	AFBI; CEFAS; EA; MSS; SMHI
110247	*Protoperidinium pentagonum*	AFBI; CEFAS; EA; MSS; SMHI
110248	*Protoperidinium punctulatum*	AFBI; CEFAS; SMHI
110249	*Protoperidinium pyriforme*	AFBI; EA; MSS; PML; SMHI
110250	*Protoperidinium quarense*	MSS
110257	*Protoperidinium steinii*	AFBI; CEFAS; EA; MSS; PML; SMHI
110258	*Protoperidinium subicurvipes*	MSS
110259	*Protoperidinium subinerme*	AFBI; CEFAS; MSS; SMHI
110260	*Protoperidinium thorianum*	AFBI; MSS; SMHI
232861	*Protoperidinium thulense*	AFBI; MSS
233390	*Protoperidnium decipiens*	MSS
115061	*Prymnesiales*	SMHI
115057	*Prymnesiophyceae*	AFBI; EA; MSS; PML; SEPA; SMHI
160563	*Prymnesium*	SMHI
149217	*Psammodictyon panduriforme*	AFBI; PML
177588	*Pseudanabaena*	SMHI
577876	*Pseudanabaena acicularis*	SMHI
177590	*Pseudanabaena limnetica*	Unallocated
103990	*Pseudobodo*	SMHI

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AphiaID	Taxon	Institutes
104515	*Pseudocalanus elongatus*	PML; SEPA; SMHI
104517	*Pseudocalanus minutus*	SMHI
149711	*Pseudocalanus minutus elongatus*	Unallocated
104165	*Pseudocalanus* spp.	MBA; MSS; SEPA; SMHI
531445	*Pseudochattonella*	SMHI
531467	*Pseudochattonella farcimen*	SMHI
531446	*Pseudochattonella verruculosa*	SMHI
104757	*Pseudocyclopia minor*	MSS; SEPA
157680	*Pseudodiaptomus* spp.	MBA
573543	*Pseudoguinardia recta*	AFBI; CEFAS; EA
478556	*Pseudo-nitzschia americana*	CEFAS
246604	*Pseudo-nitzschia australis*	AFBI
246605	*Pseudo-nitzschia calliantha*	SMHI
149153	*Pseudo-nitzschia delicatissima*	CEFAS; EA; MBA; PML; SMHI
246606	*Pseudo-nitzschia fraudulenta*	SMHI
411764	*Pseudo-nitzschia heimii*	Unallocated
175738	*Pseudo-nitzschia multiseries*	Unallocated
246608	*Pseudo-nitzschia multistriata*	CEFAS
156548	*Pseudo-nitzschia pseudodelicatissima*	SMHI
160528	*Pseudo-nitzschia pungens*	PML; SMHI
149152	*Pseudo-nitzschia seriata*	CEFAS; EA; MBA; PML
175749	*Pseudo-nitzschia seriata f. seriata*	SMHI
149151	*Pseudo-nitzschia* spp	AFBI; CEFAS; EA; MSS; SEPA; SMHI
411767	*Pseudo-nitzschia subcurvata*	Unallocated
418222	*Pseudo-nitzschia subpacifica*	Unallocated
621601	*Pseudopediastrum boryanum*	Unallocated
160599	*Pseudopedinella*	CEFAS; SMHI
248149	*Pseudopedinella elastica*	SMHI
160600	*Pseudopedinella pyriformis*	CEFAS; SMHI
160601	*Pseudopedinella tricostata*	SMHI
418160	*Pseudopfiesteria shumwayae*	Unallocated
577639	*Pseudopodosira westii*	Unallocated
105445	*Pseudosagitta maxima*	SEPA
134566	*Pseudoscourfieldia marina*	SMHI
163344	*Pseudosolenia calcar-avis*	AFBI; CEFAS; EA; MBA; MSS; SEPA; SMHI
178959	*Pseudostaurastrum hastatum*	Unallocated
160595	*Pterosperma*	MBA; PML; SMHI
345881	*Pterosperma vanhoeffenii*	SMHI
109478	*Ptychodiscus*	AFBI; EA
109888	*Ptychodiscus noctiluca*	AFBI; MBA
1302	*Pycnogonida*	MBA
134529	*Pyramimonas*	AFBI; CEFAS; EA; PML; SEPA; SMHI
134550	*Pyramimonas (Trichocystis) grossii*	Unallocated
495333	*Pyramimonas disomata*	SMHI
160513	*Pyramimonas longicauda*	SMHI
134559	*Pyramimonas virginica*	CEFAS; SMHI
109571	*Pyrocystis*	AFBI; CEFAS; EA; MBA; MSS; SEPA
164053	*Pyrocystis lunula*	AFBI
110332	*Pyrocystis noctiluca*	Unallocated
109555	*Pyrophacus*	AFBI; CEFAS; MBA
110266	*Pyrophacus horologicum*	MSS; PML
232598	*Pyrophacus horologium*	AFBI; CEFAS; EA; SMHI
623185	*Quadricoccus ellipticus*	SMHI
613622	*Quadricoccus euryhalinicus*	SMHI
582421	*Radiozoa*	Unallocated

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AphiaID	Taxon	Institutes
160581	*Raphidophyceae*	AFBI; PML
708245	*Raphidosphaera tenerrima*	EA
149065	*Raphoneis* spp.	AFBI; CEFAS; EA; MSS
117848	*Rathkea octopunctata*	MSS; SEPA
375891	*Resultor mikron*	Unallocated
292925	*Rhabdoaskenasia*	Unallocated
626382	*Rhabdolithes claviger*	PML
157072	*Rhabdonema*	AFBI; CEFAS; MBA; MSS
149066	*Rhaphoneis amphiceros*	AFBI; CEFAS; EA; MBA; SMHI
104172	*Rhincalanus*	SEPA
104542	*Rhincalanus cornutus*	MBA
104543	*Rhincalanus nasutus*	MBA; MSS; SEPA
118071	*Rhizomonas setigera*	SMHI
149069	*Rhizosolenia*	AFBI; CEFAS; EA; MBA; MSS; SEPA; SMHI
196805	*Rhizosolenia acuminata*	AFBI; MBA
149223	*Rhizosolenia alata*	Unallocated
196808	*Rhizosolenia alata f. curvirostris*	Unallocated
196811	*Rhizosolenia bergonii*	AFBI; MBA
567120	*Rhizosolenia borealis*	AFBI; CEFAS; EA; MSS
163346	*Rhizosolenia calcar-avis*	AFBI
341502	*Rhizosolenia chunii*	PML
573572	*Rhizosolenia fallax*	MSS
149070	*Rhizosolenia hebetata*	AFBI; CEFAS; EA; MBA; SEPA; SMHI
163347	*Rhizosolenia hebetata f. hebetata*	EA
149071	*Rhizosolenia hebetata f. semispina*	CEFAS; MSS; PML; SMHI
149116	*Rhizosolenia imbricata*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
149117	*Rhizosolenia pungens*	AFBI; EA; MBA; MSS; SEPA; SMHI
149115	*Rhizosolenia setigera*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
547544	*Rhizosolenia setigera f. pungens*	CEFAS; EA
149165	*Rhizosolenia shrubsolei*	MSS
149224	*Rhizosolenia stolterfothii*	MSS
149629	*Rhizosolenia styliformis*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
106289	*Rhodomonas*	EA; SMHI
106313	*Rhodomonas baltica*	SMHI
106314	*Rhodomonas marina*	SMHI
106316	*Rhodomonas salina*	SMHI
175794	*Rhoicosphenia abbreviata*	CEFAS
146182	*Rhynchobodo*	SMHI
149105	*Roperia tesselata*	AFBI; EA; PML
14260	*Rotifera*	SMHI
105410	*Sagitta*	SMHI
105450	*Sagitta elegans*	SMHI
154102	*Sagitta elegans elegans*	SMHI
154107	*Sagitta setosa*	SMHI
5953	*Sagittidae juvenile*	MSS; SEPA
137272	*Salpa fusiformis*	MSS; SEPA
137217	*Salpidae*	MBA; SEPA
183566	*Salpingella*	SMHI
417228	*Salpingella acuminata*	SMHI
128722	*Sapphirina* spp.	MBA; SEPA
117070	*Sarsia* spp.	MSS; SEPA
117491	*Sarsia tubulosa*	MSS; SEPA
104793	*Scaphocalanus echinatus*	MBA
104228	*Scaphocalanus* spp.	MBA
160541	*Scenedesmaceae*	Unallocated

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AphiaID	Taxon	Institutes
160602	*Scenedesmus*	CEFAS; EA; SEPA; SMHI
162929	*Scenedesmus armatus*	Unallocated
596169	*Scenedesmus quadricauda*	Unallocated
615516	*Sclerodinium calyptoglyphe*	AFBI; EA
104811	*Scolecithricella minor*	MSS; SEPA; SMHI
104229	*Scolecithricella* spp.	MBA; PML; SEPA
196125	*Scolecithricidae*	SEPA; SMHI
104820	*Scolecithrix bradyi*	MBA
104821	*Scolecithrix danae*	MBA
104230	*Scolecithrix* spp.	MBA; SEPA
104103	*Scolecitrichidae* C1-5	MSS
104832	*Scottocalanus persecans*	MBA
104833	*Scottocalanus securifrons*	MBA
109545	*Scrippsiella*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
233093	*Scrippsiella hangoei*	AFBI; SMHI
110172	*Scrippsiella trochoidea*	AFBI; CEFAS; EA; MSS; PML; SMHI
135220	*Scyphozoa*	MSS; SEPA; SMHI
106731	*Sergestidae*	MBA
105464	*Serratosagitta serratodentata*	MSS; SEPA
573446	*Shionodiscus oestrupii*	Unallocated
610927	*Siderocelis ornata*	Unallocated
663187	*Sinophysis ebriolus*	Unallocated
109467	*Sinophysis species*	AFBI; CEFAS; EA; MSS; SEPA
1371	*Siphonophora*	MBA; MSS; PML; SEPA; SMHI
1104	*Siphonostomatoida*	MBA; PML; SEPA
410762	*Sipunculus*	Unallocated
149073	*Skeletonema*	AFBI; CEFAS; EA; MSS; SEPA
149074	*Skeletonema costatum*	AFBI; CEFAS; EA; MBA; PML
376667	*Skeletonema marinoi*	AFBI; SMHI
163390	*Skeletonema potamos*	Unallocated
149075	*Skeletonema subsalsum*	Unallocated
565148	*Slabberia halterata*	SEPA
146644	*Snowella*	SMHI
177465	*Snowella fennica*	SMHI
117947	*Solmaris corona*	MSS; SEPA
15177	*Spadellidae*	MSS; SEPA
109502	*Spatulodinium*	AFBI
109923	*Spatulodinium pseudonoctiluca*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
660753	*Spirulina subsalsa*	Unallocated
162728	*Staurastrum*	EA
565161	*Stauridiosarsia gemmifera*	SEPA
248146	*Stauridium tetras*	Unallocated
149078	*Stauroneis phoenicenteron*	Unallocated
594013	*Staurostoma mertensii*	MSS; SEPA
149653	*Stellarima stellaris*	SMHI
178825	*Stenosemella*	SMHI
149080	*Stephanodiscus hantzschii*	Unallocated
149081	*Stephanodiscus medius*	Unallocated
149082	*Stephanodiscus niagarae*	Unallocated
149083	*Stephanodiscus parvus*	Unallocated
149630	*Stephanopyxis*	AFBI; CEFAS; EA; MBA; MSS; SEPA
231888	*Stephanopyxis palmeriana*	AFBI; PML
149631	*Stephanopyxis turris*	AFBI; CEFAS; EA; MSS; SEPA; SMHI
14355	*Stomatopoda*	MBA; SMHI
149177	*Striatella unipunctata*	AFBI; CEFAS; EA; MSS; SEPA; SMHI

AphiaID	Taxon	Institutes
101185	*Strobilidium*	SMHI
578585	*Strobilidium sphaericum*	SMHI
101198	*Strombidinopsis*	SMHI
101195	*Strombidium*	SMHI
595215	*Strombidium chlorophilum*	SMHI
732820	*Strombidium emergens*	SMHI
602678	*Strombus*	Unallocated
110678	*Stylocheiron*	SEPA
104544	*Subeucalanus crassus*	MBA; MSS; SEPA
104545	*Subeucalanus monachus*	MBA
104546	*Subeucalanus mucronatus*	MBA
104547	*Subeucalanus pileatus*	MBA
104173	*Subeucalanus* spp.	PML
345526	*Subsilicea fragilarioides*	Unallocated
345525	*Subsiliceae* sp.	MSS
149084	*Surirella*	AFBI; CEFAS; MBA
149085	*Surirella crumena*	Unallocated
149087	*Surirella ovalis*	Unallocated
134958	*Synchaeta*	SMHI
160572	*Synechococcus*	SMHI
610181	*Synechococcus elongatus*	Unallocated
177482	*Synechocystis*	Unallocated
149186	*Synedra*	AFBI; CEFAS; EA
163712	*Synedra fulgens*	Unallocated
149187	*Synedra ulna*	Unallocated
341536	*Synedropsis hyperboreoides*	Unallocated
178594	*Synura*	EA
236039	*Syracosphaera molischii*	PML
235979	*Syracosphaera pulchra*	PML
149333	*Tabellaria*	AFBI; CEFAS; MSS
106285	*Teleaulax*	CEFAS; SMHI
106305	*Teleaulax acuta*	CEFAS; SMHI
106306	*Teleaulax amphioxeia*	CEFAS; SMHI
118028	*Telonema*	SMHI
118075	*Telonema subtile*	SMHI
104241	*Temora*	SMHI
104878	*Temora longicornis*	MBA; MSS; PML; SEPA; SMHI
104879	*Temora stylifera*	MBA; PML; SEPA
104880	*Temora turbinata*	MBA
1249	*Tentaculata*	SMHI
178949	*Tetraedron*	CEFAS; EA; MSS; SEPA
178956	*Tetraedron minimum*	Unallocated
134526	*Tetraselmis*	Unallocated
162935	*Tetrastrum staurogeniaeforme*	Unallocated
149089	*Thalassiocyclus lucens*	Unallocated
555052	*Thalassionema frauenfeldii*	AFBI; CEFAS; SMHI
149093	*Thalassionema nitzschioides*	AFBI; CEFAS; EA; MBA; PML; SEPA; SMHI
704849	*Thalassionema nitzschoides*	Unallocated
149092	*Thalassionema* spp	AFBI; EA; MSS; SEPA
148912	*Thalassiosira*	AFBI; CEFAS; EA; MBA; MSS; PML; SEPA; SMHI
345529	*Thalassiosira aestivalis*	AFBI
148913	*Thalassiosira angulata*	AFBI; CEFAS; SMHI
148914	*Thalassiosira anguste-lineata*	AFBI; CEFAS; PML; SMHI
149099	*Thalassiosira antarctica*	AFBI; SMHI
156690	*Thalassiosira baltica*	SMHI

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345531	*Thalassiosira constricta*	AFBI; CEFAS; PML; SMHI
148919	*Thalassiosira decipiens*	AFBI; CEFAS; SMHI
555264	*Thalassiosira delicatula*	SMHI
148922	*Thalassiosira eccentrica*	AFBI; PML; SMHI
149102	*Thalassiosira gravida*	AFBI; CEFAS; PML; SMHI
148923	*Thalassiosira hendeyi*	Unallocated
149100	*Thalassiosira hyalina*	CEFAS; SMHI
495332	*Thalassiosira kushirensis*	Unallocated
163494	*Thalassiosira lacustris*	SMHI
149308	*Thalassiosira levanderi*	AFBI; SMHI
345546	*Thalassiosira lineata*	Unallocated
148925	*Thalassiosira minima*	CEFAS; SMHI
555293	*Thalassiosira minuscula*	PML
149256	*Thalassiosira nana*	Unallocated
148929	*Thalassiosira nodulolineata*	Unallocated
148931	*Thalassiosira nordenskioeldii*	AFBI; CEFAS; SMHI
960571	*Thalassiosira nordenskioldii*	MSS
148932	*Thalassiosira pacifica*	Unallocated
148933	*Thalassiosira proschkinae*	Unallocated
148934	*Thalassiosira pseudonana*	Unallocated
148936	*Thalassiosira punctigera*	AFBI; CEFAS; MSS; PML; SMHI
148942	*Thalassiosira rotula*	AFBI; CEFAS; EA; MSS; PML; SMHI
149101	*Thalassiosira subtilis*	AFBI; PML
163513	*Thalassiosira weissflogii*	CEFAS
157081	*Thalassiothrix*	AFBI; PML
157083	*Thalassiothrix longissima*	AFBI; CEFAS; MBA; SMHI
22626	*Thaliacea*	SMHI
109557	*Thecadinium*	AFBI; MSS
13703	*Thecosomata*	MBA; SEPA; SMHI
101800	*Themisto* spp.	MSS
110708	*Thysanoessa inermis*	MSS; SEPA; SMHI
110709	*Thysanoessa longicaudata adult*	MSS; SEPA
110711	*Thysanoessa raschii*	SEPA; SMHI
237874	*Thysanoessa spinifera*	SMHI
110679	*Thysanoessa* spp. *furcilia*	MSS; SEPA
247913	*Tiarina*	Unallocated
247943	*Tiarina fusus*	SEPA; SMHI
117978	*Tiaropsis multicirrata*	MSS; SEPA
115351	*Tigriopus*	SEPA
117527	*Tima bairdii*	SEPA
425497	*Tintinnida*	SEPA
247915	*Tintinnidium*	SMHI
732976	*Tintinnina*	AFBI
163780	*Tintinnopsis*	SMHI
163782	*Tintinnopsis beroidea*	SMHI
334946	*Tomopteris helgolandica*	PML; SEPA
129715	*Tomopteris* spp.	MBA; MSS; SEPA; SMHI
101196	*Tontonia*	SMHI
427744	*Tontonia ovalis*	Unallocated
109479	*Torodinium*	AFBI; CEFAS; EA; SEPA; SMHI
109889	*Torodinium robustum*	AFBI; CEFAS; EA; MSS; PML; SMHI
109890	*Torodinium teredo*	PML
720592	*Tortanus (Boreotortanus) discaudatus*	SEPA
157684	*Tortanus discaudatus*	MBA
248074	*Toxarium*	Unallocated

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AphiaID	Taxon	Institutes
163412	*Trachelomonas hispida*	Unallocated
16350	*Trachymedusae*	SEPA
149146	*Trachyneis*	Unallocated
576713	*Treubaria*	CEFAS; EA
149170	*Triceratium favus*	AFBI; MBA
149154	*Triceratium* sp	AFBI; CEFAS; EA; MSS; SEPA
177604	*Trichodesmium*	MBA
836581	*Trieres*	AFBI; CEFAS
839991	*Trieres mobiliensis*	AFBI; CEFAS; SMHI
699394	*Trigonium alternans*	AFBI; CEFAS; EA; MSS; PML; SEPA
254445	*Trigonium* spp.	MSS
494057	*Tripos*	AFBI
841182	*Tripos arietinus*	AFBI; CEFAS
837310	*Tripos azoricus*	AFBI
841188	*Tripos bigelowii*	AFBI
841199	*Tripos compressus*	AFBI
841211	*Tripos eugrammus*	EA
840627	*Tripos furca*	AFBI; CEFAS
840626	*Tripos fusus*	CEFAS
837453	*Tripos horridus*	CEFAS
837456	*Tripos kofoidii*	AFBI
837459	*Tripos lineatus*	AFBI; CEFAS
841259	*Tripos longipes*	AFBI; CEFAS
841260	*Tripos macroceros*	AFBI; CEFAS
841263	*Tripos minutus*	AFBI
495363	*Tripos muelleri*	CEFAS
841746	*Tripos pentagonus*	AFBI
841751	*Tripos pulchellus*	AFBI
837234	*Tripos ranipes*	AFBI
447746	*Tryblionella compressa*	PML
176534	*Tryblionella navicularis*	Unallocated
146420	*Tunicata*	SMHI
117056	*Turritopsis*	SEPA
447744	*Ulnaria ulna*	SMHI
235937	*Umbellosphaera*	PML
104342	*Undeuchaeta major*	MBA; SEPA
104343	*Undeuchaeta plumosa*	MBA; SEPA
104128	*Undeuchaeta* spp.	MBA; SEPA
367334	*Undinula vulgaris*	MBA
128639	*Urocorycaeus* spp.	MBA
143943	*Uronema*	SMHI
120566	*Vannella*	SMHI
163573	*Vorticella*	Unallocated
109491	*Warnowia*	AFBI; PML
104204	*Xanthocalanus* spp.	MBA; MSS; SEPA
117998	*Zanclea costata*	SEPA
196832	*Zoothamnium pelagicum*	Unallocated

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Table B1: Relevant traits in lifeform traits list. The trait list reflects the lifeforms and types of plankton data in the datasets used to date in lifeform-based assessment. The list is a living document, whose status reflects ongoing efforts to refine and improve the lifeform approach as well as a necessary compromise between focusing on traits which inform the lifeforms currently used for assessments and including additional information and traits where these are known and readily available. Trait groups for the plankton type "Protozoa" have recently been added to the trait list but are not shown here as they are not finalised and not used in any of the current lifeforms. The inclusion of '*protozoa*' and '*ciliates*' (which are protozoa) designation under '*phytoplankton type*' is to ensure these key taxa are captured into lifeforms. One important example is the abundant group '*Flagellates*' which has '*Plankton Type = phytoplankton*' to allow assignment of the phytoplankton trait groups, despite including both phototrophic and heterotrophic taxa and thus *Phytoplankton Type = protozoa*'.

In the traits list: spaces between words are omitted, e.g. '*Plankton Type*' is written as '*PlanktonType*', and Zooplankton is often abbreviated as '*Zoo*'. For all trait categories, '*Y*': yes (trait applies); '*N*': no (trait does not apply); The following definitions apply to all columns (trait categories) of the list, with additional details given in the table where relevant:

1. '*Ambiguous'*: taxa cannot be reliably assigned to any one category for this trait, mostly because taxa within this group can fall under more than one trait category (e.g.: taxa categories which include individuals of both 'large' and 'small' size classes);
2. '*[blank]*': trait is not use for this Plankton Type (e.g.: "PhytoHabitat" is blank for all zooplankton taxa groups);
3. '*NA'*: (Not applicable) trait is used for this Plankton Type but not relevant for this taxa (e.g.: the line "fish larvae" has a "ZooHabitat" of *NA* because they are neither meroplankton nor holoplankton, the line is intended to only contribute to the "fish larvae" lifeform);
4. 'NYA': (Not Yet Assigned) trait is used for this Plankton Type but is not yet assigned (e.g. phytoplankton which have not been assigned any of "tychopelagic", "pelagic", or "ambiguous" under "PhytoDepth".

Trait Category		Trait Assigned	Description/notes (see also main text, Table 2)
	Plankton Type	Phytoplankton	The 'type' defines which of the following groups of traits applies to the taxa group in question.
		Protozoa	
		Zooplankton	
Phytoplankton Traits	Phytoplankton Type	(various)	Types included are: Cercozoa; Charophyte; Chlorophyte; Chrysophyte; Ciliate*; Cryptophyte; Cyanobacteria; Diatom; Dictyochophyte; Dinoflagellate; Euryarchaeote; Eustigmatophyceae; Haptophyte; Protozoa*; Raphidophyte; Silicoflagellate; Xanthophyceae. *Note that while the trait groups for the plankton type "Protozoa" have recently been added to the master taxa list, "protozoa" and "ciliates" (which are protozoa) remain designated under "phytoplankton type" to ensure these key taxa are captured in the lifeforms currently used in assessments. This reflects the 'living' nature of the Master Taxa List.
	Plankton Size	Sm	Small (≤ 20 µm individual cell diameter)
		Lg	Large (> 20 µm individual cell diameter)
	Size Class	1	Used to differentiate between taxa/groups that are of ambiguous size but have size information recorded in the raw datasets. 1 is large 'Plankton Size'; 2 is small 'Plankton Size'
		2	
		[blank]	Additional Size Class not required.
	Phytoplankton Depth	Pelagic	Living in the water column.

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		Tychopelagic	Benthic taxa, which can become mixed into the water column.
	Phytoplankton Feeding Mechanism ('PhytoFeedingMech')	Auto	Autotrophic: nutrition by photosynthesis.
		Auto/Mixo	Auto- and mixotrophic
		Hetro	Heterotrophic: non-photosynthesising.
		Mixo	Mixotrophic: capable of obtaining nourishment via photo(auto)trophy and phago(hetero)trophy, as well as via osmo(hetero)trophy.
	Phytoplankton Habitat	Freshwater	
		Marine	
	Potentially Toxic or Nuisance	Ambiguous	Cannot assign trait: Some taxa in the group may be toxic. Taxa in this group cannot be identified to the taxonomic level required to confirm if they are a toxin producing strain or species using routine monitoring techniques. Toxin production in the relevant species may be strain dependent requiring confirmation using molecular methods. The mechanism of harm for this species may not be confirmed (e.g.: fish mortalities caused by either anoxia or ichthyotoxins).
		Nuisance	Taxa produce effects which are detrimental to aquaculture and benthos via physical harm or causing anoxia or produce water discolourations, scums or foams that can be aesthetically, socially, or economically negative
		Non-Toxic	Taxa do not produce toxins which pose a risk to marine biota or human health, and do not produce nuisance effects, and do not produce nuisance effects.
Zooplankton Traits	Zooplankton Type	(various)	Types included are: Bryozoan; Cephalochordate; Cephalopod; Chaetognath; Cladoceran; Crustacean; Echinoderm; Fish; Gastropod; Gelatinous; Hemichordate; Mollusc; Nematode; Nemertea; Phoronid; Polychaete; Rotifer; Sipuncula; Tunicate.
	Habitat	Holoplankton	Zooplankton taxa which spend their entire lifecycle in the plankton.
		Meroplankton	Taxa which spend part of their lifecycle as zooplankton.
	Diet	Carnivore	Taxa which prey mainly on other zooplankton.
		Herbivore	Taxa which are predominately suspension or filter feeders.
		Omnivore	Can use both carnivorous and herbivorous feeding.
		Ambiguous	Cannot assign trait: feeding mechanism variable or none of carnivore, herbivore or omnivore.
		Parasite	Feeds attached to food source either internally or externally.
	Crustacean	Y	Taxa of the Subphylum Crustacea
		N	
	Copepod	Y	Taxa of the Subclass Copepoda.
		N	
	Gelatinous	Y	Taxa of the phyla Cnidaria and Ctenophora only.
		N	
	Zooplankton Size	Sm	< 2 mm adult total body length.
		Lg	≥ 2 mm adult total body length.
		Ambiguous	Cannot assign trait: taxa in group includes those both under and over 2 mm.

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Table C1: Definitions of lifeforms by trait as defined in the traits list. See Table 2 for descriptions of traits used.

Lifeform	**Definition (Trait(s))**
(micro)Phytoplankton	**PlanktonType** = *Phytoplankton*
Large (micro)phytoplankton (>= 20 µm)	**PlanktonType** = *Phytoplankton* AND **PhytoplanktonSize** = *Lg*
Small (micro)phytoplankton (< 20 µm)	**PlanktonType** = *Phytoplankton* AND **PhytoplanktonSize** = *Sm*
Diatoms	**PhytoplanktonType** = *Diatom*
Pelagic diatoms	**PhytoplanktonType** = *Diatom* AND **PhytoDepth** = *Pelagic*
Tychopelagic diatoms	**PhytoplanktonType** = *Diatom* AND **PhytoDepth** = *Tychopelagic*
Potentially toxic or nuisance diatoms	**PhytoplanktonType** = *Diatom* AND **Toxic_Nuisance** = (*Toxic* OR *Nuisance*)
Dinoflagellates	**PhytoplanktonType** = *Dinoflagellate*
Autotrophic and mixotrophic dinoflagellates	**PhytoplanktonType** = *Dinoflagellate* AND **PhytoFeedingMech** = (*Auto* OR *Auto/Mixo*)
Potentially toxic or nuisance dinoflagellates	**PhytoplanktonType** = *Dinoflagellate* AND **Toxic_Nuisance** = (*Toxic* OR *Nuisance*)
Ciliates	**PhytoplanktonType** = *Ciliate*
Holoplankton	**ZooHabitat** = *Holoplankton*
Meroplankton	**ZooHabitat** = *Meroplankton*
Gelatinous zooplankton	**PlanktonType** = *Zooplankton* AND **Gelatinous** = *Y*
Carnivorous zooplankton	**PlanktonType** = *Zooplankton* AND **ZooDiet** = *Carnivore*
Non□carnivorous zooplankton	**PlanktonType** = *Zooplankton* AND **ZooDiet** = (*Herbivore* OR *Omnivore* OR *Ambiguous*)
Crustaceans	**Crustacean** = *Y*
Large copepod species(>=2 mm)	**Copepod** = *Y* AND **ZooSize** = *Lg*
Small copepod species (< 2 mm)	**Copepod** = *Y* AND **ZooSize** = *Sm*
Fish larvae	**ZooType** = *Fish*