L4 Zooplankton time-series

Ongoing zooplankton research at the Plymouth Marine Laboratory has established a time series of zooplankton species since 1988 at L4, a coastal station off Plymouth. Samples were collected by vertical net hauls (WP2 net, mesh 200 µm; UNESCO 1968) from the sea floor (approximately 50m) to the surface and stored in 4% formalin. Much of the zooplankton analysis has been to the level of "major taxonomic groups" only, and a number of different analysts have participated over the years. The level of expertise has generally been consistent, but the user should be aware that levels of taxonomic discrimination may vary during the course of the data-set.

The dominant calanoid copepods are generally well discriminated to species throughout. *Calanus* has not been routinely examined for species determination, the assumption being that the local population is entirely composed of *Calanus helgolandicus*. In certain years there has been a particular interest in *Temora stylifera, Centropages cherchiae* and other species reflected in the data-set. The lack of records in other previous years does not necessarily reflect species absence. “

We view it as essential for all users of L4 plankton data to establish and maintain contact with the nominated current data originators as well as fully consulting the metadata. While not impinging on free data access, this ensures that this large, species-rich but slightly complex species database is being used in the correct way, and any potential issues with the data are clarified. Furthermore, a proper dialogue with these local experts on the time series will enable where appropriate the most recent sampling timepoints to be used. Click here to download the data. Alternatively the data can be downloaded from BODC or the Pangaea website as files for each year by searching for "L4 zooplankton". The most comprehensive dataset is the version downloadable directly from this page.

The entire set of zooplankton samples is stored at the Plymouth Marine Laboratory in buffered formalin, and may be available for further taxonomic analysis on request.

Notes:

Increased taxonomic resolution since 2009 and spreadsheet layout

From 2009 onwards, a more detailed species list has been compiled, to increase information on several important taxonomic groups: hydromedusae, siphonophores, echinoderm larvae and decapod larvae. All taxa are given with their **WORMs ID**, details can be found here http://www.marinespecies.org/. The metadata table provided with the spreadsheet should be a useful guide to advise on the consistency of identification of organisms throughout the dataset.

Cumulative Data

For consistency, we have tried to maintain the same catergories for the whole time-series, so most of these added taxa are also counted in a more general column, e.g. “Total Siphonophores”, allowing the years 2009+ to be directly comparable to previous years. Any columns that contain summed data are recorded in the “cumulative data” row below each taxa, and more detail is recorded in the metadata table.

Identified since

There are some taxonomic groups that have no category prior to 2009, e.g. “Phoronid actinotroch larvae”, these fall into no other taxonomic group in the earlier dataset, so it is difficult to say whether they were not present in samples, or just not identified. These categories are identified using the “identified since” row below each taxa**.** If there is no value in a cell then there is **no data**, it cannot be assumed that the organism was not there.

Small calanoid juveniles (*Clausocalanus, Ctenocalanus, Paracalanus* and *Pseudocalanus*)

Juveniles of small calanoid copepods can be difficult to ID routinely, and so juveniles of four genera (*Clausocalanus, Ctenocalanus, Paracalanus* and *Pseudocalanus*) are counted and lumped together in an “unidentified juvenile calanoid” category. Between 1988 and 2008, these juveniles were attributed to these four genera according to the proportions of the adults in the sample. For example, if *Pseudocalanus* adults were the only species present in a sample, the juveniles observed in that sample were all assumed to be *Pseudocalanus* too. Since 2009, these calculations were abandoned and the data is left in the raw format for the end-user to treat as required. This is worth noting if looking at these genera in particular.

L4 ZOOPLANTKON TIME SERIES: TAXA METADATA

TAXA	IDENTIFIED SINCE	NOTES ON SAMPLING CONSISTENCY ETC	RARITY	POOLED? (1=YES, 0=NO, -1=IN POOL)	POOLED IN TAXA
Total Zooplankton	N/A	Sum total of all zooplankton	N/A	1	ALL ORGANISMS COUNTED. (Excludes pooled data)
Noctiluca scintillans	First observation 1997	Not recorded annually so possibly overlooked by analysts	Not rare	0	
Foraminifera	1988	Possibly inconsistently sampled by nets and overlooked by analysts	Rare	0	
Acantharia	2009	Possibly inconsistently sampled by nets and overlooked by analysts	Rare	0	
Radiolaria	First observation 1997	Possibly inconsistently sampled by nets and overlooked by analysts	Rare	0	
Tintinnida	1988	Possibly inconsistently sampled by nets and overlooked by analysts	Rare	0	
Anemone larvae	1988	Recorded pre-2009 as “Arachnatis Larvae”. Numbers pre-2009 seem inconsistent	Not Rare	0	
Total medusae	1988			1	
Solmaris corona (Narcomedusae)	1988	Numbers pre-2009 seem inconsistent. Possibly due to Narcomedusae being counted as “Hydromedusae”.	Not Rare	-1	Total medusae
Total Trachymedusae	1988	Numbers pre-2009 seem inconsistent. Possibly due to Trachymedusae being counted as	Not Rare	1/-1	Total medusae

		"Hydromedusae". Pooled data since 2009 of *A. digitale* and *L. tetraphylla*			
Aglantha digitale	2009	Consistent ID since 2009	Not Rare	-1	Total Trachymedusae
Liriope tetraphylla	2009	Consistent ID since 2009	Not Rare	-1	Total Trachymedusae
Total Hydromedusae	1988	Pooled data		1/-1	Total medusae
Hydromedusae unidentified	1988	Pre-2009 will show higher numbers as all hydromedusae recorded in this column. Since then only truly *unidentified* specimens recorded in this column	Not Rare	-1	Total Hydromedusae
Planula larvae	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Polyp	2009	Benthic stage so not sampled consistently with nets	Rare	-1	Total Hydromedusae
Actinula larvae	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Aurelia aurita ephyrae	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Scyphozoan ephyrae	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Amphinema spp	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Bougainvillia muscus	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Clytia hemisphaericum	2009	Consistent since 2009	Rare	-1	Total Hydromedusae
Corymorpha nutans	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Coryne prolifer	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Cosmetira pilosella	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Eirene viridula	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae

Eutima gracilis	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Hydractinia borealis	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Leukartiara octona	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Lizzia blondina	2009	Consistent since 2009	Not Rare	-1	Total Hydromedusae
Lovenella clausa	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Mitrocomella brownei	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Obelia spp.	2009	Consistent since 2009	Not Rare	-1	Total Hydromedusae
Phialella quadrata	2009	Consistent since 2009	Not Rare	-1	Total Hydromedusae
Podocoryne hartlaubi	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Rathkea octopunctata	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Sarsia prolifera	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Sarsia spp.	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Turritopsis nutricula	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Zanclea costata	2009	Rarity reflected in low number of observations	Rare	-1	Total Hydromedusae
Total Siphonophore	1988	Numbers appear consistent	Not Rare	1	
Muggiaea kochi (polygastric)	2009	Consistently identified since 2010	Not Rare	-1	Total Siphonophore
Muggiaea atlantica (polygastric)	2009	Consistent since 2009	Not Rare	-1	Total Siphonophore
Muggiaea sp. (eudoxid)	1988	Consistent since 2009	Not Rare	-1	Total Siphonophore
Siphonophore unidentified	1988	Pre-2009 will show higher numbers all siphonophores recorded in this column. Since then only truly *unidentified*	Not Rare	-1	Total Siphonophore

		specimens recorded in this column			
Nanomia cara (nectophore)	2009	Possibly confused with nectophores of A. elegans		-1	Total Siphonophore
Agalma elegans (nectophore)	2009	Possibly confused with nectophores of N.cara		-1	Total Siphonophore
Nematoda	1988	Numbers appear inconsistent, possibly due to changing analysts		0	
Flatworm larvae	2009	No record pre-2009, but cannot be assumed to have been absent		0	
Kuhnia scombri eggs (Trematoda)	2009	Only one record since 2009. Probably overlooked by analysts	Rare	0	
Total Ctenophora	1988	Pooled since 2009.	Not Rare	1	
Pleurobrachia pileus	2009	Consistent since 2009		-1	Total Ctenophora
Polychaete larvae unidentified	1988	Consistent	Not Rare	0	
Tomopteris helgolandica	1988	Consistent	Not Rare	0	
Total Chaetognath	1988	Consistent		1	
Chaetognath eggs	1988	Numbers appear inconsistent, possibly due to changing analysts	Not Rare	0	
Chaetognath unidentified	1988	Since 2009 used for counting unidentifiable juveniles. Pre-2009 possibly all Chaetognaths counted in this column at various points in time series	Not Rare	-1	Total Chaetognath
Sagitta elegans	1988	Inconsistent pre-2009 (see Unidentified Chaetognath)	Not Rare	-1	Total Chaetognath
Sagitta setosa	1988	Inconsistent pre-2009 (see Unidentified Chaetognath)	Not Rare	-1	Total Chaetognath
Phoronida actinotroch larvae	2009	No record pre-2009, but cannot be assumed to have been absent	Not Rare	0	

Bryozoa cyphonautes larvae	1988	Consistent	Not Rare	0	
Nemertea pilidium larvae	1988	No record pre-2009, but cannot be assumed to have been absent	Not Rare	0	
Gastropod larvae	1988	Numbers appear inconsistent around 2000s, possibly incorrectly recorded as "*Limacina retroversa*"	Not Rare	0	
Limacina retroversa	1988	Numbers appear inconsistent around 2000s, possibly due to inclusion of "Prosobranch gastropod larvae"	Not Rare	0	
Bivalvia	1988	Consistent	Not Rare	0	
Lamellaria echinospira larvae	2009	No record pre-2009, but cannot be assumed to have been absent.	Rare	0	
Gymnosome larvae	2009	No record pre-2009, but cannot be assumed to have been absent. Possibly recorded as *Clione* pre-2009	Rare	0	
Clione	1988	Numbers appear inconsistent, possibly due to changing analysts	Rare	0	
Cephalopoda larvae	1988	Few records of this organism, possibly due to inconsistent samples by nets	Very Rare	0	
Total Echinodermata	1988	Consistent	Not Rare	1	
Echinoderm larvae unidentified	1988	Pre-2010 will show higher numbers as most echinoderms recorded in this column. Since then only truly *unidentified* specimens recorded in this column	Not Rare	-1	Total Echinodermata
Ophiopluteus larvae	2010	Consistent since 2010		-1	Total

					Echinodermata
Ophiuroid juvenile	2009	Consistent since 2009		-1	Total Echinodermata
Echinopluteus larvae	2010	Consistent since 2010		-1	Total Echinodermata
Echinoid Juvenile (Sea urchin larvae)	2009	Consistent since 2009		-1	Total Echinodermata
Asterioid bipinnaria/brachiolaria	2009	Consistent since 2010		-1	Total Echinodermata
Asteroid juvenile	2009	Consistent since 2009		-1	Total Echinodermata
Luidia sp. larvae	2009	Consistent since 2009		-1	Total Echinodermata
Auricularia larvae (Holothuria)	1988	No data in 2009, included in "Echinoderm larvae unidentified"		-1	Total Echinodermata
Doliolaria larvae (Holothuria)	2009	Consistent since 2009		-1	Total Echinodermata
Tornaria larvae (Hemichordata)	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Branchiostoma (Cephalochordata)	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Ascidian tadpole	1988		Very Rare	0	
Doliolida	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Appendicularia	1988	Consistent	Not Rare	0	
Total Fish Eggs	1988	Pooled since 2009 to include Sardine eggs identified seperately	Not Rare	1	Total Fish Eggs
Sardine eggs (Clupeidae)	2009	Consistent since 2009	Rare	-1	Total Fish Eggs
Fish eggs	1988	Consistent	Not Rare	-1	
Fish larvae	1988	Consistent	Not Rare	0	

Cirripede nauplii	1988	Consistent	Not Rare	0	
Rhizocephalan nauplii	2009	Possibly overlooked by analysts and counted as “cirripede nauplii”	Rare	0	
Cirripede cyprid	1988	Consistent	Not Rare	0	
Evadne spp.	1988	Consistent	Not Rare	0	
Podon spp.	1988	Consistent	Not Rare	0	
Penilia avirostris	2009	Only one record since 2009, probably due to rarity	Very Rare	0	
Isopoda	1988	Numbers appear inconsistent, possibly due to changing analysts	Rare	1	
Gammariida	1988	Consistent	Not Rare	0	
Hyperiida	1988	Consistent	Not Rare	0	
Caprellida	2009	Only a few records since 2009, probably due to rarity	Very Rare	0	
Tanaid	2009	Only one record since 2009, probably due to rarity	Very Rare	0	
Cumacea	1988	Only a few records since 1988, probably due to rarity	Very Rare	0	
Mysida	1988	Consistent	Rare	0	
Euphausid eggs	1988	Numbers appear inconsistent, possibly due to changing analysts	Rare	0	
Euphausiid nauplii	1988	Numbers appear inconsistent, possibly due to changing analysts	Rare	0	
Euphausiid calyptopis	1988	Numbers appear inconsistent, possibly due to changing analysts	Rare	0	
Euphausiid furcilia	1988	Numbers appear inconsistent, possibly due to changing analysts	Rare	0	
Euphausiid adult	1988	Numbers appear	Rare	0	

		inconsistent, possibly due to changing analysts			
Total Decapoda	1988	Consistent	Not Rare	1	
Decapod larvae unidentified	1988	Pre-2010 will show higher numbers as most Decapods recorded in this column. Since then only truly *unidentified* specimens recorded in this column	Not Rare	-1	
Brachyuran larvae	1988	Some years with no records, but otherwise consistent. Cannot be assumed to be absent for these periods	Not Rare	-1	
Porcellanid larvae	1988	Some years with no records, but otherwise consistent. Cannot be assumed to be absent for these periods	Not Rare	-1	
Callianassa spp	2010	Consistent since 2010	Not Rare	-1	
Caridea	2010	Consistent since 2010	Not Rare	-1	
Ebalia spp	2010	Consistent since 2010	Not Rare	-1	
Galathea spp	2010	Consistent since 2010	Not Rare	-1	
Necora spp	2010	Consistent since 2010	Not Rare	-1	
Paguridae	2010	Consistent since 2010	Not Rare	-1	
Pontophilus sp	2010	Only one record since 2010, either due to rarity or not being identified when seen previously.	Rare	-1	
Upogebia spp	2010	Consistent since 2010	Not Rare	-1	
Metridia lucens	1988	Consistent	Not Rare	0	
Total *Acartia clausi*	1988	Consistent	Not Rare	1	
Acartia clausi (1-5)	2009	Counted consistently from 2009	Not Rare	-1	Acartia clausi
Acartia clausi (female)	1988	Counted occasionally through dataset,	Not Rare	-1	Acartia clausi

		consistently from 2009			
Acartia clausi (male)	2009	Counted consistently from 2009	Not Rare	-1	Acartia clausi
Candacia armata	1988	Consistent	Not Rare	0	
Centropages chierchiae	1988	Inconsistent, difficult to distinguish from more common Centropages typicus	Rare	0	
Total *Centropages typicus*	1988	Consistent	Not Rare	1	
Centropages spp (1-5)	1988	Counted occasionally through dataset, consistently from 2009	Not Rare	-1	Total Centropages typicus
Centropages typicus (female)	1988	Counted occasionally through dataset, consistently from 2009	Not Rare	-1	Total Centropages typicus
Centropages typicus (male)	2009	Counted consistently from 2009	Not Rare	-1	Total Centropages typicus
Centropages hamatus	1988	Numbers appear inconsistent, possibly overlooked by some analysts, as similar to "Centropages typicus" which is much more common	Rare	0	
Isias clavipes	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Anomalocera pattersoni	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Parapontella brevicornis	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Labidocera wollastoni	1988	Numbers appear inconsistent but this may be due to rarity of	Rare	0	

		organism			
Total *Temora longicornis*	1988	Consistent	Not Rare	1	
Temora longicornis (1-5)	2009	Counted consistently from 2009	Not Rare	-1	
Temora longicornis (female)	1988	Counted occasionally through dataset, consistently from 2009	Not Rare	-1	
Temora longicornis (male)	2009	Counted consistently from 2009	Not Rare	-1	
Temora stylifera	1988	Numbers appear inconsistent, possibly overlooked by some analysts, as similar to "Temora longicornis" which is much more common	Rare	0	
Calanoides carinatus	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Total *Calanus helgolandicus*	1988	Consistent	Not Rare	1	
Calanus copepodites (1-5)	2006	Appear consistent since 2006	Not Rare	-1	
Calanus helgolandicus (female)	1992	Appear consistent since 1992	Not Rare	-1	
Calanus helgolandicus (male)	1996	Numbers appear inconsistent, may have been recorded in "Total Calanus helgolandicus"	Not Rare	-1	
Calanus eggs	1988	Numbers appear inconsistent, possibly due to changing analysts. Probably not sampled effectively by nets	Not Rare	0	
Calanus finmarchicus female	2009	Only a few records since 2009, due in part to rarity and also the difficulty in distinguishing apart from	Rare	0	

		the more common "Calanus helgolandicus"			
Calocalanus spp.	1988	Only a few records since 1988, probably due to rarity	Rare	0	
Total *Clausocalanus* spp. (Calculated)	1988-2007	See notes on "small calanoid juveniles" for details of calculations used in dataset. Numbers appear consistent, but higher in 1980s	Not Rare	0	
Total Ctenocalanus vanus (Calculated)	1988-2007	See notes on "small calanoid juveniles" for details of calculations used in dataset. Numbers appear inconsistent, no records in some years in the 2000s	Not Rare	0	
Total Paracalanus parvus (Calculated)	1988-2007	See notes on "small calanoid juveniles" for details of calculations used in dataset. Numbers appear consistent	Not Rare	0	
Total Pseudocalanus elongatus (Calculated)	1988-2007	See notes on "small calanoid juveniles" for details of calculations used in dataset. Numbers appear consistent	Not Rare	0	
Para/Pseudo/Cteno/Clausocalanus Unidentified (1-5)	2008	Used to record unidentifiable juvenile stages of calanoid copepods from four genera	Not Rare	0	
Clausocalanus spp. (adults)	2008	Consistent	Not Rare	0	
Ctenocalanus vanus (adult)	2008	Consistent	Not Rare	0	

Paracalanus parvus (adult)	2008	Consistent	Not Rare	0	
Pseudocalanus elongatus (adult)	2008	Consistent	Not Rare	0	
Subeucalanus spp.	1988	Consistent	Rare	0	
Microcalanus spp.	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Diaixis hibernica	1988	Numbers appear inconsistent but this may be due to rarity of organism	Very Rare	0	
Paraeuchaeta hebes	1988	Numbers appear inconsistent pre-2006, but this may be due to rarity of organism	Rare	0	
Scolecithricella spp.	1988	Numbers appear inconsistent but this may be due to rarity of organism	Very Rare	0	
Oithona spp.	1988	Consistent	Not Rare	0	
Oncaea spp.	1988	Consistent	Not Rare	0	
Ditrichocorycaeus anglicus	1988	Consistent	Not Rare	0	
Microsetella sp	1988	Consistent	Not Rare	0	
Euterpina acutifrons	1988	Consistent	Not Rare	0	
Goniopsyllus clausi	1988	Consistent	Not Rare	0	
Harpacticoid unidentified	1988			0	
Siphonostomatoida	1988	Numbers appear inconsistent but this may be due to rarity of organism	Rare	0	
Copepod nauplii	1988	Consistent	Not Rare	0	
Acarid mites	2009	Only a few records since 2009 probably due to rarity		0	