

Towards a global *in situ* monitoring of plankton using imaging systems: lessons learnt from the past 10 years of observation in Europe

List of authors:

Lars Stemmann, Romagnan Jean Baptiste, Alain Lefebvre, Gérald Grégori, Jean Olivier Irisson, Bengt Karlson, Jukka Seppala, Kaisa Kraft, Guidi Lionel, Luis Felipe Artigas, Dodji Soviadan, Guillaume Wacquet, Klas Ove Möller, Klaas Deneudt, Simon Claus, Fabien Lombard

Jean-Baptiste ROMAGNAN, Ifremer de Nantes, 44311 Cedex 03, Rue de l'Île d'Yeu, 44980 Nantes
Klas Ove Möller: Institute of Coastal Research, Helmholtz-Zentrum Geesthacht, Germany
Luis Felipe Artigas & Guillaume Wacquet: CNRS, Univ. Lille, Univ. Littoral Côte d'Opale, UMR 8187, Laboratory of Oceanology and Geosciences, Wimereux, France
Gérald Grégori & Melilotus Thyssen, Aix-Marseille Université, CNRS, IRD, Univ. Toulon, UMR 7294, Mediterranean Institute of Oceanology, Marseille, France
Klaas Deneudt & Simon Claus: Flanders Marine Institute, Ostend, Belgium
Bengt Karlson: Swedish Meteorological and Hydrological Institute, Oceanographic Research
Lars Stemmann, Fabien Lombard, Jean Olivier irisson, Lionel Guidi, Dodji Soviadan: Sorbonne Université, UMR 7093, Laboratoire d'Océanographie de Villefranche sur Mer
Alain Lefebvre: Ifremer, Laboratory of Environment and resources, Boulogne sur mer, France
Jukka Seppälä, Kaisa Kraft: Marine Research Centre, Finnish Environment Institute, Finland

Plankton plays a key role in the biological pump and has a big impact on marine living resources. However, plankton is difficult to observe in a consistent manner across its extended size range and by the multiple observers that uses protocols that are not inter calibrated. Imaging sensors have the potential to provide key **“ecosystem essential ocean variables” eEOVs** (plankton biodiversity, morphological traits) that complement other sensors such as optical ones. Lab and *in-situ* imaging sensors have been deployed the 10 last years to provide insights into local dynamics in the frame of time series programs (from daily to decadal scales) and during oceanographic surveys across ocean basins. Combining observations from the different programmes has sometimes allowed to detect concomitant changes in different areas or provide a better spatial distribution of plankton communities. For example, such efforts were supported by the European FP7 JERICO, H2020 JERICO-NEXT, BRIDGES, EURO-BASIN programs. Most of the observation efforts were performed independently and hundreds of millions of images have been collected (and billions to come as sensors are getting more available). All those sparsely distributed images are usually not available for the users because of limited development in software solutions for identification, archiving and distribution, which are in a current improving process. Several attempts for developing web based services for image recognition, distribution and archiving have been performed (ecotaxa.obs-vlfr.fr) but only a fraction of the existing and future data can be treated by them. Based on the past ten years of

effort, we will present a synthesis of successful developments in using imaging systems to provide information on plankton community at local, regional and ultimately global scales. These examples will show how relevant they are for ecosystem monitoring (e.g. detection of ecosystem changes and regime-shifts) and services (e.g. aquaculture, fisheries, biological carbon pump). We will then build on these examples to discuss future developments with the aim of, better observing, harmonizing practices and developing state of the art marine data and information management in order to increase the connection with the relevant stakeholders and community of users among researchers, conservation managers and private companies.