

Long-term plankton measurements using semi-automatic image classification techniques

Amadei Martínez Luz, Mortelmans Jonas, Deneudt Klaas and Hernandez Francisco

Flanders Marine Institute (VLIZ), Wandelaarkaai 7, 8400 Oostende, Belgium
E-mail: luz.amadei.martinez@vliz.be

Long-term biodiversity measurements are necessary to understand changes and pressures on an ecosystem. To support scientific research on biodiversity and ecosystem functioning, the Flanders Marine Institute (VLIZ) established a marine observatory as part of LifeWatch Belgium within the European Strategy Forum on Research Infrastructures (ESFRI). This observatory carries out sampling campaigns in the Belgian part of the North Sea (BPNS) onboard the RV Simon Stevin, visiting in total 17 stations on a monthly or seasonal basis. During these campaigns, various seawater and seabed characteristics are measured, as well as biological samples including phytoplankton, zooplankton, and macrobenthos.

Large amounts of biological samples are generated, and processing these using traditional methodologies is labor-intensive and time-consuming. Thus, innovative techniques that generate high-resolution data in a time-efficient process are favored.

As an accepted technique to carry out taxonomic classification of plankton samples, image analysis is applied within LifeWatch with two different methodologies. For zooplankton, samples are collected with a vertical 200 µm WP2 plankton net and fixed in formaldehyde. Zooplankton samples are scanned with the ZooScan (Hydroptic) and the images are processed with ZooProcess and Plankton Identifier. On the other hand, Phytoplankton samples are collected by filtering surface water in a 50 µm Planktonnet Apstein net and fixed in Lugol. The samples are processed with the FlowCam using the VisualSpreadsheet software. Both techniques generate pictures of the particles in the water sample that can be classified on the basis of the imaged particle's properties. After the automatic classification, the annotation by software is manually validated.

In total, we have measured the abundance of plankton from January 2014 onwards for zooplankton, and from May 2017 onwards for phytoplankton. Zooplankton is processed only at a higher taxonomic level: 18 taxa over 900.000 observations are currently validated. Phytoplankton is processed mostly at genus level, and 45 taxa over 120.000 observations are currently validated. In both cases, the use of software allows experts to work on the samples and enhance taxonomic resolution.

In addition, the datasets generated are freely available through the LifeWatch Data Explorer (<http://www.lifewatch.be/en/lifewatch-data-explorer>), on the condition that the dataset is cited. The improvement of classification algorithms and camera resolution would result in even more accurate classifications, and require less human effort. Nonetheless, we have succeeded in implementing image analysis methodologies to process large amounts of plankton samples. By distributing these data to the wider scientific community, we hope to enable researchers to gain quick access to biodiversity parameters in the BPNS.

Keywords: biodiversity; plankton; image analysis; zooplankton; phytoplankton; Belgian Part of the North Sea