Appendix C

GLOBEC/SPACC ZooImage Workshop Report

Background

Mr. S. Tsotsobe attended the GLOBEC/SPACC ZooImage Workshop hosted by AZTI-Tecnalia in San Sebastian, Spain on 1-3 November 2005. This workshop, attended by 62 scientific personnel from around the globe focused on new image analysis and recognition methods for identifying and counting zooplankton. The workshop was an opportunity to bring developers and end-users (oceanographers) together, so that end-users can learn and evaluate new systems, or alternatively, developers can obtain feedback about real applications of their systems.

Zooplankton is a major component of the diet of small pelagic fish. Assessing the state of zooplankton in our ocean allows us to better understand and manage our commercial pelagic fish stocks. The Workshop focused on new image analysis and recognition methods for identifying and counting zooplankton. Image analysis systems begin to offer an advantage over manual methods of counting/sizing zooplankton: the digital images can be used for automated species identification using different recognition systems to identify at least major zooplankton groups. These new image analysis methods are still not well known among fisheries and zooplankton scientists. The long-term objective is to initiate a network of laboratories involved in large-scale surveys using the same approach to count and identify zooplankton. This would provide valuable information about the factors affecting zooplankton distribution and food fields encountered by, for instance, small pelagic fish.

Programme

The workshop had two aspects: theoretical and practical. Both developers of automated recognition methods/software and end-users interested in these new techniques took part in this workshop. The workshop was split over a three-day period. The program was as follows:

1 November 2005: Talks on the new image analysis and recognition techniques:

To start off, participants were informed about the initial recommendations when creating the ZooImage software:

1. The software must be available free of charge.
2. It must run on most platforms (e.g. MS Windows).
3. It must be fully documented.
4. It must be flexible and expandable – to account for most situations and future enhancements.
5. It must be both powerful (programmable for specialists) and simple (user-friendly graphical interface).
6. It must be able to import and process all digital zooplankton images, e.g. ZooScan, camera, etc.

Various methods of acquiring digital images were presented and discussed. These involved "in situ" imaging (Video Plankton Recorder-VPR, ZooVIS, SIPPER, FlowCAM, HAB bouy, etc) and also those methods used in the case of fixed samples (ZooSCAN, FlowCAM). Technologies that stood out were: SIPPER (shadowed image particle profiling and evaluation recorder), which aims at addressing the mismatch between OPC and net data; HAB bouy, which is suitable for both micro- and mesozooplankton, and can be used on site or in the laboratory; VPR (video plankton recorder), tricky because live, *in situ* animals constantly change shape, making positive identification difficult.

2 November 2005: A step-by-step demonstration of the ZooImage software for automated zooplankton recognition was given:

Other concerns voiced by participants related to varying angles in which animals lie. It was advised that the same sub-sample be counted three times. It was also recommended that to cater for the presence of detritus, the sample should be stained.

3 November 2005: Same as previous day, and in addition, discussion (evaluation of ZooImage by both end users and developers) and conclusion (including proposing an international project).

Way forward

The long-term objective is to initiate a network of laboratories involved in large-scale surveys using the same approach to count and identify zooplankton. This would provide valuable information about the factors affecting zooplankton distribution and food fields encountered by, for instance, small pelagic fish.

During the workshop participants engaged in a discussion about setting up support websites for continuing work and support on image analysis. Presently, Philippe Grosjean (Belgium) is creating documentation for the ZooImage software, as well as mailing lists for general announcements and a platform for developers. In the meantime, Jens Rasmussen (Scotland) has also set up an online forum in which users can communicate with one another and discuss issues on image analysis of plankton (see Appendix A for list of web-based tools).

Mr. Tsotsobe is currently investigating the applicability of image analysis for plankton analysis at MCM. This work is done in collaboration with Mr. T. Tanci, who is responsible for the ichthyoplankton component of this project. The growing volume of zooplankton samples collected during MCM's routine monitoring surveys calls for quicker and efficient techniques of analysis. It is envisaged that the use of image analysis would go a long way in alleviating the enormous sample load. In addition, it will be useful in the continuing retrospective analysis of the SWAPELS zooplankton collection, therefore contributing to the building of a long-term data set for the northern Benguela ecosystem.

Recent publications

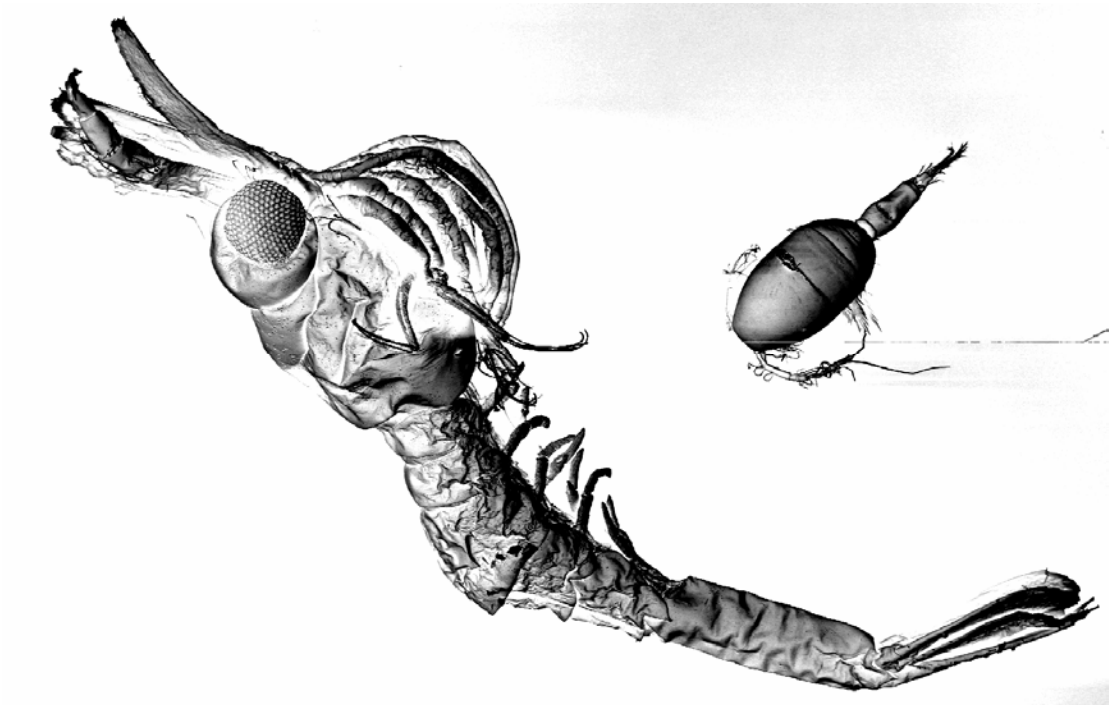
1. Boyra, G., Irigoien, X, Aristegieta, A. and I. Arregi 2005 – Plankton visual analyser. *Globec International Newsletter – April 2005*: 9-10.

2. Grosjean, P., Picheral, M., Warembourg, C. and G. Gorsky 2004 – Enumeration, measurement, and identification of net zooplankton samples using ZOOSCAN digital imaging system. *ICES J. mar. Sci.* **61(4)**: 518-525.

APPENDIX

Some images captured using a FlowBioCam (A) and Zooscan (B).

A.



B.