FlowCam®

Using FlowCam Macro for the Study of Zooplankton

A Conversation with Kathryn Cook, PhD

Zooplankton form a critical link between trophic levels in marine and freshwater environments. Changes in the structure of zooplankton communities can be indicators of environmental and anthropogenic impacts on our water systems; therefore, studying these small aquatic microorganisms is crucial to our understanding of these systems.

We recently spoke with zooplankton biologist and pelagic biogeochemist Dr. Kathryn Cook to learn how FlowCam Macro has advanced her research. She's currently a Research Associate at the University of Exeter and completed her doctoral degree in zooplankton ecology at the University of Swansea in Wales. Dr. Cook was happy to share her experience with FlowCam and its benefits.

Why did you choose this field of study?

Zooplankton, and plankton in general, fascinate me. They are so abundant and diverse and play important roles in our global ecosystem. However, most people have barely heard of them, let alone seen them. As a hands-on scientist, I love being in the lab equally with participating in research cruises. I recently returned from a 6-week cruise sailing from the Falkland Islands in the South Atlantic to Southampton in the North Atlantic – taking zooplankton samples along the way. As part of Mission Atlantic, this EU-funded research mission is dedicated to mapping and assessing the Atlantic marine ecosystem's present and future status to monitor the influence of climate change and exploitation. It's extremely gratifying to be able to contribute to this important work.

In what context did you first learn about FlowCam?

I vividly remember the first time I saw a demonstration of FlowCam Macro at the 2016 Zooplankton Production Symposium in Bergen, Norway. Having spent hours at a microscope analyzing plankton samples, I was amazed at how quickly a sample could be imaged through FlowCam Macro and by the quality of the images! I was delighted to discover that the National Oceanography Centre (NOC) in Southampton had just bought one when I went to work there in 2017.

What method or technique were you using previously?

Before FlowCam, I used a microscope to examine zooplankton and phytoplankton, which would take at least half a day per sample, much longer if I needed to measure the organisms using an eye-piece graticule, and even then, I could only measure the length and width of organisms. There was also the requirement to let the sample settle for 24 hours before analysis was possible.

Figure 1. (Left) FlowCam image of *Haloptilus* sp. (Right) Manual microscope image of *Haloptilus* sp.

FlowCam removed the requirement to settle the sample, greatly reduced analysis time from days to minutes, and provided me with highly resolved images and morphological data that helped me differentiate between living and dead cells and perform taxonomic classification. Prior to FlowCam, our Coulter Counter could provide cell counts, but without morphological data, we could not expand the classification to distinguish between healthy phytoplankton cells and detritus/empty cells.

How has this technology contributed to your research overall?

Organisms' size and shape are generally enough data to calculate metabolic rates and their energy-flow impacts on ecosystems. Most ecosystem models represent plankton as different sizes and functional groups. FlowCam provides a variety of size measurements for each particle, allowing us to construct size spectra of plankton communities and convert from biovolume to biomass for each individual organism instead of applying a conversion factor based on an average size.

Much of my research focuses on the size and quantity of organisms within rough taxonomic groups rather than on identifying which species are present. We use FlowCam Macro to analyze preserved zooplankton samples quickly and obtain size and coarse taxonomic information. I use a standard, size-based classification template to sort my sample into rough-size categories, effectively sorting organisms into approximate taxonomic groups. Then I manually sort the ones that need to be reclassified.

FlowCam provides us with a digital record of our samples, reducing the physical space we need in our lab to store preserved zooplankton samples and allowing us to perform sample classification analyses at our leisure in the comfort of our office (or living room!). Plus, it is far easier to train someone to run a sample through FlowCam than to train them to identify plankton samples using a microscope.

Have you experienced challenges that FlowCam has helped you overcome?

FlowCam has helped us immensely by reducing analysis time and freeing up considerable storage space. Phytoplankton samples take up a lot of space, as phytoplankton samples preserved using the standard Lugol's iodine solution have a limited life span (as do formaldehyde-preserved zooplankton samples). FlowCam's streamlined workflow has supported my ability to accommodate more undergraduate and master's projects in my laboratory. Students can conduct analyses independently, and I can easily check their work with less subjectivity than comes with manual microscopy; FlowCam gives us increased confidence in the data.

In what ways has FlowCam changed your workflow?

Our FlowCam instruments have increased the number of samples I can analyze, increased the amount of information I can get from each sample (in terms of organism size), and provided a permanent digital photographic record of the sample and how organisms were classified.

This makes it much easier to apply QA processes. It also makes it easier for students to conduct analyses as I can check and correct everything afterward before the final dataset is analyzed.

Figure 2. A team of Mission Atlantic scientists carrying out a Mammoth net deployment onboard a research vessel. Dr. Cook is pictured at left in a white helmet.

We'd like to thank Dr. Cook for sharing her experience. Routine sampling with FlowCam provides scientists with a rapid and repeatable means to measure and characterize plankton communities to advance understanding of harmful algal bloom dynamics, trophic relationships, particle transport, and other environmental phenomena. To learn about FlowCam for plankton research applications, visit our website.

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