

Reports to SCOR (2020)

1. Name of group

WG 150 - Translation of Optical Measurements into particle Content, Aggregation & Transfer (TOMCAT)

2. Activities since previous report to SCOR (e.g., virtual or in-person meetings, email discussions, special sessions). Limit 1000 words

Special issue

Our Research Topic (special issue) in *Frontiers in Marine Sciences* called “We Shed Light: Optical Insights into the Biological Carbon Pump” following on from the session at the Ocean Science Meeting is closed now and has 7 accepted publications.

Literature Review

Our literature review has been published this year. Title: “Particles in the ocean - what can we learn from optical devices?” The review provides a practical overview of the challenges and potential of using optical instruments for estimating carbon fluxes. It gives plenty of recommendations and a useful guide for improving the application of optical devices as well as allowing intercomparisons. Since its publication in Feb 2020, it has had over 3500 views and has already been cited in *Science*.

Data sharing platform

Several of the TOMCAT members have been involved in starting the Joint Exploration of the Twilight Zone Ocean Network (JETZON; <http://jetzon.org/>). JETZON hosts a dedicated website for data and method sharing, which we have identified as the perfect platform for TOMCAT methods to be broadcasted. We are now in the process of contributing to the JETZON website.

Capacity building – Postgraduate training

In an effort to bring TOMCAT methods to South Africa, Sari Giering is currently supervising a PhD student based at the Nelson Mandela University (NMU), South Africa. In Jan-Feb 2020 she worked at NMU where she advised and trained the PhD student and staff in collecting flux data using traditional methods and optical methods and assisted in the data analysis and interpretation.

Capacity building – SUMMER school

Members of TOMCAT are preparing a 1-week summer school in Cape Town, South Africa. The summer school was originally planned for October 2020, but due to COVID-19 we are now anticipating hosting it in early 2021. The focus of the school is capacity building, so the teaching material will be accessible and hands-on with a focus on optical instruments that are affordable (< US\$ 2,000). For example, we will introduce the affordable "PlanktoScope" (<US\$400 in parts), which is of comparable quality to more costly commercial instruments. Therefore, this instrument is a potential chance to allow a low-cost approach to extend imaging approaches in oceanography as well as citizen sciences projects. The anticipated number of students is 20. SCOR has already kindly approved US\$ 5,000 for travel support of developing country scientist to attend the summer school.

Group meeting

An social group meeting was held during the Ocean Sciences meeting in San Diego bringing together TOMCAT scientists and related researchers from the imaging and biological carbon pump community to exchange ideas, and discuss potential project and collaboration activities.

3. Documents published since previous report to SCOR (e.g., peer-reviewed journal articles, reports, Web pages) and should be limited to publications that resulted directly from WG activities and which acknowledge SCOR support

Research topic: <https://www.frontiersin.org/research-topics/7817/we-shed-light-optical-insights-into-the-biological-carbon-pump>

Publications:

Lombard et al. (2019) Globally Consistent Quantitative Observations of Planktonic Ecosystems. *Frontiers in Marine Science*. doi: 10.3389/fmars.2019.00196

Giering et al. (2020) Review: Sinking organic particles in the ocean - Flux estimates from in situ optical devices. *Frontiers in Marine Science*. Doi: 10.3389/fmars.2019.00834

Giering et al. (2020) The interpretation of particle size, shape and carbon flux of marine particle images is strongly affected by the choice of particle detection algorithm. *Frontiers in Marine Science*. doi: 10.3389/fmars.2020.00564

Website pages:

Details on optical methods via the JETZON data sharing platform. (www.jetzon.org)

4. Progress toward achieving group's terms of reference. List each term of reference separately and describe progress on each one. Limit 1000 words

TOF:

- 1. Review current devices that optically measure particles, and document the capabilities and limitations of each device.**
Achieved.
- 2. Make vocabularies more transparent and interoperable using international standards.**
Some of these have been defined as part of the literature review. Darroch and Giering will apply for funding to build official recommendations and specifications for the optical community for describing individual images and the overall fluxes. The specifications will include all the necessary metadata (e.g. threshold, focus, etc.) and guides on formatting the information in a consistent, interoperable format. It would also define controlled vocabularies and supply digital notebooks such as Jupyter notebooks for documenting data workflows.
- 3. Define key parameters for interpretation of optical information, and recommend which optical measurements are useful for characterizing particle type, interactions and export.**

Partly achieved as part of the literature review and recent publication (Giering et al. 2020). More will follow via TOF2 and method distribution via jetzon.org.

4. Evaluate various techniques and algorithms for the conversion of optical observation into particle type, size, concentration, mass, composition, and fluxes, and recommend ways of improving our understanding of the relationships between these properties.

Achieved. We have addressed this issue as part of the literature review as well as a separate paper submitted to the TOMCAT research topic.

5. Promote sharing of software examples and codes, placed on a public repository.

We have started using digital notebooks to document data analysis workflows (e.g. for one of the Research Topic papers exploring the effect of thresholding on particle size estimates). We will further promote method sharing and provide templates via the JETZON portal.

6. Improve the visibility and usage of data by hosting an inventory of published datasets.

We have discussed options with different platforms and came to the conclusion that EcoTaxa is currently the best platform for sharing. EcoTaxa is a web application dedicated to the visual exploration and the taxonomic annotation of plankton images, and it has the potential to be extended or used as a template for marine snow images.

5. WG activities planned for the coming year. Limit 500 words

Capacity building

We will continue our capacity building efforts in South Africa by supervising and training students and staff at NMU. One goal is to introduce the PlanktoScope to the community as a low cost camera system, and increase the general usage of imaging devices in the framework of oceanography.

More transparent and interoperable vocabulary. Giering will apply for a fellowship to follow-up the TOFs that have not been achieved owing to lack of time and resources. The aim is to extend the work started with TOMCAT, building a global data sharing and analysis framework that will eventually allow us to compute global POC process maps.

Example codes

First example codes have been published as part of the papers submitted to the Research Topic (Giering et al. 2020). We have identified the JETZON website as a great tool for sharing data and methods and will publish examples here.

6. Is the group having difficulties expected in achieving terms of reference or meeting original time schedule? If so, why, and what is being done to address the difficulties Limit 200 words

We are pleased with the overall progress we have made. This working group has opened the dialogue between many different research groups and – as hoped - has brought researchers from the different fields together. We are looking forward to the summer school and to sharing data and methods via JETZON.

7. Any special comments or requests to SCOR. Limit 100 words.

We thank SCOR for the generous contribution of \$5,000 to the summer school. Any additional support (incl. advertisement) is – as always – highly appreciated.

Additional information can be submitted and will be included in the background book for the SCOR meeting at the discretion of the SCOR Executive Committee Reporter for the WG and the SCOR Secretariat.