

Annual SCOR Working Group Report for WG 161 2021-2022

Summary

WG 161 (Respiration in the Mesopelagic Ocean) has started a seminar series so members can learn about each others' work. So far we have had three presentations, and four more are planned this year. The seminars are recorded, and we are discussing whether to make these available to the wider community through our website and YouTube. We also launched a ReMO mentoring scheme. Four early career mentees (from Mexico, India, China and France) were chosen from applicants to the open call. They gave presentations to the WG, and are now paired with WG mentors and are working on collaborative objectives which include progressing data interpretation, learning and setting up the facilities for a new analytical method and progressing a fellowship proposal. We aim to open another call for mentees before the end of 2022.

We are planning to hold a combined annual meeting, training course and methods intercomparison workshop in Las Palmas de Gran Canaria in May next year. The training course will be open to early career researchers from developing and developed nations and focus on hands-on experience with methods used to measure and model mesopelagic respiration. During the training course we will produce a series of online learning materials including recorded lectures, method demonstrations and data analysis and modelling exercises. During the intercomparison workshop, WG members will compare and contrast methods which estimate mesopelagic respiration and prepare the results for publication.

1. Name of group

Respiration in the **Mesopelagic Ocean (ReMO)**: Reconciling ecological, biogeochemical and model estimates

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

We continue to hold virtual meetings at approximately monthly intervals. The membership spans 21 time zones and so we hold duplicate meetings at 08:00 UTC on the last Thursday of every month and at 19:00 UTC on the following Monday. These meetings are recorded for anyone who cannot attend, they last for up to 2h and they each focus on a particular task or tasks and include progress updates from the co-leaders of each task. We have held 10 such meetings this year. We have also held additional virtual task team meetings to progress deliverables including the action plan (ecological, biogeochemical and modelling components), the review paper, the modelling paper and the mentoring scheme. We continue to use a Google site for all working group documents.

We planned to hold a face-to-face annual meeting in Spain in May 2022 alongside the Gordon Research Conference on Marine Biogeochemistry at which 4 WG members were due to give keynote presentations. However, due to continuing international travel restrictions due to COVID-19, we eventually held this virtually on 28 and 29 April 2022 and SCOR Executive Officer Patricia Miloslavich attended.

We have started a working group seminar series so members can learn about each others' work. So far we have had presentations by Iris Kriest on Modelling respiration, Gerhard Herndl on The impact of hydrostatic pressure and Javier Arístegui on the ETS technique. Further seminars are planned in August, October and November this year. The seminars are recorded. We are discussing whether to also make these available to the wider community through our website and YouTube.

At the beginning of 2022 we launched a ReMO mentoring scheme (see details below). Four mentees (Josué Villegas Mendoza, México; Saumya Silori, India; Jordan Toullec, France and Yi Xu, China) gave presentations to the WG, and are now paired with WG mentors and confirming their collaborative objectives. So far these include progressing data interpretation, learning and setting up the facilities for a new analytical method and progressing a fellowship proposal. We aim to open another call for mentees before the end of 2022.

ReMO activities were mentioned within an invited presentation at the Marine Biogeochemistry Gordon Research Conference in May 2022, at the SCOR exhibit at the virtual Ocean Sciences meeting in Feb 2022 and acknowledged in two manuscripts (Herndl et al.; Iversen et al.) submitted to Annual Review of Marine Science and currently under review.

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

There are no peer-reviewed journal articles or reports arising from this WG yet. ReMO is acknowledged in two papers submitted to Annual Review of Marine Science.

We have produced a Google Site to use within the WG – this includes all minutes and recordings from the meetings, editable WORD and EXCEL documents that we use to progress the tasks, information on membership, the mentoring scheme and outputs.

We have completed a living document 'action plan' (Deliverable #1 from Terms of Reference #1) which we are using as the basis of a review paper and a position paper (Deliverable #2 from Terms of Reference #1).

The review paper is at preliminary draft stage with an expected submission date of early 2023. A shorter position paper will be developed during 2023.

We have produced an external facing website specifically to launch the mentoring scheme <https://carolrobinson62.wixsite.com/remo161/home> which links to our twitter account @ReMO_SCOR161.

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

Terms of reference (1-5) are detailed below, along with the relevant deliverables (D1-D11), the year-end by which they were planned to be completed (2021-2024) and a [statement on progress](#).

1. Identify, quantify and prioritise gaps in our knowledge, and prepare an action plan to reduce these gaps by reviewing available information on mesopelagic respiration

D1. An action plan to identify gaps in knowledge and propose ways to address those gaps (2021)

We have divided this task into three themes (biogeochemistry, ecology and modeling), with at least two WG members delegated to lead each theme. This deliverable is now complete and hosted on the WG Google site. We envisage the plan to be a 'living document', evolving as new information becomes available and that it provides the foundations for a review paper and a position paper.

D2. A position paper, based on the plan, highlighting the importance of reliable estimates of mesopelagic respiration, and suggesting priority research questions (2021)

A review paper led by Jack Middelburg and Gerhard Herndl is at a preliminary draft stage, with sections delegated to WG members to write. Submission is expected to be in early 2023. A position paper will lead on from this, with submission expected by end 2023.

D3. A model intercomparison / data sensitivity paper (2022)

This paper also derives from the action plan and is thus at a first draft stage. Because of complications due to Covid restrictions, and the large diversity of global model setups and outputs we expect to submit this towards the end of 2023 rather than 2022. If possible, the manuscript will also apply and use knowledge gained from the working group on measured respiration rates.

2. Develop a global dataset of mesopelagic respiration estimates, derived from the range of ecological and biogeochemical techniques available, in order to create a resource for validation of biogeochemical models including Earth System Models used for climate projection

D4. A global dataset, linked to international marine data hubs, for use by modellers, launched at a Town Hall meeting at an international conference such as Ocean Sciences (2023)

We have consulted with national data centres and produced a draft of a template that will be used to collate data from the international community. This was advertised to the marine community at the SCOR virtual exhibit at the Ocean Sciences conference in February 2022. We have applied for external funding for data centre and postdoctoral staff time to speed up the collation of this global database (submitted April, decision pending). Once the outcome of the funding application is known the template can be released to the community (anticipated in Aug 2022). We would encourage the community to submit data during 2022 so that the dataset can be launched together with the data paper during 2023.

D5. A data paper in Earth System Science Data <https://www.earth-system-science-data.net/> (2023)

This will be progressed alongside D4.

3. Produce a new synthesis of open ocean mesopelagic respiration

D6. A synthesis paper on a model/observational case study, and presentations at appropriate international conferences (2024)

This is being led by Javier Aristeguí and Anton Salgado based on their data collected in the N Atlantic Ocean and still scheduled for submission in 2024.

4. Produce a best practice manual of techniques and approaches to determine mesopelagic respiration, and make recommendations as to which is the most appropriate method or combination of methods for a particular application, including best practice on how to reconcile approaches across time and space scales

D7. A best practice manual for ecological and biogeochemical methods used to derive mesopelagic respiration (2023)

We have a draft structure of this manual, with co-leads identified for the different sections. We have had two discussion sessions on the structure and the document is editable on the Google site. Section writing will progress during the method intercomparison workshop in 2023.

D8. A method inter-comparison paper and dataset (2024)

This derives from the method intercomparison exercise planned for May 2023 in Las Palmas, Canary Islands. We have held 2 focused discussion meetings and have a draft plan for the experiments, techniques, equipment, personnel involved.

5. Build capacity, share knowledge and transfer technical skills, particularly to scientists in developing nations

D9. A training course on model and observational approaches to derive mesopelagic respiration for early career and experienced researchers, particularly aimed at scientists from developing nations (2023)

This is currently being planned alongside the intercomparison workshop in Las Palmas in 2023. We have held 2 focused discussion meetings and have a draft timetable and implementation plan. The next steps are to raise sufficient funding to make it viable, and advertise to the early career researcher community.

D10. Online training materials such as lectures and practical demonstrations of analytical techniques, budgeting exercises and modelling approaches (2024)

These are being planned linked to the training course above. They will include recorded lectures, method demonstrations and data/model exercises. They will be available online and also as 'modules' that could be incorporated into summer schools and capacity development activities organized by SCOR projects such as IMBeR and SOLAS.

D11. A manuscript for children on mesopelagic microbial respiration in Frontiers for Young Minds <https://kids.frontiersin.org/> (2024)

This is currently being planned, linked to the review and position papers described above, and potentially with input from the early career researchers attending the training course.

Capacity development : Mentoring scheme

Four early career mentees (within 10y of receiving their PhD) have been paired with WG members to progress collaborative tasks such as data interpretation, learning new methods and writing proposals. The mentees have given presentations to the WG on their current work and planned ReMO activities. They have attended the WG seminars, have regular meetings with their mentors, and are due to report progress to the WG meeting in October 2022. We aim to open a second call for mentees before the end of 2022.

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

The review paper and position paper (D2) are planned to be submitted during 2023 – a delay of 12 months from the original proposal. During 2023 we will progress the data compilation (D4) and data comparison paper (D5) and complete the methods manual (D7). We will also undertake the training course (D9), and methods intercomparison experiments to progress the intercomparison paper (D8) and the production of training materials (D10) and have a second call for the mentoring scheme.

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

Due to COVID-19, we haven't had the opportunity to meet face to face. The dual meetings and Google site have enabled us to progress with the science tasks, but interactions between members living in different time zones (who therefore attend different virtual meetings) and the usual networking which occurs at face-to-face meetings has been limited.

The extra workload created by the COVID-19 pandemic (creating online lectures and virtual fieldcourses, re-organising practical work, increased time devoted to student well-being and working from home) has reduced the time we all have to dedicate to the WG and so slowed our progress in terms of publication submissions.

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

We would like to hold a combined annual meeting, training course and methods intercomparison workshop (~16 days in May 2023) in Las Palmas, Gran Canaria, and ask that we can use < \$23,000 SCOR funds towards this. This is based on the estimated cost of 10 WG members attending the annual meeting and intercomparison workshop (average travel \$600, 3 days for annual meeting @ \$165, plus 7 days for intercomparison workshop @ \$165). We are sourcing less expensive accommodation to try to extend the number of days this will cover. We will calculate a registration fee for the attendees of the training course to cover the additional days costs of the lecturers. We request that if some of the full members can cover their own expenses to attend this meeting, we can use SCOR funds to cover some of the expenses of some associate members (up to a total of 10 members). We have one early career associate member and would aim to apply to the SCOR Capacity Development committee for a contribution to their expenses to attend. We have also approached OCB and KIOST for support for early career researchers to join the training course and have applied for external research funds for additional WG members to join the combined event.

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.