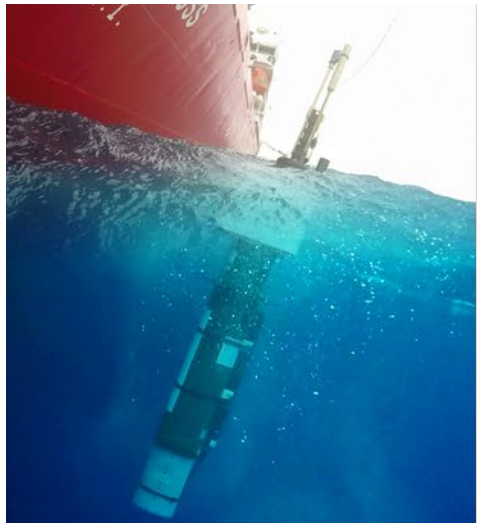
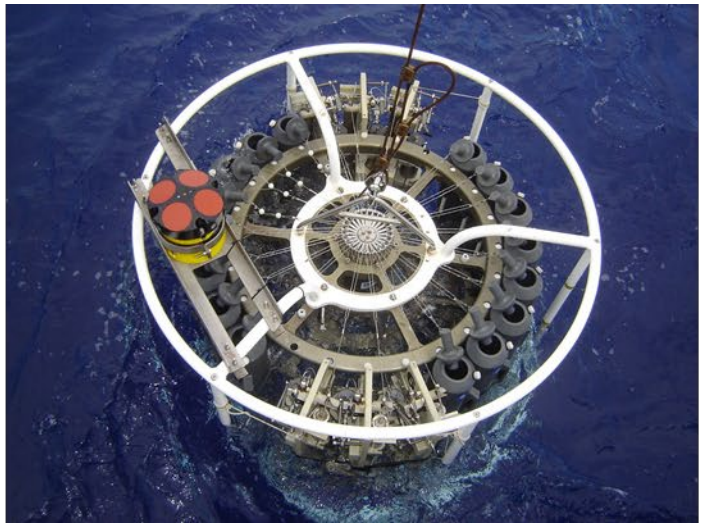
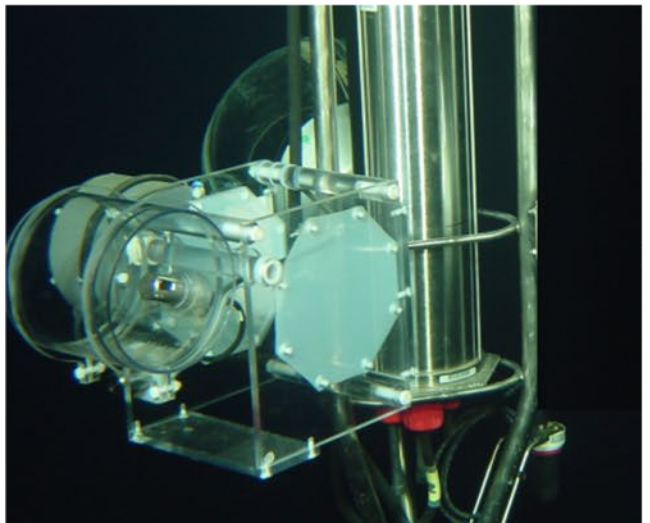
# Respiration in the Mesopelagic Ocean (ReMO): Reconciling ecological, biogeochemical and model estimates

**SCOR Working Group 161**

Co-Chairs : Carol Robinson, Javier Arístegui, Iris Kriest



# Terms of reference & deliverables

ReMO
Respiration in the Mesopelagic Ocean

## 1.

**Identify, quantify and prioritise knowledge gaps**

#1 action plan
#2 position papers
#3 model paper

## 2.

**Develop a global dataset**

#4 dataset
#5 data paper

## 3.

**Produce a new synthesis**

#6 case study

## 4.

**Produce a best practice manual**

#7 best practice manual
#8 method intercomparisons

## 5.

**Develop capacity**

#9 training course
#10 training materials
#11 *Frontiers for Young Minds*

**Widen participation, knowledge exchange**

# seminar series, # mentoring scheme for early career researchers

# #1 Identify knowledge gaps

ReMO
Respiration in the Mesopelagic Ocean

ANNUAL REVIEWS

*Annual Review of Marine Science*

## Prokaryotic Life in the Deep Ocean's Water Column

Gerhard J. Herndl,[1,2,*] Barbara Bayer,[3] Federico Baltar,[1] and Thomas Reinthaler[1,*]

ANNUAL REVIEWS

*Annual Review of Marine Science*

## Carbon Export in the Ocean: A Biologist's Perspective

Morten H. Iversen[1,2]

[1]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany; email: morten.iversen@awi.de

[2]Center for Marine Environmental Sciences (MARUM), University of Bremen, Bremen, Germany

AGU ADVANCING EARTH AND SPACE SCIENCES

Geophysical Research Letters

RESEARCH LETTER

10.1029/2022GL102645

Key Points:

- Our model study confirms earlier findings that oxygen utilization rate (OUR) underestimates true respiration ($R_{true}$) in mesopelagic ocean
- Despite OUR underestimate $R_{true}$, OUR can adequately estimate

## Can Oxygen Utilization Rate Be Used to Track the Long-Term Changes of Aerobic Respiration in the Mesopelagic Atlantic Ocean?

Haichao Guo[1], Iris Kriest[1], Andreas Oschlies[1,2], and Wolfgang Koeve[1]

[1]GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany, [2]Kiel University, Kiel, Germany

Global Biogeochemical Cycles

Research Article | Open Access

## Respiration Patterns in the Dark Ocean

Olivier Sulpis, David S. Trossman, Mark Holzer, Emil Jeansson, Siv K. Lauvset, Jack J. Middelburg

First published: 15 August 2023 | https://doi.org/10.1029/2023GB007747

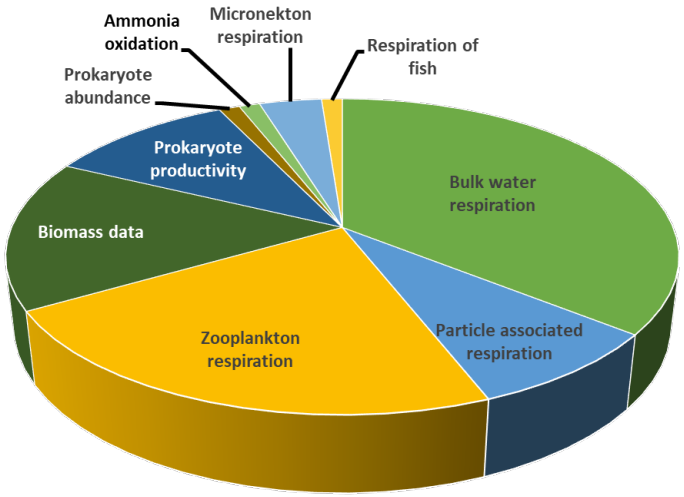
# #2 Develop a global dataset

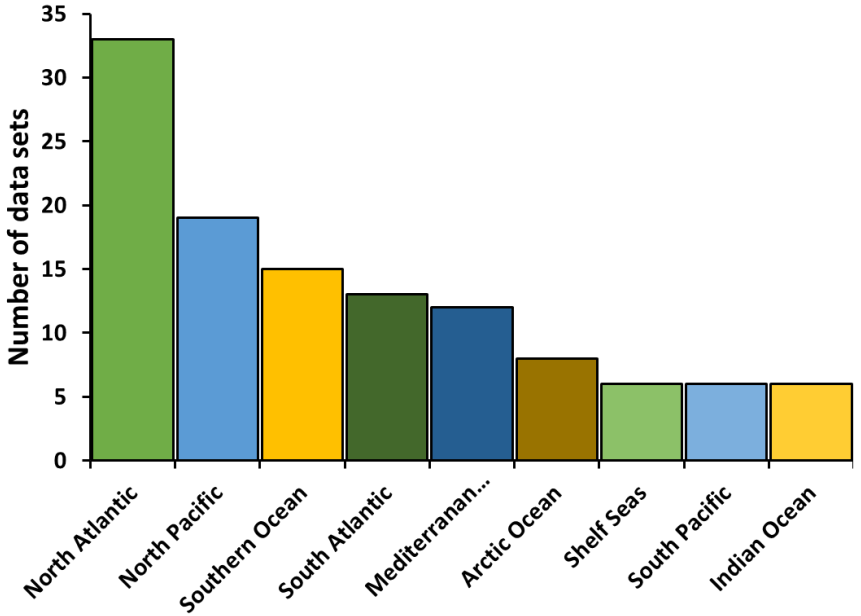
Natural Environment Research Council

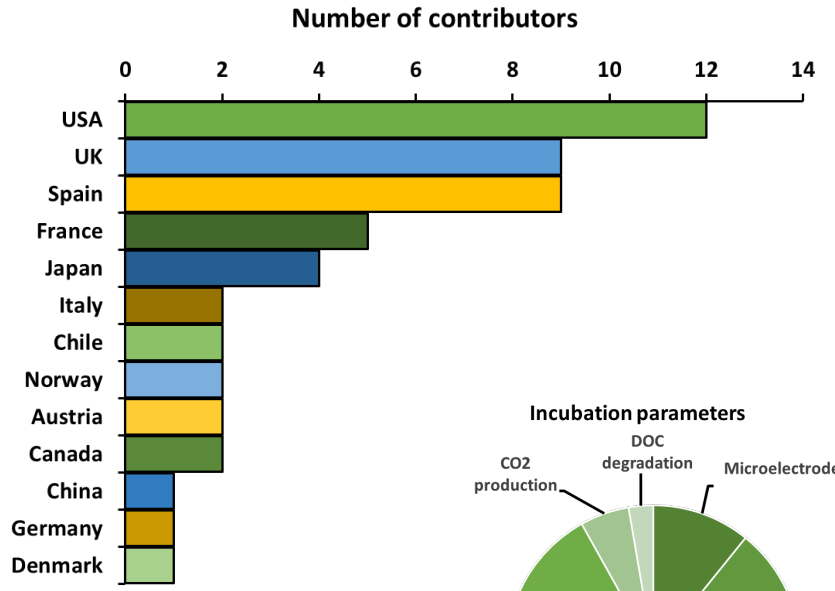
Micro RESPIRE

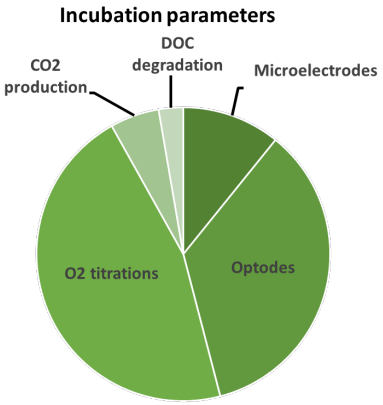
ReMO Respiration in the Mesopelagic Ocean

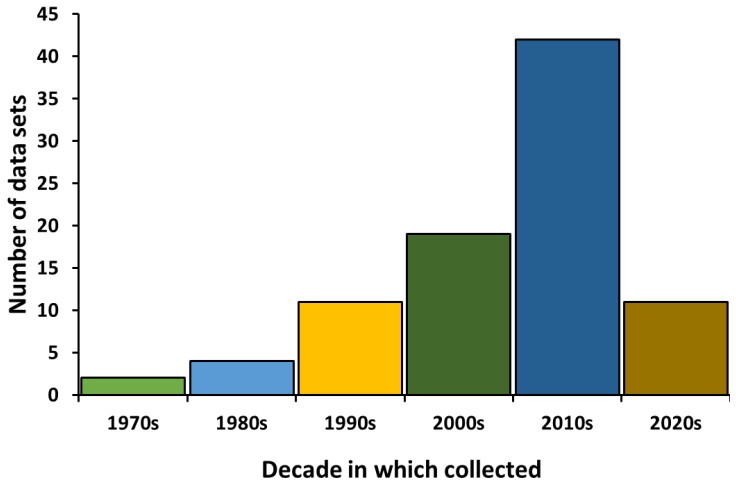
## Metadata 58 responses, May 2023

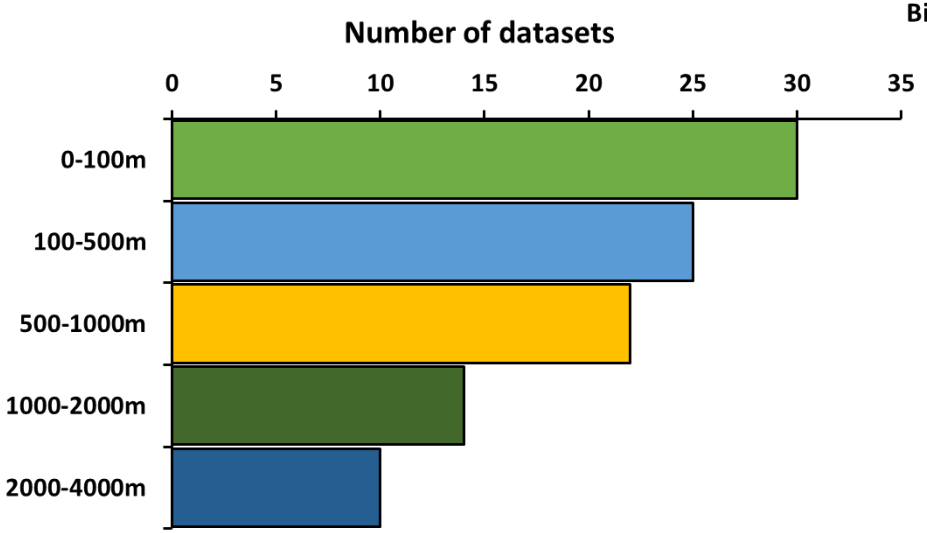


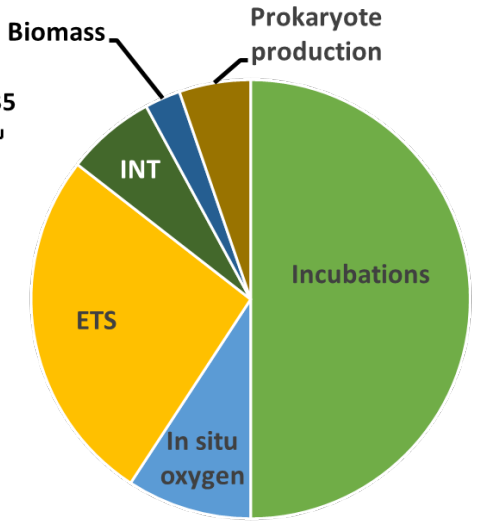



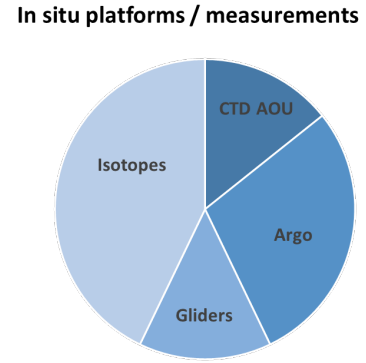



# #2 Develop a global dataset

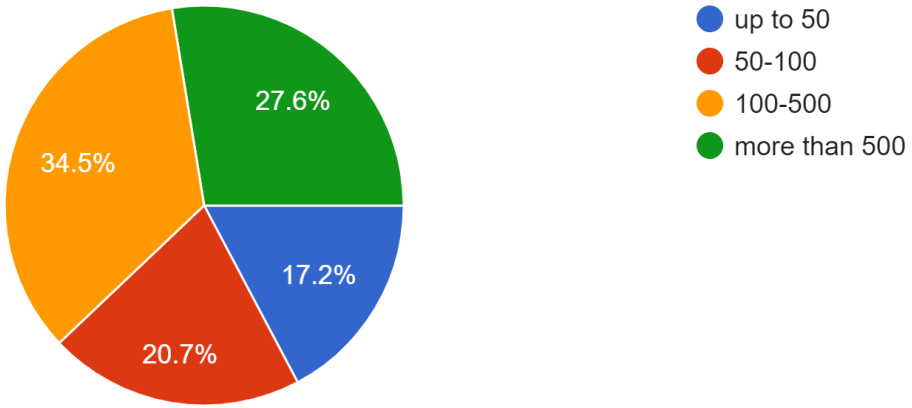
Natural Environment Research Council

Micro RESPIRE

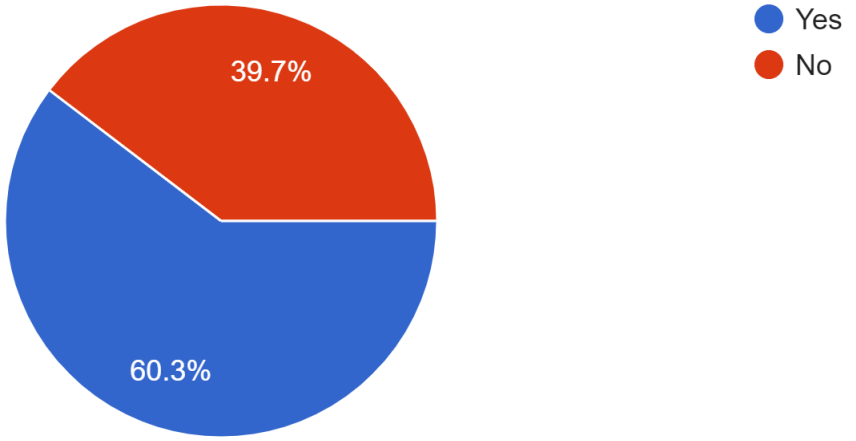
ReMO Respiration in the Mesopelagic Ocean

**Metadata 58 responses, May 2023**

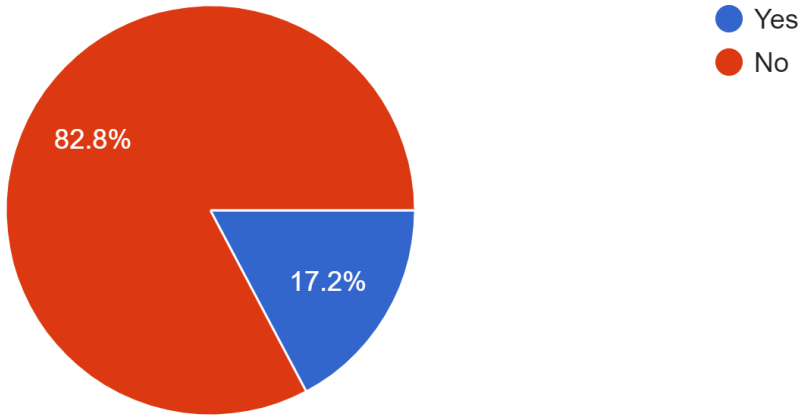
**Approximate number of measurements to contribute to the database**



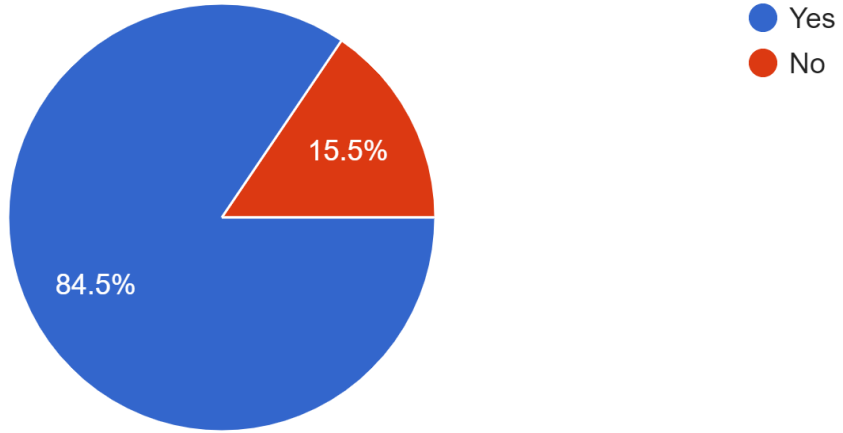

**Are the respiration data published ?**




**Are the respiration data deposited at a data centre ?**




**Are concurrent environmental data such as nutrients, dissolved oxygen, particulate organic carbon and temperature available ?**



# #5 Develop capacity

SCOR WG 161
Respiration in the Mesopelagic Oc

Home | Mentoring scheme | ReMO Webinars

## International training course on Mesopelagic Respiration

Canary Islands, Spain – 21-27 May 2023

### Recordings

**Lecture 1** – International training course on Respiration in the Mesopelagic Ocean - Introduction (Carol Robinson)
**Lecture 2** – Oxygen consumption (Dominique Lefèvre, Matthieu Bressac)
**Lecture 3** – Enzymatic approaches to estimate respiration: ETS activity, Enzyme Kinetic Model
(Javier Arístegui, María F. Monteiro, Natalia Osma, Isabel Seguro)
**Lecture 4a** – Aggregate respiration (Morten Iversen)
**Lecture 4b** – RedoxSensorGreen to estimate single cell respiration (Gerhard Herndl)
**Lecture 5** – Estimating mesopelagic respiration from BGC-Argo data (Giorgio Dall'Olmo)
**Lecture 6** – Biogeochemical approaches to respiration: AOU-tracer ages, O/C/N/P mass balances (Xos
Alvarez-Salgado)
**Lecture 7** – (Global) models and remineralisation (respiration) (Iris Kriest)

### Material for students

**Practical D -** Biogeochemical Argo data
**Practical E -** Apparent oxygen utilization and mass balance approaches (documents #1 & #

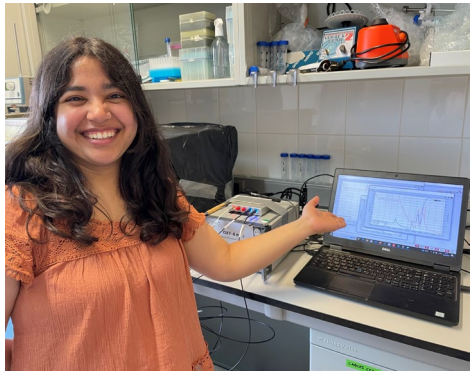
**Aim**

- To train early career researchers in the latest science and technologies related to mesopelagic respiration
- To provide hands-on experience in using traditional and state-of-the-art methods to measure and model

*The lectures were quite inspiring*

*The lessons I learned were beyond my expectations*

*The practical sessions were super-useful*

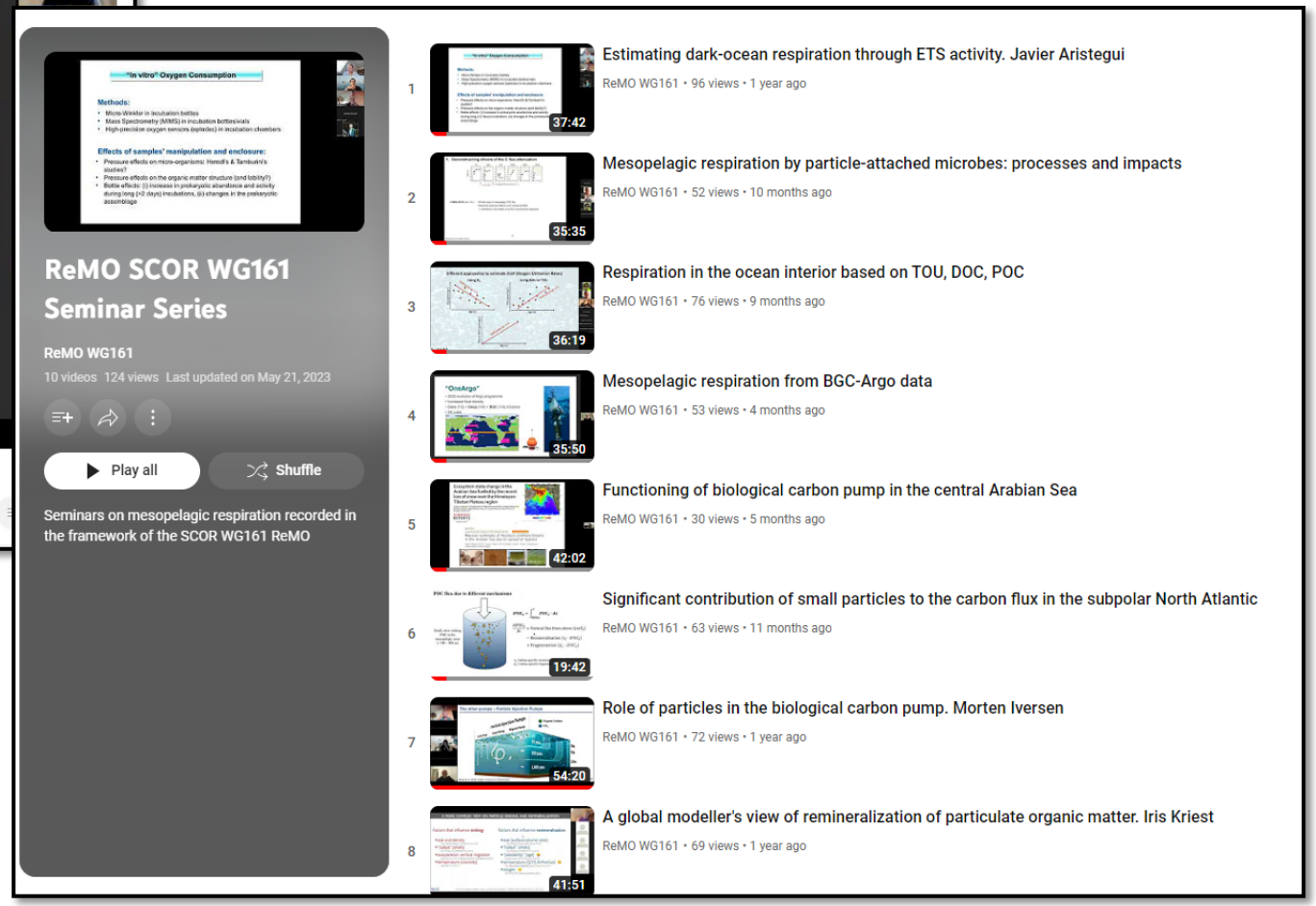


# # Widen participation, knowledge exchange

ReMO
Respiration in the Mesopelagic Ocean

https://www.youtube.com/@remowg161

YouTube GB



# # Widen participation, knowledge exchange

**Dr. Josué Rodolfo Villegas Mendoza**
Universidad Autónoma de Baja California (UABC), Ensenada, México
**Mentors: Natalia Osma (Chile) & Carol Robinson (UK)**

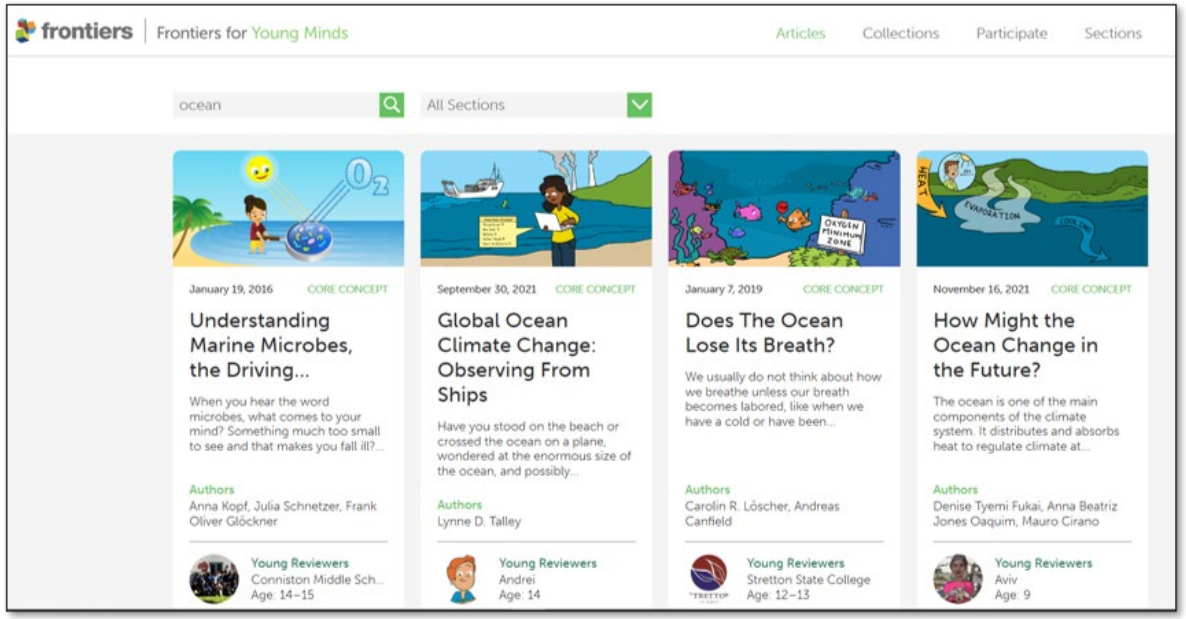
**Dr. Saumya Silori,** CSIR-National Institute of Oceanography, Visakhapatnam, India
**Mentor: X. Antón Álvarez-Salgado (Spain)**

- 3 calls (2022, 2023 + one ongoing), with 10 applications from early career researchers based in 7 countries.
- 5 mentees and 6 working group members involved.
- writing postdoc fellowship proposals, funding acquisition for research stays, training on specific techniques (optics, enzymes), data analysis and writing papers.

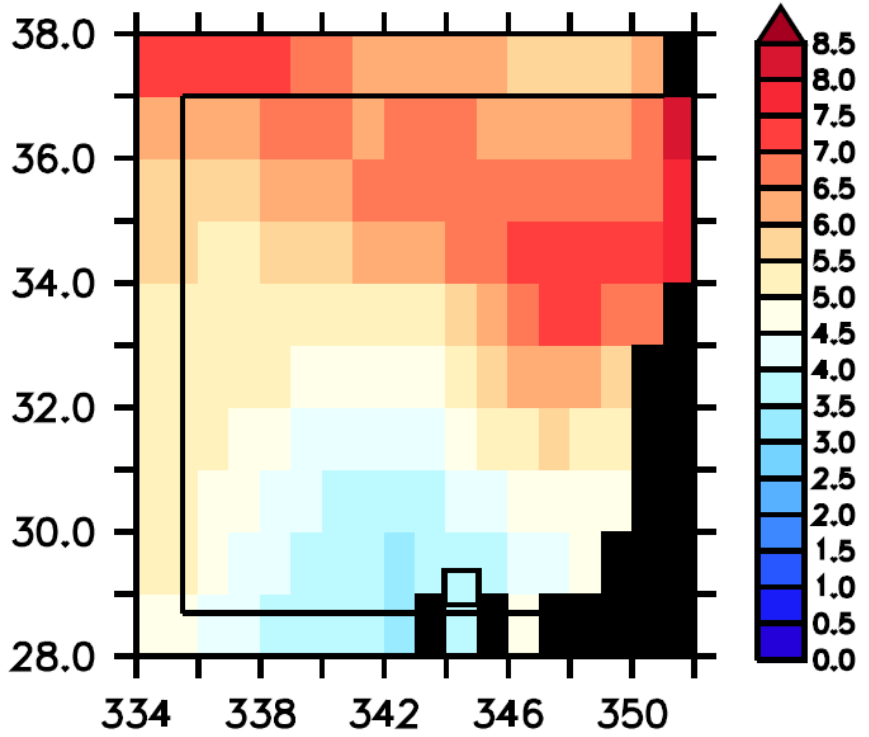
# Plans for 2024 (year 4)

**During 2024** we will:

Continue the mentoring scheme & seminar series
Publish the position paper, model paper, data paper and a paper in *Frontiers for Young Minds*
Complete the best practice methods manual
Aim to hold an in person meeting in 2024 to progress these
Request a 2 year no cost extension




*The mystery of respiration in the dark ocean*




Vertically integrated mesopelagic remineralisation (mmol C $m^{-2}$ $d^{-1}$) north of the Canary Islands simulated by the global model MOPS (Kriest et al., 2023).

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Scientific Committee on Oceanic Research

ReMO
Respiration in the Mesopelagic Ocean

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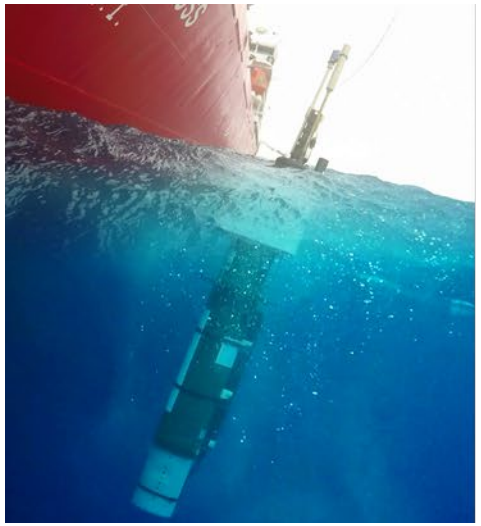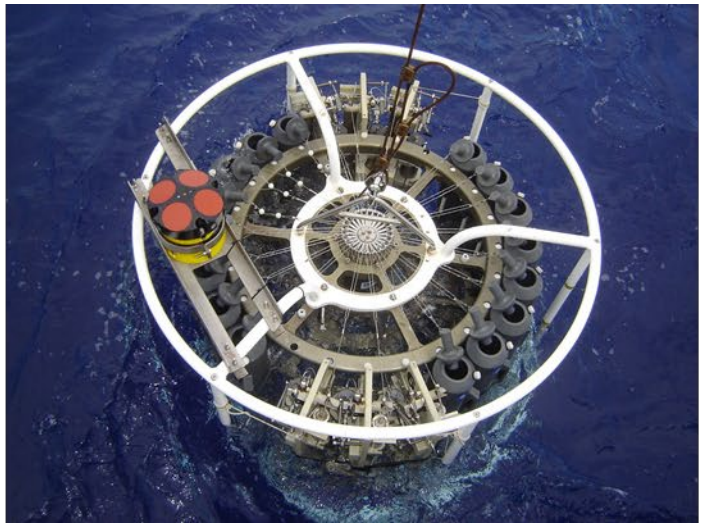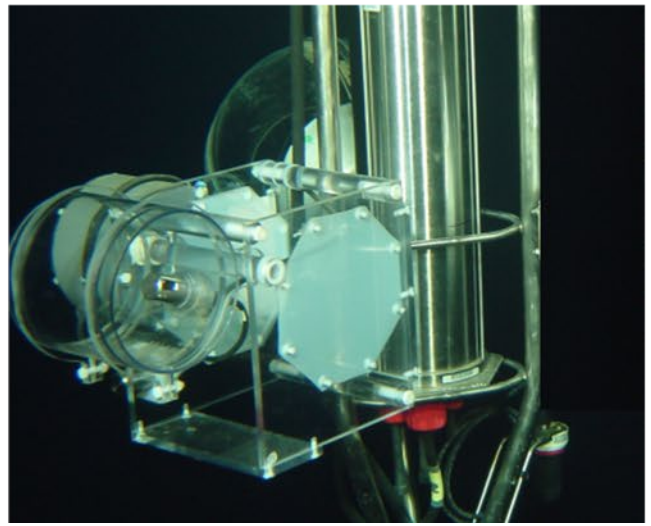
# Thank you SCOR