SCOR Virtual Annual Meeting 2020

20-22 October 2020

Session 2. Chair: Sinjae Yoo / Note taker: Nuria Casacuberta

7:00 – 7:05 am (EDT): Introduction to Day session

7:05 – 8:30 am (EDT): Working Group Reports

- Dissolved N2O and CH4 measurements – Sam Wilson (*Casacuberta*)
- MARCHEMSPEC – David Turner (*Sicre*)
- IQuOD – Guilherme Castelhao (*Myers*)
- TOMCAT – Sari Giering (*Burkill*)
- FeMIP – Alessandro Tagliabue (*Casacuberta*)
- ECV-Ice – Brent Else (*McDougall*)
- FLOTSAM – Stefano Aliani (*Myers*)

10 minutes Q&A

- P-OBS – Anya Waite (*Montes*)
- EBUS – Rubén Escribano (*Halpern*)
- Active chlorophyl fluorescence – Nina Schubak (*Yoo*)
- MetaZooGene – Ann Bucklin (*Montes*)
- C-GRASS – Emmett Duffy (*Zhang*)
- DeepSeaDecade – Kerry Howell (*Montes*)

10 minutes Q&A

Session 2. Chair: Sinjae Yoo / Note taker: Nuria Casacuberta (cont.)

8:30 – 8:40 am (EDT): BREAK

8:40 – 9:15 am (EDT): Research project reports

- GEOTRACES – Alessandro Tagliabue (*Halpern*)
- SOLAS – Lisa Miller (*Penner*)
- IMBeR – Carol Robinson (*Burkill*)
- IQOE – Peter Tyack (*Halpern*)
- IIOE-2 – Peter Burkill (*Burkill*)

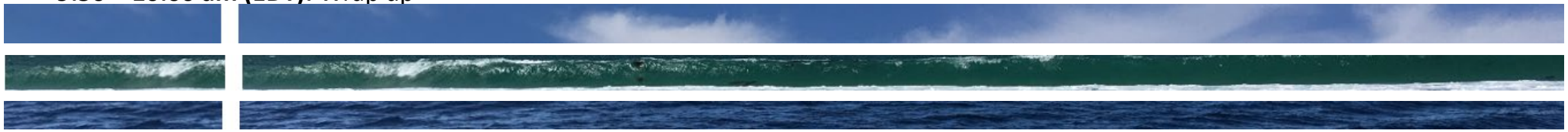
10 minutes Q&A

9:15 – 9:50 am (EDT): Infrastructural project reports

- COBS – Sinead Collins (*Yoo*)
- GlobalHAB – Elisa Berdalet (*Yoo*)
- IOCCP – Masao Ishii (*Halpern*)
- SOOS – Eileen Hofmann (*McDougall*)
- JCS – Rick Pawlowicz (*McDougall*)

10 minutes Q&A

9:50 – 10:00 am (EDT): Wrap up



Working Group reports

SCOR Working Group #143: Oceanic methane and nitrous oxide

2020 Scientific Committee on Oceanic Research (SCOR)
Annual Meeting

21 October 2020 7-10 am East Coast Time
(1-4 am Hawaii Time)

Sam Wilson (University of Hawaii) and Hermann Bange (GEOMAR)

Overall objective to SCOR WG 143#: Begin the process of achieving a coordinated international program of oceanic methane and nitrous oxide observations

Presenter: Sam Wilson

Background to SCOR Working Group #143

1. Conduct an intercalibration exercise between the time series programs → Wilson et al. (2018) An intercomparison of oceanic methane and nitrous oxide measurements. Biogeosciences 15, 5891–5907

2. Establish the appropriate standards to be used by the scientific community → Bullister et al. (2016) Technical Report: The production of methane and nitrous oxide gas standards for Scientific Committee on Ocean Research (SCOR) Working Group #143. pp 1-9.

3. Recommend the analytical reporting procedures to be used for N_2O and CH_4 → *ongoing*

4. Establish framework for an N_2O/CH_4 ocean time series network and write a global oceanic N_2O/CH_4 summary paper for publication in an open access journal.
   → Bange et al. (2019) A harmonized nitrous oxide ocean observation network for the 21st century. Front. Mar. Sci. 6, 157.
   → Wilson et al. (2020) Ideas and perspectives: A strategic assessment of methane and nitrous oxide measurements in the marine environment. Biogeosciences Discuss. https://doi.org/10.5194/bg-2020-270.

Highlight specifically from 2020

Best Practices for Dissolved Methane and Nitrous Oxide Measurements

SOP1 Sampling
SOP2 Calibration
SOP3 Internal controls
SOP4 Purge-and-trap measurements
SOP5 Headspace measurements
SOP6 Underway measurements
SOP7 Data reporting

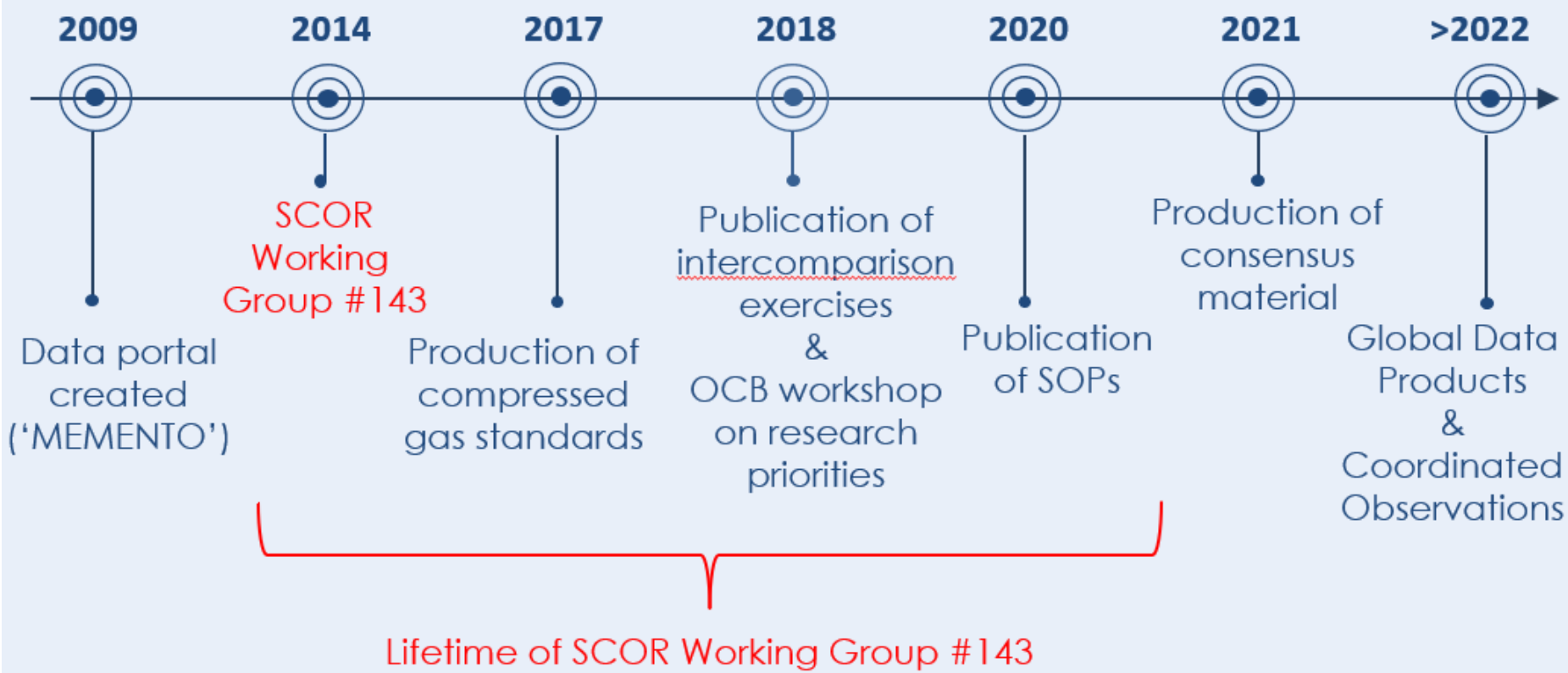
SOP on Process measurements of CH4
SOP on Process measurements of N2O

Lead authors include:
Damian Arévalo-Martínez, Annie Bourbonnais, Bonnie Chang, Mercedes de la Paz, Sara Ferrón, Claudia Frey, John D. Kessler, Annette Kock, Cara Manning, Gregor Rehder, Robert Upstill-Goddard, Sam Wilson

Each SOP will be posted on the Ocean Carbon & Biogeochemistry website for 2 months, prior to uploading to the Ocean Best Practice portal

Presented to the Ocean Best Practices: 4th Workshop on 21 September 2020

Long term process of coordinating methane and nitrous oxide measurements



Acknowledgements: The progress made so far and the ongoing efforts is made possible by a large number of scientists who are coauthors on the resulting publications.

Vision

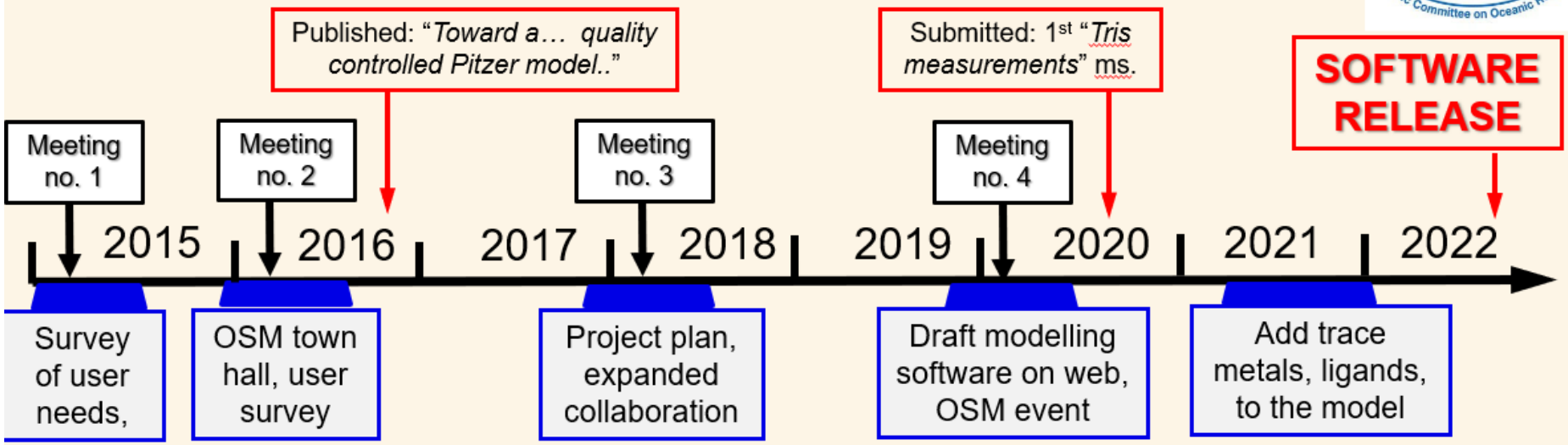
The marine science community will have free access to fully documented, state of the art, user-friendly software for chemical speciation calculations, including uncertainty estimates.

Work towards this vision involves:

- **Communication** with the marine science community (OSM events, publications, user surveys, web site)
- **Code development**
- **Documentation** of models for seawater, and pH buffers in artificial seawater, identifying the source data for all coefficients
- **Model improvement** from **new measurements** of key interactions

Presenter: David Turner

WG145: Presentation to SCOR, October 2020



NERC/NSF project: code development, and measurements at **NIST**

Other measurements : GEOMAR – complete; **NMIJ** – complete; **University of Bristol** – complete; **City University of Hong Kong** – in progress; **PTB** – 2020

Current status:

- **Communication:** draft code presented at OSM 2020, paper on "*Best practices in chemical speciation modelling*" in preparation
- **Code development:** draft code available on the web
- **Documentation:** complete for pH buffer in artificial seawater, and standard seawater
- **New measurements:** underway at multiple institutions
- **Model improvement:** work on uncertainties, and identifying key systems for study, at UEA

The Future

We do not require further financial support from SCOR since we have leveraged substantial resources to support our work. These include:

- A three year research grant from the **NERC/NSF:GEO** joint program
- In-kind contributions from **GEOMAR** (Germany), the **University of Bristol** (UK), **City University of Hong Kong**, and the national metrology institutes in France (**LNE**), Germany (**PTB**), Japan (**NMIJ**), and the US (**NIST**)
- An **IAPSO** study group

We have also established effective collaboration with the IAPWS/SCOR/ IAPSO **Joint Committee on Seawater**.

We respectfully request that we continue as a SCOR WG until mid 2022, so that the software release can be clearly identified as a SCOR product. The benefits are:

1. *A clear SCOR contribution to the development of marine science.*
2. *SCOR sponsorship will help to ensure acceptance and use by the marine science community.*

Highlights

To maximize the quality, consistency and completeness of our data

WG148

International Quality controlled Ocean Database

IQuOD Co-chairs:
Catia Domingues & Simon Good

SCOR Virtual Annual Meeting 2020
20-22 October 2020

International Council for Science
SCOR
Scientific Committee on Oceanic Research

IODE International Oceanographic Data and Information Exchange

Presenter: Gui Castelhao

IQuOD - 2020 Highlights

- **New Co-Chair** Simon Good. Thanks, Matt Palmer!
- Continuous development and improvements of **Open Source code for QC** available at GitHub:
  - AutoQC
  - CoTeDe (Castelão, 2020)
- **Auto-QC benchmarking** (Good et al., in prep.)
- A **Machine Learning Approach to QC** Oceanographic data (Castelão, in review)

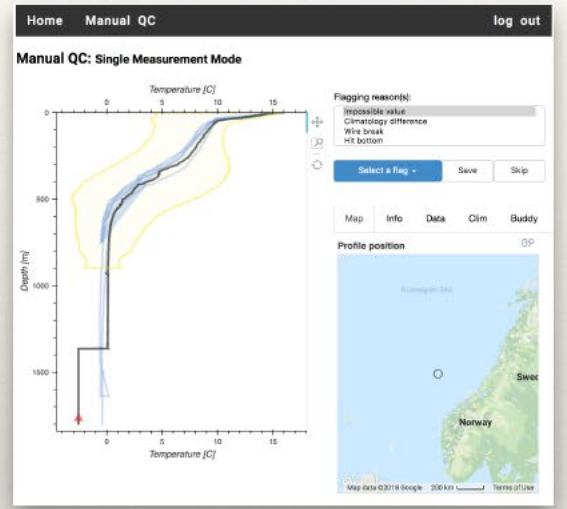
IQuOD

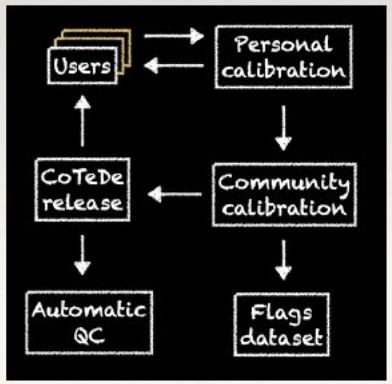
www.iquod.org

Expert QC with Machine Learning

Community Quality Control - A Common Sense

- **Castelão, 2020**: A Machine Learning Approach to QC Oceanographic data (**in review**)
- **Web App** to integrate experts around the world https://expertqc.castelao.net
- To improve efficiency of the manual QC, the experts are paired with an **interactive learning** schema of Machine Learning to **combine** the high skill of the **human** with the speed of the **machine**.
- Benefits the community in twofold: **Expert QC flags** on the WOD; and public access to the calibrated **open source CoTeDe**.
- Extending for **salinity** and **chlorophyll**.





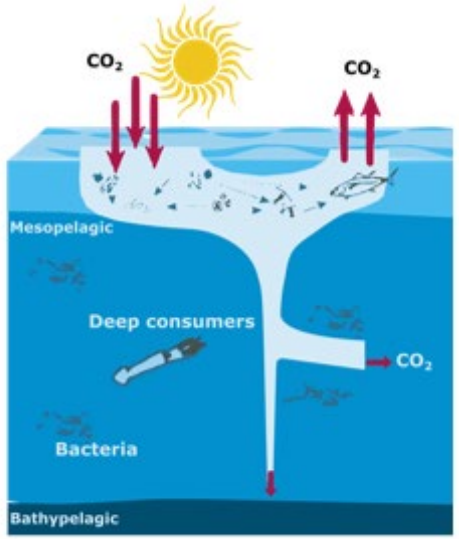
IQuOD

www.iquod.org

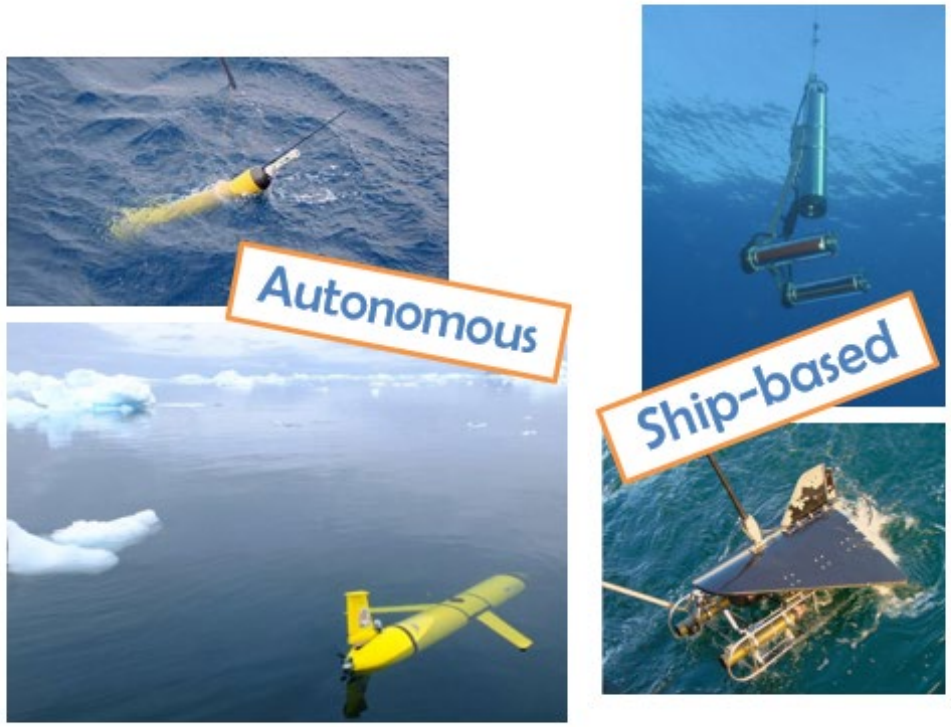
Working Group 150: TOMCAT

Translation of Optical Measurements into particle Content, Aggregation & Transfer

Sinking particles in the ocean



Optical measurements: the future



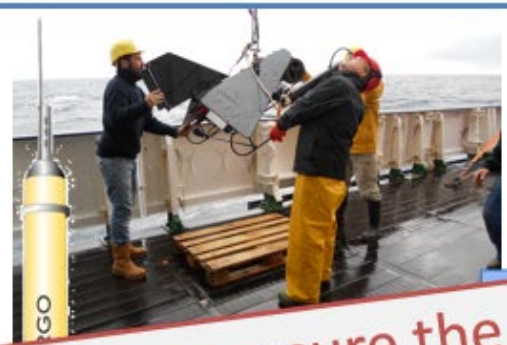
Presenter: Sari Giering

SCOR International Council for Science Scientific Committee on Oceanic Research

TOMCAT FROM OPTICS TO EXPORT

The challenge!

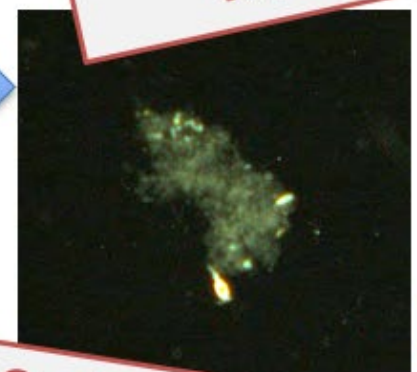
Optical measurement



Do we measure the same thing?

How big is it?

What is it?



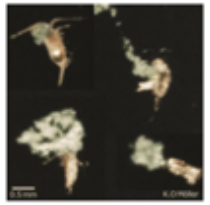
Carbon content?

Sinking speed?

Particle flux

Highlights

Publications



Research Topic

We Shed Light: Optical Insights into the Biological Carbon Pump

VIEWS
17,387

Review Article: Lombard et al. (2019) Globally Consistent Quantitative Observations of Plankton Ecosystems.

Review Article: Giering et al. (2020) Sinking Organic Particles in the Ocean – Flux Estimates from in situ Optical Devices

Research Article: 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

Networking

2018 OCEAN SCIENCES MEETING

JETZON

AtlantOS

WG154 P-OBS

Fieldwork data

Intercalibration between different systems and traps

COMICS
INVESTIGATING THE TWILIGHT ZONE

CUSTARD

SUMMER

ANTICS

SOLACE
Southern Ocean Large Area Carbon Extent

Capacity building

Autumn school - Oct 2018

PhD supervision (South Africa)

Summer school – mid/end 2021

Iron Model Intercomparison Project

SCOR WG 151

Co-chairs: Alessandro Tagliabue (UK) and Stephanie Dutkiewicz (USA)

Other Full Members: Tatiana Ilyina (Germany), Kazuhiro Misumi (Japan), Fanny Monteiro (UK), J. Keith Moore (USA), Yeala Shaked (Israel), Marcello Vichi (South Africa), Christoph Völker (Germany), Mustafa Yücel (Turkey)

Associate Members: Olivier Aumont (France), Alex Baker (UK), Philip Boyd (Australia), Fei Chai (China-Beijing), Peter Croot (Ireland), Christel Hassler (Switzerland), Eun Young Kwon (Korea), Jun Nishioka (Japan), Maite Maldonado (Canada), Mark Moore (UK), Andy Ridgwell (USA), Benjamin Twining (USA)

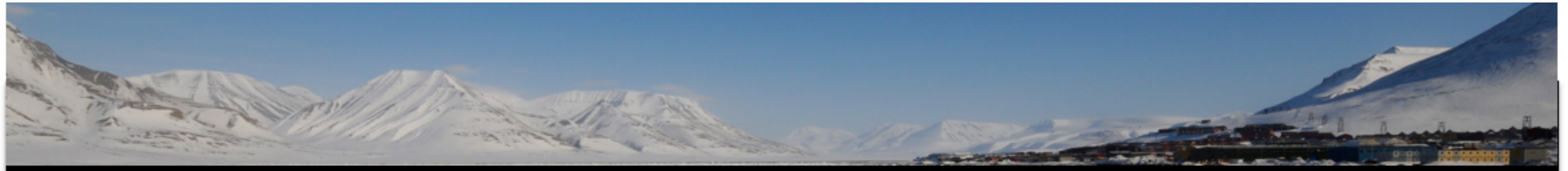
Presenter: Alessandro Tagliabue

Activity

- Meeting prior to Ocean Sciences in Feb 2020
    - This meeting was attended by 23 people (2 remotely), including most of the working group and several guests.
- Major topics covered mapped onto the WG objectives
    - Iron inputs and internal cycling; iron model evaluation; role of dust in ocean iron cycle; role of biology in ocean iron cycle.
- Clear plans for taking objectives forward

Plans

- Objective 1: Iron inputs and internal cycling
  - Sharing code premature, but input fields would be helpful
  - Model initialisation field
  - Needs discussion on where / how to share – can SCOR help?
- Objective 2: New tools for ocean iron model evaluation
  - New downloadable tool for model evaluation available on github
  - Being tested by group
- Objective 3: Role of dust in the ocean iron cycle
  - Seem as a priority, some work underway, but discussion needed specifically on this topic
- Objective 4: Role of biology in the ocean iron cycle
  - Summarise hierarchy of modelling approaches and knowledge on organisms Fe requirements
  - Consider additional targeted meeting
- Pandemic has slowed down momentum



ECV–Ice:

https://sites.google.com/view/ecv-ice/

Measuring Essential Climate Variables in Sea Ice

SCOR WG152

D. Nomura (Japan), F. Fripiat (Germany), B. Else (Canada),
B. Delille (Belgium), M. Fernandez–Méndez (Norway),
L.A. Miller (Canada), I. Peeken (Germany), J–M. Rintala (Finland),
M.A. van Leeuwe (Netherlands), F. Zhang (China)

A working group for sea ice biology and biogeochemistry:

- Publish synthetic reviews
- Design inter-calibration/-comparison experiments
- Create a guide of best practices

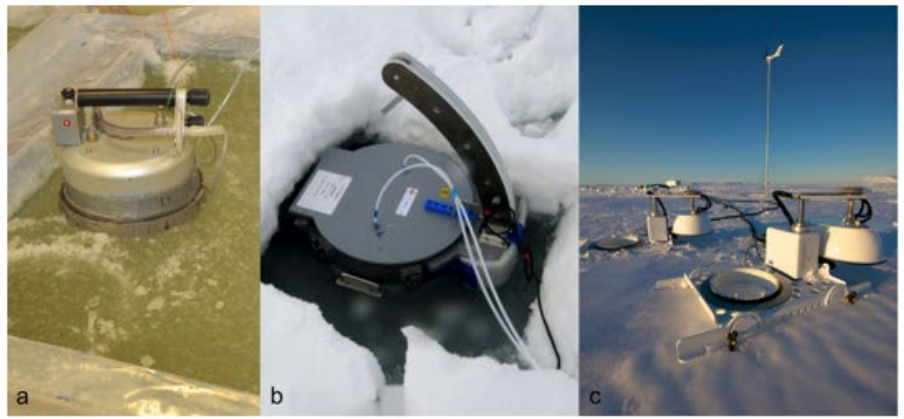
Presenter: Brent Else

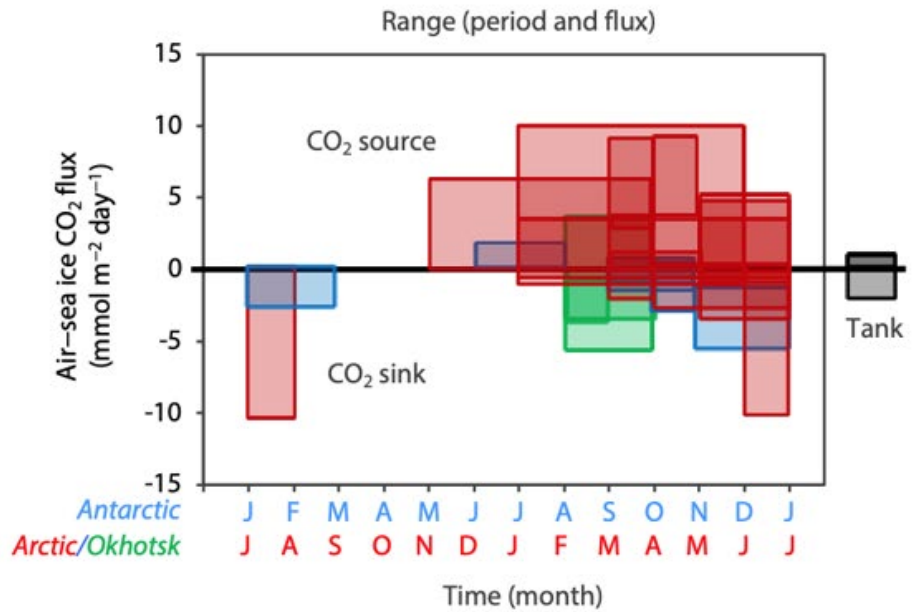
Method Reviews:

Example:

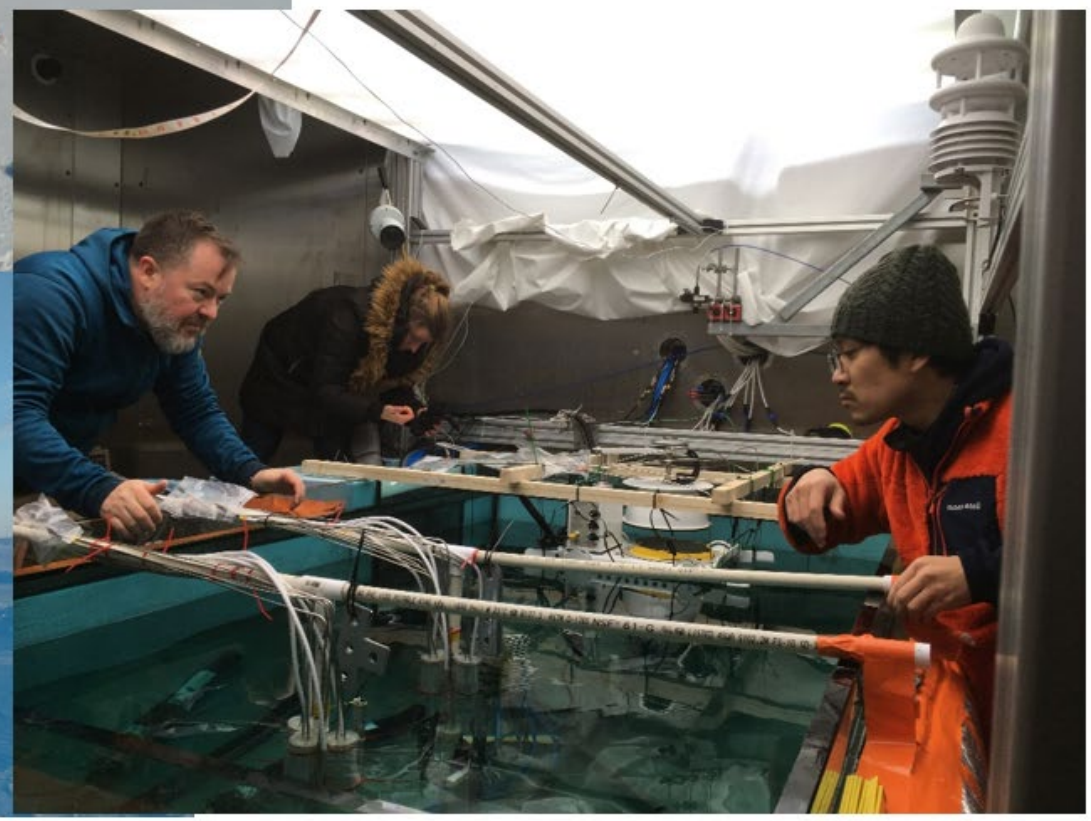
World-wide compilation of air-sea ice CO_2 flux with the enclosure method: Similar amplitudes to open ocean measurements

D. Nomura, N.X. Geilfus, J.L.-Tison, B.G.T. Else, and 14 other co-authors





Intercalibration Experiments:



Floating Litter and its Oceanic TranSport Analysis and Modelling (FLOTSAM)

SCOR Working Group 153

http://scor-flotsam.it/

Vice-Chairs:

Kara Lavender Law (SEA Woods Hole USA)

Nikolai Maximenko (U. Hawaii, USA)

Erik van Sebille (U. Utrecht, Netherlands)

Stefano Aliani

National Research Council Italy

Full Members

1. Bertrand Chapron (FR)
2. Irina Chubarenko (RU)
3. Atsuhiko Isobe (JP)
4. Victor Martinez-Vicente (UK)
5. Peter Ryan (ZA)
6. Won Joon Shim (KR)
7. Martin Thiel (CL)

Associate Members

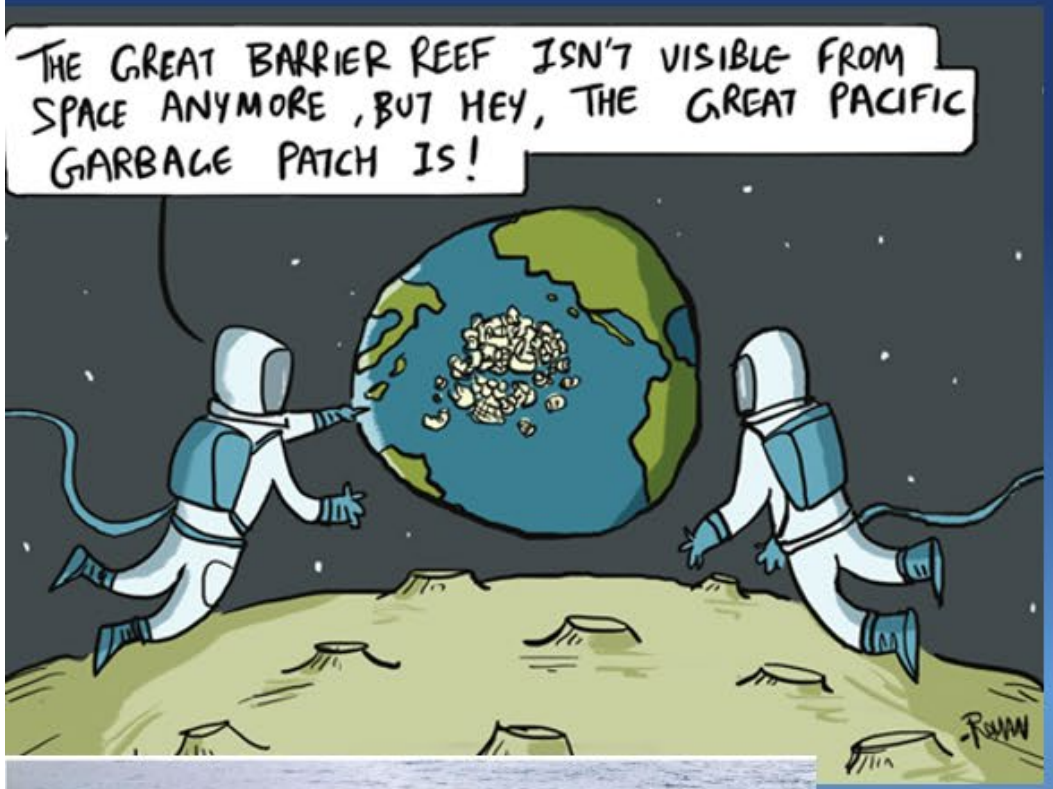
1. Melanie Bergmann (DE)
2. Yi Chao (US)
3. Baylor Fox-Kemper (US)
4. Denise Hardesty (AU)
5. Tobias Kukulka (US)
6. Laurent Lebreton (NZ)
7. Christophe Maes (FR)
8. Miguel Morales Maqueda (UK)

Observer Members

1. Joao Sousa (IUCN)
2. Georg Hanke (EU-JRC)
3. Nancy Wallace (NOAA)
4. Paolo Corradi (ESA)

Presenter: Stefano Aliani

Setting the stage:Popular notion of "Garbage Patch"



How much plastic debris in the ocean, what are its characteristics, and what are its major sources?

How is plastic debris distributed in the ocean? Are there trends in time?

What are the major transport pathways of plastic debris in the ocean?

How is plastic debris transformed in the ocean, and what is its fate?

FLOTSAM Terms of Reference

- Identify gaps in our knowledge of the near-surface ocean dynamics that may affect litter distribution and transport.
- Improve future marine litter modelling capabilities.
- Evaluate existing and emerging remote sensing technologies that can be applied to marine litter in the open ocean.
- Improve awareness of the scientific understanding of marine debris, based on better observations and modelling results.

FLOTSAM WG meetings

11 March 2018
6th International Marine Debris Conference
San Diego, CA

7-9 May 2019
Utrecht University, Netherlands

I would like to acknowledge people who supported us during meetings on S. Diego and especially in Utrecht

FLOTSAM products

IOP Publishing Environ. Res. Lett. 15 (2020) 023003 https://doi.org/10.1088/1748-9326/ab6d7d

Environmental Research Letters

TOPICAL REVIEW

The physical oceanography of the transport of floating marine debris

Erik van Sebille[1], Stefano Aliani[2], Kara Lavender Law[3], Nikolai Maximenko[4], José M Alsina[5], Andrei Bagaev[6,7], Melanie Bergmann[8], Bertran Philippe Delandmeter[1], Matthias Egger[11], Bayl Lonneke Goddijn-Murphy[15], Britta Denise Hard Cleo E Jongedijk[19], Mikael L A Kaandorp[1], Liliya Tobias Kukulka[21], Charlotte Laufkötter[22], Laure Christophe Maes[9,25], Victor Martinez-Vicente[26] Marie Poulain-Zarcos[28,29], Ernesto Rodríguez[30], Giuseppe Suaria[2], Martin Thiel[34,35,36], Ton S va

[1] Institute for Marine and Atmospheric Research, Utrecht Unive
[2] Institute of Marine Sciences—National Research Council (ISM
[3] Sea Education Association, Woods Hole, MA, United States of
[4] International Pacific Research Center, School of Ocean and Ea United States of America

OPEN ACCESS

RECEIVED 18 October 2019
REVISED 15 January 2020
ACCEPTED FOR PUBLICATION 20 January 2020
PUBLISHED 17 February 2020

frontiers in Marine Science

REVIEW
published: 28 August 2019
doi: 10.3389/fmars.2019.00447

OPEN ACCESS

Edited by:

Toward the Integrated Marine Debris Observing System

imenko[1*], Paolo Corradi[2], Kara Lavender Law[3], Erik Van Sebille[4], mwoyo P. Garaba[5], Richard Stephen Lampitt[6], Francois Galgani[7], nez-Vicente[8], Lonneke Goddijn-Murphy[9], Joana Mira Veiga[10], Thompson[11], Christophe Maes[12], Delwyn Moller[13], Carolin Regina Löscher[14] Addamo[15], Megan R. Lamson[16], Luca R. Centurioni[17], Nicole R. Posth[18], in[19], Matteo Vinci[20], Ana Maria Martins[21], Catharina Diogo Pieper[21], nbe[22], Georg Hanke[15], Margo Edwards[23], Irina P. Chubarenko[24], riguez[25], Stefano Aliani[26], Manuel Arias[27], Gregory P. Asner[28], sich[29], James T. Carlton[29], Yi Chao[13], Anna-Marie Cook[30], Andrew B. Cund alloway[32], Alessandra Giorgetti[20], Gustavo Jorge Goni[19], Yann Guichoux[33] ram[34], Britta Denise Hardesty[35], Neil Holdsworth[36], Laurent Lebreton[37], eslie[38], Ilan Macadam-Somer[39], Thomas Mace[40], Mark Manuel[41,42], sh[21], Elodie Martinez[12], Daniel J. Mayor[6], Morgan Le Moigne[7], ia Molina Jack[20], Matt Charles Mowlem[6], Rachel W. Obbard[43], abortsava[6], Bill Robberson[30], Amelia-Elena Rotaru[14], Gregory M. Ruiz[34], a Spedicato[44], Martin Thiel[45], Alexander Turra[46] and Chris Wilcox[35]

As of May/June 2020, this **highly cited paper** received enough citations to place it in the top 1% of the academic field of Environment/Ecology based on a highly cited threshold for the field and publication year.

Data from ***Essential Science Indicators***

remote sensing

MDPI

Perspective

Measuring Marine Plastic Debris from Space: Initial Assessment of Observation Requirements

Víctor Martínez-Vicente [1,*], James R. Clark [1], Paolo Corradi [2], Stefano Aliani [3], Manuel Arias [4], Mathias Bochow [5], Guillaume Bonnery [6], Matthew Cole [1], Andrés Cózar [7], Rory Donnelly [8], Fidel Echevarría [7], François Galgani [9], Shungudzemwoyo P. Garaba [10,11], Lonneke Goddijn-Murphy [12], Laurent Lebreton [10], Heather A. Leslie [13], Penelope K. Lindeque [1], Nikolai Maximenko [14], François-Régis Martin-Lauzer [4], Delwyn Moller [15], Peter Murphy [16,17], Lorenzo Palombi [18], Valentina Raimondi [18], Julia Reisser [19], Laia Romero [20], Stefan G.H. Simis [1], Sindy Sterckx [21], Richard C. Thompson [22], Konstantinos N. Topouzelis [23], Erik van Sebille [24], Joana Mira Veiga [25] and A. Dick Vethaak [13,25]

The future of FLOTSAM

Third and final meeting: Spring 2021, Tokyo (tentative)

- with thanks to **Richard Lounsbery Foundation** for additional support

Next steps:

- design and implement IMDOS
    - develop standards for and/or harmonize observational protocols
    - establish community repository for observational data
- expand the FLOTSAM community of collaborators
- engage public and stakeholders

stefano.aliani@ismar.cnr.it

Q&A

WG 143. Dissolved N2O and CH4 measurements

WG 145. Chemical Speciation (**MARCHEMSPEC**)

WG 148. Subsurface temperature profiles (**IQuOD**)

WG 150. Optical Measurements (**TOMCAT**)

WG 151. Iron Model (**FeMIP**)

WG 152. Climate Variables in Sea Ice (**ECV-Ice**)

WG 153. Floating Litter (**FLOTSAM**)

SCOR WG 154

- *To identify the technologies and sampling protocols best suited to incorporate plankton measurements into global ocean observing platforms:*
- *GO-SHIP and OceanSITES*

Recommendations:

Six broad categories:

1. Genetics.
2. Quantitative imaging.
3. Flow cytometry
4. Pigments and elemental analysis.
5. Bio-acoustics.
6. Bio-optics.

Three collection methods (GO-SHIP):

1. Hull mounted
2. CTD-rosette
3. Flow-through system

OceanSITES discussions underway

Presenter: Anya Waite

Timeline of Activities

Date	Activity	Outputs
Sep. 2017-Feb. 2018		• Sourced technology champions to review Bio-optics, flow-cytometry, genetics, Bioacoustics, imaging, HPLC
Feb. 10, 2018	Kickoff Meeting – Ocean Sciences, Portland OR	• Decision to focus on commercial technologies • ASLO Bulletin Article Drafted
Aug. 2018		• ASLO Bulletin article published
Nov. 7-8, 2018	Meeting of subgroup leads, Villefranche-sur-Mer, France	• *GO-SHIP Report First Draft* • Contributed to *Lombard et al., 2019. Globally Consistent Quantitative Observations of Planktonic Ecosystems*
Jan – Aug 2019	Editing and finalization of draft GO-SHIP report.	• *Finalized GO-SHIP Report.*
Nov 2019	Full group meeting – OceanObs, Honolulu, HI	• Report submitted to GO-SHIP and for community review. • SCOR WG 154 (2020) *Recommendations for plankton measurements on the GO-SHIP program with relevance to other sea-going expeditions.* Scientific Committee on Oceanic Research, 70pp. DOI: http://dx.doi.org/10.25607/OBP-718
Sept. 2020	Online Group Meeting	• Finalize Draft OceanSITEs report

Publications /Recommendations to date:

Recommendations for plankton measurements on the GO-SHIP program with relevance to other sea-going expeditions. SCOR Working Group 154 GO-SHIP Report.

Tracking how ocean life is responding to increased human use and climate change will empower the global community to predict, mitigate, and manage our ocean. In this document we demonstrate the existence of mature technologies to measure 'biology' as a combination of biomass and diversity indicators across the plankton size spectrum. These are now ready to deploy within the GO-SHIP constraints.....

Other Title
SCOR Working Group 154 GO-SHIP Report.

Publisher
Scientific Committee on Oceanic Research (SCOR)

Document Language
en

- Methods should be standardized.
- Plankton samples associated with environmental variables acquired simultaneously.
- Sampling should include complete spectrum of plankton size and function.
- Methods should be inter-calibrated
- Protocols drafted (BPS).
- Physical plankton samples should be archived

BEYOND CHLOROPHYLL FLUORESCENCE

The Time is Right to Expand Biological Measurements in Ocean Observing Programs

Emmanuel Boss, Anya Waite, Frank Muller-Karger, Hidekatsu Yamazaki, Rik Wanninkhof, Julia Uitz, Sandy Thomalla, Heidi Sosik, Bernadette Sloyan, Anthony Richardson, Patricia Miloslavich, Johannes Karstensen, Gérald Grégori, Katja Fennel, Herve Claustre, Marcela Cornejo, Ilana Berman-Frank, Sonia Batten, and Silvia Acinas

Presenter:
Rubén Escribano

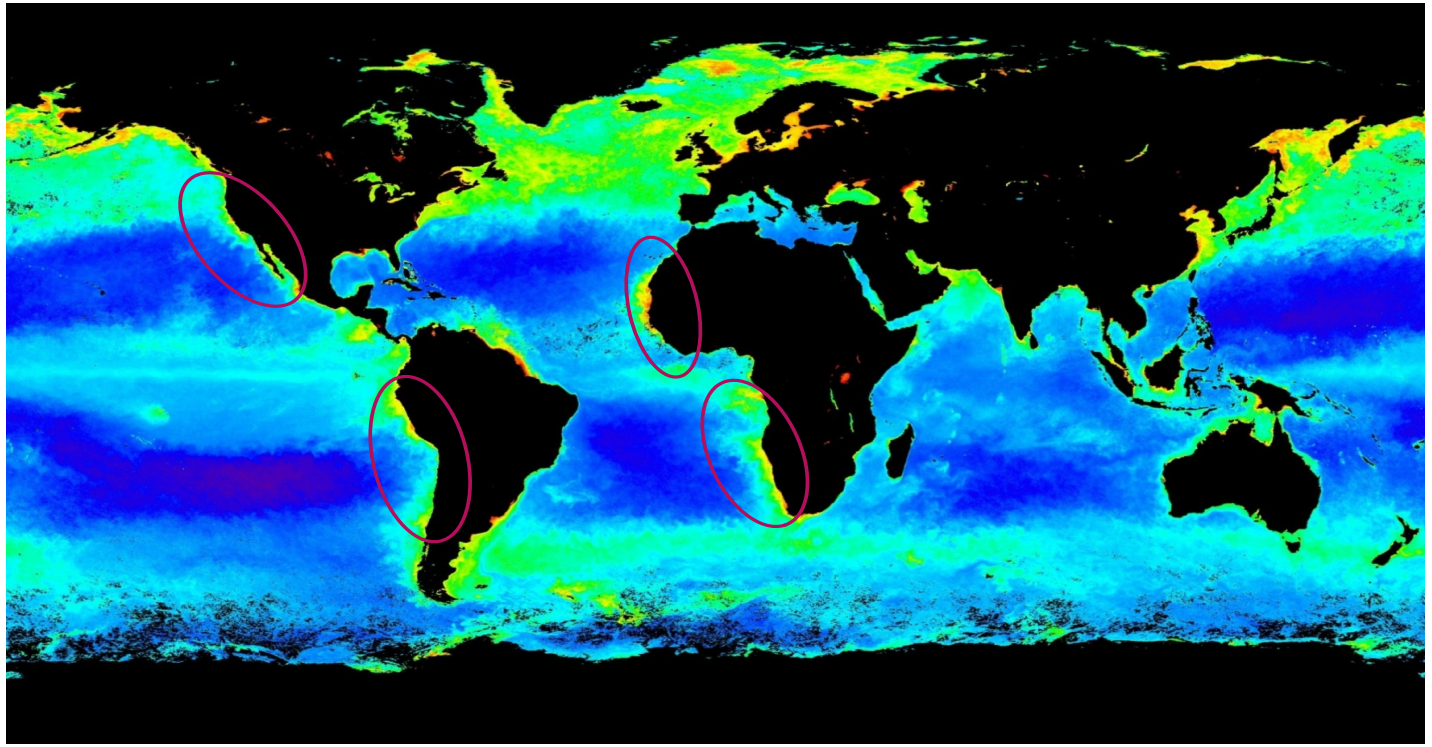
SCOR WG 155

Eastern Boundary Upwelling Systems (EBUS): Diversity, Coupled Dynamics and Sensitivity to Climate Change

2018-2022

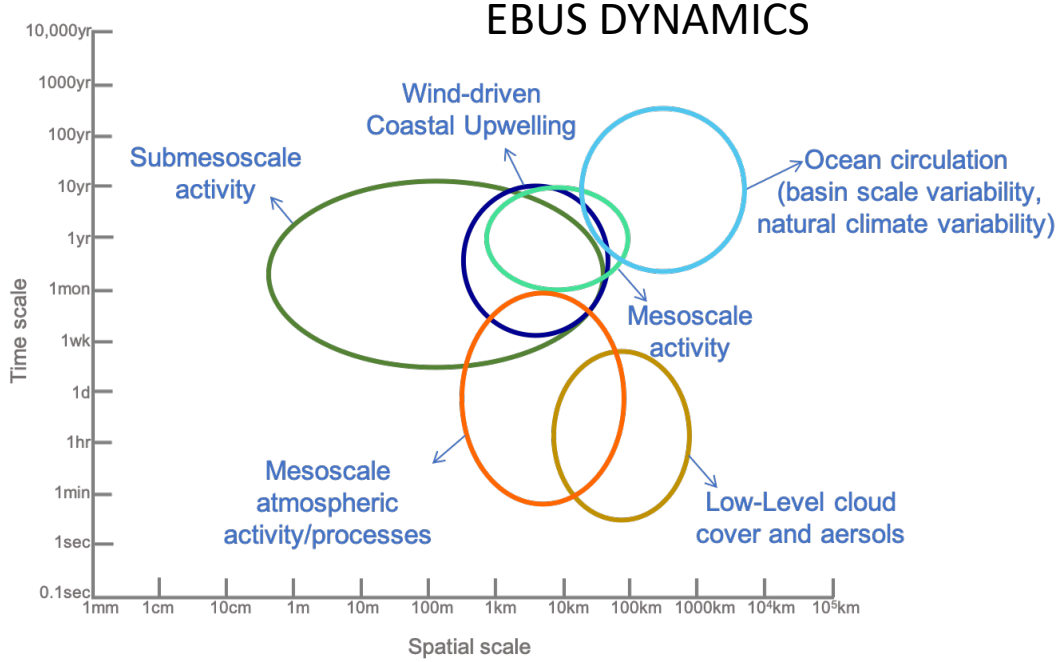
https://scah.igp.gob.pe/scor-working-group-155

Name	Gender	Place of work	Expertise relevant to proposal
1. Francisco Chavez (United State of America)	Male	Monterey Bay Aquarium Research Institute, USA	Biological Oceanography/ California, Peru
2. Enrique Curchitser (United State of America)	Male	Institute of Marine and Coastal Sciences, Rutgers University, USA	Physical oceanography Modelling / CLIVAR
3. Boris Dewitte (France)	Male	IRD-LEGOS, CEAZA-Chile	
4. Ruben Escribano (Chile) Co-chair	Male	Physical Oceanographer, EBUS Dynamics, Air-sea interactions	
5. Sara Fawcett (South Africa)	Female	Biological Oceanography, Chile/ IMBER	Biogeochemical Oceanographer
6. Salvador Lluch-Cota (Mexico)	Male	Programa de Ecología Pesquera. CIBNOR-CONACYT, México	Fishery/Socio-economist ecology
7. Baye Cheikh Mbaye (Senegal)	Male	Laboratoire de Physique de l'Atmosphere et de l'Ocean Simeon Fongang (LPAOSF), University Cheikh Anta Diop of Dakar (UCAD), Senegal	Physical/biological Oceanography - Senegalese- Mauritanian coastal upwelling within the Canary upwelling system off North-West Africa
8. Ivonne Montes (Peru) Co-chair	Female	Instituto Geofísico del Perú (IGP)	Physical Oceanographer, biogeochemical coupled modelling and dynamics of the Peru/Chile System
9. Andreas Oschlies (Germany)	Male	Helmholtz-Zentrum für Ozeanforschung Kiel (GEOMAR)	Physical Oceanography, Marine Biogeochemical Modelling
10. Parv Suntharalingam (UK)	Female	University of East Anglia (UEA)	Oceanographer, biogeochemical modelling



- **Four major EBUS: California current, Humboldt current, Benguela currents, Canary Current**
- **Most productive marine ecosystems in the world ocean. Sustaining 25% of the world's fisheries.**
- **Wind-driven coastal upwelling is the key process promoting PP and fishery productivity**
- **EBUS play a global role in biogeochemical cycles in the ocean and climate regulation and have important socio-economical implications**

EBUS DYNAMICS



AN OBSERVING SYSTEM FOR EBUS

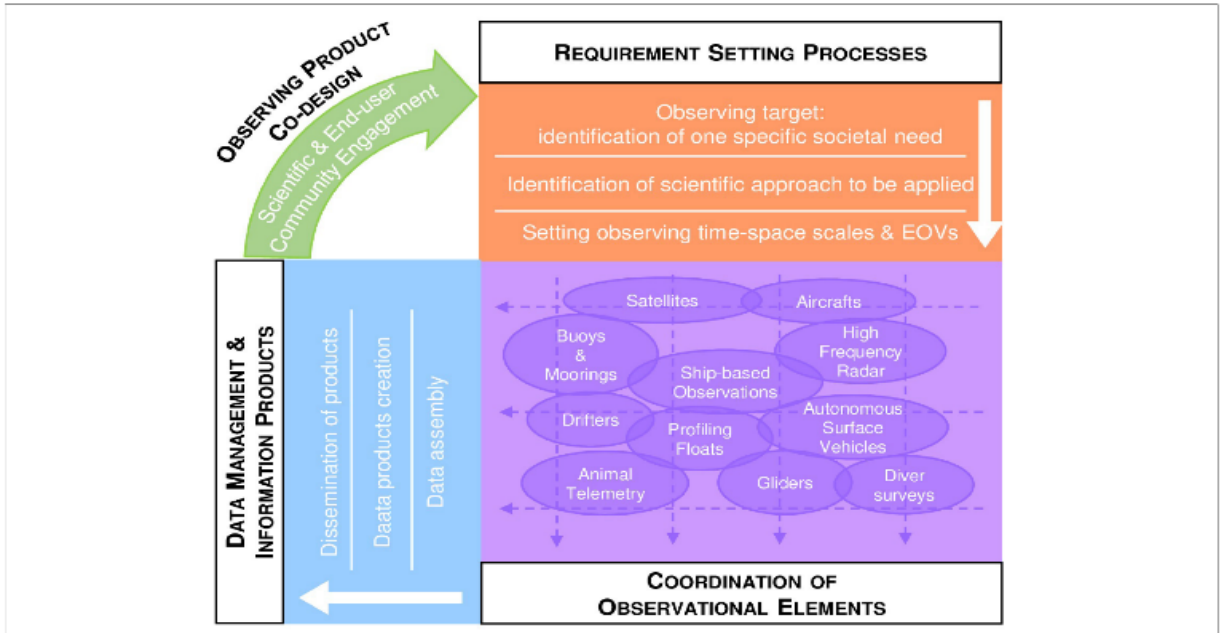
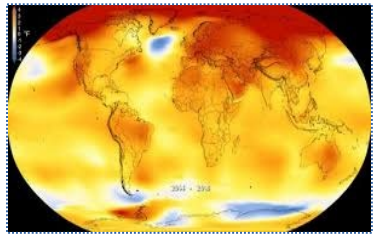


FIGURE 1 | Conceptual structure for an ocean observing value chain designed to match the original structure of the Framework for Ocean Observing (FOO) (Adapted from the FOO, 2012).



TERMS OF REFERENCE

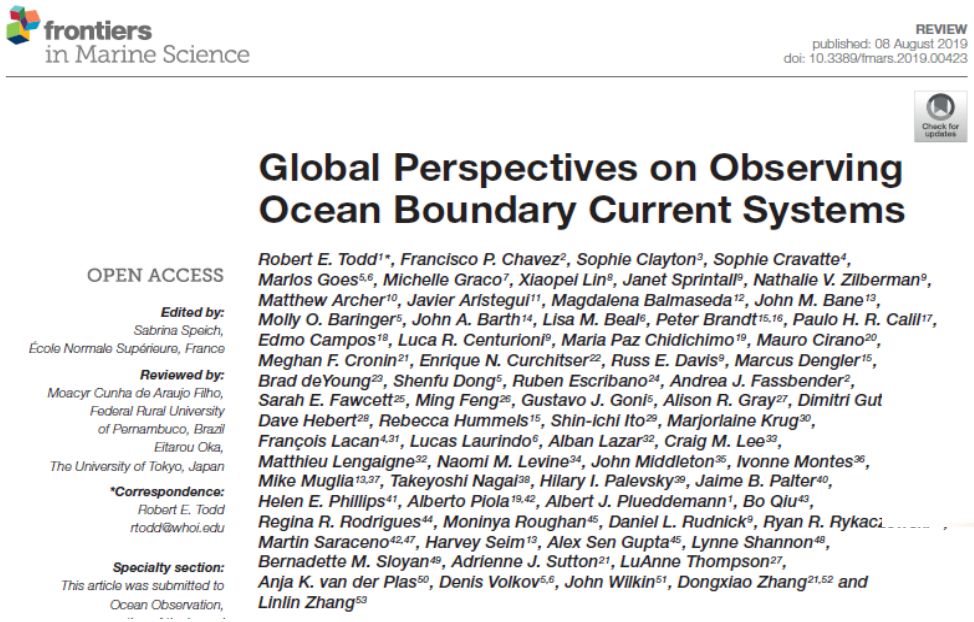
ToR #1. Synthesis of the available information about key processes controlling the dynamics of EBUS, with emphasis on the time and spatial scales of these processes, and the implications for water column properties, biogeochemical cycles, biodiversity/ecosystem structure and functioning and the ecosystem services.

ToR #2. Develop a Web portal for EBUS by building a web-based platform to graphically integrate information on published data, model outputs, as well as protocols for measuring key properties and indicators in EBUS.

ToR # 3 Analysis of existing EBUS coupled physical-biological models.

ToR # 4 Recommending a framework for regional interdisciplinary EBUS observing and modeling systems.

ADVANCES AND ACTIONS



frontiers in Marine Science

REVIEW
published: 08 August 2019
doi: 10.3389/fmars.2019.00423

Global Perspectives on Observing Ocean Boundary Current Systems

OPEN ACCESS

Edited by:
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École Normale Supérieure, France

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Specialty section:
This article was submitted to Ocean Observation,

Robert E. Todd[1], Francisco P. Chavez[2], Sophie Clayton[3], Sophie Cravatte[4], Marlos Goes[5,6], Michelle Graco[7], Xiaopei Lin[8], Janet Sprintall[9], Nathalie V. Zilberman[9], Matthew Archer[10], Javier Aristegui[11], Magdalena Balmaseda[12], John M. Bane[13], Molly O. Baringer[5], John A. Barth[14], Lisa M. Beal[6], Peter Brandt[15,16], Paulo H. R. Calil[17], Edmo Campos[18], Luca R. Centurioni[9], Maria Paz Chidichimo[19], Mauro Cirano[20], Meghan F. Cronin[21], Enrique N. Curchitser[22], Russ E. Davis[9], Marcus Dengler[15], Brad deYoung[23], Shenfu Dong[5], Ruben Escribano[24], Andrea J. Fassbender[2], Sarah E. Fawcett[25], Ming Feng[26], Gustavo J. Goni[5], Alison R. Gray[27], Dimitri Gut Dave Hebert[28], Rebecca Hummels[15], Shin-ichi Ito[29], Marjorlaine Krug[30], François Lacan[4,31], Lucas Laurindo[6], Alban Lazar[32], Craig M. Lee[33], Matthieu Lengaigne[32], Naomi M. Levine[34], John Middleton[35], Ivonne Montes[36], Mike Muglia[13,37], Takeyoshi Nagai[38], Hilary I. Palevsky[39], Jaime B. Palter[40], Helen E. Phillips[41], Alberto Piola[19,42], Albert J. Plueddemann[1], Bo Qiu[43], Regina R. Rodrigues[44], Moninya Roughan[45], Daniel L. Rudnick[9], Ryan R. Rykaci Martin Saraceno[42,47], Harvey Seim[13], Alex Sen Gupta[45], Lynne Shannon[48], Bernadette M. Sloyan[49], Adrienne J. Sutton[21], LuAnne Thompson[27], Anja K. van der Plas[50], Denis Volkov[5,6], John Wilkin[51], Dongxiao Zhang[21,52] and Linlin Zhang[53]*

Review paper "From physics to ecosystem services and beyond: a review of Eastern Boundary upwelling systems" Lead authors: Ivonne Montes, Ruben Escribano, Boris Dewitte, Véronique Garçon. Coauthors: full and associated SCOR WG EBUS members distributed in 4 groups.

Data web portal: linking to existing data portals, but aiming to a global observing system for EBUS

ANTARES

The Global Ocean Observing System

POMeO

Coupled physical-biological models

Eastern Boundary Upwelling Systems (RF-EBUS)

SCOR WG 155 EBUS
Summer school
Dakar, Senegal 2021/2022??

Open Science Conference on Eastern Boundary Upwelling Systems (EBUS): past, present and future
&
Second International Conference on the Humboldt Current System
LIMA, PERU, 2021/2022?

- **March-December 2020 Online meetings: writing review paper, modelling exercises with CLIVAR RF**
- **2020..starting an EBUS Webinar series**
- **2021-2022 EBUS Summer School and Open Science Conference**
- **2021-2022: Summary for policy makers**

SCOR Working Group 156

Active Chlorophyll fluorescence for autonomous measurements of global marine primary productivity

Track Year 1 outputs

- Finalise inter-comparison data (2019 workshop)
- Advance “Best Practice” volume
- Advance fluorometry (F) data processing hub

Initiate Year 2 activity

- Compile F-Carbon comparison data
- Plan field- and lab-work for F-Carbon data gaps
- Explored global F database (NASA)

Deliver ASLO “Tutorial” presentation

Develop flagship paper (distilled “Best Practice”)
Frontiers in Marine Science (submit end 2020)

Year 2 Meeting: ASLO San Diego, February 2020
(mix in-person and remote attendance)

Presenter: Nina Schubak

SCOR Working Group 156

Active Chlorophyll fluorescence for autonomous measurements of global marine primary productivity

Outputs

Articles:
Gorbunov & Falkowski (Limnology & Oceanography)
Ryan-Keogh & Robinson (Frontiers In Marine Sci)
Hughes et al. (J. Phycology)
Fisher et al. (PLoS One)
Several other papers in various draft form

Wiki resource hub ("Best Practice" build)
(http://scor156.com/)

Data Processing Hub beta

Initiated more regular zoom meetings
Regularly maintain progress on year 1-2 outputs

On-going

Data analysis past-current campaigns:
Vancouver workshop, Polar cruises (Tortell), Tropical cruises (Berman-Frank), new F-Carbon meta-analysis

New campaigns to road-test 'Best Practice":
Atlantic Ocean (multiple sensors aligned to PACE), pursue FALKOR discussions

Developing training workshops:
South & central America

COVID19 contingency:
2021 "global workshop" across home institutions

Presenter:
Ann Bucklin

SCOR WG157

MetaZooGene

Toward a new global view of marine zooplankton biodiversity based on DNA metabarcoding and reference DNA sequence databases

SCOR Annual Meeting - October 20, 2020
Ann Bucklin, Chair WG157, *University of Connecticut (USA)*

metazoogene.org/ and scor-int.org/group/157

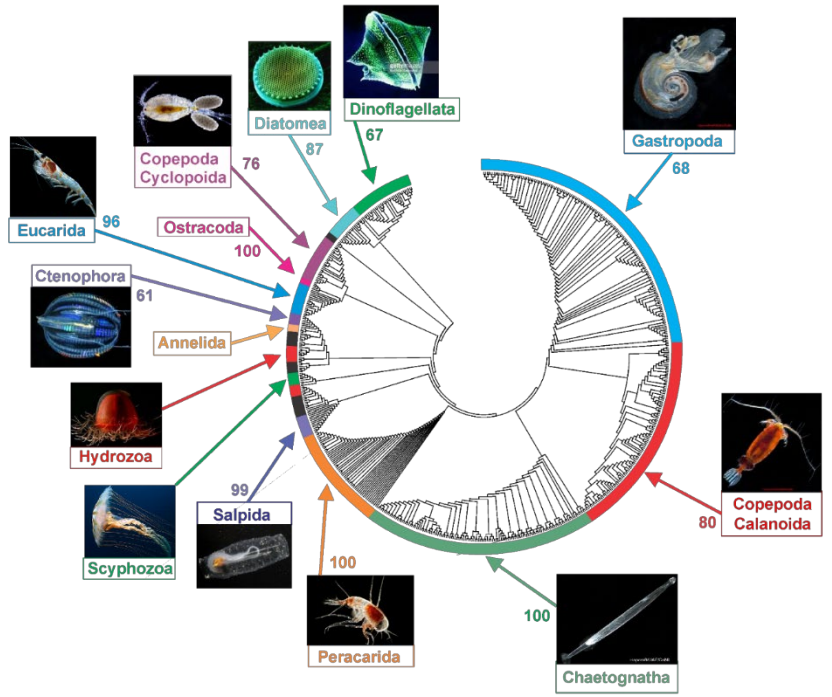
WG157 Meeting @ 2020 Ocean Sciences, San Diego (USA)

Partner and precursor organizations and programs

ICES CIEM

CENSUS OF MARINE LIFE

CMarZ



Bucklin et al. (2019) ICES Journal of Marine Science

SCOR WG157

MetaZooGene

Membership:

Chair:

- Ann Bucklin, Univ. Connecticut (USA)

Vice-Chairs:

- Katja Peijnenburg, Naturalis Biodiversity Centre (NL)
- Ksenia Kosobokova, Russian Acad. Sciences (RU)

Total of 23 Members from 19 countries

Primary focus:

~8,000 species of holozooplankton (15 phyla, 32 classes) of animals that drift with ocean currents

Primary goal:

Integrative molecular – morphological taxonomic analysis of marine zooplankton biodiversity throughout global ocean

Terms of Reference

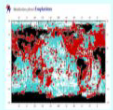
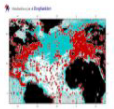
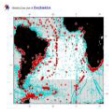
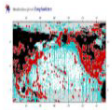
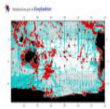
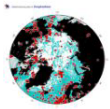
1) Create an open-access web portal for DNA barcodes for marine zooplankton
2) Design an optimal DNA barcoding pipeline for marine zooplankton
3) Develop best practices for DNA metabarcoding of marine zooplankton biodiversity

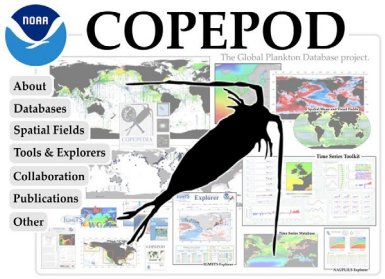
SCOR WG157

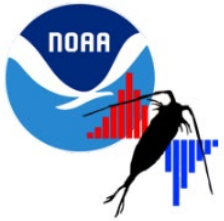
MetaZooGene

MZGdb: Web Portal and Atlas for DNA Barcodes of Marine Zooplankton

Todd O'Brien, NOAA Fisheries (USA)

Taxonomic Group	Entire World *B00*	North Atlantic *B02*	South Atlantic *B03*	North Pacific *B07*	South Pacific *B06*	Indian Ocean *B05*	Arctic Ocean *B01*
All_Taxa_Groups *T4000000* The data files in this row contain ALL of the groups listed individually in the rows below.	 SEQs: 151163 *uIDs: 10498* ***Species: 9182*** MZGdb .CSV *.PSV* .fasta .mothur	 SEQs: 81536 *uIDs: 4310* ***Species: 3338*** MZGdb .CSV *.PSV* .fasta .mothur	 SEQs: 47626 *uIDs: 2186* ***Species: 1484*** MZGdb .CSV *.PSV* .fasta .mothur	 SEQs: 87139 *uIDs: 4353* ***Species: 3371*** MZGdb .CSV *.PSV* .fasta .mothur	 SEQs: 52733 *uIDs: 3207* ***Species: 2345*** MZGdb .CSV *.PSV* .fasta .mothur	 SEQs: 56510 *uIDs: 3178* ***Species: 2358*** MZGdb .CSV *.PSV* .fasta .mothur	 SEQs: 33880 *uIDs: 1505* ***Species: 1012*** MZGdb .CSV *.PSV* .fasta .mothur





- Over 154,000 DNA sequences; ~9,000 species
- Data from NCBI GenBank; BOLD; MZG members
- Download data by taxonomic group / ocean region
- View completeness / gaps in interactive visual "atlas "

COPEPOD: Coastal and Oceanic Plankton Ecology, Production, and Observation Database

SCOR WG157

MetaZooGene

ICES Journal of Marine Science

Patterns of Biodiversity of Marine Zooplankton Based on Molecular Analysis

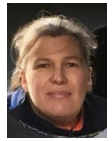
Open call for papers for special issue on revisiting biodiversity of marine zooplankton based on novel molecular approaches. Manuscript deadline: October 30, 2020

- Howard I. Browman, ICES JMS Editor-in-Chief

- Ann Bucklin*, Katja Peijnenburg*, Ksenia Kosobokova*, Ryuji Machida*, Themed Set motivators

Selected Recent Publications and Recommended Readings





Silke Laakmann*, Leocadio Blanco-Bercial*, Astrid Cornils* (2020) ***The crossover from microscopy to genes in marine diversity – from species to assemblages in marine pelagic copepods.*** **Philos. Trans. Roy. Soc. B. Doi:10.1098/rstb.2019.0446.**

Katja Peijnenburg*, Arie Janssen, Deborah Wall-Palmer, Erica Goetze*, Amy Maas, Jonathan Todd, Ferdinand Marlétaz (2020) The origin and diversification of pteropods precede past perturbations in the Earth's carbon cycle. Proc. Natl. Acad. Sci. Doi: 10.1073/pnas.1920918117.

Junya Hirai*, Aiko Tachibana, Atsushi Tsuda (2020) Large-scale metabarcoding analysis of epipelagic and mesopelagic copepods in the Pacific. PLoS ONE

Presenter:
Emmett Duffy

C-GRASS

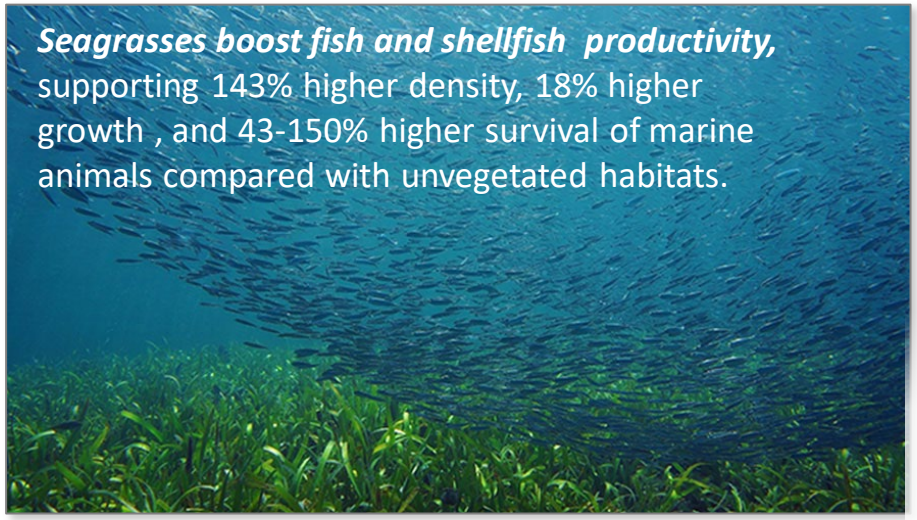
Coordinating
Global
Research
Assessment of
Seagrass
Systems

1st Meeting - Virtual
14 Sep – 02 Oct 2020

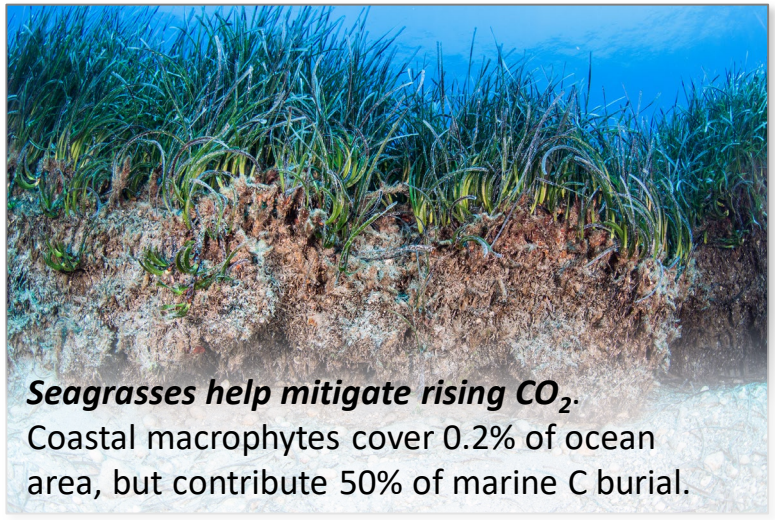
Why seagrasses?

Seagrasses foster biodiversity.
Threatened megafauna depend on seagrass habitats: 80% of dugongs & manatees, 57% of sea turtles, and 11% of sharks and rays.

Seagrasses support local economies.
Seagrass fisheries yield A$114 M per year in S Australia; 30–40% of commercial fishery value in Mediterranean but occupy 2% of area.



Seagrasses boost fish and shellfish productivity,
supporting 143% higher density, 18% higher growth , and 43-150% higher survival of marine animals compared with unvegetated habitats.



Seagrasses help mitigate rising CO_2.
Coastal macrophytes cover 0.2% of ocean area, but contribute 50% of marine C burial.

Our mission

Data schema

Develop recommended seagrass data schema and standardised vocabularies, aligning with Darwin Core and the EOV sub-variables.

Data synthesis

Assemble a database of existing records of seagrass occurrence, aerial extent and in situ surveys, and a schema to harmonize disparate kind of data.

Community of practice

Organise an interdisciplinary community of practice around specific topics and approaches, in order to support implementation.

Best practices

Produce a handbook of standard protocols and best practices for collecting, curating and sharing data on seagrass ecosystems.

Vision:

A rigorous, dynamic picture of global seagrass status and trends

and a global Community of Practice that stewards it for the public good.

Presenter: Kerry Howell

SCOR Working Group 159

Roadmap for a Standardised Global Approach to Deep-Sea Biology for the Decade of Ocean Science for Sustainable Development (DeepSeaDecade)

Inaugural meeting held in Jan 21-24th 2020

A Blueprint for a Decade to Study Deep-Sea Life

DEEP-OCEAN STEWARDSHIP INITIATIVE

International Science Council SCOR Scientific Committee on Oceanic Research

The six Societal Outcomes (SO) of the Decade of Ocean Science for Sustainable Development

1. *A clean Ocean whereby sources of pollution are identified, quantified and reduced, and pollutants removed from the Ocean*
2. *A healthy and resilient Ocean whereby marine ecosystems are mapped and protected, multiple impacts (including climate change) are measured and reduced, and provision of ocean ecosystem services is maintained*
3. *A predicted Ocean whereby society has the capacity to understand current and future ocean conditions, forecast their change and impact on human wellbeing and livelihoods*
4. *A safe Ocean whereby human communities are protected from ocean hazards and where safety of operations at sea and on the coast is ensured*
5. *A sustainably harvested and productive Ocean*

Key questions

i. What is the diversity of life in the deep ocean?

ii. How are populations & habitats connected?

iii. What is the role of living organisms in ecosystem function & service provision?

THE *DEEP* OCEAN WE HAVE

Current Challenges

- Pollution
- Deoxygenation
- Warming
- Acidification
- Unsustainable fishing
- Expanding human use e.g. oil and gas, mining, bio-prospecting
- Biodiversity loss
- Inequity in capacity
- Unpredicted
- Unseen

DECADE OBJECTIVES

O1 — Capacity development and knowledge sharing

- Broaden the deep-sea research and knowledge base
- Coordinate ship-board training opportunities
- Co-design and co-deliver research
- Open sharing of research activities, expertise and outputs

O2 — Generate ocean data

- Follow blueprint for global-scale field programme[9]
- Identify new sites for sustained observations
- Develop and integrate low-cost technologies

O3 — Build ocean understanding

- Map biological components
- Map human impacts
- Identify role and functioning of deep-sea biology
- Integrated modelling and prediction

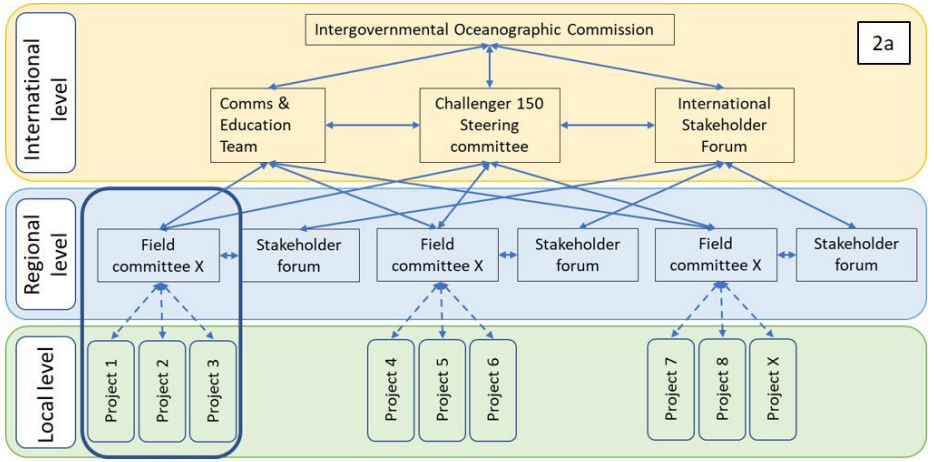
O4 — Increase use of ocean knowledge

- Develop strong knowledge to end-user pathways
- Use established DOSI network
- Apply decision support tools
- Co-develop knowledge products

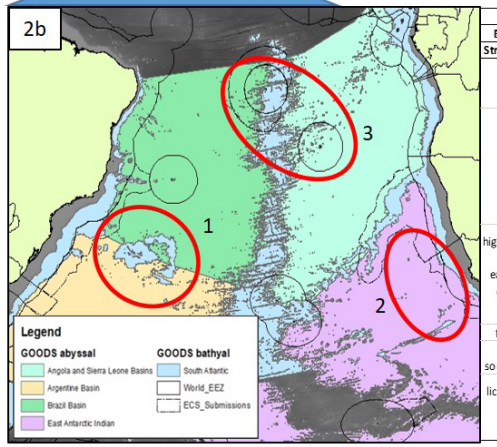
THE *DEEP* OCEAN WE WANT

Decadal Outcomes

- Clean ocean
- Healthy and resilient ocean
- Productive ocean
- Predicted ocean
- Safe ocean
- Accessible ocean
- Inspiring and engaging ocean



Theoretical example for South Atlantic Region



Project	Project 1	Project 2	Project 3
Ecosystem type	Seamount	Seamounts | Abyssal Plain	Seamount | Hydrothermal Vent
Stratification factor			
Biogeographic region	Brazil basin | Argentine basin | South Atlantic	East Antarctic Indian basin | South Atlantic	Angola and Sierra Leone basin | Brazil basin | South Atlantic
Depth bands	1000-1500 | 1500-2000 | 2000-2500 | 2500-3000 | 3000-3500 | 3500-4000 | 4000-4500 | 4500-5000	150-300 | 300-500 | 500-1000 | 1000-1500 | 1500-2000 | 2000-2500	150-300 | 300-500 | 500-1000 | 1000-1500 | 1500-2000 | 2000-2500 | 2500-3000 | 3000-3500 | 3500-4000 | 4000-4500 | 4500-5000
high and low climate hazard under early/late time of climate change emergence	high climate hazard, early climate change emergence	low climate hazard, early climate change emergence | low climate hazard, late climate change emergence	high climate hazard, early climate change emergence | high climate hazard, late climate change emergence
fished/unfished	fished	fished | unfished	unfished
near/far from sources of pollution	near sources of pollution	near sources of pollution	far from sources of pollution
licensed/protected from industry activities	licensed for industry activities	licensed for industry activities | protected from industry activities	protected from industry activities

Two sister publications in submission

Next Steps

Terms of Reference

1. To develop a global plan for survey / sampling deep-sea ecosystems to underpin deep-sea research for the UN Decade of Ocean Science. - COMPLETE

2. To agree on methods and standards for the acquisition of biological data, including the role of existing and novel technologies. – SUBJECT OF NEXT MEETING

3. To develop habitat-specific approaches for survey / sampling the deep-sea ecosystem (following the Census of Marine Life model), that integrate the global approaches developed under ToRS 1 and 2, but allow greater specialisation. – COMPLETE

4. To integrate ToRs 1-3 with wider efforts under the Global Ocean Observing System (GOOS) via the Deep Ocean Observing Strategy (DOOS). – TO DO

5. To actively facilitate efforts to build capacity in developing nations for deep-sea science. – IN DEVELOPMENT

Q&A

WG 154. Plankton-Observing (**P-OBS**)

WG 155. Eastern boundary upwelling systems (**EBUS**)

WG 156. Active Chlorophyll fluorescence

WG 157. Zooplankton DNA biodiversity (**MetaZooGene**)

WG 158. Assessment of Seagrass System (**C-GRASS**)

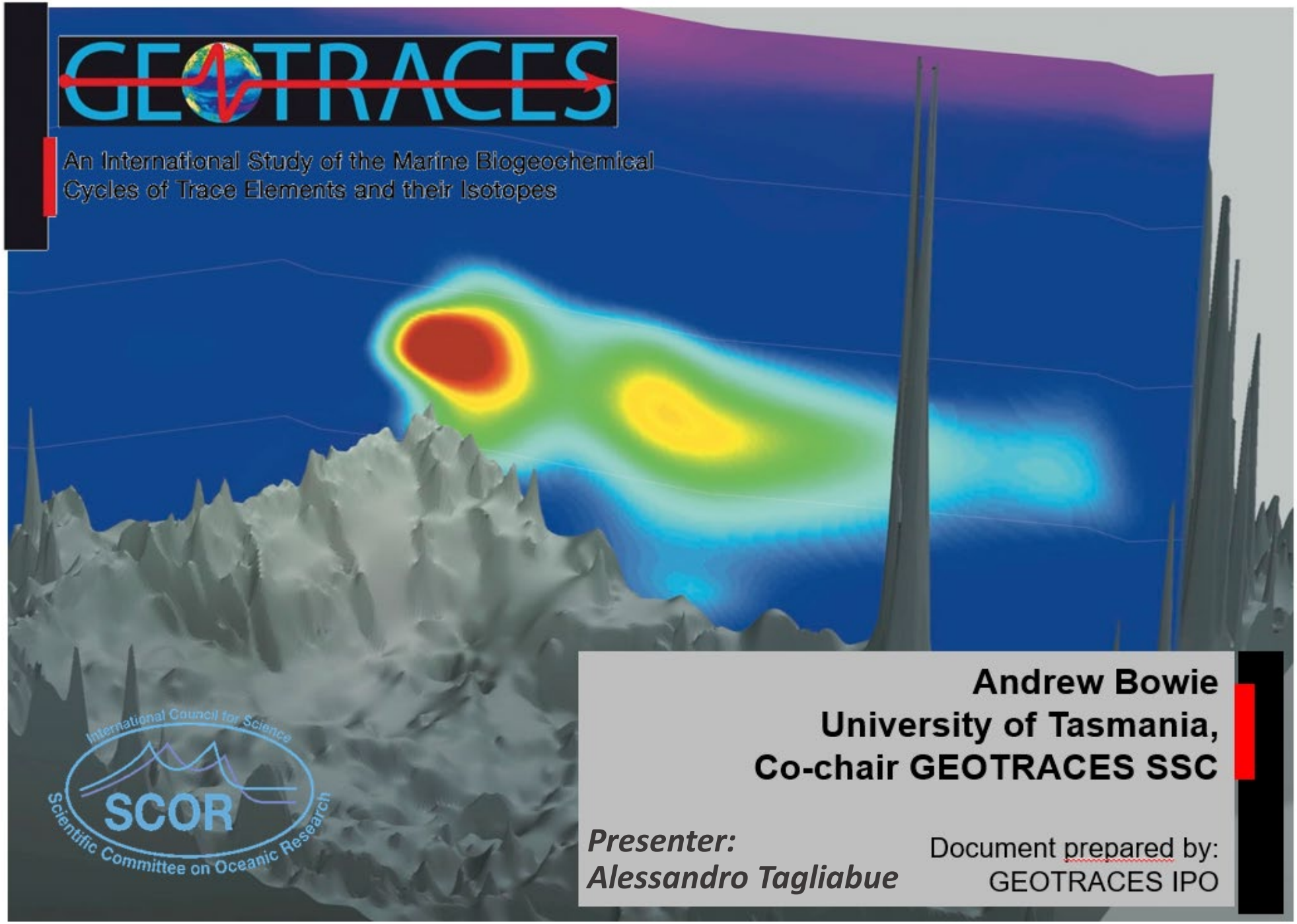
WG 159. Deep-Sea Biology for the Decade (**DeepSeaDecade**)

10-minute BREAK

8:30 – 8:40 am /

12:30 – 12:40 UTC

Research Projects reports

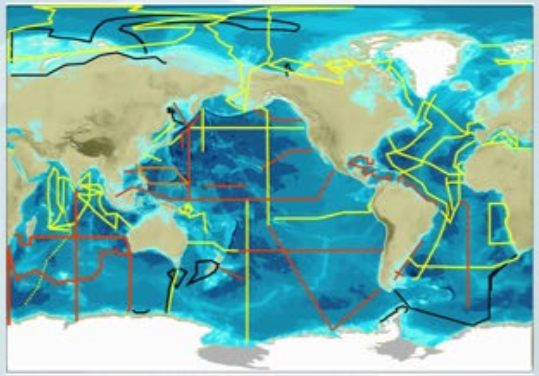


Andrew Bowie
University of Tasmania,
Co-chair GEOTRACES SSC

Presenter:
Alessandro Tagliabue

Document prepared by:
GEOTRACES IPO

Progress on Implementation of the Project



120 cruises (41 Section cruises) completed

1 section cruise (China) and
4 process studies (France, US and Brazil (2))
completed since last report

Working for a next release of the

GEOTRACES Intermediate Data Product 2021

Goldschmidt 2021 (4-9 July, Lyon, France)

New! Fair Use Agreement

https://www.geotraces.org/idp2021-fair-use-document/

GEOTRACES Data for Oceanic Research (DOoR)

>> Version 1 released in December 2019
>> Version 2 released in July 2020

GEOTRACES events completed April 2019 – March 2020

Dates	Event
21-25 April 2019	*GEOTRACES session at SOLAS Open Conference*
18-23 August 2019	*GEOTRACES sessions Goldschmidt 2019*
11 June 2019	Standards and Intercalibration Committee Meeting
5-6 September 2019	Exploring GEOTRACES Data with ODV (Hobart, Australia)
7-8 September 2019	Data Management Committee Meeting (Hobart)
9-11 September 2019	GEOTRACES SSC Meeting (Hobart)
12-13 September 2019	Southern Ocean Biogeochemistry Workshop (Hobart)
23-28 September 2019	GEOTRACES Summer School (Cadiz, Spain)
8-10 December 2019	4th Asia GEOTRACES Workshop (Qingdao, China)
13-14 January 2020	GEOTRACES DOoR Meeting (Toulouse, France)
7 February 2020	2nd Russian GEOTRACES Seminar (Moscow, Russia)
16-21 February 2020	*GEOTRACES sessions at Ocean Sciences Meeting 2020* *SCOR Booth*

3rd GEOTRACES Summer School planned for 2021

- **28th June - 2nd July 2021 in Bremerhaven, Germany**
- 50 students and 12 lecturers
- Course to include:
  - Lectures
  - Training in shipboard sampling (*RV Heincke*)
  - Sample processing
  - Some key analytical techniques
  - (web)ODV training
  - Workshops: Environmental aspects, Global change

  (considering organising series of webinars in case in person summer school is not possible)

- **Organisers:** Walter Geibert (AWI), POLMAR Graduate School @AWI (Claudia Hanfland)

Thank you very much!

SSC Co-chairs:
Andrew Bowie (University of Tasmania, Australia)
Karen Casciotti (University of Stanford, USA)

International Coordination:

GEOTRACES International Project Office
(LEGOS-OMP, Toulouse, France)

Catherine Jeandel (Scientific Director)
Elena Masferrer Dodas (Executive Officer)

Data Management:

Mohamed Adjou (Data Manager)
GEOTRACES Data Assembly Centre (BODC, Liverpool)

Join us on Facebook

www.geotraces.org

Follow

GEOTRACES

SOLAS Summary 2020
Governance

Changing IPO

From:

GEOMAR, Kiel, Germany
+
Nodal office, MEL, Xiamen University, China

To:

IPO-Ireland, NUI-Galway
Executive Director & International SOLAS master's program
+
IPO-China, MEL, Xiamen University
Deputy Executive & Project Officer

Changing Steering Committee

Chair:

Rotating off at end of 2020
Lisa Miller (F, Canada)
Nominated new co-chairs
Minhan Dai (M, China)
Cliff Law (M, New Zealand)

Members:

Rotating off at end of 2020
- Cristina Facchini (F, Italy, atmospheric chemistry)
- Laura Gallardo (F, Chile, atmospheric chemistry)
- Maurice Levasseur (M, Canada, DMS/aerosols)

Nominated new members
- Maria Kanakidou (F, Greece, atmospheric chemistry)
- Marcela Cornejo (F, Chile, upwelling systems)

- **Network of integrated air-sea observatories**

  To foster innovation & capacity building

- **Geoengineering**

  Launching collaborative & governance organization w/WCRP

  Targeted workshop on the science of Ocean Alkalinization in 2021

- **Indian Ocean Integrated Topic**

  Workshop on 30 September, 2020

- **Ship emission projects**

  Workshop in early 2021

- **Southern Ocean Workshop**

  Austral winter 2021

SOLAS Summer School 2021 (or 2022?)

70 students, 20 instructors, 2 weeks

Lectures, practicals, cruise, career development

Applications now open

SOLAS Open Science Conference 2022

Cape Town, South Africa

25-30 September, 2022

Presenter:
Carol Robinson

IMBeR Outputs 2019-2020

Integrated Marine Biosphere Research

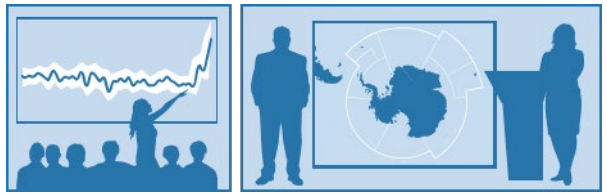
Publications

105 Peer-reviewed

24 in 2 *Frontiers in Marine Science* Research Topics

2 Policy relevant reports

Meetings



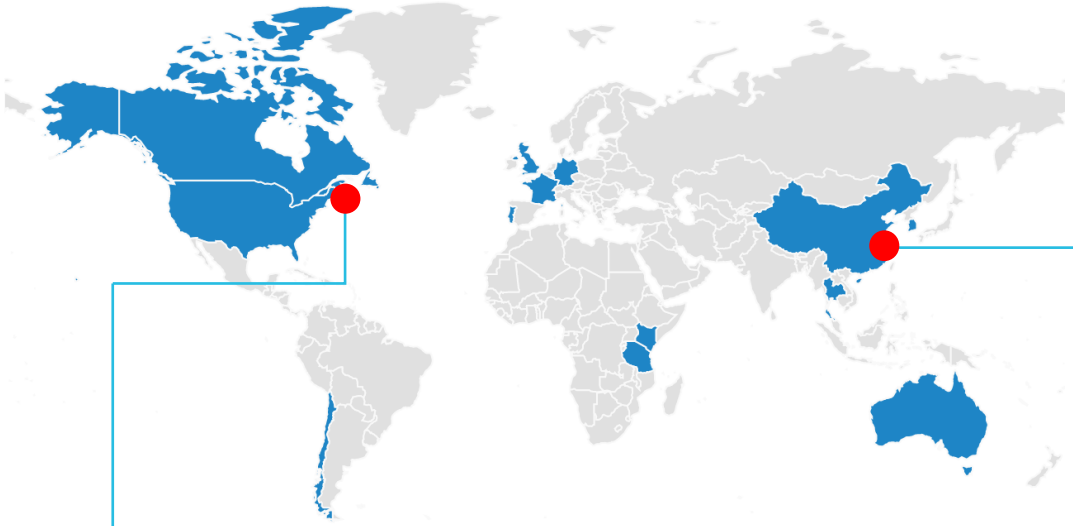
6 Workshops

9 Conference sessions

7 Training courses

SCOR International Council for Science Scientific Committee on Oceanic Research · OCEAN FRONTIER INSTITUTE · MEOPAR · DALHOUSIE UNIVERSITY · SKLEC · EAST CHINA NORMAL UNIVERSITY · futureearth research for global sustainability

IMBeR ssc
Integrated Marine Biosphere Research



IPO - China

SKLEC

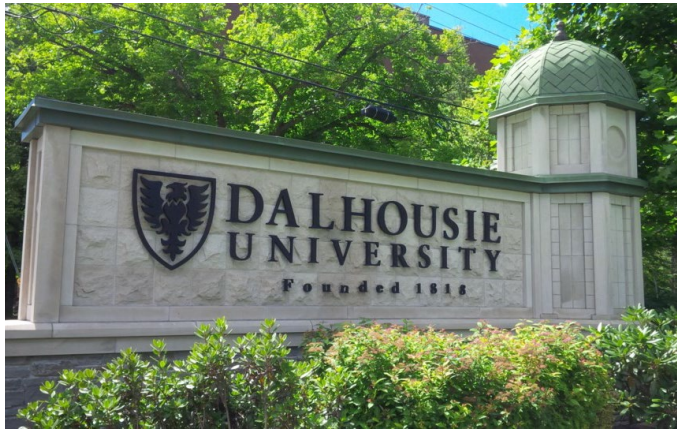
EAST CHINA NORMAL UNIVERSITY

IPO - Canada

OCEAN FRONTIER INSTITUTE

MEOPAR

DALHOUSIE UNIVERSITY



IMECaN
Interdisciplinary Marine Early Career Network

Integrated Marine Early Career Network

729 members 96 countries

IMBeR Upcoming events

Integrated Marine Biosphere Research

International Council for Science
SCOR
Scientific Committee on Oceanic Research

OCEAN FRONTIER INSTITUTE

MEOPAR

DALHOUSIE UNIVERSITY

SKLEC

EAST CHINA NORMAL UNIVERSITY

futureearth
research for global sustainability

IQOE

International Quiet Ocean Experiment

Prof Peter L Tyack
Scottish Oceans Institute, School of Biology
University of St Andrews

IQOE Fundamental Questions

1. How have human activities affected the global ocean soundscape compared with natural changes over geologic time?
2. What are current levels and distribution of sound in the ocean?
3. What are trends in sound levels across the global ocean?
4. What are current effects of sound on important marine animal populations?
5. What are potential future effects of sound on marine life?

Presenter: Peter Tyack

International Science Council
SCOR
Scientific Committee on Oceanic Research

pogo

IQOE Progress in Past Year (1)

- IQOE WGs on Standardization and Marine Bioacoustic Standardization issued report on *Guidelines for Observation of Ocean Sound* in December 2019.
- IQOE WG on Acoustic Measurement of Ocean Biodiversity Hotspots publishes paper on “Listening forward: approaching marine biodiversity assessments using acoustic methods” in *Royal Society Open Science* in August 2020.
- IQOE initiated a project to examine the effects of COVID-19 pandemic on ocean noise in March 2020.
- IQOE issued endorsements for two new projects, which are waiting for funding decisions.
- An IQOE-related data office was created at the Alfred Wegener Institute in Germany.

IQOE Progress in Past Year (2)

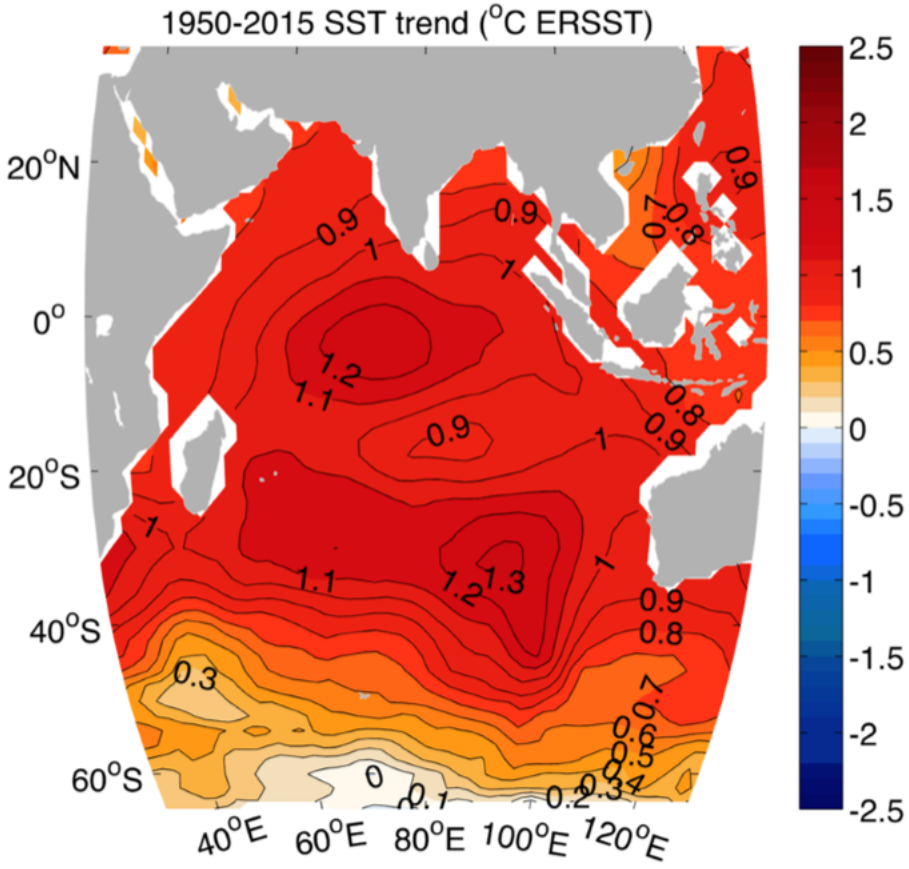
- The Richard Lounsbery Foundation is supporting a software project to produce standardized outputs from passive acoustic recordings based on the *IQOE Guidelines*, called Ocean Sound Software for Making Ambient Noise Trends Accessible (MANTA). This software will be available in early 2021, free of charge to the ocean acoustics community.
- The IQOE WG on Arctic Acoustic Environment is planning a virtual conference on Sound in the Arctic Ocean on 11-12 November 2020.
- IQOE is in the process of forming a committee to create an implementation plan for the Ocean Sound Essential Ocean Variable (EOV).

IIOE-2 Synthesis Slides (P Burkill)

2nd International Indian Ocean Expedition 2015-2025

One recent Research Development

- IO is our smallest ocean, yet warming of surface waters is higher that anywhere else
- Increase of 1° C in IO compared to 0.6° C for global ocean average.
- Mechanisms are poorly understood
- But consequences are huge for mankind (sea-level rise, cyclone impacts) and for ecosystems (corals, plankton, fish)
- It must be a major focus for future research.



Anon (2020). The Recent Decadal Review (2020-2030) of the Indian Ocean Observing System (IndOOS-2) and its Outcomes CLIVAR Special Issue Exchanges 78: Doi: https://doi.org/10.36071

Presenter: Peter Burkill

Present and Future Issues

1) IIOE-2 Links across SCOR

GEOTRACES. Cruises in IO

SOLAS. The IO is considered as a 'Key Environment". SOLAS-IO is lead by Anoop Mahajan (India).

- Their first meeting of SOLAS IO was held on-line on 30th September with ~360 scientists registered.
- Aid IIOE-2 with "role in Earth System"?

2) UN Decade of Ocean Science for Sustainable Development

- Interaction of IIOE-2 with the DECADE programme
- Important of IIOE-2 Co-Chair Vladimir Ryabinin
- Mapping of IIOE-2 onto DECADE
- Note call for DECADE EOI due shortly

3) Evolution of IIOE-2

- Pure science versus societal relevance issues
  e.g. cause of IO heating and what is the societal impact?
- Importance of Data & Information Management
  This must be one of the IIOE-2 legacies. Need not just a strong DIM strategy but also take up by community.

Future Timetable

When? Year, month	*What?*	*Who?*
2020, Nov-Dec	Core Group 18	Members
2021, Feb	IIOE-2 SSC 4	Members
2021, Feb	IIOE-2 Science Talks	Open
2021, Oct	IIOSC 2020	Open
2021, Oct	IIOE-2 SSC 5	Members

Request to SCOR

We request that SCOR agrees that the already allocated $15k is used to underpin T&S for SCOR participants at the postponed Goa meeting. This assumes that the meeting will take place

Q&A

GEOTRACES – Trace elements and isotopes

SOLAS – Ocean/atmosphere interactions

IMBeR – Marine biosphere research

IQOE – Quiet Ocean

IIOE-2 – Indian Ocean expedition II

Infrastructural Projects reports

SCOR WG149 (COBS) Changing Ocean Biological Systems - Highlights 2019 & 2020

Presenter: Sinead Collins

WG members
Sam Dupont &
Christina McGraw
Leading the IAEA
Workshop in mid 2019

Mentoring took place at both international fora such as IAEA (see left) and at national meetings such as in New Zealand in early 2020

We also developed a 24 slide workshop template that we shared with our growing team of national advocates to simply running workshops

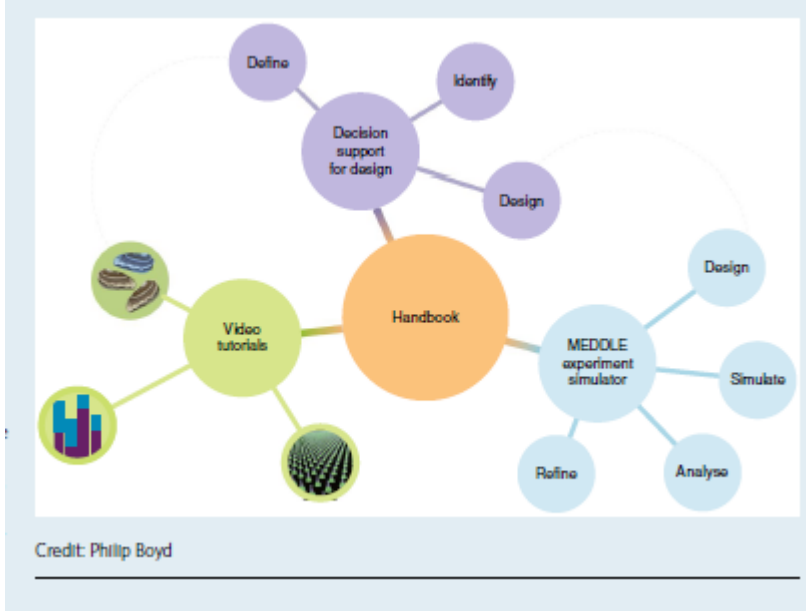
ToR #5 Mentor early-career scientists in the design process for complex multiple driver manipulation experiments, familiarize them with BPG, and teach them practical methodologies for the analysis of their experimental findings.

SNAPSHOT

Experimenting with multistressors

https://meddle-scor149.org/

Advocates in many countries (e.g. Spain, Portugal, Finland, Mexico, Israel) beyond the SCOR membership group (14 countries) – help to promote the MEDDLE online multiple driver simulator



Credit: Philip Boyd

"Advocacy has been exerted at three levels:

1.Publicity:
-I recommended MEDDLE explaining the strength of its use and referring to the web link, to all of my collaborators across 8 countries (25 top-scientists working on plankton from different angles).
- In three PhD defenses in Spain in which I was in the evaluating panel before Covid-19, the issue on how to deal with multiple stressors was a hot topic of discussion. I then explained MEDDLE and recommended its use. People did not know about it and it turned out they were absolutely keen on using it. I am aware they indeed did.

2. Lecturing:
-I use MEDDLE with my master students, in the part I lecture within the Environment Management Master

3. Research
-MEDDLE is referred as a key tool for experimental design and analyses in 2 grants I have applied as PI during the last 2 months."

From Professor Maria Segovia University of Malaga

IOC/INF-1367

Scientific Summary for Policy Makers

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

2021 2030

https://www.oceandecade.org/

Ocean Under Stress: Managing a Changing Ocean at All Locations

Several members of the SCOR WG149 are contributing to formulation and writing of a Scientific Summary for Policy Makers

TOR #7) Engage with policy-makers and science communication experts to produce a glossary of terms and an implementation guide for policy-makers to better understand the role of multiple drivers in altering marine living resources and ecosystem services.

Presenter:
Elisa Berdalet

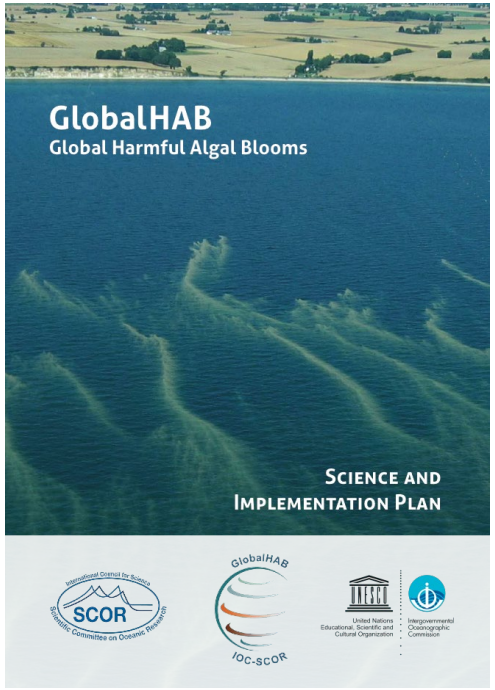
United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

GlobalHAB
Global Harmful Algal Blooms
Progress Report 2019-2020

Elisa Berdalet and the GlobalHAB SSC
www.globalhab.info

SCOR Annual Meeting, October 21, 2020



- Overall **Goal:** to improve understanding and prediction of HABs in aquatic ecosystems, and management and mitigation of their impacts

- Overall **Mission**: to foster international coordination and co-operative research to address the scientific and societal challenges of HABs in a rapidly changing world.

➢ **GlobalHAB acknowledges SCOR support** to conduct in 2021 the activities postponed due to the Covid-19 pandemics

➢ **New GlobalHAB SSC, 2020 – 2022:**

C. Anderson, N. Banas, T. Davis, H. J. Jeong, B. Karlson, P. T. Lim
R. Siano, S. Wood, A. Yñiguez, E. Berdalet (Chair)
and Liaisons: D. Clarke, J. Silke, V. Trainer, R. Kudela
www.globalhab.info

Capacity building:

- **UNESCO/IOC WESTPAC Training Workshop on HABs and Fish-killing Raphidophyt**
- **species in Western Pacific Region.** February 2019, Chulalongkorn University
  - Yñiguez, A.T. et al. 2020. *Harmful Algae* https://doi.org/10.1016/j.hal.2020.101776
  - Lum, W.M., et al. 2019. *Philippine Journal of Natural Sciences* 24: 50-56

- **AZTI-SOPHIE Summer School 2019 "Does human health and well**
  a Healthy Ocean? June 2019, Aquarium of San Sebastian, Spain
  - Borja et al. 2020. *Frontiers Mar Sci* doi: 10.3389/fmar.2020.00037

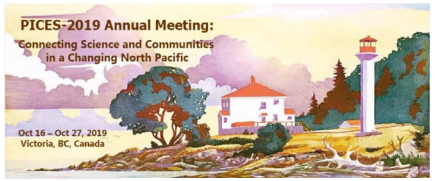
Collaboration with other institutions and programs:

- **External Advisor in SOPHIE ("Seas, Oceans & Public Health in Europe") to develop a programme on Oceans and Human Health in Europe.** Final presentation in Brussels, 20 March 2020

- **External Advisor of the European Food Safety Agency, contribution to the EFSA Report:** "Climate change as a driver of emerging risks food and feed safety, plant, animal health and nutritional health". Maggiore et al. 2020. doi:10.2903/sp.efsa.2020.EN-1881. June 2020

✓ **Special issue on "Harmful Algae and Climate Change" -** *Harmful Algae*, C. Gobler (eds). January 2020 - https://www.sciencedirect.com/journal/harmful-algae/vol/91/suppl/C

✓ ***Trainer, V.L., Davidson, K., Wakita, K. (Ed) 2020. GlobalHAB Workshop (2019): Evaluating, Reducing and Mitigating the Cost of Harmful Algal Blooms, a Compendium of Case Studies. PICES Sci. Rep. November 2020. 7 Chapters***
https://meetings.pices.int/meetings/annual/2019/pices/Program



Participants from the GlobalHAB Workshop (#28): Evaluating, reducing and mitigating the cost of Harmful Algal Blooms, at PICES-2019, Victoria, British Columbia, Canada

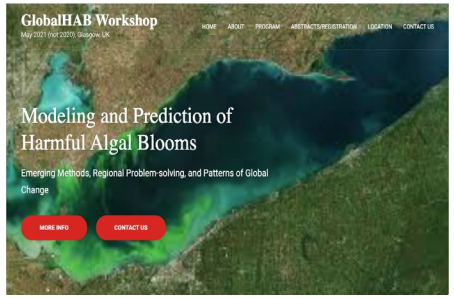
Venue: Puerto Varas, Chile
Dates: 8th – 11th October, 2019

✓ **Puerto Varas, Chile. 8th – 11th October, 2019**
Funding: GlobalHAB (IOC & SCOR) and Gobierno de Chile
Organizing Committee: L. Guzmán, J. Mardones. O. Espinoza, A. Cembella and the IPHAB Task Team on Fish Killing Algae
White paper (in prep)

✓ **Best Practice Guidelines for the Study of HABs and Climate Change.** M. Wells, M. Burford, A. Kremp, M. Montresor, G. Pitcher, G. Usup (Eds.) **5 Chapters Online - December 2020**

- **GlobalHAB Workshop on "Modelling and prediction of harmful algal blooms, from event response to multi-decadal projections"**

Organizers: N. Banas, D. McKee, B. Chen, P. Udom, C. Anderson, D. McGillicuddy, B. Karlson, K. Davidson, D. Aleynik, S. Spatharis, M. Llewellyn
2021: Master class and tutorials
2022: Physical meeting, Glasgow, UK



- **GlobalHAB symposium on automated in situ observations**

Organizers: P. Tiselius, B. Karlson, E. Berdalet, M. Montresor, R. Kudela, K. Davidson, L. Naustvoll, F. Artigas, H. Sosik
May 31 – June 4, 2021

Sven Lovén Centre for Marine Sciences, Kristineberg, Sweden

- **Open Science Meeting on *Sargassum***

GlobalHAB subcommittee: B. van Tussenbroek, B. Lapointe, E. Serrao, J. E. Martinelli Filho
Objective: To identify research priorities to understand *Sargassum* growth dynamics and to develop adequate forecasting and warning systems
Co-organizers: UNEP, GESAMP, IAEA, Regional governments, EuroSea

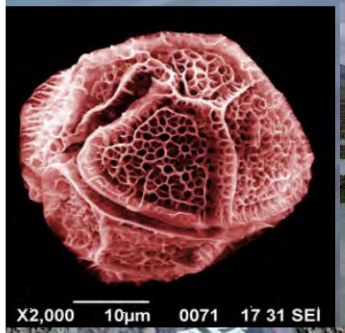
Mexico, 2021, TBD

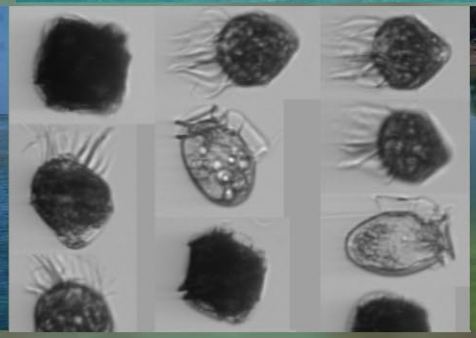
- **On the pipeline (2021 – 2025), organized by the new GlobalHAB SSC:**

- Economic impacts of HABs in collaboration with NOWPAP, PICES and NOAA
- Expert workshop on qPCR and metabarcoding applied to HAB research
- Analysis of the Adaptation Strategies of HABs
- A Scientific Summary for Policy Makers on HABs and Climate Change

Thanks for your attention

www.globalhab.info





@ioccp_org

www.ioccp.org

Presenter: Masao Ishii

International Ocean Carbon Coordination Project

for a communication and coordination for marine biogeochemistry

Masao Ishii,
Co-Chair
JMA-MRI, Japan

Kim Currie,
Co-Chair
NIWA, New Zealand

Maciej Telszewski,
Director
IO PAN, Poland

Artur Palacz
Officer
IO PAN, Poland

IOCCP is constantly evolving within its ToRs,
to meet the **needs of the ocean observing community**
for **carbon and biogeochemistry**.

IOCCP adapt the structure of its Panel to **pursue new activities**
according to future directions set by the IOCCP SSG
and based on inputs from **a wide range of stakeholders**.

Institute of Oceanology of Polish Academy of Sciences, ul. Powstańców Warszawy 55, 81-712 Sopot, Poland
Phone: +48 58 731 16 10 / Fax: +48 58 551 21 30, **www.ioccp.org**

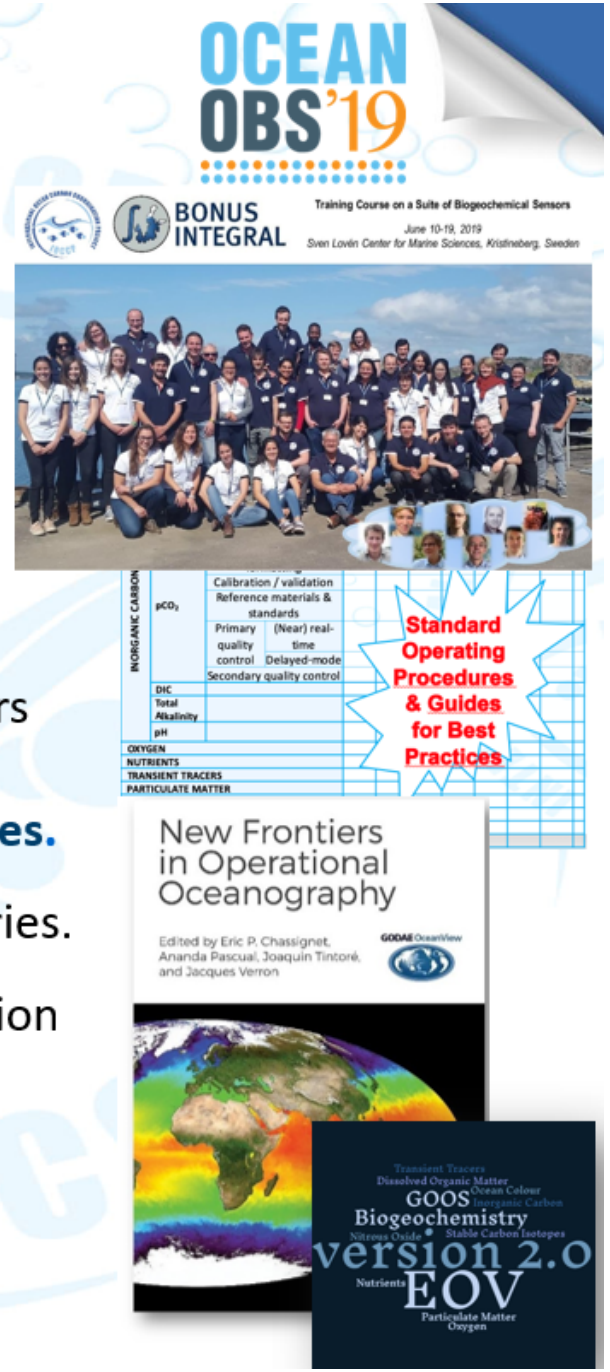
Biogeochemistry Panel

IOCCP accomplishments (after September 2019)

- Development of **the Marine BGC Global Data Assembly Centre (GDAC)**
  - GDAC partners (NOAA PMEL and BCDC at the U. Bergen) signed a Memorandum of Understanding and applied to become IODE Associated Data Units.
- Progress towards the **Ocean Oxygen Data Portal** for oxygen decline from all relevant observing platforms – scoping and design
  - Joint effort by IOCCP, GO2NE, IOC, NOAA NCEI & GLODAP. IOCCP engaged in building the framework in terms of aims, end users, structure, funding sources, community coordination, etc.
  - Scoping workshop in Sopot, Poland, on 11-13 November 2019; paper in submission; 2nd workshop on-line in 5-6 November 2020.
- **WG on Integrated Ocean Carbon Research (IOC-R)**
  - Co-convened by the IOC, IOCCP/GOOS BGC, SOLAS, IMBeR, WCRP-CLIVAR and GCP. IOCCP played a central role for coordination and implementation.
  - **"Summary of Ocean Carbon Research, and Vision of Coordinated Ocean Carbon Research and Observations for the Next Decade"** - a white paper contributing to the science plan of the UN Decade of Ocean Science and bridging between science and policy to be open soon.

IOCCP short- to medium-term (1-3 years) future focii

- Expand coordination to raise the readiness level for **Particulate Matter EOVs** in addition to other EOVs (E. Boss).
- Strengthen the ***in situ* measurements & modelling interface** recognizing biogeochemistry is a new frontier in operational oceanography (F. Chai).
- Strenghten the ***in situ* & remote sensing interface** for biogeochemical and related biological EOVs and phenomena (E. Boss and F. Chai).
- Strengthen the link between **BGC instrument and sensor** providers, developers and users combined with **technical capacity development** (a unique niche occupied by IOCCP), accompanied by continuous development of **Best Practices.**
- Develop **data synthesis products** around Oxygen EOV and ship-based time series.
- Develop **Online Data Quality Control Packages**, starting with Ocean Acidification as critical element of technical training for the use of BGC sensors.
- Greater focus on **the coastal ocean observing system** for applications broadly categorized as operational services and ocean health.



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IOCCP-SSG-14 was held in Sopot, Poland, 13-15 November 2019

Report available from:
http://www.ioccp.org/images/D3meetingReports/IOCCP-SSG-14-report_FINAL.pdf

IOCCP-SSG-15 to be held on-line on 17-19 November 2020.

Thank you!

International Council for Science
SCOR
Scientific Committee on Oceanic Research

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT
IOCCP

The Global Ocean Observing System
GOOS

UNESCO
United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

Institute of Oceanology of Polish Academy of Sciences, ul. Powstańców Warszawy 55, 81-712 Sopot, Poland
Phone: +48 58 731 16 10 / Fax: +48 58 551 21 30, **www.ioccp.org**

GOOS Biogeochemistry Panel

Presenter:
Eileen Hofmann

The Southern Ocean Observing System

2019-2020 Milestones and looking forward

Louise Newman: SOOS Executive Officer
Eileen Hofmann: Co-Chair SOOS

SOOS Highlights

IPO Funding Partnership

3-year Hosting Agreement in Hobart,

Australia

UNIVERSITY of TASMANIA

IMAS INSTITUTE FOR MARINE & ANTARCTIC STUDIES

Tasmanian Government

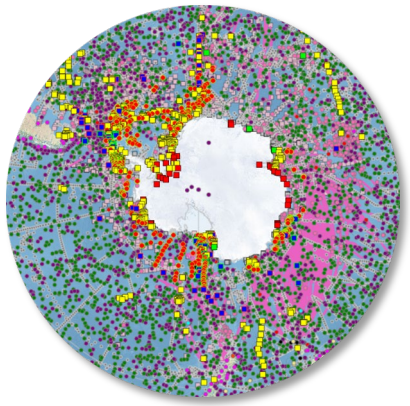
CSIRO

STATE OCEANIC ADMINISTRATION

Antarctica New Zealand

SWEDISH POLAR RESEARCH SECRETARIAT

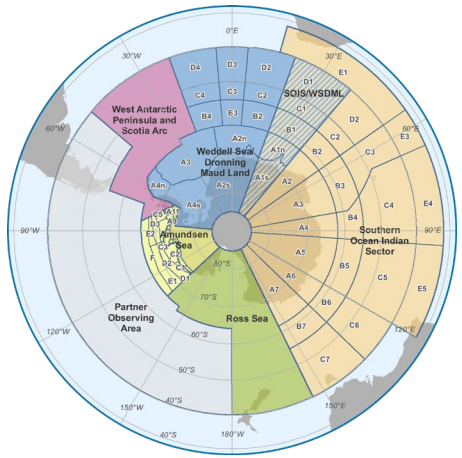
SOOS map



EMODnet

European Marine Observation and Data Network

EUROPEAN POLAR BOARD



WGs, Task Teams

Capability Groups

Virtual Networks

Risk Register

IPO funding post 2022

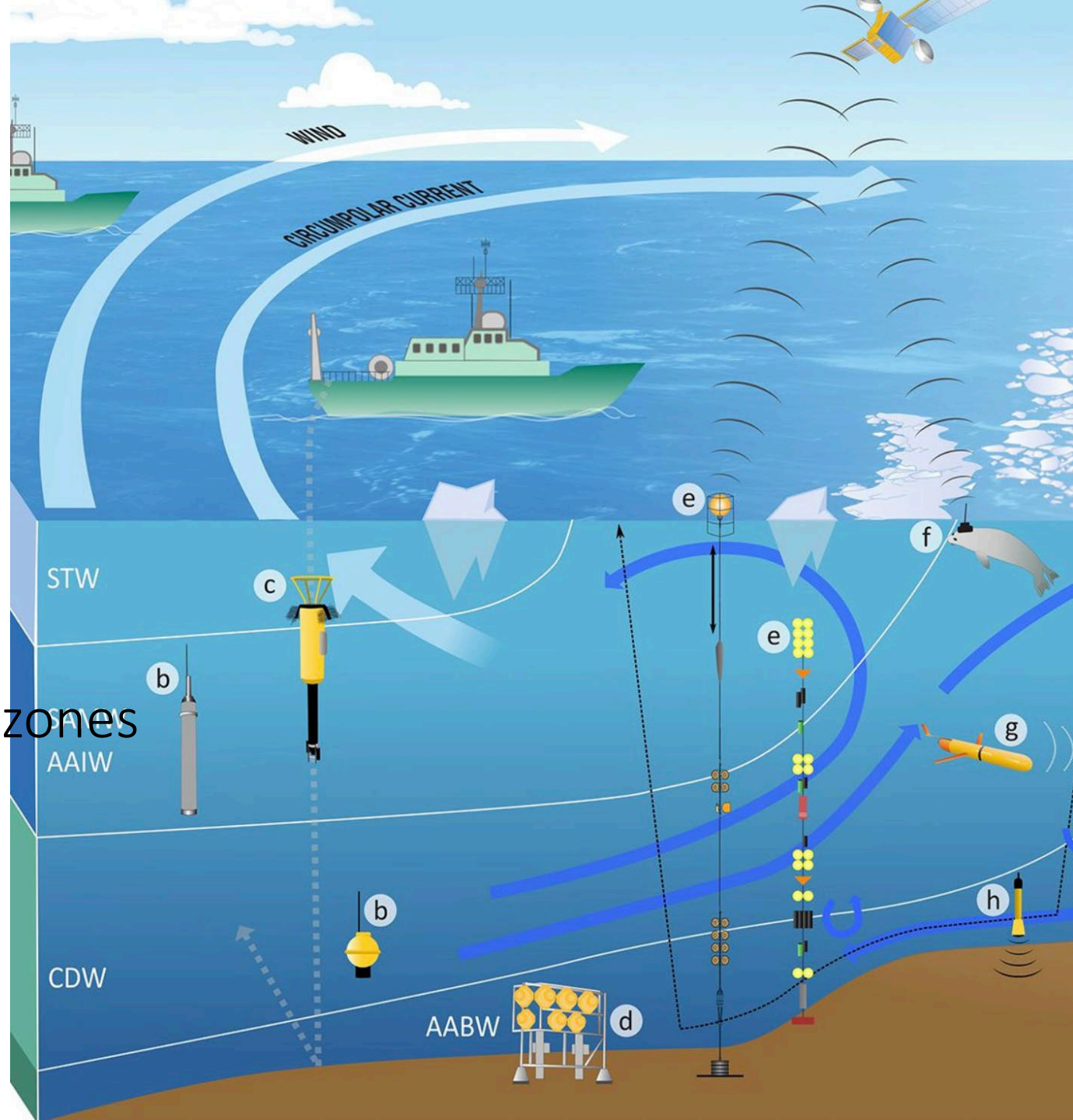
Reduced field work

Virtual SSC Meeting

4 x 3 hour meetings – 1 topic/meeting

Each held twice – across time zones

SOOS and Risks



Going Forward

- **New 5-year Science and Implementation Plan (2021-2025)**
  - Current implementation plan ends 2020; Science Plan 10 years old
  - Drafting new SIP is underway
- **UN Decade of Ocean Science for Sustainable Development**
  - Co-convened SO regional workshop (February 20220)
  - Community input to Implementation Plan
  - Partner in BELSPO proposal for workshop joint with annual Polar Data Forum Workshop to develop SO contribution to UN Decade (pending)
  - Participant in webinars/meetings

www.soos.aq newman@soos.aq

Report on activities of the SCOR/IAPWS/IAPSO Joint Committee on the Properties of Seawater (JCS)

Rich Pawlowicz
Chair, JCS
University of British Columbia
Vancouver, Canada

Presenter:
Rick Pawlowicz

Purpose of JCS

- JCS is meant to act as:
  - an “international point of contact” for seawater-related questions
  - a permanent source of expertise on seawater issues for “parent” organizations
  - the maintainers of seawater-related software and standards for the scientific community (especially for **TEOS-10**)
  - a conduit for cooperation with other scientific/technical organizations, e.g., BIPM, WMO, IUPAC
- JCS supports and promotes research activities related to the properties of seawater (field, lab, numerical)
- JCS may, from time to time, summarize knowledge and suggest gaps

JCS Structure (2020)

- **Executive**
  - Chair: R. Pawlowicz, Vice Chairs: R. Feistel, S. Seitz
- **Taskgroups:**
  - **Salinity/Density**
    - Chair: (Pawlowicz), (Seitz), H. Uchida, F. Millero, S. Weinreben, Y. Pang, R. Woosley, Y. Kayukawa
    - *Links to BIPM/CCQM-EAWG*
  - **pH**
    - Chair: A. Dickson, M.F. Camoes, D. Stoica, S. Clegg, F. Bastkowski
    - *Links to SCOR WG 145*
  - **Moist Air**
    - Chair: O. Hellmuth, J. Lovell-Smith, (Feistel). S. Bell
    - *Links to BIPM/CCT-WG-Humidity*
- **Expert Subgroups**
  - **Thermodynamics** (Feistel)
  - **Numerical modelling and applications** T. McDougall
  - **Software** P. Barker
  - **Industry** B. Laky/Anton Paar, R. Williams/OSIL

(21 members: Canada/US, Germany/Portugal/France/ UK/Austria, Australia/NZ, China/Japan)

TEOS-10 related activities: Web site www.teos-10.org

Unique downloads:	June 2011 June 2013	June 2013 June 2014	June 2014 June 2015	June 2015 June 2016	June 2016 June 2017	June 2017 June 2018	June 2018- Apr 2019	May 2019- May 2020
Manual	920	360	535	552	418	427	349	472
"Getting Started"	879	362	558	547	427	475	349	444
Slides	704	284	374	318	219	248	204	272
Primer	584	197	289	297	222	217	187	253
Lecture Notes								22
Thermo Overview								24
GSW MATLAB	1920	1102	1485	1814	1235	1552	1233	1556
GSW FORTRAN	366	222	171	162	127	116	82	98
GSW C	202	84	133	151	85	96	59	81
GSW PHP	-	55	61	43	29	60	28	52
SIA VB	72	100	46	45	45	48	43	47
SIA FORTRAN	59	118	58	44	36	42	37	42

- 73311 "unique user views" since Oct 2010 (9007 in past year)
- 350-1300 views per month

In 2018, JCS held a number of workshops at the 17th International Conference on the Properties of Water and Steam (ICPWS 17; Prague, Czech Republic) **:**

As a result of these workshops, JCS recommended to SCOR, IAPSO, and IAPWS that:

- JCS continue as an organization sponsored by these organizations
- JCS Terms of reference remain unchanged for the next cycle,
- Membership of the various JCS taskgroups, which are largely independent of one another, should be increased slightly to assist them in their work, by including a number of scientists who are currently contributing to the tasks of JCS. Taskgroup chairs are also appointed.

…these recommendations were accepted

A series of technical goals was developed to guide taskgroup activities over the next few years.

Recent papers

W. Ebeling, R. Feistel and M. F. Camões: Trends in statistical calculations of individual ionic activity coefficients of aqueous electrolytes and seawater. Trends in Physical Chemistry (in press)

2) R. Feistel, O.Hellmuth: Zur Rolle des Wassers in der Energiebilanz des Klimasystems [On the role of water in the energy balance of the climate system] Sitzungsberichte der Leibniz−Sozietät Berlin (in press)O. Hellmuth, J. W. P. Schmelzer and R. Feistel: Ice−Crystal Nucleation in Water: Thermodynamic Driving Force and Surface Tension. Part I: Theoretical Foundation, Entropy 2020, 22, 50; doi:10.3390/e22010050

4) S. Weinreben, R. Feistel: Anomalous salinity−density relations of seawater in the eastern central Atlantic, Deep–Sea Research I 154 (2019) 103160, https://doi.org/10.1016/j.dsr.2019.103160

5) H. Uchida, Y. Kayukawa and Y. Maeda, Ultra high−resolution seawater density sensor based on a refractive index measurements using the spectroscopic interference method, Scientific Reports, 9 15483 (2019), https://doi.org/10.1038/s41598−019−52020−z

6) H. Uchida, T. Kawano, T. Nakano, M. Wakita, T. Tanaka, and S. Tanihara, An expanded batch−to− batch correction for IAPSO standard seawater. *J. Atmos. Oceanic Technol.*, doi: https://doi.org/10.1175/JTECH−D−19−0184.1.

7) Barker, P. M. and T. J. McDougall, 2020: Two Interpolation Methods using Multiply−Rotated Piecewise Cubic Hermite Interpolating Polynomials. *Journal of Atmospheric and Oceanic Technology,* **37**, 605−619. http://dx.doi.org/10.1175/JTECH−D−19−0211.1

Q&A

COBS – Changing ocean on biota

GlobalHAB – Harmful Algal Blooms

IOCCP – Ocean carbon

SOOS – Southern Ocean observing

JCS – Joint Committee on Seawater

Wrap up for the day