Introduction to Oceanographic Survey Techniques and Data Management (BLENDED)

A training report by Gabriel Akoko Juma & Anabel von Jackowski

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Acknowledgement

Funding agencies

Collaborating partners

1. Introduction

Global change requires studying the ocean in more detail and at longer and larger scales. Capacity development and training on standard survey techniques and simple sensors have been identified as tools to enhance ocean observation. This specialized course served as an introduction to oceanographic survey techniques and data processing. It was designed for Early Career Ocean Professionals (ECOPs), students, and other oceanographers at the postgraduate level who intend to pursue oceanography and marine sciences further. Relevant oceanographic (physical, chemical, and biological) datasets were obtained and used during the training, making it easy to relate, understand, and apply.

By enhancing the technical capabilities of participants, the course contributed to several key Ocean Decade challenges, particularly:

- Challenge 7: Sustainably expand the Global Ocean Observing System. By training on oceanographic survey techniques, we promote sustainable ocean observation and deliver accessible and timely data.
- Challenge 9: Skills, knowledge, technology, and participation for all. Through the training, ECOPs were equipped with the necessary knowledge and techniques to access ocean data, information, and technology for application in ocean management and conservation.
- Challenge 10: Restore society's relationship with the ocean. The training aimed at strengthening meaningful society-ocean connections and driving increased capabilities, opportunities and motivation among ECOPs to understand the various oceanographic facets and make decisions that promote ocean health.

Participants' demographics

Target region
The course targeted ECOPs from the Mediterranean region, that is, **Southern Europe,** including Albania, Bosnia and Herzegovina, Croatia, France, Greece, Italy, Malta, Monaco, Montenegro, Slovenia, and Spain; **Northern Africa,** including Algeria, Egypt, Libya, Morocco and Tunisia, and **Western Middle East** including Syria Cyprus, Israel, Lebanon, and Turkey. Additionally, we targeted ECOPs pursuing their undergraduate or graduate degrees up to a Masters degree and intending to pursue a PhD.

Applicants' demographics
The application time frame for the BlueCaD training was only open for three days. In those three days, we received 98 applications. Of the 98 applications, 58% identified as female and 42% as male. Furthermore, 38% were from the Southern European region, 38% were from the Northern African region, 4% were from the Western Middle East region, and 18% were from other regions. Of the 80 applications from the targeted regions, 19% had a Bachelor's degree, 63% had a Master's degree, and 16% had a PhD degree, while 1% indicated "other" as they were finishing an engineering degree.

We aimed to select participants from all countries with a focus on the Master's level, resulting in 17 students who attended and completed the online and in-person training. Of the

participants, 53% identified as female and 47% identified as male, of which 47% were from the Southern European region, 41% were from the Western Middle East region, and 12% were from the Western Middle East region. Furthermore, 29% of participants had a Bachelor's degree and were pursuing a Master's degree, and 71% had completed the Master's degree possibly intending to pursue a PhD degree.

2.   Course outline and learning outcomes

The course was divided into four modules, each designed to chronologically and progressively build participants' skills on the subject. The training started with an introduction to oceanographic parameters and field sampling techniques, followed by data visualization and analysis in R. The third module introduced the basics of scientific writing, while the fourth module explored the basics of scientific communication and stakeholder engagement. Each module is explained in more detail in the following sections.

Module 1: Introduction to coastal oceanographic parameters and field sampling techniques

Overview
This module introduced learners to different oceanographic parameters and how they interact. Parameters such as temperature, salinity, turbidity, density, depth, dissolved oxygen, and chlorophyll were discussed. Understanding these coastal oceanographic variables was essential in understanding their sampling techniques for monitoring and managing coastal ecosystems. Their influence on water quality, marine life, coastal habitats, and environmental health was also discussed.

Learning Outcomes
By the end of the lesson, the learners were able to:

1. Identify key coastal oceanographic parameters - Describe essential parameters like temperature, salinity, turbidity, depth, dissolved oxygen, and chlorophyll, and explain why they are essential in coastal studies.
2. Understand field sampling techniques - Familiarize with the methods and tools used to measure the parameters in a coastal environment, such as CTD devices, turbidity meters, and oxygen sensors.
3. Prepare land and cruise expedition checklists - Develop data collection sheets, safety information sheets, and other logistical planning for field sampling.
4. Understand the challenges of coastal fieldwork - Recognize potential challenges in field sampling, such as changing environmental conditions, equipment limitations, and data variability, and understand how this affect data reliability.

Module 2: Data visualization and management

<u>Overview</u>
In this module, the participants were taken through data visualization and analysis. The learners were first introduced to the R programming language and software environment (RStudio) for data exploration, cleaning, organizing, analysis, and visualization. A relevant oceanographic dataset (OBIS data) containing various physical, chemical, and biological parameters was used in the training, making it easy to relate, understand, and apply the lessons.

Learning outcomes
By the end of the module, the learners were able to:
1. Get an introduction to the R and R environment - Install and set the R and RStudio environment, install the important packages, and understand the R environment
2. Upload data into R from different sources using different formats that are readable in R
3. Explore data in R - Use essential R packages, including *tidyverse* and *dplyr* to understand vectors, matrices, factors, lists, and data frames and sort data accordingly in R.
4. Visualize data in R software using the ggplot package - Learned how to build different plots with ggplot2 and apply different geoms. Students also learned how to add labels, facet, arrange, customize, save, and export different types of R plots.
5. Conduct Simple analysis using R - In this lesson, the learners were taught to conduct normality tests on data, choose different significance tests, perform data transformations, and report results. The tests included univariate and multivariate statistics.
6. Arrange, store, and share data in repositories.

Module 3: Basics of scientific writing

<u>Overview</u>
This module provided guidance on standards and tools for scientific writing. The students were introduced to the standard guidelines for manuscripts and thesis writing, graphical concepts, principles, and general scientific writing tips. The module highlighted good scientific practices, including "How to avoid plagiarism." The students were also presented with hypothetical environmental problems and were tasked to develop ideas and research funding proposals in which they explained how their research projects would tackle the problems.

Figure 1: Learning session for Module 3 in Malta. Photo Credit: ABT

Learning outcomes

By the end of the module, the learners were able to:
- Acquire knowledge of the structure and general guidelines for writing a manuscript or thesis
- Acquire knowledge on tips for scientific writing and best practices
- Define research aims (objectives) and questions
- Familiarize with graphic concepts and principles

Module 4. Stakeholder engagement in Ocean Science-Ocean policy-making based on science

In this module, the learners were taken through the basics of ocean governance. The module highlighted the basics of policy-making and how to achieve good governance supported by optimum policy and decision-making based on sound information and science.

Learning outcomes

By the end of the module, the learners were able to:
- Define governance
- Understand the ocean policy-making process, its scope, and importance
- Understand and develop a toolkit for stakeholder engagement and good governance
- Understand the challenges in ocean governance

3.   Course feedback

Fourteen participants provided feedback on the course, focusing on four key areas: the clarity of objectives and outcomes, the information available on the course platform, the quality of the course content, and the performance of the facilitators and instructors.

a.   Course objectives and time

Most respondents (64%) agreed that the learning outcomes were clearly stated, measurable and were appropriate to the level of the target audience. They also agreed that the course covered the announced content, especially the R and R Studio modules (Fig. 2).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The learning outcomes are clearly stated, measurable and are appropriate to the level of the target audience	4	9	1	0	0
Expectations for student learning were clearly defined	6	5	1	1	1
The course covered the content announced/expected	8	3	1	2	0
I achieved the course stated aims and objectives	8	5	1	0	0

Figure 2: Participant's feedback on the course objectives and timeline

b.   Course platform, resources and materials

The participants were generally satisfied with the arrangement of the course content in the OTGA platform. They also noted the chronological order, and the consistency of the display (Fig. 3). However, a few of the participants felt that the platform was a bit complicated, given that some figures were not accessible, and that some sections did not show "completed" even after going through all the contents.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The course platform is well-organized and easy to navigate	5	5	3	1	0
All course pages are readable and visually consistent	5	7	1	1	0
All course pages are functionally consistent and communicate course information clearly and in sequential order throughout the course	5	7	1	1	0

Figure 3: Participants' feedback on course platform, materials and resources

c. Course content

The course participants noted that the files and software used during the course were compatible with multiple operating systems and required standard and easily downloadable plug-ins. They also appreciated the additional time taken by the facilitators to help, in case of technical problems (Fig 4).

They also appreciated the idea that there were assignments to help evaluate learners' understanding. However, they indicated that more time should be allocated for the assignment to reduce time pressure.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Multimedia files are clear, adequate, compatible with multiple operating systems and requires only a free, standard, and easily downloadable plug-in	6	7	0	1	0
The course content is appropriate to the goals of the course	6	6	1	0	1
The learning activities helped me achieve the stated learning outcomes	7	5	2	0	0
The relationship between completing learning activities and meeting the learning outcomes was clearly explained	6	5	2	1	0
During this course, I was often engaged in learning activities such as discussion forums, wikis, chat, projects, group work, etc	11	3	0	0	0

Figure 4: Participants' feedback on course content

d. Course facilitators and instructors

Participants appreciated the response from the facilitators regarding their questions. They also appreciated the additional support from the teachers to enhance their understanding and address technical problems (Fig 5). Other resources such as the course discussion forum, WhatsApp and additional zoom links created by the facilitators enhanced course delivery.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	Very good	Good	Neutral	Poor	Very Poor
The course facilitators provided effective guidance and feedback	9	4	1	0	0
During this course, I had the opportunity to interact with the instructor as often as needed	8	5	1	0	0
During this course, I had the opportunity to interact with other learners	12	2	0	0	0
How do you rate the response from the course facilitators to your questions or issues raised?	7	5	2	0	0
How do you rate the response from the OTGA Secretariat to your questions or issues raised regarding the use of the Ocean?	9	3	1	0	0

Figure 5: Summary of participants' feedback on course facilitators and instructors

e. Overall comments from the participants about the course

In addition to feedback on specific aspects of the course, the learners also shared open comments on their overall experience and the key benefits they gained. Additionally, they provided some recommendations to improve the course. Below are some of the responses shared by the participants:

Q1. What 2-3 things did you find most useful or valuable for learning?

"Data Visualization: It helps in simplifying complex data, making it easier to interpret and communicate insights effectively."
"Intercultural and multilingual learning, building connections with people from the same or similar professional fields, and improving knowledge about R."
"The communication, skills and knowledge of the organizers enabled me to improve and create a solid foundation. "

Q2. What 2-3 suggestions do you think would make this course a better learning experience?

"I would personally do the lesson on policy and stakeholder either online or at the beginning of the in-presence session"
"A bit more time between lectures and tasks in general would be appreciated, as well as some kind of cultural experience (like an organized trip, dinner, or similar) to better explore the country

we are staying in. We didn't have much time to explore Malta, especially considering the course was held in winter, when it gets dark early. With lectures throughout the whole day and assignments, there was little opportunity for sightseeing."

"- define earlier the group project "

"Slower steep curve for people who don't know or have limited knowledge of R. Maybe instead of having written the script in the platform, upload a video where a deeper explanation can be given (suggested length 15-30m not more)"

Q3. How do you plan to apply what you've learned during the training in your work or studies?

"I plan to apply what I've learned during the training in my work and studies by improving my scientific writing, particularly in the statistical analysis and data visualization aspects. This will help me present data more effectively and support my research with clearer, well-structured insights."

"The training on Introduction to Oceanographic Survey Techniques and Data Management has equipped me with valuable technical knowledge that I plan to integrate into my current work and academic pursuits."

"The training improved my knowledge of R and statistics, which will be very useful for my Master's thesis and my professional career in general."

"For me, personally, the course was too basic and so I already known everything explained"

4. Training Schedule

Module	Date	Lesson	Activity/Topic	Time
			Online sessions	
Module 1			**- Field sampling techniques for basic coastal oceanographic parameters**	
	04.11.24	Lesson 1	**Gabriel Akoko Juma and Anabel von Jackowski	BlueCaD Coordinators** - Introduction and housekeeping	17:00-17:10
			**Gabriel Akoko Juma	BlueCaD Coordinator** - Introduction to oceanographic parameters: Temperature, salinity, turbidity	17:10-17:55

			- Break	17:55-18:05
			Gabriel Akoko Juma | BlueCaD Coordinator - Other oceanographic parameters: Depth, oxygen, chlorophyll	18:05-19:00
	05.11.24	Lesson 2	**Anabel von Jackowski | BlueCaD Coordinator** - Preparing a fieldwork checklist - Safety measures during fieldwork	17:00-17:55
			- Break	17:55-18:05
Module 2			**- Data visualisation in R and data management**	
	05.11.24	Lesson 1	**Anabel von Jackowski | BlueCaD Coordinator** - Installing R and R Studio - Introduction to R Environment	18:05-19:00
	06.11.24	Lesson 1 cont.	**Anabel von Jackowski | BlueCaD Coordinator** - Installing and exploring essential packages in R (ggplot, Tidyverse, dplyr, etc) - Importing and exploring data in R	17:00-18:00
			- Break	18:00-18:10
		Lesson 2	**Anabel von Jackowski | BlueCaD Coordinator** - plotting with ggplot2 - Building plots, themes, customisation	18:10-19:00
Module 3			**- Basics of scientific writing**	

	07.11.24	Lesson 1	- Language and structure - Graphics and visuals	17:00-18:10
			- Break	18:00-18:20
			- Overall Q & A - Preparation for travel and logistics	18:20-19:00

On-site sessions

Module 1 cont.			**- Field sampling techniques**	
	11.11.24	Lesson 3	**Dr. Simona Paolacci | Head of RDI department** - Official Welcome and Overview of AquaBioTech Group and R&D&I activities	10:00 -10:15
			Ines Boujmil | AquaBioTech - ECOP Programme – empowering future young leaders	10:15 -10:30
			Dr. Alfonso Siciliano | AquaBioTech - Fisheries summary of activities at AquaBioTech	10:30 – 10:45
			Alberto M. Monteleone | Head of Human Resources - Career and Internship opportunities offered at AquaBioTech Group	10:45 – 10:50
			Anabel von Jackowski | BlueCaD Coordinator - Introduction and setting environment - Defining research questions and sampling techniques	10:50-12:30

			- Lunch	12:30-14:00
			Anabel von Jackowski | BlueCaD Coordinator - Assembling and calibrating fieldwork equipment - Revising sampling protocols, establishing groups and preparing data sheets	14:00-15:45
			- Coffee Break	15:45-16:05
			- Facility Tour (Labs Level 2, Wet Labs Level	16:05-16:20
	12.11.24	**Lesson 4**	**Anabel von Jackowski | BlueCaD Coordinator** - Assembling and calibrating fieldwork equipment **Justin Galea & Francisco Suarez | AquaBioTech** - AquaTroll 500 sonde deployment in ABT's tanks	10:30 – 11:30 11:30 – 12:30
			- Lunch	12:30-14:00
Module 2 cont.			**- Data visualisation in R and data management**	
	12.11.24	**Lesson 3**	**Anabel von Jackowski | BlueCaD Coordinator** - Data retrieval and data entry - Data visualisation in R software using ggplot2 continued.	14:00-17:00
	13.11.24	**Lesson 4**	**Anabel von Jackowski | BlueCaD Coordinator** - Testing assumptions for statistical analysis - Simple analysis in R	9:30 -12:30

			- Lunch	12:30-14:00
Module 3 cont.			**- Basics of scientific writing**	
	13.11.24	**Lesson 2**	**Daniel Depellegrin | IHCantabria** - Citations and referencing - Plagiarism	14:00-17:00
Module 4			**- Basics of science communication and outreach**	
	14.11.24	**Lesson 1**	**Cosmin Chivu | IOI** - Language and sentence structure in science communication - PowerPoint Presentation	9:00 -12:30
			- Lunch	12:30-14:00
		Lesson 2	**Cosmin Chivu | IOI** - Visuals for infographics - Policy briefs	14:00-17:00
	15.11.24		**Gabriel Akoko Juma and Anabel von Jackowski | BlueCaD Coordinators** - Group and individual presentations - Course wrap-up	9:00 -13:00
Departure	**16.11.24**		Departure	

5.   Course organizers and lecturers

Gabriel Akoko Juma and Anabel von Jackowski designed the training. The modules were taught by Gabriel Akoko Juma, Anabel von Jackowski, Daniel Depellegrin, and Cosmin Chivu, with pedagogical support from the OTGA Secretariat. Ines Boujmil provided additional moderation support throughout the course. Below are brief bios of all contributors.

Gabriel Akoko Juma *Coordinator*: Blue CaD Project	Bio: Gabriel is a Doctoral Researcher at the Coastal Ecology Department of Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (Germany). He holds a Postgraduate Diploma in Oceanography from Alfred Wegener Institute and an MSc & BSc in Environmental Science from Chuka University (Kenya). Role: ● Development of course concept and work plan ● Uploading & review of training materials on OGTA Platform ● Teaching module 1 ● Evaluation and grading ● Report writing ● Course coordinator

Dr. Anabel von Jackowski *Coordinator*: Blue CaD Project ECOP Germany, Austria, and Switzerland National Node Coordinator	Bio: Anabel is a Postdoctoral Researcher at the Department of Environmental Science of Stockholm University. She obtained her PhD degree from the Christian Albrecht University of Kiel and GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany), MSc in Marine Microbiology at the University of Bremen and Max Plack Institute for Marine Microbiology (Germany), and BSc in Marine Science at Hawaii Pacific University (USA). Role: ● Developing, uploading & review of modules on the OGTA Platform ● Teaching modules 1 and 2 ● Evaluation and grading ● Report writing ● Course coordinator
OTGA Secretariat	Bio: Ocean Teacher Global Academy (OTGA) delivers customised training for ocean experts and professionals to increase national and regional capacity in coastal and marine sciences, services, and management. Role: ● Hosting of an e-learning platform ● Financial support for in-person training. ● Provision of pedagogical support ● Provision of administrative support

Dr. Daniel Depellegrin *Guest Instructor*: Blue CaD Project	Bio: Daniel Depellegrin is an international expert who applies science to Maritime Spatial Planning, Blue Economy and Marine Socio-Ecological Systems Analysis and a lecturer in scientific writing and research methods. He is a former Marie-Curie Post-Doctoral Research Fellow in the Project Blue-Paths at the University of Girona (Spain) and Ramon y Cajal Fellow/Senior Researcher at IHCantabria - Instituto de Hidráulica Ambiental (Santander, Spain). Role: ● Development of training materials ● Teaching module 3 ● Evaluation of assignments and grading
Cosmin Chivu *Guest Instructor*: Blue CaD Project	Bio: Cosmin Chivu graduated with a BA in International Relations (with Honours) and an MA in Ocean Governance from the University of Malta. Since 2018, Cosmin has been working with the International Ocean Institute as a Project Officer to conduct day-to-day project planning and coordination across the global network of IOI Centres and Focal Points. Cosmin also actively implements and coordinates practical exercises and lectures on Sustainability and Ocean Policy for IOI's Ocean Governance capacity-building programmes. Role: ● Development of training materials ● Teaching module 4 ● Module evaluation and grading

Bio: Inès Boujmil is a Fisheries and environmental Engineer and holds a Master of Science in Geomatics applied to Operational Oceanography. She is the R&D&I project coordinator at AquaBioTech Group, which operates in marine pollution, digital technologies, and blue cultural heritage excellence Hubs projects.

Inès worked previously on modelling plastic accumulation areas at the National Institute of Marine Sciences and Technologies (INSTM) in Tunisia.

She is part of the SciNMEET programme as an expert in the Task Team "Knowledge Transfer and Capacity Building".

Role:

- Moderating online sessions
- Coordinating data collection training by ABT marine experts
- Logistical support during on-site sessions
- Coordinating the outreach and dissemination of video produced by ABT

Ines Boujmil

On-site Host: Blue CaD Project

ECOP North Africa - Mediterranean Sub-regional Node coordinator within ECOP Programme Africa node