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Case Studies of COVID-19 Pandemic Affecting Early-Career Scientists' Mobility within the Mediterranean Blue Economy Sector

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The COVID-19 pandemic has profoundly impacted scientific international mobility, particularly for early-career scientists (ECSS). This paper aims to provide a comprehensive analysis of the challenges faced

by ECSS in the Mediterranean region during the pandemic, specifically focusing on scientific mobility. Additionally, the study will explore the implications of the pandemic on the career trajectories of ECSS and the long-term effects on scientific research and academia in the Mediterranean. We incorporate individual experiences of three researchers, providing first-hand insights into the challenges and impacts of the COVID-19 pandemic. These personal experiences which will enrich the paper by offering a nuanced understanding of the practical implications and emotional aspects associated with the discussed issues.

[88]

Key Words: scientific mobility, early-career scientists, Mediterranean region, blue economy, COVID-19 pandemic

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GRAPHICAL ABSTRACT



INTRODUCTION

Early career scientists (ECSS) are researchers who are in the initial stages of their professional careers after completing their formal education, such as undergraduate or graduate studies (ECNP n.d.). ECSS are often characterised by their relatively limited experience in their field compared to more established scientists, and they may still be working towards establishing themselves, building their research portfolio, and developing their expertise (Papin, Keim-Malpass, and Syed 2015).

The COVID-19 pandemic (COVID) had far-reaching effects on various research fields worldwide (Korbel and Stegle 2020; Aziz et al. 2021; Squazzoni et al. 2021; Lobe, Morgan, and Hoffman 2020). The blue economy, a sector encompassing sustainable marine and maritime practices and economic activities, has been significantly impacted

by the pandemic, leading to disruptions in scientific mobility and research activities, especially in the Mediterranean (European Commission 2021). The Mediterranean region is a hub for interdisciplinary research, and attracts scholars, scientists, and researchers from diverse fields and other geographic locations (European Commission n.d.a). [89]
During COVID, the mobility of researchers, especially ECSS, faced unprecedented challenges due to widespread travel restrictions and safety concerns (Zabaniotou 2021). International collaborations were hindered as ECSS encountered barriers to travelling abroad for attending conferences, fieldwork, collaborative projects, and other research opportunities (Falk and Hagsten 2020). ECSS had to adapt to remote work and virtual collaboration tools, which, while enabling some level of continued scientific activity, presented communication and productivity challenges. Despite these obstacles, the pandemic prompted innovative solutions, such as virtual conferences and remote data collection methods, fostering new modes of scientific collaboration and knowledge exchange, arrangements that have persisted and remain in place today.

This paper aims to provide an analysis of shared challenges that ECSS face during mobility and to highlight the tools that can be crucial to improving any reduced mobility situation. Scientific mobility is essential for disseminating scientific knowledge, making informed decisions in science management, and training qualified personnel (Ackers 2005; Gureyev et al. 2020). It is a form of cultural exchange hence bringing academic communities closer through collaboration.

We discuss the adaptation strategies that ECSS used during COVID and the resulting impact on scientific collaborations and knowledge dissemination. By examining the shifts in research activity patterns during the pandemic, we seek to elucidate the evolving landscape of scientific mobility in the blue economy sector in the Mediterranean. Analysing the impact of circulation of highly skilled scientists and researchers and the corresponding knowledge transfer within the European Research Area requires understanding the direction of the flows and the nature of scientists' movement.

EARLY-CAREER SCIENTISTS' INTERNATIONAL MOBILITY DURING COVID AND MAIN RELATED ISSUES

International scientific mobility refers to the movement of researchers, students, and professionals across borders to engage in scientific activ-

ities such as research collaboration, training, and conferences (Ackers 2005). It is driven by the desire to access expertise and resources not readily available in one's home country (Aman 2020). ECS design their career path by joining selected research groups to acquire specialised
[90] knowledge or by conducting studies contingent on access to instruments or research infrastructures or in areas that feature unique natural, cultural, and historical attributes (e.g., biodiversity hotspots, geological formations). Scientific mobility may involve short-term visits, long-term stays, or relocation to another country or institution.

The policy briefing *New Concepts of Researcher Mobility* (European Science Foundation 2013) distinguishes among four types of mobility:

- Physical international mobility among countries denotes the cross-border movement of individuals for travel, work, study, or relocation.
- Intersectoral mobility across academia, industry, and public sectors includes the dynamic movement of individuals between academia, industry, and public sectors, facilitating employment opportunities and knowledge exchange initiatives.
- Interdisciplinary mobility is characterised by the movement of individuals across disciplinary boundaries.
- Virtual mobility acknowledges the collaborative nature of research facilitated by digital communication technologies.

In Europe, the mobility of ECSS for research purposes increased significantly before the start of the pandemic in 2020 (Lambert and Merriman 2020; Skakni 2018; Yang 2020). The impact of the pandemic on research productivity, the job market, and funding has been a cause for concern for ECSS (Termini and Traver 2020). The closure of universities and laboratories at the beginning of the pandemic has halted most of the research not directly focused on COVID, leading to a substantial and long-lasting impact on the productivity of the scientific workforce worldwide (Subramanya, Lama, and Acharya 2020; Riccaboni and Verginer 2022). A study by the National Institutes of Health (2020) found that 63% of early career investigators anticipated a negative impact on their career trajectory at a higher proportion than contributed to mobility of senior-career investigators.

Thus, ECSS' ability to travel internationally has been dramatically hampered by the COVID pandemic, which, through lockdowns, quarantines, and social isolation, has impacted their career development

plans, networking opportunities, and chances for international cooperation (Harrop et al. 2021). The mobility restrictions that hampered access to laboratories, especially impacted sea and maritime specialised infrastructures and fieldwork (Korbel and Stegle 2020; Termini and Traver 2020). Korbel and Stegle's (2020) survey confirmed that twenty-five percent of respondents reported losing from 1 to 6 months of work due to laboratory shutdown (wet lab – 73%, and dry lab – 31%). ECS had to adapt to working remotely, exploiting online forums and meeting platforms that became the only space to share ideas (Lopez-Leon, Forero, and Ruiz-Díaz 2020; Mendrika et al. 2021). Results from online surveys sent to 704 academics indicated that working at the office boosts brainstorming ideas with colleagues (Aczel et al. 2021). Yang (2020) argued that information processing workers undergoing social distancing at a technology company experienced a decrease in the number of connections among different working groups in the same firm and a negative impact on the spread of information among workers. According to Harrop et al. (2021), 149 out of 150 ECSS stated that the pandemic had a detrimental effect on their study and 85% of ECSS reported low productivity. In addition, at the beginning of the lockdown period, ECS were inundated with new issues related to slow internet connections and other technical challenges, such as not being able to analyse big data from home (Yoosefi Lebni et al. 2023).

As argued by the European Commission (n.d.b), women generally published less than male researchers, increasing the work-related gender gap. In the ECS career stage, female researchers find it more arduous to reach a stable academic position (Murgia and Poggio 2018; Carreri and Dordoni 2020). Korbel and Stegle (2020) reported less productive working hours for female scientists (70% of females in wet labs versus 60% of male respondents work primarily experimentally). Researchers with caregiving responsibilities or children had an additional disadvantage, struggling to reconcile work and domestic commitments and producing fewer publications (Ipe et al. 2021)

The pandemic has also resulted in the cancellation or postponement of scientific events, including national and international conferences, workshops and training programmes (Subramanya, Lama, and Acharya 2020), further hindering the exchange of scientific knowledge. Conferences are critical for sharing the newest scientific discoveries and building networks (Neuilly and Stohr 2016). The discussions that spark during coffee breaks or social dinners bring invaluable opportunities

that cannot be planned remotely. Sugimoto et al. (2017) showed the physical proximity's importance in enhancing research and scientific advances. During the pandemic, less contact with people led to the loss of brainstorming opportunities and of social exchanges in the work
[92] environment (Duede et al. 2024; Korbel and Stegle 2020). ECSS who were able to move to another country during the pandemic had problems integrating because of fewer social events, quarantine, difficulty with bureaucracy, and less administrative support (Duede et al. 2024). A higher percentage of exchanged ECSS lived alone, as argued by Korbel and Stegle (2020) in their survey, compared to respondents working in their home country. In addition, exchanged ECSS might have faced additional problems with understanding updates to local guidelines and regulations during the emergency (Korbel and Stegle 2020).

Finally, the emergency triggered by the coronavirus pandemic has increased the focus on health issues and the importance of mental health, which is now a central issue regarding personal health in work environments (Venkatesh and Edirappuli 2020). Chrikov et al. (2021) argued that 32% of graduate and professional students suffered from major depressive disorder (two times higher in 2020 compared to 2019). In contrast, and according to the same study, more than a third of undergraduate and graduate students reported experiencing generalised anxiety disorder (1.5 times higher than in 2019).

OGS DEEP BLUE MOBILITY PROGRAMME FOR YOUNG PROFESSIONALS IN THE MARINE AND MARITIME FIELDS

The Deep Blue Fellowships and Programme

The National Institute of Oceanography and Applied Geophysics – OGS coordinated the Deep Blue (Developing Education and Employment Partnerships for a Sustainable Blue Growth in the Western Mediterranean Region) project for the period 01.01.2019–30.06.2021. Deep Blue was funded by the European Maritime and Fishery Fund (EMFF) and the European Agency for Small and Medium-sized Enterprises (EASME) within the framework of the Sustainable Blue Economy Call 2017.[1] The project's core aimed to foster talent circulation across the Mediterranean region by offering innovative training paths to young

[1] EASME/EMFF/2017/1.2.1.12/S3/02/SI2.789633, https://blueskills.inogs.it/projects/deepblue.

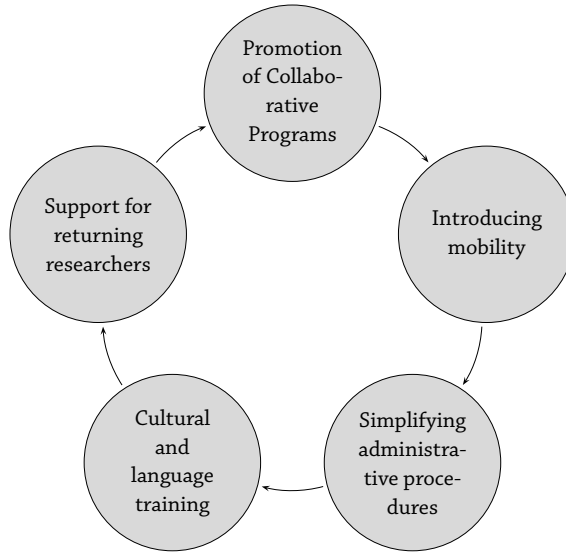


FIGURE 1
Key Initiatives to Enhance Researcher Mobility and Collaboration

professionals in the blue economy sector through increased international scientific cooperation.

With the support of local stakeholders, partners from Italy, Spain, and Tunisia collaborated to develop training paths to share knowledge among Blue Economy's key sectors while fostering North-South and South-South cooperation in the Mediterranean area (figure 1). The lack of research opportunities in the countries of the South Mediterranean poses significant challenges to scientific advancement and socioeconomic development in the region. Limited infrastructures and resources hinder the researchers' ability to conduct high-quality research and address funding pressing local and global challenges. European financial support is crucial in bridging these gaps by providing resources, expertise, and collaboration opportunities.

Case-Studies on ECSS Moving in the Mediterranean during COVID

Three case studies from three ECSS who won Deep Blue mobility grants to relocate to another Mediterranean country during the pandemic are presented below. These case-studies testify to the importance of international mobility for ECSS and show the opportunities for professional development, skills transfer, networking, and transcultural learning that these programs offer to their participants, even in challenging circumstances such as COVID.

ECS1

Female, 35 years old, intern at OGS, Trieste Italy – Exchange at Laboratory of Applied Bioacoustics (LAB), Vilanova i la Geltrù, Spain.

[94]

Fellowship duration 6 months from 2nd March to 2nd September 2020.

Project title 'Using Machine Learning Methods for Wildlife Conservation.'

Topic Cetacean Bioacoustics and Underwater Noise.

Home Institution The National Institute of Oceanography and Applied Geophysics – OGS (Italian: Istituto Nazionale di Oceanografia e di Geofisica Sperimentale – OGS), commonly referred to as OGS, is an Italian public research institution under the supervision of the Italian Ministry of University and Research. It specializes in conducting research in the fields of earth science and oceanography on an international level.

Host Institution The LAB creates technical and interdisciplinary solutions to reduce anthropogenic noise's impact and contribute to the sustainable development of human activities.[2] The proposed research activity contributed to enriching the current knowledge on a cutting-edge topic relevant to marine ecology, oceanography, conservation, and marine policy (Moretti and Affatati 2023).

A Brief Introduction to the Scientific Topic The ocean is not a silent place. Marine organisms, especially marine mammals, have learned to exploit sound as a primary cue for underwater communication and sensing (Affatati 2020; Madsen, Siebert, and Elemans 2023). Anthropogenic noise sources are increasing in number, changing the ocean soundscape and elevating noise levels (Duarte et al. 2021; Affatati and Camerlenghi 2023).

Scientific Activities and Personal Experience After the first two weeks of in-person work at the LAB, starting on 16th March 2020, a strict lockdown was imposed by the government of Spain, and the LAB members started working remotely. Working from home poses specific, different challenges compared to working in a lab or an office (Catayoc 2019). There is a need for additional structure and routine and a lack of social connections, both being crucial even in work environments. Part of

[2] https://michel-andre.squarespace.com/lab.

the first challenges of the experience was focused on succeeding in setting work timetables, improving time management skills, and learning this different work modality. Along with the LAB co-workers, internet connection problems were solved, and professional and human bonds were developed. In addition to daily study sessions with LAB members [95] and numerous Skype meetings per week, project video conferences and general LAB meetings were scheduled.

For her project, ECS1 studied dolphin vocalizations and ship noise using a Controlled Acoustic Repository, which stores data and manual annotations in a structured way and allows training and validation algorithms for Machine Learning. Long-term monitoring is essential for gaining information about animal conservation (Gitzen 2012). However, a large amount of data is difficult to handle manually, possibly leading to biases and subjectivity (Gibb et al. 2019). The data were collected in the Providence Project framework, one of the LAB's projects developed during field work in the South-American Amazons.[3] Target sound types were used to train models that allow the calculation of activity indicators. Vocal activity can be used to estimate long-term changes in the behaviour and presence of the animals (Parks, Clark, and Tyack 2007; Bautista Parra et al. 2023). Oceanic dolphins produce vocalisations that have been relatively well characterised for most species (Au 1993). Less is known about the vocal structure and behaviour in taxa such as Amazon river dolphins, boto (*Inia geoffrensis*) and tucuxi (*Sotalia fluviatilis*), animals living in the reserve (Podos et al. 2002). Starting from the literature, 'buzzes,' 'burst pulses,' and 'squeaks' were defined in terms of acoustic characteristics, waveforms and spectrograms. Similar sounds were found in the Amazon recordings through the labelling campaign, and this activity served as a crucial first step in defining the main sounds produced by these elusive cetaceans.

A Brief Look at Pros and Cons The negative side of this experience mainly revolved around the lockdown and the social distancing. However, this enabled the fostering of friendships with colleagues faster than usual. The beginning of the remote work sessions was not easy either, mainly because long meetings online were more tiring than those in-person. Furthermore, the big monitor, the proper chair, and the desk make a difference in the office. Another aspect to be considered is the impor-

[3] http://www.providence.listentothedeep.com, https://whc.unesco.org/en/list/998.

tance of a team in research fields, and a team is not only built to share the same professional goals but also to have lunch and small breaks together. The social part was difficult to maintain during the lockdown, but the LAB team gave great support. Apart from the team, some of
[96] the many positive aspects of the six months with the LAB were the continuous training in marine bioacoustics, coding, and digital signal processing and the focus on transdisciplinary research activities.

ECS2

Female, 31 years old, post-doctoral researcher at Analyses and Applied Processes to the Environment APAE UR17ES32 ISSAT-Mahdia, University of Monastir, Tunisia – Exchange at University of Aveiro, GeoBioTec Research Centre, Portugal.

Fellowship Duration 3 months from 1st January to 31st March 2021 (Distance cross-border online traineeship).

Project Title 'Mining By-Products as Low-Cost Materials for Heavy Metals and Antimicrobial Water Treatment.'

Topic Waste recycling and water treatment.

Home Institution Analyses and Applied Processes to the Environment (APAE) is a specialised Research Unit UR offered by the Higher Institute of Applied Science and Technology of Mahdia (ISSAT-Mahdia), which is part of the University of Monastir in Tunisia. APAE main activities focus on environmental science, technology, and engineering, emphasizing the analysis and application of processes to address environmental issues.

Host Institution The GeoBioTec Research Centre, Geology Dep., Aveiro Campus, Aveiro-Portugal was created in 2007 by merging two pre-existing research units (ELMAS – Evolução Litosférica e Meio Ambiental de Superfície, and MIA – Minerais Industriais e Argilas). GEOBIOTEC has a mission to explore the geological, biological, physical, and chemical processes that shape the Earth's environment, emphasizing the role of humans as an agent of change aiming for sustainable development. GEOBIOTEC is now the largest Portuguese research unit in the field of Earth sciences.

A Brief Introduction to the Scientific Topic The mining by-products and wastes from the processing of raw materials are often a problem for

manufacturers (Nouairi, Rocha, and Medhioub 2019; Nouairi et al. 2021; Yildiz 2024). In recent decades, the focus has been on recycling the waste in order to reduce its effect on human health and the environment. Nowadays, the relative scarcity and the rising costs of raw geomaterials in the global markets require the valorisation and recycling of non-conventional materials as alternatives. Recent studies focused on recycling of mining by-products in construction materials for a sustainable pathway (Nouairi et al. 2017). Geopolymers, for example, offer several environmentally and economically attractive features: they are materials requiring low energy for their production, and they can be obtained for highly available by-products within a vast panoply of industrial activities. Depending on the physical, chemical, and mechanical properties, geopolymers can be used in civil engineering to immobilise toxic materials and metal pollutants from water. The main goal of this project was to build a new geopolymer for water treatment purposes from low-cost mining residues.

[97]

Scientific Activities and Personal Experience The onset of the COVID-19 pandemic significantly impacted the planned research activities for ECS2, which were initially scheduled to take place in Aveiro Campus, Portugal, over a period of 6 months. The implementation of travel restrictions and safety precautions meant that she had to quickly adapt to the new reality of remote working for only 3 months. This shift brought about a unique set of challenges, particularly in adjusting to the limitations on in-person collaboration and the unavailability of certain resources that would have been accessible in a traditional on-site research setting. However, the circumstances also presented unexpected opportunities. The team and colleagues at GeoBioTec lab offered to conduct all the lab work and experiments that ECS2 was supposed to do during her Deep Blue internship. All the steps, from the formulation of geopolymers to the physical, mineralogical, and mechanical characterisation, were conducted by the GeoBioTec team. With the collected data, ECS2 and GeoBioTec colleagues managed to participate in several international conferences and they publish their work in peer-reviewed journals.

This experience not only demonstrated the resilience, adaptability, and solidarity of the research community but also provided valuable insights into the future integration of remote work practices within the field of research. It sparked important conversations about the poten-

tial for increased flexibility and work-life balance, as well as the role of technology in ensuring the continuity and effectiveness of scientific work, even in the face of unprecedented global challenges. ECS2 and her supervisor, Prof. Fernando Rocha, were also asked to give feedback
[98] on her internship experience on 25th May 2021 during the Deep blue-round table-final event via Zoom.

A Brief Look at Pros and Cons The shift to online research experiences during the pandemic presented both advantages and challenges for ESC2. On the positive side, the ability to continue scientific work and to pursue project milestones provided a sense of continuity, productivity and purpose, which helped reduce stress and improve mental well-being. However, the lack of hands-on laboratory or fieldwork experience hindered the acquisition of essential practical skills and knowledge, potentially diminishing the depth and quality of the research. Additionally, the reduction in funding by half for the Deep Blue Cross-Borders online traineeship adversely affected ECS2, potentially resulting in prolonged ramifications for productivity.

ECS3

Male, 32, Freelancer, exchange at the Mediterranean Information Office for Environment, Culture, and Sustainable Development (MIO-ECSDE) – Athens (Greece).

Fellowship Duration 6 months from 16th March to 17th September 2020.

Project Title 'Streamlining Blue Economy Aspects in the MIO-ECSDE Work Programme.'

Topic Regional cooperation for environmental protection and education.

Home Institution Freelancer.

Host Institution MIO-ECSDE[4] is a non-profit Federation of 134 Mediterranean Non-Governmental Organizations (NGOS) working in the fields of Environment and Development across 28 countries in the Euro-Mediterranean region. Their mission is 'to protect the Natural Environment and Cultural Heritage and promote Sustainable Develop-

[4] https://mio-ecsde.org.

ment in a peaceful Mediterranean by bringing together the efforts of environmental and developmental NGOs.'MIO-ECSDE aims to achieve this by playing an active role in furthering synergies and strengthening public participation in the Mediterranean region and its countries, in close cooperation with governments, international organisations, other socio-economic partners and networks. [99]

Scientific Activities and Personal Experience The placement was marked by the onset of the global COVID-19 pandemic. The appointment was meant to begin on 16th March 2020. However, the MIO-ECSDE Director decided on the very same day to take the precautionary approach and decreed that everybody should work from home that week. The Greek Government declared a national emergency later the same week, enforcing a strict lockdown nationwide. Lockdown measures began to be relaxed on 4th May, with people being allowed to walk freely in the street once again and some organisations returning to the office on a rotating basis. Nevertheless, MIO-ECSDE employees were not fully back in the office until 8th June, only after the Government fully eased the lockdown measures for most activities. Full return to normal activity began on 15th June, 2020.

MIO-ECSDE leads the celebration of Mediterranean Action Day every year. Aside from their own campaign, they support their partner organisations through the provision of small grants for the celebration of their events. MAD2020 was originally meant to take place mainly in May, with the topic 'Marine and coastal Natura2000 Sites.' Due to the COVID-19 emergency, this was no longer the case. Sergio contributed to the organisation and coordination of the campaign, including managing the call for proposals for the events and providing technical support to the organisations implementing them. However, the actual events took place between September 2020 and March 2021.

ECS3 provided expert input to strengthen the MIO-ECSDE's position and contribution to the 'Union for the Mediterranean (UfM) consultation on the future of the blue economy in the Mediterranean regarding environmental governance, fisheries and agriculture, green and circular economy, and sustainable development' (Union for the Mediterranean 2020). He also coordinated MIO-ECSDE's contribution to the First Mediterranean Assessment Report by MedECC (2020).

A Brief Look at Pros and Cons Although the pandemic was far from over, there were no more lockdowns in Greece until the Autumn, and

[100]

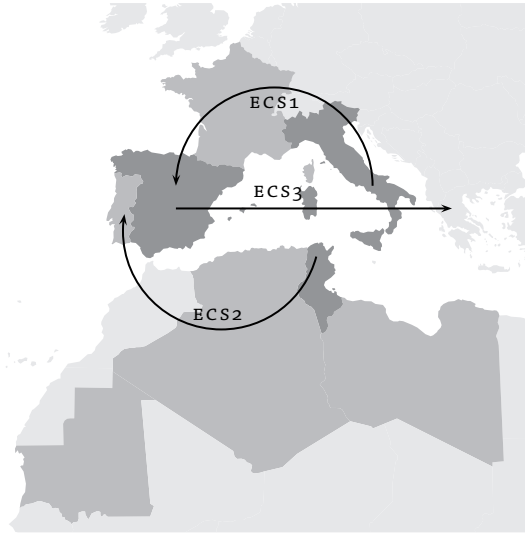


FIGURE 2

Map with member countries (Algeria, France, Italy, Libya, Malta, Mauritania, Portugal, Spain and Tunisia); partners in dark gray: Italy, Spain and Tunisia; arrows show ECSS case-studies movements from home country to host country

the placement could, therefore, continue with relative normalcy (there was still rotation of personnel in the office, together with other precautionary measures such as the use of masks). However, even after the lockdown, caution measures were mostly lifted in Greece in June, but the COVID-19 global emergency continued to limit the workplan implementation. Despite this, MIO-ECSDE satisfactorily managed the crisis. They reacted with proactiveness and precaution in the early days of the pandemic, taking social distancing measures and telework and implementing a progressive return to office and social distancing measures for the work in person. These behaviours allowed, in the end, for a successful placement, characterised by the support and understanding of the colleagues and the collaboration for the implementation of the chosen activities. MIO-ECSDE is an organisation with a regional vision and purpose, and most of its work requires travel and the celebration of training, courses, workshops, and conferences. None of these were possible. Whereas some of these could be run remotely (such as the celebration of the Mediterranean Action Day, which was changed to be run locally by each organisation in their city at their best timing between July and October, without MIO-ECSDE providing anything but remote support and advice), some other proved just impossible to take place (such as the Asterousia Summer University, which was transferred to a hybrid modality, and the dates postponed to 30th November – 20th December 2020, well beyond the duration of the placement).

INTERNATIONAL MOBILITY IN SCIENTIFIC RESEARCH AS A TOOL FOR EARLY-CAREER SCIENTISTS

In today's globalised world, international collaboration is critical in the scientific sector, and international qualifications are highly valued for early-career scientists (Bauder, Hannan, and Lujan 2017; Radloff 2016; Rodrigues, Nimrichter, and Cordero 2016). [101]

It has been proven that mobility leads to better science (Edler et al. 2011; Aman 2020). For example, a study by Sugimoto et al. (2017) reports 40% more publications for mobile researchers, i.e., enrolled in an exchange-mobility programme than sedentary/physically inactive people. Creating a global network is essential for addressing complex scientific challenges and it can lead to opportunities for joint research projects and funding initiatives. International collaboration can foster a sense of community among scientists, helping to build networks of knowledge and exchange, promoting understanding between different cultures and enhancing dialogue amongst scientists as an instrument of science diplomacy (John et al. 2023).

Challenges Associated with International Mobility for Early-Career Scientists and General Strategies and Recommendations to Facilitate and Enhance International Mobility in the Blue Economy Sector

Challenges

Navigating the international scientific mobility as an ECS presents multifaceted challenges. Firstly, stringent visa regulations and immigration policies can hinder the free movement of researchers, leading to delays in collaborative efforts and limitations in attending conferences or collaborating with colleagues from different countries (González 2022). The process of obtaining visas can often be lengthy and complex. Secondly, international research collaborations may encounter language and cultural barriers, which significantly hinder effective communication, a critical aspect for the success of any collaborative project in academic organisations (Chevan, M'kumbuzi, and Biraguma 2012). Language differences can result in misunderstandings, misinterpretations, and delays in decision making processes, while cultural disparities can impact problem-solving approaches, decision-making, and interpersonal interactions (Kalra, Szymanski, and Alike 2023). Thirdly, administrative complexities, including securing funding, obtaining necessary permits and logistical arrangements, can pose sig-

nificant challenges to mobility (Dewhirst 2013). Moreover, concerns about brain drain, referring to the displacement of highly skilled individuals seeking better opportunities elsewhere, highlight the potential loss of valuable expertise within local communities (Johnson and
[102] Regets 1998). This complex scenario calls for a delicate balance between encouraging international opportunities and ensuring the retention of expertise within home countries, highlighting the crucial role of policymakers in enhancing the scientific appeal of nations globally (Ackers and Gill 2005).

General Strategies

Providing opportunities for ECS to engage in international research collaborations and mobility is crucial for fostering a globally connected scientific community and enabling the exchange of ideas, skills, and knowledge across borders. Some general strategies that can help facilitate and enhance international mobility include:

- Promoting collaborative programmes. Establishing joint research programmes, exchange agreements and institutional partnerships may encourage mobility and collaborative projects. Researchers' circulation and interaction at the international level can boost the creation of dynamic networks, improving knowledge and technology transfer.
- Introducing mobility as a positive asset in evaluating universities, research institutes, researchers, and integrating mobility into existing funding schemes.
- Simplifying administrative procedures. Implementing more efficient regulations for issuing visas and residence permits, improving bureaucratic processes, and adopting strategies to simplify and expedite application procedures for EU and non-EU researchers could help facilitate international mobility in science.
- Implementing cultural and language training. Training programmes on cross-cultural communication and collaboration can provide ECSS with the skills to navigate cultural differences effectively.
- Instituting support for returning researchers. To address this concern, it is essential to implement incentives that encourage researchers to return to their home countries after completing their international collaborations. These may include funding

opportunities for research projects, career development programmes, and establishing research centres or institutes that provide attractive working conditions and resources.

Amidst the challenges faced by ECSS working in the blue economy sector during COVID, several tools could serve as opportunities to transform crises into paths for growth and innovation. The European Commission provides funding to support the mobility of researchers in the Mediterranean region through various initiatives.

Overview of International Mobility Programmes

Oceans are crucial for global sustainability and climate regulation, providing vital resources. To maintain ocean health under increasing human impact, advanced understanding of marine processes and human effects is essential. Effective conservation relies on strong research, but there is a shortage of skilled researchers, especially in developing countries, which need to build capacity for marine science (Morrison et al. 2013). A comprehensive review of internationally funded programs, fellowships, exchange funds, contradictions in pacing systems, and internship platforms for the blue economy and other relevant marine-related areas could provide valuable information to support the current and future professionals (Charles 2017). For this, a set of substantial international mobility initiatives available across two marine-related areas, such as the blue economy and the broader marine-related area, were reviewed and analysed. The purpose of the study is to provide the universities and training institutions with the necessary information they need to adapt and promote future international programmes and to graduates of the blue economy field, or of the wider relevant marine-related industries, to facilitate their participation in them.

Despite constraints, graduates from the marine-related industry, including the blue economy sector, tend to have a highly developed international professional network because of their internships and job opportunities in maritime-related international projects. Assembling the profile, the increase in popularity in the impressive international knowledge and information exchange initiatives, which have been launched to attract future young professionals from both developing and developed countries, is conveniently situated in the increasingly international focus of higher educational institutions. An international perspective in higher education not only enables students to become more mobile, understand internships, discover fellowships and

scholarship programs, but also helps to develop the important critical thinking, linguistic, problem-solving, and social skills that all graduates need to be competitive in an increasingly knowledge-based and globalised job market (Öztabak 2022).

[104]

Opportunities for Mediterranean Blue Economy Mobility Tenders and Funds

Furthermore, two major flagship initiatives were launched in the framework of the Union for the Mediterranean and play a pivotal role for the Mediterranean region: the UfM-labelled project 'BlueSkills4Med' funded through the Erasmus+ Capacity-building in Higher Education (CBHE) programme and focused on the development of Marine Data Technicians and Blue Data Specialist skills, thereby contributing to the implementation of the Blue Economy agenda in the Mediterranean; the UfM-labelled project 'BlueGreenFacts: Multiplying Employment Opportunities for a Sustainable Economic Development in the Indian Ocean Area,' funded by the European Neighbourhood Instrument (ENI) and aimed at fostering new business opportunities for young people in the environmental economy in the Indian Ocean Area with a focus on the blue and green economy (Battarra, Gargiulo, and Zucaro 2020). Project Coordination Mechanisms (PCM) aiming at enhancing mobility across the Mediterranean in the blue economy sector are increasingly available (Cañibano, Otamendi, and Solís 2011). Some are designed specifically for the blue economy sector, while others are aimed at enhancing cross-sector interaction and exchange. Among the available European financial instruments that foster mobility programmes in the blue economy, Erasmus for Young Entrepreneurs seems to be a noteworthy case. In the maritime field, the benefits for both the Mediterranean and the European regions are generated by INTERREG funding.

These efforts highlight the European Commission's commitment to fostering research collaboration and mobility in the Mediterranean, ultimately contributing to the advancement of scientific knowledge and the blue economy in the region.

In this context, European scholarships play a crucial role in supporting scientists from the Mediterranean area. The European Union's initiatives address the obstacles to regional integration, including those related to research and innovation, thereby offering valuable support to scientists in the Southern Mediterranean (European Commission

TABLE 1 Summary of the Main Programs and Funding Schemes Available for Mediterranean Countries and Main Features

Program/ Fund	Description	Eligibility	Funding Amount	Application Deadline
ENI CBC Med Programme	Supports cooperation across the Mediterranean to address common challenges.	Public and private entities from eligible countries.	Varies per project; typically, up to €3 million.	Calls for proposals periodically.
Horizon Europe (Cluster 6)	Focuses on research and innovation for food, bioeconomy, natural resources, agriculture, and environment.	EU member states and associated countries.	Up to €10 million per project.	Varies; several calls per year.
Blue Economy Window (EMFF)	Funds innovative projects contributing to the blue economy, including technology development.	SMEs and other entities in the blue economy sector.	Up to €2.5 million per project.	Annual calls for proposals.
Interreg MED Programme	Promotes sustainable growth in the Mediterranean area through innovative practices and cooperation.	Public bodies, SMEs, NGOs, and universities.	Varies per project; typically, up to €5 million.	Calls for proposals periodically.
PRIMA (Partnership for Research and Innovation in the Mediterranean Area)	Supports projects in water management, farming systems, and agro-food value chains.	Public and private entities from participating countries.	Up to €2 million per project.	Annual calls for proposals.
BlueInvest Grants	Supports innovative SMEs in the blue economy to develop and scale up.	SMEs established in an EU member state or associated country.	Up to €2.5 million per project.	Varies; several calls per year.

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n.d.b). These efforts are essential for promoting knowledge exchange, capacity building, and sustainable development in the region, highlighting the importance of European assistance for scientists from the South Mediterranean.

International Mobility Exchange Programmes (IMEPS) offer a unique chance for ECSS to broaden their perspectives, to learn from different cultures, and to collaborate with international colleagues. By participating in an IMEP, early-career researchers can develop a global

TABLE 1 *Continued from the previous page*

Program/ Fund	Description	Eligibility	Funding Amount	Application Deadline
Life Programme	EU's funding instrument for environmental and climate action projects, including marine projects.	Public and private bodies.	Up to 60% of eligible costs; varies per project.	Annual calls for proposals.
Mediterranean Cooperation Programme (MEDCOP)	Facilitates cooperation among Mediterranean regions to tackle shared challenges.	Regional authorities, NGOS, academic institutions.	Varies per project; typically, up to €4 million.	Calls for proposals periodically.
European Maritime and Fisheries Fund (EMFF)	Supports sustainable fishing and coastal communities.	Fisheries, aquaculture producers, public authorities.	Varies per project; typically, up to €2 million.	Continuous intake; varies by country.
UfM Grant Scheme	Supports projects enhancing regional cooperation and integration in the Mediterranean.	NGOS, local authorities, educational institutions.	Varies per project; up to €1 million.	Calls for proposals periodically.
Marie Skłodowska-Curie Actions (MSCA)	Provides grants for all stages of researchers' careers and encourages transnational, intersectoral, and interdisciplinary mobility.	Researchers and institutions worldwide.	Varies; typically €50,000 to €150,000 per year per researcher.	Varies; multiple calls annually.
Sustainable Blue Economy Partnership (SBEP)	Supports transformative solutions for a sustainable blue economy, addressing economic, environmental, and societal challenges.	Public and private entities from participating countries.	Varies per project; typically up to €5 million.	Annual calls for proposals.

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network of contacts and build relationships that will serve them well throughout their careers. Moreover, IMEPS offer a chance to access funding opportunities that may not be available in their home country or institution, especially for ECSS with limited research resources. IMEPS enable young researchers to work with leading experts in their field and to gain exposure to cutting-edge research methodologies and techniques. This experience can be invaluable for those looking to launch their research projects or pursue an academic career (Netz, Hampel, and Aman 2020).

CONCLUSIONS

The experiences of ECSS in international mobility vary, and more research is needed to understand their motivations and the long-term effects of mobility on their careers. In summary, the COVID-19 pandemic had a significant and potentially long-lasting impact on early career scientists, affecting their research activities, career prospects, and overall well-being. International mobility exchange programmes offer many opportunities for young researchers in Europe. Participating in these programmes, allows researchers to gain valuable experience, expand their networks, and enhance their career prospects. These programmes offer a unique opportunity to gain new perspectives, broaden horizons, and build a brighter future for the global community of scholars.

The illustrated three case studies vividly demonstrate the potential for transforming crises into opportunities within the blue economy sector. These examples serve as compelling evidence that even in the face of adversity, innovative solutions and strategic actions can lead to significant scientific and technological advancements and career growth. These transformative endeavours not only mitigate the impacts of crises but also contribute to the long-term prosperity and resilience of the blue economy sector.

Overall, the COVID-19 pandemic has highlighted the importance of resilience, adaptability, and innovation within the scientific community as researchers navigate challenges and continue to pursue scientific advancement in an evolving global landscape.

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