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The Ocean Incubator Network Learning Toolkit

Margherita Paola Poto
Laura Vita

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2021 2030 United Nations Decade of Ocean Science for Sustainable Development

We dedicate this book to all the sea lovers and to the agents of peace who silently work every day to protect the rights of humans and nature.

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The editors are thankful to all contributors to the Ocean Incubator Network project, as well as to Frank Sejersen (University of Copenhagen and the Arctic House) for hosting our Living Laboratory, where the seeds of this book were planted. Additional thanks go to videographer Artem Krykhtenko for creating a video version of the book and to Igor Peftyiev for his support in editing the final manuscript. The editors thank Marcelle Dabbah for the educational scrutiny of our Toolkit, as well as Rada Pandeva and Dana Ahmed for their attention to accessibility throughout the entire work.

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This publication is endorsed by the UN Ocean Decade, and we are committed to supporting the UNESCO team in addressing the 10 challenges by 2030.

Finally, we thank the ocean, which inspires us every day, from the Norwegian Sea to the coasts of Canada. Thank you, ocean, for the gift of life.

Tromsø, Norway — Margherita Paola Poto
Tromsø, Norway — Laura Vita
September 2024

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

NORGES ARKTISKE UNIVERSITET • UIT •

UArctic


collaborative
empathy
compassion
with
care
governance
Mucha Amor
2021 ECO...CIDE


OCEAN INCUBATOR NETWORK


SUSTAINABLE DEVELOPMENT GOALS
Life Below Water
Quality Education
Gender Equality
OCEAN INCUBATOR NETWORK


STUDII
UNIVERSITAS
TAURINENSIS
1404
UNIVERSITÀ
DI TORINO


EUGLOH
European University Alliance for Global Health

About This Book

This innovative Toolkit merges advanced transdisciplinary research on ocean science (law, marine geosciences, political sciences, linguistics, pedagogy, global health, visual arts) with a series of engaging activities aimed at enhancing ocean literacy. It provides a comprehensive overview of the Ocean Incubator Network (OIN) work in the past two years and its connections to the Sustainable Development Goals and especially SDG 14, the UArctic Values linked to our project, and the UN Decade of Ocean Science for Sustainable Development.

The Toolkit outlines the conceptual framework, detailing the two main pathways (*Connecting with each other and Connecting with the ocean*) and thematic areas (*positionality*, *inter-cross- and trans-disciplinarity*, *co-creation*), the structure (*Part 1 The Toolkit Blueprint; Part Two: An In-depth Analysis of Ocean Literacy*), and the steps involved in creating this resource (participatory approaches that included multisensory workshops, activities with local and Indigenous communities, Monthly Coffee Meetings, a Living Laboratory and an Autumn School on Co-creation at the University of Bari, Sede di Taranto). Building on the previous chapters, Chapter 8 presents over twenty adaptable, downloadable and fully-accessible activities designed to raise awareness about the importance of protecting the ocean and fostering connections among people.

The Toolkit aligns with the Ocean Decade Challenges for collective impact, specifically addressing Challenges 9 and 10, which focus on 'Skills,

Knowledge, Technology and Participation for All' and 'Restoring Society's Relationship with the Ocean', respectively. It showcases how our initiatives and activities contribute to these global objectives, emphasizing the importance of inclusive participation, accessibility, and renewed ocean stewardship.

As authors and project members, we acknowledge the dynamic nature of ocean literacy in this endeavour. This Toolkit reflects our current knowledge and perspectives, aiming to create a wave of change where ocean-related issues are tackled from a collective perspective. We recognize that as the network continues to research, gain understanding, and welcome new members, perspectives and approaches will evolve.

Endorsed by UNESCO, UN Ocean Decade for Sustainable Development, this guide is expected to advance ocean literacy on a global scale.

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Abbreviations

OIN	Ocean Incubator Network
OL	Ocean Literacy
SDG	Sustainable Development Goal

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PART I

The Toolkit Blueprint

CHAPTER 1

The Ocean Incubator Network (OIN) Project and the Toolkit

Laura Vita, Margherita Paola Poto, and Giuliana Panieri

Abstract This chapter serves as the foundational entry point into understanding the Ocean Incubator Network (OIN) Project and this Toolkit as its milestone. Section 1 provides a comprehensive overview of the OIN Project, detailing its vision, objectives, key project results, and milestones. Following this, Sect. 2 explains the purpose of this Toolkit, which stands as a principal milestone of the project. It outlines the structure of the Toolkit and offers a preliminary summary of its contents, setting the stage for detailed exploration in subsequent chapters. In Sect. 3, the chapter concludes with reflections on potential future applications and developments of both the network and the Toolkit.

OIN Project developer, MSc in Global Health at McMaster, Canada. LV contributed to the design of the chapter, drafting, revisions, editing and proofreading, and wrote Sects. 1, 2, and 3. She is also the author of infographics.
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OIN Project Coordinator, Professor in the Department of Geosciences, UiT The Arctic University of Norway. GP contributed to the project design, development, implementation, and editing of the chapter.

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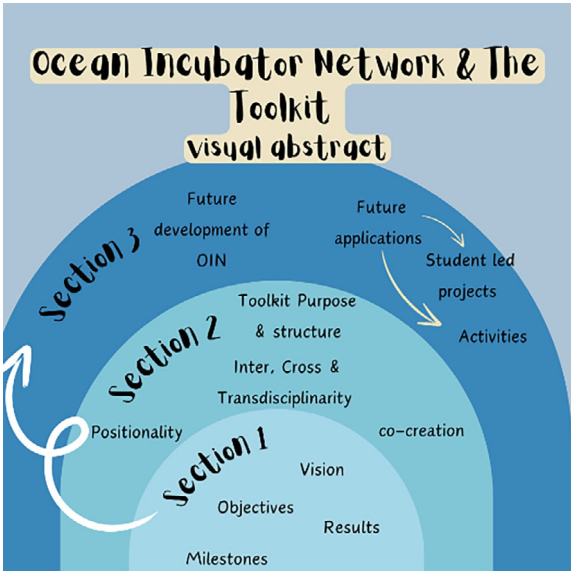
As an extensive guide endorsed by UNESCO to advance ocean literacy, the publication directly addresses Challenges 9 and 10 of the Ocean Decade.

Abstract (Italiano) Il presente capitolo introduce il progetto The Ocean Incubator Network (OIN) e offre una panoramica della struttura del Toolkit come pietra miliare del progetto. La Sect. 1 si sofferma sul Progetto OIN, offrendo una descrizione dettagliata della visione progettuale, degli obiettivi e dei principali risultati e alle milestones Successivamente, la Sect. 2 approfondisce lo scopo del Toolkit, e illustra la struttura, riassumendo il logico sviluppo dei capitoli. Nella Sect. 3 del presente capitolo, vengono condivise alcune conclusioni preliminari sulle potenziali future applicazioni e sviluppi sia della rete sia del Toolkit. Con l'endorsement dell'UNESCO, il Toolkit affronta direttamente le Challenges 9 e 10 dell'Ocean Decade.

Visual Abstract



Laura Vita 2024

Keywords Ocean · Incubator · Network · Ocean Decade · Ocean Literacy

1 The Ocean Incubator Network (OIN) Project

1.1 A Brief Story of OIN

The Ocean Incubator Network (hereinafter: OIN) Project,[1] established for the years 2023–2025 and funded by UArctic (Tromsø), represents a collaborative initiative to foster interdisciplinary engagement and innovation in ocean literacy and sustainability. Led by Margherita Paola Poto, Giuliana Panieri, and developed by Laura Vita, the project aligns with SDG 4 (quality education), SDG 5 (gender equality), SDG 14 and the vision of the UN Decade of Ocean Science for Sustainable Development,Agenda 2030 (the science we need for the ocean we want). The OIN Project focuses on ocean literacy as a tool to amplify and deepen our knowledge of the ocean and ultimately enhance our connection with it. As for its team composition, the OIN Project engages a multitude of UArctic partners, including UiT The Arctic University of Norway, the Arctic Centre at the University of Lapland in Rovaniemi, Finland, the James Hutton Institute and the University of Edinburgh in Scotland, the Centre for the Ocean and Society at Kiel University, Women of the Arctic in Finland, and the Marine & Environmental Law Institute at the Schulich School of Law, Dalhousie University. Additionally, it brings together a diverse group of researchers, students, and activists in the fields of global health, climate youth and law, environmental law, and ecolinguistics.

1.2 Alignment of the Project with the Ocean Decade Vision and Mission and Endorsement of the Toolkit as One of the Ocean Decade Activities

The framework of the UN Decade of Ocean Science for Sustainable Development (the Ocean Decade)[2] asks stakeholders to generate, apply and disseminate knowledge to achieve "the science we need for the ocean we want". Enhancing Ocean Literacy is critical to the success of the Ocean

[1] OIN official website: https://en.uit.no/project/oceanincubator, last access July 23, 2024. The project is funded by UArctic, UiT The Arctic University of Norway (Project number UArctic 580512124).

[2] Ocean Decade official website: https://oceandecade.org/, last access July 23, 2024.

Decade. Ocean Literacy refers to "the understanding of the ocean's influence on us and our influence on the ocean".[3] Thus, to achieve sustainable development and well-being across the globe, everyone requires the skill of ocean literacy to understand how we can contribute to ocean protection, conservation, and sustainable use. Per the Intergovernmental Oceanographic Commission (IOC) UNESCO Implementation Plan,[4] Ocean Literacy has been evolving from its applications within educational environments to a societal approach that catalyses public understanding of the ocean's relevance for a sustainable future for all. In this context, our project is one of the Ocean Literacy initiatives the IOC UNESCO Implementation Plan seeks to develop and implement. Education and sustainability literacy (ESL) are integral to sustainable development and the key to actualizing Agenda 2030's SDGs.[5] The UNGA established the need to increase the capacities of educators as facilitators of transformative learning (need a). To implement ESL for Agenda 2030, UN Member States are invited to mobilize and facilitate multi-stakeholder partnerships and networks, thus increasing advocacy and communication efforts to highlight the critical role of ESL in achieving the SDGs (need b).

As mentioned earlier, by pursuing quality education in ocean science, our OIN Project and the Toolkit align with SDGs 4 and 14 of the Agenda 2030. Specifically, by focusing on ocean interconnectedness through two pathways—connecting with each other and connecting with the ocean—[6]we address Challenges 9 and 10 of the Ocean Decade.[7] These challenges

[3] UNESCO-IOC. (2021). The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) Implementation Plan Vol. 20 (Paris: UNESCO); see also Santoro, F., Selvaggia, S., Scowcroft, G., Fauville, G., & Tuddenham, P. (2017). Ocean Literacy for All: A Toolkit (Vol. 80). UNESCO Publishing.

[4] UNESCO-IOC. (2021). The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) Implementation Plan Vol. 20 (Paris: UNESCO); Guan, S., Qu, F., & Qiao, F. (2023). United Nations Decade of Ocean Science for Sustainable Development (2021–2030): From Innovation of Ocean Science to Science-Based Ocean Governance. Frontiers in Marine Science, 9, 1091598.

[5] United Nations (UN). (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. New York, NY: Author: https://sdgs.un.org/2030agenda, last access July, 2024. On ESL see Panieri, G., Poto, M. P., & Murray, E. M. (ed. by) (2024) Emotional and Ecological Literacy for a More Sustainable Society, Palgrave MacMillan, Springer Nature, ISBN: 978-3-031-56771-1.

[6] See Sect. 1.6.

[7] https://oceandecade.org/challenges/, last access July 25, 2024.

aim to ensure skills, knowledge, and technology for all (Challenge 9) and to transform humanity's relationship with the ocean (Challenge 10). This sub-section is specifically focused on examining SDG 5 in the context of our project, while an entire chapter (Chapter 2) is devoted exclusively to exploring the gender dimension within ocean literacy and the project itself.

1.3 A Special Focus on Gender Equality[8]

The OIN Project also aligns explicitly with SDG 5 (Gender Equality) and the OECD recommendations to develop a joint agenda that is gender and environmentally-sensitive, emphasizing women's and girls' empowerment in environmental action.[9] Gender equality and women's and girls' empowerment are promoted in all organizational aspects of the project, including overall leadership, work package leadership, and within the project activities. It is worth noting that though the OIN Project is female-led, having projects that strive to align with SDG 5, especially in academic, research, and policy spaces, is the work of all genders. The OIN Project results, outcomes, and impacts aim to empower women and girls in environment-related sectors by including measures to grant equal access to quality education and leadership experience, health and other social services, and discussing the legal barriers to gender equality in employment policies and practices and decision-making bodies in the public and private spheres.

1.4 Endorsement of the Ocean Decade

To demonstrate its full alignment with the vision and mission of the Ocean Decade, it is noteworthy that the Toolkit has been endorsed as a Decade Activity. The opportunity to use the Ocean Decade logos and explore their various formats (available in as many languages as there are authors of this book) undoubtedly presents a significant chance to synchronize our goals with the UN's ocean literacy mandate. Here is the disclaimer: "This publication is endorsed by the United Nations Decade

[8] For an in-depth analysis of the Gender dimension in OIN, see Chapter 2.

[9] OECD. (2022), Gender Equality and the Empowerment of Women and Girls: DAC Guidance for Development Partners, OECD Publishing, Paris, https://doi.org/10.1787/0bddfa8f-en.

of Ocean Science for Sustainable Development as a Decade Activity. Use of the United Nations Decade of Ocean Science for Sustainable Development logo by a non-UN entity does not imply the endorsement of the United Nations of such entity, its products or services, or its planned activities. For more information please access: https://forum.oceandecade.org/page/disclaimer."

1.5 Accessibility Within the Toolkit and Ocean Literacy

This toolkit includes visual abstracts, multilingual abstracts, and infographics where possible to increase accessibility to users. Visual abstracts and infographics were designed and used with the intention of presenting the information within the chapter in an alternative way, supporting various toolkit users to better understand the content. Multilingual abstracts were written for each chapter, reflecting the various languages spoken by the authors of that section. By including multilingual abstracts within this publication, we aim to provide ocean literacy education and information to as many different language groups as possible. The ocean literacy activities in this Toolkit have been developed with accessibility in mind. Some were crafted with the input of accessibility experts,[10] and all activities have been thoroughly reviewed by an education expert.[11]

As contributors to this work, we recognize that more work is required to promote accessibility within Ocean Literacy and within this toolkit resource. This project's thematic pathways of "connecting with each other" and "connecting with the ocean" require us to include people of all languages, abilities, and disabilities in co-creating knowledge and approaches for a better future. The OIN is committed to continually learning and improving support for accessible approaches to our work.

1.6 The OIN and Toolkit Integrated Logo[12]

See Fig. 1.

[10] See Chapter 8, and specifically the activities developed by Dana Ahmed.

[11] See Chapter 8. The authors are grateful to Marcelle Dabbah for her revision work.

[12] The integrated infographic contains the logo of the UN Ocean Decade since this publication has been endorsed by the United Nations Decade of Ocean Science for Sustainable Development as a Decade Activity.

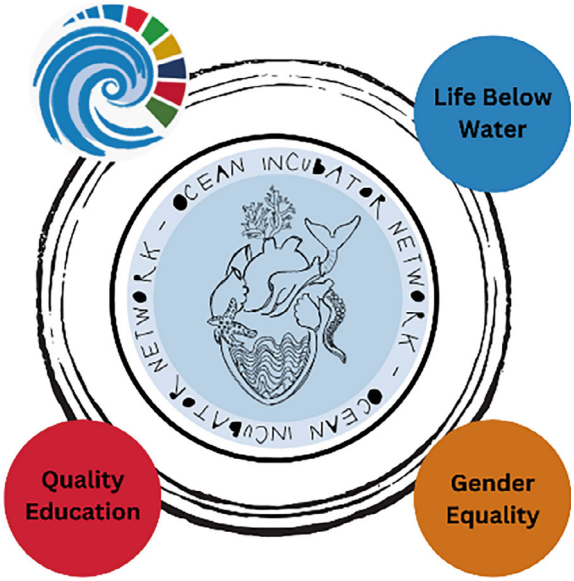


Fig. 1 Infographic created by Laura Vita, 2024. The OIN logo is encircled by the Ocean Decade logo and the SDGs Life Below Water, Gender Equality, and Quality Education, which signify the impact and guiding principles of the SDGs and Ocean Decade on the OIN

1.7 Alignment with the UArctic Strategic Plan

The OIN is in line with the six values of the UArctic Strategic Plan[13] by aiming to establish a network on Ocean Literacy for All with a focus on the Arctic that is rooted in the following core values:

Circumpolar (1), Inclusive (2), and based on Respect, Empathy, Compassion and Care (3): These three values are achieved through the development of an educational and research programme that encompasses northern voices (from local and Indigenous communities in the Arctic[14]), embracing cultural diversity, language plurality, and gender

[13] See UArctic Strategic Plan https://www.uarctic.org/media/1601710/item-8-uarctic-strategic-plan-2030.pdf, last access July 23, 2024.

[14] It is worth mentioning that our Living Laboratory, hosted by the Arctic House in Copenhagen, opened with a tribute to the Arctic Sápmi. In particular, the opening of the

equality. At the centre of our network's exploration of ocean literacy is the importance of caring for the ocean and each other, reflecting on the relationship between oceans and communities, and highlighting the importance of interconnectivity[15] and the role of emotions in the evolution and development of an ocean-informed knowledge base.

Collaborative (4): Based on participatory and community-based approaches to education and research,[16] our OIN Project is aligned with the UArctic values.[17] Collaborative approaches are reflected in many aspects of our project development: (a) research methodology (based on co-creation of project results); (b) collaborative approaches in all the project stages; c. long-term expected outcomes. In the methodology we apply (a.), we have been focusing on the concept of co-creation of this Toolkit (a specific section dedicated to co-creation and the entire Part II focusing on co-created activities for ocean literacy). As for the approach we adopted in all project stages (b.), the very architecture of our project workflow embodies this collaborative ethos. Our multi-stage project achieved collaboration by engaging all team members from its inception and throughout its development. Collaboration also guides our project's long-term expected outcomes (c.). In particular, the OIN team members aim to seek funding opportunities to strengthen and

Laboratory started with a Sámi story, told by Aila Biret Henriksen Selfors (UiT The Arctic University of Norway) and narrated by Harald Gaski in "Indigenous Elders' Perspective and Position". The story is centred on the need to listen to and listen for (guldalit, in Sámi language) the Earth's heartbeat and, therefore, to and for our hearts. See Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606; Gaski, H. (2019). Indigenous elders' perspective and position. Scandinavian Studies, 91(12): 259–268.

[15] Panieri, G., Poto, M. P., Bertella, G., Bertolotto Bianc, G., Médici, N., Murray, E. M., Pandeva, R., & Vita, L. (2023). Ocean Interconnectedness: An Interdisciplinary Workshop to Learn from the Ocean, Through Multisensory Activities and Reflections on the Role of Emotions in Science and Law: Senses & Science, Love & Law. Septentrio Reports, (1). https://doi.org/10.7557/7.7271.

[16] On the foundational principles of participatory approaches to research see Poto, M. P. (2022) Environmental Law and Governance: The Helicoidal Pathway of Participation a study of a nature-based model inspired by the Arctic, the Ocean, and Indigenous Views Giappichelli, Torino, ISBN/EAN 978–88-921–2225-3, pp. 1–241.

[17] See UArctic Strategic Plan https://www.uarctic.org/media/1601710/item-8-uarctic-strategic-plan-2030.pdf cit.

expand the network and leverage their wide-ranging expertise in immersive research and learning techniques to generate positive, sustainable relations between Arctic nations and northern European Member States.

Open (5) and Influential (6): Our network is an open (5) and influential route to achieving SDGs 4, 5, and 14. In particular, our OIN is ensuring that all project results are open to the entirety of the UArctic network (a digital platform with regular press releases,[18] scientific reports,[19] media,[20] and this very publication, funded with the Open Access Library Funds at the UiT The Arctic University of Norway). In addition, our project activities align with the value of reducing barriers to education, research, and participatory climate governance and further establishing good practices for future cooperation on Ocean Literacy in the Arctic and beyond. In this ambitious endeavour, our network adheres to FAIR principles for data (findable, accessible to all,[21] interoperable, reusable) and the Open Science approach. The OIN also follows the EU Open Science Policy on data collection, handling, transfer, protection, and specific security strategy, including GDPR (General Data Protection Regulation), while ensuring a sound base for a powerful, sustainable, and valued data system. With specific regard to Open Access, the project supports the cOAlition-S initiative and is dedicated to contributing to its development by publishing research only in true open-access journals that promote green and gold routes of open access. Regarding adopting an open science approach, the partner institutions have agreed that the pure

[18] https://en.uit.no/project/oceanincubator, last access September 3, 2024.

[19] Two main full open-access reports marked the main milestones of the project kick-off (September 2023, at UiT The Arctic University of Norway in Tromsø) and Living Laboratory (May 2024, at the Arctic House, Copenhagen, Denmark), and respectively: Panieri, G., Poto, M. P., Bertella, G., Bertolotto Bianc, G., Médici, N., Murray, E. M., Pandeva, R., & Vita, L. (2023). Ocean Interconnectedness: An Interdisciplinary Workshop to Learn from the Ocean, Through Multisensory Activities and Reflections on the Role of Emotions in Science and Law: Senses & Science, Love & Law. Septentrio Reports, (1). https://doi.org/10.7557/7.7271; Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

[20] See The Living Laboratory on Ocean Literacy by Artem Krykhtenko: https://youtu.be/DyzTAA39V8k?si=leL0KC5bj0KJ741q, last access July 2024.

[21] With exception of security, privacy concerns, commercialization, and intellectual property rights.

research components in the project and all results will be disseminated to the relevant scientific communities via key international conferences, workshops, and recognized, peer-reviewed scientific journals. All project results, including key findings, major datasets, and publications, will be readily available via the OIN and the UiT open repositories (UiT open research data for data and Munin for publications).

Our team strives to be influential (6) by maintaining an ongoing dialogue with the Ocean Decade team and its initiatives,[22] actively participating in international conferences and workshops,[23] and engaging young professionals who are involved in the development of projects that resonate with our values, such as the Thalassophile Project coordinated by Rada Pandeva,[24] the EcoSpectrum, coordinated by Dana Ahmed,[25] and the work conducted by Mojgan Pooladi on student-led projects on Ocean Literacy in 2024.[26] All the young professionals are team members and co-authors of this publication (Fig. 2).

1.8 The OIN Conceptual Framework: Pathways and Thematic Areas

The OIN conceptual framework developed has inspired the activities and project results, providing a structured foundation for this Toolkit.

[22] Request for endorsement submitted for three main activities in the Spring 2024; participation to the online events and engagement in the development of feedback for white papers connected to Ocean Literacy.

[23] A few events that will see the involvement of some of the OIN team members include: the development of an interdisciplinary and transgenerational EUGLOH Course on Planetary Health; the organization of an Autumn School, funded by DAAD on the Protection of the sea and at sea adopting co-productive created methods of participation—human rights and nature rights approaches of sea governance; the participation to conferences and events, such as the Oxford Real Farming Conference 2025. For further details see https://en.uit.no/project/oceanincubator/nyheter/artikkel?sub_id=849264, last access July 23, 2024.

[24] The Thalassophile Project, coordinated by Rada Pandeva: https://www.thalassophileproject.org/, in particular the section on Educational Projects: https://www.thalassophileproject.org/educational-episodes, last access July 23, 2024.

[25] EcoSpectrum coordinated by Dana Ahmed: https://www.instagram.com/reel/C9ZcHq2xpId/?utm_source=ig_web_button_share_sheet&igsh=MzRlODBiNWFlZA==, last access July 23, 2024. See also the OIN blogpost Dana Ahmed, Connecting Blue Souls: The Role of Justice in Accessible Ocean Literacy, June 12, 2024.

[26] See the blogpost Mojgan Pooladi's Journey with the Ocean Incubator Network Toolkit, May 2nd, 2024.

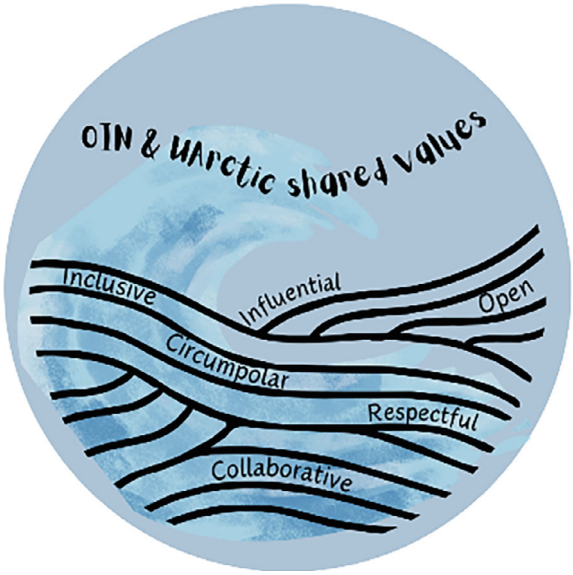


Fig. 2 Infographic created by Laura Vita, Shared Values between OIN and UArctic, 2024

It follows two pathways that intersect across three thematic areas. As a team, we committed to these pathways on our ocean literacy journey: "Connecting with Each Other" and "Connecting with the Ocean". Through critical reflections, we have explored the relational dimensions of connecting as ocean experts and the reciprocal dynamics of human-ocean interactions.

Pathway 1: Connecting with Each Other. This pathway emphasizes the importance of fostering connections among individuals, communities, and institutions involved in climate and ocean-related education and research. It invites critical reflection on the relational aspects of climate and ocean health, encouraging our team members and co-authors to examine their roles, perspectives, and responsibilities within the broader environmental discourse.

Pathway 2: Connecting with the Ocean. This pathway focuses on the intrinsic connections between human and ocean health. By engaging with ocean literacy principles, we strive to understand how the ocean influences

our lives and how our choices and behaviours affect the ocean's well-being. Through emotional and experiential learning, scientific inquiry, and cultural exchange, we have deepened our appreciation of the ocean's ecological, economic, and cultural importance, inspiring collective action and stewardship.

The two pathways intersect across three thematic areas: positionality, inter-/trans-/cross-disciplinarity, and co-creation.

Reflecting on the process that led to their formulation, we recognized these areas as conceptual stepping stones in our reflective process (initially considering our positionality in relation to ocean literacy, then reflecting on the interdisciplinary characteristics of our group, and finally exploring how we could co-create as a team). These areas also served as foundational hubs for developing activities that implement ocean literacy. Consequently, our team worked in three groups, each focusing on one of these conceptual frameworks, to develop activities under these areas. This organizational structure is also mirrored in the book's layout.

Positionality: Reflecting on how we position ourselves in relation to the two pathways (as team members and co-authors) is a self-critical and deliberate exercise in introspection. It encourages us to reflect on our identity, life trajectory, experiences, values, and significant issues. This reflective process helps identify aspects of our work in connection to ocean literacy with broader sociological relevance, refining the focus of research, education, and study.

Inter-, Trans-, and Cross-disciplinarity: Our team rises from an inter-, trans-, and cross-disciplinary collaboration that intersects knowledge from law, marine sciences, climate and ocean governance, marine ecology, marine socio-ecology, ocean policy, and planetary health. The main objective of this collaborative effort is to deepen the understanding of diverse knowledge and viewpoints on ocean literacy from various disciplines and sectors, exploring their applications and challenges in academic and research contexts. This synergy outlines a practical framework for advancing ocean literacy to influence ocean protection and sustainability efforts positively.

Co-creation: In pursuing ocean literacy, emphasizing the process of knowledge co-creation is crucial. This involves active participation and input from individuals across various disciplines in research and education endeavours. In line with UNESCO, our approach to ocean literacy relies on collaborative efforts from participants in diverse fields, including marine sciences, environmental studies, sociology, education,

policymaking, and community engagement. By integrating insights from these disciplines, we develop a more comprehensive understanding of the complexities surrounding ocean health and sustainability. This diversity enriches the dialogue, fosters innovative thinking, and promotes systematic approaches to addressing ocean-related challenges. Moreover, engaging in knowledge co-creation processes allows participants to contribute actively to developing inclusive and accessible educational materials and resources, ensuring that ocean literacy initiatives resonate with a diverse audience, whether they are stakeholders and project partners, students and learners, or co-authors in scholarly publications. In essence, knowledge co-creation for ocean literacy underscores the importance of collaboration, inclusivity, and shared responsibility in fostering a deeper appreciation and stewardship of our oceans.

1.9 OIN Project Activities and Milestones

The OIN Project was developed through a series of activities (a kick-off workshop in September 2023,[27] followed by Monthly Coffee Meetings from October 2023 to June 2024), which culminated in two main milestones, the Ocean Incubator Network Living Laboratory (hereinafter: The Living Laboratory)[28] in May 2024 and this Toolkit.

The kick-off workshop in September 2024 helped the OIN reflect on the theme of Ocean Interconnectedness (between science and law, scientific approaches and other knowledge systems, and between humans and the ocean) and laid the foundations for the preparation and content creation of the Living Laboratory. The group began working on essential aspects of the two pathways, and some team members contributed to the publication of the first project results: a scientific book on emotional and

[27] Panieri, G., Poto, M. P., Bertella, G., Bertolotto Bianc, G., Médici, N., Murray, E. M., Pandeva, R., & Vita, L. (2023). Ocean Interconnectedness: An Interdisciplinary Workshop to Learn from the Ocean, Through Multisensory Activities and Reflections on the Role of Emotions in Science and Law: Senses & Science, Love & Law. Septentrio Reports, (1). https://doi.org/10.7557/7.7271.

[28] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

ecological education for a more sustainable society.[29] This book included a specific section dedicated to Ocean Literacy and served as a valuable resource for designing and planning the Living Laboratory's conceptual framework and activities.

In the Coffee Monthly Meetings, the OIN team members started drafting ideas on the three main thematic areas of the book. They were exposed to the idea that they had to reflect on their participation in the Living Laboratory as an interactive experience of "entering the Toolkit". The three groups prepared themselves for the Living Laboratory experience. They worked on collecting ideas and props for the activities that they were asked to co-create during the Living Laboratory.

1.10 The OIN Living Laboratory

In May 2024, the Living Laboratory unfolded in five stages (1. brainstorming and the first round of presentations, 2. feedback, 3. implementing the feedback, 4. circle of gratitude, and 5. reflective practice). Because of the innovative characteristics of stage 4 and stage 5, a specific sub-section is dedicated to their description.

1. First, participants met in person and started brainstorming on defining their respective thematic areas (positionality, inter-/cross-/transdisciplinarity, co-creation) and creating an activity that highlighted their thematic area's connection to Ocean Literacy, presenting their preliminary ideas to the audience.
2. Second, each group's work underwent peer feedback from the other groups. The following questions developed the feedback:
   - If there was one thing we could add to our section to improve it, what would it be?
   - How did the presentation of this theme (positionality, interdisciplinarity, co-creation) improve your overall understanding of the topic?
   - In what ways can you use this information to inform your work?

[29] Panieri, G., Poto, M. P., Murray E. M. (ed. by) (2024) Emotional and Ecological Literacy for a More Sustainable Society, Palgrave Macmillan, Springer Nature SDGs Series, ISBN: 978–3-031–56,771-1.

3. Third, groups iteratively refined their sections based on the feedback received. Throughout, participants were prompted to consider the potential impact of the Toolkit on their respective communities (researchers, educators, learners, and society at large). The participants were also asked to envision strategies for gathering feedback and evaluating the Toolkit's effectiveness in promoting ocean literacy. The three groups were encouraged to work together on their co-created project and fill in a booklet as part of their reporting tasks and as a preliminary foundational resource to be further developed into a scientific chapter of the Toolkit.
4. In stage four, the parties closed their first working day with a practice learned by Indigenous scholars, known as the Circle of Gratitude (Sect. 1.9).
5. In stage five, the group returned to the most relevant working aspects and dynamics of the first working days through a reflective practice exercise (Sect. 1.10) (Figs. 3, 4, 5, 6, 7, and 8).

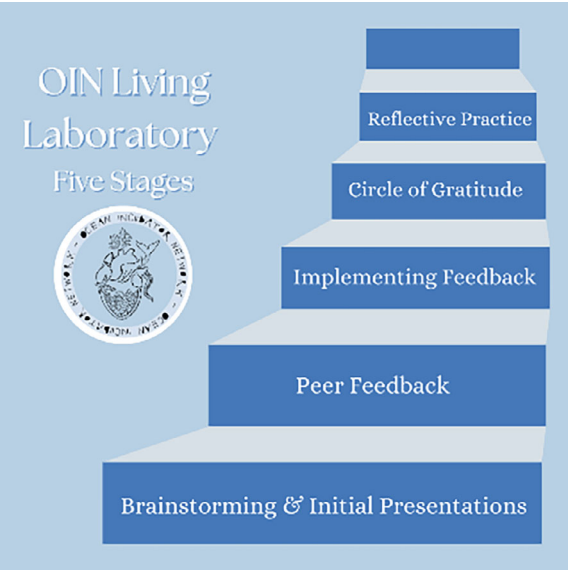


Fig. 3 Infographic created by Laura Vita, Five Stages of the OIN Living Laboratory, 2024

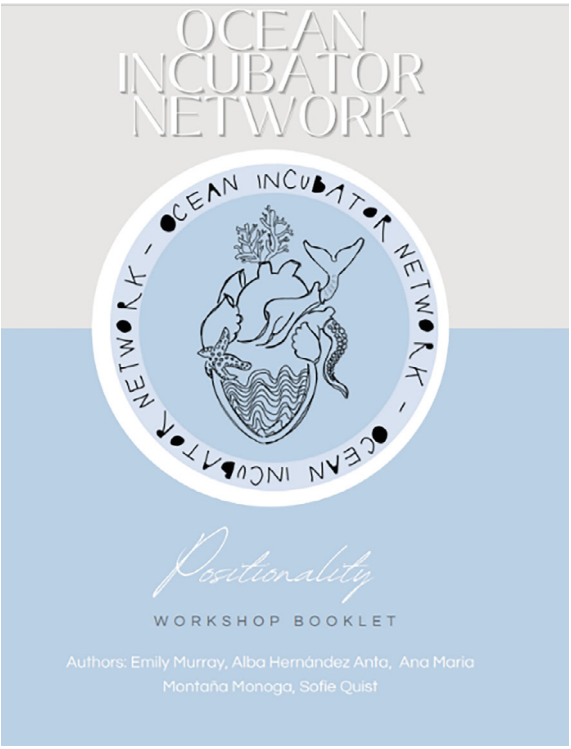


Fig. 4 Cover of the booklet cover

1.11 Circle of Gratitude

The Circle of Gratitude is a practice introduced by Val Napoleon and Rebecca Johnson (ILRU)[30] during a workshop on Indigenous Law and Methodology in 2018.[31] The first step of this practice consists of forming a circle with the team members, creating a space of mutual respect and appreciation. Each member steps into the centre of the circle one by one, becoming the focal point of the group's attention. Those forming the

[30] https://ilru.ca/, last access July 24, 2024.

[31] https://cas-nor.no/yc-project/workshop-indigenous-law-and-methodology#abstract, last access September 3, 2024.

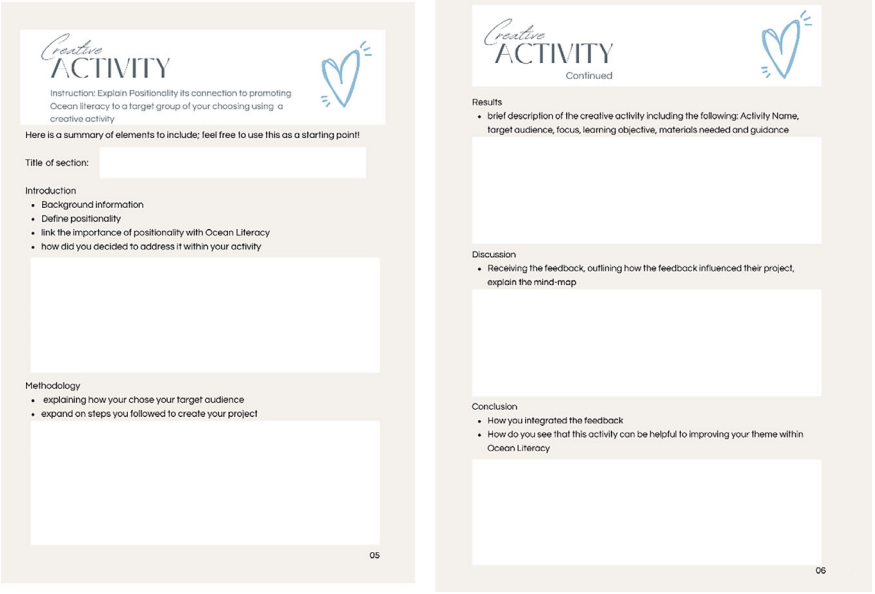


Fig. 5 Activity outline

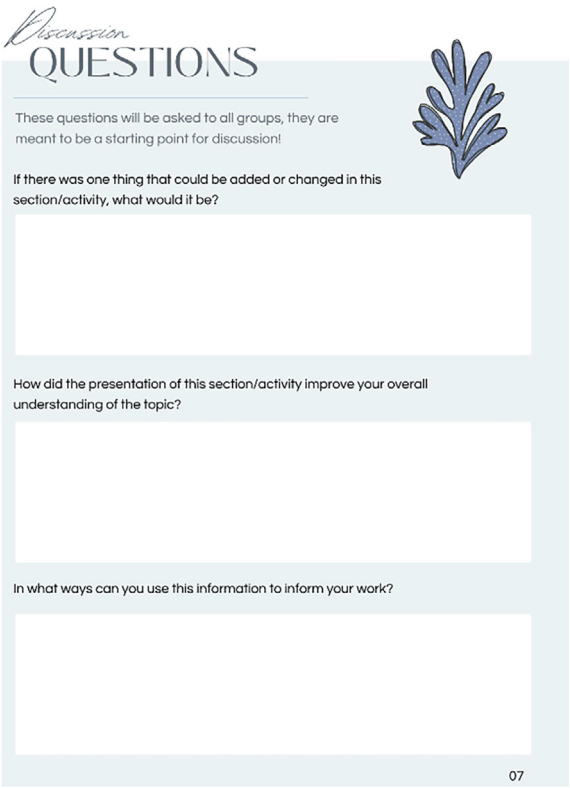


Fig. 6 Discussion outline distributed during the workshop in May 2024. These pages, along with additional background information on each thematic area, were provided to participants in the form of a workbook completed during the workshop. The activity outline provided a consistent structure for creating each activity, ensuring groups captured each process step. The discussion section was added to encourage strategic feedback and participation from all OIN members, promoting the sharing of various perspectives

outer ring then take turns to offer compliments or express their gratitude, reflecting on the positive aspects of their interactions with the individual in the centre. After receiving these affirmations, the person in the middle rotates out, allowing the next member to step in and experience this powerful exchange of appreciation. This process continues until

Fig. 7 Cover of the Program, created by Laura Vita and illustrated by Valentina Russo, 2024

every member has had the opportunity to stand at the circle's centre and be acknowledged by their peers. The Circle of Gratitude fosters a sense of community and belonging and serves as a heartfelt tribute to the individual contributions within the group (Figs. 9 and 10).

1.12 Reflective Practice Inspired by Team Development Dynamics: An Example of Experiential Learning Along the Two Pathways

Throughout the entire work of the Living Laboratory and especially in the implementation of its second day (reflective practice), we leveraged insights from the health sciences sector to guide the group's dynamics. This knowledge served as a conceptual framework for understanding team dynamics and shaped our team development and learning strategies. In tandem, we have used Tuckman's theories of team development[32]

[32] Tuckman, B. W. (1965). Developmental Sequence in Small Groups. Psychological Bulletin, 63(6), 384. In his first study, Tuckman identified four stages (forming, storming,

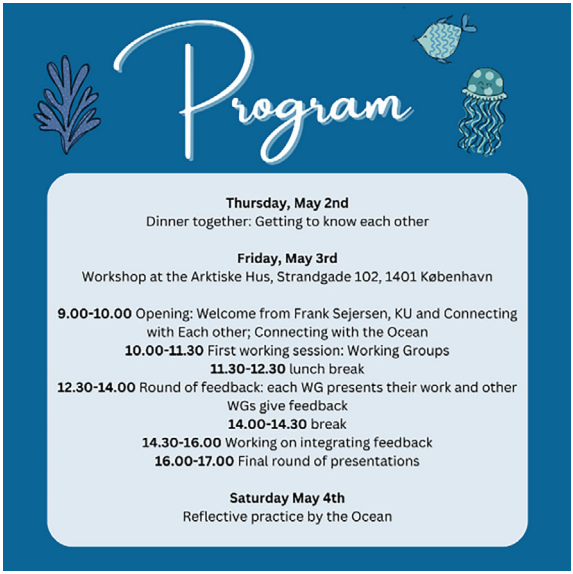


Fig. 8 Workshop activities in detail, created by Laura Vita and illustrated by Valentina Russo, 2024

and the experiential "learning by doing" methodology initially introduced by Graham Gibbs.[33] Bruce Tuckman has described five main stages of team development: forming, storming, norming, performing,

norming, and performing). Twelve years after the introduction of the model, and in response to certain critiques, he conducted a series of reviews to scrutinize the existing research on small-group development that could serve as an empirical evaluation of his original 1965 hypothesis, which posited that groups progress through the aforementioned four stages. These investigations led to the expansion of the hypothesis with the addition of a fifth stage, termed "adjourning", as detailed in Tuckman, B. W., & Jensen, M. A. C. (2010). Stages of Small-Group Development Revisited1. Group Facilitation, (10), 43.

[33] Gibbs, G.(1988) Learning in Doing: A Guide to Teaching and Learning Methods. London: Oxford Centre for Staff and Learning Development, Oxford Polytechnic; Gibbs, G. (1998) Learning by Doing: A Guide to Teaching and Learning. London: Brookes Oxford University; Gibbs' Reflective Cycle. (2016). Academic Services & Retention Team, University of Cumbria; https://my.cumbria.ac.uk/media/MyCumbria/Documents/ReflectiveCycleGibbs.pdf, last access April 21, 2024.

Fig. 9 Annegret Kuhn, being acknowledged at the centre of the circle of gratitude (*Photo* Igor Peftiyev)

Fig. 10 All OIN workshop attendants were participating in the circle of gratitude (*Photo* Igor Peftiyev)

and adjourning or transforming.[34] The forming is the initial phase of team building, where members are uncertain about their roles, rules, norms, and expectations. The next step is storming, where members tend to get into competitiveness, defensiveness, jealousy, and conflict over roles and personalities; members may become critical of the leader and each other. In norming, members get to know each other and agree on the norms, working styles and systems to follow. In performing, the team works positively and creatively to achieve the goals. Finally, in adjourning, after completion of the team tasks, members bring a sense of closure and bonding between members. Teams go through the five stages mentioned above, but how fast a team moves through each stage will depend on the team members, their skills, the work they are expected to do, and the type of leadership available to the team.

Reflecting on the phases of team development in an experiential learning context, such as the one promoted in Gibbs' studies, has given rise to our distinctive reflective circle of learning and interaction. Participants were introduced to Tuckman's cycle and the reflective practice exercise inspired by Gibbs' Reflective Cycle at the beginning of the workshop to enhance their understanding of team dynamics and emphasize the importance of reflecting on the collaborative learning process. Integrating these two concepts is the cornerstone of our workshop, guiding participants through a journey of collaborative growth, reflective practice, and emotional awareness.

The interaction of the two models (Tuckman and Gibbs')[35] helped us give structure and a framework to learning from experiences. Hence, the development of different phases in the reflective practice (Fig. 11).

Drawing on the foundational theories of Tuckman and Gibbs, we have merged these models to forge our unique framework. Our network model, specialized in ocean literacy, is inspired by the dual pathways of connecting with each other and with the ocean, guiding our group's dynamics effectively. In particular, the group was formed over

[34] Gibbs, G.(1988) Learning in Doing: A Guide to Teaching and learning methods. London: Oxford Centre for Staff and Learning Development, Oxford Polytechnic.

[35] See Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

Fig. 11 Steps of our reflective practice inspired by Gibbs' theory, developed by Laura Vita, 2024. The ocean wave pattern is symbolic of the reflective practice cycle, the initiation of the swell with the description of the event building through reflecting on one's feelings during the event, cresting with the evaluation and analysis, followed by the conclusions drawn from the experience as the energy shifts to the wave trough where the intensity decreases and the actions for future (dreamers) can begin to take form

a period stretching from September 2023 to May 2024, during which it experienced several "storming" moments.[36] These occurred during our Monthly Coffee meetings and the in-person workshops, where critical and sensitive topics such as positionality were discussed. Through constructive feedback, the group transitioned into the "norming" phase, where critical issues were redefined, and feedback was integrated, setting the stage

[36] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

for the subsequent "performing" phase. In this phase, the projects were presented, showcasing the progress from earlier stages. The practice of reflection was instrumental in pacing the group for the eventual "adjourning" phase, which is currently ongoing as we prepare the learning Toolkit. Additionally, the nature of reflecting and learning from our collective insights will serve us as we continue to work collaboratively as a network in the future, allowing us to engage more deeply in the next cycle of group work.

During the reflective practice, we adhered to a series of questions inspired by Gibb's cycle. Gibbs' cycle covers six stages that provide structure to learning from experiences; the stages are as follows: description of the experience, feelings and thoughts about the experience, evaluation of the experience, both good and bad, analysis to make sense of the situation, conclusion about what was learned and what could have been done differently, and action plan for future similar situations.[37] The project developer and manager created a set of reflective questions inspired by Gibbs. They described the phases followed during the workshop, assessed the feelings involved, evaluated the impacts, analysed them, and then drew concluding remarks. The group walked by the ocean and discussed each set of reflective questions at various locations facilitated by the project developer.

Here are the steps we followed:

1. Description of the learning experience
    a. Our outstanding OIN members gathered in Copenhagen at the Arctic House to create a learning Toolkit on the Ocean to provide resources to increase Ocean Literacy. We came together to learn about one another, connect with each other, and connect with the Ocean.
2. Feelings Questions
    a. What were you feeling/thinking coming into the workshop?
    b. What were you feeling/thinking during the working period yesterday?
    c. How are you feeling today, upon the workshop's conclusion?

[37] Gibbs, G.(1988) Learning in Doing: A Guide to Teaching and Learning Methods. London: Oxford Centre for Staff and Learning Development, Oxford Polytechnic.

3. Evaluation/ Analysis Questions

   a. What were the "good" and "bad" things about the workshop? And why were they either "good" or "bad".
   b. What went well, and what needs improvement? And why.
   c. What of our three key themes (co-creation, interdisciplinarity, and positionality) do you want to explore further, and why do you think it's important to learn more about?

4. Conclusion Questions:

   a. Share a learning from the workshop.
   b. What skills would you like to develop to help you engage more with the next workshop?

5. Dreamers Questions:

   a. What are your dreams for future OIN workshops, projects, or gatherings?
   b. What creative ways can we engage more people in this vital work and share what we learn?

This process effectively integrated Tuckman's and Gibbs' models, providing a structured and theoretical framework supporting our living lab in achieving its short-term and long-term objectives. This structured approach not only facilitated immediate project outcomes but also laid a foundation for sustained impact in the realm of ocean literacy.

2 The Toolkit

2.1 Structure and Scope

This co-created Toolkit is the final result and second milestone (after the Living Laboratory) of the OIN Project and is designed to be inclusive, participative, and interdisciplinary. It reflects the OIN Project's goals and is structured to facilitate intersectional approaches and multisensory learning (inclusive), participatory methodologies and co-creation (participative), crossing of science and other ocean knowledge sets (interdisciplinary), scientific thinking, and participatory methodologies. It is co-developed by scientists from many disciplines (law, global health, marine geosciences, social sciences), young professionals, and activists. It

targets a diverse audience of stakeholders (researchers, educators, Indigenous, and local communities). It is structured into two parts, mirroring the dual-phase approach adopted during the Living Laboratory.
After this foundational Chapter 1, Part I, *The Toolkit Blueprint*, contains:

Chapter 2 Introduction to Gender, Oin Project, and Ocean Literacy (Sareen Ali, Margherita Paola Poto, Laura Vita, Arianna Porrone), that deepens our understanding of the gender dimension, aligning with our mission to integrate diverse perspectives in our work.

The first two introductory chapters are then followed by the three thematic chapters. Developed by our thematic groups, these chapters explore "Positionality", "Inter-, Cross-, and Transdisciplinarity", and "Co-creation". Each chapter combines theoretical insights with practical activities, reflecting our vision of bridging academic concepts with real-world applications.

Chapter 3 Positionality (Emily Margaret Murray, Alba Hernández Ant, Ana Maria Montaña Monoga, Sofie Elise Quist).

Chapter 4 Inter-, Cross- and Transdisciplinarity (Juliana Hayden-Nygren, Margherita Paola Poto, Annegret Kuhn).

Chapter 5 Co-creation of Knowledge (Margherita Paola Poto, Laura Vita, Igor Peftyiev, Zia Madani, Olena Peftieva).

Part II, *In-depth analysis of Ocean Literacy* applied to specific research fields and educational activities, transitions into a practical textbook format designed specifically for education. It offers an array of practical implementing activities, such as student-led project mappings and educational projects aimed at deepening engagement with ocean literacy.

Chapter 6 Reimagining Ocean Connections: Relationality and Care in Ocean Literacy (Mana Tugend).

Chapter 7 Ocean Literacy Accessibility (Dana Ahmed, Margherita Paola Poto, Stéphanie Heckman).

Focusing on "Relationality of Care" and "Accessibility", these chapters advance our mission to foster inclusivity and care within the community and towards the ocean.

Chapter 8 Activities for Ocean Literacy (Laura Vita, Marcelle Dabbah, Alba Hernández Ant, Ana Maria Montaña Monoga, Emily Margaret Murray, Sofie Quist, Juliana Hayden-Nygren, Olena Peftieva, Dana Ahmed, Stéphanie Heckman, Arianna Porrone, Giuliana Panieri, Ines Angeles, Jane Zimmermann, Mojgan Pooladi, Shamim Wasii Nyanda). Showcasing over 20 co-created activities and student-led projects (as

a OIN satellite project developed at the University of Turin, Department of Management and Earth Sciences),[38] this chapter exemplifies our commitment to collaborative and interdisciplinary approaches to learning, particularly emphasizing SDG 14 in connection with other SDGs. The activities of this chapter can be downloaded separately and adapted to any learning and research environment.

The Toolkit is enriched with references, resources, infographics, and mind maps and includes innovative features like accessible video and audio versions through QR codes to ensure broad accessibility.

2.2 Expected Future Results and Outcomes in Line with the OIN Project

This endeavour aligns with, mirrors, and strengthens the OIN's expected results and outcomes, which include but are not limited to: the development of future workshops on Ocean Literacy where the Toolkit activities could be fully implemented with specific target audiences (Result 1 and Outcome 1); upscaling the network among and beyond the UArctic Members, and by doing so developing further research on ocean literacy. The network is also committed to the development of novel scientific research (Result 3 and Outcome 3), in collaboration with academic institutions, research institutes, and sea and ocean communities around the world, ultimately contributing to collaboration with a generation of cross-disciplinary researchers, educators, learners, and activists (Result 4 and Outcome 4).

[38] In addition to some of our team members, and namely Margherita Paola Poto, Giuliana Panieri, Juliana Hayden-Nygren, Mojgan Pooladi, Laura Vita, credits go to the students of the two courses in Administrative Law and Environmental Law (respectively, bachelor and master's students) who co-created projects for ocean literacy during the Spring semester 2024. Mojgan Pooladi mapped and categorized the projects in a resource available on our website: https://en.uit.no/Content/861466/cache=20242609095727/Mojgan%20Pooladi%20Student%20led%20projects_final%20with%20logo.pdf, last access September 26, 2024.

2.3 Target Audience and Needs

The Toolkit is designed to cater to diverse target audiences, reflecting the interdisciplinary nature of the network members involved in its co-creation.[39] The target audiences include cross-disciplinary researchers, educators, learners, and activists who critically advance understanding and action in ocean-related issues. For researchers, including marine scientists, legal scholars, political scientists, linguists, and global health and sustainability experts, the Toolkit addresses the need to interface with diverse communities of researchers, educators, learners, and sea lovers. It provides tools and resources for transdisciplinary collaboration and communication, fostering innovative ocean-related research and problem-solving approaches. The Toolkit emphasizes transgenerational learning experiences for educators and learners, recognizing the importance of learning from young people and providing opportunities for teaching adults. It offers accessible, engaging materials promoting ocean literacy and inspiring lifelong curiosity and stewardship. For young climate activists, earth allies, and defenders, the Toolkit serves as a platform for effective communication and interaction with policymakers and other stakeholders involved in ocean protection. Finally, as highlighted above, we strive to ensure all that our research findings and all the activities developed in this Toolkit are fully accessible. Aiming to continue working with accessibility partners in the future, we encourage readers, Toolkit users, and activity facilitators to use an accessibility lens to this Toolkit and the activities developed in it, and modify the activities to work best in their setting. We encourage the community of researchers, scientists, educators, and learners to share any constructive feedback or suggestions. We value any input as it helps us improve and better align our efforts with the goals of OIN and ocean literacy.

[39] On target audiences and public engagement in ocean literacy Toolkits see Kelly, R., Evans, K., Alexander, K., Bettiol, S., Corney, S., Cullen-Knox, C., … & Pecl, G. T. (2021). Connecting to the Oceans: Supporting Ocean Literacy and Public Engagement. Reviews in Fish Biology and Fisheries, pp. 1–21.

3 Concluding Remarks

In this chapter, we have offered a detailed overview of the OIN and its connection to the Sustainable Development Goals, the UArctic Values connected to our project, and the UN Decade of Ocean Science for Sustainable Development, that has endorsed this publication as an Ocean Decade Activity (since September 1, 2024). We outlined the conceptual framework (the two main pathways and thematic areas), the structure, and the steps involved in creating this Toolkit. As anticipated, our subsequent chapters will provide a more in-depth exploration of these areas and practical applications for advancing ocean literacy, through an innovative Chapter 8, where more than twenty activities have been developed and can be adapted to raise awareness on the importance to protect the ocean and connect to each other.

Moreover, the chapter aligns with the Ocean Decade Challenges for collective impact, specifically addressing Challenges 9 and 10.[40] These challenges are dedicated to "Skills, Knowledge, Technology and Participation for All" and "Restoring Society's Relationship with the Ocean", respectively. The chapter showcases how our initiatives and activities contribute to these global objectives, emphasizing the importance of inclusive participation, accessibility and renewed ocean stewardship.

Finally, as authors and project members, we acknowledge the dynamic nature of ocean literacy in this endeavour. This toolkit reflects our current knowledge and perspectives. We aim to create a wave of change where ocean-related issues are tackled from a collective perspective, so we recognize that as the network continues to research, gain understanding, and new members join, perspectives and approaches will evolve and change. With this in mind, we are receptive to constructive feedback from those who use this resource. In this dynamism, we feel inspired by the ocean: we are the ocean, and the ocean is us.

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[40] See https://oceandecade.org/challenges/, last access September 26, 2024.

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CHAPTER 2

Introduction to Gender, OIN Project, and Ocean Literacy

Sareen Ali, Margherita Paola Poto, and Arianna Porrone

Abstract This chapter highlights the key role of the gender dimension in enhancing ocean literacy, focusing on the necessity to close the gender gap in education, research, and policymaking in the realm of ocean protection. It centres around the Ocean Incubator Network (OIN) project, which exemplifies how integrating gender considerations can significantly influence research and education outcomes as well as teamwork dynamics. After an analysis of the gendered impacts of climate change and the prevalent gender disparities in STEM and research sectors, the chapter underscores the challenges faced by women and the imperative for gender equality to foster effective and inclusive environmental policies. The core discussion then moves to the analysis of the OIN Project's adoption of a gender-focused approach, emphasizing feminist research methodologies that empower women and girls to share their unique insights and

SAli, MSc McMaster, Canada, contributed to Sects. 2–5. MPPoto, Faculty of Law, UiT The Arctic University of Norway, contributed to the overall supervision and editing of the chapter and wrote Sect. 1. LVita, MSc McMaster, Canada, and OIN Project developer, contributed to the overall supervision and editing of the chapter and designed the visual abstract. APorrone, PhD in Global Studies. Justice, Rights, Politics, University of Macerata, contributed to Sects. 2–4 and 6.

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experiences. This strategy not only enhances research and education but also cultivates inclusive spaces and paves the way for visionary leadership models that redefine and shape the future of ocean literacy.

Abstract (Italiano) Il capitolo si sofferma sul ruolo chiave della dimensione di genere nel contesto dell'*ocean literacy*, concentrandosi sulla necessità di superare il divario di genere nella ricerca, istruzione e *policy making* che supportano e promuovono la conservazione e la sostenibilità degli oceani. L'analisi poi si sposta alla dimensione di genere nell'ambito del progetto Ocean Incubator Network (OIN). Dopo un'analisi degli impatti di genere del cambiamento climatico e delle disparità di genere prevalenti nei settori STEM e della ricerca, il capitolo sottolinea le sfide affrontate dalle donne e ed enfatizza il ruolo centrale che riflessioni sull'uguaglianza di genere debbono avere per favorire politiche ambientali efficaci e inclusive. La discussione principale si sposta quindi sull'analisi dell'adozione da parte del progetto OIN di un approccio focalizzato sul genere, enfatizzando le metodologie di ricerca femministe che permettono alle donne e alle ragazze di condividere le loro intuizioni ed esperienze. Questa strategia non solo arricchisce la ricerca e l'educazione, ma crea anche uno spazio che promuove l'equità di genere e modelli di leadership inclusivi capaci di trasformare l'*ocean literacy*.

Visual Abstract

Visual abstract created by Laura Vita and based on Valentina Russo's illustrations

Keywords Gender · Equality · Gap · SDG 5 · SDG 17 · Climate change · Ocean literacy

1 Brief Introductory Remarks

This chapter explores the significant role of the gender dimension in ocean literacy, emphasizing the need to bridge the gender gap in education, research, and policy formulation to enhance ocean conservation and sustainability. The Ocean Incubator Network (OIN) project serves as a focal point for this discussion, illustrating how gender considerations are integral to research, education, and teamwork connected to ocean literacy. For this purpose, the chapter begins by defining ocean literacy and its importance in fostering an understanding of the complex interactions between humans and the ocean.[1] It then addresses the gender disparities prevalent in STEM and research fields, highlighting the challenges women face and the necessity for gender equality to promote effective and inclusive environmental policies. The analysis then moves to showcase how the OIN Project incorporates a gender-focused approach in its research approach, choice of activities, and group formation dynamics.[2] It discusses the project's commitment to feminist research methodologies, which empower women and girls by providing spaces for them to contribute their unique perspectives and experiences. This approach not only enriches research and education but also fosters environments where diverse voices can influence ocean literacy and conservation strategies. Furthermore, the chapter details the project's efforts to integrate positionality[3] and intersectionality, recognizing the varied identities and experiences that influence how individuals interact with ocean issues. This inclusive strategy enhances the project's impact, promoting more resilient and equitable conservation efforts. By emphasizing the gender dimension in ocean literacy, this chapter contributes to a broader understanding of how inclusivity and diversity are crucial for addressing the challenges of ocean conservation and sustainability. It argues that recognizing and integrating women's roles and perspectives in ocean literacy can lead to an effective interconnectedness between humans and the ocean.

[1] See Chapter 1 and the report Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

[2] See more on this in Chapters 1 and 5.

[3] See Chapter 3, entirely dedicated to Positionality.

2 Gendered Impacts of Climate Change

Global warming and the current climate crisis are among the most urgent challenges of our time. They undermine decades of collective effort to advance human rights, dignity, and gender equality. As global temperatures reach record highs and government actions fall short, the Paris Agreement's goal to limit warming to 1.5 degrees Celsius above pre-industrial levels is under threat.[4] Even minor temperature increases can cause catastrophic sea level rise, flooding, fires, droughts, etc., leading to global food insecurity, illnesses, and irreparable damage to our environment. Nearly 4.5 billion people—almost half the world's population—are exposed to extreme weather events.[5] While climate change affects both men and women, its impacts are experienced differently across genders. In 2020, over 2.3 billion people were considered to live below the poverty line, with 70% residing in low- and middle-income countries.[6] It is projected that 158 million women and girls—16 million more than the combined total of men and boys—will be directly forced into poverty because of climate change.[7]

The poorest and most vulnerable, particularly women and girls, face disproportionate burdens from climate change due to structural barriers and restricted access to resources such as land, food, water, finances, and technology.[8] This increased vulnerability is compounded by their reliance on threatened natural resources and inequities in roles, responsibilities, and decision-making power, which further restrict their ability to cope.

[4] UNFCC (2015). Paris Agreement. https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

[5] Doan, M. K., Hill, R., Hallegatte, S., Corral, P., Brunckhorst, B., Nguyen, M., Freije-Rodriguez, S., & Naikal, E. (2023). Counting People Exposed to, Vulnerable to, or at High Risk from Climate Shocks. World Bank Group. https://documents1.worldbank.org/curated/en/099602511292336760/pdf/IDU07639ca570f3cb048db09bf60fc2cc82df22d.pdf?_gl=1*nnptob*_gcl_au*OTkyNjExNDM2LjE3MjQ2ODY2MDU, last access September 1st, 2024.

[6] Ibid.

[7] UNESCO. (2024). Women in Science, Not in Silence: Pioneering Change in the Global Climate Crisis. https://www.unesco.org/en/articles/women-science-not-silence-pioneering-change-global-climate-crisis, last access September 1st, 2024.

[8] UNDP. (2017). Gender and Climate Change—Overview of Linkages Between Gender and Climate Change. https://www.undp.org/sites/g/files/zskgke326/files/publications/UNDP%20Linkages%20Gender%20and%20CC%20Policy%20Brief%201-WEB.pdf, last access September 1st, 2024.

In many developing regions, women and girls, who are primarily responsible for gathering wood and water for household chores and cooking, find these tasks increasingly challenging due to climate change, often having to travel longer distances to find these resources.[9] This not only limits their time for domestic duties, income generation, education, and rest but also heightens their risk of injury and exposure to sexual harassment and assault.[10] Additionally, displacement and migration caused by climate-related disasters can exacerbate the risk of gender-based violence, including domestic abuse, child, early and forced marriage, and human trafficking.

Earth's oceans and coastal regions are vital to sustaining life on our planet, providing essential services that support both ecological balance and human well-being. They provide crucial habitats for diverse species and act as buffers against global warming. For humans, oceans are a primary source of food, energy, and economic activity, making their health integral to our survival and prosperity. Nearly 40% of the world's population live within 100 km of the coast.[11] Coastal communities are often the first victims of global warming, facing immediate threats from rising sea levels, intensified storms, and increased flooding that directly impact their homes, livelihoods, and way of life.[12] Women and girls, in particular, are especially vulnerable to these climate effects, as flooding not only jeopardizes their homes and livelihoods but also threatens their access to essential services like healthcare and severely compromising

[9] Regassa, S., Givey, C., & Castillo, G. (2010). The Rain Doesn't Come On Time Anymore: Poverty, Vulnerability, and Climate Variability in Ethiopia. Oxfam International. http://hdl.handle.net/10546/112339, last access September 1st, 2024.

[10] Pirzadeh, A., Solôrzano, J., Xiong, Y., Irfan, M., Kwasi, S., Hanna, T., Moyer, J. D., Azcona, G., Bhatt, A. & Valero, S. D. (2023). Gendered Analysis of the Impact of Climate Change on Poverty, Productivity and Food Insecurity. UNWomen. https://www.unwomen.org/sites/default/files/2023-11/gendered_analysis_of_the_impact_of_climate_change_on_poverty_productivity_and_food_insecurity.pdf.

[11] World Meteorological Organization. (2023). Ocean. https://wmo.int/topics/ocean, last access September 1st, 2024.

[12] Bangladesh Red Crescent Society, Cruz Roja Mexicana, IFRC, Norwegian Red Cross, the Red Cross Red Crescent Climate Centre and Somalia Red Crescent Society. (2021). Turning the Tide. Adaption to Climate Change in Coastal Communities. https://disasterdisplacement.org/resource/adapting-to-climate-change-in-coastal-communities/, last access September 1st, 2024.

their sexual and reproductive health and rights (SRHR).[13] This heightened vulnerability is largely due to rigid, gender-biased societal structures that limit their access to resources, decision-making power, and adaptive measures, leaving them more exposed and less able to recover from environmental disruptions.[14] Additionally, women make up nearly half of the global fishing workforce.[15] Rising ocean temperatures, acidification, and coral reef loss are causing declines in fisheries, which undermines their livelihoods in fish catching, processing, and trading.[16] Addressing these challenges is essential to sustaining both marine ecosystems and the economic well-being of those dependent on them.

The intricate connection between gender equality and environmental sustainability is now widely acknowledged. Environmental justice (EJ) studies have brought to light the ways in which environmental concerns entangle societal dynamics, producing structural social inequalities and an unequal power distribution that marginalize certain voices in crucial decision-making processes.[17] Women, in particular, stand at a unique crossroads—they are often the most impacted by environmental harm, yet they possess invaluable knowledge and perspectives that can drive transformative environmental initiatives.[18]

[13] United Nations Population Fund and Queen Mary University of London. (2023). Taking Stock: Sexual and Reproductive Health and Rights in Climate Commitments—An Asia and the Pacific Review. New York: United Nations Population Fund. https://www.unfpa.org/sites/default/files/pub-pdf/2553-UNFPA-NDC-Asia%20Pacific%20Report.pdf, last access September 1st, 2024.

[14] Rose, P. (2024). A Climate Crisis Is a Gender Equality Crisis—Life on Small Island States in the Pacific. UNFPA. https://www.unfpa.org/stories/climate-crisis-gender-equality-crisis, last access September 1st, 2024.

[15] Londono, A. L. (2024). Women's Vital Role Toward Achieving a Sustainable Ocean Future. UNDP. https://www.undp.org/pacific/blog/womens-vital-role-toward-achieving-sustainable-ocean-future, last access September 1st, 2024.

[16] Londono, A. L. (2024). Women's Vital Role Toward Achieving a Sustainable Ocean Future. UNDP. https://www.undp.org/pacific/blog/womens-vital-role-toward-achieving-sustainable-ocean-future, last access September 1st, 2024.

[17] Figueroa, R. M. (2022). Environmental Justice. In The Routledge Companion to Environmental Ethics (pp. 767–782). Routledge; Haluza-DeLay, R. (2013). Educating for Environmental Justice in M. Brody, J. Dillon, R. Stevenson and A. Wals (eds.) International Handbook on Environmental Education Research (pp. 394–402), London: Routledge.

[18] MacGregor, S. (2020). Gender Matters in Environmental Justice. In Environmental Justice (pp. 234–248). Routledge.

It is therefore crucial to recognize that while women and girls face significant vulnerabilities to climate change, they are also powerful agents of change in both mitigation and adaptation efforts. They play a crucial role in protecting the environment and reversing climate change through their unique perspectives and responsibilities. In many communities, they are primary caretakers of natural resources, managing agriculture, water, and energy needs. Their deep connection to the environment often makes them effective advocates for sustainable practices and environmental stewardship. For example, Nous Sommes la Solution is a formidable rural women's movement in West Africa with 115,000 members, which began as a campaign against industrial agriculture, environmental degradation, and gender inequality.[19] It focuses on promoting traditional knowledge, family farming through agroecology, and influencing agricultural governance to support sustainable, small-scale farming while enhancing rural women's leadership and challenging cultural restrictions imposed by gendered roles.

Women and girls are also pivotal in grassroots movements, leading efforts to promote conservation, renewable energy, and climate adaptation strategies. By leveraging their traditional knowledge and leadership roles within families and communities, they can drive significant change in resource management. A prime example is the Queensland Indigenous Women Rangers Network, which empowers Indigenous women to combine ancient wisdom with modern technology, such as drones, to monitor soil erosion, coral changes, and wildfires.[20] This innovative approach creates a new feminist conservation method that integrates storytelling and knowledge sharing with women's empowerment to restore ecosystems like the Great Barrier Reef for future generations. Supporting women and girls with the necessary resources enhances their ability to contribute to climate solutions and fosters more resilient and sustainable communities.

[19] Associated Press. (2024). West African Project Helps Women Farmers Claim Their Rights, Land. VOA. https://www.voanews.com/a/west-african-project-helps-women-farmers-claim-their-rights-land-/7546756.html, last access September 1st, 2024.

[20] Hamilton, M. (2023). Meet the Indigenous Women Who are Saving Australia's Great Barrier Reef. AFAR. https://www.afar.com/magazine/these-indigenous-women-rangers-are-saving-the-great-barrier-reef, last access September 1st, 2024.

3 Ocean Literacy and Gender Equality: The OIN Project's Inclusive Approach

In its simplest form, ocean literacy is about understanding how the ocean influences our lives and how our actions, in turn, affect the ocean.[21] It involves comprehending the ocean's systems, its role in climate regulation, and its significance to global biodiversity and human societies. By cultivating a deep understanding of oceanic processes and their connection to human well-being, ocean literacy empowers individuals and communities to make informed decisions and take responsible actions that impact marine health and promote sustainable resource management.[22] It also promotes greater appreciation for the ocean, encouraging stewardship and proactive engagement in preserving marine ecosystems for the long term. The Ocean Incubator Network (OIN) Project mirrors this commitment by using ocean literacy to amplify and deepen our understanding of the ocean, ultimately enhancing our connection with it.

Given the heightened vulnerability of women and girls to environmental degradation and climate change, amplifying their lived experiences and strengthening their voices in policymaking is crucial to ensuring these challenges are recognized and effectively addressed.[23] Gender equality is vital for tackling oceanic challenges, as women's diverse perspectives lead to more effective and sustainable solutions. When women contribute to environmental policies, their insights enhance the management of ocean resources and improve conservation outcomes.[24] Intersectionality further enriches this approach by recognizing and addressing the complex, interconnected factors that shape individuals' experiences, ensuring that

[21] McKinley, E., Burdon, D., & Shellock, R. J. (2023). The Evolution of Ocean Literacy: A New Framework for the United Nations Ocean Decade and Beyond. Marine Pollution Bulletin, 186(114,467). https://doi.org/10.1016/j.marpolbul.2022.114467.

[22] See Chapter 1 (OIN Project and the Toolkit).

[23] UNESCO. (2024). Women in Science, Not in Silence: Pioneering Change in the Global Climate Crisis. https://www.unesco.org/en/articles/women-science-not-silence-pioneering-change-global-climate-crisis, last access September 1st, 2024.

[24] Ibid.

solutions are both inclusive and equitable.[25] The OIN Project incorporates intersectional approaches to research in ocean literacy, thoughtfully considering how intersecting social identities influence individuals' interactions with ocean issues.[26] This inclusive approach enhances the project's impact and promotes more resilient and equitable ocean conservation efforts.

The OIN Project intentionally and organically uses feminist research methodology by creating empowering spaces for women and girls and leveraging their roles as sources of valuable wisdom and change.[27] It fosters environments where women and girls can access resources, share their perspectives, and shape their roles in ocean conservation, driving innovative and inclusive solutions to ocean challenges. The team intentionally nurtured self-reflection and positionality, recognizing that meaningful engagement stems from understanding one's identity, experiences, and values. Incorporating these practices boosts the project's effectiveness, ensuring solutions tackle the varied and complex challenges of different communities. In the project's Living Laboratory, for example, the OIN team embraced a transgenerational approach and included a diverse group of women researchers, from an 11-year-old girl accompanying her mother to a senior researcher in her 70 s, who contributed a wealth of experience with remarkable humility.[28] Their ability to connect in a safe, ego-free environment and collaboratively brainstorm solutions

[25] Kapilashrami, A., & Hankivsky, O. (2018). Intersectionality and Why It Matters to Global Health. The Lancet, 391(10,140), 2589–2591. https://doi.org/10.1016/S0140-6736(18)31431-4.

[26] See Chapter 1, 3 and 6.

[27] Kiguwa, P. (2019). Feminist Approaches: An Exploration of Women's Gendered Experiences. In S. Laher, A. Fynn, & S. Kramer (Eds.), Transforming Research Methods in the Social Sciences: Case Studies from South Africa (pp. 220–235). Wits University Press. http://www.jstor.org/stable/10.18772/22019032750.19; Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

[28] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

for ocean protection exemplifies the spirit of feminist research, characterized by a commitment to equality, reflexivity, and the sharing of power.[29]

The project also exemplifies diversity by including women and perspectives from both the Global North and Global South, enriching its efforts with a broad range of perspectives and expertise.[30] This international representation enhances the project's ability to address ocean literacy and sustainability from multiple viewpoints, ensuring that solutions are culturally and contextually relevant while fostering innovative, globally informed strategies. Central to the project's success is the application of the ethics of care, that is a way of thinking and acting which cultivates close and supportive relationships within the team and beyond.[31] This approach emphasizes mutual respect, empathy, and open communication, creating a collaborative environment where every team member feels valued and heard. This is because the ethics of care calls for a deliberate shift from self-interest to a focus on others.[32] It invites to resist the impulse to impose solutions on complex problems without first asking, "What is needed?" "What has already been done?" and "How can I fit into this intricate web?". The goal is not to intervene with a predatory mindset, but rather to nourish the minds and hearts of those who care, fostering strong connections and communities of thinkers and practitioners who support one another and share their talents. Not only that. The ethics of care encourages deep listening and demands to develop the ability of speaking a new language, one that welcomes new and different words—such as those of Indigenous communities and that better portray

[29] Wilson, G. (2023). Research Made Simple: An Introduction to Feminist Research. Evidence-Based Nursing, 26(3), 87–88, https://doi.org/10.1136/ebnurs-2023-103749.

[30] On the implementation of some of the project activities in the Global South thanks to the mediation of indigenous researchers see Montaña Mónoga, A. M., Parola, G., Poto, M. P., Panieri, G., Muniz de Souza (Otomorinhori'õ Xavante), J., Médici Machado, N., Wennerstrom, A., Barrenechea Angeles, I., & Zimmermann, J. (2024). ECO_CARE Multisensory and Experimental Workshop 2024 "We are the Ocean, and the Ocean is us. A Living Laboratory to Learn from Each Other and Learn from the Ocean". Septentrio Reports, (1). https://doi.org/10.7557/7.7828; Médici, N. (2024). Indigenous Resilience Through the Waters: The Story of the Aldeia Maraka'nà, https://blogs.egu.eu/geolog/2024/08/19/indigenous-resilience-through-the-waters-the-story-of-the-aldeia-marakana/, last access August 28, 2024.

[31] See Chapter 6.

[32] See Chapter 6.

the role, rhythms, and power of nature—beyond the narrow definitions of value and priority set by Western societies. It aligns with the slow, seemingly unproductive, or undervalued time of planetary restoration. Indeed, as feminist thinker Joan Tronto reminds us, the ethics of care threads together our bodies, selves, and environment into a vibrant, life-sustaining web.[33] In this sense, it considers the health and well-being of all inhabitants of the planet through an inclusive and expansive lens—acknowledging that there is no single correct way to practice care, but rather a multitude of ideas to draw from.

Additionally, the shared commitment to gender equality and environmental sustainability that underpins the network's operations is guided by principles that promote fairness and inclusivity. These ethical foundations not only enhance teamwork but also ensure that the project's strategies are implemented effectively, reflecting a collective dedication to both social and environmental goals.

OIN's mission, echoing the UN's commitment to intertwining gender and environmental priorities, is to turn the tide and spotlight women's pivotal roles in environmental decision-making, policy formulation and strategic planning, especially in ocean governance. Despite often being sidelined, women and girls have lead impactful initiatives, developing essential tools and altruistic solutions, that benefit both human and non-human communities from an integral ecology perspective. Research indicates that women and girls are generally more concerned with climate and sustainability issues than men.[34] Their deep involvement in care-related activities and resource management within their communities—also defined by the literature as "care-work", "domestic work", and "reproductive labour" which refer to the unpaid activity of renewing daily life, a crucial element for maintaining healthy environments—has honed their abilities to listen, and view issues from a multitude of perspectives. Their marginalization, often marked by intersecting forms of discrimination, has enabled them to develop radical perspectives, envisioning and creating alternative, new worlds.[35]

[33] Tronto, J. (1993). Moral Boundaries: A Political Argument for an Ethic of Care (p. 103). Routledge.

[34] Ojeda, D., Nirmal P., Rocheleau, D., & Emel, J. (2022) Feminist Ecologies, Annual Review of Environmental Ecologies, pp. 149–171, https://doi.org/10.1146/annurev-environ-112320-092246.

[35] Meyer, M. H. (2002). Care Work: Gender, Labor, and the Welfare State. Routledge.

To harness and value this space of possibility, the OIN Project, driven by a dedicated team of visionary women, fosters women and girls' empowerment and leadership in all organizational aspects of the project, from the overall and work package coordination to the project activities and results.

4 Bridging the Gender Gap in Research and STEM

Women in academia, especially in STEM, face a complex web of challenges, including workplace bullying, gender biases, and inflexible work conditions that interfere with care responsibilities. These hurdles contribute to the persistent gender gap. As reflected in the She Figs. 2021 report,[36] while women make up over 48% of PhD graduates in Europe, they account for only 33% of researchers and occupy a mere 26% of top academic positions. The disparity is even more pronounced in STEM fields, where women drop significantly at advanced levels of study and research.

This disparity stems from multiple mechanisms within the system that marginalize women, including discrimination, biased assessment tools, and meritocratic ideals that often undervalue women's contributions. For instance, women's strengths in areas like teaching are often undervalued compared to traditional metrics like publishing. Evaluation criteria that prize "excellence" often overlook the capacities of women, reinforcing these structural barriers.

Furthermore, epistemic injustice—where certain groups are denied full participation in knowledge creation, either by being excluded from discussions and research or by having their input dismissed or undervalued—plays a crucial role.[37] Women, in particular, often face exclusion from shaping knowledge practices, with their contributions frequently questioned or less readily believed. This criticism often emerges when an approach to research and teaching breaks away from traditional norms,

[36] European Commission: Directorate-General for Research and Innovation. (2021). She Figs. 2021: Tracking Progress on the Path Towards Gender Equality in Research and Innovation, Publications Office. https://data.europa.eu/doi/10.2777/602295.

[37] Duarte M., Losleben K., & Fjørtoft K. (eds.) (2023) Gender Diversity, Equity, and Inclusion in Academia. A Conceptual Framework for Sustainable Transformation. Routledge (pp. 129–139).

shifting the focus from serving the instructor's preferences to nurturing the learner's creativity. This very deviation from convention is what ignites the spark for groundbreaking and innovative ideas. As Black scholar bell hooks[38] eloquently illustrates in *Teaching Community*, it is in offering alternative ways of thinking that learners can engage in the liberation of suppressed knowledge. The OIN Project coordinators take a bold stance by breaking away from convention, fostering an innovative feminist methodology for research and knowledge sharing that prioritizes inclusivity and collaboration. They embrace the practice of sharing power, creating an environment where authority is decentralized and all voices are equally valued in the process of knowledge creation and exchange. Gender stereotyping, implicit biases, the scarcity of role models due to mentorship, and hostile environments marked by microaggressions and violence further compound these issues. Women in academia often bear a double burden, as they continue to perform the majority of caregiving responsibilities, both in their personal lives and within institutional settings.

In response to these challenges, organizations like OIN are pivotal. They are co-created and supported by women, providing a protective and encouraging space for knowledge exchange and resource sharing. By nurturing a collaborative environment, OIN not only helps women navigate the deeply entrenched biases of academia but also works to close the gender gap in STEM, driving greater participation and leadership among women researchers. Through these supportive networks, the invisible barriers are confronted, and the landscape of academia is reshaped to be more inclusive and just.

5 Sustainable Development Goal (SDG) 17 in Action—Prioritizing Connections Within the OIN Project

Sustainable Development Goal (SDG) 17 aims to invigorate global partnerships crucial for sustainable development. It emphasizes the need for inclusive collaborations grounded in shared values, principles, and a

[38] Hooks, bell, 1952–2021. (2003). Teaching Community: A Pedagogy of Hope. Routledge.

common vision, focusing on both people and the planet.[39] By fostering such comprehensive and value-driven partnerships, SDG 17 seeks to enhance collective efforts towards sustainable development and ensure that global challenges are addressed holistically and equitably.

The OIN Project's framework aligns with SDG 17 by emphasizing the critical role of connections in achieving sustainable development. Adopting a relational view of the ocean, the team highlights the interconnectedness and interdependence of all organisms, essential not only for survival but for collective thriving. This perspective views the ocean as a spiritual, living entity and an active participant in the intricate network of life.[40] The OIN Project is committed to respecting, nurturing, and cultivating this partnership with the ocean, recognizing that such a deep, reciprocal relationship is essential for supporting sustainable management and ensuring the health and vitality of marine ecosystems.

Additionally, the OIN Project's framework prioritizes relationships and connections through its two pathways—"Connecting with Each Other" and "Connecting with the Ocean"—which facilitate the exploration of relational dynamics and interactions between humans and the ocean.[41] Through in-depth analysis, the team critically examines its roles and identities (positionality),[42] integrates diverse disciplinary perspectives (inter-/trans-/cross-disciplinarity),[43] and emphasizes collaborative knowledge creation (co-creation).[44] This approach strengthens efforts to build relationships within the climate and ocean sectors and deepens understanding of the human-ocean connection.

By incorporating knowledge from fields such as law, marine sciences, climate and ocean governance, marine ecology, marine socio-ecology, ocean policy, and planetary health, as well as perspectives from both the

[39] United Nations. (2023). Sustainable Development Goals—Goal 17: Revitalize the Global Partnership for Sustainable Development. https://www.un.org/sustainabledevelopment/globalpartnerships/, last access September 1st, 2024.

[40] See Chapter 6.

[41] See Chapter 1.

[42] See Chapter 3.

[43] See Chapter 4.

[44] See Chapter 5.

Global North and Global South, the team exemplifies SDG 17's commitment to fostering inclusive, multi-level partnerships.[45] This collaborative synergy not only enriches ocean literacy but also provides a practical framework for advancing ocean protection and sustainability. It enhances global cooperation and addresses the complex nature of these challenges, reflecting SDG 17's dedication to holistic solutions and effective partnerships in advancing ocean literacy and stewardship.

6 Women's Leadership in Ocean Literacy and the Voice of the Participants

In the concluding remarks of this chapter, it is worth observing how, beyond contributing to address gender imbalances in ocean literacy, the OIN Project also contributed to shaping a new model of ocean leadership. The discussion emphasizes the importance of re-shaping women leadership in ocean literacy, to foster a collaborative and supportive environment essential for addressing today's complex environmental challenges.

The traditional model of leadership perpetuates a rigid narrative that underscores innate traits such as assertiveness, authority, self-confidence, and sacrifice, often portraying the leader as an exceptional and heroic figure.[46] Health research, however, indicates that effective leadership is more about mastering the conversational skills necessary for excelling in a specific domain.[47] This perspective demystifies the traditional approach to leadership, presenting it not as an exceptional or biological attribute but as an attainable possibility for those who can dynamically integrate

[45] Montaña Mónoga, A. M., Parola, G., Poto, M. P., Panieri, G., Muniz de Souza (Otomorinhori'õ Xavante), J., Médici Machado, N., Wennerstrom, A., Barrenechea Angeles, I., & Zimmermann, J. (2024). ECO_CARE Multisensory and Experimental Workshop 2024 "We are the Ocean, and the Ocean is us. A Living Laboratory to learn from each other and learn from the ocean". Septentrio Reports, (1). https://doi.org/10.7557/7.7828; Médici, N., (2024) Indigenous Resilience Through the Waters: The Story of the Aldeia Maraka'nà, https://blogs.egu.eu/geolog/2024/08/19/indigenous-resilience-through-the-waters-the-story-of-the-aldeia-marakana/, last access August 28, 2024.

[46] Marshall, C., Johnson, M., & Edwards, T. (2017). A Feminist Critical Policy Analysis of Patriarchy in Leadership. Critical Approaches to Education Policy Analysis: Moving Beyond Tradition, pp. 131–150.

[47] Souba, W. (2011). A New Model of Leadership Performance in Health Care, Academic Medicine, 86, pp. 1241–1252, 10.1097/ACM.0b013e31822c0385.

insights from diverse contexts with an open-minded approach. Additionally, the prevailing model fails to address the contemporary challenges that require adaptability, empathy, the capacity to learn from mistakes, and the ability to form transdisciplinary alliances for collective well-being.[48]

The OIN Project employs a leadership model in the realm of sustainability and environmental education that transcends the limitations of traditional approaches; it creates platforms for dialogue and engagement—including monthly coffee meetings, workshops, manuals, visual and written educational tools[49]—specifically designed for those typically marginalized in environmental discussions, such as women and girls. Project coordinators Margherita P. Poto, Laura Vita, and Giuliana Panieri provide open-access resources that empower individuals to drive community-centred change. In this sense, leadership assumes new meanings. This evolving approach indeed reshapes educational and pedagogical paradigms by promoting a form of leadership that is horizontal, inclusive, and deeply rooted in lived experiences. It encourages active participation through care,[50] gentle mentorship, and authentic self-expression, celebrating the unique perspectives that each person brings. The OIN Project empowers project participants to break free from traditional academic moulds and truly define themselves. Through an engaging online survey, each one was invited to share what makes them unique and fuels their passion, and to identify the areas where they feel they are contributing to a transformative impact. The responses eventually offer a vibrant glimpse into OIN's world—highlighting the way ocean science and research connect all project participants. These testimonies paint a dynamic picture of their unique contributions and boundless enthusiasm, revealing how their individual sparks of excitement can collectively transform the field. By celebrating and incorporating these personal revelations, the OIN's project reshapes leadership to be more inclusive, inspiring, and reflective of each participant's distinctive potential. In the spirit of care and respect, and to safeguard the deeply personal stories shared, we've come together to honour everyone's privacy by sharing these narratives anonymously,

[48] Marshall, C., Johnson, M., & Edwards, T. (2017). A Feminist Critical Policy Analysis of Patriarchy in Leadership. Critical Approaches to Education Policy Analysis: Moving Beyond Tradition, pp. 131–150.

[49] See Chapter 1 and 5.

[50] See Chapter 6.

making use of the pronouns "They/them", allowing the focus to remain on the heart of the storytelling rather than the storyteller.

> I am a very sensitive person, that loves deep conversations and to discuss about emotional things. My passion for nature shapes my world and perspective on life.
>
> I am passionate for science and education, I want to reach a new perspective of knowledge where the meeting point is science and art. I seek adventure in nature and new experiences.
>
> My passion is to enjoy the versality of life between dedication to research and the richness of bonds of family and beloved friends.
>
> I'm a passionate reader, a curious traveler, and a mindful listener. Through words and yoga, I love to weave connections between people, cultures, elements, and places. My mission is to guide individuals in reconnecting with themselves, enabling a deeper, renewed bond with the Earth and all her living beings.
>
> I am a multipotentialite who loves to learn, spend time in nature, and create unique projects with beautiful people who see the interconnectedness of life. I have a deep passion for using my unconventional journey to connect with those who struggle to find their purpose or answer the question "what do you want to be when you grow up?". My optimism, empathetic heart and authenticity help to shed light on the dark parts of life and make others feel heard and seen.
>
> Love photography and helping kids. Sharing the story is important, especially one that helps to share the knowledge. Pictures gain value with time, becoming priceless snapshots of past memories and turning themselves into knowledge.
>
> With a long-standing interest in education, I would describe myself as immensely curious. I'm particularly interested in how society navigates and adapts to challenging natural environments. This curiosity has led me all over the world to explore unique stories of communities' climate resilience strategies and their ingenious decision-making processes.
>
> I am an imaginative thinker who seeks to see and make creative connections between people and concepts. My storytelling nature, love of animals and

> the natural world, and care-giving nature shape how I show up in the world.
>
> I am dynamic, ambitious, courageous, open, and eager to explore new experiences and fields. I am passionate about languages, books, nature (specifically the Nordic's), education, cultures, and food. I am a good listener and support others, especially women, in writing their path and not letting others write it on their behalf.
>
> Dreamers' supporter, ally of the Earth, mother.
>
> I am a tiny part of this amazing globe and I would like to make my contribution to nature protection and specifically ocean literacy, the cradle of life.
>
> I am a human skyscraper with dimples and a thalassophile (a lover and friend of the seas and Ocean). I lead my life with joy, and I believe that each and every one of us has a unique superpower which will help protect the Ocean and Mother Nature.
>
> I am dedicated to working with marginalized communities to ensure equal access to healthcare for everyone. I am passionate about shedding light on the unique sociocultural challenges that women and girls face in accessing healthcare, aiming to drive more equitable policies. My personal roles as a mother, wife, daughter, and sister define me and shape my perspective on life. There's a lot I don't know, but as I get older, I'm learning more about myself and the world. It helps me keep growing and improving.
>
> I am a steward of the world's most vital resources, weaving together the threads of law, science and policy to protect our planet, especially its oceans and polar regions.

What emerges from the different stories is a deep commitment to fostering change through diverse lenses, all tied by a common thread of environmental stewardship, particularly in relation to the Ocean. There is who is driven by a desire to understand human behaviour, specifically why some are engaged in protecting the oceans while others are not. This curiosity fuels their passion for transformative change, guided by feminist research and pedagogy, aimed at nurturing ecosystems and human connections alike.

Others emphasize the importance of connecting with nature, believing that this bond, when fostered within ourselves and society, holds the potential to challenge the status quo and create a healthier, safer world. This belief in the oneness of humans and nature underpins their optimism in tackling today's crises.

Education is central for many. Some emphasize equal education as a gateway to equal opportunities, committed to breaking down barriers for children and families. Others are dedicated to making complex scientific research accessible, spinning technical data into engaging, understandable formats to inspire sustainable change.

Collaboration emerges as a key theme. For some participants, crafting proposals for European public grants is an exciting team effort, essential for advancing ocean literacy and marine governance. Similarly, teaching and languages inspire others, as they develop educational tools to engage children with Ocean science, climate change, and sustainability.

The global nature of the initiative is highlighted by the collaborative efforts taking place across countries like Denmark, Norway, Namibia, and Brazil. Many reflect on the incredible achievements of the group, marvelling at what has been accomplished in such a short span of time.

A shared commitment to inclusivity runs through many testimonies. There's who is passionate about making marine science accessible to differently-abled individuals, emphasizing that the ocean does not discriminate, and advocating for the involvement of everyone in preserving the Blue Planet.

Others focus on uplifting underrepresented voices, particularly women and girls in climate-vulnerable areas, whose resilience and leadership are often overlooked. By bringing their stories to the forefront, they hope to inspire policy changes and highlight the vital roles these unsung heroes play.

Finally, a systems-thinking approach to research is another source of inspiration for participants, with a focus on understanding the complex interactions between human activity and the environment. This holistic methodology is seen as key to addressing the pressing issues of sustainability and governance, ensuring a future for the planet's most vulnerable ecosystems.

In conclusion, the OIN Project's approach to women's leadership in ocean literacy presents a dynamic reimagining of leadership models, emphasizing inclusivity, collaboration, and the power of diverse voices. Through the participants' unique contributions, personal passions, skills,

and lived experiences collectively fuel transformative change. This evolution of leadership, shaped by empathy, care, creativity, and transdisciplinary connections, not only addresses environmental challenges but also fosters a deeper connection between people and the planet. Ultimately, the OIN Project stands as a testament to the power of community-centred, feminist-driven approaches to redefine what leadership looks like in the context of ocean literacy and beyond.

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CHAPTER 3

Positionality

Emily Margaret Murray, Alba Hernandez Anta, Ana Maria Montaña Monoga, and Sofie Elise Quist

Abstract This chapter explores the concept of positionality as one of the main themes of the OIN Ocean Literacy Toolkit. It draws on positionality theory and anti-oppressive, decolonial research methodologies that incorporate positionality as a reflexivity tool in social research. Drawing on Donna Haraway's seminal essay on "Situated Knowledges", the chapter elaborates on questions that researchers might ask themselves to understand the ways in which their positionality influences how they come to know the Ocean and how they may edge towards epistemic justice. Thus, linking positionality to epistemology, the chapter charts how multiple ways of knowing the Ocean is surfacing in both academic scholarship and policy. Finally, the authors connect and translate the main dimensions to the two pathways "connecting with each other" and "connecting with

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the ocean" and introduce the positionality activities included in the OIN Toolkit.

Abstract (Resumen en Español) Este capítulo explora el concepto de Posicionalidad como uno de los temas principales del OIN "Ocean Literacy Toolkit". Se basa en la teoría de posicionalidad y en metodologías de investigación antiopresivas y decoloniales que incorporan la posicionalidad como una herramienta reflexiva en la investigación social. Basándose en el ensayo de Donna Haraway "Situated Knowledges", el capítulo elabora en las preguntas que las investigadoras se pueden preguntar a sí mismas para entender maneras en las cuales su posicionalidad puede influir en cómo conocen el océano y cómo se inclinan hacia una justicia epistemológica. Entonces, al conectar la posicionalidad con la epistemología, este capítulo muestra cómo diferentes maneras de entender el océano están surgiendo tanto en investigación académica como en las políticas. Finalmente, las autoras conectan y traducen las dimensiones principales a los dos caminos "conectando con cada uno" y "conectando con el océano", e introducen las actividades de posicionalidad incluidas en el OIN kit de herramientas.

Abstract (Abstrakt på dansk) I dette kapitel udforskes begrebet positionalitet som et af hovedtemaerne i OIN Ocean Literacy Toolkitet. Kapitlet gennemgår positionalitetsteori og anti-undertrykkende, dekoloniale forskningsmetoder, hvor positionalitet er inkorporeret som et værktøj for kritisk reflektion i samfundsfaglig forskning. Med udgangspunkt i Donna Haraways essay om "Situated Knowledges" uddyber kapitlet spørgsmål, som forskere bør stille sig selv for at forstå de måder, hvorpå deres positionalitet påvirker deres forhold til havet. Med andre ord, måden hvorpå vi lærer havet at kende og hvordan vi kan udvikle vores forskning imod epistemisk retfærdighed. Ved at forbinde positionalitet med epistemologi, kortlægger kapitlet, hvordan forskellige måder at lære havet at kende på havet på er udforsket både i akademisk litteratur, jura og politiske dokumenter. Til slut forbinder og oversætter forfatterne hoveddimensionerne i de to pathways "forbindelse til hinanden" og "forbindelse til havet" og introducerer positionalitetsaktiviteterne inkluderet i OIN-værktøjskassen.

Keywords Positionality · Identity · Reflexivity · Epistemic Justice · Situated Knowledges · Ocean Literacy

1 Introduction

> The starting point of critical elaboration is the consciousness of what one really is and is "knowing thyself" as a product of the historical process to date which has deposited in you an infinity of traces, without leaving an inventory.[1]

As outlined in Chapter 1, the OIN Ocean Literacy Toolkit aims to catalyse public understanding of the Ocean's relevance for a sustainable future for all. The Toolkit works as a guide for researchers, educators, and learners to help themselves and their communities better understand the Ocean[2] and our relationship with it through two pathways: "Connecting with each other" and "Connecting with the Ocean". Through critical reflection and interdisciplinary inquiry, the Toolkit explores the relational dimensions of climate and ocean health and the reciprocal dimension of human-ocean interactions. Ocean Literacy is not only about *what* we know about the Ocean, but *how* we come to know the Ocean. Positionality, that is, reflects upon our identities and how we position ourselves in relation to others and to the Ocean, is a self-critical and deliberate exercise of introspection. Thinking about positionality encourages us to reflect on our identity, life trajectory, work experiences, values, knowledge, privileges, choices, worldviews, and relation to the humans, critters, and more-than-human communities around us. This reflective process helps identify aspects of our work and personal lives in connection to Ocean Literacy with broader sociological relevance, refining the focus of research, education, and study. Although mostly used in the context of social science and humanities research, positionality has great potential beyond its academic origins to

[1] Gramsci, A. (1971). *Selections from the prison notebooks* (Q. Hoare & G. Nowell-Smith, Trans.). International Publishers. (Original work published 1929–1935).

[2] The authors of this chapter chose to capitalize "Ocean" to recognize its vital importance to human and more-than-human life. Ocean is usually only capitalized when part of a name, like the "Atlantic Ocean"; however, the Ocean is one interconnected body of water thus the "Ocean" is a name in itself.

act as a powerful educational tool to foster deeper connection and appreciation for the Ocean.[3] Positionality can illuminate the diverse ways in which humans interact with marine environments and the more-than-human creatures that live in these spaces, and the bidirectional influence between humans and the Ocean.

In this chapter, and throughout the Toolkit, we understand positionality in relation to Ocean Literacy as fostering self-awareness and as an introspective exercise that guides us in reflecting on how our views of the world, lived experiences, and where we have live(d) on planet Earth impact how we know and relate to the Ocean.[4] Our understanding of positionality is not only about looking inwards, but also understanding how we are part of Earth's ecosystems and how we interact with its cycles and rhythms. To explore positionality in the context of the Ocean Incubator Network (OIN), members first connected with each other through positionality exercises for the purpose of learning about one another on a deeper level; to understand the ways in which our identity influences the research we do and why we do it. Through developing the aims and objectives of the OIN, it became clear that translating the concept of positionality and applying it to a Toolkit for improving Ocean Literacy would align closely with the increasing calls for (mainly Western) scholarship to move beyond the nature/culture divide inherited from Enlightenment thinking,[5] which has been proposed by many as the root cause of the

[3] For example, Processwork and deep democracy are tools originating from the field of psychiatry, which are used for community building and mediation organized around awareness, including self-awareness. In Processwork, many of the dimensions of positionality discussed in academic literature are incorporated in community work to guide often diverse groups through difficult processes or topics. See: https://www.processworkuk.org/processwork/. Accessed 11 August 2024.

[4] We arrived at this definition in collaboration with the OIN network during an in-person workshop in Copenhagen in May 2024.

[5] See Latour, B. (1991). *We have never been modern*. Harvard University Press, United Kingdom; Tsing, A.L. (2015). *The mushroom at the end of the world: on the possibility of life in capitalist ruins*. Princeton University Press, United States; Artmann, M. (2023). Human-nature resonance in times of social-ecological crisis—a relational account for sustainability transformation. *Ecosystems and People, 19*(1), 2168760. https://doi.org/10.1080/26395916.2023.2168760.

grave ecological crises we are facing today.[6] A better awareness of how our positionalities influence our worldviews and ways of knowing is thus a prerequisite for decolonizing ocean-related research and moving towards epistemic justice. Furthermore, learning to situate ourselves in relation to the Ocean and to feel an emotional connection to its complex lifeworlds and importance in our everyday lives, from the water we drink to the air we breathe, can build a community that stands up for the Ocean and promotes a healthier planet. Positionality is important in the context of Ocean Literacy then not just from a philosophy of science perspective, but also from the activist perspective that feeling connected to, and part of, the Ocean leads to a greater sense of responsibility, care, and empathy towards its ecosystems.[7]

2 Defining Positionality

In research, especially qualitative social science research, positionality is a concept, and a reflexive exercise, that offers insights into how individuals perceive and interact with the world around them.[8] For the researchers, being aware of our positionality can help us understand nuanced perspectives and inherent biases that shape the research we undertake and the interactions we have with the human (or more-than-human) communities in which we work. Most often, research is a shared space and the process and outcomes are influenced by the identities of both the researcher(s) and participant(s)[9]; however, as researchers we tend to be trained to perform our research as objective and as neutral as possible, which can result in an unawareness of how our own lived experiences,

[6] Ives, C.D., Abson, D.J., von Wehrden, H., Dorninger, C., Klaniecki, K., & Fischer, J. (2018). Reconnecting with nature for sustainability. *Sustainability Science, 13,* 1389–1397. https://doi.org/10.1007/s11625-018-0542-9.

[7] Murray, E.M., Poto, M.P., & Russo, V. (2022). *Follow your heart: the school for multipotentialites*. la Bussola, Rome.

[8] Mason-Bish, H. (2019). The elite delusion: reflexivity, identity and positionality in qualitative research. *Qualitative Research, 19*(3), 263–276. https://doi.org/10.1177/1468794118770078.

[9] Bourke, B. (2014). Positionality: reflecting on the research process. *The Qualitative Report, 19*(33), 1–9. Retrieved from: http://nsuworks.nova.edu/tqr/vol19/iss33/3?utm_source=nsuworks.nova.edu%2Ftqr%2Fvol19%2Fiss33%2F3&utm_medium=PDF&utm_campaign=PDFCoverPages.

beliefs, worldviews, and privilege influence the research process, especially our relationships with research participants.

Positionality is a particularly important tool for identifying one's position as the researcher in relation to the "object" of one's research. When we work with a population or community that we do not belong to, the resulting insider/outsider dynamics will impact the research process and raise important epistemological, ethical, and arguably political questions. For instance, in research projects concerning Indigenous Peoples, the underlying ontological and epistemological understandings of the world and how knowledge is created and owned may be vastly different between a non-Indigenous researcher with Euro-centric research training and the Indigenous communities in which they work.[10] This dynamic can lead to problematic translations of knowledge and in the worst case to harmful, objectifying research due to a lack of understanding and awareness about the culture, history, and knowledges one engages with.[11] Neglecting to reflect on how our positionality influences our work and the people around us can result in the "researched" or participants feeling exploited, and the knowledge gathered is often misconstrued.[12] The same dynamics may arise in research beyond the university or in community work, where the researchers or project leaders work with a community they are not part of. Even in situations where we as researchers or community project leaders are part of the community we research, reflecting on our positionality entails recognizing new power dynamics that arise in the context of our status as researcher and our multiple accountabilities.[13]

The concept of positionality can be traced back to the 1980s and is rooted within feminist theory that originally aimed to challenge white,

[10] Magaya, S., & Fitchett, J.M. (2022). Approaching positionality in research on indigenous knowledge systems. In: Ebhuoma, E.E., Leonard, L. (eds) *Indigenous knowledge and climate governance: a sub-Saharan African perspective*. Springer, 81–93; Moffat, M. (2016). Exploring positionality in an aboriginal research paradigm: a unique perspective. *International Journal of Technology and Inclusive Education, 5*(1), 750–755.

[11] Fournier et al. (2023). Systemic disruptions: decolonizing indigenous research ethics using indigenous knowledges. *Research Ethics, 19*(3), 325–340. https://doi.org/10.1177/17470161231169205.

[12] Bayeck, R.Y. (2022). Positionality: the interplay of space, context and identity. *International Journal of Qualitative Methods, 21,* 1–9. https://doi.org/10.1177/16094069221114745.

[13] Sunder Rajan, K. (2021). *Multisituated, ethnography as diasporic praxis.* Duke University Press, London.

male-dominated perspectives and ideals of "objective" and "universal" knowledge and knowledge production.[14] The core claim of this feminist and decolonial approach to science is "that individuals have a *position* that impacts how they socially construct the world".[15] An individual's "position" is a result of many different, intersecting identities, such as race, gender, class, and religion, which overlap and intertwine, and are contextually bound.[16] Intersectionality is thus a key component of positionality, which has been further developed over the past few decades by Black feminists and Indigenous decolonial scholars.[17] Intersectionality brings attention to how social categorizations such as race, gender, and class intertwine and result in new and multiple forms of discrimination that influence power dynamics within society.[18] Additionally, the multiple identities that make up one's position are dynamic and fluid, changing constantly throughout one's life and depending on their sociopolitical context.[19]

The questions in box 1 are intended to help craft a positionality statement as a self-critical and deliberate exercise in introspection based on our definition of positionality.[20] The aim of the positionality statement is to prompt the authors to contemplate their identity, life trajectory,

[14] Jackson et al. (2023). Positionality in critical feminist scholarship: situating social locations and power within knowledge production. *Feminist Inquiry in Social Work, 39*(1), 5–11. https://doi.org/10.1177/08861099231219848.

[15] Kezar, A., & Lester, J. (2010). Breaking the barriers of essentialism in leadership research positionality as a promising approach. *Feminist Formations, 22*(1), 163–185. https://doi.org/10.1353/nwsa.0.0121.

[16] Haraway, D. (1991). *Simians, cyborgs, and women*. New York: Routledge.

[17] Jackson et al. (2023). Positionality in critical feminist scholarship: situating social locations and power within knowledge production. *Feminist Inquiry in Social Work*, *39*(1), 5–11. https://doi.org/10.1177/08861099231219848.

[18] Crenshaw, K. (1991). Mapping the margins: intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, *43*(6), 1241–1299.

[19] Fournier et al. (2023). Systemic disruptions: decolonizing indigenous research ethics using indigenous knowledges. *Research Ethics, 19*(3), 325–340. https://doi.org/10.1177/17470161231169205.

[20] As found in the *Introduction,* the authors of this chapter define "positionality" as a reflective, self-critical exercise of introspection regarding our identities and how we position ourselves in relation to others and to the Ocean. Positionality encourages us to reflect on our identity, life trajectory, work experiences, values, knowledge, privileges, choices, worldviews, and relation to the humans, critters, and more-than-human communities around us.

experiences, values, and the issues that hold significance to them. It may, however, not be safe or comfortable for all students or researchers to disclose their identity, background, and position. When working with positionality statements, not disclosing should always be an option.

Box 1: Questions for crafting a positionality statement[21]

- What identities do I align with or present myself as? (list all that come to mind)
- How did I come to these identities? (think about your upbringing, family, culture, religion, the places/countries you lived in, your languages, etc.)
- Which institutions have I been educated in/do I work for? How do they shape the way I show up in research and education projects?
- What are my privileges? How do my privileges impact me as a researcher/student/teacher?
- Which communities do I feel related and accountable to?
- How do my identities intersect and influence each other?
- What role has the Ocean played in shaping my identities? How have my identities shaped how I relate to the Ocean?

The reflective process of crafting a positionality statement aids in identifying aspects of the researcher's identity that bear broader sociological relevance and influences the research as discussed above. However, as Sunder Rajan insists, reflexivity and self-knowledge is not an epistemic absolution.[22] Reflective awareness of one's' identities, blind spots, biases, possibly objectifying gaze, or the power relations within a research group does not on its own rectify epistemic injustice nor change how a research object (e.g. the Ocean or marine communities) is constituted in the research at the expense of other alternatives. This objection to a more superficial engagement with positionality and reflexivity reveals how both concepts are closely connected to larger debates about philosophy of science. That is, researchers' positionality relates to reflections on how knowledge is generated and how claims to truth and reality are made in

[21] Adapted from Katsikana, M. (2024). Feminist scholar-activism. In Peake, L., Razavi, N.S., & Smyth, A. (eds.) *Doing feminist urban research.* Routledge.

[22] Sunder Rajan, K. (2021). *Multisituated, ethnography as diasporic praxis*. Duke University Press, London, 51.

different disciplines. Important implications of our positionality are therefore power, worldviews and how we think about knowledge. While these factors are interconnected in research, they are explored separately here for analytical clarity.

3 Positionality and Power

Reflecting on and recognizing one's positionality is increasingly being used in discussions around power dynamics and privilege, inside and outside the research space. As researchers, our multiple, intersecting social identities do not only influence the way we understand and perceive reality, but they also impact the way we interact with other beings and shape power dynamics and imbalances. Even when research is carried out with the best intentions, failing to step back to reflect on how our worldviews, privileges and lived experiences can affect the way our being and our research is perceived by those who come from the communities we chose to work with can lead to feelings of mistrust and disempowerment. In the past couple of decades, this concept of positionality has been part of anti-oppressive, decolonial research approaches that recognize the historical imbalances between researchers and the researched (i.e. the participants) in marginalized communities and the need to do research in a more ethical, participatory way.[23] Hence, the importance of reflecting upon and being continuously aware of one's position or identity when interacting with a community in which the researcher is considered to be an "outsider".

In anthropology and sociology, early discussions of power dynamics within the research process were framed around this "insider/outsider" status that researchers assume when carrying out their work.[24] The insider and outsider designation is specifically related to the researcher's cultural identity, and how their biases of being an insider or ignorance of being an outsider impact the way they carry out their research. For

[23] Nimführ, S., & Meloni, G.N. (2021). Decolonial thinking: a critical perspective on positionality and representations in island studies. *Island Studies Journal, 16*(2), 3–17. https://doi.org/10.24043/isj.178; Potts, K.L., & Brown, L. (2015). Becoming an anti-oppressive researcher. In: Strega, S., Brown, L. (eds) *Research as resistance: revisiting critical, indigenous and anti-oppressive approaches*. Canadian Scholars' Press Inc., 17–42.

[24] Merriam, S.B., et al. (2001). Power and positionality: negotiating insider/outsider status within and across cultures. *International Journal of Lifelong Education, 20*(5): 405–416. https://doi.org/10.1080/02601370120490.

example, as Merriam et al. describe, an insider might be blinded by their own culture and not ask provocative enough questions, while an outsider might be unaware of cultural taboos.[25] However, one's culture is not the only factor that shapes identity. As critical, anti-oppressive theories and community-based participatory research approaches emerged at the beginning of the twenty-first century, using a simple insider/outsider status to understand a researcher's relationship with the community in which they work shifted away from this black and white idea towards a deeper, more intertwined understanding of how past experiences, worldviews, race, gender, and class influence power dynamics within the research process.[26] As there are social inequities in everyday life, and positionality is socially constructed, these inequities are inherently part of research activities and lead to power imbalances.

This more holistic understanding of how positionality and power plays out in research and knowledge production breaks with the prevailing, European positivist research paradigm where sound knowledge production is seen as objective, assuming that neither the researcher nor the participants' positionality should have any influence on its development.[27] However, it is precisely this scientific paradigm that creates power imbalances when the researcher is unaware of how their intersecting social identities shape and control the research journey and its outcomes. From an ontological standpoint, a positivist paradigm is "based in the assumption that a single tangible reality exists—one that can be understood, identified, and measured".[28] The negative implications of doing research with or "on" people, grounded in the belief that (1) knowledge production is not affected by social relations and (2) there is only one way of knowing, create an environment that is exploitative and oppressive. Indigenous scholar, Linda T. Smith, brings attention to the ways in which "outsider research" among Indigenous communities has been "profoundly exploitative", and that an approach to research that assumes "Western ideas about the most fundamental things are

[25] Ibid.

[26] Ibid.

[27] Park, Y.S., Konge, L., & Artino, A.R. Jr. (2020). The positivism paradigm of research. *Academic Medicine, 95*(5), 690–694. https://doi.org/10.1097/ACM.0000000000003093.

[28] Ibid., 691.

the only ideas possible to hold" is one that "conveys of innate superiority and an overabundance of desire to bring progress into the lives of indigenous peoples".[29] Knowledge production within an Indigenous worldview is one that is relational and connected to all forms of life, even beyond human beings.[30] Thus, when (Western) researchers apply their own positivist paradigm that assumes knowledge is objective and separate from individual or collective experiences and values, the outcome of the research is one that does not portray the true realities of the participants themselves; the Western research approach dominates or trumps other ways of knowing and leaves Indigenous (or other marginalized) communities without the autonomy to share their culture, language, and lives in a truthful and accurate manner. Thus, using positionality as a reflexive practice to understand, as a researcher, how your worldviews and privilege can impact the research process can help to mitigate oppressive practices and ensure the research is honouring different knowledge systems. Being critically aware of our positionality can facilitate research environments that are more reciprocal and collaborative, giving space to participants to share their stories with openness and mutual understanding rather than enforcing knowledge frameworks that do not respectfully capture the complexities of different realities and ways of knowing.

Moving beyond the concept of positionality and power dynamics in human–human research interactions, this introspective reflective practice can also guide us in rethinking human-nature power dynamics in the context of environmental exploitation and domination. In the twenty-first century, it is clear that human activity is the dominant force changing the natural ecosystems, causing unprecedented rates of biodiversity loss and environmental degradation. As previously mentioned, (Western) society's disconnect from the natural world has been associated with extractive, unsustainable practices, which are linked to the "underlying philosophical and functional shifts such as the dominance of materialism and over-consumption".[31] The domination human society has over nature is

[29] Smith, L.T. (1999). *Decolonizing methodologies: research and indigenous approaches*. University of Otago Press, New Zealand, 56.

[30] Wilson, S. (2008). *Research is ceremony: indigenous research methods*. Fernwood Publishing, Canada.

[31] Ives, C.D., Abson, D.J., von Wehrden, H., Dorninger, C., Klaniecki, K., & Fischer, J. (2018). Reconnecting with nature for sustainability. *Sustainability Science, 13*, 1389–1397. https://doi.org/10.1007/s11625-018-0542-9.

reflected by the utilitarian concept that non-human nature is readily available to serve and benefit humanity to foster growth and development,[32] and the humanistic ideologies that place human beings at the top of the hierarchy of Earth's ecosystems. The worldview that constructs this human-nature divide fails to recognize the interconnectedness between human society and the natural environment; in other words, a worldview that allows humans to become blind to nature's intrinsic value and the central role it plays to our well-being and survival. In the context of the Ocean and mending this human-nature disconnect that dominates Western ways of knowing and interacting with the natural world, understanding our own positionality can help to acknowledge our relationship with nature and how our actions contribute to damaging its ecosystems, in often irreversible ways.

4 Positionality, Worldviews, and Situated Knowledges

In a recent article on "crossing disciplinary boundaries" in the ICES Journal of Marine Sciences, Schellock et al. recommend young researchers to engage with and reflect on their positionality *and* their epistemological and ontological positions throughout their research, from design to dissemination.[33] This is an important exercise because our positions affect not only power dynamics within research, but also our thoughts on what is real (ontology) and what can be known and how (epistemology). In other words, positionality shapes our worldviews and how we think about knowledge, in turn affecting our orientation in research.

For Ocean Literacy, the links between positionality, ontology, and epistemology are crucial since ways of knowing and relating to the Ocean vary around the world, yet the knowledge systems that have shaped how (and why) we study and know the Ocean today have been historically

[32] Artmann, M. (2023). Human-nature resonance in times of social-ecological crisis—a relational account for sustainability transformation. *Ecosystems and People, 19*(1), 21668760. https://doi.org/10.1080/26395916.2023.2168760.

[33] Shellock, R.J., et al. (2023). Crossing disciplinary boundaries: motivations, challenges, and enablers for early career marine researchers moving from natural to social sciences. *ICES Journal of Marine Science, 80*(1), 40–55.

limited.[34] Since European colonialism, Western and masculine theories of science have dominated marine scientific research, and science in general, with certain disciplines afforded substantially more funding and influence than others.[35] This dominant Western approach to science rests mainly on a positivist research paradigm that has roots in the Cartesian mind-body split and an ontology according to which the physical and social world exists beyond us humans and can be fully and objectively measured.[36] In contrast, local and Indigenous knowledge systems, more experiential knowledge, and feminist perspectives have been far less influential on marine sciences and ocean governance and sustainability discourses.[37] Such disparities between different ways of knowing the Ocean constitute a form of *epistemic inequality*. When embedded in ocean governance, epistemic inequality results in *epistemic injustice* whereby certain types of knowledge are privileged and "utilised as a form of power to inform decision-making".[38] In Sect. 5 below, we reflect on how multiple knowledge systems are gradually being incorporated across research, law, and policy and what this signifies for considerations of positionality and the future of Ocean Literacy. Before turning to how researchers and policymakers are exploring multiple ways of knowing the Ocean, this section introduces Donna Haraway's notion of "Situated Knowledges"[39] as a foundational feminist perspective on positionality that can help counter epistemic injustice in marine research.

The positivist approach to science still dominates formal academic education in both natural sciences and social sciences, where researchers are taught to strive for objectivity and universality. However, as we argued

[34] Hornidge, A.K., Partelow, S., & Knopf, K. (2023). Knowing the ocean: epistemic inequalities in patterns of science collaboration. In: Partelow, S., Hadjimichael, M., Hornidge, A.K. (eds) *Ocean governance*. MARE Publication Series, vol. 25. Springer, Cham.

[35] Ibid.

[36] Ochulor, C.L. (2005). Positivism as philosophy of science. *Global Journal of Humanities*, *4*(1), 1–4.

[37] Hornidge, A.K., Partelow, S., & Knopf, K. (2023). Knowing the ocean: epistemic inequalities in patterns of science collaboration. In: Partelow, S., Hadjimichael, M., Hornidge, A.K. (eds) *Ocean governance*. MARE Publication Series, vol 25. Springer, Cham.

[38] Ibid., 26.

[39] Haraway, D. (1988). Situated knowledges: the science question in feminism and the privilege of partial perspective. *Feminist Studies 14*(3), 575–599, 589.

above, researchers inevitably have values, beliefs, biases, and multiple identities that are contextual and influence the way they make sense of the world around them, as well as to whom they consider themselves accountable.[40] The absolute detachment of the person from their social, economic, and personal circumstances central to the positivist scientific paradigm is therefore questionable, since to remain completely outside from the object studied would require getting rid of the human condition[41] and would infer an unattainable objective "view from nowhere".[42] In a bid to overcome epistemic inequality favouring the positivist approach to science, feminist and decolonial scholars have insisted on a concept of positionality that breaks with the notion of the fully objective and disembodied researcher. Striving for objectivity is unsatisfactory, if not dangerous, for feminist and decolonial scholars who know what it is like to be excluded from hierarchical ideas of what counts as knowledge. According to feminist critiques, the scientific "view from nowhere" serves to mask a very specific position (namely the white, male human) and makes this position neutral and universal.[43] The ethical and political ramifications of this "god trick" is that all other positions and perspectives are rendered subjective and invalid.[44]

In her seminal essay "Situated Knowledges", Donna Haraway calls for an alternative approach to science that fulfils a feminist ethics: "a more adequate, richer, better account of a world, in order to live in it well".[45] Haraway's essay thus cuts through the objectivity/relativism dichotomy in scientific debates at the time, insisting that simply uncovering biases in science does not provide us with a better theory of the real world. Instead, feminist objectivity means a partial and situated, contextual and politically alert theory of knowledge that eschews Western, masculinist

[40] Sunder Rajan, K. (2021). *Multisituated, ethnography as diasporic praxis.* Duke University Press, London.

[41] Bukamal, H. (2022). Deconstructing insider–outsider researcher positionality. *BJSE British Journal of Special Education 49*(3), 327–349.

[42] Haraway, D. (1988). Situated knowledges: the science question in feminism and the privilege of partial perspective. *Feminist Studies 14*(3), 575–599, 589.

[43] Ibid., 581 and 589.

[44] Ibid.

[45] Ibid., 579.

epistemology.[46] Reflexiveness and positionality thus become key to epistemology. Power remains a central theme; using vision as a metaphor for knowledge, Haraway argues that "vision is *always* a question of the power to see – and perhaps of the violence implicit in our visualizing practices".[47] Her provocative question "with whose blood were my eyes crafted?"[48] is both insistence that our vision is a function of where we come from (positionality) and that we take accountability for what we see and the way in which we see. Positioning oneself is a critical first step for identifying how our knowledge is situated, and doing so requires careful attention to power relations. Haraway suggests working through the following questions: "How to see? Where to see from? What limits to vision? What to see for? Whom to see with? Who gets to have more than one point of view? Who gets blinded? Who wears blinders? Who interprets the visual field? What other sensory powers do we wish to cultivate besides vision?".[49] The last question points to the openness of situated knowledges to alternative forms of knowledge production, including through bodies and objects.[50]

To operationalize Haraway's Situated Knowledge thesis, Dragos Simandan identifies four unavoidable epistemic gaps that researchers can pay attention to.[51] The first gap is that the world around us is more contingent than we might think it is. In other words, there were many other possible worlds that could have been realized. This reflection invites a "politics of possibility" where, for example, the contingency of institutions that seem inevitable, such as the capitalist economic system or the international law of the sea, allows us to imagine alternatives by noticing breaks with them, such as pockets where alternative ocean law

[46] Ibid.

[47] Ibid., 585.

[48] Ibid.

[49] Ibid., 587.

[50] This theory of knowledge and positionality is taken further by New Materialism literature. Hartmut, R., Henning, C., & Bueno, A. (eds). (2021). *Critical theory and new materialisms*. Routledge, London.

[51] Simandan, D. (2019). Revisiting positionality and the thesis of situated knowledge. *Dialogues in Human Geography, 9*(2), 129–149.

rules.[52] The second gap is that how we witness or perceive the "realized" world is shaped by our positionality and is "always only a subset of the total informational content of the respective situation".[53] This gap can be characterized as one between the realized and the "encountered" or "witnessed" world, where "the situation, its observers, and their knowledge of it are all co-produced in the moment in discursive webs of power".[54] The third epistemic gap is that a significant part of knowledge is "remembered information", meaning that much knowledge is lost both intentionally (e.g. destroyed through processes of assimilation) and unintentionally due to the imperfections of human memory. Simandan's fourth and final gap is that "we know more than we can tell".[55] Much remembered knowledge cannot be consciously relayed and, furthermore, since knowledge is socially constructed, social factors will influence what we choose to share and how.[56] This means that knowledge might be lost due to political motivations, social pressures, fear of repression or isolations, concerns over self-presentation, or other social factors. Knowledge may also be partial when silencing occurs by "*not* listening",[57] for example when information is processed through a colonial or masculine gaze.

Haraway's Situated Knowledges thesis and Simandan's four epistemic gaps provide a set of factors to be aware of when considering our positionality and situating how we know the Ocean. Specific questions that we may then ask ourselves include: How do the four epistemic gaps influence how we come to know the Ocean? How do our research practices construct and compose the marine realm? Who decides in what ways we generate knowledge? Whose knowledge do we build on when doing so? What futures and worlds are we open to? Which are we not? How can we ethically embrace uncertainty? Asking such questions can help researchers, students, and practitioners engaging with Ocean Literacy go beyond

[52] See: Gibson, K. (2001). Regional subjection and becoming. *Environment and Planning D: Society and Space,* 19(6), 639–667.

[53] Simandan, D. (2019). Revisiting positionality and the thesis of situated knowledge. *Dialogues in Human Geography, 9*(2), 129–149, 130.

[54] Ibid., 136.

[55] Polanyi, M. (1966). *The tacit dimension.* Routledge & Kegan Paul, London.

[56] See, for example: Foucault, M. (1980). *Power/knowledge: selected interviews and other writings, 1972–79.* Pantheon, New York.

[57] Janz, B. (2018). Dialogue and listening. *Dialogues in Human Geography*, 124–127.

identifying their positionality and biases and move towards humbler and more ethical ocean-related research. Haraway's work has been an important cornerstone for further feminist epistemologies that explore "the possibilities and limits of knowing the world".[58] This scholarship has resulted in concepts that relate to and expand on the feminist understanding of positionality, including reflexivity,[59] emotions,[60] embodiment and somatics,[61] relationality,[62] performativity,[63] and intersectionality[64]—which was introduced briefly above. It is beyond the scope of this chapter to discuss each of these concepts in detail; however, facilitators using this book and Toolkit may wish to introduce some of them and explore with their group how they influence Ocean Literacy. Importantly, when diving into the activities in the Toolkit, we invite readers to take up Donna Haraway's celebration of "the *privilege* of partial perspective".[65] As Simandan reminds us, the situatedness and partiality of knowledge is not an impoverished position compared to the kind of universal knowledge we are often taught to strive for as students, researchers, and scientists. Rather, it refers to an honest acknowledgement of "how one's capacity for knowing is made possible by, and suffused with, one's specific positioning",[66] which is indeed a privilege.

[58] Simandan, D. (2019). Revisiting positionality and the thesis of situated knowledge. *Dialogues in Human Geography, 9*(2), 129–149, 129.

[59] Kohl, E., & McCutcheon, P. (2015). Kitchen table reflexivity: negotiating positionality through everyday talk. *Gender, Place & Culture, 22*(6), 747–763.

[60] Pedwell, C., & Whitehead, A. (2012). Affecting feminism: questions of feeling in feminist theory. *Feminist Theory*, *13*(2), 115–129.

[61] van Wingerden, E., (2022). Unmastering research: positionality and intercorporeal vulnerability in international studies. *International Political Sociology, 16,* 1–17. https://doi.org/10.1093/ips/olac008.

[62] Nedelsky, J. (2012) *Law's relations: a relational theory of self, autonomy, and law*. Oxford Academic, New York.

[63] Butler, J. (1988) Performative acts and gender constitution: an essay in phenomenology and feminist theory. *Theatre Journal, 40*(4), 519–553; Nelson, L. (1999) Bodies (and spaces) do matter: the limits of performativity. *Gender, Place & Culture, 6*(4), 331–353.

[64] Crenshaw, K. (1991). Mapping the margins: intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, *43*(6), 1241–1299.

[65] Haraway, D. (1988).

[66] Simandan, D. (2019). Revisiting positionality and the thesis of situated knowledge. *Dialogues in Human Geography, 9*(2), 129–149, 142.

5 Connecting Positionality to the Two Pathways: Connecting with Each Other and Connecting with the Ocean

This section relates our understanding of positionality to the two pathways underpinning the activities in the Toolkit and our concept of Ocean Literacy: connecting with each other and connecting with the Ocean. The first pathway, "Connecting with each other", focuses on the emotional and relational aspect of Ocean Literacy and environmental education. Fostering a sense of connectedness within ourselves and to the communities we belong to is important for instilling responsibility, care, and stewardship in ways that complement learning and research. Building strong emotional connections within ourselves and with others creates more empathetic, cooperative relationships, which supports a transformation in the way we perceive ourselves as connected and part of the same interconnected web of life.[67] The second pathway, "Connecting with the Ocean", invites an awareness of the interconnectedness of human and non-human ecosystems, and the way the Ocean and human health and well-being are inextricably linked to one another. If we accept that our bodies, identities, and relationships are fundamental to how we produce knowledge, then both pathways are critical to how we come to know the Ocean.

5.1 Charting Multiple Ways of Knowing the Ocean

Knowing the Ocean necessitates understanding its physical and social-ecological systems, its stressors, capacities, and drivers of change, and its social, cultural, and economic meanings. A growing awareness of the critical role that the Ocean and marine ecosystems play in regulating and sustaining our planet has also meant new calls to enhance our knowledge of the Ocean. This rush to know the Ocean is exemplified by the framework of the UN Decade of Ocean Science for Sustainable Development (the Ocean Decade), Sustainable Development Target 14.A to "Increase Scientific Knowledge, Research and Technology for Ocean Health", and

[67] Murray, E.M., & Poto, M.P. (2023). Ecological literacy: theory and practice. In: Panieri, G., Poto, M.P., Murray, E.M. (eds) *Emotional and ecological literacy for a more sustainable society.* Palgrave Macmillan.

indeed this volume and other works on Ocean Literacy.[68] Marine scientific research, predominantly the natural sciences, is promoted to uncover the many unknowns of the Ocean better and thus improve stewardship, conservation, and restoration of the marine environment and facilitate exploitation and management of marine resources and to expand blue economies.

Both formal research and experiential, traditional knowledge underpins good decisions around use, management, and conservation of the Ocean.[69] However, in a 2021 review of published ocean-related research, Hornidge et al. show that when it comes to knowing the Ocean, there is still a great deal of epistemic inequality globally, which hinders achievement of common sustainability goals and justice.[70] In particular, they find that current Ocean Literacy is dominated by the values and outputs of the Global North, and that there are significant geographic, disciplinary, and thematic gaps in ocean research. As the focus on the Ocean matures, Hornidge et al. advocate for "re-shaping the structures of knowledge production" for "more equal epistemic ways of knowing and doing" ocean research and development.[71] To do so will require self-reflective efforts and a genuine engagement with not only positionality, but also the two other themes of this Toolkit: transdisciplinarity and co-creation.

While Ocean Literacy may still be characterized by epistemic inequality, counter-currents that embody the two pathways do exist. Recent years have seen sustained calls for inclusion of local and Indigenous knowledge in ocean governance, law, and policy. Within academia, there have been calls to focus on the Ocean and ocean-dependent communities across the social sciences. Important steps to break from a disembodied and Western perspective on the Ocean have been made in the field of environmental humanities with the Blue Turn and the emergence of Critical

[68] Ocean Decade official website: https://oceandecade.org/, last access August 24, 2024.

[69] Hornidge, A.K., Partelow, S., & Knopf, K. (2023). Knowing the ocean: epistemic inequalities in patterns of science collaboration. In: Partelow, S., Hadjimichael, M., Hornidge, A.K. (eds) *Ocean governance*. MARE Publication Series, vol 25. Springer, Cham.

[70] Ibid.

[71] Ibid.

Ocean Studies.[72] Works in this field have "fathomed the oceanic depths in relationship to submarine immersions, multispecies others, feminist and Indigenous epistemologies, wet ontologies, and the acidification of an Anthropocene ocean" and in which "the animated ocean has come into being as "wet matter" rather than inert backdrop".[73] This multifaceted surge of knowledge generation on and for the Ocean, in addition to work carried out beyond academia by countless communities and non-profit organizations, results in multiple epistemological approaches to knowing the Ocean. Each of these sites of knowledge production, and their potential coming together, involves different considerations of positionality, world views, and ways of knowing in relation to the researchers' main disciplines, research subjects, and the Ocean itself.

5.2 Connecting Through Reflexivity in Research with People and the Sea

In the innovative edited collection "Researching People and the Sea" by Gustavsson, M. et al., reminds readers that "knowing what one brings to the research encounter is paramount to researching people and the sea".[74] The contributors reflect on the particularities of reflexive human and social science research in coastal and marine settings and on how especially researchers' gender shapes knowledge production.[75] In coastal and marine settings, such as fishing communities, an outsider position on several intersecting accounts (no fishing experience, gender, age, ethnicity, class) can be both limiting and productive, but must be

[72] DeLoughrey, E. (2019). Toward a critical ocean studies for the anthropocene. *English Language Notes, 57*(1), 21–36. https://doi.org/10.1215/00138282-7309655; Steinberg, P., & Peters, K. (2015). Wet ontologies, fluid spaces: giving depth to volume through oceanic thinking. *Environment and Planning D: Society and Space, 33*(2), 247–264. https://doi.org/10.1068/d14148p; Braverman, I., & DeLoughrey, E. (2020). *Blue legalities: the life and laws of the sea*. Duke University Press; Mentz, S. (2024). *An introduction to the blue humanities*. Routledge.

[73] DeLoughrey, E. (2019). Toward a critical ocean studies for the anthropocene. *English Language Notes, 57*(1), 21–36. https://doi.org/10.1215/00138282-7309655.

[74] Ibid.

[75] Gustavsson, M., White, C.S., Phillipson, J., Ounanian, K., (eds). (2021). *Researching people and the sea*. Palgrave Macmillan Cham. https://doi-org.mime.uit.no/10.1007/978-3-030-59601-9.

taken into account.[76] Instead of naively pursuing an idea of equality between researcher and research participants, the contributors advocate that the researchers' position in relation to research subjects is written into research practice from the beginning. The collection also highlights how marine settings present "specific risks and unique socio-cultural subjectivities" that should be taken into account when considering positionality and power dynamics.[77] Commercial fishing, for example, is one of the world's most dangerous occupations and personal safety of both researcher and research participants is a common theme across research on maritime activities. These risks stem from both the unpredictable natural elements and the political and social turbulence that often surround coastal and marine communities and industries.[78] Both factors create unique power dynamics which require careful attention. Pafi, M. et al. offer an insightful reflection on how "advocating time and effort in building rapport with coastal communities, and adding a stage to allow an exchange of knowledge, served a purpose beyond reconciling contrasting methodologies".[79] Though time-consuming, this reciprocal approach to the research became a key ethical stance for the authors, and indeed the most rewarding part of the process.[80] Gustavsson moreover shows how reflexivity can be used to identify the way in which one's positionality influences what interlocutors tell you in interviews, and ultimately the knowledge produced.[81]

Further considerations of positionality and the ethics of connecting with each other arise in the growing interdisciplinary scholarship on Blue Justice.[82] Focused on small-scale fisheries and other local coastal livelihoods and communities, this scholarship is characterized by its

[76] Ibid.

[77] Chiswell et al. in White, C.S. et al., (eds) *Researching people and the sea* 2021, p. 93.

[78] Ibid.

[79] Pafi, M., Flannery, W., & Murtagh, B. (2021). Imagining the coast: a mixed methods approach to elicit perceptions and conflicts on the west coast of Ireland. In: Gustavsson, M., White, C.S., Phillipson, J., Ounanian, K., (eds) *Researching people and the sea*. Palgrave Macmillan Cham, 278.

[80] Ibid., 277.

[81] Gustavsson, M., White, C.S., Phillipson, J., Ounanian, K., (eds). (2021). *Researching people and the sea*. Palgrave Macmillan Cham, 329.

[82] For a recent review see: Blythe, J.L., et al. (2023). Blue justice: a review of emerging scholarship and resistance movements. *Cambridge Prisms: Coastal Futures*, *1*, e15. https://doi.org/10.1017/cft.2023.4.

commitment to social and environmental justice for ocean-dependent communities.[83] The term "Blue Justice" was coined at the 3rd World Small-Scale Fisheries Congress and has since been the focus of a steady body of scholar-activism,[84] which documents intersectional injustices experienced by ocean-dependent communities and different forms of "blue resistance".[85] As Jessica Blythe et al. remind us,[86] activism in defence of the Ocean reflects a long-standing history of coastal people's fight for justice against various forms of "ocean grabbing".[87] What is new is the "emerging scholarship on blue justice that is developing alongside local resistance efforts"[88] and as a counterweight to the accelerated research focus on the blue economy.[89] Notable networks and efforts include the Too Big To Ignore (TBTI) Global Foundation and research network,[90] the transdisciplinary research network "One Ocean

[83] Ibid.

[84] Bashiri, F. (2024). Conceptualizing scholar-activism through scholar-activist accounts. In: Mattsson, P., Perez Vico, E., Salö, L. (eds) *Making universities matter. Innovation, technology, and knowledge management*. Springer, Cham. https://doi.org/10.1007/978-3-031-48799-6_4.

[85] See, for example: Barbesgaard, M. (2018). Blue growth: savior or ocean grabbing? *The Journal of Peasant Studies, 45*(1), 130–149; Ertör, I. (2021). "We are the oceans, we are the people!": Fisher people's struggles for blue justice. *The Journal of Peasant Studies,* 1–30; Gustavsson, M., Frangoudes, K., Lindström, L., Ávarez, M.C., & de la Torre Castro, M. (2021). Gender and blue justice in small-scale fisheries governance. *Marine Policy, 133*, 1–8.

[86] Blythe, J.L., et al. (2023). Blue justice: a review of emerging scholarship and resistance movements. *Cambridge Prisms: Coastal Futures*, *1*, e15. https://doi.org/10.1017/cft.2023.4; Bennett, N.J., López de la Lama, R., Le Billon, P., Ertör, I., & Morgera, E. (2023). Ocean defenders and human rights. *Frontiers in Marine Science*, *9*, 1089049.

[87] Barbesgaard, M. (2018). Blue growth: savior or ocean grabbing? *The Journal of Peasant Studies*, *45*(1), 130–149.

[88] Blythe, J. L., et al. (2023). Blue justice: a review of emerging scholarship and resistance movements. *Cambridge Prisms: Coastal Futures*, *1*, e15. https://doi.org/10.1017/cft.2023.4.

[89] Schutter, M. S., Hicks, C. C., Phelps, J., & Waterton, C. (2021). The blue economy as a boundary object for hegemony across scales. *Marine Policy*, *132*, 104673.

[90] The TBTI foundation and research networks' key mandates are to rectify the marginalization of small-scale fisheries in national and international policies, and to develop research and governance capacity to address global fisheries challenges. See: TBTI Global, https://tbtiglobal.net/about-us/. Accessed 31 August 2024.

Hub",[91] Imar Ertörs documentation of the transnational fishers movement,[92] and countless local studies of blue (in)justice and grassroots resistance.[93] Scholar-activism is often grounded in a feminist ethics and epistemology where researchers enter into reciprocal and "ethical relations with communities" and ground theory and knowledge production in everyday life.[94]

Conducting research with, for, and alongside coastal communities (human and non-human) and "blue" social movements in this manner supports the critically oriented approach Ocean Literacy we have advocated in this chapter and Toolkit. Doing so, however, also raises important questions about positionality when we as a researcher transgress the boundary between being a "scholar" and an "activist" and work with marginalized communities. Scholar-activists find themselves accountable to at least two communities: their university and the social movements they research. Feminist scholar Katsikana warns of reducing one's political engagement to "methodological issues of reflexivity and positionality" in such situations.[95] From the authors of this chapters' own experience with scholar-activism, we reflect that accountability and reflexivity

[91] The One Ocean Hub brings together coastal people, researchers, and decision-makers to value and learn from different knowledge(s) and voices. The network aims to collaboratively influence decisions and practices shaping the future of the ocean for justice and sustainability. See: About One Ocean Hub | One Ocean Hub. Accessed 31 August 2024.

[92] Ertör, I. (2021). "We are the oceans, we are the people!": fisher people's struggles for blue justice. *The Journal of Peasant Studies*, *50*(3), 1157–1186. https://doi.org/10.1080/03066150.2021.1999932.

[93] For example: Jentoft, S., Chuenpagdee, R., Bugeja Said, A., and Isaacs, M. (eds). (2022). *Blue justice, small-scale fisheries in a sustainable ocean economy*. Springer; Tafon, R., Saunders, F., Pikner, T., & Gilek, M. (2023). Multispecies blue justice and energy transition conflict: examining challenges and possibilities for synergy between low-carbon energy and justice for humans and non-human nature. *Maritime Studies*, *22*(4), 45; Gutierrez-Graudins, M., & Macey, G.P. (2023). Coastal justice: lessons from the frontlines. *George Washington Journal of Energy & Environmental Law*, *14*, 81; Movik, S. (2024). Contested coastal commons and blue spatial justice: enclosures, rescaling, and resistance in Northern Norway. *Journal of the Commons*, *18*, 1.

[94] Katsikana, M. (2024). Feminist scholar-activism. In Peake, L., Razavi, N.S., Smyth, A. (eds) *Doing feminist urban research*. Routledge.

[95] Ibid., 73.

include continually asking how you and your research is connected to the social movement, how your research (teaching or other work) serves the movement, allowing members to shape your research or teaching, and ensuring that your research output is accessible. From this starting point, the Toolkit's central themes "co-creation" and "cross-, inter-, and trans-disciplinarity" are equally important to ensure accountable and ethical engagement with Blue Justice and resistance in Ocean Literacy knowledge production.[96]

5.3 Reflexivity in Natural Marine Scientific Research

Positionality and reflexivity tend to be most prominent in the social and human sciences, but researchers in the natural sciences have also begun to reflect on their position in relation to connecting with the Ocean and the communities that depend on it. One site of such reflections is on the boundaries between scientific knowledge generation, marine resource *exploration*, and resource *exploitation*, which may involve the same methods and give way to one another. The exploration/exploitation dilemma has been discussed by scholars in several disciplines such as artificial intelligence, organizational learning, technological innovation, organizational adaptation, strategic management, and organizational design.[97] However, how can it be applied to natural sciences, in particular, the earth sciences that are enrolled to explore new ocean resources frontiers?

The dichotomy between exploration and exploitation trade-off was first introduced by March, who defined exploration with words such as "search, risk taking, experimentation, discovery, innovation", and exploitation with "production, efficiency, implementation, execution".[98] Another concise description is given by Baum et al., who state that exploitation "refers to learning gained via local search, experiential refinement, and selection of existing routines", and exploration "refers to

[96] See Chapters 4 and 5.

[97] Stadler, C., Rajwani, T., & Karaba, F. (2013). Solutions to the exploration/exploitation dilemma: networks as a new level of analysis. *International Journal of Management Reviews, 16*(2), 172–193. https://doi.org/10.1111/ijmr.12015.

[98] March, J.G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71–87. https://doi.org/10.1287/orsc.2.1.71.

learning gained through processes of concerted variation, planned experimentation, and play".[99] The ultimate difference between these two concepts is that when exploration comes into the equation, the result is an unknown variable—adding an extra layer of risk and uncertainty. Marine exploration is often coupled with an exploitative practice, whether breaking massive sheets of ice in the Arctic to disrupting the seabed in search for oil.

From a scientific point of view, the "unknown" is the underlying motivation that drives many researchers towards conducting studies with the aim of finding an undiscovered piece of knowledge. So, should we not apply this premise to the discovery of the seabed? Humankind has been using marine resources for centuries, but challenges always arise; the extractive-ness that is associated discovering and taking marine resources has become especially problematic in the twenty-first century which is marked with rapid ecological degradation and biodiversity loss, particularly in the Ocean. For example, the mining industry has expressed interest in the Ocean because of the seabed reserves that could be of use since availability of land resources is declining and the demand for metals continues to grow.[100] This interest has positioned seabed minerals as a new resource frontier, as it represents to the energy sector a new way to help decarbonization,[101] where friction is created between policy, science, and justice.

Bringing the exploration/exploitation dilemma in this case, it is important to remember how resource extraction has facilitated for decades different industries of marine resource exploitation from fisheries to offshore wind and oil, as well as new industries like deep-sea mining, marine renewables, and biotechnology'.[102] On the other hand, technological advancements and research in marine sciences have opened a new era for conservation and preservation of the marine biome.

[99] Baum, J.A., Li, S.X., & Usher, J.M. (2000). Making the next move: how experiential and vicarious learning shape the locations of chains' acquisitions. *Administrative Science Quarterly*, *45*(4), 766–801.

[100] Toro, N., Robles, P., & Jeldres, R.I. (2020). Seabed mineral resources, an alternative for the future of renewable energy: A critical review. *Ore Geology Reviews*, *126*, 103699.

[101] Ibid.

[102] Our Shared Seas official website https://oursharedseas.com/threats/threats-industrial-impacts/, last access September 5, 2024.

Referring to the example of the sought-after seabed by the emerging industry of deep-sea mining. The dilemmas connected to the deep-sea mining are connected to the environmental impacts of materials extraction for technology and the related governance issues, as there are vulnerabilities to the political system controlling resource access.[103] One of the main reasons why there is a massive interest in this mining industry is the need for renewable energy. According to the Intergovernmental Panel on Climate Change (IPCC), in order to keep global warming to 1.5 °C by 2050, 70–85% of all electricity would need to come from renewable sources.[104] Therefore, even though the industry is still in an exploratory stage, advances in ocean mining activities and marine engineering geology are taking place.[105] On a negative note, deep-sea mining represents a risk for biodiversity since it can cause forced species migration and possible extinctions in the deep ocean due to loss of connectivity.[106] There is still a great extensive of fauna living in those areas that have yet to be discovered and studied. So, an increase of mining the seabed, without weighting in these ecological factors, could have severe repercussions for the seabed and overall marine ecosystems. Although the deep-sea mining may provide solutions for more renewable energy sources, there is an imperative to reflect on the more-than-human life and sea creatures that will be harmed by such extractive processes.

Now, taking management studies as an example for exploration/exploitation discussion, it is important to consider how the rapid advancements of technology affect the relationship between exploration and exploitation. Bernal et al. suggest that there is a positive impact on exploration and negative impact on exploitation,[107] as well as a positive effect on both with market evolution. It is a fact that since there are better and

[103] Levin, L.A., Amon, D.J., & Lily, H. (2020). Challenges to the sustainability of deep-seabed mining. *Nature Sustainability, 3*, 784–794. https://doi.org/10.1038/s41893-020-0558-x.

[104] Ibid.

[105] Guo, X., Fan, N., Liu, Y. et al. (2023). Deep seabed mining: frontiers in engineering geology and environment. *International Journal of Coal Science & Technology, 10*, 23. https://doi.org/10.1007/s40789-023-00580-x.

[106] Van Dover, C., Ardron, J., Escobar, E. et al. (2017). Biodiversity loss from deep-sea mining. *Nature Geoscience, 10*, 464–465. https://doi.org/10.1038/ngeo2983.

[107] Bernal, P., Maicas, J.P., & Vargas, P. (2019). Exploration, exploitation and innovation performance: disentangling the evolution of industry. *Industry and innovation*, *26*(3), 295–320.

bigger boats for exploration, the amount of scientific research has rapidly increased due to the application of Geophysics in seafloor exploration.

Overall, there are several ideas surrounding the exploration/exploration trade-off in earth sciences. So, the key question to ask from now on is how to keep the balance between the present exploitation and the future exploration? In a perfect world, we would have found this answer by now, but maybe the missing link stems from the reflexivity of positionality practices where scientists partake in more holistic decision-making processes, where they must not only fulfil their role as researchers but also as members of their wider community—including the Ocean. Although geoscientists and other natural science researchers may not be working with research participants who are necessarily human, reflecting on their position towards the natural environment and the more-than-human creatures they interact with could foster a less exploitative research environment.

5.4 Integrating Multiple Knowledges in Ocean Law and Policy

An important outcome of a more reflexive Ocean Literacy that is sensitive to multiple ways of knowing the Ocean is better ocean governance. Another development to assess then is how law and policy documents are integrating positionality into their statements. In other words, what is the current approach towards positionality in the incorporation of multiple knowledges in Ocean and law and policy? In particular, many Indigenous Peoples and local communities (ILPC) directly rely on a healthy and rich Ocean to maintain their way of life, livelihoods, cultures, and identity. Such ocean-dependent peoples have developed what is often called traditional knowledge based on unique relationships with the Ocean, experiential learning, and generational wisdom.[108] Historically, Indigenous Peoples and local communities have suffered from administrative neglect

[108] United Nations, Department of Economic and Social Affairs, "Traditional Knowledge-an Answer to the Most Pressing Global Problems?" Available at: https://www.un.org/es/desa/traditional-knowledge-%E2%80%93-answer-most-pressing-global-problems#:~:text=%E2%80%9CA%20product%20of%20learning%20through%2C%20languages%2C%20experiences%20and%20practices. Accessed 7 September 2024.

due to, among other reasons, the epistemic inequality that is discussed in the sections dedicated to positionality and situated knowledges of this chapter. However, as stewards of the vast majority of the world's biodiversity, their values, practices and institutions of nature conservation are becoming an accepted norm in global policy processes.[109] Recognition of Indigenous Peoples' knowledge systems and rights in law and policy is thus an essential aspect of both epistemic and environmental justice. This recognition can occur through diverse mechanisms, such as legal recognition of indigeneity, identity or rights, or through actions and interactions. References to both Indigenous peoples' rights and traditional knowledge are beginning to appear in key international legal agreement and marine policy developments. The recent Agreement on the Conservation and sustainable use of Marine Biological diversity of areas beyond national jurisdiction (the BBNJ Agreement)[110] (which has yet to achieve the necessary number of signatories to enter into force) is a prominent example. The BBNJ Agreement includes within its general principles in Article 7(j) "The use of relevant traditional knowledge of Indigenous Peoples and local communities, where available".

Despite the legal recognition of traditional knowledge in the BBNJ Agreement, some concerns remain about the participation process for Indigenous Peoples and local communities. Indigenous Peoples' considerations were not heard for the three rounds of negotiations of the 1982 UN Convention on the Law of the Sea (UNCLOS),[111] to which the BBNJ agreement is closely connected. Consequently, the UNCLOS includes no provisions regarding the rights or participation of Indigenous Peoples and local communities when it comes to the conservation

[109] Dawson, N., Carvalho, W.D., Bezerra, J.S., Todeschini, F., Tabarelli, M., & Mustin, K. (2021). Protected areas and the neglected contribution of indigenous peoples and local communities: struggles for environmental justice in the Caatinga dry forest. *People and Nature*, 1747.

[110] The Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Agreement) adopted on June 2023.

[111] United Nations Convention on the Law of the Sea, entered into force in November 1994.

and exploitation of marine resources, which is the central focus of the international law of the sea. For this reason, the BBNJ Agreement can be considered a breakthrough in recognizing ILPC rights. Still, how this will be implemented at a national level remains uncertain. Traditional knowledge may now serve as a guidance for making decisions connected to Area Based Management Tools (AMBT) for example, and this is a crucial achievement for the purpose of protecting marine biodiversity. However, the position of Indigenous Peoples' rights and knowledge systems in legal texts needs to be further clarified by the national governments and in global environmental policies. Moreover, although the recognition of traditional knowledge is consistent throughout the BBNJ Agreement, within the apparatus of the international agreement, Indigenous Peoples are recognized as consultants, rather than decision-makers on par with nation states. We contend that coastal Indigenous Peoples and local communities ought instead to be recognized as the rightful stewards of the Oceans. The position of the Indigenous Peoples and Local Communities as guardians of nature should be fully respected and integrated into the law system, balanced with the economic exploitation of the sea. It is essential not to leave them in the background, but to give them the necessary voice so that they can collaborate with policymakers and researchers.

6 The Positionality Project Prototype

In this chapter, we have argued that our positionalities as researchers, teachers, and students are intimately tied to how we see the world, how we come to know it, and power dynamics in knowledge generation. Positionality is thus influenced by a complex web of factors including where we come from, where we live, who and what we identify with, our upbringing, our values and beliefs, our formal and informal education, the communities we are surrounded by, our ethnicity, race, sexuality, gender, age, and the languages we speak. However, as we have also argued, reflexivity and positionality statements do not amount to accountability or epistemic justice on their own. So how and where to begin when exploring our positionality for Ocean Literacy? How do we identify how our knowledge is situated, how to see the Ocean and who to see it with?

And how do we keep ourselves accountable to the Ocean's many communities? As you will find towards the end of the Toolkit in Chapter 8, we developed a set of exercises to adapt the concept of positionality into learning spaces for Ocean Literacy. These exercises are divided into three domains that can be explored as three stages: *the self, the ocean,* and *the community.*[112] In this section, we introduce the first activity "the self", which is focused on exploring our identities through introspection and visual arts. Rather than writing, which can be prone to labelling, we opted to invite participants to express their identities through painting and drawing. Presenting your reflections orally to the group is optional, keeping in mind the importance of the option to refuse.

7 ACTIVITY ONE: THE SELF

Introduction

In order to understand the connection, we as individuals have with the Ocean, a self-reflection exercise is needed. The first step towards the reflection of positionality in Ocean Literacy comes exactly from the bond that we, as humans, feel that we have with the Ocean. As a first step, we can consider our backgrounds, circumstances, beliefs, knowledge, experience, and privileges.

Before starting the activity, it may be useful for facilitators to introduce and (briefly) discuss some concepts that are central to positionality. The following definitions may be helpful, but facilitators are encouraged to adapt them to the group:

- *Positionality* is our understanding of ourselves, of who we are, how we consequently see the world, and what we bring to our research.
- *Reflexivity* is a second-order questioning and challenging of one's own thoughts and beliefs. As such, reflexivity is a process that we engage in throughout our research from conception through to dissemination.

[112] In Chapter 8, you can find the positionality activities focusing on *the Ocean*. This activity has 3 parts, which have been split into "How do we know the Ocean?", "How does the Ocean speak?", and "How does the Ocean know us?" (p. XX). In Chapter 8, you can also find the positionality activity focusing on *the community*. Overall, the activity found in this chapter and the activities found at the back of this Toolkit comprise a "Positionality for Ocean Literacy Toolkit".

- *Intersectionality* refers to the way multiple identities intersect and influence who we are, and how these identities (for instance being a child and a woman, or being a professor and speaking a minority language) create unique identities and possibly marginalizations that are not fully captured by either of those identities on their own.
- *Privilege* refers to the social advantages or benefits that an individual has simply because they belong to a particular social identity (i.e. religion, gender, sexuality).
- *Worldviews* are "cognitive, perceptual, and affective maps that people continuously use to make sense of the social landscape and to find their ways to whatever goals they seek".[113] In other words, our worldview is the lens in which we understand and perceive the world around us, built upon social interactions and experiences, and are shaped over the course of a lifetime.

To look inside, and understand how we come to know the Ocean, facilitators might further ask participants to reflect on what they understand by "the Ocean". What does it include? You can brainstorm this together.

Materials

– Recycled drawing canvas (e.g. old cereal boxes, recycled paper, etc.)
– Colouring pencils, markers

Group size and time

– Group size can vary; depends on space and amount of materials available
– 5–10 minutes for explanation
– 15–20 minutes for reflection and drawing exercise

Instructions

Step 1: Explain to the group a background on positionality, using *Chapter 3: Positionality* as a key resource. Talk about the 5 different areas that help one to reflect on positionality: lived experiences, where you

[113] Hart, M.A. (2010). Indigenous worldviews, knowledge, and research: the development of an indigenous research paradigm. *Journal of Indigenous Voices in Social Work, 1*(1), 1–16.

live(d), worldviews, privilege, and intersectionality. Ask some questions to encourage participants to begin reflecting about their own positionality and how they relate to the Ocean.

> What is the first thing that comes to your mind when you think of the Ocean?
> What is the emotion that best represents the Ocean when you think about it?
> Have you lived near the Ocean? Have you lived very far away from the Ocean?
> What identities do you align with and how did you come to these identities?
> How do your identities intersect and influence each other?
> What role has the Ocean played in shaping my identities? How have my identities shaped how I relate to the Ocean?

Step 2: Each person starts drawing their answers to the reflective questions for 20–30 min.

Step 3: Once the given time has finished, the drawings can be displayed to the group, either on the wall or in the middle of a circle. Participants are invited (but also given the option to refuse) to explain and show to the others what their drawing represents. What's the meaning behind that drawing? Why did they choose those materials or colours, etc.

Step 4: The facilitator asks the participants to choose a name for their portraits.

Debrief

Once each participant has finished its drawing, presenting to each other, and chosen a title, the activity could lead to exploring the following debrief question:

> In which ways you believe that your representation differs from the others, what are the main characteristics that compound your position to the ocean?

Appendix: Implementation of Creative Activities

Through the interconnections within and beyond the OIN research network, the authors of this chapter wish to share an infographic (Fig. 1) as an example of the implementation of creative projects in the Campestre Goyavier school in Colombia. Thanks to the support and scientific outreach of the AKMA project, the teachers have created a new learning environment to engage students in Ocean Literacy activities, especially since their school and community are located in a landlocked area. Using a combination of art and science techniques inspired their teaching approaches, which opened a new perspective to their curriculum. In the words of Maria Alexandra Cabeza Hernandez, teacher leader at the school, "learning from this project has helped us discover the Ocean and its enigmas that call us to be more conscious and care for it. We are very grateful for the opportunity to work and connect with the scientists in Norway. This is the science and art that we like, the one that teaches, amazes and entertains". Another example of an implementation activity stemming from Ocean Literacy initiatives connected to the OIN research network members is the recent workshop organized in June 2024 at the Aldeia Maraka'nà in Rio de Janeiro. The workshop focused on the idea of an exchange of knowledge, with UiT providing scientific knowledge and the Aldeia contributing traditional knowledge, for the conservation of the marine environment.[114]

The previous examples reflect on the perception one has of the Ocean (or body of water) depending on where you live. In this case, the goal was to bring together two communities, one from Latin America and the other from Norway, two places in the world marked by different social and economic situations. But these differences in thinking allowed for an exchange of knowledge regarding in how to "connect with the ocean" (Fig. 2, representing the activity developed in Spanish for the Campestre Goyavier school in Colombia).

[114] Montaña Mónoga, A.M., Parola, G., Poto, M.P., Panieri, G., Muniz de Souza (Otomorinhori'õ Xavante), J., Médici Machado, N., Wennerstrom, A., Tavares, R., Barrenechea Angeles, I., Zimmermann, J. (2024). ECO_CARE Multisensory and Experimental Workshop 2024 "We are the ocean, and the Ocean is us. A Living Laboratory to learn from each other and learn from the ocean", *Septentrio Reports*, (1). https://doi.org/10.7557/7.7828.

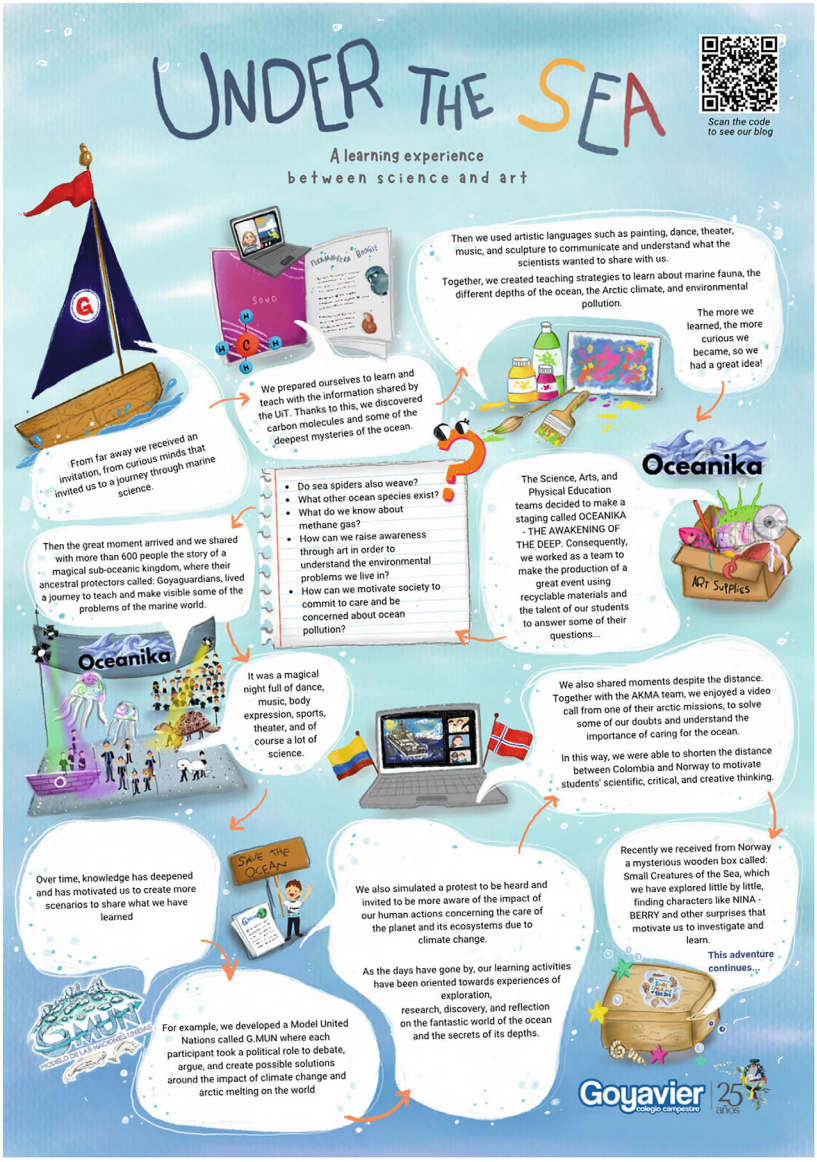

Fig. 1 "Under the Sea, a learning experience between science and art", an infographic showcasing the co-creation process between Campestre Goyavier school in Colombia and Giuliana Panieri team at UiT. Design, illustration and content: Maria Alexandra Cabeza Hernandez. Translation to English: Frank Acevedo. The blog linked to the QR code can be found at https://coordinacionpreesc6.wixsite.com/my-site-2

Fig. 2 "Under the Sea, una experienca de aprendizaje entre la ciencia y el arte", an infographic -Spanish version- showcasing the co-creation process between Campestre Goyavier school in Colombia and Giuliana Panieri team at UiT. Design, illustration and content: Maria Alexandra Cabeza Hernandez

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CHAPTER 4

Inter-, Cross-, and Transdisciplinarity

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Abstract The research developed within this Toolkit stems from an inter-, trans-, and cross-disciplinary collaboration including marine sciences, climate and ocean governance, ocean policy, marine ecology, marine socio-ecology, planetary health, and transdisciplinary science. This chapter explores the definitions and applications of inter-, trans-, and cross-disciplinary approaches within the context of ocean literacy research and education. The primary objective of this exploration is to develop a learning activity for young people that integrates inter-, cross-, and trans-disciplinarity into ocean literacy education. The overall aim of this Toolkit

Juliana Hayden, Law Department, University of Turin, Italy, contributed to all chapter sections. The brainstorming activities were conducted during the Living Laboratory in collaboration with Katharina Heinrich. MPPoto, Faculty of Law UiT The Arctic University of Norway, developed the chapter outline, suggested edits to the drafts, contributed to the editing of the Abstracts, and wrote Sect. 1.
MPPoto thanks Laura Vita for the supervisory work in the editing of the written text and illustrations and Eva Lohse for the abstract in German.
Annegret Kuhn, the Center for Ocean and Society, Kiel University, contributed to Sects. 1.2 and 1.3.

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chapter is to advance ocean literacy's role in ocean protection and sustainability efforts through inter-, cross-, and transdisciplinary approaches to research and education.

Abstract (Italiano) La ricerca sviluppata all'interno di questo *Toolkit* nasce da una collaborazione inter, cross e transdisciplinare che comprende le scienze marine, il diritto e la *governance* del clima e degli oceani, le *policy* riguardanti l'oceano, la socio-ecologia marina, la salute planetaria e la scienza transdisciplinare. Questo capitolo esplora le definizioni e le applicazioni degli approcci inter, cross e transdisciplinari nel contesto della ricerca e dell'educazione all'*ocean literacy*. L'obiettivo primario di questa esplorazione è sviluppare delle attività di apprendimento per i giovani che integrino diverse discipline nell'ambito dell'*ocean literacy*. L'obiettivo generale del capitolo è quello di far progredire il ruolo dell'*ocean literacy* verso la protezione e sostenibilità dell'oceano attraverso un approccio inter, cross e transdisciplinare alla ricerca e all'insegnamento.

Résumé (Français) La recherche contenue dans cette boîte à outils est le résultat d'une collaboration inter-, trans- et transdisciplinaire, en particulier dans les domaines des sciences marines, de la gouvernance du climat et des océans, de la politique océanique, de l'écologie marine, de la socio-écologie marine, de la santé planétaire et de la science transdisciplinaire. Ce chapitre examine les définitions et les applications des approches inter-, trans- et transdisciplinaires dans le contexte de la recherche et de l'enseignement en "Ocean literacy". L'objectif principal de cette exploration est de développer des activités éducatives pour les jeunes qui intègrent l'inter-, la trans- et la transdisciplinarité dans l'enseignement de l' "Ocean literacy". L'objectif global de ce chapitre est de faire progresser le rôle de l' "Ocean literacy" dans les efforts de protection et de durabilité des océans par le biais d'une collaboration de recherche inter-, cross- et transdisciplinaire.

Zusammenfassung (Deutsch) Die Forschung zu diesem Toolkit beruht auf inter- trans- und multidisziplinärer Zusammenarbeit, die Meereswissenschaften, Klimagovernance, Ozeangovernance und –politiken, Meeresökologie, planetare Gesundheit und transdisziplinäre Wissenschaft verbindet. Dieses Kapitel untersucht die Begriffsbestimmung und Anwendungsbereiche inter- trans- und multidisziplinärer Ansätze im Rahmen der Forschung und Bildung zu Ocean Literacy. Vorrangiges Ziel war es eine Lerneinheit für junge Menschen zu entwickeln, die inter- trans- und multidisziplinäre Ideen innerhalb der Ocean Literacy Bildung verwirklicht. Darüber hinaus soll dieses Kapitel über den Toolkit die Rolle

von Ocean Literacy für den Schutz der Meeresumwelt und für Nachhaltigkeit durch inter- trans- und multidisziplinäre Ansätze in Forschung und Bildung weiterentwickeln.

Keywords Interdisciplinarity · Transdisciplinarity · Cross-disciplinarity · Collaborative research methodology · Ocean literacy

1 Introductory Remarks

This chapter delves into the nuanced distinctions between transdisciplinary, interdisciplinary, and cross-disciplinary approaches within the context of ocean literacy (OL), a field increasingly recognized for its pivotal role in understanding and addressing the complex interplay between human and oceanic systems. The discourse on disciplinarity, particularly in environmental and sustainability research, has become a staple in academic and policymaking arenas. Despite their widespread application, the definitions of "inter-", "trans-", and "cross"-disciplinarity remain uncertain, with these terms often used interchangeably, thereby risking the clarity of research methodologies and their implementation in areas such as citizen science and policy development. This chapter is structured to clarify these distinctions: beginning with a definitional section that sets the conceptual groundwork, followed by a graphical representation that visually differentiates these approaches, and concluding with a dedicated activity section. This final section not only reinforces the theoretical concepts discussed but also engages with OL in a practical manner, focusing on developing participants' understanding of the dual pathways of connecting with the ocean and connecting with each other.[1] Through this structure, the chapter aims to enhance the application of disciplined research approaches in ocean literacy, thereby contributing to more effective research and educational initiatives that address the pressing issues of climate change and marine sustainability.

[1] For references, see Chapter 1 of this Toolkit.

1.1 *Definitions*

The discussion of disciplinarity—referring to trans-, inter-, and cross-disciplinary—in environment and sustainability research and practice has become commonplace in epistemic and policymaking circles.[2] Yet despite the widespread use of these concepts, their respective definitions are ambiguous as the prefixes "inter", "trans", and "cross" have become synonymous.[3] Interchanging these prefixes when labelling a research approach risks blurring the lines between their distinct functions and applications in both research methodology and practice, including issues of citizen science and policymaking processes. Consequently, this Toolkit chapter aims to differentiate the key elements of transdisciplinary, inter-disciplinary, and cross-disciplinary research approaches within the context of ocean literacy (OL)[4] so as to promote and advance their uses within the field. Following in the tradition of environmental and social science research methodology authors,[5] we argue that to effectively develop and implement OL research and education initiatives there is a need for greater inter-, trans-, and cross-disciplinary collaborative research expertise. The evolving field of ocean literacy (OL), defined as "the understanding of the ocean's influence on humans and of our influence on the ocean",[6] includes concepts, theories, and principles from numerous academic disciplines and sectors; thus it is essential to understand how the dynamics of disciplinarity—trans, inter and cross—influences OL research

[2] Phoenix, C., Osborne, N. J., Redshaw, C., Moran, R., Stahl-Timmins, W., Depledge, M. H., … & Wheeler, B. W. (2013). Paradigmatic approaches to studying environment and human health: (Forgotten) implications for interdisciplinary research. Environmental Science & Policy, *25*, 218–228.

[3] Stock, P., & Burton, R. J. (2011). Defining terms for integrated (multi-inter-trans-disciplinary) sustainability research. Sustainability, *3*(8), 1090–1113.

[4] Throughout the entirety of this chapter the term ocean literacy is abbreviated as OL.

[5] Please refer to the literature exploring the intersection of environmental research, law, and research methodology including Grip, K. (2017). International marine environmental governance: A review. *Ambio*, *46*(4), 413–427; Parola, G., Da Costa, M., Fernandes, L. R., & Poto, M. P. (2022). Is a decolonial law possible? Epistemologies of the south and constitutional law; Grünhagen, C., Schwermer, H., Wagner-Ahlfs, C., Voss, R., & Riekhof, M. C. (2023). The multifaceted picture of transdisciplinarity in marine research. In *Transdisciplinary marine research*. Taylor & Francis.

[6] UNESCO-IOC. (2021). The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) implementation plan Vol. 20 (Paris: UNESCO); see also Chapter 1 of this Toolkit.

and policy formulation. Moreover, from an OL perspective, the rapidly increasing ramifications of climate change and global warming on the ocean[7] demand that research, including the development of OL educational activities, carefully considers the circuitous relationship between the well-being of the natural environment and societal systems.[8] It is this consideration that prompts this Toolkit's examination of disciplinarity in OL and how the interchange of theoretical and methodological approaches can advance marine knowledge.

1.2 Interdisciplinarity (ID)

Ocean literacy is often referred to as an interdisciplinary field of research. However, an interdisciplinary (ID)[9] approach to research is particularly difficult to define as that the prefix "inter" is ambiguous.[10] The interpretation of the prefix "inter" is determined by its intent. It can be used to describe merging ideas and forging connections between academic disciplines; conversely, it can refer to the creation of an undefined space between disciplines.[11] In effect, the opaqueness of the prefix "inter" enables its interchangeability with the terms cross-disciplinarity and transdisciplinarity. Within the context of environmental research, particularly

[7] This chapter refers to the one global ocean, as per the internationally accepted National Oceanic and Atmospheric Administration (NOAA) definition of the world's one ocean. While there is only one global ocean, the toolkit authors recognize that the concept of one global ocean may be novel to those previously unfamiliar with the principles of Ocean Literacy. For more information on the global ocean and the historically named four oceans (Atlantic, Pacific, Artic, Indian) please refer to National Ocean Service, National Oceanic and Atmospheric Administration (NOAA). n.d. *How many oceans are there?* https://oceanservice.noaa.gov/facts/howmanyoceans.html#:~:text=There%20is%20only%20one%20global%20ocean.&text=However%2C%20most%20countries%20%2D%20including%20the,the%20'newest'%20named%20ocean, last access September 1st, 2024.

[8] Steinberg, P. E. (1999). Navigating to multiple horizons: Toward a geography of ocean-space. *The Professional Geographer*, *51*(3), 366–375.

[9] ID is used throughout this work as an abbreviation for the terms interdisciplinarity and interdisciplinary.

[10] Newell, W. H. (2013). The state of the field: Interdisciplinary theory. *Issues In Interdisciplinary Studies*, *31*, 22–43.

[11] Krohn, W. (2010). Interdisciplinary cases and disciplinary knowledge. *The Oxford handbook of interdisciplinarity*, 31–49.

OL, it is common practice to define ID by its outcome, that is the generation of new forms of knowledge resulting *from* the interactions between traditionally defined academic disciplines. In this chapter, ID is defined as

> an interaction between researchers of different disciplines, that includes a continuous transfer of methods and knowledge between the academic disciplines during different stages of the entire research process.[12]

In this regard, interdisciplinarity clearly differs from cross-disciplinary approaches to research collaboration, which delineates the cooperation of researchers from several different disciplines. In cross- (and multi-) disciplinary research, each research unit is working in its own specific context and there is limited cross-fertilization among disciplines.[13] Research interchange within a cross-disciplinary is primarily realized by sharing information and results after finalizing the disciplinary research endeavours so as to support the overall research results.[14] It is noteworthy that ID's transfer of methods and knowledge throughout the entirety of a research process can implicitly serve as a critique of academia's dogmatic practices.[15] ID research has the potential to challenge institutions' strict classification of fields of study. Therefore, ID approaches can additionally be identified by their diversity of disciplinary perspectives and organizational structure. OL research generally meets these two benchmarks (diverse perspectives and organizational structure) as it "integrates knowledge, techniques and tools from marine sciences (ecology, oceanography, ecosystem modeling), education sciences, social and behavioural sciences

[12] This definition is generated by integrating elements from Lawrence, M. G., Williams, S., Nanz, P., & Renn, O. (2022). Characteristics, potentials, and challenges of transdisciplinary research. *One Earth*, *5*(1), 44–61 and Parola, G., Da Costa, M., Fernandes, L. R., & Poto, M. P. (2022). Is a decolonial law possible? Epistemologies of the south and constitutional law.

[13] Keith, W., & Rehg, W. (2008). Argumentation in science: The cross-fertilization of argumentation theory and science studies. *The handbook of science and technology studies*, 211–239.

[14] Rosenfield, P. L. (1992). The potential of transdisciplinary research for sustaining and extending linkages between the health and social sciences. *Social Science & Medicine, 35*(11), 1343–1357.

[15] Holland, D. (2013). Integrating knowledge through interdisciplinary research: Problems of theory and practice. Routledge.

(e.g., sociology and psychology), public health, geography, marine policy, science communication, arts and digital techniques".[16]

1.3 Cross-Disciplinarity (CD)

Cross-disciplinarity (CD) comprises both inter- and multidisciplinary research and can thus be considered a kind of umbrella term to explain the collaboration of different research disciplines, at different scales and with diverging intensity.[17] Cross-disciplinarity itself can be most simply defined as: "The use of multiple different academic disciplines to investigate a singular research problem or question however, there can be multiple disciplinarity goals within this research collaboration".[18]

Researchers using a CD approach will exchange knowledge to address the research question, but they do not integrate their insights or seek to create a new form of knowledge. Typically, the trajectory of a CD research project follows parallel disciplinary investigations that eventually converge to compare results. The advent of cross-disciplinarity stems from the widespread recognition that major societal issues, particularly those concerning climate change, global warming, and the marine environment, can no longer be addressed by a singular academic discipline or sectoral approach.[19] Consequently, the emergence of CD approaches was a response to the urgent need to integrate ideas and methods from numerous fields of study that explore the socioeconomic, scientific, political, and legal dimensions of complex global problems.[20] Pertaining to the development of OL research, a CD approach can be effectively applied

[16] Kelly, R., Evans, K., Alexander, K., Bettiol, S., Corney, S., Cullen-Knox, C., … & Pecl, G. T. (2021). Connecting to the oceans: supporting ocean literacy and public engagement. Reviews in Fish Biology and Fisheries, 1–21.

[17] Hall, K. L., Stipelman, B. A., Vogel, A. L., & Stokols, D. (2017). Understanding cross-disciplinary team-based research. The Oxford handbook of interdisciplinarity, 338–356.

[18] Feller, I. (2006). Multiple actors, multiple settings, multiple criteria: Issues in assessing interdisciplinary research. *Research Evaluation, 15*(1), 5–15.

[19] McIntyre-Mills, J., & Romm, N. R. (2019). Mixed Methods and Cross Disciplinary Research. Springer International Publishing.

[20] Mobjörk, M., Berglund, C., Granberg, M., & Johansson, M. (2020). Sustainable development and cross-disciplinary research education: Challenges and opportunities for learning. *Högre utbildning, 10*(1), 76–89.

when creating comprehensive common frameworks for marine protection as such frameworks require contributions from natural sciences, economics, and law, among other related fields. When utilizing a CD approach in an OL research setting, it is standard to incorporate participants from outside of the realm of academia, including but not limited to civil servants and policymakers, private sector stakeholders, NGO representatives, young people, and Indigenous communities.[21]

It is noteworthy that one of the most significant obstacles to effectively carrying out a CD research approach is managing research team dynamics.[22] This challenge also holds to similar extents for TD and ID research teams.[23] This significant managerial challenge can be distilled into five questions: How will the research team members bridge their respective disciplines to work together respectively and transparently? Will there be parity between individual inputs and team contributions? Are the researchers open to developing new methods or augmenting their current approaches should the need to arise? How will system barriers across different disciplines be addressed? Are there university support systems and sufficient funding available for all disciplines involved?[24] The seminal literature supports that argument that the success of CD research can be more dependent upon the researchers' perception of shared value in the work and cohesiveness of the team itself rather than the actual content and aims of the research activities.[25] Within the context of marine research,

[21] Dewulf, A., François, G., Pahl-Wostl, C., & Taillieu, T. (2007). A framing approach to cross-disciplinary research collaboration: Experiences from a large-scale research project on adaptive water management. *Ecology and Society, 12*(2).

[22] Hall, K. L., Stipelman, B. A., Vogel, A. L., & Stokols, D. (2017). Understanding cross-disciplinary team-based research. The Oxford Handbook of interdisciplinarity, 338–356.

[23] Ibid.

[24] O'Rourke, M. (2017). Comparing methods for cross-disciplinary research. The Oxford handbook of interdisciplinarity, 2.

[25] For greater detail on the possible strengths and challenges and applications of cross-disciplinary research, please refer to O'Rourke, M. (2017). Comparing methods for cross-disciplinary research. The Oxford handbook of interdisciplinarity, 2; Hall, K. L., Stipelman, B. A., Vogel, A. L., & Stokols, D. (2017). Understanding cross-disciplinary team-based research. The Oxford Handbook of interdisciplinarity, 338–356; Aagaard-Hansen, J., & Svedin, U. (2009). Quality issues in cross-disciplinary research: Towards a two-pronged approach to evaluation. *Social Epistemology, 23*(2), 165–176.

collaboration across disciplines has increasingly become the norm.[26] However, to further advance and strengthen CD approaches to marine research, in this instance OL research, greater investigation is needed into the process of knowledge generation, such as collaboration-based research teams' strategic planning and research management.[27]

1.4 Transdisciplinarity (TD)

Research that extends beyond the scope of traditional disciplinary boundaries is by no means a novel practice. Since 1990, there has been significant knowledge generated on transdisciplinary approaches to knowledge production.[28] Yet within the discourse on TD research authors have continuously struggled to substantiate what exactly *is* transdisciplinary research and *how* does it differentiate from more traditional methods (i.e. single discipline) and closely related research practices such as cross-, multi, and/or interdisciplinarity.[29] For example, Wickson et al. (2006) argue that transdisciplinary research is characterized by three fundamental aspects, the scope and contents of the problem focus, its evolutionary nature, and its focus on collaboration.[30] Regarding the problem focus, it is widely agreed upon that TD research tackles complex, real-world problems, is action-oriented, and typically involves the interfaces between natural ecosystems and humans.[31] The second characteristic of TD, its evolutionary nature, refers to the fact that TD research is a highly responsive approach. In essence, TD methods adapt and evolve according to

[26] Markus, T., Hillebrand, H., Hornidge, A. K., Krause, G., & Schlüter, A. (2018). Disciplinary diversity in marine sciences: The urgent case for an integration of research. *ICES Journal of Marine Science, 75*(2), 502–509.

[27] Ibid.

[28] Hernandez-Aguilar, C., Dominguez-Pacheco, A., Martínez-Ortiz, E. J., Ivanov, R., Bonilla, J. L. L., Cruz-Orea, A., & Ordonez-Miranda, J. (2020). Evolution and characteristics of the transdisciplinary perspective in research: A literature review. *Transdisciplinary Journal of Engineering & Science, 11.*

[29] Pohl, C., & Hadorn, G. H. (2008). Methodological challenges of transdisciplinary research. *Natures Sciences Sociétés, 16*(2), 111–121.

[30] Wickson, F., Carew, A. L., & Russell, A. W. (2006). Transdisciplinary research: Characteristics, quandaries and quality. *Futures, 38*(9), 1046–1059.

[31] Ibid.

the specific context of the research question at hand.[32] Lastly, there is consensus that TD research approaches are centred on collaboration with numerous stakeholders and/or participants. While inter- and cross-disciplinary research also incorporates collaboration to varying degrees, what separates a TD approach is the intentional involvement of stakeholders in the definition of problems, research criteria, project objectives, and resources used to analyse and address them.[33] Therefore, it is the meaningful and sustained collaboration with a diverse range of stakeholders, not only between researchers from different disciplines, that distinguishes a TD research approach from an ID or CD endeavour. Subsequently, this Toolkit adheres to Lawrence et al. (2022) definition of transdisciplinarity according to the possession of seven attributes. These are: (1) a focus on theoretical unity of knowledge, (2) the inclusion of multi- and interdisciplinary research, (3) the involvement of societal actors in the research process, (4) a focus on societally relevant real-world problems, (5) working in a transformative manner, (6) the orientation towards a common good, and (7) self-reflexivity.[34]

In this sense, transdisciplinarity necessarily contains some degree of interdisciplinary collaboration; however, a TD approach goes beyond that of an ID design by also including societal actors in the process of knowledge generation. Accordingly, TD research can be utilized as a mechanism to study and implement societal transformations. In practice, TD collaboration includes a highly differing degree and range of stakeholder participation. According to Shirk (2012), societal actors can be involved through a comparatively low level of collaboration in the sense that the project is conceptualized, conducted, and evaluated by scientists only, whereas societal actors exclusively contribute information or data.[35] In transdisciplinary research approaches, societal actors can also be integrated in the planning of the research and in the empirical analysis of data and information.[36] It is important to note that in co-creative research

[32] Ibid.

[33] Ibid.

[34] Lawrence, M. G., Williams, S., Nanz, P., & Renn, O. (2022). Characteristics, potentials, and challenges of transdisciplinary research. *One Earth, 5*(1), 44–61.

[35] Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., … & Bonney, R. (2012). Public participation in scientific research: A framework for deliberate design. *Ecology and Society, 17*(2).

[36] Ibid.

societal actors are involved in all stages of the research process right from the beginning, and thus they can also contribute to the research design and the formulation of the research questions.[37]

Existing research on transdisciplinarity has highlighted numerous theoretical and practical challenges to carrying out this approach. These challenges include but are not limited to: TD research collaboration carries a risk of unbalanced problem ownership, conflicting epistemologies, legitimization of research partners, and difficulties of measuring the impact of transdisciplinary research.[38] Nevertheless, transdisciplinary collaboration has significant benefits such as the capacity to comprehensively address complex, interlocked problems which pose serious challenges to environmental management and governance (notably in the context of the marine environment) and large-scale issues impacting society and science.[39] TD collaboration addresses complex, real-world challenges through facilitating the coordination of and collaboration between different disciplines and societal sectors to redress environmental threats.

2 Defining Inter-, Cross-, and Transdisciplinarity for Pupils and Young Learners

Given its complex nature, it may be challenging to teach and integrate the concept of disciplinarity in an accessible terminology or in terms more suitable for pupils and young learners. As a remedy to this challenge, this chapter promotes the use of experiential learning activities such as creating visuals or even tactile elements, to help learners conceptualize a range

[37] Grünhagen, C., Schwermer, H., Wagner-Ahlfs, C., Voss, R., & Riekhof, M. C. (2023). The multifaceted picture of transdisciplinarity in marine research. In Transdisciplinary marine research. Taylor & Francis; Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., … & Bonney, R. (2012). Public participation in scientific research: A framework for deliberate design. *Ecology and Society, 17*(2).

[38] For further details please consult Lawrence, M. G., Williams, S., Nanz, P., & Renn, O. (2022). Characteristics, potentials, and challenges of transdisciplinary research. *One Earth, 5*(1), 44–61.

[39] Grünhagen, C., Schwermer, H., Wagner-Ahlfs, C., Voss, R., & Riekhof, M. C. (2023). The multifaceted picture of transdisciplinarity in marine research. In *Transdisciplinary marine research*. Taylor & Francis; Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., … & Bonney, R. (2012). Public participation in scientific research: A framework for deliberate design. *Ecology and Society, 17*(2).

of inter-, cross-, and transdisciplinary research approaches. This chapter uses Bailey's (2019) "disciplinary recipes: a visual guide" to clearly and concisely explain disciplinarity to young people using a familiar medium, food items.[40] Bailey, a science and society researcher, takes an unorthodox approach to explaining the distinctive concepts of inter-, cross-, and transdisciplinarity as the following: interdisciplinarity can be understood as a "stew" of information, the original ingredients (i.e. distinct academic disciplines) are still somewhat distinguishable but the overall result is a blended pot of mixed flavours; cross-disciplinarity can be seen as a plate or a bowl filled with different ingredients but unlike the "interdisciplinary stew", on the "cross-disciplinarity plate" the ingredients remain whole rather than mixed together; transdisciplinarity can be thought of as a cake, you can no longer see the individual ingredients (i.e. ideas from science, politics, law) as they have been combined all together to take on a different shape and flavour.[41]

See below for the following visual depictions of cross-, inter-, and transdisciplinarity (Figs. 1, 2, and 3).

3 Connections to the Two Pathways

As discussed throughout the preceding chapters, this Toolkit has been developed following two main pathways: connecting with the ocean and connecting with each other. This Toolkit argues that these two pathways are vital to the development of a holistic understanding of ocean literacy. The two pathways encompass supporting concepts such as ocean connectedness, ocean empathy, and marine citizenship. Regarding the first pathway, given that explorations of disciplinarity (ID, CD, TD) in OL research and discourse underscore much of its contents and organizational structure, it is crucial to study how the interactions between diverse academic and societal perspectives, knowledge, and values can further the relationship between the ocean and people.[42] The second pathway,

[40] Bailey, J. (2019). Disciplinary recipes: A visual guide!. Tasty Jo Bailey: Making good design. https://makinggood.design/thoughts/tasty/, last access September 1st, 2024.

[41] Bailey, M., & Spencer, N. (2019). The why and how of design-led multidisciplinary innovation education: Context and Curriculum. *The International Journal of Design Education, 13*(4), 89–109.

[42] Greely, T. (2008). *Ocean literacy and reasoning about ocean issues: The influence of content, experience and morality*. University of South Florida.

Fig. 1 "Cross-disciplinary bowl", supports many different ingredients, like the vegetables we see here, but they do not get mixed together (*Source* From Vegetable Bowl [ClipArt] by cg4share, 2017, Rawpixel)

Fig. 2 In an "interdisciplinary stew", in this instance illustrated by a bowl of ramen, ingredients are mixed in and cooked together but you can still see and taste their original distinctive flavours (*Source* From Ramen [ClipArt] by Oksmith, 2019, OPENCLIPART https://openclipart.org/detail/317093/ramen-4 BY CC0 1.0)

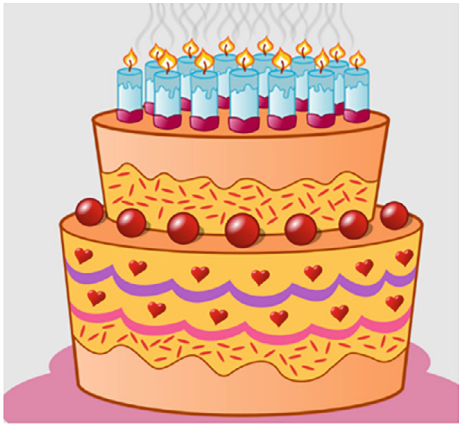

Fig. 3 In a "transdisciplinary cake", all of the original ingredients have been combined and baked together (think of this as the process of developing ideas and integrating them). Through the act of combining all of the different ingredients needed in the TD cake, an entirely different flavour, shape, and texture comes together as the result of creatively mixing the ingredients (*Source* From Birthday Cake [ClipArt] by dstankie, 2014, Open Clip Art Library. Public domain http://www.publicdomainfiles.com/show_file.php?id=13939231819722, last access September 1st, 2024)

connecting with each other, recognizes that OL is a societal initiative generally shaped by interdisciplinary methods.[43]

Christie argues that the "noticeable imbalance in the degree of effort allocated to monitoring the ecological and social dimensions of ocean resource use and policy processes" can be redressed by "rebalancing" the contributions of scientific, methodological, and sociological aspects (Christie, 2011, p. 172).[44] For example, the establishment of marine protected areas, a necessity for blue ecosystems, must be demarcated with input from the neighbouring communities to assess and plan for

[43] Ghilardi-Lopes, N. P., Kremer, L. P., & Barradas, J. I. (2019). The importance of "Ocean Literacy" in the Anthropocene and how environmental education can help in its promotion. *Coastal and marine environmental education*, 3–17.

[44] Christie, P. (2011). Creating space for interdisciplinary marine and coastal research: Five dilemmas and suggested resolutions. *Environmental Conservation*, *38*(2), 172–186.

possible ramifications to their livelihoods.[45] Undertaking truly holistic OL research may require re-envisioning elements of the epistemology of educational programmes and multidisciplinary research team practices and norms. This Toolkit puts forth that an ID, CD, or TD approach to OL research can be further strengthened by integrating both self-reflexive and environmental empathy activities into the research design.

4 The Project Prototype, an "OL Investigation"

At the 2024 OIN Living Laboratory in Copenhagen, participants were tasked with integrating their respective insights into disciplinarity with their knowledge of ocean literacy in the aim of creating a marine-related learning activity for young people.[46] Prior to attending the OIN Living Lab, participants held three virtual ideation sessions to formulate the scope and content of an OL learning activity including the type of activity, the plausible strengths and weaknesses of the activity type, the target group, and the logistics involved in executing the project prototype.[47] Each virtual ideation session lasted for approximately one hour and the participants contributed materials following each virtual meeting including relevant research briefs on OL, proposals for OL educational tools, and activity designs.[48] By the third and final virtual ideation session, the participants reached a consensus to co-create a prototype of a

[45] Gall, S. C., & Rodwell, L. D. (2016). Evaluating the social acceptability of Marine Protected Areas. *Marine Policy*, *65*, 30–38.

[46] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

[47] See Chapter 1 and Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

[48] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

phenomenon-based learning activity, herein referred to as the "OL Investigation". The decision was based on the OL Investigation's potential to effectively engage learners with multidisciplinary concepts and principles by using self-directed learning[49] and investigative elements. At the OIN Living Lab, key details of the prototype were finalized including the target group of secondary school pupils (aged 14 and 15), the materials needed for the learning activity, and the possible timetable for carrying out the learning activity.[50]

4.1 OL Activity Prototype Rationale

The use of a dynamic investigative lens can serve as a powerful tool for learning.[51] For example, investigative podcasts and documentary series have become wildly popular with young people around the world.[52] It is worth mentioning that many educators, parents and guardians, and other relevant adults in a young person's inner social circle are also likely to be familiar with learning about a topic through an "investigative" lens.[53] Considering the OIN's goal to effectively engage secondary school age pupils (ages 14 and 15) with the concepts of ocean literacy,

[49] This toolkit chapter defines "self-directed learning" as the process in which a teacher helps their students to use strategies and perceptual skills to learn on their own and take on greater responsibility for their learning. The goal in implementing self-directed learning (SDL) is twofold, firstly to enable students to develop a deep understanding of the subject matter and secondly, to assess themselves, their study habits, perceptions, aspirations, value systems, and potential in and outside of the classroom. For further information please refer to Areglado, R. J. (1996). *Learning for life: Creating classrooms for self-directed learning*. Corwin Press, Inc., 2455 Teller Road, Thousand Oaks, CA 91,320–2218 (hardback: ISBN-0-8039-6385-8; paperback: ISBN-0-8039-6386-6).

[50] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

[51] Bolliger, D. U., Supanakorn, S., & Boggs, C. (2010). Impact of podcasting on student motivation in the online learning environment. *Computers & Education, 55*(2), 714–722.

[52] Newman, N., & Gallo, N. (2019). News podcasts and the opportunities for publishers. Digital News Report.

[53] Lee, M. J., McLoughlin, C., & Chan, A. (2008). Talk the talk: Learner-generated podcasts as catalysts for knowledge creation. *British Journal of Educational Technology, 39*(3), 501–521.

a learning activity that integrates investigative elements via phenomenon-based learning has real potential to interest and resonate with this target group.

The concept of phenomenon-based learning is understood as a multidisciplinary approach to learning that adopts student-led inquiry and problem analysis.[54] Phenomenon-based learning requires learners to investigate and determine their own questions by examining the phenomenon through multiple academic subjects[55] to explore and solve questions.[56] Grounding an OL learning activity in a phenomenon-based learning approach requires that elements of project-based learning and inquiry-based learning are incorporated into the activity, in particular the promotion of critical appraisal and creative thinking.[57] The most significant difference between project-based, inquiry-based, and phenomenon-based learning is that a phenomenon-based activity must include a real-world issue, a "phenomenon" that the students then explore through different academic disciplines.[58]

4.2 The "OL Investigation" Learning Activity

In a classroom setting, participating students will be shown a dynamic short video clip (under 10 minutes) of a natural phenomenon taking place in the Arctic Ocean. Instead of proceeding with a more traditional teacher-led lecture in which the teacher would explain the key environmental and socioeconomic elements in the footage, the learners will then be divided into breakout groups to explore the Arctic Ocean phenomenon using self-directed learning. Each breakout group is to explore the clip from a different "persona".[59] Each of the breakout

[54] Wolff, L. A. (2022). Phenomenon-based learning. In Encyclopedia of Sustainable Management (pp. 1–9). Cham: Springer International Publishing.

[55] Such as STEM, social sciences, history, and any other relevant academic discipline.

[56] Bobrowsky, M. (2018). Q: How can I make science fun and have students learn more by using phenomenon-based learning? *Science and Children, 56*(2), 70–73.

[57] Friesen, S., & Scott, D. (2013). Inquiry-based learning: A review of the research literature. *Alberta Ministry of Education, 32*, 1–32.

[58] Pedaste, M., Mäeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A., Kamp, E. T., … & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, *14*, 47–61.

[59] Refer to Sect. 4.4 for examples of the possible OL-related personas.

groups' personas will represent key stakeholders in ocean literacy and governance in an Arctic setting.

Five persona cards will be handed out to the class, with each breakout group receiving one persona card. For example, one breakout group may represent the persona of a local fisher and thus would likely examine the video from a socioeconomic perspective, whereas another breakout group may receive the persona of a marine biologist and accordingly explore the clip for its potential environmental impact on life below water. Through the lens of their respective personas, the breakout groups will then undertake an investigation of the video answering "*what, where, when, why, and how*" the phenomenon depicted in the video may have come to be. The breakout groups will address those questions from a different lens relevant to OL. Each breakout group will then present the findings of their persona's investigation to the entire class.

Following all the groups' presentations, the breakout groups will then work together to revise and integrate their answers to co-create a final, comprehensive interdisciplinary analysis pieced together from their breakout groups' investigations. This final analysis may be presented in a more traditional format such as a report, essay, or through a creative format such as a podcast episode or short video documentary—as per wishes of the teacher and the students. The following details provide suggestions for breakout group personas and the structure of the groups' ideation sessions.

Examples of Breakout Group Personas:

Persona 1: Subsistence/small-scale fisher from a coastal Arctic community.
Persona 2: Central government representative, such as an official from a Ministry of Environment. This persona is a bureaucrat who implements national-level marine and coastal policies.
Persona 3: Marine biologist, who has had lab and field work experience.
Persona 4: Whale, the inclusion of a non-human perspective is intended to represent the OL principle of protecting life below water.
Persona 5: Legal researcher in international law, such as a subject matter expert in law of the sea.

Potential Breakout Group Ideation Session Structure:

Round 1: Learners are divided into the 5 breakout groups (5 personas).

R1 Research Question: How does your persona understand and/or conceptualize the video clip?

Round 2: Breakout groups discuss the findings presented from the other personas.

R2 Research Question: What are the commonalities and differences in how the personas understood the clip?

Round 3: Breakout groups dissolve and students assess their findings all together.

R3 Activity Reflection: The teacher asks the students how they would like to integrate their personas insights and present their revised findings. The students will be asked if they would prefer to develop a more traditional form of assessment such as an essay or report, or if they would like to use a creative method such as a comic book, a podcast episode, short video documentary clip, or travel blog.

4.3 Logistical Considerations

At the OIN Workshop, the question of how the "OL Investigation" activity could take place in participating classrooms without seriously disrupting the participating teachers' scheduled lesson plans became a considerable concern.[60] Following consultation with OIN researchers who continuously work closely with primary and secondary schools in Italy and Norway, we propose the following activity schedule for any interested teacher.

Proposed Duration:

1 day, (ideally held) on World Ocean Day.

[60] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) Living Laboratory and Ocean Literacy Toolkit. Septentrio Reports, (1). https://doi.org/10.7557/7.7606.

OL Activity Day Structure:
Part A (Approximately 40 minutes): An Introduction to OL Activity Day

1. Teacher-led introduction to World Ocean Day.
2. Explanation of ocean literacy (OL).
3. Brief explanation of the concept of disciplinarity, specifically inter-disciplinarity, cross-disciplinarity, and transdisciplinarity.
4. Concise sum-up of why OL matters.

Part B (15 minutes minimum to 30 minutes maximum): Presenting OL Activity Day's Schedule and Screening the OL Phenomenon Video Clip

1. Provide a brief summary of how the OL Activity Day will unfold (5–10 minutes).
2. Show clip to students (5–10 minutes).
3. Hand out the persona cards and establish 5 breakout groups (approx. 5–10 minutes).

Part C: Group work – Two Sessions.
Breakout group session 1—organized by persona group (45 minutes to 1 hour)

1. Each breakout group researches their persona.
2. Group members develop their develop clip investigation as per their persona, answering the "who what where when why and how" of the clip.
3. Each breakout group presents their initial findings in their video clip investigation.

Breakout group session 2—compare and contrast the findings (45 minutes)

1. Breakout groups map the similarities and differences of each personas' ideas, challenges, and goals regarding the video.

2. Breakout groups are then asked to consider if they'd like to revise their initial findings to include any ideas from the other presentations in their respective investigations.

Part D (Teacher-led full class discussion: 40 minutes): Final reflection

1. Directed by the teacher, the entire class reflects on the question: "How do you think the concepts of inter-, trans-, and cross-disciplinarity frame how we understand the ocean?"
2. Class brainstorm on the following questions: "How would the class like to progress with the presentation of their findings; Is this an engaging assignment for the class to continue?".

4.4 Persona Card Mock-Up

The following is a simple example of potential persona cards to be used by participating classrooms. Upon confirmation of participation, teachers may request to work with OIN researchers to co-create the 5 requisite persona cards. The teacher(s) will select the 5 persona cards based on the OL stakeholder perspectives they feel are the most important for their classroom to explore in order to gain a deep understanding of OL concepts.

Possible persona cards as follows (Figs. 4, 5, 6, 7, and 8).

5 Concluding Remarks

This chapter was developed in line with this Toolkit's two main pathways and thematic areas. The objective of this work was to explore the practical application for advancing ocean literacy, in this instance by delving into the intricacies of cross-, inter-, and transdisciplinarity and their importance to OL research. Given that the state of affairs (health) of the global ocean is one of the greatest environmental issues facing humanity, this work puts forth that generating greater knowledge on the interrelationships between scientific and societal disciplines is essential to the futureproofing

Fig. 4 Persona card 1 (*Source* Stock Image, copyright free)

of our planet.[61] Further, this Toolkit chapter seeks to promote young people's active involvement in generating inter-, cross-, and transdisciplinary marine knowledge so as to inspire their senses of environmental empathy, environmental citizenship, and ocean stewardship. In order for the next generations to take on environmental leadership roles, such as ocean stewardship and co-creating marine protection strategies and mechanisms, we put forth that young people should gain a deep understanding of the methodological approaches utilized and integrated within marine sciences, international law and policy, economics, and other related fields of study as early as possible. Accordingly, our aim was to make this chapter accessible to educators and students, as well as professionals

[61] Strand, M., Ortega-Cisneros, K., Niner, H. J., Wahome, M., Bell, J., Currie, J. C., … & Winkler, A. (2022). Transdisciplinarity in transformative ocean governance research—Reflections of early career researchers. *ICES Journal of Marine Science*, *79*(8), 2163–2177.

Fig. 5 Persona card 5 (*Source* Stock Image, copyright free)

Fig. 6 Persona card 3 (*Source* Stock Image, copyright free)

Fig. 7 Persona 4 (*Source* Stock Image, copyright free)

Fig. 8 Persona Five (*Source* Stock Image, copyright free)

and practitioners who participate in marine and coastal governance and management, education policy, public policy, and other relevant fields.

References and Resources

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CHAPTER 5

Co-creation of Knowledge

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Abstract (English) This chapter provides a comprehensive overview of co-creation as a methodological approach, specifically within the context of ocean literacy. It is structured into five sections, each aimed at deepening the understanding and practical application of co-creation. Section 1 sets the stage by outlining the chapter's scope and structure. Section 2 defines co-creation, starting from its relevance in climate law

M.P. Poto, UiT The Arctic University of Norway contributed to the draft, design and writing and revision of the entire chapter.
L. Vita, MSc McMaster, Canada and OIN Project developer, contributed to the draft, design, writing, revision, and proofreading of the entire chapter, and developed the infographic of the abstract and of knowledge co-creation (see Visual Abstract).
I. Peftyiev, LLM, Mariupol State University, wrote the concluding remarks in Sect. 5.2, as well as the abstracts in Russian and Ukrainian.
Z. Madani, Institute of Humanities and Social Sciences, University of Tsukuba, Japan, contributed to Sect. 2.2.
O. Peftieva, The Center for Ocean and Society, Kiel University and Mariupol State University, contributed to Sect. 5.2 by suggesting the co-created activity using critical discourse analysis. The work during the Living Laboratory was conducted in cooperation with Sarah Parry and Tahnee Prior.

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studies, then describes its two components, and then focuses on its specific application in ocean literacy. In Sect. 3, the concept of knowledge co-creation is aligned with the two thematic pathways. This section bridges the theoretical foundations with the practical implications of co-creation in enhancing ocean literacy. Section 4 examines the co-creation process by reflecting on the guiding questions used during the OIN Living Laboratory in Copenhagen, in May 2024. These questions played a crucial role in directing the discussions and activities of the working group, showcasing a structured approach to exploring co-creation that could be replicated in future projects. The chapter culminates in Sect. 5, which presents the ideas developed by the co-creation group during the Living Laboratory, demonstrating how co-creation can be effectively understood and implemented in ocean literacy. This section translates theoretical concepts into practical, actionable insights, enabling readers to experiment with and apply co-creation approaches and contribute to ocean literacy.

Аннтоация (Русский) Данная глава представляет собой всесторонний обзор совместного творчества как методологического подхода, в частности, в контексте океанической грамотности. Структура главы состоит из пяти разделов, каждый из которых направлен на углубление понимания и практического применения совместного творчества. Раздел 2 определяет совместное творчество, начиная с его актуальности в исследованиях климатического права, затем описывает его две составляющие и затем фокусируется на его конкретном применении в океанической грамотности. В разделе 3 концепция совместного создания знаний корелируется с двумя тематическими путями. Этот раздел связывает теоретические основы с практическими результатми совместного творчества для повышения океанической грамотности. Раздел 4 исследует процесс совместного творчества, размышляя над основными вопросами, поднятыми во время Живой Лаборатории. Э ти вопросы сыграли решающую роль в направлении обсуждений и деятельности рабочей группы, демонстрируя структурированный подход к изучению совместного творчества, который может быть использован в будущих проектах. Глава завершается разделом 5, в котором представлены идеи, разработанные группой совместного творчества во время Живой Лаборатории, демонстрируя, как как механизмы совместного творчества могут быть успешно внедрены и реализованы в океанической грамотности. Этот раздел переводит теоретические концепции в практические, применимые идеи, позволяя

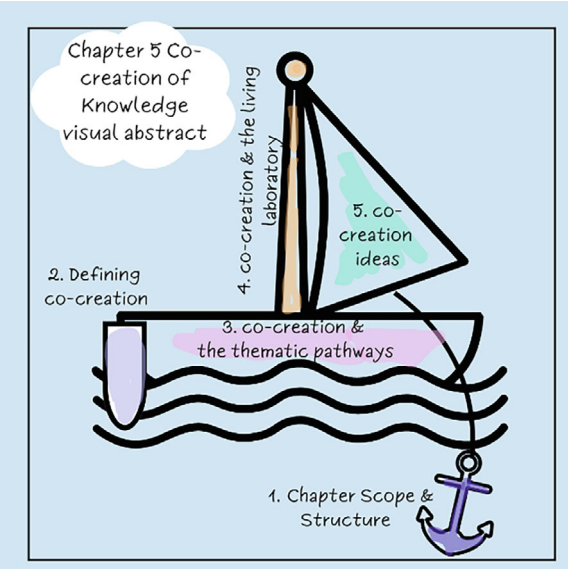
читателям экспериментировать с подходами совместного творчества и вносить свой вклад в океаническую грамотность.

Анотація (Українська) Ця глава представляє собою всебічний огляд спільної творчості як методологічного підходу, зокрема в контексті океанічної грамотності. Структура глави складається з п'яти розділів, кожен з яких спрямований на поглиблення розуміння та практичного застосування спільної творчості. Розділ 2 визначає спільну творчість, починаючи з її актуальності у дослідженнях кліматичного права, далі описує її дві складові та зосереджується на її конкретному застосуванні в океанічній грамотності. У розділі 3 концепція спільного створення знань корелюється з двома тематичними шляхами. Цей розділ пов'язує теоретичні основи з практичними результатами спільної творчості для підвищення океанічної грамотності. Розділ 4 досліджує процес спільної творчості, розмірковуючи над основними питаннями, що виникли під час Живої Лабораторії. Ці питання відіграли вирішальну роль у напрямку обговорень та діяльності робочої групи, демонструючи структурований підхід до вивчення спільної творчості, який може бути використаний у майбутніх проєктах. Глава завершується розділом 5, у якому представлені ідеї, розроблені групою спільної творчості під час Живої Лабораторії, демонструючи, як механізми спільної творчості можуть бути успішно впроваджені та реалізовані в океанічній грамотності. Цей розділ перетворює теоретичні концепції в практичні, застосовні ідеї, дозволяючи читачам експериментувати з підходами спільної творчості та вносити свій внесок у розвиток океанічної грамотності.

Abstract (Italiano) Il capitolo offre una panoramica del concetto di co-creazione dal punto di vista metodologico, specificamente nel contesto dell'*ocean literacy*. È strutturato in cinque paragrafi (*sections*). *Section 1* prepara il terreno delineando l'ambito e la struttura del capitolo. *Section 2* contiene la definizione di co-creazione, partendo dalla sua rilevanza nella ricerca sul diritto del clima e poi concentrando l'attenzione sulla sua applicazione specifica nell'ambito dell'*ocean literacy*. Nella *section 3*, il tema della co-creazione viene esaminato alla luce dei due *pathways* dell'*ocean literacy*. La *section 4* esamina il processo di co-creazione riflettendo sulle domande guida proposte alle partecipanti del Living Laboratory (maggio 2024). Il capitolo culmina con la section 5, offrendo esempi pratici di attività che dimostrano come la co-creazione possa essere compresa ed implementata efficacemente nel campo dell'*ocean literacy*.

چکیده (پارسی) این فصل در پی بررسی فراگیر هم‌آفرینی به عنوان یک رویکرد روش‌شناختی است، به‌ویژه در زمینه دانش دریایی. این فصل به پنج بخش دسته‌بندی شده است که هر یک برای تعمیق درک و کاربرد عملی هم‌آفرینی طراحی شده‌اند. بخش نخست با بیان دامنه و ساختار فصل، زمینه را آماده می‌کند. بخش دوم هم‌آفرینی را تعریف می‌کند، از اهمیت آن در مطالعات حقوق اقلیم گفته، سپس دو مؤلفه آن را توصیف می‌کند و در نهایت بر کاربرد خاص آن در دانش دریایی متمرکز می‌شود. در بخش سوم، مفهوم هم‌آفرینی دانش با دو مسیر موضوعی هماهنگ می‌شود. این بخش پایه‌های نظری را با پیامدهای عملی هم‌آفرینی در افزایش دانش دریایی پیوند می‌دهد. بخش چهارم به فرآیند هم‌آفرینی می‌پردازد و به پرسش‌های راهنمای استفاده شده در آزمایشگاه زنده او.آی.ان (OIN) در کپنهاگ، در ماه مه ۲۰۲۴، نگاهی می‌اندازد. این پرسش‌ها نقش اساسی در هدایت گفتگوها و فعالیت‌های گروه کاری داشته و نمایان‌گر یک رویکرد ساختارمند برای بررسی هم‌آفرینی بودند که می‌تواند در پروژه‌های آینده بکار گرفته شود. این فصل در بخش پنجم به اوج خود می‌رسد و با ارایه ایده‌های پدیدآمده توسط گروه هم‌آفرینی در آزمایشگاه زنده، نشان می‌دهد که چگونه هم‌آفرینی می‌تواند به طور کارآمد درک و پیاده‌سازی شود. این بخش مفاهیم نظری را برگردان به بینش‌های عملی و قابل اجرا می‌کند و به خوانندگان این امکان را می‌دهد تا با روش‌های هم‌آفرینی آنها را آزمایش کرده و به کار گیرند و به دانش دریایی یاری رسانند.

Visual Abstract



Laura Vita 2024

Keywords Co-creation · Methodological approach · Components · Process · Example · Ocean Literacy · Activities

1 Introductory Remarks

This chapter unfolds across five sections, each designed to deepen the understanding of co-creation as a methodological approach within the context of ocean literacy.

The chapter begins with an introduction that outlines the scope and objectives, setting the stage for a detailed exploration of the topic.

Following this introduction, Sect. 2 defines co-creation as a methodological approach, initially within the broader spectrum of climate law studies, before narrowing down to its specific application to ocean literacy. This definition is crucial as it guided our reflections on co-creation in ocean literacy from the inception of OIN to its implementing activities, providing the conceptual framework for the work conducted by the entire OIN team, offering guidelines for the work developed by the co-creation group during the Living Laboratory, and then finally inspiring all the activities mapped in this Toolkit.

Section 3 examines how the defined concept of knowledge co-creation aligns with the two thematic pathways identified in our project and highlighted in this book. This specific section connects the theoretical foundations with the practical implications of co-creation in ocean literacy.

In Sect. 4, the narrative moves to an overview of the guiding questions distributed to the working group during the Living Laboratory. These questions played a key role in guiding the group's discussions and activities, offering a structured framework for delving into co-creation. Additionally, they can serve as valuable guidelines for future strategies for those engaging with co-created approaches in ocean literacy and other areas.

The chapter concludes with Sect. 5, which presents practical examples of activities that illustrate how the concept of co-creation can be understood, taught, and implemented in the field of ocean literacy. This section aims to translate theoretical concepts into practical, actionable insights, enabling readers, learners and the ocean literacy community at large to experiment with and apply co-creation principles in real-world scenarios.

2 Co-creation as a Methodological Approach with Two Components

In pursuing ocean literacy, we underscore the significance of knowledge co-creation, which involves active participation and input from individuals across various disciplines in research and education endeavours.[1] Previous research in the fields of climate law and knowledge co-production has highlighted the dual nature of the co-creation of knowledge, which is crucial for understanding its application in inter-, trans-, and cross-disciplinary environmental research.[2] In this sense, the OIN team has conceptualized co-creation as a methodological approach and identified two elements: a subjective component, characterized by the involvement of a diverse array of collaborating actors of co-creation (or the *subjects* of co-creation), and an objective component, which involves the intersection and interaction of multiple disciplines (diverse sectors and discipline becoming the *objects* of co-creation) (Figs. 1 and 2).[3]

2.1 The Subjective Component of Co-creation

As for the subjective component, in the scholarly examination of co-creation actors, particularly within the context of climate governance processes—which is also pertinent to discussions on ocean literacy—Hege Hofstad et al. highlight the necessity for co-creation strategies to be underpinned by robust institutional design and proactive public leadership.[4] Institutional design necessitates the development of platforms and

[1] Lohse, E. J., & Poto, M. P. (2023). *Coproduction of knowledge in climate governance*, Berliner Wissenschafts-Verlag, ISBN 978-3-8305-5538-4.

[2] Poto, M. P., Porrone A., & Hayden-Nygren J. (2023), Knowledge co-creation as a methodological approach. participatory approaches to environmental legal research, in Lohse, E. J., & Poto, M. P. (eds.) *Coproduction of knowledge in climate governance*, Berliner Wissenschafts-Verlag, ISBN 978-3-8305-5538-4, p. 2728.

[3] Poto, M. P., Lohse E. J., & Owino, R. (2023), Mapping co-production of knowledge, in Lohse, E. J., & Poto, M. P. (eds.), *Coproduction of knowledge in climate governance*, Berliner Wissenschafts-Verlag, ISBN 978-3-8305-5538-4.

[4] Hofstad, H., Sørensen, E., Torfing, J., & Vedeld, T. (2022). Designing and leading collaborative urban climate governance: Comparative experiences of co-creation from Copenhagen and Oslo. *Environmental Policy and Governance*, *32*(3), 203–216.

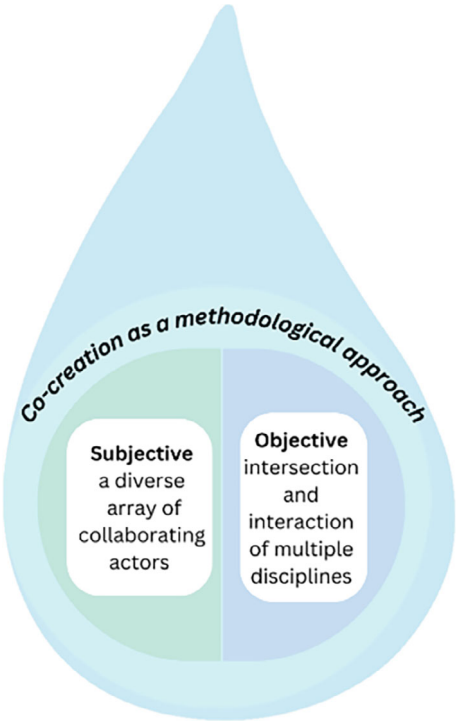


Fig. 1 Co-creation as a methodological approach. Infographics by Laura Vita

arenas that establish an organizational framework conducive to collaborative processes governed by clearly defined rules.[5] Within this structured space, public leadership is posited as crucial for promoting, supporting, and guiding co-creation initiatives.[6] Specifically, leaders are tasked with

[5] Ansell, C., & Gash, A. (2018). Collaborative platforms as a governance strategy. *Journal of Public Administration Research and Theory, 28*, 16–32. https://doi.org/10.1093/jopart/mux030.

[6] Hofstad, H., Sørensen, E., Torfing, J., & Vedeld, T. (2022). Designing and leading collaborative urban climate governance: Comparative experiences of co-creation from Copenhagen and Oslo. *Environmental Policy and Governance, 32*(3), 203–216; Hofstad, H., Sørensen, E., Torfing, J., & Vedeld, T. (2021). Leading cocreation for the green shift. *Public Money & Management*, 1–10. https://doi.org/10.1080/09540962.2021.1992120.

Fig. 2 Transdisciplinary OIN team participating in one of the Monthly Coffee Meetings (*Photo* Emily Murray)

developing, disseminating, and maintaining shared perspectives, determining activities, and exploring solutions to complex issues through the empowerment of involved actors and the facilitation of cross-sectoral collaboration.[7]

[7] Hofstad, H., Sørensen, E., Torfing, J., & Vedeld, T. (2022). Designing and leading collaborative urban climate governance: Comparative experiences of co-creation from Copenhagen and Oslo. *Environmental Policy and Governance, 32*(3), 203–216.

Such a model is built on the foundational concept of polycentric governance,[8] which posits that, in addition to leaders seen as facilitators of the process, a diverse array of key actors emerges as knowledge translators, learners and teachers, and experts in developing educational and learning methodologies.[9] This approach emphasizes a dynamic and interactive approach to governance, where facilitation and adaptability become central to navigating and managing complex governance landscapes. Moreover, it underscores the importance of positionality—recognizing each actor's situated knowledge,[10] and a commitment to inter-cross-transdisciplinarity, where participants collaborate to forge new understandings and solutions to complex transboundary challenges.[11]

[8] Hofstad, H., & Vedeld, T. (2021). Exploring city climate leadership in theory and practice: Responding to the polycentric challenge. *Environmental Policy and Planning*, 1–15, 496–509. https://doi.org/10.1080/1523908X.2021.1883425. For polycentric governance all the studies of Elinor Ostrom are of relevance: Ostrom E. (1998). Scales, polycentricity, and incentives: Designing complexity to govern complexity, in Guruswamy, M. (eds.), *Protection of global biodiversity: Converging strategies*, Duke University Press, Raleigh, pp. 149–167. Ostrom, E., & Ostrom, V. (1977). Public economy organization and service delivery. Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, pp. 1–53; Ostrom, V., & Ostrom, E. (1977). A theory for institutional analysis of common pool problems. Managing the Commons. Freeman, San Francisco, pp. 157–172; Ostrom, V., & Ostrom, E. (1977). Public goods and public choices. Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, pp. 1–42; Ostrom, E., Whitaker. (1973). Does local community control of police make a difference? Some preliminary findings. *American Journal of Political Science*, 48–76; Ostrom, E., Baugh, Guarasci, Parks, Whitaker. (1973). *Community organization and the provision of police services*. Sage, Beverly Hills, CA, Ostrom, E., Parks, Whitaker, Percy. (1978). The public service production process: A framework for analyzing police services. *Policy Studies Journal, 7*(s1), 381–389. Ostrom, E., Parks, Percy, Whitaker. (1979). Evaluating police organization. *Public Productivity Review*, 3–27. Ostrom, E. (1985). Formulating the elements of institutional analysis. Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington.

[9] Panieri G., Poto, M. P., & Murray E. M. (ed.). (2024). *Emotional and ecological literacy for a more sustainable society*. Palgrave Macmillan, Springer Nature, ISBN: 978-3-031-56,771-1.

[10] See Chapter 3 of this Toolkit.

[11] Chapter 4 of this Toolkit; see also Poto, M. P., Kuhn, A., Tsiouvalas, A., Hodgson, K. K., Treffenfeldt, M. V., & M. Beitl, C. (2022). Knowledge integration and good marine governance: A multidisciplinary analysis and critical synopsis. *Human Ecology, 50*(1), 125–139. https://doi.org/10.1007/s10745-021-00289-y; Lohse, E. J., & Poto, M. P. (2023). *Coproduction of knowledge in climate governance*, Berliner Wissenschafts-Verlag, ISBN 978-3-8305-5538-4.

2.2 *The Objective Component of Co-creation: Transdisciplinarity*

Transdisciplinarity represents the most advanced stage of disciplinary interaction, which comprises and elaborates on the inter- and cross-disciplinary approaches by co-creating different forms of knowledge.[12] In this sense, it serves as a critical objective component in a co-created methodology for sustainability research, building upon what we defined as the subjective component of multiple actors' involvement.[13] This approach facilitates the empowerment of diverse actors, enabling the connection and development of academic, non-academic, and experiential knowledge systems through what is referred to in scholarly literature as the spiral of co-creation.[14]

This spiral unfolds through five stages: (1) the collective articulation of the problem and the project or initiative's objectives; (2) the integration of natural and social sciences facilitated by academic actors; (3) the incorporation of knowledge from non-academic actors such as Indigenous peoples and local communities; (4) a process of social learning and collective reflection on the objectives; and (5) the initiation of collective action for implementation. Furthermore, scholarship on transdisciplinary methodologies in co-creation for sustainability highlights that transdisciplinary research brings together diverse actors and epistemologies and fosters the co-creation of new forms of knowledge, including transformational, target, and systems knowledge.[15]

The systems knowledge created through the avenue of transdisciplinarity is of particular significance since an entirely siloed and linear

[12] Pohl, C., Klein, J. T., Hoffmann, S., Mitchell, C., & Fam, D. (2021). Conceptualising transdisciplinary integration as a multidimensional interactive process. *Environmental Science & Policy, 118*, 18–26.

[13] Jacobi, J., Llanque, A., Mukhovi, S. M., Birachi, E., von Groote, P., Eschen, R., … & Robledo-Abad, C. (2022). Transdisciplinary co-creation increases the utilization of knowledge from sustainable development research. *Environmental Science & Policy, 129*, 107–115.

[14] Jacobi, J., Llanque, A., Mukhovi, S. M., Birachi, E., von Groote, P., Eschen, R., … & Robledo-Abad, C. (2022). Transdisciplinary co-creation increases the utilization of knowledge from sustainable development research. *Environmental Science & Policy, 129*, 107–115.

[15] Jacobi, J., Llanque, A., Mukhovi, S. M., Birachi, E., von Groote, P., Eschen, R., … & Robledo-Abad, C. (2022). Transdisciplinary co-creation increases the utilization of knowledge from sustainable development research. *Environmental Science & Policy, 129*, 107–115.

understanding of knowledge utilization is not sufficient. That's because such understanding neither addresses the intricacies of the systems being researched nor the diversity of development pathways that such research can favour when taking inclusive and participatory approaches.[16] Therefore, systems knowledge steps beyond the boundaries of identity, e.g. gender, race, ethnicity, class, etc., and centres on inclusive and holistic problem-solving frameworks.[17] This knowledge complements and enhances each stage of the spiral of co-creation in sustainability research, particularly when applied to ocean literacy and sustainability projects. Systems knowledge, with its focus on interconnectedness, feedback loops, and not only existing but also emergent elements, offers a methodology that can help integrate and operationalize the co-creation of knowledge across academic, non-academic, and experiential knowledge systems.

In the first stage, systems knowledge is pivotal in helping stakeholders frame the ocean sustainability problem holistically. Through systems mapping, actors can visualize how different components of the ocean system—such as marine ecosystems, human communities, applicable legal frameworks, and economic activities—interact with one another. This encourages participants to shift from a linear understanding of problems to one that acknowledges the complexity and interdependency of issues related to the ocean.[18] Systems thinking also fosters the identification of key leverage points where small interventions can yield significant

[16] Jacobi, J., Llanque, A., Bieri, S., Birachi, E., Cochard, R., Chauvin, N. D., Diebold, C., Eschen, R., Frossard, E., Guillaume, T., Jaquet, S., K¨ampfen, F., Kenis, M., Kiba, D. I., Komarudin, H., Madrazo, J., Manoli, G., Mukhovi, S. M., Nguyen, V. T. H., Pomal'egni, C., Rüegger, S., Schneider, F., TriDung, N., von Groote, P., Winkler, M. S., Zaehringer, J. G., & Robledo-Abad, C. (2020). Utilization of research knowledge in sustainable development pathways: Insights from a transdisciplinary research-for-development programme. *Environmental Science & Policy, 103*, 21–29. https://doi.org/10.1016/j.envsci.2019.10.003.

[17] Jacobi, J., et al. (2022). Transdisciplinary co-creation increases the utilization of knowledge from sustainable development research. *Environmental Science & Policy, 129*, 107–115; Alvargonzález, D. (2011). Multidisciplinarity, interdisciplinarity, transdisciplinarity, and the sciences. *International Studies in the Philosophy of Science, 25*(4), 387–403. https://doi.org/10.1080/02698595.2011.623366; Nicolescu, B. (2014). Methodology of transdisciplinarity. *World Futures*, *70*(3–4), 186–199. https://doi.org/10.1080/02604027.2014.934631.

[18] Jacobi, J., et al., 2020. Ibid.; Landry, R., Amara, N., & Lamari, M. (2001). Climbing the ladder of research utilization: Evidence from social science research. Science *Communication, 22*(4), 396–422. https://doi.org/10.1177/1075547001022004003.

change. By including diverse actors early in the articulation process, participants can jointly explore how various factors, from overfishing to climate change, interact to affect the ocean's health, thus enabling a more inclusive and nuanced understanding of the problem.[19]

In stage 2, where integration of natural and social sciences facilitated by academic actors often poses challenges due to the assumption that natural and social sciences have different ontologies and epistemologies, systems thinking and knowledge can serve as a bridge between these fields, providing a shared language of systems, feedback loops, and causal connections. For example, marine biology and economics might use system dynamics models to explore how ecological changes impact social and economic systems, creating common ground for interdisciplinary collaboration. In the context of this project, such integration is crucial for addressing ocean literacy, as it allows scientific insights (e.g. from marine biology) to be contextualized within social systems (e.g. human behaviours and governance). As a result, systems knowledge helps to ensure that natural and social sciences inform one another in the co-creation of actionable knowledge, through facilitating dialogue between disciplines.[20]

In stage 3, where the incorporation of non-academic knowledge, especially from Indigenous peoples and local communities, is involved, systems knowledge forms the cornerstone of transdisciplinarity. It is beneficial in this context because it values multiple perspectives and emphasizes the importance of, and builds upon, feedback mechanisms, which resonate with Indigenous epistemologies or "ways of knowing" that view nature and society as deeply interconnected.[21] Non-academic actors can use systems knowledge tools such as causal loop diagrams to express their understanding of ocean systems, particularly the relational dynamics they have developed over centuries of engagement with the ocean. For instance, Indigenous knowledge of sustainable fishing practices can be integrated into broader systems maps that include scientific data on fish populations, helping to create a more holistic understanding of ocean

[19] See Chapter 1 of this Toolkit.

[20] See Chapter 1 of this Toolkit.

[21] Olsvig, S., & Cullen, M. (2024). Arctic indigenous peoples and international law. *Nordic Journal of International Law*, *93*(1), 152–169. https://doi.org/10.1163/15718107-bja10079.

sustainability.[22] Therefore, while systems knowledge positions Indigenous knowledge as critical to understanding and managing ocean systems, it helps elevate these perspectives, ensuring they are not marginalized in the knowledge co-creation process.

In stage 4, where the stakes are social learning and collective reflection on objectives, systems knowledge offers support by fostering ongoing reflection through the iterative social learning process. In systems knowledge, learning is viewed as a continuous feedback process, where stakeholders reflect on the outcomes of their actions, adapt their approaches, and refine their understanding of the system. This aligns well with the transdisciplinary spiral of co-creation, as it requires collective reflection and adaptability.[23] In the context of ocean literacy, this reflection can involve stakeholders assessing how their knowledge—scientific, experiential, and Indigenous—has influenced the co-creation process and shaped their collective understanding of ocean systems. As they engage in this social learning, participants may discover previously unseen connections or overlooked system components, which can lead to new objectives or strategies for action. Systems knowledge tools such as system archetypes (recurring patterns in systems) can help stakeholders recognize and address systemic issues, such as the "tragedy of the commons" in fisheries,[24] and encourage collective reflection on how to overcome these challenges.[25]

In the final stage on initiating collective action for implementation, systems knowledge provides a roadmap for translating co-created knowledge into action. This is done by identifying leverage points and critical feedback loops within the ocean system, which enables stakeholders to design interventions that are more likely to lead to systemic change.

[22] Obiero, K. O., Mboya, J. B., Ouko, K. O., Kembenya, E. M., Nyauchi, E. A., Munguti, J. M. et al. (2023). The role of indigenous knowledge in fisheries resource management for aquaculture development: A case study of the Kenyan Lake Victoria Region. *Aquaculture, Fish and Fisheries, 3*, 175–183. https://doi.org/10.1002/aff2.101.

[23] Jacobi, J., et al., 2020. Ibid.

[24] See, for instance, McWhinnie, S. F. (2009). The tragedy of the commons in international fisheries: An empirical examination. *Journal of Environmental Economics and Management, 57*(3), 321–333. https://doi.org/10.1016/j.jeem.2008.07.008.

[25] McLean, S., Read, G. J. M., Hulme, A., Dodd, K., Gorman, A. D., Solomon, C., & Salmon, P. M. (2019). Beyond the tip of the iceberg: Using systems archetypes to understand common and recurring issues in sports coaching. *Frontiers in Sports and Active Living, 1*, 49. https://doi.org/10.3389/fspor.2019.00049.

Systems knowledge encourages stakeholders to focus on interventions that address the root causes of problems rather than merely treating symptoms. For instance, an initiative to promote ocean literacy may use systems knowledge to identify key actors who can drive change—such as educators, policymakers, and community leaders—and engage them in a coordinated effort to shift public perceptions of the ocean. In so doing, strategies need to be devised to amplify the impact of those interventions in which different actors influence the system. Moreover, systems knowledge supports adaptive management, where stakeholders continuously monitor the effects of their actions and adjust as needed.[26] This is particularly relevant in ocean sustainability, where environmental conditions constantly change, and interventions must be flexible and responsive.

2.3 The Two Components in the Work of the OIN Team and the OIN Living Laboratory

In applying this analytical framework to the OIN team and its prototypical system of co-creation of the Living Laboratory,[27] we observe quite an accurate application of the two mentioned elements (subjective and objective components of co-creation) to the implementation of the ocean literacy vision. The team members worked together in the space of the network (the Ocean Incubator Network) which in many ways constituted the institutional framework where the members collaboratively searched for solutions that could respond to the central tenet of ocean literacy.[28]

[26] Thelen, J., Sant Fruchtman, C., Bilal, M., et al. (2023). Development of the systems thinking for health actions framework: A literature review and a case study. *BMJ Global Health,* 8, e010191. https://doi.org/10.1136/bmjgh-2022-010191.

[27] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

[28] Co-led by the Faculty of Law UiT The Arctic University of Norway and the Department of Geosciences and realized by the project developer and knowledge translator Laura Vita, the project engages a multitude of UArctic institutional partners, including UiT The Arctic University of Norway, the Arctic Centre at the University of Lapland in Rovaniemi, Finland, the James Hutton Institute and the University of Edinburgh in Scotland, the Centre for the Ocean and Society at Kiel University, Women of the Arctic in Finland, and the Marine & Environmental Law Institute at the Schulich School of Law, Dalhousie University. Additionally, it brings together a diverse group of researchers,

Such a framework was built following the rules of group formation, combining, adapting, and implementing the theoretical approaches of Bruce W. Tuckman[29] and Graham Gibbs.[30]

Within the established organizational framework from the project's inception, we ensured the involvement of all parties at every stage, from the co-creation of the project proposal (development phase) to the monthly meetings[31] and ultimately to the final Living Laboratory event focused on dissemination and maintenance.[32] Within this polycentric governance structure, project and group leaders served as project coordinators, developers, and group facilitators. This leadership structure facilitated the integration of various perspectives and the smooth progression of project phases,[33] by explicitly implementing SDG 5, focusing on

students, and experts in global health, youth participation and climate justice, environmental law, food justice, and ecolinguistics (Cork University College, The University of Exeter, The Thalassophile Project, the University of Turin, Mariupol State University). More on the institutional structure of the network in the scientific report of the Living Laboratory: Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

[29] Tuckman, B. W. (1965). Developmental sequence in small groups. *Psychological Bulletin, 63*(6), 384.

[30] See Chapter 1, section 1.8. Gibbs, G. (1988) *Learning in doing: A guide to teaching and learning methods*, Oxford Centre for Staff and Learning Development, Oxford Polytechnic, London; Gibbs, G. (1998). *Learning by doing: A guide to teaching and learning*. Brookes Oxford University, London; Gibbs' reflective cycle. (2016). *Academic services & retention team*, University of Cumbria; https://my.cumbria.ac.uk/media/MyCumbria/Documents/ReflectiveCycleGibbs.pdf, last access August 15, 2024.

[31] The Monthly Coffee Meetings, inspired by the World Café Method, were developed to provide a space for a structured conversational process intended to facilitate open and intimate discussion. It links ideas within a larger group to access "collective intelligence" of the participants and to understand and learn from multiple points of view. See Ravneberg, B. E. (2024, February). Co-creating and co-producing learning environments in adult education through the World Café method. *Frontiers in Education*, *9*, 1335747. Frontiers Media SA. For a documentation of the OIN Team Monthly Coffee Meetings see https://en.uit.no/project/oceanincubator, last access, August 28, 2024.

[32] For documentation of all the initiatives undertaken by the OIN team members see https://en.uit.no/project/oceanincubator, last access, August 21, 2024.

[33] On this model of leadership see also the Chapter 2.

women's leadership. This perspective emphasized the values of relationality, compassion, and care,[34] which were integrated into various facets of the research subject and influenced the selection of relational group dynamics.

Team members assumed dynamic roles as knowledge translators, learners, and facilitators, actively engaging in every facet of the project.[35] This engagement spanned from the initial project conception to the planning and development phases, the testing of the Living Laboratory prototype, the creation of activities, and the consolidation of research findings in co-authored chapters.

This comprehensive involvement ensured that all team members were contributors, co-learners, and co-creators, embodying the principles of co-creation throughout the project lifecycle. This approach fostered a collaborative environment where knowledge was not only shared but also generated collectively, leading to a richer, more integrated outcome that reflected all participants' diverse inputs and expertise (Figs. 3 and 4).[36]

2.4 The Objective Component of Co-creation

In our OIN team, we adhered to the objective component of co-creation by embedding transdisciplinarity throughout all stages of our project development. This comprehensive approach encompassed a wide range of

[34] See Chapter 6.

[35] For some examples of the role of the OIN team members at the inception of the project see Panieri, G., Poto, M. P., Bertella, G., Bertolotto Bianc, G., Médici, N., Murray, E. M., Pandeva, R., & Vita, L. (2023). Ocean Interconnectedness: An interdisciplinary workshop to learn from the ocean, through multisensory activities and reflections on the role of emotions in science and law: Senses & Science, Love & Law. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7271. For their role during the implementation of the Living Laboratory see Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

[36] On the importance of developing a structured system of feedback see Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

Fig. 3 Reflective practice exercise by the sea at the conclusion of the Living Laboratory, Copenhagen, May 2024 (*Photo* Igor Peftiyev)

knowledge systems: (a) academic disciplines, (b) non-academic disciplines, and (c) experiential knowledge (Figs. 5 and 6).

(a) Academic Disciplines: We drew on expertise from diverse fields, including marine geosciences, law education, global health, political sciences, gender studies, and ecolinguistics. This interdisciplinary academic collaboration enriched our understanding and approach to the complex issues at hand.
(b) Non-Academic Disciplines: With the invaluable assistance of Indigenous scholars, our project embraced perspectives rooted in Arctic Indigenous knowledge, specifically referencing the works of Harald Gaski[37] and in collaboration with Aila Biret Henriksen

[37] Gaski, H. (2019). Indigenous elders' perspective and position. *Scandinavian Studies, 91*(12), 259–268.

Fig. 4 Circle of Gratitude exercise with OIN Team members (*Photo* Igor Peftiyev)

Selfors.[38] Moreover, we developed follow-up activities on ocean literacy in collaboration with the Indigenous peoples from the Aldeia Maraka'nà in Rio de Janeiro (June 2024).[39] There, our OIN team members, in collaboration with Indigenous experts, developed a follow-up workshop where Indigenous knowledge and one

[38] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

[39] On the history of the Aldeia Maraka'nà and its relationship to water see Médici, N. (2024). Indigenous resilience through the waters: The story of the Aldeia Maraka'nà, https://blogs.egu.eu/geolog/2024/08/19/indigenous-resilience-through-the-waters-the-story-of-the-aldeia-marakana/, last access August 28, 2024; Médici Machado, N. C., Poto, M. P., & Murray, E. M. (2024). The paths of water and their relations: A dialogue between Brazil and Norway, in Panieri G., Poto, M. P., & Murray E. M. (eds). (2023). *Emotional and ecological literacy for a more sustainable society*, Springer Nature SDGs Series, ISBN: 978-3-031-56771-1.

Fig. 5 Foraminifera box and materials during the workshop on experiential knowledge in ocean literacy at the Aldeia Maraka'nà, in Rio de Janeiro (*Photo* Ana Maria Montaña Monoga)

of the co-created activities developed during the Living Laboratory were shared with children, elders, researchers, and other community members. This inclusion ensured that Indigenous and local insights were integral to our methodology, providing depth and context beyond conventional academic frameworks.[40]

[40] Montaña Mónoga, A. M., Parola, G., Poto, M. P., Panieri, G., Muniz de Souza (Otomorinhori'ð Xavante), J., Médici Machado, N., Wennerstrom, A., Barrenechea Angeles, I., & Zimmermann, J. (2024). ECO_CARE Multisensory and Experimental Workshop 2024 "We are the Ocean, and the Ocean is us. A Living Laboratory to learn from each other and learn from the ocean". *Septentrio Reports*, (1). https://doi.org/10.7557/7.7828.

Fig. 6 Ocean literacy co-created activity with the Aldeia Maraka'nà, in Rio de Janeiro (*Photo* Ana Maria Montaña Monoga)

(c) Experiential Knowledge: Our project actively incorporated experiential knowledge through reflective practices[41] and outreach educational activities. In particular, among these activities, it is worth mentioning the workshop organized in June 2024 at the Aldeia Maraka'nà in Rio de Janeiro and the activities of the foraminifera box with local school Goyavier in Colombia, which

[41] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606. Our reflective practice was largely inspired by Gibbs, G. (1988). *Learning by doing: A guide to teaching and learning methods*. Further Education Unit. Oxford Polytechnic: Oxford. The whole Living Laboratory experience built on the experience developed through emotional and experiential education: Panieri, G., Poto, M. P., & Murray, E. M. (eds.). (2024). *Emotional and ecological literacy for a more sustainable society*, Palgrave Macmillan, Springer Nature, ISBN: 978-3-031-56771-1.

facilitated a hands-on learning experience that was both immersive and enlightening.[42]

By integrating these diverse forms of knowledge, the team fully embraced transdisciplinarity, engaging in collaboration across academic and non-academic disciplines, and enhancing their experience through experiential learning. This approach fostered a richer, more comprehensive understanding of the issues we addressed, highlighting the value of combining academic, non-academic, and experiential knowledge in co-creative processes for ocean literacy.

3 Connection to the Two Pathways

Our commitment to pursuing co-creation, in alignment with the dual pathways of connecting with each other and connecting with the ocean,[43] is evident in numerous aspects and steps of our project, particularly through the subjective and objective components. For example, as explained above, to connect with each other, we designed our institutional space, developing a system of Monthly Coffee Meetings inspired by the World Café methods, to facilitate interaction and collaboration, ensuring it is conducive to co-creation. This environment supported open dialogue through online and in-person meetings and the sharing of diverse perspectives, which are crucial for nurturing solid connections among team members, stakeholders, and communities.

Moreover, another tangible example of how we fostered a sense of connection among our OIN team members was by creating working stations in our Living Laboratory as prototypes of the three thematic chapters in this Toolkit. The stations, defined by illustrated posters printed on fabric designed by our project illustrator, Valentina Russo, were referred to as "hubs". We encouraged each working group to convene

[42] For the latter see https://en.uit.no/project/ecocare/nyheter/artikkel?sub_id=848392, last access August 21, 2024; for both see Montaña Mónoga, A. M., Parola, G., Poto, M. P., Panieri, G., Muniz de Souza (Otomorinhori'õ Xavante), J., Médici Machado, N., Wennerstrom, A., Barrenechea Angeles, I., & Zimmermann, J. (2024). ECO_CARE Multisensory and Experimental Workshop 2024 "We are the Ocean, and the Ocean is us. A Living Laboratory to learn from each other and learn from the ocean". *Septentrio Reports*, (1). https://doi.org/10.7557/7.7828.

[43] See more on this in Chapter 1 and throughout the different Chapters 2–4.

around these hubs, utilizing them as vision boards for displaying the outcomes of their efforts and as focal points for cultivating a sense of community centred around a shared thematic focus (namely: positionality, inter-cross-transdisciplinarity, and co-creation) (Figs. 7 and 8).

Moreover, we have been mindful to keep our ocean connection open constantly. Adopting a multisensory approach, we immersed participants in experiences emphasizing sensory interactions with the ocean. This included encouraging them to craft positionality statements related to the ocean, engaging them in reflective practices linked to ocean experiences, and organizing a "sound bathing experience" where we listened to music inspired by the ocean. In particular, at the beginning of the Living Laboratory, the participants were encouraged to connect with the Arctic story

Fig. 7 Cover of co-creation developed to create a working space during the Living Laboratory (*Illustration* Valentina Russo)

Fig. 8 Example of the working hub inter-cross-transdisciplinarity that helped the team members connect with each other (*Photo* Igor Peftiyev)

by listening to the heartbeat from our sea heart.[44] In addition, at the end of the first presentation round, the team was immersed in listening to two ocean-related auditory experiences. The first was a soundtrack composed by Giuliano Bertolotto Bianc from the University of Turin, celebrating

[44] In the animation created by Artem Krykhtenko and illustrated by Valentina Russo: https://youtu.be/TOAY88Znx-8, last access August 22, 2024. Other examples of multisensory experiences developed to connect with the ocean can be found in the Living Laboratory report and in the kick-off meeting where a morning concert with the theme "Ocean Interconnectedness" was organized in collaboration with the Music Conservatory at UiT The Arctic University of Norway. Respectively: Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606; Panieri, G., Poto, M. P., Bertella, G., Bertolotto Bianc, G., Médici, N., Murray, E. M., Pandeva, R., & Vita, L. (2023). Ocean interconnectedness: An interdisciplinary workshop to learn from the ocean, through multisensory activities and reflections on the role of emotions in science and law: Senses & Science, Love & Law. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7271.

the discovery of the volcano Borealis during the Akma Expedition in 2023 by Giuliana Panieri.[45] The premiere of the recording was featured on the occasion of the Ocean Incubator Network kick-off meeting in September 2023. The second auditory and visual experience consisted of watching the documentary "Blue Mind",[46] which showcased Rada Pandeva's (one of our OIN team members) profound connection with the ocean (Fig. 9).

These reflections prompt us to consider how interconnected we are with the ocean and how our actions impact this vital ecosystem. Furthermore, the outcomes of our co-creation efforts are designed to deepen our understanding and help us and our target audience re-establish and

Fig. 9 A space for a multisensory experience: hearing an Arctic Indigenous story, connecting with the ocean through our heartbeats (*Photo* Igor Peftiyev)

[45] A live version of the music piece is available on the ECOCARE youtube channel at the link https://youtu.be/J3I3ypiuV4Q?si=fH_xVG4WGhhDV8mC (up to minute 4.29), last access August 28, 2024.

[46] BLUE MIND—Short Documentary (RED Komodo + DZO Vespid Primes), director Alexandra Karadzhova, available at https://youtu.be/_JrMcj1NuiI?si=luQKzO0l9UbNkNwK, last access August 28, 2024.

strengthen our connection with the ocean. This approach ensures that our project resonates on a personal level, making the importance of ocean conservation and literacy more tangible and immediate.

By integrating these strategies into our project, we ensure that every aspect of our work aligns with and supports the pathways of connecting with each other and with the ocean. This holistic approach amplifies the impact of our efforts, making our project a powerful catalyst for change in ocean literacy and conservation.

4 Guidelines for Effective Co-creation in Ocean Literacy: A Summary from the Living Laboratory Workshop

The Living Laboratory workshop provided a structured set of guidelines designed to steer the development of activities aimed at effectively communicating the importance and applicability of co-creation in the context of ocean literacy.[47] These guidelines not only served as a roadmap for the Living Laboratory participants but also stand as valuable principles for future endeavours in similar subject matters. Here's a comprehensive summary of the guidelines discussed:

(a) Purpose and Objectives:
The primary step involves clearly defining the specific goals of the co-creation project. Participants were encouraged to consider how co-creation could enhance the outcomes or the quality of the end result, ensuring that the objectives align with the overarching aim of promoting ocean literacy.

[47] The guidelines were developed during online meetings and subsequently distributed among the thematic groups via Teams. Throughout the Living Laboratory, thematic booklets containing detailed instructions and step-by-step processes were provided to participants to aid in the development of their thematic projects. See more on this in Chapter 1 and in Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

(b) Stakeholder Identification:
Identifying key stakeholders is crucial. The guidelines emphasized understanding the perspectives, expertise, and interests of these stakeholders to ensure their contributions effectively support the co-creation process.

(c) Collaborative Framework:
A robust methodology or framework that facilitates effective collaboration among participants is vital. The workshop highlighted the importance of ensuring equitable participation and decision-making, which are foundational for successful co-creation.

(d) Resource Allocation:
Discussing the allocation of necessary financial, human, and technological resources was pointed out as essential for supporting the co-creation efforts. Efficient resource management maximizes the benefits derived from co-creation.

(e) Communication and Feedback:
Establishing and maintaining open communication channels among all participants ensures transparency and continuous engagement. Implementing mechanisms to gather and incorporate feedback throughout the process helps refine and improve the co-creation activities.

(f) Roles and Responsibilities:
Clarity regarding each participant's roles and responsibilities is imperative. The guidelines stressed accountability and clear communication to avoid overlaps and ensure that all tasks are covered effectively.

(g) Flexibility and Adaptability:
Adapting to changes and responding to uncertainties and challenges is crucial in a dynamic co-creation environment. Strategies to enhance adaptability and resilience among participants were discussed as essential components.

(h) Ethical Considerations:
Ethical principles must guide the co-creation process. Ensuring that diverse perspectives and voices are respected and valued is fundamental to the integrity and inclusiveness of the project.

(i) Evaluation and Reflection:
Evaluating the effectiveness and impact of the co-creation exercise is critical for understanding its success and areas for improvement. Opportunities for participants to reflect on their experiences and lessons learned contribute to personal and collective growth.
(j) Long-Term Sustainability:
Finally, promoting sustainability and continuity beyond the immediate scope of the project ensures that the benefits of co-creation extend into the future. Measures to foster long-term collaboration and innovation among participants were considered essential for ongoing impact.

These guidelines facilitated activities during the Living Laboratory and provided a structured approach that can be replicated in future projects focused on ocean literacy and beyond. By adhering to these principles, future endeavours can achieve more structured, inclusive, and effective outcomes in the field of co-creation.

5 Examples of Co-created Activities

In the other thematic chapters, we have showcased one example of a co-created activity for each theme. However, in the context of co-creation, it is clear that every activity developed by the OIN Team—before, during, and after the Living Laboratory—serves as an example of knowledge co-creation for ocean literacy. Therefore, in this section, after presenting the outcomes from the co-creation group, we will highlight the most exemplary instance of co-creation in ocean literacy, drawing from the collective experiences of the entire OIN Team.

5.1 Co-creation in Ocean Literacy: Preliminary Ideas Developed During the Living Laboratory

The co-creation group's efforts during the Living Laboratory led to the development of three clear, prototypical ideas for enhancing ocean literacy through co-creation:

(a) Co-creation of an Ocean Literacy Video Game:

The group explored developing a video game centred on ocean literacy. In this game, players would co-create their strategies to achieve a deeper understanding of ocean-related issues.[48] This interactive approach allows participants to engage actively with the content, fostering a personal connection to ocean literacy through collaborative problem-solving and strategy development.

(b) Ecolinguistics-Inspired Activities:

Drawing inspiration from the book "The Concept of Water" by Rupert D. Glasgow,[49] the group reflected on the diverse cultural representations of water. This reflection led to the idea of using storytelling or other creative methods to give water a central role in educational activities. By exploring how different cultures and communities articulate their relationship with water, rivers, seas, and oceans through proverbs, sayings, and idioms, these activities aim to enrich participants' understanding of the symbolic and philosophical significance of water.[50]

(c) Critical Discourse Analysis for Ocean Literacy:

The group proposed using critical discourse analysis as a foundational step in developing resources for ocean literacy. This approach ensures that all co-creation participants have a common understanding and that the foundational documents are thoroughly analysed for complexity.[51] By critically evaluating information, individuals can make informed decisions about

[48] Poto, M. P., Vita, L., Brown, K., Hayden-Nygren, J., Heinrich, K., Hernández Ant, A., Kuhn, A., Montaña Monoga, A. M., Murray, E. M., Pandeva, R., Panieri, G., Parry, S., Peftieva, O., Prior, T., & Quist, S. E. (2024). The Ocean Incubator Network (OIN) living laboratory and ocean literacy toolkit. *Septentrio Reports*, (1). https://doi.org/10.7557/7.7606.

[49] Glasgow, R. D. (2009). *The concept of water*, RDV Glasgow.

[50] Glasgow, R. D. (2009). *The concept of water*, RDV Glasgow.

[51] For critical discourse analysis in ecological literacy see Haig, E. (2001). A study of the application of critical discourse analysis to ecolinguistics and the teaching of eco-literacy. *Studies in Language and Culture* (Nagoya University, Faculty of Language and Culture), *22*(2), 205–226.

ocean-related policies and practices, enhancing their advocacy for sustainable ocean practices.[52] This method not only raises awareness but also empowers participants to advocate effectively for positive changes at local, national, and global levels.

These ideas collectively aim to deepen engagement with ocean literacy through innovative, interactive, and reflective methods, ensuring that participants learn about and actively contribute to the discourse on ocean conservation.

5.2 An Example of Co-created Activity for Ocean Literacy Through Critical Discourse Analysis

In the work completed by Olena Peftieva, a co-creation group member, reflecting after the Living Laboratory, the author further explored how a critical discourse analysis for Ocean Literacy could be laid out as an activity to enhance engagement with ocean-related texts and use analytical skills to promote ocean literacy.

A critical reading approach to reading documents, reports, or research is not about being sceptical or negative; it rather triggers creativity and curiosity.[53] Critical reading helps identify ambiguities, contradictions, or misleading statements to avoid miscommunicating information to others.[54] Using the skill of critical reading to analyse a text with a group of students from different educational settings opens the opportunity for co-creating new knowledge by combining the perspectives brought by the participants.

By bringing together diverse perspectives from disciplines such as philology, logic, lexicology, language studies, and critical thinking, we can nourish a rich and dynamic environment for co-creation. Philology with its focus on the historical development of languages and texts can

[52] Ghorbanpour, A., & Davari, H. (2024). Promoting ecoliteracy through communication: How language can shape our relationship with the more-than-human world: Ecological communication and ecoliteracy: Discourses of awareness and action for the lifescape, in Bortoluzzi, M., & Zurru, E. (eds.), Bloomsbury, London, 288 p. (hardback), ISBN 9781350335820.

[53] Lucas, B., & Spencer, E. (2017). *Teaching creative thinking: Developing learners who generate ideas and can think critically* (Pedagogy for a Changing World series). Crown House Publishing Ltd.

[54] Manarin, K., Carey, M., Rathburn, M., & Ryland, G. (2015). *Critical reading in higher education: Academic goals and social engagement*. Indiana University Press.

provide a deep understanding of the context and background of the text that is analysed. Logic can help identify and analyse the underlying arguments and reasoning. Lexicology can offer insights into the meaning and usage of specific terms and concepts, while language studies can provide a broader understanding of linguistic structures and patterns. Finally, critical thinking can equip us with the tools to evaluate the validity and reliability of the information presented and identify the target audience of the information.

When these disciplines are combined in a group setting, the process of co-creation becomes even more powerful. By sharing their expertise and insights, participants can challenge each other's assumptions, identify blind spots, and generate new ideas. This collaborative and multidisciplinary approach not only leads to an enhanced understanding of the material but also helps to develop critical thinking skills and a sense of intellectual curiosity.

Through this co-creative process, the group can not only develop new methodologies for critical reading (by creating a unique combination of different disciplines) but also gain a more comprehensive understanding of the information being analysed. By applying the tools and perspectives from different disciplines, participants can identify hidden meanings, uncover underlying assumptions, identify bias, and evaluate the credibility of the source material. This, in turn, allows them to clearly articulate their own interpretations and insights, contributing to a more informed understanding of the text.

Here is the description of an activity that could help students reflect on the possibilities of legal texts and documents critically and eventually suggest a co-created new interpretative content to the text. The activity description is followed by Appendix A, with a more complete list of some possible examples of linguistic elements to review prior to conducting the critical reading activity.

To conclude, it is worth noting that all the activities developed by the three working groups during the Living Laboratory, as well as those identified, mapped, and shared by the extended Ocean Incubator Network Team at a later stage, can be found in Chapter 8 in this book, and all are enumerated as outputs of co-creation useful for ocean literacy.

Activity Name: Ocean Literacy, Ecolinguistics & A Critical Lens

Target Audience: Bachelor-level Students (preferably from many different academic disciplines).

Learning Objectives: This activity aims to foster a deep understanding of marine issues, identify biases, integrate interdisciplinary knowledge, promote critical thinking, and empower advocacy. By scrutinizing the sources and evidence presented in documents, we can assess the credibility and reliability of the information. Critical reading and appraisal are essential skills for distinguishing between scientifically sound data and misinformation. Developing these skills is imperative for creating a more informed and engaged society that effectively addresses our oceans' challenges.[55]

Materials Needed: A public access document related to ocean protection or water governance—paper copy of the document, pens/pencils, and highlighters.

*For contextual applicability, having the document from the region/province/state/country where this activity is being run is best. For example, if you were running this activity in Canada, you could choose to critically read Canada's Oceans Protection Plan.

*The activity can be completed digitally by having an online version of the document, and participants can type notes and highlight the document on their computer/tablet/phone.

Guidance to complete activity:

1. Gather the students and provide them with a copy of the document you are reviewing. Instruct the students to read through the document to familiarize themselves with its content, and allow them time to review and consider it from their perspective. They are encouraged to take notes or comment on their document copy.
2. Once the students have completed their reading time, reorient them and commence a short discussion, with students sharing their initial impressions of the text and its contents.
3. Complete a short review of essential linguistic and critical reading elements to be aware of while reading the document.

[55] Kelly, R., Evans, K., Alexander, K. et al. (2022). Connecting to the oceans: Supporting ocean literacy and public engagement. *Reviews in Fish Biology and Fisheries, 32*, 123–143. https://doi.org/10.1007/s11160-020-09625-9.

4. Have students re-read the document using the elements they just reviewed as a reminder to apply a critical lens to what they are reading. Again, encourage them to make notes on their copy of the document to aid them in the next discussion.
5. Re-orient students once they have completed the second reading and commence a discussion of their new findings and thoughts on the document. Encourage each student to share their perspective so that a variety of information is shared, and encourage them to identify any underlying biases or assumptions they may have brought to the text based on their educational background.
6. Have the students share their results in smaller groups, then try to develop a short summary, re-writing the text and applying a co-created and collaborative approach.

Additional information: Below is an example of one linguistic element that could be reviewed during step 3. For additional examples, please refer to Appendix A; facilitators running this activity should include additional elements relevant to their field of study and the context where the activity is being run.

Framing	Refers to how the content of a text is presented and what sort of perspective (angle, slant) the writer is taking
Foregrounding	Foregrounding is generally used to highlight important parts of a text, aid memorability, and refer to specific linguistic devices, i.e. deviation and parallelism, that are used to give special prominence to certain information

* * *

Appendix

Examples of linguistic elements to review prior to conducting the "critical reading" activity. Facilitators running this activity should include additional elements relevant to their field of study and the context of the activity.

Framing	Refers to how the content of a text is presented and what sort of perspective (angle, slant) the writer is taking
Foregrounding	Foregrounding is generally used to highlight important parts of a text, aid memorability, and refer to specific linguistic devices, i.e. deviation and parallelism, that are used to give special prominence to certain information[56]
Omission	An omission, a manipulation of the text, occurs when information is deliberately left out or altered in a written or spoken communication. Omission of agents/does is a common form of manipulation at the sentence level. It occurs most often through nominalization and the use of passive verbs. If the author omits information, a reader cannot scrutinize it[57]
Presupposition	A presupposition is a piece of information that a writer assumes to be true or takes for granted as if there were no alternative. These assumptions serve as background knowledge for the author and the audience. Sometimes presuppositions arise from context and discourse expectations, sometimes they are encoded in specific words or phrases[58]
Agent-patient	Agent-patient (doer-recipient) relations on the syntax level can also be presented in a manipulative manner. An agent is the initiator of some action, and a patient is the entity undergoing the effect of some action. Many texts describe things so that a certain person is consistently depicted as initiating actions (agent/doer exerting power) while others are described as being (often passive) patient/recipient of those actions[59]
Register	Register refers to a document's level of formality or informality, its degree of technicality, its subject field, etc. Writers can deceive readers by affecting the register that induces a certain misplaced trust[60]

* * *

[56] Simpson, P. (2004). *Stylistics, a resource book*. Routledge, London; Van Peer, W., Zyngier, S., & Hakemulder, J. (2007). Foregrounding: Past, present, future, in *Stylistics*, Brill, pp. 1–22.

[57] Peftieva, O. (2022). *Omission as a manipulative element in different types of discourse*. Mariupol State University. Digest of Abstracts, Kyiv, pp. 294–296.

[58] Polyzou, A. (2015). Presupposition in discourse: Theoretical and methodological issues. *Critical Discourse Studies, 12*(2), 123–138.

[59] Lingle, W. A. (2018). Nominalizations, agentless passives and social actor mystification: newspaper editorials on the Greek financial crisis (Doctoral dissertation, University of Birmingham).

[60] Huckin, T. N. (1997). *Critical discourse analysis. Functional approaches to written text: Classroom applications*, pp. 87–92.

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PART II

In-Depth Analysis of Ocean Literacy

CHAPTER 6

Reimagining Ocean Connections: Relationality and Care in Ocean Literacy

Mana Tugend

Abstract This chapter re-evaluates our relationship with the ocean, challenging traditional views that reduce it to a mere resource. It advocates for a shift towards ocean literacy, emphasizing the interconnectedness and interdependence between humans and the marine environment through the values of relationality and care. Relationality rejects Western dualisms, promoting a holistic perspective that sees humans and the ocean as deeply interconnected. Care highlights the ethical and emotional dimensions of this relationship, advocating for empathy and responsibility. By exploring these values through two pathways—connecting with each other and with the ocean—the chapter illustrates how integrating relationality and care can transform ocean governance.

Abstract (Français) Ce chapitre réévalue notre relation avec l'océan en remettant en question les vues traditionnelles qui le réduisent à un simple ressource. Il plaide pour un passage à une littératie océanique (ou une éducation aux oceans), mettant en avant l'interconnexion et l'interdépendance entre les humains et l'environnement marin à travers les valeurs de relationnalité et du care. La relationnalité rejette les dualismes occidentaux, promouvant une perspective holistique qui voit les humains et

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l'océan comme profondément interconnectés. Le care met en lumière les dimensions éthiques et émotionnelles de cette relation, plaidant pour l'empathie et la responsabilité. En explorant ces valeurs à travers deux voies — se connecter les uns aux autres et avec l'océan — le chapitre illustre comment intégrer la relationnalité et le care peut transformer la gouvernance océanique.

Keywords Ocean Literacy · Care · Relationality · Ocean Governance

1 Introduction

The dire state of the ocean necessitates a re-evaluation of how we understand and engage with this vital element of our world. Traditional views often reduce the ocean to a mere resource, disconnected from human experience and value. This utilitarian perspective fails to acknowledge the deep and reciprocal relationship between humans and the ocean, treating them as separate entities.[1] Ocean literacy, however, offers a transformative framework for understanding this relationship.[2] At its core, it amplifies the interactions, interconnectedness, and interdependence between humans and the ocean and embraces the ecological vulnerabilities of our times.[3] It advocated for a paradigm shift from a dominion-based relationship to one of holism and mutual enhancement.[4] Key to this shift are the values of relationality and care, which highlight the moral

[1] Sarah Dalrymple, "Are Humans Separate from Nature?" (*British Ecological Society*, 1 June 2022), https://www.britishecologicalsociety.org/are-humans-separate-from-nature/, accessed 22 July 2024.

[2] UNESCO-IOC (2021). The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) Implementation Plan Vol. 20 (Paris: UNESCO); see also Santoro, F., Selvaggia, S., Scowcroft, G., Fauville, G., & Tuddenham, P. (2017). *Ocean Literacy for All: A Toolkit* (Vol. 80). UNESCO Publishing.

[3] National Oceanic and Atmospheric Administration (NOAA), *Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages* (Silver Spring, MD 2024).

[4] There are growing initiatives aiming to foster a revitalized human-ocean relationship acknowledging the interdependence between all life on Earth, including the Ocean Incubator Network (OIN) Project.

and emotional dimensions of our interactions with the marine environment. This chapter explores how integrating relationality and care into ocean literacy can foster a more ethical and sustainable human-ocean relationship.[5] By emphasizing these values, we can move beyond traditional paradigms and cultivate a deeper appreciation of our role within the ocean's systems. This, in turn, has the potential to influence broader governance frameworks, promoting a more inclusive and just approach to ocean stewardship.

Acknowledging my own positionality as a legal scholar with a deep connection to the ocean, I approach this research with the awareness of how my background informs my research and shapes my perspective. Throughout this research, I remain committed to conducting my work ethically and respectfully. To ensure a balanced and comprehensive analysis, I engage with diverse perspectives and methodologies, particularly those beyond Western and Eurocentric epistemologies and ontologies to reduce their dominance. This chapter employs a sociolegal research method, focusing on different ontologies and epistemologies, aiming to offer a nuanced understanding of how ocean literacy respects and integrates multiple worldviews. The chapter draws on a blend of sources, including primary legal documents, and secondary scholarly and policy literature.

The chapter is structured as follows. Building on the foundational understanding of ocean literacy, Sect. 2 explores how the values of relationality and care can reshape our interactions with the ocean, challenging traditional Western paradigms and embracing a more holistic and inclusive approach. Section 3 examines the interplay of relationality and care in ocean literacy. In Sect. 4, the chapter illustrates the application of relationality and care in ocean literacy. The chapter concludes in Sect. 5 by synthesizing the insights of the previous sections, highlighting the potential of relationality and care-based ocean literacy as a catalyst for more equitable, just, and sustainable human-ocean relationships.

[5] Emily Margaret Murray and Margherita Paola Poto, "Ecological Literacy: Theory and Practice" in Giuliana Panieri, Margherita Paola Poto and Emily Margaret Murray (eds), *Emotional and Ecological Literacy for a More Sustainable Society* (Springer Nature Switzerland 2024) 46, https://link.springer.com/10.1007/978-3-031-56772-8_2, accessed 10 July 2024.

2 Relationality and Care: Cornerstones of Ocean Literacy

As part of the UN Decade of Ocean Science for Sustainable Development,[6] ocean literacy has gained significant momentum as a framework for enhancing public understanding, engagement, and stewardship of the ocean.[7] Beyond the technical understanding of ocean systems and processes, ocean literacy also encompasses the social, cultural, and emotional dimensions of human-ocean relationships. Central to ocean literacy is the understanding that humans are inextricably connected to the ocean and that this relationship is reciprocal and multifaceted.[8] Rather than perceiving the ocean as a distant, separate entity, ocean literacy emphasizes the ocean's absolute influence on every aspect of human life—from the air we breathe and the climate we experience to the food we eat.[9] This expanding view is crucial, as it recognizes the ocean as an integral part of our lived experience and collective well-being. Moreover, this view challenges the dominant Western paradigms that have historically treated the ocean as a mere resource to be exploited,[10] ignoring the dynamic and

[6] UN Ocean Decade official website: https://oceandecade.org/, last access July 23, 2024.

[7] See Chapter 1.

[8] National Oceanic and Atmospheric Administration (NOAA) (n 4).

[9] UNESCO, "Ocean Literacy Principles" (*Ocean Literacy Portal*), https://oceanliteracy.unesco.org/principles/, accessed 25 July 2024.

[10] See, e.g., Gregory Ferguson-Cradler, "The Overfishing Problem: Natural and Social Categories in Early Twentieth-Century Fisheries Science" (2021) 54 *Journal of the History of Biology* 719; Roberto Bermejo, "The Commodification of Nature and Its Consequences" in Roberto Bermejo, *Handbook for a Sustainable Economy* (Springer Netherlands 2014), https://link.springer.com/10.1007/978-94-017-8981-3_2, accessed 6 August 2024; Noel Castree, "Commodifying What Nature?" (2003) 27 *Progress in Human Geography* 273; Stephen A Mrozowski, "Colonization and the Commodification of Nature" (1999) 3 *International Journal of Historical Archaeology* 153.

interconnected nature of human-ocean relationships,[11] and which are in direct conflict with ocean literacy goals.[12]

Ocean literacy embraces a more holistic relational understanding, positioning the ocean as a living, breathing entity with its own agency, needs, and vulnerabilities. The two core values that underpin this relational perspective are those of relationality and care. This section therefore examines these concepts in more detail and examines how they can reshape our interactions with the ocean.

2.1 Relationality: The Bedrock of Ocean Literacy

Relationality, as a core value, recognizes that all entities, human and non-human, including the ocean, are fundamentally interconnected and interdependent.[13] It serves as both a philosophical and practical framework that highlights the inherent reciprocal and interconnected relationships between humans and nature, including bodies of water like oceans and seas.[14] As such, relationality rejects the traditional Western dualistic separation between humans and nature, which has historically driven the exploitation and degradation of natural resources, including the ocean.[15]

[11] Bastiaan E Klerk, Katharina Heinrich and Raul Primicerio, "Beyond Equilibrium Thinking: Dynamic Area-Based Management Tools in a Changing Ocean" (2024) 11 *Frontiers in Marine Science* 1418435; Anna Grear, "Towards a New Horizon: In Search of a Renewing SocioJuridical Imaginary" (2013) 3 *Oñati Socio-Legal Series* 966.

[12] Kathleen Schwerdtner Manez, Susanne Stoll-Kleemann and Helen M Rozwadowski, "Ocean Literacies: The Promise of Regional Approaches Integrating Ocean Histories and Psychologies" (2023) 10 *Frontiers in Marine Science* 1178061.

[13] Meg Parsons, "Governing with Care, Reciprocity, and Relationality: Recognising the Connectivity of Human and More-Than-Human Wellbeing and the Process of Decolonisation" (2023) 13 *Dialogues in Human Geography* 288; Vanessa Wijngaarden, "Relationality", *Showing Theory to Know Theory: Understanding Social Science Concepts Through Illustrative Vignettes*, vol 1 (Patricia Ballamingie and David Szanto, Showing Theory Press 2022), https://ecampusontario.pressbooks.pub/showingtheory/chapter/relationality/, accessed 9 May 2024.

[14] Lauren Tynan, "What Is Relationality? Indigenous Knowledges, Practices and Responsibilities with Kin" (2021) 28 *Cultural Geographies* 597.

[15] Camille Ottmann, "Par-delà nature et culture: repenser notre rapport au monde et aux autres" (*Contrepoints*, 30 January 2020), https://mastersts.hypotheses.org/235, accessed 25 July 2024; Florencia Tola and Antonela Dos Santos, "Ontology and Ontologies. Theoretical, Political, and Methodological Debates" [2020] *América Crítica* 163; Jacques Pollini, "Bruno Latour and the Ontological Dissolution of Nature in the Social Sciences: A Critical Review" (2013) 22 *Environmental Values* 25.

It counters the prevailing perception of humans as isolated, rational beings driven by individualism and linear causality.[16] Instead, relationality presents humanity as part of a larger network of life and relationships, with corresponding obligations and duties to that network, seeking to transcend human exceptionalism.[17] As Shawn Wilson asserts, "relationships do not merely shape reality, they are reality",[18] which emphasizes that reality is fundamentally relational. Similarly, Julie Perini's statement that "reality is the consequence of what we do together"[19] underscores that the existence of any entity is intrinsically linked to the interactions and connections it has with others, humans and non-humans, and its surroundings. Relationality redefines humans as entities formed through continuous interactions and entanglements with the world around them. The ocean, in shaping our cultures, economies, and ways of living, is impacted by human activities. Relationality thus encourages us to consider our individual and collective human impacts on the broader network of relationships that define our reality, aligning with the goal of ocean literacy of fostering awareness and motivating action to mitigate these impacts.

Relational values specifically "refer to a normative human sense of connection or kinship with other living things, reflective and expressive of care, identity, belonging and responsibility, and congruent with notions of what it means to live a "good life"".[20] These values encourage the

[16] Elizabeth Macpherson, "Can Western Water Law Become More "Relational"? A Survey of Comparative Laws Affecting Water Across Australasia and the Americas" (2023) 53 *Journal of the Royal Society of New Zealand* 395; Parsons (n 14).

[17] Parsons (n 14).

[18] Shawn Wilson, *Research Is Ceremony: Indigenous Research Methods* (Fernwood Publishing 2008) 7.

[19] Julie Perini, "About—Diary of Julie Perini", https://julieperini.com/About, accessed 23 July 2024.

[20] Simon West and others, "Stewardship, Care and Relational Values" (2018) 35 *Current Opinion in Environmental Sustainability* 30, 30. The "good life", as described by West and others in the context of relational values, shares connections with the concept of Buen Vivir (the "good way of living") as practised in Ecuador and Bolivia. Both revolve around the idea of fostering a sense of kinship and responsibility towards other living beings and the environment. They call for a re-evaluation of what constitutes a fulfilling life, proposing a shift from a focus on individual gain to a collective, ecologically integrated existence.

consideration of the individual impacts on the broader network of relationships that define one's reality and emphasize that these relationships are not merely transactional. In this context, relational values are argued to transcend both instrumental values, which focus on usefulness, and intrinsic values, which recognize inherent worth,[21] by incorporating a deeper, normative connection to the well-being of others and the environment. Relational values thus bridge the divide between humans and nature, acknowledging the ocean as an active participant in the network of life. Ocean literacy, by emphasizing the ocean's influence on us and our impact on the ocean,[22] acknowledges the relationality between humans and the ocean, and the belonging of humans to the web of life within the natural system that sustains life on Earth.[23]

Relational values have a moral dimension that requires active and ongoing consideration and care.[24] This ethical responsibility towards others and the ocean arises from the awareness of relationality and can inspire an emotional connection with the ocean.

2.2 Care: The Ethos Underpinning Ocean Literacy

In the context of ocean literacy, care emerges from acknowledging this fundamental interconnectedness between humans and the ocean. As Nel Noddings asserts, care is a relational ethical framework, that is focused on maintaining and enhancing relationships, rather than adhering to abstract

[21] Sanna Stålhammar and Henrik Thorén, "Three Perspectives on Relational Values of Nature" (2019) 14 *Sustainability Science* 1201.

[22] UNESCO (n 10). There are seven key principles of ocean literacy, namely: (1) the Earth has one big ocean with many features, covering approximately 70% of the planet's surface; (2) the ocean and life within it shape the features of Earth; (3) the ocean is a major influence on weather and climate, connecting all of the Earth's water reservoirs via evaporation and precipitation processes; (4) the ocean makes the Earth habitable, containing 97% of its water; (5) the ocean supports a vast diversity of life and ecosystems; (6) the ocean and humans are inextricably interconnected; and (7) the ocean is largely unexplored.

[23] Murray and Poto (n 6) 48.

[24] Austin Himes and Barbara Muraca, "Relational Values: The Key to Pluralistic Valuation of Ecosystem Services" (2018) 35 *Current Opinion in Environmental Sustainability* 1.

principles or rules.[25] This makes care an essential element of relationality. In examining care within the context of ocean literacy, this section examines its role at the intersection of the ethics of care and environmental ethics.

The ethics of care moves beyond the narrow focus of the dominant Western ethical framework that emphasizes individual rights, impartiality, and universal principles.[26] Instead, it prioritizes the maintenance of relationships, the fulfilment of responsibilities to others, and contextual responsiveness.[27] Influenced by feminist scholars such as Carol Gilligan and Noddings,[28] the ethics of care underscores the significance of attentiveness, sensitivity, and empathy in our relationships with others, including non-human entities like the ocean, therefore recognizing the emotional dimensions of relationality.[29] This perspective extends morality beyond individual actions, to include the virtues, practices, and knowledge necessary for caring for oneself and others.[30]

[25] Nel Noddings, "The Language of Care Ethics" (2012) 40 *Knowledge Quest* 52; Nel Noddings, "The Caring Relation in Teaching" (2012) 38 *Oxford Review of Education* 771.

[26] Andreas Spahn, ""The First Generation to End Poverty and the Last to Save the Planet?"—Western Individualism, Human Rights and the Value of Nature in the Ethics of Global Sustainable Development" (2018) 10 *Sustainability* 1853.

[27] Ibid.

[28] Caring and caretaking are often associated with gendered and inherently feminine roles. This perpetuates existing stereotypes, hierarchies, and oppressive biases, which unfairly burden women and minorities, including Indigenous peoples. This perspective has been noted across various fields including health sciences, and social sciences. See, e.g., Elizabeth Macpherson and others, "A Critical Feminist Evaluation of Climate Adaptation Law and Policy: The Case of Aotearoa New Zealand" (2024) 14 *Climate Law* 1; Jennifer Nedelsky and Tom Malleson, *Part-Time for All: A Care Manifesto* (1st edn, Oxford University PressNew York 2023), https://academic.oup.com/book/45834, accessed 17 October 2023; Joukje Swinkels and others, "Explaining the Gender Gap in the Caregiving Burden of Partner Caregivers" (2017) 74 *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 309; Martha Nussbaum, "Women's Capabilities and Social Justice" (2000) 1 *Journal of Human Development* 219.

[29] Fiona Robinson, "Resisting Hierarchies Through Relationality in the Ethics of Care" (2020) 4 *International Journal of Care and Caring* 11; Kyle Whyte and Chris J Cuomo, 'Ethics of Caring in Environmental Ethics: Indigenous and Feminist Philosophies', *The Oxford Handbook of Environmental Ethics* (Stephen M Gardiner and Allen Thompson, Oxford University Press 2016); Noddings (n 26).

[30] Whyte and Cuomo (n 30).

Similarly, environmental ethics focuses on the moral relationship between humans and the natural world. It calls for greater moral consideration for non-human entities, the lack of which is often identified as a cause of ongoing environmental harm and destruction.[31] Care-based environmental ethics recognizes the intrinsic value of nature and seeks to affirm and cultivate the relational bonds between humans and the natural world. It challenges the traditional Western views of the ocean as inert or merely a resource for human exploitation, promoting instead a perspective that sees the ocean as active kin deserving of care.[32]

By integrating these perspectives, we address a unique intersection where care is applied not only to human relationships but also to our interactions with the ocean. Emily Murray and Margherita Paola Poto propose the concept of a "community of care", where individuals, communities, and the natural world engage in a shared learning experience to preserve our common home, Earth, and its constituents.[33] In this community, caring becomes a collaborative effort, emphasizing learning from each other and the ocean itself.[34] This approach extends beyond the awareness of our interconnectedness with the ocean; it embodies a sense of responsibility and stewardship. In this context, care is not merely a passive sentiment but an active commitment to the ocean, driven by

[31] 11/21/2024 8:24:00 PM ibid.

[32] 11/21/2024 8:24:00 PM ibid.

[33] Murray and Poto (n 6) 48.

[34] It is my personal view that effective ocean governance should better reflect the ocean's dynamic and fluid nature. Currently, the governance frameworks often rely on rigid principles, such as fixed maritime boundaries for delimitation, but also for marine protected areas, which may not adequately capture the ocean's ever-changing and interconnected state. These static frameworks can lead to conflicts and inefficiencies in managing resources, addressing environmental issues, and responding to climate change impacts. For instance, the delineation of maritime boundaries does not account for shifting ecosystems, ocean currents, and the migratory patterns of marine species. A governance model that is more adaptable and responsive to the ocean's fluidity could improve management practices by integrating dynamic environmental data and fostering collaborative approaches across jurisdictions. Embracing a more flexible and holistic perspective might enhance our ability to address transboundary challenges, promote sustainable use, and ensure the long-term health of ocean ecosystems. For more on dynamic ocean management, see, e.g., Klerk, Heinrich and Primicerio (n 12); Tim Cashion and others, "Shifting Seas, Shifting Boundaries: Dynamic Marine Protected Area Designs for a Changing Climate" (2020) 15 *PLOS ONE* e0241771; Sara M Maxwell and others, "Dynamic Ocean Management: Defining and Conceptualizing Real-Time Management of the Ocean" (2015) 58 *Marine Policy* 42.

knowledge and emotional connections, and aiming at its protection and preservation. It serves as a crucial piece for a revitalized human-ocean relationship that is mutually enhancing and dynamic.

At the intersection between the ethics of care and environmental ethics, care-based ocean literacy challenges traditional views of the ocean, advocating for anti-imperialist moral principles and knowledge systems that incorporate relationship-focused customs and methodologies.[35] This perspective rejects oppressive systems and colonial mindsets that exploit nature and marginalize Indigenous worldviews, traditions, and knowledge.[36] Rather, it calls for an inclusive approach to caretaking that respects non-Western ontologies and epistemologies, honouring the rights of all beings to coexist in harmony. Care, interwoven with empathy and compassion, echoes the inherent relationality of human-ocean relationships. Such emotional connections can be drivers of behavioural changes, fostering feelings of generosity, hope, and empowerment, that inspire positive action for the ocean's well-being.

3 The Interplay of Relationality and Care in Ocean Literacy

In Chapter 1, Laura Vita, Margherita Paola Poto, and Giuliana Panieri described ocean literacy as manifesting through two pathways: "connecting with each other" as individuals, communities, and institutions, and "connecting with the ocean".[37] These pathways not only underscore the relational nature of human interactions but also highlight the importance of understanding our connection to the ocean. Connectedness embodies the relational aspects of human-ocean relationships, rooted in values of care, empathy, and responsibility. Understanding these pathways is essential for a comprehensive grasp of the ocean's central role in human and planetary well-being. This section explores how relationality and care are embodied within these pathways.

[35] 21/11/2024 20:24:00 Elizabeth Allison, "Toward a Feminist Care Ethic for Climate Change" (2017) 33 *Journal of Feminist Studies in Religion* 152; Whyte and Cuomo (n 30).

[36] 21/11/2024 20:24:00 Whyte and Cuomo (n 30).

[37] Chapter 1.

The first pathway, "connecting with each other", emphasizes the importance of nurturing human relationships. At its core, this pathway advocates for cultivating meaningful connections among individuals, communities, and institutions.[38] It underscores the value of shared experiences and collaborative efforts in building a collective understanding of the ocean. Relationality plays a crucial role here, promoting pluralism and inclusivity, and recognizing the diverse ways of knowing and understanding the ocean across the world. This inclusive perspective not only celebrates different ontologies and epistemologies but also fosters a sense of shared responsibility and collective stewardship. In this context, care takes on an emotional dimension, drawing attention to how our relational interactions and decision-making processes mirror our responsibilities towards others and the environment.

This pathway resonates strongly with the vision of a "community of care", as articulated by Murray and Poto, where caring for each other and the ocean becomes a shared, collective endeavour.[39] By nurturing new connections—emotional, physical, and cultural—and cultivating a sense of interconnectedness and solidarity, this pathway reflects the core values of relationality and care. It does so through collaborations, inclusive dialogue, and sharing knowledge and lived experience.[40]

In parallel, the second pathway, "connecting with the ocean", emphasizes forging direct, embodied, and emotional connections with the ocean

[38] While we are in an era where connectivity is facilitated by the internet and various modes of communication, such as phones, it is paradoxical that disconnection and animosity towards "Others" persist. Historically, this phenomenon is not new (e.g. colonialism, the Crusades, and slavery). It is disheartening that, despite unprecedented opportunities for connection, humanity continues to struggle with recognizing its interconnectedness. Why does difference instill fear rather than curiosity and a desire to understand? Why is there a persistent need for some to impose their ways on others? While acknowledging that not all individuals are the same and that these questions may seem naïve and generalized, it is noteworthy that violence and wars of domination continue, predominantly originating from the Western world's desire to impose its ways globally. This issue is undoubtedly complex, influenced by historical, economic, and geopolitical factors, underscoring the interconnected nature of all things. The concept of relationality acknowledges that nothing exists in isolation; reality is a web of interrelationships. Similarly, the path to ocean literacy emphasizes the interconnectedness of all matter in the universe, advocating for a holistic understanding of our relationship with the ocean and each other.

[39] Murray and Poto (n 6) 48.

[40] See especially section of Chapter 1 and how the OIN fosters new connections.

itself. This pathway urges us to recognize the relational nature of human-ocean ties and expand the Western horizons to appreciate the ocean as a living, communicative, and dynamic partner, rather than a mere resource. To truly connect with the ocean, we must transcend the traditional, anthropocentric understanding of the ocean and value its inherent sentience, giving voice to its needs and perspectives, and embracing its agency in shaping human cultures, narratives, and identities. Marine spaces are more than just physical sites; they are entangled with human stories, cultural memories, and lived experiences. For example, the Inuit people regard the ocean as central to their identity and livelihoods. As Lisa Qiluqqi Koperqualuk highlights, the Arctic Ocean, from liquid to frozen, is integral to cultural, economic, and existential well-being.[41] This profound bond is reflected in their traditional knowledge, cultural beliefs, stories, worldviews, and language.[42] Inuit mythology recounts the tale of Sedna, the goddess and mother of the sea, whose severed fingers transformed into marine mammals and other marine creatures.[43] Sedna governs the availability of marine creatures, thereby impacting Inuit hunters' livelihoods. When people neglect her and the marine life she has created, she becomes angry and withholds the creatures until she is appeased. Her story underscores the importance of responsible hunting and living in harmony with nature, reflecting the Inuit's role as custodians of the ocean. To illustrate further, Māori culture perceives water as the essence of all life, with rivers, such as the Whanganui River, regarded as ancestors.[44] This worldview is exemplified by the following Whakataukī (Māori proverb), "Ka ora te whenua, ka ora te wai, ka ora te tangata"—"if the land is well, and the water is well, the people will thrive".[45] Tikanga (Māori customs) embody a "relational philosophy and foundational aspect of Māori law, decision-making and ethics" that contrast with Western,

[41] Lisa Qiluqqi Koperqualuk in Jeffrey McLean, *Learning from Inuit Perspectives on Marine Governance* (Master of Global Health, McMaster University 2021), 58.

[42] Ibid.

[43] Nadine Fabbi, "Retelling the Myth of Sedna to Teach About Inuit Culture and the North" (2002) 21 *Teaching Canada* 24.

[44] James DK Morris and Jacinta Ruru, "Giving Voice to Rivers: Legal Personality as a Vehicle for Recognising Indigenous Peoples' Relationships to Water?" (2010) 14 *Australian Indigenous Law Review* 49, 58.

[45] Parsons (n 14) 292.

settler-colonial legal systems, narratives, and markets.[46] Tikanga and its associated concepts, such as Kaitiakitanga, Whakapapa (genealogy), and Rangatiratanga (sovereignty), emphasize an integrated view of humans as part of the environment.[47] Kaitiakitanga extends beyond conventional conservation, advocating for a holistic management of relationships within Te taiao (the environment).[48] This contrasts with traditional conservation which is characterized by humans managing the environment, including the ocean, as if they were separate from it.[49] In the context of ocean literacy, connecting with the ocean thus involves more than intellectual understanding; it requires the ability to connect, empathize, understand, and emotionally invest in the ocean's well-being. Furthermore, integrating diverse knowledge systems and cultural perspectives within this pathway fosters a deep sense of care, respect, responsibility, and emotional engagement in the well-being of the ocean.

In both pathways, the values of relationality and care are fundamental to deepening the comprehension of our place within the natural world and our ethical responsibilities towards it. These pathways inform the development of effective educational strategies and environmental initiatives that are both interdisciplinarity and collaborative.[50] Building on Vita and Poto's two pathways of ocean literacy, this section illustrates how relationality and care are embedded in ocean literacy through three key interrelated dimensions: (1) emotional connections and empathy; (2) expanding the circle of moral consideration; and (3) collective responsibility and stewardship.

At the individual and community levels, ocean literacy nurtures a sense of empathy, compassion, and responsibility towards others and the ocean. As the awareness of our relational entanglements with the ocean deepens, we may be inspired to engage in actions that promote its balance and well-being. Effective education and co-creation are essential for fostering

[46] Ani Mikaere, *Colonising Myths Māori Realities: He Rukuruku Whakaaro* (Huia Publishers 2011) 208.

[47] Ibid.

[48] "Kaitiakitanga Is More Than Guardianship—The University of Auckland", https://www.auckland.ac.nz/en/news/2023/04/05/kaitiakitanga-guardianship.html, accessed 4 August 2024.

[49] Ibid.

[50] Chapter 1.

this understanding. Moreover, integrating diverse worldviews and knowledge systems is crucial for creating a fair, equitable, and just framework for ocean literacy, ensuring meaningful connections for everyone. On a broader scale, ocean literacy holds the potential to challenge prevailing frameworks of ocean governance, prompting a re-evaluation of the law of the sea and ocean governance.[51] By embedding relationality and care into our understanding and practices, we can advance towards more holistic and inclusive governance models that reflect our interconnectedness with the ocean.

4 Discussion

The previous sections of this chapter have articulated a vision for transforming our relationship with the ocean through the lens of ocean literacy, emphasizing the core values of relationality and care. The question now is how to practically achieve this transformation towards mutually enhancing human-ocean relationships.

According to Murray and Poto, this shift necessitates moving from "linear thinking"—from cause to effect—to system thinking.[52] This approach recognizes the complexity, interconnectedness, and dynamism of ocean ecosystems and human societies, underscoring the need for a holistic approach to ocean literacy and governance. It aligns with the two pathways of ocean literacy: "connecting with each other", emphasizing the relational nature of human interactions, and 'connecting with the "ocean", focusing on deepening our emotional and embodied relationship with marine environments. Both pathways advocate for acknowledging the interconnectedness of all life forms and the ocean's role as an active participant in Earth's systems and well-being.[53]

[51] The concept of care and ocean relationality is often overlooked in mainstream law of the sea and ocean governance, such as the United Nations Declaration on the Law of the Sea (UNCLOS), which is deeply rooted in Western paradigms. These paradigms place a strong emphasis on the sovereign rights of states and the utilitarian value of the marine environment. For more on rethinking the law of the sea and ocean governance see, e.g., Margherita Paola Poto, "Thinking About Ocean Governance: By Whom, for Whom?" in Vito De Lucia, Alex Oude Elferink and Lan Ngoc Nguyen (eds), *International Law and Marine Areas Beyond National Jurisdiction* (Brill | Nijhoff 2021).

[52] Murray and Poto (n 6) 48.

[53] In the legal domain, there is a global movement advocating for the recognition of Earth's interconnected systems in legal frameworks through Earth System Law. It

Furthermore, both pathways stress the importance of respect for diverse worldviews. Cultural connections and perspectives play a crucial role in fostering a sense of relationality and care. For instance, the Māori worldview perceives the interrelationship between all things, including the environment, humans, and the animate and inanimate as sacred and cosmologically determined. This worldview instils a sense of Kaitiakitanga, or the "obligation to care for one's own",[54] and stewardship over nature.[55] Similarly, the Pasifika concept of Vā (relationship/relatedness)—the space between people and all living things—recognizes the interconnectedness and interdependence of all living things.[56] Diverse worldviews contribute to a holistic understanding of ocean literacy, where the values of relationality and care are not merely theoretical constructs but are lived realities that challenge the separation between humans and nature.

In addition to diverse epistemologies and ontologies, Kathleen Schwerdtner Manez and others suggest that incorporating ocean history in ocean literacy is essential to reflect the diverse and evolving human-ocean relationships.[57] Given the historical and cultural variations in human relationships with the ocean, a universal and timeless ocean literacy framework may not be as effective as locally informed approaches.[58] Thus, regional ocean literacies would systematically integrate emotional elements and be

proposes the development of legal principles and systems that reflect the complex, interdependent nature of Earth's ecological, atmospheric, and social systems. For more, see, e.g., Louis J Kotzé and others, "Earth System Law: Exploring New Frontiers in Legal Science" (2022) 11 *Earth System Governance* 100126; Rakhyun E Kim and Louis J Kotzé, "Planetary Boundaries at the Intersection of Earth System Law, Science and Governance: A State-of-the-Art Review" (2021) 30 *Review of European, Comparative & International Environmental Law* 3; Michelle Bender, "The Earth Law Framework for Marine Protected Areas: Adopting a Holistic, Systems, and Rights-Based Approach to Ocean Governance" (2017).

[54] "Kaitiakitanga Is More than Guardianship—The University of Auckland" (n 49).

[55] Fikret Berkes, *Sacred Ecology*, vol 3 (Routledge 2012) 7.

[56] Martyn Reynolds's work further illustrates the practical application of the Vā in education, advocating for respectful and balanced relationships between students, teachers, families, and the community. See Martyn Reynolds, "Relating to Va: Re-Viewing the Concept of Relationships in Pasifika Education in Aotearoa New Zealand" (2016) *12 AlterNative: An International Journal of Indigenous Peoples* 190.

[57] Schwerdtner Manez, Stoll-Kleemann and Rozwadowski (n 13).

[58] On place-based governance see, e.g., Macpherson (n 17); Liz Charpleix, "The Whanganui River as Te Awa Tupua: Place-Based Law in a Legally Pluralistic Society" (2018) 184 *The Geographical Journal* 19.

constructed through knowledge co-production, engaging diverse expertise, and actors to produce context-specific knowledge and pathways towards a sustainable future.[59] This approach ensures that ocean literacy is responsive to local contexts while embracing the diverse perspectives that contribute to a comprehensive understanding of our relationship with the ocean.

Achieving ocean literacy involves promoting an understanding of the ocean's influence on us and vice versa through diverse means, including education.[60] This process helps individuals appreciate the ocean's importance, encourages sustainable practices, and fosters emotional connections and a sense of responsibility towards marine conservation.[61] Integrating diverse worldviews into educational and governance frameworks enhances this understanding.[62] Incorporating ocean literacy into both formal and informal education programmes, such as the OIN, and even activities like surfing,[63] is essential for cultivating this perspective. Recognizing the ocean as an actor reinforces our responsibility to protect, conserve, and care for it for the benefit of all life. The rise of the rights of nature, exemplified by initiatives such as granting legal personhood to entities like whales in the Pacific,[64] the Whanganui River,[65] as well as the project for

[59] Schwerdtner Manez, Stoll-Kleemann and Rozwadowski (n 13).

[60] Reynolds (n 57).

[61] Ibid.; Murray and Poto (n 6).

[62] Reynolds (n 57).

[63] Natalie Fox, Jamie Marshall and Dorothy Jane Dankel, "Ocean Literacy and Surfing: Understanding How Interactions in Coastal Ecosystems Inform Blue Space User's Awareness of the Ocean" (2021) 18 *International Journal of Environmental Research and Public Health* 5819.

[64] See, e.g., Remy Tumin, "In Move to Protect Whales, Polynesian Indigenous Groups Give Them "Personhood"" *The New York Times* (29 March 2024), https://www.nytimes.com/2024/03/29/world/australia/whale-personhood-polynesia-maori.html, accessed 17 April 2024; Rachael Evans, "What If Whales Took Us to Court? A Move to Grant Them Legal Personhood Would Include the Right to Sue" (*The Conversation*, 14 April 2024), http://theconversation.com/what-if-whales-took-us-to-court-a-move-to-grant-them-legal-personhood-would-include-the-right-to-sue-227335, accessed 17 April 2024.

[65] See e.g., Miriama Cribb, Elizabeth Macpherson and Axel Borchgrevink, "Beyond Legal Personhood for the Whanganui River: Collaboration and Pluralism in Implementing the *Te Awa Tupua Act*" [2024] The International Journal of Human Rights 1; Jérémie Gilbert and others, "The Rights of Nature as a Legal Response to the Global Environmental Crisis? A Critical Review of International Law's "Greening" Agenda" in Daniëlla

the rights of the Pacific Ocean reflects a shift towards the recognition of nature's agency with inherent rights.[66]

Beyond responsibility, Murray and Poto introduce the concept of "response-ability" in ecological literacy to highlight a encompasses a proactive and relational stance.[67] This concept underscores the capacity and obligation to address the needs and challenges faced by both people and the environment.

Against this backdrop, the concept of marine citizenship emerges as another practical application that bridges individual behaviour with broader ethical and systemic changes.[68] Marine citizenship reflects an individual's active and responsible engagement with marine environments, guided by a profound sense of relationality and care. It embodies how personal actions and behaviours can align with the ethical commitments to the ocean, extending the values discussed into tangible practices. Marine citizenship further highlights the need for deeper, systemic changes in how we perceive and engage with marine environments—which should be informed by diverse epistemologies and ontologies. This concept builds on relationality by integrating the understanding that all entities, including humans and the ocean, are fundamentally interconnected. Marine citizenship also embodies care by fostering a commitment to maintain and enhance these relationships through responsible behaviour, advocacy, and stewardship. It challenges the traditional, utilitarian view of the ocean and promotes a more holistic, ethical approach to human-ocean relationships.

Dam-de Jong and Fabian Amtenbrink (eds), *Netherlands Yearbook of International Law 2021*, vol 52 (TMC Asser Press 2023), https://link.springer.com/10.1007/978-94-6265-587-4_3, accessed 2 November 2023; Dana Zartner, "Watching Whanganui & the Lessons of Lake Erie: Effective Realization of Rights of Nature Laws" (2021) 22 *Vermont Journal of Environmental Law* 1; Charpleix (n 59).

[66] Michelle Bender, Rachel Bustamante and Kelsey Leonard, "Living in Relationship with the Ocean to Transform Governance in the UN Ocean Decade" (2022) 20 *PLOS Biology* e3001828, 2; Victor David, "Towards a Regional Convention on the Rights of the Pacific Ocean as a Legal Entity" ("One Ocean" Symposium, New York, 24 August 2019).

[67] Murray and Poto (n 6) 48.

[68] Pamela M Buchan and others, "Marine Citizenship: The Right to Participate in the Transformation of the Human-Ocean Relationship for Sustainability" (2023) 18 *PLOS ONE* e0280518.

5 Conclusions

This chapter has explored how integrating relational and care-based values into ocean literacy can reshape our understanding and engagement with the ocean, moving us beyond traditional paradigms of exploitation. Relationality challenges entrenched dualistic separation between humans and nature, proposing instead a worldview where all entities are interconnected and interdependent. Insights drawn from traditional belief systems, such as those held by the Inuit and Māori, provide integrated and relational approaches to human-ocean relationships, rejecting the Western separation of nature and culture.[69] This perspective is crucial in reorienting our relationship with the ocean from one of exploitation to one of mutual respect and responsibility. Acknowledging the ocean as a dynamic, fluid, and sentient kin in the web of life enhances the understanding of our role in it. Care, as an extension of relationality, adds an ethical and moral dimension to our interactions with the ocean. Central to ocean literacy infused with the values of relationality and care are three dimensions: (1) emotional connections and empathy; (2) expanding the circle of moral consideration; and (3) collective responsibility and stewardship.

The two pathways of ocean literacy—"connecting with each other" and "connecting with the ocean"—illustrate how relationality and care manifest in practical terms. These pathways not only highlight the importance of emotional and embodied connections with the marine environment but also underscore the need for inclusivity and respect for diverse ontologies. Incorporating diverse cultural perspectives and historical contexts into ocean literacy, such as those of the Inuit and the Māori, highlights the value of relationality and care as lived realities rather than abstract concepts. Furthermore, regionally informed approaches that integrate emotional elements and knowledge co-production offer a more effective framework than a one-size-fits-all model. These call for interdisciplinary and inclusive educational practices that reflect diverse cultural and epistemological perspectives. It also demands policy reforms that address the ocean's vulnerabilities and promote sustainable, equitable practices.

The future of ocean literacy lies in embracing the profound interconnectedness of all life, guided by principles of relationality and care. This approach not only enriches our understanding but also empowers us to

[69] Zack Walsh, Jessica Böhme and Christine Wamsler, "Towards a Relational Paradigm in Sustainability Research, Practice, and Education" (2021) 50 *Ambio* 74, 77.

act with greater responsibility, response-ability, and compassion towards each other, the ocean, and its constituents. By doing so, we can cultivate a collective responsibility to protect and care for the ocean, recognizing it as an active, vital participant in the health of our planet. Since ocean health is human health, maintaining the status quo "equates to the legalized destruction of nature",[70] so that relational and care-based values show a path towards re-imagined human-ocean relationships, defined not by dominion, but by care, empathy, and a sense of responsibility towards the ocean.

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[70] Bender, Bustamante and Leonard (n 67) 2.

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CHAPTER 7

Ocean Literacy Accessibility

Dana Ahmed, Margherita Paola Poto, and Stéphanie Heckman

Abstract (English) This chapter explores the practical aspects of accessibility in ocean literacy, embodying the principles of Dana Ahmed's approach to blue education as demonstrated in her project, EcoSpectrum. The focus is on pragmatic strategies to enhance inclusivity and accessibility within the realm of ocean education, ensuring that learning about the ocean is an opportunity available to all. Central to the chapter is the embedded ocean literacy activity designed to foster inclusion within educational settings. This activity serves as a practical example of how educators and facilitators can integrate accessible practices into their teaching methodologies. Additionally, the chapter explores various case studies where creativity has been a pivotal element in delivering

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MPPoto, Faculty of Law, UiT The Arctic University of Norway, revised the draft version of the chapter.
S. Heckman, Graphic Recorder and Visual Facilitator, www.stephanieheckman.com/visualpractice, contributed to the infographics illustrations and wrote Sect. 8.

M. P. Poto and L. Vita, *The Ocean Incubator Network Learning Toolkit*,
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effective ocean literacy programmes. The case studies highlight innovative approaches that merge artistic expression with educational content, making ocean literacy engaging and accessible to diverse audiences. The chapter concludes with insights from Stéphanie Heckman, our visual facilitator who has collaborated with Dana Ahmed in her projects. Heckman's contribution through the development of infographics has been instrumental in providing visually engaging formats that enhance understanding and retention. Her work exemplifies the synergy between visual art and education, further emphasizing the role of creativity in making ocean science accessible to all. Overall, this chapter not only highlights the importance of inclusion and accessibility in ocean literacy but also contributes significantly to the toolkit by providing practical tools and inspiring examples that advocate for an inclusive approach to learning about the ocean.

Keywords Ocean literacy · Accessibility · Case studies

لمن علمني أن المياه أساس الحياة وما فيها، وذكّرني بآيات الله الكريمة: 'وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ'. أهدي هذا البحث لروحه، راجيًا أن يكون حسنة وصدقة عنه. جعلك الله سببًا في زرع أصفى ما في نفسي وحبي للطبيعة والبحر الأحمر. إليك يا جدي عصفور، الحاضر دومًا رغم الغياب.

1 Introduction

The world used to follow the common notion suggesting that once you grow up in a melting pot of different nationalities, backgrounds, races, cultures, and, most importantly, struggles, you become defenceless to consciousness and human connection. Yet, in the age of social media and the public web that Generation Z has had immense access to and control over, connecting is no longer reliant on your physical proximity or your immediate environment. Instead, it thrives in the digital space, where ideas, both enlightening and dangerous, can spread like wildfire. One then begins to question, how is it that the very tools that are meant to connect us are risking the adoption of discriminatory ideologies that hurt our authentic access to information and data, and what does it mean to be connected, or acquire accessibility of knowledge?

Though the digital world and the access to information that has become at one's fingertips have opened society to the reality that ignorance has become a choice, it has also never been clearer that with accessibility to knowledge comes the responsibility to connect with the truth. As seamless as social media can be in creating avenues for education, it has also become a hub for informed manipulation. Those genuinely searching for the truth can easily fall into a black hole of misinformation, where exposure to even a single strand of fake news leads to an algorithmic spiral of biased content. This often results in entrenched perspectives, resistant to open-mindedness and growth, which contrasts sharply with the original purpose of social media. This is a key challenge that global governance is currently grappling with in addressing the most pressing humanitarian crisis of our time: Climate Change.

As a young person, the common misperception about my generation is that we are attached to our social media. In reality, it was the previous generation's expertise in different methods of learning that led to our extensive use of these platforms, inadvertently fuelling negative and divisive narratives rather than highlighting each generation's unique strengths. Generation Z, my generation, has grown up with the tools and the critical thinking skills to navigate a digital landscape. We are not passive consumers of information but active participants in shaping and challenging the narratives we encounter. Though our elders may see social media as a tool for distraction, we recognize it as a platform for activism, a space for marginalized voices to be heard, and a means to mobilize for causes that matter. Most importantly, we continue the mission of our ancestors through advanced forms of transactional knowledge, fighting for the same goal, an equitable future for all, fuelled by radical love. The challenge we face is not just about discerning fact from fiction, but about reclaiming social media as a force for good, a tool for empowerment rather than manipulation. As a result, the notion of accountability, and the responsibility that comes with access to information, has become central to youth today, making intergenerational collaboration essential for counteracting misinformation and fostering communal growth, shared understanding, and a more inclusive and informed society for future generations.

Accountability in the age of social media goes beyond merely distinguishing right from wrong; it demands that those with privilege and power take meaningful action to reshape the narrative and address the gaps in understanding accessibility. Accessibility is not just about making

information available, but about challenging society's acceptance of inaccessible information, especially when it impacts the livelihood, health, and security of communities. In this context, accountability forces us to confront the question: With the current access to information about injustice in accessibility and education that one can no longer be ignorant to, how can we move beyond the current discriminatory education system and create one that is truly inclusive and designed for everyone even in the use of social media, particularly neurodivergent and disabled youth?

2 Indigenous Accessibility in Nature and Radical Love

The accessibility of information and the education system begins to evolve into a structure that truly represents the diversity of society, rather than one that is hierarchical and blind to different backgrounds, once we radicalize the system that perpetuates misconceptions or simplistic understandings of accessibility. While the knowledge and expertise needed to create scientifically backed data on accessibility already exist, it is often the voices that piece together this puzzle for transformative action that is missing. When we stand up for change, our collective refusal to accept a system that fosters prejudiced differentiation is frequently misinterpreted as mere anger, loud voices echoing into the void. In truth, I like to call it radical love—a profound grieving for those impacted by an unjust system, one they neither created nor deserved. To genuinely transform the education system into one that is inclusive and representative, we must embrace a broader range of perspectives and experiences, particularly those that are marginalized or overlooked. Focusing on the autistic and neurodivergent community, we must rebuild our education system by reconsidering the very foundations on which it is based—foundations that have long been centred around neurotypical forms of knowledge. This transformation requires us to shift away from a narrow focus on standardized metrics and embrace a more expansive understanding of learning. We must leverage advanced forms of information access, such as the internet, but do so through the lens of our elders and the teachings of Indigenous communities that predate us, whose wisdom is rooted in a deep connection and radical love to the Earth, Ocean, and one another, guaranteeing our community is treated and vested in as one. Acknowledging that our communities, ancestors, and origins are all interlinked with nature and one another regardless of where we are in the world exposes the reality

that connecting and fighting for one another was never an option but has been an inevitable outcome of life throughout generations. We do not need books, pens, or a formal education to acknowledge our interconnectedness; it flows through our very existence, woven into the stories we share and the experiences we live. Consider that the chemicals found in deep-sea hydrothermal vents and the energy that they provide could have fuelled many of the chemical reactions necessary for the evolution of life, suggesting the ocean to be Earth's first life forms. The notion of how all human beings are inevitably connected to nature equally becomes central in understanding the importance of the radicalization of typical prejudiced forms of learning via grounding in nature and incorporating ancestral wisdom and emotions in accessible education. Aside from scientific explanations, religious teachings that have ruled entire empires for centuries and continue to do so also demonstrate an ecological balance by emphasizing our communal connection to the Earth from water and the Ocean, particularly making it necessary in the spread of information and education on living beings. For example, the Quran stresses in Surat-Al-Anbya (21:30) "*And we created from water every living thing*" highlighting water to also be the origin of all of mankind and life on Earth, or the Torah in its telling of the story of the Splitting of the Sea that emphasizes how it represented all which is concealed, the divine energy within every created being, and the spark of holiness that is at the core of every creation. Recognizing the intersectionality in our understanding of accessibility results in actions that not only demand change to reconnect society as a whole but also build a new system that forges a necessary shift in ideologies and actions between each other. This new system discards outdated knowledge, which forces accessibility advancements to become mechanical and unemotive, incapable of looking beyond typical discriminatory foundations of knowledge and what we know of it, therefore often leading to the same outcomes. As Daniel Quinn aptly stated (1999), "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete".[1]

[1] Quinn, D. (2000). Beyond Civilization: Humanity's Next Great Adventure. Crown.

3 Equity in Nature's Laws

Breaking away from a mechanic or typical forms of change has led us to radicalize several existent fields of knowledge and opened the floodgates into creative forms of education that power connection. An example of such is Rights of Nature, which operates on the elimination of conventional, and even shallow, understandings of environmental regulatory structures that permit environmental harms such as fracking, mining, or factory farming, to occur under existent protective laws. These environmental laws permit destructive actions by following global legal systems which govern these environmental laws, treating nature, the land, and ocean, as "property". Given that anything that is considered "property" confers upon the property owner the right to damage or destroy it, those who "own" natural ecosystems are largely permitted to use them however they wish, even if that includes destroying the health and well-being of nature. Ultimately, laws and contracts are written to protect the property rights of individuals, corporations, and other legal entities under many legal systems. Therefore, environmental laws can only regulate how much pollution or destruction of nature can occur within the law, rather than preventing pollution and environmental demolition from even occurring in the first place, identifying nature as distinct from a global interconnected ecosystem to mankind and insignificant to the health of society. However, laws recognizing Rights of Nature deem to be different by distinguishing that ecosystems and natural communities are not mere properties that can be owned, but rather entities that have an independent and inalienable right to exist and flourish as "rights-bearing entities". The establishment of Rights of Nature compels laws and regulations to work within the framework of environmental protection in order to uphold its "rights".[2] As spearheaded by the Indigenous Māori of New Zealand and supported by leaders from the Cook Islands, Tahiti, Tonga, Hawaii, and Easter Island, the Rights of Nature in action has been exhibited in the case of the He Whakaputanga Moana (Declaration for the Ocean) Treaty, which recognizes Whales as legal persons with inherent rights, and thus safeguarding such magnificent creatures from threats like pollution, unsustainable fishing, and climate change.[3] Now if such a traditionally

[2] See more on this in Chapter 6.

[3] Shelton, D. (2015). "Nature as a Legal Person." *VertigO-la revue électronique en sciences de l'environnement* (Hors-série 22).

rigid and strict field like Law can demonstrate openness to the interconnectedness between nature and humanity, emphasizing the accessibility of treating living beings and society as one in the interdisciplinary exchange of knowledge, how could it possibly be objectionable to incorporate this perspective into every other field if it almost guarantees that community is undivided and equity is ensured across everyone via its recognition as one unified entity to nature? This suggests that the issues in global governance have never been about cultural or monetary feasibility, as often claimed in formal arenas advocating for change. Instead, the real obstacle has been the perception that such growth is unnecessary, rather than recognizing it as a desperate and urgent response to a social, ancestral, and ecological crisis. For such awareness to occur, thus, education systems must be inclusive and accessible to all.

4 Misconceptions on Accessibility

However, accessibility of education for autistic youth cannot be rooted in neurodiversity being a "disorder", a fault, or a mistake in the system of human genetics, because it is simply a difference that brings unique qualities, but society is structured in a way that prevents these abilities from flourishing. An example of such misconceptions is when such differences are appreciated; in some contexts, there remains an expectation for neurodivergent individuals to pose "talent" or "skill" as if one's worth is linked to a "superpower" rather than accepting one for being who they are, and not what thrilling differences they may have. Oftentimes, accessibility is spoken to with regard to education, but such a concern goes beyond education within formal avenues such as schools and universities, but rather education on accessibility and inclusion must roam in deeper waters, whereby it is firmly integrated with society accepting neurodiversity for what it truly is; it is nature in a different form. Similar to the concept of Rights of Nature, the ocean, the land, forests, and coastlines in all their shapes and sizes are not discriminated or segregated in their qualification to bear rights; instead, nature is treated as one entity deserving of rights regardless of what anthropological benefit it may acquire, thus, what gives mankind the right to be any different to nature in the treatment of each other? By requiring different abilities to qualify as a "talent", we indirectly reinforce neurotypical standards of "normality" where a difference must be seen as such in order to force societal acceptance. As a result, we create a discriminatory prerequisite that constructs harmful and

unnecessary barriers to accessibility, breaking nature and its rooted foundation as an interlinked entity in us. More significantly, by having such a prerequisite, we pose the thought that the structure of our common inaccessible education system is right. Embracing nature in its different forms should be the norm; acceptance, inclusion, and changing society to understand how inaccessibility should not be a customary standard should and must be the norm in order for nature to flourish. Understanding and accepting differences in their distinctive ways does not make us unalike, but rather highlights how strong our interconnectedness must be if our foundation is inevitably rooted in nature. We acknowledge how resilient nature and the ocean are when despite being in a global coral bleaching crisis, the Red Sea reefs continue to demonstrate remarkable heat resilience, or that hydrothermal vent communities found along the Mid-Atlantic Ridge have ecosystems of tube worms and giant clams that are thriving in complete darkness, high pressure, and temperatures that can exceed 400 degrees Celsius. Such challenges do not only question scientific norms, but societal understandings. Nature shows us that no matter how much we try to alter an ecosystem to fit human-centric expectations, we will always be a part of the earth's ecosystem, no matter how much we try to escape and shape the world around our needs as if we and the earth are separate. We are all merely different versions of nature. Therefore, interconnectivity to nature is inevitable, and such an understanding must be incorporated deeply in education systems within and outside schools as it reaffirms nature's indiscriminatory practices that foster authentic accessibility to knowledge for everyone, compelling then and again the question, how do we still believe that our access to knowledge and education system is right, or rather even, natural?

5 Connecting Nature, the Ocean, and Neurodiversity

The link between nature, the ocean, and neurodiversity was not always vivid to me, mainly due to the lack of scientifically backed and up-to-date research in the area. Yet, common conversations with autistic youth and the modernization of research on neurodiversity very clearly show a direct and almost consequential relationship between neurodiversity well-being and nature. A study by Faber Taylor and Kuo in 2009 found that children with ADHD who took a walk in a park had elevated attentional performance, compared with children who walked indoors, and that in

everyday settings, children who play in green spaces show milder overload symptoms compared to children who play mostly in indoor and built outdoor settings.[4] Such studies are promising because ADHD and ASD (or autism) share similarities. Recent research has not only revealed high clinical comorbidity of ADHD and ASD,[5] but have also found similar genome areas and overlapping genetic influences.[6] However, more recent findings such as in the study on *"Exposure to nature for children with autism spectrum disorder: Benefits, caveats, and barriers"* show that nature exposure provides emotional benefits for children with ASD where parents reported that their children smiled and laughed more when they were in nature. Such responsive behaviour is explicitly significant when it is found that mood disorders, including depressive disorder, anxiety disorder, separation anxiety disorder, and obsessive–compulsive disorder, are common comorbid conditions among children with autism.[7]

The ocean is no outlier to the impact nature has on behavioural and emotional well-being, particularly in consideration of the scientific explanations of the Blue Mind Theory. The Blue Mind, as iterated by the late Dr.Wallace J. Nichols, is "A mildly meditative state characterized by calm, peace, unity and a sense of general happiness and satisfaction with life in the moment. It is inspired by water and elements associated with water, from the colour blue to the words we use to describe the sensations associated with immersion".[8] The Blue Mind does not only champion the scientific explanation of the state of relaxation in water but

[4] Taylor, A. F., and Frances E. K. (2009). "Children with Attention Deficits Concentrate Better After Walk in the Park." Journal of Attention Disorders vol. 12, 5.

[5] Simonoff, E. et al. (2008). "Psychiatric Disorders in Children with Autism Spectrum Disorders: Prevalence, Comorbidity, and Associated Factors in a Population-Derived Sample." Journal of the American Academy of Child and Adolescent Psychiatry vol. 47, 8.

[6] Ronald, A. et al. (2008). "Evidence for Overlapping Genetic Influences on Autistic and ADHD Behaviours in a Community Twin Sample." Journal of Child Psychology and Psychiatry, and Allied Disciplines vol. 49, 5.

[7] Leyfer, O. T. et al. (2006). "Comorbid Psychiatric Disorders in Children with Autism: Interview Development and Rates of Disorders." Journal of Autism and Developmental Disorders vol. 36, 7.

[8] Nichols, W. J. (2014). Blue Mind: The Surprising Science That Shows How Being near, in, on, or under Water Can Make You Happier, Healthier, More Connected and Better at What You Do. Brown and Company.

also advocates for reserving such authentic feelings by protecting marine ecosystems because they are significant to our health and well-being.

The ocean provides a profound lens through which we can grasp the significance of accessibility in its entirety. Our call to action for ocean conservation is often rooted in a deep, personal connection to nature, and the ocean, in particular, embodies this connection simply. Though the ocean is often seen from an exploitative lens, it has long been established that connectivity to the ocean is important to human beings as individuals and as a community, apart from its financial benefits. Gee has famously iterated "there are fundamentally different ways of seeing the ocean. The first is the practice of regarding the ocean as a collection of material, tangible entities, resulting in particular spaces composed of physical-material facts—such as ocean currents, water depth, water temperature, and flora and fauna. The second is the understanding of the ocean as a visual phenomenon, referring to the appearance of the ocean as we see it. The third…is the sea not as a space but as a place—moreover, a place that can generate deep-seated attachment and with this, care".[9] This showcases how the ocean is more than a financial resource made for exploitation, but rather an experience that enhances sensory and human connection. Deloughry in Submarine Futures of the Anthropocene notes how Earth's future is a "watery" one given the future of sea-level rise, climate and weather changes that will heavily be influenced by the ocean.[10] When we pair this understanding with Laplantine's conclusion that all humans are subjective, living, sensory beings and that our social interactions are intersubjective and political, it produces a concept of "participant-sensation".[11] This idea suggests that our engagement with the ocean is not merely observational but deeply experiential, impacting us on both a sensory and emotional level. Such acknowledgement is exacerbated when considering that the ocean composes 78% of our bodies, provides at least 50% of the oxygen we breathe, and traps 90% of heat that would otherwise unalive the human race. The ocean inevitably is the sole reason we exist. In recognition of such reliance on

[9] Gee, K. (2019). "The Ocean Perspective," in: Zaucha J., Gee K. (eds.) Maritime Spatial Planning. Cham: Palgrave Macmillan.

[10] Deloughrey, E. (2017). Submarine Futures of the Anthropocene. Comp. Lit. vol 69, 32–43.

[11] Laplantine F. (2015). The Life of the Senses: Introduction to Modal Anthropology. Translated by Jamie Furniss. Bloomsbury: London.

the ocean, interdependence, and thus, interconnectivity, to nature and understanding the need of not only its survival, but flourishment and prosperity, becomes a personal matter, determining an impact on every single being on the planet. Once ocean connectivity is championed, action then becomes inescapable and urgent. It is therefore significant to understand the contextual and evidential teachings about the ocean in order to adequately comprehend the urgency of protective solutions to take place: "we need to more actively acknowledge the diversity of human relationships with the ocean – both personal and collective, historical and contemporary… understanding our changing relationship with the ocean is critical for future decision-making processes about sustainable marine management of its resources, ecosystem services, and wider dimension of health".[12]

5.1 The EcoSpectrum Project

Incorporating sensory connections to the ocean as a key component of climate education has the potential to transform how we teach, making education more accessible and inclusive for neurodivergent and autistic youth, who rely on sensory accessibility for grasping knowledge. With the aim to start an educational revolution through accelerating accessibility and inclusion of knowledge, EcoSpectrum aims to build educational content co-created by a community of autistic students, youth, mothers, teachers, and experts on climate action and ocean conservation in order to heighten their participation and consideration in formal climate and ocean negotiations as valid stakeholders and vital members in the climate movement.

To enhance inclusivity and support for autistic and neurodivergent communities in the context of climate and ocean issues, several key actions should be undertaken. First, there must be an increase in the representation of these communities at climate and ocean conferences to ensure their voices are heard and valued. Additionally, it is crucial to provide easy and sufficient access to climate and ocean-related resources tailored for neurodivergent and autistic youth. Integrating accessible forms of ocean and climate literacy such as via sensory connection within schools that cater to neurodiverse students is also essential, ensuring that generalized

[12] Rock, J., Sima, E., Knapen, M. (2019). What Is the Ocean: A Sea-Change in our Perceptions and Values? Aquat Conserv., 1–8.

education is truly inclusive. Finally, it is important to advocate for laws that support the rights of individuals on the spectrum who are affected by climate change, implementing policies that address their specific needs and mitigate the impacts of global warming on their lives.

In aiming to achieve such goals, two case studies have been conducted in order to imagine and test a vision where autistic and neurodivergent youth are given a platform to share their perspectives, demonstrating the potential for inclusive, integrated, and accessible learning and representation within global and local environmental governance and educational frameworks.

5.2 First Case Study: Luderitz Blue School

The Luderitz Blue School is a school rooted in Ocean Education empowering students to become ocean stewards by fostering a deeper understanding of marine ecosystems, the challenges they face, and how individuals can help preserve this vital resource. The Luderitz Blue School is situated perfectly on the Luderitz Coast on the Atlantic Ocean, and thus was a perfect place to carry out an integrated learning approach in ocean education, where topics ranging from the Blue Mind Theory to Deep Sea Mining and the Ocean Carbon Cycle were taught in an accessible manner to students of diverse ages ranging from 6 to 11 as part of the EcoSpectrum Ocean Curriculum trial. The EcoSpectrum Ocean Curriculum was taught through the class "Ocean Culture and Education" or OEC, which is a class subject labelled by the school to teach Ocean Education.

The EcoSpectrum Ocean Curriculum was developed over six dedicated months, during which we gathered information and data from a range of organizations and tested curricula from schools across the globe. Our curriculum was inspired by key organizations including the Ocean Race, Take 3 For The Sea, Ocean Conservation Trust, the Food and Agriculture Organization (FAO), World Ocean Observatory, and the UNESCO Ocean Literacy Portal. Their contributions, along with insights from UNESCO's White Papers on ocean literacy, helped shape the foundation of our programme. Drawing from these rich resources, we tailored our teaching methods to ensure the content was delivered effectively without being overwhelming. A personalized learning approach was central to the design, ensuring that each class was accessible, engaging, and adaptable for all types of learners. By integrating global ocean literacy standards with inclusive educational practices, we created a curriculum that fosters deep

understanding and active participation, making ocean education relevant and engaging for everyone.

A total of 43 students were taught aspects of EcoSpectrum's ocean curriculum at the Luderitz Blue School. However, this section focuses on a closer look at 20 students who received a more comprehensive and focused ocean education through EcoSpectrum. The content was altered to fit the appropriate ages of each class of students. A total of 13 lessons were provided to 20 students, each ranging from 30 to 60 minutes. The lessons were taught from August 1, 2024, to August 29, 2024.

Although the content was consistent across classes, it was tailored to each age group to ensure a balanced mix of fun, informative, and engaging content throughout the curriculum. The following topics in each class were taught:

- Ages 5–8 (Seahorses and Dolphins class):
  - The Blue Mind Theory
  - Emotional Connection to the Ocean
  - Deep Sea Creatures
  - Ocean challenges
- Ages 9–12 (Penguin class)
  - The Blue Mind Theory
  - Human Impacts on the Ocean; Deep Sea Mining
  - Deep Sea Creatures
  - The Carbon Cycle
  - Marine Photosynthesis
  - Ocean and Human Interdependence

In each class, the principles of accessible education were emphasized, showing how inclusive and diverse classrooms thrive when instruction is tailored to individual needs. I explained that the teaching methods used in my class aim to be flexible, organized, personalized, and engaging for all students, whether autistic or neurotypical. I also introduced students to a wide variety of learning disabilities, including autism, discussing how these conditions can influence learning styles and development. This context helped students understand the purpose behind the accessible learning strategies being implemented during class. Additionally, students were encouraged to share their personal opinions and provide feedback on the teaching style and curriculum, fostering a responsive and adaptive learning

environment while promoting a supportive and trustworthy relationship with students.

The first classes introduced the concept of Blue Mind Theory, exploring our emotional connection to the ocean. We distinguished and defined the Blue Mind, a state of calm and mindfulness associated with water, and the Red Mind, characterized by stress, anxiety, and overwhelm. To help students internalize this concept, we integrated a mindfulness practice into each lesson. This involved a brief break where students could meditate to the natural sound of waves from the nearby coast, fostering a sense of peace and grounding before diving into class material. Over time, this Blue Mind practice was incorporated at the beginning, middle, or end of each lesson to provide a mental reset amid potentially overwhelming information. Students reported feeling "happier" and "calmer" during class as a result. It's important to note that OEC classes were held right after break time, when students often returned feeling hyperactive or stressed. This further underscored the importance of practising the Blue Mind to create a balanced and productive learning environment, contrasting it with the Red Mind's heightened state of panic and anxiety.

The OEC classrooms were highly personalized and activity-based. During my time at the Luderitz Blue School, I made it a priority to build trusted connections with each student by learning about their individual interests, future aspirations, and favourite marine animals. I then integrated these personal elements into our lessons, creating a more engaging and meaningful learning experience. For example, during the lesson on Deep-Sea Creatures, some students mentioned that their favourite animal was the angler fish, a fascinating species from the depths of the ocean. I incorporated this into the class by focusing on the angler fish and using their interest as a gateway to discuss deeper oceanic concepts. Even for students whose interests were not directly linked to the ocean, like one who aspired to be a pilot, I found meaningful ways to connect. In that case, I linked the student's aviation dream to a lesson on the carbon cycle, exploring the aviation industry's role in carbon emissions and climate change. We discussed how a deep understanding of the carbon cycle could inspire future advancements in sustainable aviation, and I encouraged the student by suggesting that they could one day become a pilot leading the way in environmentally friendly flying practices. Similarly, for a student who wanted to become a football player, I drew parallels between their passion for teamwork and the interconnectedness of Earth's systems. Just as a successful football team requires collaboration from every player, the

carbon cycle depends on each element (whether it's plants, oceans, or the atmosphere), working together to maintain the planet's balance.

Both collective and individual activities were incorporated into every class, from having students illustrate the drivers of fossil fuel and carbon emissions on the board, using arrows to connect processes like combustion, deforestation, and ocean absorption, to writing letters and questions to the ocean on postcards. These activities showcased a range of creativity and independence, helping to identify each student's preferred learning style. A more personalized learning approach, however, would require an extended period of engagement, one that is much longer than 4 weeks, to build student confidence by tailoring activities to their individual preferences overtime.

The way the content was showcased to the students was also attempted in an accessible manner, where presentations were particularly used to incorporate visual aids alongside written information. A pastel blue colour was used as a consistent theme in the presentations, with black-coloured text in Arial font in order to avoid potential distractions from heavily bright and contrasting colours, acknowledging potential sensory difficulties otherwise. A sensory-based approach to learning was further integrated through activities where students were asked to collect plastic from streets or beaches. The collected items were then passed around the classroom, allowing students to engage their sensory needs while recognizing the variety of plastic products that contribute to the pollution of our planet. Additionally, each presentation featured a slide with the classroom objectives which were mentioned prior to each class to set an organized structure for each lesson. Flexibility was also emphasized during lessons; if we couldn't complete all the content in one session, it was explained that the remaining slides would be covered in the next class. The objectives were then adjusted and reviewed the following week to ensure that students still received a comprehensive understanding of the material, with all the necessary knowledge covered. Flexibility was also championed in class by offering students the choice of activities, such as completing a question–answer worksheet, drawing a postcard of the ocean, or writing a letter to the ocean. This approach was an example of one lesson that allowed students to engage with the material in a way that suited their individual preferences and learning styles.

Students were later asked to complete a survey to provide feedback on their overall experience with the curriculum. The survey aimed to gather their thoughts on which topics they enjoyed most, how comfortable they

felt participating in class activities, and how openly they could express themselves when speaking with me during, before, or after class. The following charts summarize a few of their responses (Figs. 1, 2, and 3).

The EcoSpectrum Case Study at the Luderitz Blue School was nothing short of a revelation. In a world where policymakers and international bodies often complicate language to the point of exclusion, where youth voices are dismissed as too emotional for political spaces, this case study shattered that narrative. It proved that connection is not only possible, it's effortless. Loving nature is instinctual. Protecting our oceans and our planet is within reach. What unlocked this potential was a curriculum driven by action and fuelled by open and accessible teaching. It didn't merely instruct students to care for the ocean; it awakened something ancient within them. That love, that deep bond with nature, has always been there, waiting to be acknowledged, waiting to be celebrated. All we needed to do was create a space where they could feel the ocean's heartbeat as their own, where they could see the ocean as a living ancestor, the very source of life. It isn't about teaching them to love the ocean; it's about showing them that this love is already in their souls, powerful enough to change the world (Fig. 4).

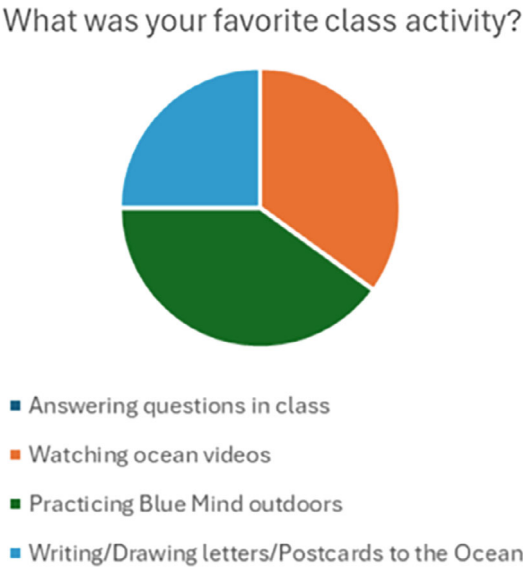

Fig. 1 Pie Chart "What was your favourite class activity?" 2024 (Image by the Dana Ahmed. Copyright free)

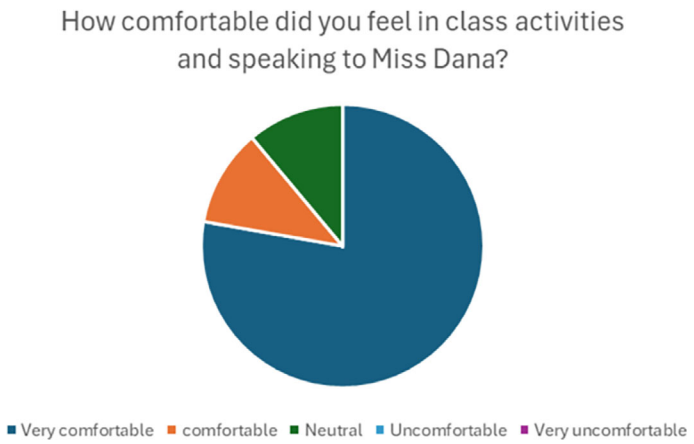

Fig. 2 Pie Chart "How comfortable did you feel in class activities and speaking to Miss Dana?" 2024 (Image by the Dana Ahmed. Copyright free)

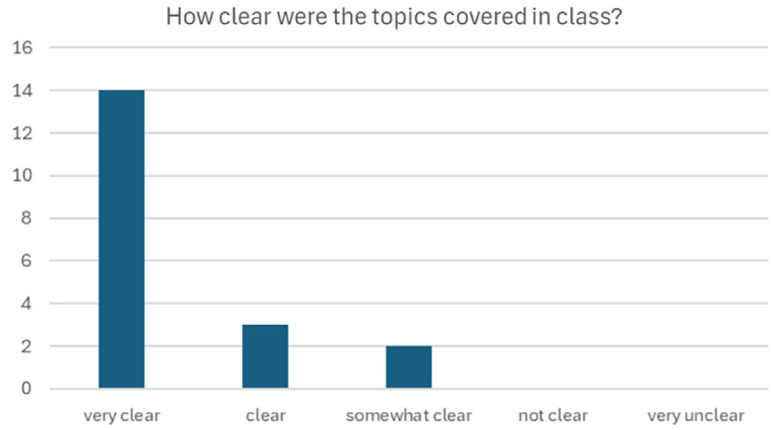

Fig. 3 Bar Chart "How clear were the topics covered in class?" 2024 (Image by the Dana Ahmed. Copyright free)

5.2.1 The Blue Mind Activity Outlined

As mentioned, the blue mind activity was used as a mindfulness practice and reset for students during moments of overstimulation.

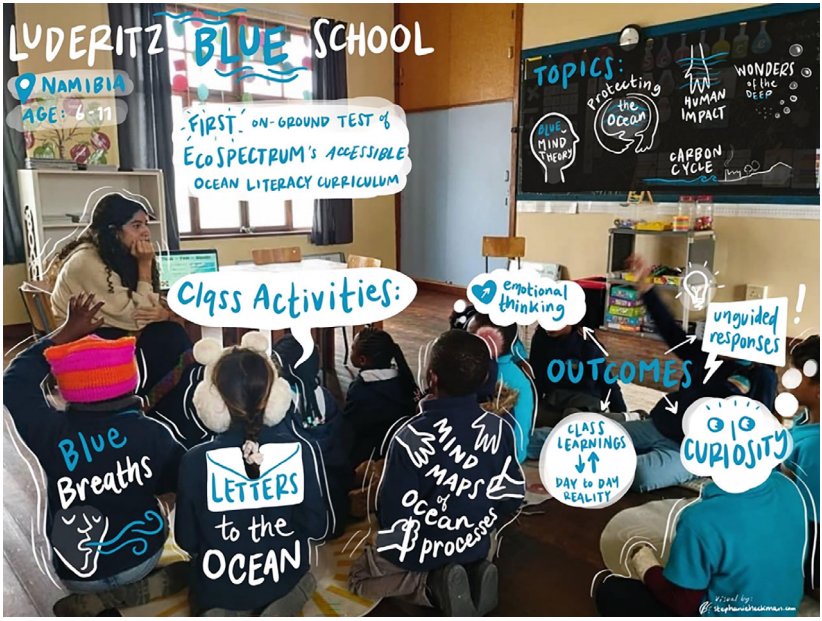

Fig. 4 Infographic by Stéphanie Heckman, Luderitz Blue School, 2024 (CC-BY-SA Compatible license)

Activity Name: The Blue Mind exercise
Target Audience: All ages (this exercise was applied in classrooms with 5- to 12-year-old students)
Focus of Activity: Engage in a mindfulness exercise to increase awareness of and explore our emotional connection to the ocean
Learning Objective: emotional regulation skills, increasing connection between nature and emotional states
Materials Needed: Ocean sounds either from an online source or, if you are able to do so, conduct this activity at the seaside

Guidance to complete the activity (instructions): This activity is an excellent tool to use to help students prepare themselves for learning. It is meant to instil feelings of peace and grounding prior to students moving on to other learning materials. As previously mentioned, this activity was also used to facilitate the transition of students from their break time back to class time. The facilitator can first introduce the concept of Blue Mind

Theory, exploring our emotional connection to the ocean. Distinguishing and defining the Blue Mind, a state of calm and mindfulness associated with water. To help students internalize this concept, have them sit or stand in a position that they are comfortable in, and instruct them to start by taking a big deep breath followed by a relaxed exhale. Inform them that you will be playing Ocean sounds for a set duration of time and that they are to close their eyes and focus on the sounds. Finally, play the video and enjoy! It is at the facilitator's discretion the duration of time that students will meditate on the ocean soundscape; it is also up to the facilitator to choose an ocean soundscape; however, we advise using an audio file with calming natural ocean sounds.

5.3 Second Case Study: The COP28 Delegation

As part of EcoSpectrum's mission to ensure that advocacy for autistic representation is action-based and holistic, we focus on making education accessible, promoting inclusive climate and ocean goals within policy spaces, and reshaping societal perceptions of autism and neurodiversity by encouraging education, empowerment, and active inclusivity. Therefore, EcoSpectrum hosted the first autism-centred delegation at the 28th Conference of the Parties (COP28) in Dubai and hosted an official UNFCCC side event titled "Revolutionising Ocean Education; Initiating Ocean Literacy for Autistic Youth" featuring a diverse panel of autistic youth, special education educators, ocean advocates, and film experts as speakers.

Navigating the journey to secure a delegation for EcoSpectrum at COP28 was both a formidable challenge and a profound reward. It took over seven months of relentless effort, and at times, the dream of hosting our own delegation seemed almost out of reach. The process was nothing short of a rollercoaster. It all began with a barrage of emails to registered UNFCCC organizations, asking them to forgo their own side events in favour of supporting EcoSpectrum. This was done without even having my own accredited attendance to COP28 or confirmed panelists. Many responses came with the word "unfortunately" in the subject line, while others were met with no response at all. Yet, just when hope was starting to wane, a glimmer of possibility appeared in the form of Dr. Mark Terry's Youth Climate Report. Dr. Terry, a passionate advocate with a personal connection to our cause, expressed how he has an autistic granddaughter, and felt inspired by EcoSpectrum's mission, responded simply

by saying "the short answer is yes", followed by yet another challenge. Dr. Terry was on an Arctic expedition in Iceland, completely cut off from reliable Wi-Fi or any network at all. This made it nearly impossible for him to navigate the complex application process for a side event, which required a registered UNFCCC organization to log in with their credentials and submit the necessary documents. Together, with several attempts at still trying to reach out to Dr. Terry, fighting through the plight access to internet he had, we eventually managed to log in. In partnering with Climate Generation and Dr. Terry's Youth Climate Report, I finally submitted the application. In the end, securing our delegation and hosting the side event felt like a serendipitous victory, a testament to perseverance and collaboration. It was a challenging journey, but the rewards were beyond anything I could have imagined.

I had the privilege of moderating the Side Event, bridging experiences from a remarkable group of speakers, each offering unique insights into the intersection of accessibility, neurodiversity, and climate ocean action. The panel featured Obaid Al Hameli, Philo Gereis, Dr. Mohamed Fteiha, and Dr. Mark Terry, each of whom contributed their perspectives on how we can create more inclusive environments, whether in education, film, policy, or advocacy spaces, all while addressing urgent climate and ocean challenges.

Dr. Mark Terry's Youth Climate Report is a film-based digital map containing more than 1,000 videos of climate research produced by the global community of youth from all different parts and communities of the world. Each year, participants create video reports on climate impacts based in their home countries and communities, which then are screened by a selection committee and added to the Youth Climate Report project presented at COP or at a series of press conferences and Side Events across the world. As a panelist at our event, Dr. Terry emphasized how filmmaking serves as a powerful and accessible form of visual knowledge-sharing. He explained that film acts as a surrogate for complex information, transforming scientific data into relatable narratives that engage audiences on a personal level and inspiring citizen-based science. By using storytelling, the Youth Climate Report enables people, regardless of their background or geographical location, to not only understand the gravity of climate change but feel connected to the solutions. This approach empowers individuals to see themselves as part of the larger climate movement, making climate and ocean action more inclusive and accessible to the average person.

Dr. Mohamed Fteiha, a Professor of Special Education at Abu Dhabi University in Al Ain Campus, provided scientific insights into the significance of accessible education and how different fields of workspaces can and must be accessible, particularly in education. Dr. Fteiha highlighted that the world is largely shaped around neurotypical needs, which often prevents true inclusivity, and called for an urgent shift in behaviour to create a more inclusive global community. Addressing the inequality of opportunities for neurodiverse youth, Dr. Fteiha stressed that business owners and executives must offer integrated opportunities for everyone, regardless of background or disability. Failure to do so, he warned, would only exacerbate discrimination and limit access to educational resources, particularly for neurodivergent youth who are essential to the urgent response to climate change. He further elaborated on how the intensity of sensory crises in autistic individuals can severely impact their quality of life, negatively affecting social interaction and communication in a neurotypical world.[13] This adversity often leads to challenges in escaping or evacuating during intense environmental disasters, resulting in disproportionately higher rates of morbidity and mortality among people on the autism spectrum. Throughout the panel, Dr. Fteiha consistently reiterated that "Education is the foundation of everything else in life" and that "without education, no action for the climate or oceans will follow". He stressed that increasing the accessibility of climate and ocean resources, which are currently not user-friendly for neurodivergent individuals, is vital for ensuring their safety and enhancing their representation in climate and ocean events, discussions, and conferences.

Obaid Al Hameli is a media student at Khalifa University in Abu Dhabi and an autistic youth delegate. He represented the storytelling element that made the entire panel feel more like a warm conversation between phenomenal experts on accessibility, rather than a typical, formal UNFCCC panel. While traditional panels, though informative, often fail to connect because the knowledge shared isn't tailored to a diverse audience, Obaid's approach brought a unique and personal touch. His ability to weave stories made complex topics more relatable and accessible, ensuring that everyone in the room, regardless of their background, could engage meaningfully, truly representing the essence of

[13] Kojovic, N. et al. (2019). "Sensory Processing Issues and Their Association with Social Difficulties in Children with Autism Spectrum Disorders." Journal of Clinical Medicine vol. 8, 10 1508.

EcoSpectrum. Obaid began his intervention by sharing a story about his childhood passion for collecting seashells near his home in Abu Dhabi, often finding hermit crabs nestled inside, which he admired and respectfully left undisturbed. As he grew older, however, he noticed a troubling shift: fewer seashells, more shards of glass and plastic, and hermit crabs that were often found lifeless. His story underscored a powerful message, as he pointed out that "policymaking on ocean literacy and accessibility originates from ocean stories; if we don't have stories, we won't have policies". Obaid's contribution was a reminder that the heart of ocean conservation and policy lies in personal, lived experiences, making his voice not only impactful but vital to the conversation.

Philo Gereis, the second autistic youth delegate featured on the panel as an EcoSpectrum ambassador, delivered a powerful message about the importance of including neurodivergent-friendly methods of education to enhance accessibility and authentically represent the autistic and neurodivergent community. He emphasized that "autistic people are not any different from anyone else", pointing out that many of the challenges faced by the autistic community arise because society is predominantly structured by neurotypical individuals. "It is not a disorder", Philo explained, "it is simply a difference". He further highlighted the complexity of neurodiversity, stating, "No one person could represent the entire autistic community. I did my best to get my point across to benefit everyone". Philo's ultimate goal is to be an ambassador for the neurodiverse community, helping to create a fairer, more inclusive world for all. Despite still being young and actively learning in school, Philo is already making an impact by changing perceptions around autistic inclusion, starting locally within his own school. He has iterated how the EcoSpectrum panel kick-started his passion for advocating for greater understanding and inclusion of neurodivergent individuals in both educational and workplace settings. Philo now works to ensure that teachers and staff in his school are aware of how to support autistic students, emphasizing the importance of emotional support, clear learning directions, and social awareness in education. He also criticized the overemphasis on "good grades" in the current education system, arguing that it detracts from the true purpose of education, which is to foster a love for learning and create a more open and inclusive society. Philo's advocacy mirrors EcoSpectrum's broader mission; to drive systemic change in how society views and supports the neurodiverse community. By starting locally and building from within, EcoSpectrum aims to continue what

Philo has already set in motion at COP28: creating spaces where neurodivergent individuals are not only included but empowered to thrive. His work and vision represent the essence of what EcoSpectrum strives to achieve on a larger scale.

One of the biggest lessons I learnt during this process was to never be ashamed of asking for help. Amid sleepless nights, juggling law exams and lectures, hospital visits, virtual family check-ins, and the immense responsibility of hosting an entire delegation and side event at one of the world's largest climate conferences, all while trying to find enough time to eat and sleep to stay sane as an international student, I came to realize, just two weeks before COP28, that I truly couldn't do it all alone. My dear friends, Felicity Silverthorne and Kate Yeo, were nothing short of phenomenal, offering unwavering support and comfort during this incredibly stressful time.

Kate Yeo, a renowned Climate Youth Delegate and dear friend from Singapore, played a crucial role by setting up virtual UNFCCC COP training calls. Her exceptional efforts ensured that each youth delegate was thoroughly prepared to navigate the complexities of the COP process, from understanding the policies to managing the logistics. With Kate's guidance and dedication, she also assisted in authoring the question prompts that were asked to each delegate and the run-through and structure of the entire event. Thanks to her dedication and expertise, myself and the delegates entered the conference confident and well-equipped to make a meaningful impact. EcoSpectrum would not have hosted such an event without her.

Felicity Silverthorne is the coordinator of the Arctic Angels Network, a youth-led, intergenerational action network of passionate young female activists committed to protecting the Arctic Ice Sea. No matter how I try to describe Felicity and her contributions, words always fall short of capturing the magnitude of her relentless and impactful efforts, as a coordinator of an organization I, so proudly, am a part of, and as a dear friend. She has been instrumental in transforming EcoSpectrum from a mere concept into a thriving organization. During the preparatory negotiations of the Side Event, Felicity graciously created the necessary presentations and sorted through several logistical and emotional challenges, ensuring that everything ran smoothly. Her attention to detail and unwavering support allowed me to focus on the broader goals of the event, knowing that every aspect was in capable hands. Felicity has always reminded me of Fire Corals, which are beautiful colonial marine cnidarians, known

for their resilience and their name which is acquired from the burning sensation they cause when touched. Felicity, to me, represents this beautiful oxymoron between the ocean and fire, one that is both captivating and powerful. Like Fire Corals, Felicity's fierce passion burns through barriers, inspiring those around her to take authentic action, yet she is deeply rooted in the cause, embodying the resilience needed to protect our planet and its beings, both above and underwater. Just like the Fire Corals in their vitality to the Red Sea's survival, Felicity's leadership and determination have been essential to EcoSpectrum's growth and to my own journey as an advocate. She reminds me that, much like the ocean, true strength lies in the balance between grace and tenacity, and for that, I will always be grateful.

EcoSpectrum's COP28 presence was a group effort and accomplishment (Fig. 5).

6 Third Case Study: The Asfour Initiative

The Asfour Initiative was named after my late grandfather, Asfour, who has and will always be my source of hope for the planet and ocean. Asfour is a direct Arabic translation for bird, which I believe to have been entirely symbolic to what he grew to represent in his passing and beyond. Gido (grandfather in Arabic) Asfour was life in its purest form, the one we imagine it to be as children; simple, romantic, thrilling, musical, busy, and ultimately, tragic. He was peace itself, embodying the quiet moments when the world seems to stand still. With him, I remember the world standing still. He was Nature in the calm of a summer morning, where the golden sun of Cairo, fiery yet steady, lingers and the air is warm, maybe a little vexing in its exhausting heat, but still, holding the promise of tomorrow without urgency or haste. He was the soft silence of winter mornings in Sharm El-Sheikh, where the sea is hushed, reflecting sunrays almost looking as though it is summer, but purely honest in its said season, cold undeceiving winds which are not exactly welcoming of summer swims, peaceful and true to how the world seems to pause in reflection. He was the steady rhythm of the seasons, a constant presence in a world that often feels unpredictable. Gido Asfour represented the moments when time slows down, the gentle sway of leaves in a light breeze, the serene reflection of the sky on a still sea, the quiet after a rainstorm. In every moment, Gido was a reminder of the beauty in stillness, the peace found in simplicity, yet in every season, in rain and in sun, he

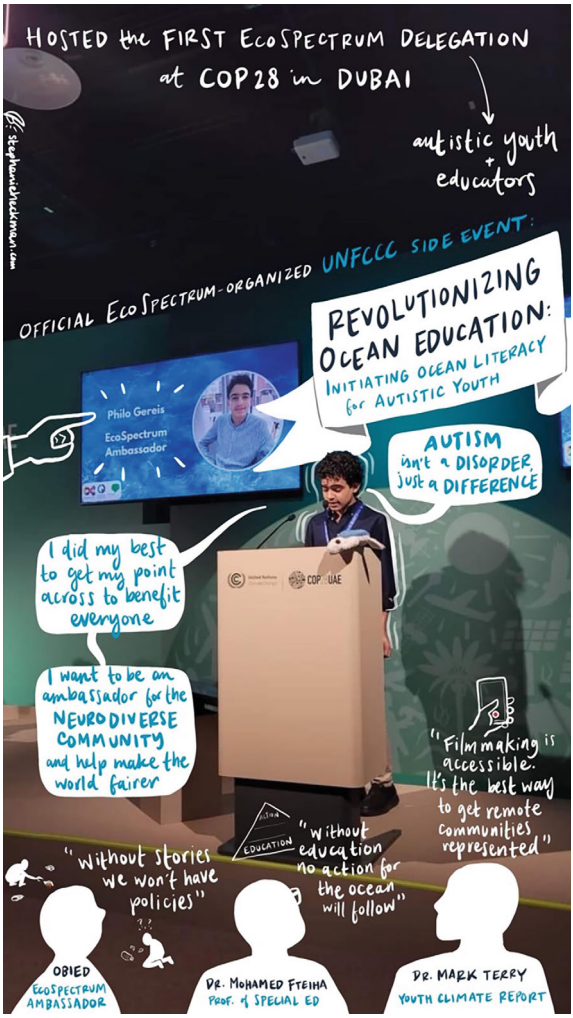

Fig. 5 Infographic by Stéphanie Heckman, 28th Conference of the Parties (COP28), 2024 (CC-BY-SA Compatible license)

was the intricate dance of life and the delicate balance of joy and sorrow, strength and vulnerability, growth and loss. His loss shook that stillness that I still eagerly search for in our shared love for the seas, flowers, skies, and the Nile.

In an attempt to find stillness after Gido, I embarked on a journey through pathways of one of the most beautiful areas of Cairo and one that I share my fondest memories with him in, Zamalek. I eventually stumbled upon Al Qursaya Island, a point on Google maps of which I was curious to learn about. Though almost unknown to my family members who peculiarly could not pinpoint its whereabouts, I ultimately found myself in an isolated island on the Nile, almost entirely segregated from the frantically busy mainland of Cairo. My serendipitous encounter with the hospitable community of Qursaya, composed of local fishermen who lost their livelihoods to the intensified plastic pollution of the Nile, and local women who create handmade crafts to compensate for the loss of income due to the declining health of the Nile, marked the birth of the Asfour Initiative—a project aimed at elevating the voices of those who face struggles, concerns, and frustrations and possess an unwavering love for the Nile, Egypt's vital source of water and life.[14] In collaboration with the local community of Qursaya, we create what I like to call Marine Dolls—handcrafted dolls shaped like underwater animals and stuffed with plastic collected by local fishermen from the Nile. This initiative helps to alleviate the financial burden on the fishermen, shifting their focus from fishing amid declining fish stocks to "fishing" plastic that we repurpose as stuffing for our dolls while utilizing the skills of the women of the Nile in crocheting. Our dolls, which carry the heartfelt narratives of Egypt's most vulnerable communities as attached cards with stories of the handcrafters from the Nile, are distributed beyond Egypt's borders and sold internationally, effectively conveying local stories from the Nile to a global audience and shared at international climate forums. All profits generated from these sales are reinvested in the island, supporting the livelihoods of coastal communities that grapple with insufficient access to clean water and food, exacerbated by currency fluctuations and the depletion of marine biodiversity. Ultimately, Asfour Initiative's underlying principle is the transformation of plastic waste into educational tools

[14] Ministry of Planning and Economic Development of Egypt. "2021 Voluntary National Review Vision", 2021.

that shed light on the plight of local communities while raising awareness about Egypt's oceanic crisis and advocating for responsible plastic consumption and waste management.

Following the Asfour Initiative's presence at the 28th Conference of the Parties (COP28) in Dubai alongside the EcoSpectrum delegation, I resolved to address the knowledge gap concerning the ocean crisis in Egypt by localizing the spread of our ocean stories and education via developing formal educational content on the ocean specifically designed for and alongside Bedouin communities along the Red Sea. Importantly, this content will be created and led by Bedouin youth themselves. By centring local expertise and elevating those who are often sidelined in formal climate avenues, this approach empowers the community to take a leading role as educators, rather than remaining passive recipients of information. This strategy not only acknowledges but also amplifies the voices and knowledge of the local community, fostering a more inclusive and accessible educational opportunity for all. Such an opportunity was spearheaded via hosting a puppet show with crocheted marine dolls at the Habiba Eco Lodge, a serene and quiet community located on the south of Sinai's Red Sea coast. Though Nuweiba is often forgotten in its plastic-infused beaches, broken reefs, and remote location, Habiba makes it known that the Bedouin community is deeply rooted in the land, present with an unwavering love for the Red Sea and passion for acknowledging its Indigenous significance. The Asfour Initiative employed magnificent children from the Habiba Community's Learning Centre who were only 6–9 years of age, to play the show's characters: the Parrotfish, Mr. Whale, the Octopus, and the Sea Turtle. The characters of the show were the educators of topics on prominent human impacts on the Red Sea such as coral bleaching and the plastic crisis.

In engaging with the community in Nuweiba, it became clear that there is frustration with projects that, despite their intent to enhance financial gain, often suffer from inconsistency and a lack of focus on securing customers for their services or products. Many such initiatives prioritize upskilling without addressing the essential need for market access and sustainable income opportunities. In contrast, the Asfour Initiative operates on an order-first basis, where dolls are crafted only after an order is placed. Within the educational sphere of the Asfour Initiative spearheaded in Nuweiba's Habiba Community, topics such as coral bleaching and plastic pollution are directly relevant to the Bedouin community's livelihoods, health, and economic well-being. By hosting a

puppet show that presents these issues in a fun, accessible, yet scientifically grounded manner, supported by data and statistics, the Initiative effectively highlights the significance of these concerns. This approach not only engages an intergenerational audience but also equips them with the knowledge needed to communicate these issues to local governmental entities, thereby facilitating the implementation of potential solutions by those in power.

Though the puppet show was conducted a few days after the globally celebrated World Ocean Day, the event highlighted the celebration of the Ocean and how conscious conservation efforts should remain consistent all year long. To maximize audience engagement, the event was not fully filmed, but the performance and script were designed to last approximately 7 minutes. Due to the young age of the students and limited educational resources in the area, the children primarily relied on memorization rather than reading from scripts, where it was gathered that such an approach, though unintentional, helped them better grasp the content as they were forced to understand before memorizing the script rather than merely reading it. The performance was prepared over two days with the guidance of two teachers who led practice sessions. However, recognizing that this was a brief period for developing reading, memorization, and acting skills, it is noted that future performances of the Asfour puppet shows would benefit from a longer rehearsal period.

Before the show, the children enjoyed a one-hour swim at the Habiba Beach Lodge, indirectly promoting the "Blue Mind". Following the swim, the children gathered under the lodge where the puppet show took place behind a cotton cover representing the show set-up, and were welcomed by the founders of the Habiba Community, Maged El Said and Lorena Rancati. After the show, the children celebrated with a cake party and participated in a pencil-colouring session featuring ocean-themed artwork, providing an opportunity to reflect on the show's content while enjoying some fun and social interactions with each other.

Accessibility must be championed across diverse communities and abilities, affirming that everyone regardless of background deserves access to information about nature, the ocean, and our fundamental connection to the ecosystems surrounding us. The Asfour Initiative is not just about making knowledge accessible to neurodivergent youth; it reveals how expanding the concept of accessibility can open doors for all, including children in Bedouin communities in the heart of the Red Sea in Egypt.

I envision the Asfour Initiative as embodying the spirit of Asfour, a bird that symbolizes freedom, adaptability, and resilience. Like a bird that soars purposefully, the Asfour Initiative navigates the challenges faced by the communities along the Nile and the Red Sea by striving to bridge the awareness gap on Egypt's ocean and water crises. It transforms adversity into opportunity, turning plastic waste into something meaningful via utilizing existent materials and skills, just as a bird weaves a nest from the materials it finds. A bird's inherent flexibility reflects the initiative's commitment to making content truly accessible by adapting it to the diverse needs of the global community, uniting mankind as a whole and embracing nature's interconnectivity. Though the Asfour Initiative may not exactly champion stillness given the need for educational adaptability, I believe I found stillness in remembering that this Initiative is for Gido Asfour, for remembering his gentle spirit and enduring love for nature. I find peace in the constant knowing that his remembrance is shared across different communities in places like the Nile and the Red Sea which we both explored, loved, and call home. The Asfour Initiative became symbolic of home in a slightly different form (Fig. 6).

7 Illustrations Information

The infographic illustrations were provided by Stéphanie Heckman. Stéphanie Heckman, Dutch originally but based in Northern Ireland, works internationally as a graphic recorder and visual facilitator. In this capacity, she translates in real-time collective conversations into hand-drawn visual summaries that distil the essence of both content and undercurrent. Her artworks are both a live sensemaking tool and a tangible memory aide. Transcending language and accessibility barriers, they communicate key takeaways of complex discussions in an engaging, visual way to a much larger audience than those originally present.

Active since 2018, Stéphanie has worked with close to 200 organizations, but focuses on supporting those advancing climate action, peace, and reconciliation and leadership development. Since 2020, she collaborates regularly with UN Climate Change, visually summarizing mandated and informal events on topics ranging from collective progress towards the Paris Agreement goals, gender, Action for Climate Empowerment, systematic observations, and the Ocean. Her 2023 article in the New

Fig. 6 Infographic by Stéphanie Heckman, Asfour Initiative Puppet Show, Habiba Community, 2024 (CC-BY Compatible License)

England Journal of Public Policy explores this collaboration (S. Heckman, 2023).[15]

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CHAPTER 8

Activities for Ocean Literacy

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Abstract This chapter showcases over 20 examples of ocean literacy activities developed during the Ocean Incubator Network Living Laboratory and beyond (the Foraminifera Box contains more than six activities that can be downloaded freely). The authors of these activities include students, scientists, researchers, educators, linguists, legal scholars, and experts in accessibility. Each activity has been scrutinized through the

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educational and pedagogical lens of Marcelle Dabbah to ensure its efficacy and relevance. Both teachers and learners can find inspiration in these activities, which are available for download and can be tailored to meet specific learning objectives and classroom needs. Each activity is structured according to an outline developed by Laura Vita, and includes details such as the contributors, activity name, target audience, focus of the activity, learning objectives, and guidance or instructions.

Keywords Ocean literacy · Activities · Accessibility

1 ACTIVITY 1: The Self

Contributors Names:	Alba Hérnandez Anta, Ana Maria Montaña Monoga, Emily Margaret Murray, Sofie Elise Quist
Activity Name:	The Self
Target Audience:	All learners in both formal and informal education settings
Focus of Activity:	Positionality and connecting with the Ocean and its more-than-human communities.

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APorrone, Dr., University of Macerata, Italy.
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IAngeles, Department of Geosciences, UiT The Arctic University of Norway.
JZimmermann, Independent illustrator, based in Tromsø, Norway.
MPooladi, Master's in Business and Management, University of Turin.
SWasii Nyanda. Lead at Tanzania Ocean Climate Innovation Hub endorsed by the UN Ocean Decade.

Learning Objective: To be able to identify and gain a deeper understanding and awareness of the sounds and acoustics found within the Ocean and its communities to develop a sense of connection to the Ocean through sound and emotions

Materials

- Recycled drawing canvas (e.g. old cereal boxes, recycled paper, etc.)
- Colouring pencils, markers

Guidance:
Group size and time

- Group size can vary (10–15 people for the given time); it depends on space and amount of materials available
- 5–10 minutes for explanation
- 15–20 minutes for reflection and drawing exercise

Step 1: Explain to the group a background on positionality, using Chapter 3: *Positionality* as a key resource. Talk about the 5 different areas that help one to reflect on positionality: lived experiences, where you live(d), worldviews, privilege, and intersectionality. Ask some questions to encourage participants to begin reflecting about their own positionality and how they relate to the Ocean.

"What is the first thing that comes to your mind when you think of the Ocean?"

"What is the emotion that best represents the Ocean when you think about it?"

"Have you lived near the Ocean? Have you lived very far away from the Ocean?"

"What identities do you align with and how did you come to these identities?"

"How do your identities intersect and influence each other?"

"What role has the Ocean played in shaping my identities? How have my identities shaped how I relate to the Ocean?"
Step 2: Each person starts drawing their answers to the reflective questions for 20–30 min.
Step 3: Once the given time has finished, the drawings can be displayed to the group, either on the wall or in the middle of a circle. Participants are invited (but also given the option to refuse) to explain and show to the others what their drawing represents. What's the meaning behind that drawing? Why did they choose those materials or colours, etc.
Step 4: The facilitator asks the participants to choose a name for their portraits.

Debrief
Once each participant has finished its drawing, presenting to each other, and chosen a title, the activity could lead to exploring the following debrief question:

"In which ways you believe that your representation differs from the others, what are the main characteristics that compound your position to the ocean?"

2 ACTIVITY 2: How Do We Know the Ocean?

Contributors Names:	Alba Hérnandez Anta, Ana Maria Montaña Monoga, Emily Margaret Murray, Sofie Elise Quist
Activity Name:	How do we know the Ocean?
Target Audience:	All learners in both formal and informal education settings
Focus of Activity:	Positionality and connecting with ourselves and the Ocean
Learning Objective:	Use senses, such as sound and touch, to explore our positionality to better understand how we connect to the Ocean (or related water body or earth process)

Materials Needed:
In preparation for the activity, the facilitator will request that each participant brings an object or sound that holds meaning in relation to the Ocean. For example, a participant might bring in a seashell from a beach

they once visited; anything that represents a memory or an experience related to the Ocean. Participants can bring in photos or video clips, or maybe a movie that makes them feel connected to the Ocean. The facilitator is also encouraged to bring their own object.

Guidance (instructions):
Group size and time

- 10 participants (if the group is larger, split into smaller groups)
- Suggested time: 30–45 minutes

Instructions
Step 1: Organize the group into a circle so that all participants face each other and ensure that everyone has with them an object/sound that connects them to the Ocean.
Step 2: As the facilitator, describe how your object/sound reminds you of the Ocean/water and how it represents your connection with it. After sharing your connection story, pass the object around the circle so that all participants have the chance to hold, feel, and look at the object. If the connection is a sound, play the audio clip on a laptop, radio, or any available device.
Step 3: Participants take turns explaining how their object or sound connects them to the Ocean. While each participant is explaining, the group members will continue to pass around the object or listen to the sound.

Debrief
Once each participant has shared their object/sound, a final consideration from the facilitator should focus on the many ways we can find a connection to the Ocean.

"Was it easy to find an object/sound at home that reminded you of your connection to the Ocean/a body of water?"

"Prior to listening to the other participants share their physical connection to the Ocean, did any of the objects surprise you? Which ones?"

"After listening to everyone's connection story, were there any examples of an object/sound that didn't come directly from the Ocean?"

3 ACTIVITY 3: How Does the Ocean Speak?

Contributors Names:	Alba Hérnandez Anta, Ana Maria Montaña Monoga, Emily Margaret Murray, Sofie Elise Quist
Activity Name:	How does the Ocean speak?
Target Audience:	All learners in both formal and informal education settings
Focus of Activity:	Positionality and connecting with the Ocean and its more-than-human communities.
Learning Objective:	To be able to identify and gain a deeper understanding and awareness of the sounds and acoustics found within the Ocean and its communities to develop a sense of connection to the Ocean through sound and emotions

Materials Needed:

- Laptop or tablet
- Audio system
- Quiet, calm space
- Collection of environmental Ocean sounds (suggested links: Sounds in the Ocean and Discovery of Sound in the Sea)

Guidance:
Group size and time

- Group size can vary; depends on space and amount of time for listening and reflection
- Suggested time: 10–15 minutes.

Instructions
Step 1: Organize the group into a circle, asking them to find a comfortable position and to close their eyes.
Step 2: Ask the participants to close their eyes, if they are comfortable to do so, and to listen to the first sound. Refrain from telling the participants

the source of the sound to encourage them to listen and figure out what the sounds might represent.
Step 3: Play the recording of one environmental sound in the Ocean (e.g. Earthquake). Play again.
Step 4: The facilitator asks the group to open their eyes and to guess the source of the sound. If the group is having a difficult time interpreting the sound, play again and offer a hint such as "You might hear this sound when you feel a rumble under your feet".
Step 5: After the group has had time to reflect, play the next environmental Ocean sound (e.g. Ice Calving), repeating steps 3 and 4 until the participants have experienced several environmental (otherwise natural) Ocean sounds.

Debrief
To finish this activity, the facilitator can ask the following reflection questions to highlight that there is a whole environment under the water that we cannot always see and hear.

"Were any of the sounds familiar to you? If so, where were you when you heard them naturally occurring?"

"When you heard these ocean sounds, did it help you to feel more connected to the Ocean?"

4 ACTIVITY 4: How Does the Ocean Know Us?

Contributors Names:	Alba Hernandez Anta, Ana Maria Montaña Monoga, Emily Margaret Murray, Sofie Elise Quist
Activity Name:	How does the Ocean know us?
Target Audience:	All learners in both formal and informal education settings
Focus of Activity:	Positionality and reflexivity on how the Ocean knows us
Learning Objective:	To be able to identify the anthropogenic sounds that affect the marine environment and realize human impact on ocean health and reflect on how human activity influences the well-being and health of sea critters

Materials Needed:

- Laptop or tablet
- Audio system
- Quiet, calm space
- Collection of environmental Ocean sounds

Guidance:

Introduction

In recent decades, the impact of human activity on the environment has become alarmingly obvious with rising temperatures, intensifying storms and forest fires, and changing precipitation patterns. The Ocean is not always at the centre of climate change mitigation and adaptation conversations and initiatives, yet the Ocean is one of the most important systems for maintaining balance among all of Earth's ecosystems. The anthropogenic (human-related) activities that are having negative consequences for the Ocean include overfishing and unsustainable marine practices, oil spills, plastic pollution, and chemical waste, among many others.

From the perspective of positionality and how we relate to the Ocean, it can be helpful to think about how the Ocean relates to humans. This activity focuses on anthropogenic ocean-related sounds to better understand how the Ocean and its creatures experience human life above and below water. The aim is to evoke feelings and emotions to increase a sense of compassion and empathy for the Ocean, and to conceptualize the Ocean as "home" to many different creatures who are impacted every day by the choices made by humankind.

Group size and time

- Group size can vary; depends on space and amount of time for listening and reflection
- Suggested time: 10–15 minutes.

Instructions

Step 1: Organize the group into a circle, asking them to find a comfortable position and to close their eyes.

Step 2: Ask the participants to close their eyes, if they are comfortable to do so, and to listen to the first sound. Refrain from telling the participants

the source of the sound to encourage them to listen and figure out what the sounds might represent.
Step 3: Play the recording of one anthropogenic sound in the Ocean (e.g. Large Vessel). Play again.
Step 4: The facilitator asks the group to open their eyes and to guess the source of the sound. If the group is having a difficult time interpreting the sound, play again and offer a hint such as "You might hear this sound when swimming underneath it".
Step 5: After the group has had time to reflect, play the next anthropogenic Ocean sound (e.g. Pile Driving—Offshore Wind Energy Construction), repeating steps 3 and 4 until the participants have experienced several anthropogenic (otherwise natural) Ocean sounds.

Debrief
To finish this activity, the facilitator can ask the following reflection questions to initiate a conversation about life under water and the ways in which human activity is impacting the quality of life of marine ecosystems and its creatures.

"When there is, for example, construction noise close to your house and it bothers you. Then, how do you think the anthropogenic sounds affect the life of sea creatures?"

"On a scorching summer day, you feel exhausted and dehydrated from the heat. With the Ocean temperature rising due to human impact, how do you think cold water animals feel if they have to migrate?"

"Imagine aliens come and steal natural resources from the ground causing a global crisis. Don't you think we are doing the same with overfishing and marine pollution which is affecting the marine ecosystem and its food webs?"

5 ACTIVITY 5: The More-Than-Human Ocean: A Systems Game

Contributors Names:	Alba Hernandez Anta, Ana Maria Montaña Monoga, Emily Margaret Murray, Sofie Elise Quist
Activity Name:	The More-than-Human Ocean: A Systems Game
Focus of Activity:	Positionality and connecting with the more-than-human Ocean

Target Audience:	All learners in both formal and informal education settings
Learning Objective:	Identify the interconnectedness between the Ocean and human society through a systems thinking approach to demonstrate how the Ocean, marine life, earth system processes, human culture and institutions such as law and policy connect to and influence each other

Materials Needed:

- List of system actors (see below or make your own)
- Two large balls of yarn or other durable string that unravels easily.
- Flip chart
- Index cards or similar to create name tags
- Coloured markers
- Tape
- Good space to move. The group should be able to stand shoulder to shoulder in a circle. For larger groups, space for observers is ideal.

Guidance:

Introduction

How we think about ocean connectivity and our own place in the web of life matters. There can be a tendency to think about our relationship with the Ocean, and consequently our actions, in isolation. It is, after all, easier to look at things from our own standpoint. However, doing so leads to fragmented solutions to pressing challenges such as climate change, biodiversity loss, or food insecurity. When we fail to see the whole, interconnected web of multiple human relationships with the Ocean, and when we fail to be aware of *how* we see those connections, some ways of knowing the Ocean are also privileged above others. Do we know the Ocean? How? … What is the Ocean? A carbon sink? A source of food? A source of wealth? A means of transport? Home? An entity with rights of its own? How are human actions affecting the Ocean? How does the changing Ocean affect different communities?

This activity is adapted from the systems game Web of Life and explores more-than-human Ocean connectivity. Using movement and dialogue,

the game aims to demonstrate how the Ocean, marine life, earth system processes, human culture, and institutions such as law and policy are interconnected. The game is designed to follow on from the other activities in the positionality tool kit that explore the "self" and the "Ocean". However, the game also works on its own or in conjunction with activities in this publication.

Group size and time

- 6–15 people
- 15–30 minutes

Instructions

Step 1: Organize the group into a circle and give the ball of yarn to someone.

Step 2: When the group is standing in a circle, discuss the complex ocean issue that you want to make visible during the game. For example, you might want to explore Ocean Literacy—"we are the Ocean, the Ocean is us"—by highlighting participants' different relationships with the Ocean. Alternatively, the group might want to think about the impact of climate change on marine food webs and human food security, the effects of different forms of pollution on the marine environment, or other issues depending on the group.

The game will help bring to the surface existing knowledge within the group about the interconnections and dynamics inherent to the chosen topic.

Step 3: Once you have discussed the system you are going to address (Ocean Literacy, ocean, and climate change…), you can either introduce the predetermined actors from the list below or brainstorm your own with the group. Write out the actors (or variables) on the flip chart one by one and note each of them on a name tag. The number of actors should correspond to the number of participants in the group. Once you have your list, assign each participant an actor, making sure they display the name tag so everyone can see it.

Step 4: The person holding the yarn names their actor. E.g. "fish stocks".

Step 5: Another person in the circle then names their actor or variable and explains how it is connected to the person holding the yarn. Once they have done so, the ball of yarn is passed to them. The first person holds on to the end of the yarn so that a string is formed between them. For

example, the second person might say "food security" and explain that their food traditions are based on seafood.

Now another person names their actor or variable and the ball of yarn is passed to them. For instance, person three might be "ocean warming" and explain that when fish stocks move due to warming oceans, traditional food and food security ways are threatened. Continuing the sequence, person four might be a legal or policy instrument that protects the human right to food or climate change.

Step 6: The group continues identifying how their actors or variables are connected using the yarn to create lines between them that will eventually form a web. Once the initial variables/actors are all used, the group may come up with additional ones (i.e. each person can have more than one actor/variable). Once an interconnected web emerges, ask: "Have you captured the most important relationships?" The group then places the web on the floor, making sure it stays intact and takes a step back.

Debrief

Once each participant has had the opportunity to hold the ball of yarn and share with the group how their actor/variable is affected by or affects another actor/variable in the ocean ecosystem, the resulting interconnected web of yarn can be used to explore the following debrief questions.

"How did anthropocentric (human-related) activities impact life below the water?"

"Were there any connections that you did not already know? Was there anything that surprised you? Why?"

"Was it difficult to find connections between life below water and life on land?"

Suggested list of actors/variables for exploring Ocean Literacy and ocean connectivity

In order to motivate the facilitator, we have included possible actors and variables related to Ocean Literacy that can be used for this activity. However, we encourage groups to come up with their own actors and connections before and/or during the activity, to create a unique web of ocean connections that is more relatable to the participants involved. One of the main objectives of the Ocean Literacy activities found throughout this book is to encourage co-learning and co-creating knowledge, sharing with each other how we come to know the Ocean through our lived experiences.

Creatures:

- Phytoplankton
- Fish
- Shark
- Killer Whale
- Coral
- Mussels

Anthropocentric actors/variables:

- Fishing vessel
- Increased carbon emissions
- Oil spill
- Plastic pollution
- Sea level rise
- Coastal erosion
- Ocean acidification
- Overfishing
- Food security

Examples of Interconnected Ocean Systems (Figs. 1 and 2).

6 ACTIVITY 6: Ocean Literacy Investigation

Contributor:	Juliana Hayden
Activity Name:	Ocean Literacy Investigation
Target Audience:	Secondary School Pupils (age 14 & 15)
Focus of Activity:	Student lead investigations, creative thinking
Learning Objective:	This learning activity integrates investigative elements via phenomenon-based learning to interest and resonate with this target group. Students will exercise their problem-analysis, creative thinking, and inquiry skills.

Materials Needed:

- Video Clip of a natural phenomenon occurring in the ocean

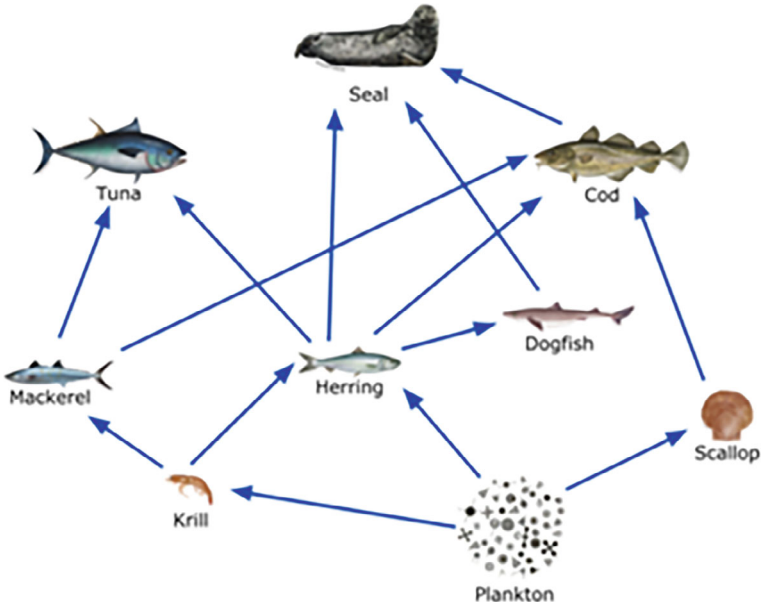


Fig. 1 Food Web Diagram for the Gulf of Maine Habitat (*Original source* Ocean Food Webs Module [https://oceanservice.noaa.gov/education/marine-ecosystem-modeling-vr/ocean-food-webs/activity-4.html])

- Area for students to gather and co-work
- Individual writing implements or computers for students to brainstorm
- Persona Cards (for an example of persona cards, please refer to Chapter 4, section 4.3 of this book)

Guidance:
In a classroom setting, participating students will be shown a dynamic short video clip (under 10 minutes) of a natural phenomenon taking place in the Arctic Ocean. The learners will then be divided into breakout groups to explore the Arctic Ocean phenomenon using self-directed learning. Each breakout group is to explore the clip from a different "persona". Each of the breakout groups' personas will represent key stakeholders in ocean literacy and governance in an Arctic setting. Five persona cards will be handed out to the class, with each breakout group receiving

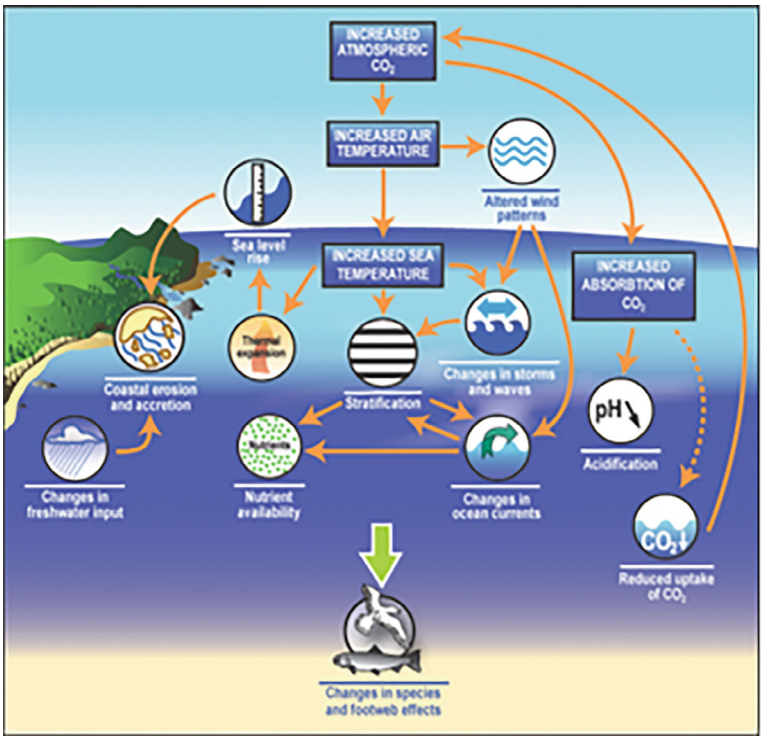


Fig. 2 Diagram depicting the effects of increased atmospheric carbon dioxide on global oceans including Oregon's coastal and nearshore environments and the species that live there (*Original source* Oregon Conservations Strategy [https://www.oregonconservationstrategy.org/oregon-nearshore-strategy/factors-stressors-affecting-species-and-habitat/])

one persona card. For example, one breakout group may represent the persona of a local fisher. Through the lens of their respective personas, the breakout groups will then undertake an investigation of the video answering "*what, where, when, why, and how*" the phenomenon depicted in the video may have come to be. The breakout groups will address those questions from a different lens relevant to OL. Each breakout group will then present the findings of their persona's investigation to the entire class. Following all the groups' presentations, the breakout groups will then work together to revise and integrate their answers to co-create a

final, comprehensive interdisciplinary analysis pieced together from their breakout groups' investigations. This final analysis may be presented in a format as per wishes of the teacher and the students.

Examples of Breakout Group Personas:

Persona 1: Subsistence/small-scale fisher from a coastal Arctic community.

Persona 2: Central government representative, such as an official from a Ministry of Environment. This persona is a bureaucrat who implements national-level marine and coastal policies.

Persona 3: Marine biologist, who has had lab and fieldwork experience.

Persona 4: Whale, the inclusion of a non-human perspective is intended to represent the OL principle of protecting life below water.

Persona 5: Legal researcher in international law, such as a subject matter expert in law of the sea.

7 ACTIVITY 7: Ocean Literacy, Ecolinguistics & a Critical Lens

Contributors:	Olena Peftieva (adapted and edited by Laura Vita)
Activity Name:	Ocean Literacy, Ecolinguistics & A Critical Lens
Target Audience:	Bachelor-level Students (preferably from many different academic disciplines)
Learning Objectives:	This activity aims to foster a deep understanding of marine issues, identify biases, integrate interdisciplinary knowledge, promote critical thinking, and empower advocacy. By scrutinizing the sources and evidence presented in documents, we can assess the credibility and reliability of the information. Critical reading and appraisal are essential skills for distinguishing between scientifically sound data and misinformation. Developing these skills is imperative for creating a more informed and engaged society that effectively addresses our oceans' challenges.

Materials Needed: A public access document related to ocean protection or water governance—paper copy of the document, pens/pencils, and highlighters.

*For contextual applicability, having the document from the region/province/state/country where this activity is being run is best. For example, if you were running this activity in Canada, you could choose to critically read Canada's Oceans Protection Plan.

*The activity can be completed digitally by having an online version of the document, and participants can type notes and highlight the document on their computer/tablet/phone.

Guidance:

1. Gather the students and provide them with a copy of the document you are reviewing. Instruct the students to read through the document to familiarize themselves with its content, and allow them time to review and consider it from their perspective. They are encouraged to take notes or comment on their document copy.
2. Once the students have completed their reading time, reorient them and commence a short discussion, with students sharing their initial impressions of the text and its contents.
3. Complete a short review of essential linguistic and critical reading elements to be aware of while reading the document.
4. Have students re-read the document using the elements they just reviewed as a reminder to apply a critical lens to what they are reading. Again, encourage them to make notes on their copy of the document to aid them in the next discussion.
5. Re-orient students once they have completed the second reading and commence a discussion of their new findings and thoughts on the document. Encourage each student to share their perspective so that a variety of information is shared, and encourage them to identify any underlying biases or assumptions they may have brought to the text based on their educational background.
6. Have the students share their results in smaller groups, then try to develop a short summary, re-writing the text and applying a co-created and collaborative approach.

8 ACTIVITY 8: The Blue Mind Exercise

Contributor:	Dana Ahmed
Target Audience:	All ages (this exercise was applied in classrooms with 5- to 12-year-old students)
Focus of Activity:	Engage in a mindfulness exercise to increase awareness of and explore our emotional connection to the ocean
Learning Objective:	Emotional regulation skills, increasing connection between nature and emotional states
Materials Needed:	Ocean sounds either from an online source or, if you are able to do so, conduct this activity at the seaside
Guidance:	This activity is an excellent tool to use to help students prepare themselves for learning. It is meant to instil feelings of peace and grounding prior to students moving on to other learning materials. As previously mentioned, this activity was also used to facilitate the transition of students from their break time back to class time. The facilitator can first introduce the concept of Blue Mind Theory, exploring our emotional connection to the ocean. Distinguishing and defining the Blue Mind, a state of calm and mindfulness associated with water. To help students internalize this concept, have them sit or stand in a position that they are comfortable in, and instruct them to start by taking a big deep breath followed by a relaxed exhale. Inform them that you will be playing Ocean sounds for a set duration of time and that they are to close their eyes and focus on the sounds. Finally, play the video and enjoy! It is at the facilitator's discretion the duration of time that students will meditate on the ocean soundscape; it is also up to the facilitator to choose an ocean soundscape; however, we advise using an audio file with calming natural ocean sounds.

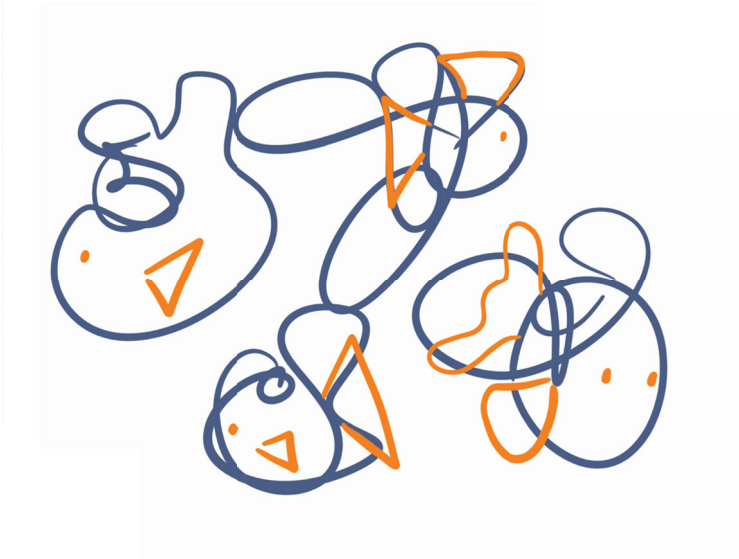
9 ACTIVITY 9: Squiggle Fish

Contributor Name:	Stéphanie Heckman, Graphic Recorder & Visual Facilitator
Activity Name:	Squiggle Fish
Target Audience:	Any age group interested in communicating their messages in a visual way (e.g. school children, students, scientists, policymakers, public engagement officers, community activists, etc.)
Focus of Activity:	Warm-up exercise to start drawing and "level the playing field" of visualizing our message in a simple and effective way.
Learning Objective:	Visual thinking is not about art, it's about communication. We do not need to be Fine Artists to communicate our message effectively. Humans are great at pattern recognition and will recognize what you're aiming to visualize even in simple drawing or pictograms.
Materials Needed:	Some blank sheets of paper or notebooks, two colours pens/pencils/markers (for example a grey pencil and blue pen work fine for this exercise)

Guidance to complete activity:

- Give all participants a sheet of paper and two colours of pencil/pen/marker. After giving a rationale/background/examples of visual communication, explain to them this is a warm-up exercise to get them visualizing their own message themselves.
- Tell them to make random "squiggles" on their page; making random shapes in a continuous line drawing for 10 seconds, filling the page without lifting the pen. Count them down out loud for 10 seconds.
- Now explain that they get 1 minute to "find" as many fish as they can in their squiggles, and make them visible by giving them a tail, a fin, and an eye, simply by adding two triangles and a dot, respectively. They can get creative and make more elaborate tails, fins or eyes if they want, but the aim is to turn as many squiggles as they can into fish within 1 minute.

– They can either find the squiggle fish on their own sheet of paper, or you can let them swap sheets with a neighbour to make this exercise a preamble to a "co-creative approach".
– Ask them to hold up their paper with squiggle fish when they're done, and reiterate the learning objective that you don't need much to make fish recognizable as fish, or any object or concept you want to draw.



10 ACTIVITY 10: Drawing in Basic Shapes

Contributor: Stéphanie Heckman, Graphic Recorder & Visual Facilitator

Activity Name: Drawing in Basic Shapes

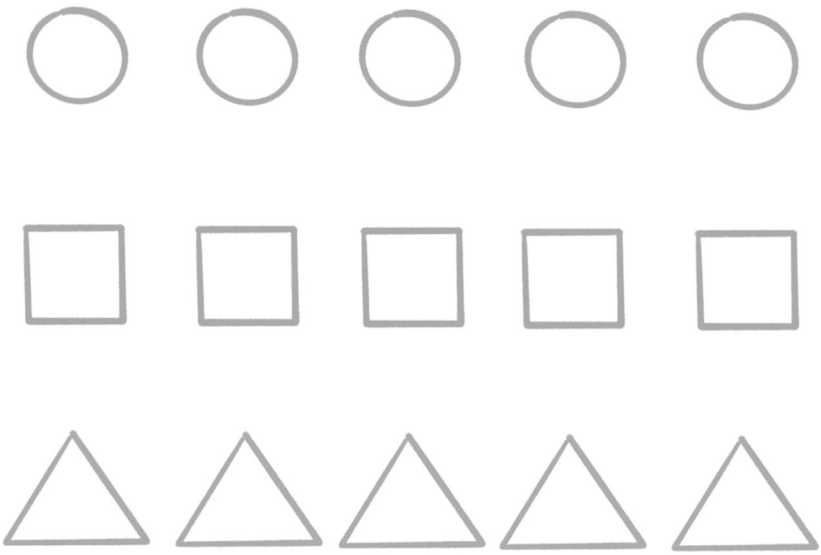
Target Audience: Any age group interested in communicating their messages in a visual way (e.g. school children, students, scientists, policymakers, public engagement officers, community activists, etc.)

Focus of Activity:	Equipping participants with a simple, accessible way to draw icons that depict objects and concepts to visualize their work/message.
Learning Objective:	A simple way to draw any object or concept they can think of, using the basic shapes of circle, triangle, square to "constructing" their icons.
Materials Needed:	Some blank sheets of paper or notebooks, two colours pens/pencils/markers (a light colour and a darker colour, for example a grey pencil and black marker or felt-tip pen)
Guidance:	Humans are hardwired to process visual information. It is estimated that 80% of our sensory input is visual (excepting those with a visual impairment). This explains why people are drawn to pictures and illustrations, and why these are so effective in communicating even complex ideas/concepts/instructions. Imagine assembling IKEA furniture with no pictures in the manual! In this exercise you will learn a simple method for visualizing objects and concepts that is accessible to everyone, regardless of artistic skill or background.

- Ask participants if they can think of the three basic shapes. They will get them all very quickly. Circle, triangle, square.
- Tell them orient their page horizontally and draw on it, with their light coloured pen (e.g. a grey pencil), a row of 5 circles, a row of 5 triangles underneath, and finally a row of 5 squares at the bottom of their page.
- Now tell them to switch to their darker pen (e.g. a black marker) give them 2 minutes to turn as many of these shapes into objects or concepts relating to their work or message they want to communicate. Objects are physical things; for example an apple, traffic sign or laptop (you can easily turn a circle, triangle, square into these respectively). Concepts are abstract, but can be still be visualized by things we can see. For example, the planet Earth can symbolize

environmental protection, a mountain top can represent challenge, and an outstretched hand can represent cooperation (again, a circle, triangle, square can be used as basic shapes for these respectively).

– They can either completely freestyle what icons they draw, or you can ask them to make them relevant to a particular topic. You can even give a list of objects/concepts for them to draw in basic shapes. Basic shapes can be combined to form more complex icons—for example, a house is a square with a triangle on top, a tree is a rectangle with a circle or triangle on top.
– To make this exercise co-creative, ask participants to exchange their sheet with a neighbour when they're done. Then ask them to "annotate" the icons their neighbour has drawn, i.e. to write beside each icon what it represents. This can be literal or symbolic. For example, beside an apple, traffic sign or laptop you could write just that, their literal description, or a symbolical interpretation, e.g. "nutrition", "danger", and "digital access" respectively. Debrief from this part of the exercise, explaining that visuals are powerful tools to illustrate messages, but if they stand on their own they are too open to interpretation. Language and imagery aren't competing; they complement each other.



11 ACTIVITY II: BECOMING THE OCEAN

Contributor:	Arianna Porrone; Original by Arianna Porrone, University of Macerata & Hatha Vinyasa Teacher (adapted to a marine-related activity by Laura Vita)
Activity Name:	Becoming the Ocean
Target Audience:	Primary School Children
Focus of Activity:	Movement of the body and increasing awareness of the Ocean by emulating its movements
Learning Objective:	Begin to establish a creative connection with the ocean, increasing awareness and engaging in environmental empathy.
Materials Needed:	Indoor or outdoor space where participants can move their bodies freely

Guidance:
Allow students/participants to spread out in an open space for comfortable movement. Explain that the students are going to experiment with becoming the Ocean, which is a very important part of our planet, it sustains many different life forms, and it is deeply connected to our climate.

Guide Students using the following prompts, and at each step, encourage them to improvise and explore how they want to move their bodies.

- First, we will connect to our bodies by pausing and taking a few deep breaths. Then, we will think of the Ocean and all its different movements.
- Second, we are going to start moving our arms gently, like the ocean on a calm day.
- Third, we are going to add our legs to our movement, gently moving them like the ocean on a calm day.
- Fourth, we are going to move our whole bodies as if we are the ocean on a calm day.
- Repeat the second, third, and fourth steps with various prompts such as "Move like the ocean on a stormy day", "move like the ocean when there is a title wave", "move like the ocean underneath a big iceberg", and "move like the ocean as the tide comes in/the tide goes out". Feel free to have your examples be specific to the context of your group.
- Fifth, when your group has completed all the prompts you have prepared, have the students sit together and facilitate a short discussion about their experience. Some sample discussion questions are: What did they think about when they moved like the ocean? How did they feel about becoming the ocean? What things (man-made or environmental) do they think would impact the Ocean?

12 ACTIVITY 12: Discovering the Wonders of Seaweed from Ecosystem to Innovation

Contributor: Shamim Wasii Nyanda. Lead at Tanzania Ocean Climate Innovation Hub endorsed by the UN Ocean Decade.

Activity Name:	Discovering the Wonders of Seaweed from Ecosystem to Innovation.
Target Audience:	University Students
Focus of Activity:	Understanding the role of seaweed in marine ecosystems and how it contributes to coastal resilience, livelihoods, and climate change mitigation through sustainable Ocean farming practices.

Learning Objective:

- To educate students about the importance of seaweed in maintaining marine biodiversity.
- To explore how seaweed farming contributes to coastal community livelihoods.
- To introduce innovative uses of seaweed, from food to cosmetics, emphasizing sustainability and conservation.

Materials Needed:

- Visual aids or slides illustrating different types of seaweed and their benefits.
- Samples of seaweed or dried seaweed for hands-on observation.
- A video or photos showcasing seaweed farming practices from the hub's activities.
- A whiteboard and markers for student participation in discussions.

Guidance:

1. Introduction (10 minutes)
    - Begin by asking students if they've ever seen or eaten seaweed.
    - Explain what seaweed is and its critical role in marine ecosystems, emphasizing biodiversity, habitat creation, and nutrient cycling.
2. Learning through Observation (15 minutes)
    - Show samples of different types of seaweed (if available).

- Let students touch and examine the seaweed samples, explaining their unique textures, colours, and biological structures.
- Use visual aids to explain the process of photosynthesis in seaweed and its contribution to carbon sequestration.

3. Understanding Seaweed Farming (10 minutes)

- Play a short video or present images of seaweed farming from the Tanzania Ocean Climate Innovation Hub's seaweed farming activities.
- Discuss how seaweed farming is done, its role in supporting local communities, and how it helps mitigate climate change through carbon capture.

4. Interactive Activity (20 minutes)

- Split students into small groups and provide them with cards showing different uses of seaweed (e.g. food, cosmetics, fertilizers).
- Each group should brainstorm how they would use seaweed in their daily lives and how they think it contributes to sustainability.

5. Wrap-up Discussion (10 minutes)

- Ask the students to reflect on how seaweed impacts the environment and their own communities.
- Lead a discussion on how they can contribute to ocean conservation efforts and sustainable practices.

6. Optional Extension

- Students can create seaweed-based products or artwork inspired by the lesson and share their creations with the class.

13 ACTIVITY 13: Becoming an Ocean Advocate

Contributors:	Inspired by the work of the Student-led Project Group 4 (see Chapter 1 for additional information)
Activity Name:	Becoming an Ocean Advocate.
Target Audience:	Young Learners Aged 12–16y.o.

Focus of Activity:	Providing an engaging learning experience that allows children and teenagers to explore the lives of people who have made contributions to Ocean and environmental conservation.
Learning Objective:	Increase awareness of the work being done globally to progress in Ocean conservation and allow students to become inspired by the work of others.

Materials Needed:

- Access to written or online materials that highlight individuals who have worked to make impactful change in Ocean advocacy or more broadly in environmental advocacy
- Any available tools for students to use in a creative presentation (pens/pencils/colours/stationary/poster board/stickers), etc.

Guidance:
Provide access to written or online materials highlighting the work of notable Ocean/environmental advocates such as Dr Sylvia Earle, Oluwaseyi Moejoh, or Sir David Attenborough. As the facilitator, feel free to use ocean or environmental advocates that you think resonate best with your participants.

Aim to provide enough examples so that students can work in groups of 5 (approx.). Instruct students that they will be working in their groups to teach their peers about their assigned Ocean advocate through a short 5-minute presentation. Allow students time to research their Ocean advocate, learning about their work, what inspired them to become involved in advocacy, and why they think Ocean advocacy is important. Have the students brainstorm how they want to share their new-found information with their peers and encourage them to be creative! Depending on the setting for this activity and the needs of the students, the facilitator can adapt the timeline for the activity to suit their needs. They could have students work on this project for one day, breaking the day into research time, creative collaboration time, and presentation time, or allow students to return to this project and their working groups many times over the course of a week.

14 ACTIVITY 14: Foraminifera Activity Box

Contributors:	Giuliana Panieri, Inés Barrenechea Angeles, Jane Zimmermann
Activity Name:	Foraminifera Activity Box[1] ()
Target Audience:	Children and Teenagers
Focus of Activity:	Providing an engaging, hands-on learning experience that introduces children and teenagers to the fascinating world of foraminifera and its significance in marine science and environmental studies.
Learning Objective:	The Foraminifera Activity Box is an educational toolkit designed to be distributed to schools globally, enabling teachers to integrate engaging and informative activities about foraminifera into their curriculum. This box serves as a comprehensive resource to help students learn about these fascinating marine organisms, often used as indicators in scientific studies about marine environments and climate change.
Materials Needed:	The material needed for the different activities is provided in the box. What you will find in this box: (1) seafloor sediment; (2) paper microscope; (3) foraminifera as sea surface thermometer; (4) modelling clay instructions for Nina & Berry; (5) modelling clay; (6) 'Foraminifera Boogie Song' instructions; (7) 3D models of foraminifera; (8) Nina & Berry stickers; (9) Meet Nina & Berry—Foraminitales from the Ocean Pixie Book

Guidance:

- Activity 1: Exploring seafloor sediment

[1] The materials of this activity and the following can be downloaded freely: https://before-dinosaurs.com/foraminifera-activity-box/

Objective: To observe and identify within seafloor sediment.
Materials needed: Seafloor sediment, paper microscope.
Instructions:

1. Spread a thin layer of seafloor sediment on a white paper plate or a flat surface.
2. Use the paper microscope to closely examine the sediment.
3. Try to identify different foraminifera based on their shapes and textures. Refer to any additional resources provided in the box and also the 3D printed foraminifera shells.

- Activity 2: Foraminifera as sea surface thermometers

Objective: Learn how planktonic foraminifera census counts can be used to estimate (historical) sea surface temperatures.
Materials needed: Educational materials on foraminifera as sea surface thermometers, scissors.
Instructions:

1. Read through the provided educational materials as a class.
2. Discuss how some species are sensitive to temperature changes and how an assemblage of planktonic foraminifera can indicate (past) sea surface temperatures.
3. Engage in a Q&A session to reinforce understanding.

- Activity 3: Crafting Nina & Berry

Objective: To create models of foraminifera characters using modelling clay.
Materials needed: Modelling clay, modelling instructions for Nina & Berry.
Instructions:

1. Follow the step-by-step instructions to use the modelling clay to create figures of Nina & Berry.
2. Allow the models to dry if necessary.
3. Display the models in the classroom to facilitate discussion.

- Activity 4: Sing the Foraminifera Boogie Song

Objective: To engage students musically while learning about foraminifera.
Materials needed: Instructions for the "Foraminifera Boogie Song".
Instructions:

1. Distribute the song lyrics and play the tune if available.
2. Practice the song together, encouraging students to sing along and perform any accompanying actions.
3. Perform the song as a group, possibly at a school event or as part of a science day.

- Activity 5: 3D Foraminifera exploration

Objective: To study the structure and form of foraminifera using 3D models.
Materials Needed: 3D models of foraminifera.
Instructions:

1. Hand out the 3D models to students.
2. Discuss the unique features of each model and their biological significance.
3. Encourage students to sketch the models, noting key structural features.

- Activity 6: Story time with Nina & Berry

Objective: To learn about foraminifera through a narrative approach.
Materials needed: "Meet Nina & Berry – Foraminitales from the Ocean" Pixie Book.
Instructions:

1. Read the storybook aloud to the class or have students read in small groups.
2. Discuss the storyline and how it relates to the science of foraminifera.
3. Engage students in a creative writing activity where they write their own short stories featuring foraminifera.

- Activity 7: Decorating with Nina & Berry stickers

Objective: To personalize learning tools and reinforce character recognition.
Materials Needed: Nina & Berry stickers. Instructions:

1. Provide each student with a set of stickers.
2. Encourage students to decorate their notebooks, folders, or other personal items with the stickers.
3. Use the stickers as rewards for participation and achievement throughout the activities.

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M. P. Poto and L. Vita, *The Ocean Incubator Network Learning Toolkit*,
https://doi.org/10.1007/978-3-031-78062-2