Ocean and Society
2025 • Volume 2 • Article 9797
https://doi.org/10.17645/oas.9797

cogitatio

ARTICLE

Open Access Journal

Ocean Literacy for Ocean Sustainability: Reflections From Australia

Rachel Kelly [1,2,†], Prue Francis [3,†], Rebecca J. Shellock [4], Stefan Andrews [5], Benjamin Arthur [6], Charlotte A. Birkmanis [7,8,9], Harry Breidahl [10], Lucy Buxton [11], Jasmine Chambers [11], Emma Church [1,2], Corrine Condie [12], Freya Croft [13], Cátia Freitas [3], Shannon Hurley [14], Emily Jateff [15], Brianna Le Busque [1,16], Justin Marshall [17], Allyson O'Brien [18], Gretta T. Pecl [1,2], Laura Torre-Williams [19], Sophia Volzke [2], and Yolanda Waters [20]

[1] Centre for Marine Socioecology, University of Tasmania, Australia
[2] Institute for Marine and Antarctic Studies, University of Tasmania, Australia
[3] Deakin Marine Research and Innovation Centre, School of Life and Environmental Sciences, Deakin University, Australia
[4] Centre for Sustainable Development Reform, University of New South Wales, Australia
[5] Great Southern Reef Foundation, Australia
[6] Marine National Facility, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
[7] Max Planck Queensland Centre for the Materials Science of Extracellular Matrices, Queensland University of Technology, Australia
[8] UWA Oceans Institute, The University of Western Australia, Australia
[9] Blue Biome Foundation, Australia
[10] Australian Association for Environmental Education, Australia
[11] Ocean Decade Australia, Australia
[12] CSIRO Environment, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
[13] Australian Centre for Ocean Resources and Security, University of Wollongong, Australia
[14] The Salty Tribe, Australia
[15] Australian National Maritime Museum, Australia
[16] Uni SA STEM, University of South Australia, Australia
[17] Coral Watch, University of Queensland, Australia
[18] School of BioSciences, University of Melbourne, Australia
[19] Gold Coast Newborn Calf Study, Griffith University – Gold Coast, Australia
[20] Centre for Biodiversity and Conservation Science, School of Environment, University of Queensland, Australia

[†] These authors contributed equally to this work

Correspondence: Rebecca J. Shellock (r.shellock@unsw.edu.au)

Submitted: 17 December 2024 **Accepted:** 11 April 2024 **Published:** 5 June 2025

Issue: This article is part of the issue "Ocean Literacy as a Mechanism for Change Across and Beyond the UN Ocean Decade" edited by Emma McKinley (Cardiff University), Benedict McAteer (Queen's University Belfast), Berit Charlotte Kaae (University of Copenhagen), and Brice Trouillet (Nantes Université), fully open access at https://doi.org/10.17645/oas.i463

Abstract

Ensuring a sustainable future for the global ocean requires meaningful dialogue and engagement with society. Around the world, efforts to engage and collaborate with society increasingly emphasise ocean literacy as a potential tool for engaging and educating people on ocean issues. A conceptual measure of people's awareness, attitudes, and behaviours towards the ocean, ocean literacy has been highlighted as a key objective in recent ocean sustainability agreements and initiatives, including the UN Decade of Ocean Science for Sustainable Development. In Australia, research and applied interest in ocean literacy is burgeoning. It is therefore timely to take stock and explore recent work that may inform future pathways towards supporting and engaging society in achieving ocean sustainability. Here, we explore examples of ocean literacy research and practice in Australia, to develop prospective thinking on inter/transdisciplinary approaches for advancing ocean literacy under sustainability objectives. In doing so, we anticipate the next steps for progressing ocean literacy in the Australian context, including supporting ocean learning and education, engaging communities at all levels, fostering cross-sector collaboration on connecting people to the ocean, and building strong and actionable policy and funding frameworks to ensure long-term impact. We emphasise the need to collaboratively develop a national ocean literacy strategy to guide and structure these efforts and to establish an Australian ocean literacy coalition to facilitate research, cross-sector collaboration, and implementation in practice.

Keywords

Australia; marine education; marine policy; ocean literacy; ocean sustainability; transdisciplinarity

1. Introduction

Around the world, efforts to engage and collaborate with society increasingly emphasise the concept of ocean literacy as a potential mechanism for engaging and educating people on ocean issues. Ocean literacy reflects people's understanding of the ocean's influence on society and of society's influence on the ocean—and encapsulates people's connection with the ocean, including their awareness, attitudes, emotions, and behaviours (Fauville et al., 2018; Kelly et al., 2022; McKinley et al., 2023). Despite being a conceptual measure, ocean literacy is increasingly presented as a key component to engage and catalyse action in ocean sustainability agreements and frameworks, including the UN Decade of Ocean Science for Sustainable Development (e.g., UNESCO, 2021).

Ocean literacy has evolved from its roots in the education sector (Cava et al., 2005), to become an approach for engaging society in pro-ocean behaviours and actions (McKinley et al., 2023), a global movement (Glithero et al., 2024), and an interdisciplinary field of research (McRuer et al., 2024; Shellock et al., 2024). This evolution of ocean literacy as a concept and practice is expected to continue (Shellock et al., 2024), and it is timely to take stock and explore recent work that may inform future pathways towards engaging and enabling society to achieve ocean sustainability.

In Australia, research and applied interest in ocean literacy is burgeoning: including an expanding education community (Freitas et al., 2022); and a growing focus on ocean literacy research (e.g., Kelly et al., 2022; Shellock et al., 2024), ocean stewardship behaviours (Church et al., 2025; Turnbull et al., 2020, 2021), and policy. Inspired by global initiatives such as the UN Ocean Decade and the broader 2030 Agenda, Australia

has started incorporating ocean literacy into national strategies, emphasising its value towards achieving sustainable ocean management. For example, the draft Australian Sustainable Ocean Plan (Commonwealth of Australia, 2024) outlines a proposed national vision and priorities for managing ocean spaces and marine resources. As such, there is a need to bring relevant stakeholders and sectors together to identify pathways for this engagement and progress towards achieving ocean sustainability.

This perspective article aims to bring together diverse stakeholders to develop prospective thinking on collaborative goals and approaches for advancing ocean literacy under sustainability objectives in Australia. We present views and input from members of a growing Australian ocean literacy community, brought together at the 2024 Australian Marine Sciences Association (AMSA) Conference, held in Tasmania. Three authors (RK, PF, and RJS) chaired a symposium titled Ocean Literacy—Key for Future Ocean Sustainability? which invited input from research on ocean literacy and associated fields, including marine science engagement and education to share insights and approaches, and to critically reflect on ocean literacy theory and practice and its contribution to ocean sustainability. The symposium initiated a dialogue on a vision for ocean literacy in Australia, collated, developed, and presented here.

In this article, we identify current progress, anticipate the next steps, and outline the need for more collaborative and strategic efforts to evolve ocean literacy as a concept, movement, and community of research in the Australian context. We intend for this article to serve as a resource for a wide range of relevant stakeholders, including ocean literacy researchers, practitioners, and marine and environmental decision-makers in Australia and elsewhere. It is anticipated that our reflections will guide the development and implementation of ocean literacy initiatives and inform policy development (at state and federal levels) in the context of ocean sustainability (e.g., Australia's Sustainable Ocean Plan and the forthcoming Australian National Marine Science Plan).

1.1. Positionality

This perspective article brings together views and input from ocean literacy researchers and practitioners from across Australia but does not intend to be comprehensive or representative. We recognise that our own positioning might contribute to our interpretations, i.e., researchers are not separate from the social processes they study (Kaikkonen et al., 2024). As a group, we are reflexive on the ways in which our personal characteristics (e.g., gender, ethnicity, age, nationality, sexual orientation, immigration status, personal experiences, linguistic tradition, theoretical, political, and ideological stances) may shape these interpretations (Holmes, 2020). Hence, we seek to provide a positionality statement (Moon & Blackman, 2014; Secules et al., 2021).

We, the authors of this article, bring a wealth of expertise from across the natural and social sciences (e.g., marine science, social science, education, psychology, and conservation), and beyond the research sector too (including government and NGOs), to contribute to a shared vision of ocean literacy in the Australian context. We represent a variety of career points, though most of us are at early or mid-career stages. The three lead authors are all white and first trained in the natural sciences (marine science and biology) before progressing to interdisciplinary marine research including ocean literacy and related topics. RK and RJS are both European early-career researchers (RK is Irish, RJS is British) who reside in Australia. PF is a mid-career scientist who was born and resides in Australia.

2. Ocean Literacy in Australia

Australia has 13.86 million square kilometres of marine waters, in three of the world's four major oceans, and a coastline of more than 30.000 kilometres. These areas of ocean and coast are also known as Sea Country. Australia's ocean ecosystems are amongst the most iconic (e.g., the Great Barrier Reef, the world's largest coral reef system) and most biodiverse in the world, and are home to more than 33,000 recorded marine species (Trebilco et al., 2021). However, these ecosystems are threatened by human activities including overfishing and pollution (Laubenstein et al., 2023), and the impacts of climate change, e.g., marine heatwaves (Kajtar et al., 2021), and species on the move (Gervais et al., 2021). Further, Australia has the world's third-largest exclusive economic zone and the nation's rapidly growing blue economy contributes $118.5 billion and 462,000 jobs to the economy annually (Department of Climate Change, Energy, the Environment and Water, n.d.).

The majority of Australians (more than 87%) live within 50 kilometres of the coast, approximately 22 million people (Department of Climate Change, Energy, the Environment and Water, 2021). Australians interact with the coast and ocean through their recreation, employment, and cultural practices. Resultantly, strong social and cultural identities linked to the ocean are observed across the country (e.g., Gollan & Curley, 2023). Ocean literacy is touted as a potential catalyst for creating and strengthening these linkages between Australians and the ocean (e.g., Australia's Sustainable Ocean Plan).

2.1. Evolution

The evolution of ocean literacy in Australia reflects a gradual progression, with many initiatives embracing its principles (Figure 1; Cava et al., 2005) and dimensions (Figure 1; Brennan et al., 2019; McKinley et al., 2023) even before the term "ocean literacy" was formally recognised (see Figure 2, for timeline). While the concept gained momentum following the development of the education-focused ocean literacy principles in the US in the early 2000s (Figure 1; Cava et al., 2005), similar ideas were already embedded in Australian marine education and engagement efforts (e.g., Sea Week commenced in 1987; Figure 1). Awareness of the ocean literacy principles grew as Australian marine educators engaged with international networks, particularly through participation in the National Marine Educators Association conferences during the early to mid-2000s. By the 2010s, organisations such as the Marine Education Society of Australasia (MESA) and the AMSA played a pivotal role in promoting ocean literacy across education, research, and policymakers. Today, there are a variety of marine education programs which are underpinned by the concept and practice of ocean literacy—and the education dimension remains the predominant focus of many ocean literacy efforts.

In parallel to the evolution of more contemporary models of ocean literacy elsewhere, which emphasise an expanded and more nuanced approach to ocean literacy (Figure 1; McKinley et al., 2023), in Australia, there is also growing momentum in developing ocean literacy outside of education. For example, this is evidenced by an increasing number of Australian researchers investigating ocean literacy theory and practice (e.g., Arthur et al., 2021; Freitas et al., 2022; Gough, 2017; Kelly et al., 2022; O'Brien et al., 2023). These examples demonstrate the multi-dimensionality of ocean literacy and highlight the complexity of factors influencing human-ocean connections and ocean stewardship behaviours.

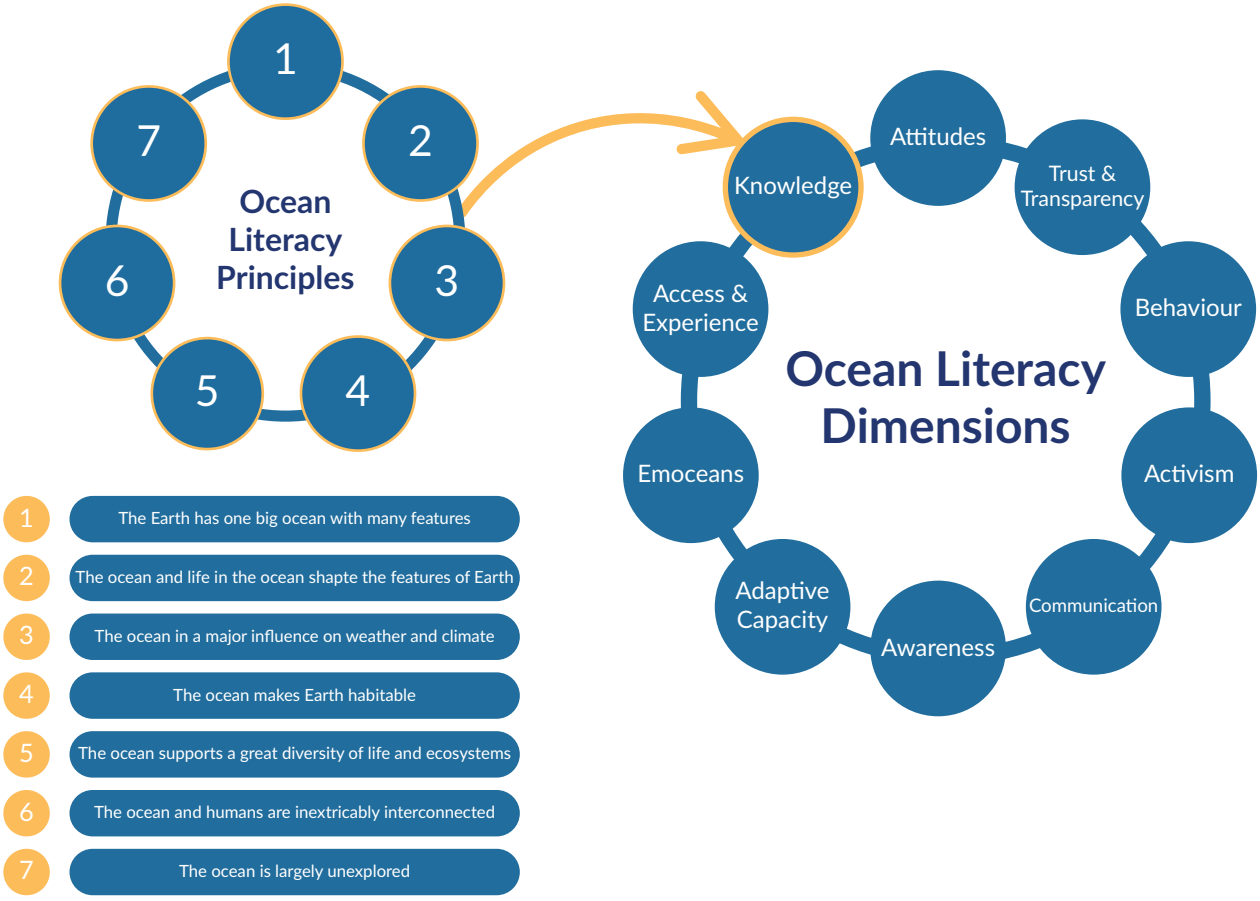


Figure 1. The evolution of ocean literacy frameworks, from 7 knowledge-focused principles (Cava et al., 2005) to 10 dimensions that demonstrate the multi-dimensionality of ocean literacy (Brennan et al., 2019; McKinley et al., 2023).

Increased recognition of ocean literacy has expanded beyond education and research, other sectors have also articulated a need for ocean literacy. For example, the 2023 Ocean Business Leaders' Summit, hosted by Ocean Decade Australia and attended by 257 ocean stakeholders (including First Nations, industry, government, and research), identified ocean literacy as a key enabler of sustainable ocean use through supporting policy and societal change (Ocean Decade Australia, 2023). Decision-making discourse in Australia has also highlighted ocean literacy as a key opportunity for collective national action (Figure 2). The federal government's draft Australian Sustainable Ocean Plan, due for implementation later in 2025, identifies ocean literacy as a catalyst for promoting informed decision-making. The Plan emphasises the importance of elevating ocean literacy through educational programs, resource development, addressing Australia's diverse marine interests, and expanding the blue economy (Commonwealth of Australia, 2024, p. 42).

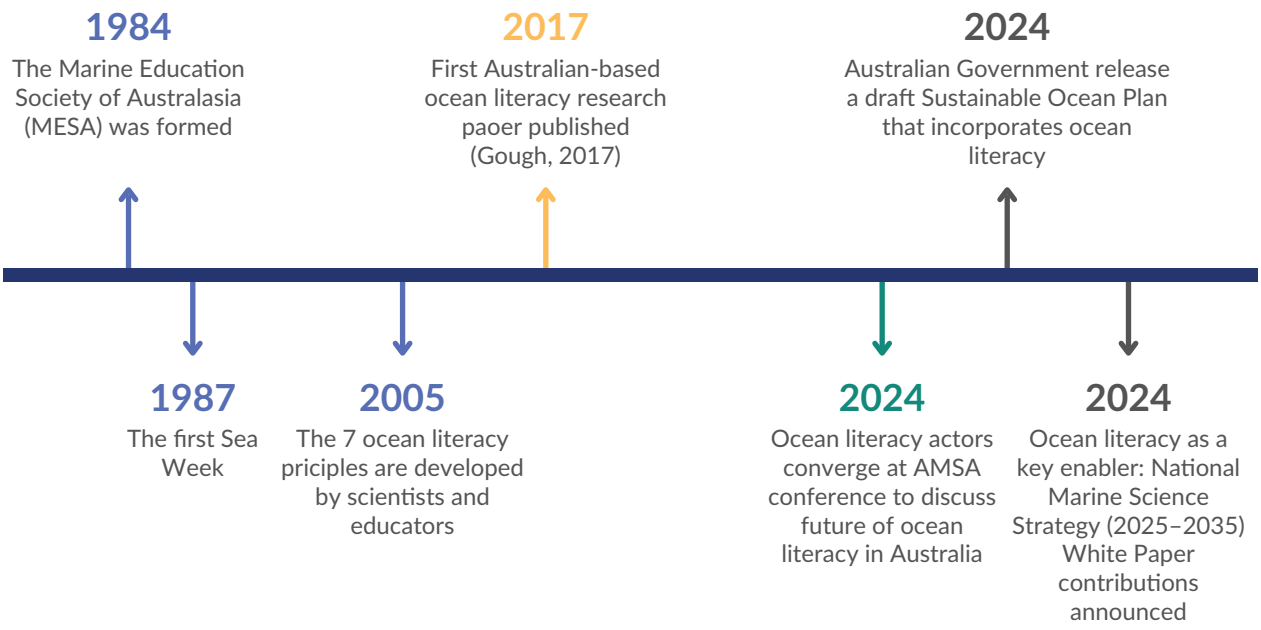


Figure 2. Evolution of ocean literacy in Australia: key milestones from the formation of the MESA in 1984 to the integration of ocean literacy into national strategies and initiatives in 2024. Note: Colour coding represents the following: blue (education-focused), orange (research-focused), dark grey (policy-focused), and teal (bringing the three ocean literacy pillars together: education, research, and policy).

2.2. Current State

Ocean literacy is a rapidly growing cross-sector and interdisciplinary field in Australia, championed by researchers, educators, conservationists, the private sector, and community leaders who aim to connect people with the ocean. The themes outlined in the following sections highlight the multifaceted approaches being used by different groups and sectors to foster ocean literacy and underscore the importance of community engagement and collaboration in progressing ocean literacy. Together, these themes illustrate the breadth and depth of ocean literacy in Australia, showcasing how it is evolving to address local and global challenges. Further, the themes reflect a uniquely Australian perspective on ocean literacy, rooted in the nation's distinct marine environments, such as the Great Barrier Reef and the Great Southern Reef (Bennett et al., 2015).

2.2.1. Ocean Literacy Research

In recent years, ocean literacy research in Australia has expanded across diverse disciplines including marine biology, socio-ecology, philosophy, technology, oceanography (Kelly et al., 2022), marine tourism, environmental psychology (Stoll-Kleemann, 2019), marine social science (McKinley et al., 2022), and marine conservation (McRuer et al., 2025). This may have resulted from the growth of marine social science in Australia, the prioritisation of ocean literacy in horizon scanning exercises (e.g., Herbert-Read et al., 2022; McKinley et al., 2022), and the global and national policy drivers for ocean literacy. This broad range of research fields reflects the multifaceted and interdisciplinary nature of ocean literacy, which combines theoretical and applied research to examine how individuals and communities engage with ocean-related issues (Shellock et al., 2024). These interdisciplinary efforts demonstrate increasing recognition that ocean

literacy is multi-dimensional and extends beyond education alone. Ocean literacy research in Australia has largely been conducted through international collaborations, rather than being exclusively Australia-focused (Paredes-Coral et al., 2021). In comparison with other countries, Australia ranks 11th in number of ocean literacy publications (Shellock et al., 2024). A recent systematic mapping of ocean research across the globe revealed that eight ocean literacy papers have been led by Australian researchers, and seven of these used Australian examples as empirical case studies (Shellock et al., 2024).

One of the first examples of Australian ocean literacy research emerged from an interdisciplinary project, delivered under the Future Seas 2030 initiative (Pecl et al., 2022). The ocean literacy component of Future Seas 2030 sought to identify strategies to improve societal connections to the ocean. To do so, it necessarily brought together expertise from multiple disciplines (including marine ecology, marine socioecology, oceans policy, marine social science, climate impacts, ecosystem modelling, oceanography, environmental communications, psychology, philosophy, public health, maritime logistics, and transdisciplinary science) to identify four drivers influencing and enhancing ocean literacy (Kelly et al., 2022). These drivers—education, cultural connections, technological advancements, knowledge exchange, and science-policy interconnections—each contribute to enhancing public understanding of the ocean, fostering broader societal engagement, and supporting more informed ocean management and conservation efforts (Kelly et al., 2022).

This emphasis on interdisciplinary solutions has also emerged in ocean literacy education research in Australia. Education has become a central focus of ocean literacy efforts in the country, likely due to its direct potential to foster ocean understanding and engagement. However, research has highlighted key challenges such as limited resources, insufficient teacher knowledge, and an overcrowded curriculum, which often hinder the integration of ocean literacy into school programs (Freitas et al., 2022). In response to these barriers, Australian researchers have collaborated with educators to find solutions, including the interdisciplinary and cross-curricular integration of ocean concepts. For example, co-developed ocean education training programs have equipped teachers with the resources needed to incorporate ocean literacy into existing subjects, raising awareness of local marine environments without adding to curriculum overload (Freitas, Venzo, et al., 2024).

Marine science engagement programs and citizen science initiatives also play a critical role in advancing ocean literacy in Australia and several case studies have been described in the literature. Similarly, research on citizen science initiatives like the SealSpotter project demonstrates the effectiveness of public involvement in marine ecological monitoring. Over five years, participants from 23 countries (including Australia) contributed to fur seal counts using drone surveys, underscoring how citizen science can address educational needs, promote ocean literacy, and facilitate data collection in marine systems (Puskic et al., 2024).

2.2.2. Education and Engagement

Building on these efforts, education remains fundamental to fostering ocean knowledge and stewardship values among young people, educators, and the broader public in Australia. While marine science has been included in some state-specific curricula—such as the option for senior secondary students to study marine science governed by the Queensland Curriculum and Assessment Authority—the Australian curriculum lacks a comprehensive and cohesive inclusion of marine and coastal education (Gough, 2017). For over 40 years,

initiatives like Sea Week—led by MESA and later by the Australian Association of Environmental Education—have worked to bridge this gap through nationwide campaigns that promote awareness, knowledge, and community connections to the ocean. However, despite these efforts, progress remains limited due to barriers such as low teacher confidence and an overcrowded curriculum (Freitas et al., 2022). To address some of these challenges, a research initiative by Deakin University implemented teacher workshops aimed at building confidence and capacity to teach ocean-related content (Freitas, Venzo, et al., 2024). Similarly, the education, training, and engagement programs at CSIRO Marine National Facility, empower the next generation of marine experts and equip participants with tools and confidence to deliver meaningful ocean literacy content. Outreach activities, such as the Marine National Facility's Floating Classroom, Educator on Board, and Indigenous Time at Sea Scholarship, target diverse audiences in learning (Arthur et al., 2021).

Informal immersive ocean education programs can also support ocean learning across formal curricula (O'Brien et al., 2023). A recent study revealed that while science is the primary Australian curriculum learning area that informal immersive ocean literacy education programs contribute to, these programs often contribute to other additional learning areas (e.g., sustainability, English, and mathematics), thus highlighting potential cross-curricula opportunities for integrating ocean literacy into formal education, and the potential role informal education programs can play in facilitating such integration (O'Brien et al., 2023).

Informal education programs have made significant contributions to ocean literacy by engaging students and the public outside of conventional classrooms. Initiatives such as the Great Southern Reef Foundation are developing localised, curriculum-linked resources for schools, with over 1,500 users accessing the Foundation's online marine education hub including more than 2,000 people engaging with a single Handfish student worksheet. Similarly, the OceansIQ Ocean Literacy Portal consolidates available ocean literacy resources to make them publicly available online. Established in 2014, and officially launched during Sea Week 2025, demand and interest in this portal are evidenced by the number of website visits, which nearly doubled in the first month post-launch—from 600 visitors between July 2024–February 2025 to over 1,100 in March 2025.

Along Australia's temperate coastline, more than 70 informal education providers offer immersive experiences in marine environments, museums, aquariums, virtual platforms, and discovery centres (O'Brien et al., 2023). For example, the Reef Guardians program initiated by the Great Barrier Reef Marine Park Authority in 2003, has engaged over 350,000 students in actions to protect the reef (Great Barrier Reef Marine Park Authority, 2023). Similarly, the Two Bays education program in Victoria ran for 15 years on a 63-foot catamaran, blending marine science, Indigenous knowledge, and community engagement under the framework of the seven ocean literacy principles. The Australian National Maritime Museum in Sydney, which reaches 6.8 million on-site and online visitors per year (Australian National Maritime Museum, 2024), has committed to a 10-year program associated with the UN Ocean Decade. This includes endorsed exhibitions (One Ocean, Our Future, Ocean Wonders, Ultimate Depth: A Journey to the Bottom of the Sea), collaborative events with communities and industry, and learning programs (e.g., on-site and online plastics programs with The Seabin Foundation and a new ocean ecosystem dynamics course for secondary students).

2.2.3. Storytelling and Communication

In Australia, ocean storytelling is strongly reflected in the lore and traditions of Aboriginal communities, particularly through Sea Country storytelling. First Nations people have long used storytelling as a powerful tool for conveying the importance of marine ecosystems and the practices needed to sustain them; these traditional practices underpin communities' deep cultural connections to the ocean (Reid et al., 2014). The South Coast Seaweed initiative is an example of a contemporary Indigenous-led ocean literacy effort that showcases storytelling and ecological practices, linking traditional knowledge to more dominant Western ocean literacy dialogues.

Communication and storytelling approaches for fostering ocean literacy in Australia can vary widely—from traditional awareness campaigns to picture books to visual media to sophisticated behaviour change initiatives. For example, narrative, non-fiction, marine science-based picture books have emerged as a creative means to promote ocean stewardship among children, whilst also fostering ocean literacy by raising awareness of marine systems, (Freitas, Francis, et al., 2024).

While narrative approaches and visual storytelling are commonly used, their effectiveness in engendering change (i.e., ocean stewardship behaviours and improved ocean literacy) likely relies on the integration of behavioural science principles and carefully designed message elements (de Salas et al., 2022). Research on Great Barrier Reef communication has demonstrated that while messages highlighting the reef's wonder and threats can raise awareness, they must be combined with specific behavioural components to motivate stewardship action (Waters, Losciale, et al., 2024). For instance, recent experimental studies revealed that reef-framed climate messages are more effective at enhancing public engagement with climate behaviours when they include clear calls to action, highlight collective efficacy, and provide tangible pathways for involvement (Waters, Wilson, et al., 2024).

Various organizations across Australia are working to implement evidence-based communication approaches. For example, the Great Southern Reef Foundation uses visual media content to engage with its growing following (1,000+ YouTube subscribers, 9,000+ Instagram followers, 8,000+ Facebook followers, and 3,000+ LinkedIn followers) on pressing marine environmental challenges, such as the deleterious impact of long-spined sea urchins on kelp forests. A recent documentary, *White Rock*, was launched as part of the Ocean Film Festival 2025 (screened at 34 locations nationwide) in tandem with a digital storytelling campaign featuring local fishers, marine scientists, and coastal communities, to further demonstrate human connections to reef ecosystems. Similarly, communication initiatives around the Great Barrier Reef have evolved based on research findings about public engagement. Media analysis of Great Barrier Reef coverage has revealed how different framing approaches and narrative elements influence public discourse and political action (Foxwell-Norton & Konkes, 2022). This growing body of evidence suggests that effective ocean communication must go beyond raising awareness to actively facilitate connections between marine conservation and climate action while providing clear pathways for public involvement in solutions.

2.2.4. Citizen Science

Citizen science is a powerful tool for advancing ocean literacy in Australia, particularly through initiatives supported by the Australian Citizen Science Association, which hosts an online portal listing over

600 programs, including 70 focused on coastal and marine environments. By actively involving individuals in data collection and marine research, these programs enhance public understanding of ocean issues and foster action, aligning with the knowledge, awareness, behaviour, and activism dimensions of ocean literacy (Church et al., 2025; Dean et al., 2018; McKinley et al., 2023). Research has shown that citizen science improves conservation outcomes while also deepening participants' engagement with ocean-related challenges (Kelly et al., 2020).

Notable examples include Coral Watch, the world's largest coral health citizen science initiative, which has been running since 2002 and operates in 135 countries. This program engages participants in coral monitoring by assessing coral colour, a key indicator of bleaching (Marshall et al., 2012). By engaging individuals directly, Coral Watch not only contributes valuable data to researchers but also promotes ocean literacy through its focus on coral health and climate change awareness. Another example is Redmap Australia, which has operated for over 15 years and encourages the public to log sightings of marine species found outside their usual geographic distribution or range. Over 1,500 citizen scientists have logged over 5,000 sightings to date (Redmap pers comms), which provide critical early insights into species' responses to climate change (i.e., evidencing climate-driven changes in the distribution of species, 91% of which had not been detected by scientific monitoring; Wolfe et al., 2025). This engagement has also enhanced participants' understanding of ocean warming and biodiversity shifts: 97% of surveyed participants reported that they trust information produced by the Redmap project (Nursey-Bray et al., 2018; Pecl et al., 2019).

2.2.5. Grassroot and Community-Led Ocean Initiatives

Community-driven initiatives are powerful tools for embedding ocean literacy within the Australian community. Events such as festivals, beach clean-ups, coastal restoration projects, public talks, and interactive outdoor experiences provide place-based opportunities to promote a deeper understanding of the ocean and its interconnectedness with human lives. For instance, the Mandurah Crab Fest and Apollo Bay Seafood Festival celebrate marine culture and ecosystems. Through interactive exhibits, cooking demonstrations, and cultural storytelling, these festivals hold the potential to enhance public appreciation and understanding of the ocean, though this impact has yet to be quantified. Similarly, Clean Up Australia Day, which has engaged over 22 million Australians since its inception in 1990, provides hands-on conservation experiences. This annual event focuses on removing rubbish from local environments, fostering direct action, and community involvement.

However, it's important to note that, to our knowledge, these initiatives do not explicitly follow ocean literacy frameworks, despite the intention to foster emotional connections to the ocean and raise awareness. That said, these activities still create valuable opportunities for diverse communities—including those living inland—to connect meaningfully with the ocean. By fostering emotional connections and raising awareness, such engagement has the potential to drive long-term behaviour change and inspire broader conservation efforts in Australia (Dean et al., 2018). These community actions can ripple outward supporting national policy goals and encouraging sustainable interaction with marine and coastal environments.

2.2.6. Governance and Policy Pathways

Ocean literacy remains in the early phases of policy integration, serving more as an aspirational framework than an implemented strategy. Still, the proposed Australian Sustainable Ocean Plan marks a significant milestone. Due for release later in 2025, the Plan articulates a national vision and national priorities to "guide collective action" on managing ocean spaces and marine resources and emphasises the importance of elevating ocean literacy (Commonwealth of Australia, 2024, p. 42).

Policy strategies developed by the marine science community also increasingly incorporate ocean literacy. For example, the AMSA *Submission on Science and Research Priorities* (https://www.amsa.asn.au/4220/australias-draft-science-and-research-priorities-and-national-science-statement) identified ocean literacy as critical for advancing marine research and supporting sustainable development in Australia. The submission underscores a need to integrate ocean literacy across education, research, and policy to deepen understanding of marine systems, promote stewardship, and strengthen the blue economy. Similarly, the National Marine Science Committee has committed to embedding ocean literacy as an enabler in the next decade of marine science (2025–2035). This commitment aims to position ocean literacy as a guiding framework for fostering public understanding, driving sustainable policy, and ensuring resilient marine ecosystems. Complementing this, the current Future Earth Australia *Our Sustainable Oceans and Coasts National Strategy 2021–2030* (https://www.futureearth.org.au/publications/sustainable-oceans-and-coasts-strategy) highlights a need to support grassroots initiatives that build community trust and promote local stewardship, with improved ocean literacy as a key outcome. Although nascent, these developments represent progress and a growing recognition of the need to embed ocean literacy in actionable policy moving forward.

3. Next Steps for Ocean Literacy in Australia

As outlined in the previous sections, interest in and development of ocean literacy is increasing in Australia. This progress has largely occurred within different sectors (i.e., education, engagement, research, and policy) with little integration to date. However, achieving the goal of ocean literacy—ocean stewardship and sustainability—demands cross-sectoral, collaborative approaches to developing ocean literacy (Shellock et al., 2024). In this section, we articulate our shared aims to contribute to fostering a multi-dimensional culture of ocean stewardship in Australia, and to supporting an Australian society that values and actively works to protect its marine ecosystems. We emphasise the need for a national agenda on ocean literacy to guide and structure these efforts, and a national ocean literacy coalition to facilitate research, cross-sector collaboration, and implementation in practice.

3.1. Progressing Ocean Literacy as an Approach, Movement, and Field of Research

3.1.1. Education

Although ocean literacy has expanded from its education origins, the role of education in advancing people's understanding and connections to the ocean remains salient (Glithero et al., 2024; McKinley et al., 2023). In the first instance, embedding ocean literacy in formal education via curricula is a need and opportunity for advancing ocean literacy in Australia—which could model mandates implemented elsewhere, including the

city of Santos, Brazil, which established ocean literacy as a public policy in its school curriculum in 2021 (UNESCO, 2021). The existing Australian curriculum already provides multiple entry points to incorporate ocean literacy, particularly within learning areas such as the arts, mathematics, chemistry, and biology (Freitas, Venzo, et al., 2024; O'Brien et al., 2023). However, accessing this opportunity will require integration across multiple disciplines in primary and secondary level curricula on a nationwide scale, as well as cooperative efforts between diverse stakeholders, including but not limited to educational institutions, policymakers, curriculum developers, the teaching community, and others such as informal education providers (Santoro et al., 2022).

In addition, teacher training and ongoing professional development are critical for embedding ocean literacy in classrooms. If ocean literacy is to be delivered across the key learning areas of the Australian curriculum, then there is a need to equip pre-service and in-service educators with resources, skills, and support for effectively integrating ocean literacy into their practice. Key challenges to this delivery include recognising and addressing the difficulties educators already face, i.e., an overcrowded curriculum, gaps in knowledge, and training related to ocean education, and poor awareness of the availability of relevant educational resources. This progress is already happening, for example, the Great Southern Reef Foundation has responded to the articulated need to support New South Wales schools and teachers to incorporate ocean literacy into their teachings by developing educational resources that support student learning and teacher capacity-building. These resources adopt a multidisciplinary approach, emphasise place-based learning, and are adaptable to various educational settings and year levels. Reflecting evolving evidence on ocean learning, these resources focus on place-based education and fostering deeper connections between students, educators, and their local marine and coastal environments.

Engagement beyond formal education is also central to progressing national-scale ocean literacy. Efforts should extend beyond school-based education to engage adults, including state and federal decision-makers and business leaders, through outreach and communication strategies that highlight the relevance of the ocean and its resources to their interests. For example, the Australian-led Tuna Champions is an outreach and educational program that provides resources on best-practice fishing for recreational fishers that promote stewardship behaviours. Programs such as these may also support peer-to-peer adult learning opportunities which in turn, may facilitate knowledge brokering through exchange of expertise, experiences, and best practices (Tuohy et al., 2024).

Educational frameworks evidence that learning can occur via diverse experiences that can include informal experiential learning as well as formal learning. Community-centred approaches, which amplify community voices and reflect on-ground context, may be better suited for facilitating experiential learning and encouraging place-based relationships with local marine environments (e.g., via coastal cleanups, citizen science, etc.). These informal experiences are likely to enhance the connection between ocean knowledge and action by linking ocean literacy (i.e., knowledge, attitudes, and behaviours) to conservation and sustainability outcomes. The success of programs such as Reef Guardians shows how more integrated approaches to education and conservation activities can foster both understanding and action across society (O'Brien et al., 2023).

Working with communities to understand what they know, understand, and value about the ocean is needed for developing relevant and engaging ocean literacy education programs. A recent ocean literacy survey

conducted as part of the inaugural Ocean Photographer of the Year exhibition at the Australian National Maritime Museum asked visitors, "How has the ocean changed you?," and "What would you change for the ocean?." With over 8,000 responses received, these data are now proving key to understanding baseline visitor ocean knowledge and assisting museum staff to generate future programming that is fit for purpose (Wright, 2024).

3.1.2. Engagement

In Australia, community engagement is a central pathway for advancing ocean literacy, particularly through initiatives that foster direct connections between people and (local) marine environments. These efforts should build on evidence-based behaviour change insights, to thoughtfully integrate educational components with practical actions, and to translate awareness into sustained pro-environmental behaviours (Kelly et al., 2022). For example, successful models of engagement (i.e., Coral Watch and Redmap Australia), demonstrate how hands-on participation can enhance participant understanding and stewardship (Marshall et al., 2012; Pecl et al., 2019). Examples of evidence-based messaging and communication strategies (e.g., for the Great Barrier Reef) highlight how collective efficacy and public-sphere calls to action encourage engagement in protection actions (Waters, Wilson, et al., 2024). Further, recent Australian research evidence shows that ocean stewardship behaviours can be encouraged by combining nature-based experiences with social interactions through engagement in citizen science programs (Church et al., 2025). Engagement initiatives can be supported by communication campaigns that use traditional and digital media platforms to reach diverse groups and demographics across Australia (Arthur et al., 2021).

Engaging cultural connections is also central to advancing ocean literacy (Glithero et al., 2024; Kelly et al., 2022); recognising the many diverse perspectives and relationships with the ocean experienced across Australia, and appreciating diverse ocean knowledge and values (McRuer et al., 2025). Cultural connections to the ocean refer to the knowledge, behaviours, and relationships people have with the marine and coastal environments (Glithero et al., 2024). Integrating cultural perspectives and narratives into ocean engagement can enrich these experiences with broader and more inclusive views of the ocean. Recognising cultural connections can also help to foster marine stewardship, as people from different groups and places may feel more empowered if they view it as a part of their identity. For example, many First Nations have been intertwined with marine environments for tens of thousands of years; they evidence the potential for sustainable use and conservation of the ocean that reflects a complex relationship between people and the sea (Fischer et al., 2022). These connections and experiences of Sea Country vary amongst First Nations across the continent, further reflecting the diversity of relationships people have with the sea and the diversity of ways that ocean literacy can be experienced and expressed. Efforts to engage with people from the many different cultures in Australia should acknowledge and celebrate the diversity of relationships with the ocean that are possible (e.g., Allison et al., 2020; Schwerdtner Manez et al., 2023).

Another opportunity for ocean literacy engagement is to connect pro-ocean attitudes and behaviour with climate action. To date, limited research has explored the intersection of both ocean and climate literacy and public engagement with pro-environmental behaviours (e.g., Waters, Losciale, et al., 2024; Waters, Wilson, et al., 2024) and evidence suggests that more is needed to help individuals and communities connect the dots between the two. For example, research has evidenced that though Australians' awareness and concern regarding climate impacts on the Great Barrier Reef is high, many people do not link climate action with reef

protection (Dean et al., 2020). Given the urgency of climate action and the deeply emotional connections many people have with marine environments, bridging the gap between ocean and climate literacy is a critical opportunity to engage broader audiences in climate solutions while advancing ocean conservation goals.

3.1.3. Co-developing Ocean Literacy Research

Ocean literacy research seeks to provide collective insights into the kinds of experiences, approaches, and framings that can enable enhancing people's understanding, connections, and relationships with the oceans (McRuer et al., 2024). These insights can inform shared efforts to enhance ocean literacy, improve awareness, influence pro-ocean behaviours, and potentially influence ocean policy and are particularly pertinent to the Australian context.

The many emerging ocean education and engagement initiatives demonstrate the appetite for improving ocean literacy, and research on understanding and measuring ocean literacy is expanding to inform these efforts (McRuer et al., 2024; Paredes-Coral et al., 2021). To date, however, there is scarce empirical evidence on how to measure and/or effectively enhance ocean literacy. For example, although behavioural components are included in the concept of ocean literacy (McKinley et al., 2023), limited research has specifically examined this aspect. As a result, many claims on the potential for ocean literacy initiatives to engender behaviour change remain unsubstantiated. This may also reflect a focus on the education dimension of ocean literacy to date. To progress the value and impact of ocean literacy initiatives, greater emphasis must be placed on the measurement and evaluation of ocean literacy programs through a multi-dimensional lens, including ocean knowledge, communication, behaviour, awareness, attitudes, activism, emotional connection, access and experience, adaptive capacity, and trust and transparency (McKinley et al., 2023). Further, national-scale baselines on societal ocean literacy are needed to inform future collaborative efforts and strategies on enhancing Australians' connections and behaviours in regard to the marine and coastal environment. These efforts may be informed by multi-dimensional evaluations and assessments conducted at national scales elsewhere (e.g., survey instruments currently being developed in Canada and the UK, *pers comms*).

Further, given international (e.g., UN Ocean Decade) and federal (e.g., Sustainable Ocean Plan) focus on ocean literacy as a potential mechanism for change, there is a role and opportunity for ocean literacy research to support this aim and potential (McRuer et al., 2024). These multidisciplinary approaches emphasise the strength and need for research to collaborate in cross-sector partnerships with educators, decision-makers, government, NGOs, industry, communities, and First Nations people's voices. As ocean literacy in Australia continues to evolve and reflect the multi-dimensionality of the concept and practice, there is a need for proactive interdisciplinary research that can support bridging the 10 ocean literacy dimensions and on-ground ocean literacy practice (e.g., McKinley et al., 2023) with overarching strategy and collective vision.

3.2. Progress at the Strategic Level: Policy and Governance

3.2.1. Australian Ocean Literacy Coalition

A key approach to advancing ocean literacy is by leveraging networks (Pedemont et al., 2024). Several ocean literary networks have emerged in Australia over the last decades, largely through grassroots initiatives since the 1980s (e.g., MESA), and continue to develop and evolve, connecting ocean literacy researchers and practitioners through interest and region-specific contexts (e.g., Tasmanian Marine Extension and Engagement Community of Practice). However, these have occurred largely ad hoc and at small scales. Stakeholders nationally have articulated the need for a national strategic effort to increase ocean literacy (Ocean Decade Australia, 2021). If ocean literacy is to advance across Australia, then such national-scale effort and cooperation will be required to co-develop and share ocean literacy resources and strategies, and to support a purposeful movement towards advancing ocean literacy (e.g., Paredes-Coral et al., 2021).

To this end, we propose the establishment of an Australian ocean literacy coalition, to foster collaboration among diverse sectors, and to support the integration of ocean literacy into policy, education, and community initiatives, together ensuring a more sustainable future for Australia's marine environments. Such a coalition aims to provide a structure for diverse individuals and organisations with a common interest in ocean literacy. The coalition will advance, coordinate, and implement ocean literacy research and practice and work together to achieve shared objectives. The coalition will also enable the exchange of knowledge, resources, and best practices to enhance ocean literacy at all levels of society. The Australian ocean literacy community is already a growing network but currently lacks the governance, structure, and resources needed to deliver our ambitious aim. The primary focus of an Australian coalition will be on co-developing and guiding a national ocean literacy strategy (Figure 3).

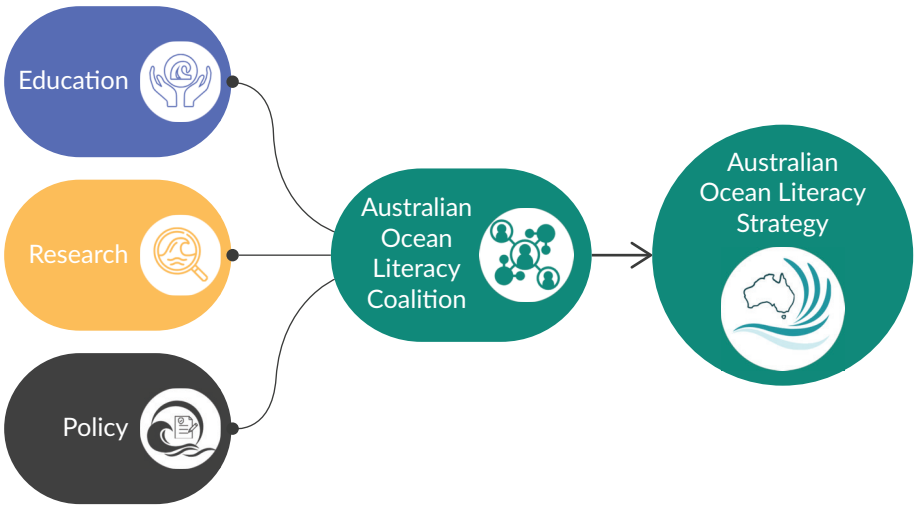


Figure 3. Conceptual framework illustrating three pillars of ocean literacy in Australia: education, research, and policy. Note: The diagram outlines the position and potential role of an Australian ocean literacy coalition, in connecting and facilitating collaboration for co-design and implementation of a cohesive national ocean literacy strategy for Australia.

The UN Ocean Literacy portal will be a valuable resource from which to inform Australian efforts. There are also national-scale examples and lessons to be learned from elsewhere, for example, the Irish Ocean Literacy

Network, which was established in 2016 as an informal network bringing together cross-sector collaborators (including NGOs, public bodies, research, education, private enterprises, and communities) with the shared aim to enhance ocean literacy across the island of Ireland. Since then, this network has expanded and become more formalised, and recently released a Strategic Plan (2024) for enhancing ocean literacy in Ireland. Other examples include the Canadian Ocean Literacy Coalition, an internationally recognised catalyst and hub for ocean literacy collaboration, research, and innovation. Similarly, this coalition evolved when a small network of self-identified ocean literacy organisations recognised the need for a coordinated approach to ocean literacy in Canada and a national ocean literacy strategic plan to guide this approach (Glithero et al., 2018). The coalition has expanded since 2018 and today is a national and international leader in ocean literacy implementation and research. The Welsh Ocean Literacy Coalition was established in 2022 by the Wales Coasts and Seas Partnership, who identified improving ocean literacy as a key focus of their work. Their efforts have included the recent *Ocean Literacy Strategy for Wales 2025* (*Y Môr a Ni*), which articulates a vision and key action areas for building ocean literacy.

The Australian coalition will lead innovative, co-created initiatives to raise awareness and inspire action to protect the ocean and its ecosystems—and to support an Australian society that values and actively works to protect its marine ecosystems. In doing so, we anticipate the coalition will play a pivotal role in driving initiatives that bring together diverse marine stakeholders and perspectives, by fostering interdisciplinary and cross-sector collaboration and providing opportunities for peer-to-peer learning across sectors. Specifically, the national network will create a hub from which to co-develop, and deliver an adaptive national ocean literacy strategy.

3.2.2. National Australian Ocean Literacy Strategy

As aforementioned, there are growing calls for a national Australian ocean literacy strategy amongst the Australian ocean literacy community, and in the research literature (e.g., Freitas et al., 2022). For example, a recent Ocean Decade Australia report evidenced that stakeholder visions for "success" prioritised the idea that government and policy should reflect an improved public understanding of ocean values and threats. A national strategy would act as a framework to enhance understanding and ocean literacy across the national population, as well as within target communities, sectors, and groups. The strategy would also offer opportunity for policy engagement on ocean literacy with the aim of integrating ocean literacy into federal and state-level decision-making and corporate strategies.

In this way, the strategy will facilitate national action to deliver Australia's broader national commitments on sustainable ocean management and marine education—and thus help position Australia as a leader in ocean literacy in forums such as the UN Ocean Decade. The aim of a national Australian ocean literacy strategy is to facilitate ocean literacy knowledge exchange (e.g., supporting peer-to-peer learning across sectors), resource and partnership development (e.g., developing collaborative projects and funding proposals), and policy engagement (e.g., delivering to more integrated approaches to ocean management)—to lead a culture of ocean stewardship in Australia, and to empower an ocean literate Australian society that values and actively works to protect its marine ecosystems (see Box 1). As such, a national strategy will also contribute to engaging Australians on the interrelated themes of climate and environmental literacy.

We anticipate that the national strategy (and the future of ocean literacy in Australia) will be co-developed, following successful examples achieved elsewhere. It will enable ocean literacy to be a cornerstone of achieving ocean sustainability and climate resilience in Australia. The strategy will provide the basis for building federal and state-level policy frameworks and secure ongoing funding for the development and implementation of cooperative, multi-sector ocean literacy programs, which are essential for ensuring long-term ocean sustainability and impact in Australia. For example, we anticipate that the strategy will specifically inform national ocean policy development (e.g., Australia's Sustainable Ocean Plan, National Marine Science Plan, etc.) and help to guide the design and implementation of state-specific marine policies (e.g., New South Wales Marine Estate Management Strategy, Victorian Coastal and Marine Management Plans, etc.). Further, an ocean literacy strategy would facilitate international cooperation and partnerships: for example, with countries such as Canada, Ireland, Wales, and England, who have already established, or are in the process of establishing, national ocean literacy strategies and agendas.

Box 1. Policy priorities moving forward.

1. Establish a national ocean literacy strategy:
    - Develop an ocean literacy strategy that articulates aims for improving ocean literacy in Australia and targets measurable goals (e.g., "By 2050, all Australians will see themselves and engage as stewards of the ocean").
    - Invest in a national ocean literacy office that will coordinate and lead national-scale ocean literacy programs, research, and development.
2. Establish an Australian ocean literacy baseline:
    - Establish an ocean literacy survey program with ongoing funding.
    - Establish a cross-sector national ocean literacy task force to develop and conduct a national-scale multi-dimensional ocean literacy survey.
    - Implement a national-scale survey to determine levels of ocean literacy across demographics in all states and territories.
3. Embed ocean literacy into primary and secondary school curricula:
    - Develop a national framework to integrate ocean literacy across school curricula in an interdisciplinary manner. This framework should align with existing curriculum priorities and learning outcomes, ensuring ocean literacy is embedded through cross-disciplinary connections rather than adding additional content to an already crowded curriculum.
    - Establish professional development opportunities for educators to equip them with knowledge and confidence to effectively integrate ocean literacy into teaching programs.
    - Expand the existing ocean education portal to include resources from all states and territories, creating a centralised national platform to enhance access to ocean literacy learning resources.
4. Develop funding mechanisms for community-led and grassroots ocean literacy initiatives:
    - Establish enduring funding schemes for informal education programs to support ocean literacy engagement and learning in schools.
    - Support local and state-level ocean literacy campaigns that connect communities with local marine and coastal environments.
5. Mandatory corporate sustainability education on ocean-related issues:
    - Mandate that businesses/industries evidence their contributions to ocean sustainability and stewardship dimensions as part of ongoing ESG frameworks and reporting requirements.

4. Conclusion

In Australia, the development of ocean literacy has occurred across different sectors and to date, has included approaches in education, community engagement, policy, and research. However, this development has been limited by poor cross-sector and national-level cooperation, and a lack of policy direction and funding to support continued sector growth. Making progress on advancing ocean literacy nationwide, and contributing to larger-scale objectives for achieving ocean sustainability, will require cooperative and integrated efforts across sectors. For example, by supporting ocean learning and education, engaging communities at all levels, fostering cross-sector collaboration on connecting people to the ocean, and building strong and actionable policy and funding frameworks, in order to ensure long-term impact.

In this article, we have outlined recommendations from members of the growing Australian ocean literacy community, for ocean literacy development, implementation, and research, and thus provide much-needed direction for the continued expansion of ocean literacy in Australia. We invite reflection and development from ocean literacy practitioners and researchers and hope to encourage discussion and action around the priorities identified here. Specifically, we hope these priorities can be useful for federal and state-level decision-makers in their efforts to embed ocean literacy in ocean policies in Australia.

Ocean literacy needs to be advanced across diverse parts of society, including in decision-making, if it is to effectively contribute to ocean sustainability. The key next steps for the growing Australian ocean literacy community are to collaborate with decision-makers at federal and state-levels to develop a national Australian ocean literacy strategy that articulates objectives in alignment with delivering the Australian Sustainable Ocean Plan (currently in draft form); including establishing an Australian ocean literacy coalition. This collaborative perspective article, from members of the Australian ocean literacy community, invites prospective thinking, cross-sector collaboration, and multi-dimensional action on enhancing ocean literacy, with a 2050 vision for all Australians to see themselves and engage as stewards of the ocean.

Acknowledgments

The authors of this article would like to acknowledge the Australian Marine Sciences Association, for facilitating the opportunity for us to meet and collaborate on ocean literacy. We also acknowledge the session participants who contributed to the initial ocean literacy session but did not engage in the development of this article.

Funding

This project was not supported by any research grant. Authors were supported by their own project and institution funding.

Conflict of Interests

This article has provided a descriptive account of the current status of ocean literacy in Australia, to the best of our knowledge. We have cited examples that several of us have been involved with, which do not necessarily represent the national ocean literacy community as a whole. For transparency however, we provide these details here: GP is the Chair of Redmap Australia, JC and LB are co-founders of Ocean Decade Australia, SA is Director of education and impact, CF is a marine science educator at the Great Southern Reef Foundation, JM founded CoralWatch, and PF is a member of the Australian Ocean literacy Reference Group for OceansIQ.

References

Allison, E. H., Kurien, J., Ota, Y., Adhuri, D. S., Bavinck, J. M., Cisneros-Montemayor, A., Fabinyi, M., Jentoft, S., Lau, S., Mallory, T. G., Olukoju, A., van Putten, I., Stacey, N., Voyer, M., & Weeratunge, N. (2020). *The human relationship with our ocean planet*. World Resources Institute. https://oceanpanel.org/publication/the-human-relationship-with-our-ocean-planet

Arthur, B., Roberts, D., Rae, B., Marrison, M., McCleary, H., Abbott, A., & Musso, B. (2021). Ocean outreach in Australia: How a national research facility is engaging with community to improve scientific literacy. *Frontiers in Environmental Science*, *9*, Article 610115. https://doi.org/10.3389/fenvs.2021.610115

Australian National Maritime Museum. (2024). *Annual report 2023–24*. Commonwealth of Australia. https://www.sea.museum/en/about/media/2024/11/annual-report-2023-24

Bennett, S., Wernberg, T., Connell, S. D., Hobday, A. J., Johnson, C. R., & Poloczanska, E. S. (2015). The 'Great Southern Reef': Social, ecological and economic value of Australia's neglected kelp forests. *Marine and Freshwater Research*, *67*(1), 47–56. https://doi.org/10.1071/MF15232

Brennan, C., Ashley, M., & Molloy, O. (2019). A system dynamics approach to increasing ocean literacy. *Frontiers in Marine Science*, *6*, Article 360. https://doi.org/10.3389/fmars.2019.00360

Cava, F., Schoedinger, S., Strang, C., & Tuddenham, P. (2005). *Science content and standards for ocean literacy: A report on ocean literacy*. College of Exploration. https://coexploration.org/oceanliteracy/documents/OLit2004-05_Final_Report.pdf

Church, E. K., Wilson, K. A., Loder, J., & Dean, A. J. (2025). From citizen science experiences to stewardship action: The importance of both nature and social experiences. *Marine Policy*, *173*, Article 106537. https://doi.org/10.1016/j.marpol.2024.106537

Commonwealth of Australia. (2024). *Australia's draft sustainable ocean plan: Navigating a course to 2040*. Commonwealth of Australia. https://www.dcceew.gov.au/sites/default/files/documents/draft-sustainable-ocean-plan.pdf

de Salas, K., Scott, J. L., Schüz, B., & Norris, K. (2022). The super wicked problem of ocean health: A socio-ecological and behavioural perspective. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *377*(1854). https://doi.org/10.1098/rstb.2021.0271

Dean, A. J., Church, E. K., Loder, J., Fielding, K. S., & Wilson, K. A. (2018). How do marine and coastal citizen science experiences foster environmental engagement? *Journal of Environmental Management*, *213*, 409–416. https://doi.org/10.1016/j.jenvman.2018.02.080

Dean, A. J., Gulliver, R. E., & Wilson, K. A. (2020). "Taking action for the Reef?"—Australians do not connect Reef conservation with individual climate-related actions. *Conservation Letters*, *14*(2), Article e12765. https://doi.org/10.1111/conl.12765

Department of Climate Change, Energy, the Environment and Water. (n.d.). *Marine*. https://www.dcceew.gov.au/environment/marine

Department of Climate Change, Energy, the Environment and Water. (2021). *Coasts*. https://www.dcceew.gov.au/sites/default/files/documents/2.%20DCCEEW-SOE_factsheet_Coasts.pdf

Fauville, G., Strang, C., Cannady, M. A., & Chen, Y. F. (2018). Development of the international ocean literacy survey: Measuring knowledge across the world. *Environmental Education Research*, *25*(2), 238–263. https://doi.org/10.1080/13504622.2018.1440381

Fischer, M., Maxwell, K., Nuunoq., Pedersen, H., Greeno, D., Jingwas, N., Blair, J. G., Hugu, S., Mustonen, T., Murtomäki, E., & Mustonen, K. (2022). Empowering her guardians to nurture our ocean's future. *Reviews in Fish Biology and Fisheries*, *32*, 271–296 https://doi.org/10.1007/s11160-021-09679-3

Foxwell-Norton, K., & Konkes, C. (2022). Is the Great Barrier Reef dead? Satire, death and environmental communication. *Media International Australia*, *184*(1), 106–121.

Freitas, C., Bellgrove, A., Venzo, P., & Francis, P. (2022). Towards a 2025 national ocean literacy strategy: Current status and future needs in primary education. *Frontiers in Marine Science*, *9*, Article 883524. https://doi.org/10.3389/fmars.2022.883524

Freitas, C., Francis, P., Bellgrove, A., & Venzo, P. (2024). Adopting ocean-themed picture books to promote ocean literacy in primary education. *Children's Literature in Education*, *55*, 701–716. https://doi.org/10.1007/s10583-023-09534-y

Freitas, C., Venzo, P., Bellgrove, A., & Francis, P. (2024). Diving into a sea of knowledge: Empowering teachers to enhance ocean literacy in primary schools through an ocean education training program. *Environmental Education Research*, *31*(2), 262–283. https://doi.org/10.1080/13504622.2024.2357342

Gervais, C. R., Champion, C., & Pecl, G. T. (2021). Species on the move around the Australian coastline: A continental-scale review of climate-driven species redistribution in marine systems. *Global Change Biology*, *27*(14), 3200–3217. https://doi.org/10.1111/gcb.15634

Glithero, L. D., Bridge, N., Hart, N., Mann-Lang, J., McPhie, R., Paul, K., Peebler, A., Wiener, C., Yen, C., Kelly, R., & McRuer, J. (2024). *Ocean decade vision 2030 white papers-challenge 10: Restoring society's relationship with the ocean*. Intergovernmental Oceanographic Commission of UNESCO.

Glithero, L. D., Stalker, J., Armstrong, J., Bartram, J., Donaghy, T., Green, G., Murray, H., Scully, S., & Stewart, A. (2018). *A development plan: Building a Canadian ocean literacy strategy*. Canadian Ocean Literacy Coalition. https://cdn.colcoalition.ca/2022/wp-content/uploads/2022/01/A_Development_Plan_-Building_a_Canadian_Ocean_Literacy_Strategy_2018.pdf

Gollan, N., & Curley, B. (2023). *NSW marine estate community wellbeing framework report*. NSW Government.

Gough, A. (2017). Educating for the marine environment: Challenges for schools and scientists. *Marine Pollution Bulletin*, *124*(2), 633–638. https://doi.org/10.1016/j.marpolbul.2017.06.069

Great Barrier Reef Marine Park Authority. (2023). *Reef guardian schools*. https://www2.gbrmpa.gov.au/our-work/programs-and-projects/reef-guardian-schools

Herbert-Read, J. E., Thornton, A., Amon, D. J., Birchenough, S. N., Côté, I. M., Dias, M. P., Godley, B. J., Keith, S. A., McKinley, E., Peck, L. S., Calado, R., Defeo, O., Degraer, S., Johnston, E. L., Kaartokallio, H., Macreadie, P. I., Metaxas, A., Muthumbi, A. W. N., Obura, D. O., . . . Sutherland, W. J. (2022). A global horizon scan of issues impacting marine and coastal biodiversity conservation. *Nature Ecology & Evolution*, *6*, 1262–1270. https://doi.org/10.1038/s41559-022-01812-0

Holmes, A. G. D. (2020). Researcher positionality—A consideration of its influence and place in qualitative research—A new researcher guide. *Shanlax International Journal of Education*, *8*(4), 1–10. https://doi.org/10.34293/education.v8i4.3232

Kaikkonen, L., Shellock, R. J., Selim, S. A., Ojwala, R. A., Dias, B. S., Li, S., Addey, C. I., Gianelli, I., Maltby, K. M., Garcia-Morales, S., Palacios-Abrantes, J., Jian, S., Albo-Puigserver, M., Alonso, V. A. G., Baker, C. A., Bove, C. B., Brodie, S., Dahlet, L. I., Das, J., Das, J., . . . Strand, M. (2024). Fostering diversity, equity, and inclusion in interdisciplinary marine science. *npj Ocean Sustainability*, *3*, Article 49. https://doi.org/10.1038/s44183-024-00087-1

Kajtar, J. B., Holbrook, N. J., & Hernaman, V. (2021). A catalogue of marine heatwave metrics and trends for the Australian region. *Journal of Southern Hemisphere Earth Systems Science*, *71*, 284–302. https://doi.org/10.1071/ES21014

Kelly, R., Evans, K., Alexander, K., Bettiol, S., Corney, S., Cullen-Knox, C., Cvitanovic, C., de Salas, K., Emad, G. R., Fullbrook, L., Garcia, C., Ison, S., Ling, S., Macleod, C., Meyer, A., Murray, L., Murunga, M., Nash, K. L., Norris, K., . . . Pecl, G. T. (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

Kelly, R., Fleming, A., Pecl, G. T., von Gönner, J., & Bonn, A. (2020). Citizen science and marine conservation: A global review. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *375*(1814), Article 20190461. http://dx.doi.org/10.1098/rstb.2019.0461

Laubenstein, T., Smith, T. F., Hobday, A. J., Pecl, G. T., Evans, K., Fulton, E. A., & O'Donnell, T. (2023). Threats to Australia's oceans and coasts: A systematic review. *Ocean & Coastal Management*, *231*, Article 106331, https://doi.org/10.1016/j.ocecoaman.2022.106331

Marshall, N. J., Kleine, D. A., & Dean, A. J. (2012). CoralWatch: Education, monitoring, and sustainability through citizen science. *Frontiers in Ecology and the Environment*, *10*(6), 332–334. https://doi.org/10.1890/110266

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*, Article 114467. https://doi.org/10.1016/j.marpolbul.2022.114467

McKinley, E., Kelly, R., Mackay, M., Shellock, R., Cvitanovic, C., & van Putten, I. (2022). Development and expansion in the marine social sciences: Insights from the global community. *Iscience*, *25*(8), Article 104735. https://doi.org/10.1016/j.isci.2022.104735

McRuer, J., McKinley, E., Glithero, D. L., Christofoletti, R., & Payne, D. (2025). Human-ocean relationships: Exploring alignment and collaboration between ocean literacy research and marine conservation. *Marine Policy*, *17*, Article 106418. https://doi.org/10.1016/j.marpol.2024.106418

McRuer, J., McKinley, E., Glithero, D. L., & Paiz-Domingo, M. (2024). Ocean literacy research community: Co-identifying gaps and priorities to advance the UN ocean decade. *Frontiers in Marine Science*, *11*, Article 1469451. https://doi.org/10.3389/fmars.2024.1469451

Moon, K., & Blackman, D. (2014). A guide to understanding social science research for natural scientists. *Conservation Biology*, *28*(5), 1167–1177. https://doi.org/10.1111/cobi.12326

Nursey-Bray, M., Palmer, R., & Pecl, G. (2018). Spot, log, map: Assessing a marine virtual citizen science program against Reed's best practice for stakeholder participation in environmental management. *Ocean & Coastal Management*, *151*, 1–9. https://doi.org/10.1016/j.ocecoaman.2017.10.031

O'Brien, M., Freitas, C., Venzo, P., & Francis, P. (2023). Fostering ocean literacy through informal marine education programs. *Marine Pollution Bulletin*, *193*, Article 115208. https://doi.org/10.1016/j.marpolbul.2023.115208

Ocean Decade Australia. (2021). *Ocean decade australia*. https://www.oceandecadeaustralia.org/public/260/system/newsAttachments/Report%202%20-%20Ocean%20Decade%20Australia%20Oct%2021.pdf

Ocean Decade Australia. (2023). Ocean business leaders' summit: White paper. Intergovernmental Oceanographic Commission of UNESCO. https://oceandecade.org/publications/ocean-business-leaders-summit-white-paper-2023

Paredes-Coral, E., Mokos, M., Vanreusel, A., & Deprez, T. (2021). Mapping global research on ocean literacy: Implications for science, policy, and the blue economy. *Frontiers in Marine Science*, *8*, Article 648492. https://doi.org/10.3389/fmars.2021.648492

Pecl, G. T., Alexander, K. A., Melbourne-Thomas, J., Novaglio, C., Villanueva, C., & Nash, K. L. (2022). Future seas 2030: Pathways to sustainability for the UN ocean decade and beyond. *Reviews in Fish Biology and Fisheries*, *32*, 1–7. https://doi.org/10.1007/s11160-022-09705-y

Pecl, G. T., Stuart-Smith, J., Walsh, P., Bray, D. J., Kusetic, M., Burgess, M., Frusher, S. D., Gledhill, D. C., George, O., Jackson, G., Keane, J., Martin, V. Y., Nursey-Bray, M., Pender, A., Robinson, L. M., Rowling, K., Sheaves, M., & Moltschaniwskyj, N. (2019). Redmap Australia: Challenges and successes with a large-scale citizen science-based approach to ecological monitoring and community engagement on climate change. *Frontiers in Marine Science*, *6*, Article 349. https://doi.org/10.3389/fmars.2019.00349

Pedemont, S., Strang, C., & Yen, C.-D. (2024). Leveraging networks to promote ocean literacy. *Current*, *39*(2), 24–30. https://doi.org./10.5334/cjme.89

Puskic, P. S., Holmberg, R., & McIntosh, R. R. (2024). Successful citizen science tools to monitor animal populations require innovation and communication: SealSpotter as a case study. *Frontiers in Conservation Science*, *5*, Article 1412510. https://doi.org/10.3389/fcosc.2024.1412510

Reid, N., Nunn, P., & Sharpe, M. (2014). Indigenous Australian stories and sea-level change. In *Proceedings of the 18th Conference of the Foundation for Endangered Languages* (pp. 82–87). Foundation for Endangered Languages Hungerford.

Santoro, F., Tereza de Magalhães, A. V., Middleton, F., & Buchanan-Dunlop, J. (2022). *A new blue curriculum: A toolkit for policy-makers*. Intergovernmental Oceanographic Commission of UNESCO.

Schwerdtner Manez, K., Stoll-Kleemann, S., & Rozwadowski, H. M. (2023). Ocean literacies: The promise of regional approaches integrating ocean histories and psychologies. *Frontiers in Marine Science*, *10*, Article 1178061. https://doi.org/10.3389/fmars.2023.1178061

Secules, S., McCall, C., Mejia, J. A., Beebe, C., Masters, A. S., Sánchez-Peña, M. L., & Svyantek, M. (2021). Positionality practices and dimensions of impact on equity research: A collaborative inquiry and call to the community. *Journal of Engineering Education*, *110*(1), 19–43. https://doi.org/10.1002/jee.20377

Shellock, R. J., Fullbrook, L., McKinley, E., Cvitanovic, C., Kelly, R., & Martin, V. (2024). The nature and use of ocean literacy in achieving sustainable ocean futures: A systematic map. *Ocean & Coastal Management*, *257*, Article 107325. https://doi.org/10.1016/j.ocecoaman.2024.107325

Stoll-Kleemann, S. (2019). Feasible options for behavior change toward more effective ocean literacy: A systematic review. *Frontiers in Marine Science*, *6*, Article 273. https://doi.org/10.3389/fmars.2019.00273

Trebilco, R., Fischer, M., Hunter, C., Hobday, A., Thomas, L., & Evans, K. (2021). *Marine*. Australia State of the Environment 2021. https://doi.org/10.26194/nvaa-rf92

Tuohy, P., Cvitanovic, C., Shellock, R. B., Karcher, D. B., Duggan, J., & Cooke, S. J. (2024). Considerations for research funders and managers to facilitate the translation of scientific knowledge into practice. *Environmental Management*, *73*, 668–682. https://doi.org/10.1007/s00267-023-01895-w

Turnbull, J. W., Clark, G. F., & Johnston, E. L. (2021). Conceptualising sustainability through environmental stewardship and virtuous cycles—A new empirically-grounded model. *Sustainability Science*, *16*, 1475–1487. https://doi.org/10.1007/s11625-021-00981-4

Turnbull, J. W., Johnston, E. L., Kajlich, L., & Clark, G. F. (2020). Quantifying local coastal stewardship reveals motivations, models and engagement strategies. *Biological Conservation*, *249*, Article 108714. https://doi.org/10.1016/j.biocon.2020.108714

UNESCO. (2021). *Ocean literacy law is signed in Santos, Brazil*. https://www.unesco.org/en/articles/ocean-literacy-law-signed-santos-brazil

Waters, Y. L., Losciale, R., Wilson, K. A., & Dean, A. J. (2024). Opportunities for meaningful climate change engagement in vulnerable nature settings. *People and Nature*, *6*(5), 2126–2143. https://doi.org/10.1002/pan3.10711

Waters, Y. L., Wilson, K. A., & Dean, A. J. (2024). The role of iconic places, collective efficacy, and negative emotions in climate change communication. *Environmental Science & Policy*, *151*, Article 103635. https://doi.org/10.1016/j.envsci.2023.103635

Wolfe, B. W., Champion, C., Gaston, T., Brown, J., Coleman, M. A., Davis, T. R., Frijlink, S., Hatley, T., Heather, F. J., Jackson, G., Keane, J. P., Kjeldsen, S., McGrouther, M., Moltschaniwskyj, N., Moore, G., Pearn, R., Rodda, K. R., Strugnell, J., Stuart-Smith, J., . . . Pecl, G. T. (2025). Continental-scale assessment of climate-driven marine species range extensions using a decade of citizen science data. *Diversity and Distributions*, *31*(4), Article e70022. https://doi.org/10.1111/ddi.70022

Wright, M. (2024). 'What will you change for the ocean? Assessing visitors' knowledge of our blue planet. *Signals*, *147*, 48–51.

About the Authors

Rachel Kelly is a knowledge broker and marine socioecologist. Her work focuses on the human dimensions of ocean sustainability. Rachel is passionate about achieving meaningful end-user engagement—improving ocean literacy and societal connections to the ocean.

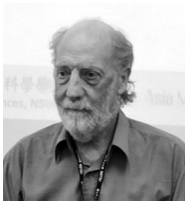
Prue Francis is a marine scientist at Deakin University whose research focuses on ocean literacy, marine education, and temperate reef ecosystems. She leads interdisciplinary projects that explore how knowledge exchange, science communication, and educational frameworks can enhance marine stewardship and inform sustainable ocean policy and management in Australia.

Rebecca J. Shellock is an expert in marine social science and is based at the UNSW Centre for Sustainable Development Reform, Sydney. She has over 10 years experience of working at the science-policy interface and has a track record of delivering evidence, which can influence decision-making processes.

Stefan Andrews is a marine biologist, educator, and filmmaker focused on ocean literacy across temperate Australia. As Director of education and impact at the Great Southern Reef Foundation, he creates films, school resources, and campaigns that connect communities with local marine ecosystems, aiming to inspire the next generation of ocean stewards.

Benjamin Arthur is a marine ecologist and science communicator. He is a passionate communicator of science and its importance to our everyday lives. He coordinates engagement programs for the CSIRO Marine National Facility on board RV Investigator leading a range of marine engagement and training programs and activities.

Charlotte A. Birkmanis is a marine ecologist, wildlife science communicator, and presenter with a research focus on shark movement, behaviour, and ecosystem resilience. As a postdoctoral research fellow and Director of a philanthropic marine foundation, Charlotte bridges the gap between science, society, policy, and philanthropy to ensure a sustainable future ocean.



Harry Breidahl has worked in Australia for over 50 years in environmental education as a secondary school teacher, university lecturer, and author. As one of the founders of the International Pacific Marine Educators Network (IPMEN), he is now internationally recognised as a leader in marine education.

Lucy Buxton is a marine scientist, strategist, and Co-Founder of Ocean Decade Australia. She advances ocean and human health policy, research commercialisation, and ocean literacy. Lucy works across government, industry, and finance to mobilise science-driven solutions, inform policy, and drive cross-sector collaboration for a sustainable ocean economy.

Jasmine Chambers is chair and Co-Founder of Ocean Decade Australia, connecting ocean stakeholders for sustainable development. With leadership experience in STEM, international diplomacy, and education, Jas links ocean health to global goals, including human health and prosperity. She is also a public speaker, strategic adviser, and board leader.

Emma Church leads research on the human dimensions of Australia's Great Southern Reef at the University of Tasmania. She examines how communities engage with this vast temperate ecosystem, blending her passion as an aquatic adventurer and marine social scientist to foster conservation across government, industry, and local stakeholders.

Corrine Condie has a background in social research, stakeholder communication, and marine-based conflict. She uses social network analysis and dynamic network modelling to understand changes in communication behaviour. In particular, the structural and mechanistic changes required to operate in the new paradigm of complex communication networks, transnational debate, and increasing public unrest.

Freya Croft is a postdoctoral research fellow at the University of Wollongong, exploring human-coastal relationships and the social impacts of coastal change. Her current research focuses on the development of offshore wind in the Illawarra and across Australia, including community engagement, emotional connections, ocean and energy literacy, and equitable governance.

Cátia Freitas is an associate teaching fellow at Deakin University and a marine science educator at the Great Southern Reef Foundation. Her work focuses on integrating ocean literacy into formal and informal education by developing marine science programs for educators and creating evidence-based, curriculum-aligned resources for students.

Shannon Hurley is the founder of The Salty Tribe, an ocean conservationist with the Victorian National Parks Association, and results coach. She empowers people to reconnect with themselves and the ocean through retreats, education, and advocacy—uniting personal well-being with marine health to inspire hopeful action for a thriving planet.

Emily Jateff is the senior curator of maritime trade and industry, and inaugural curator of ocean science and technology at the Australian National Maritime Museum. She leads partnerships, collections, and content for ocean sciences, marine technologies, climate change and sustainability, and the Museum's Ocean Futures program supporting the UN Decade of Ocean Science for Sustainable Development.

Brianna Le Busque holds a PhD in environmental psychology. Brianna is a program director of environmental sciences, and her research focuses on understanding peoples' relationships with the ocean and marine species. Using various methodologies, including mixed-method surveys and media analyses, she explores biophilia and biophobia in the marine context.

Justin Marshall is an emeritus professor from the University of Queensland and was previously an Australian Research Council Laureate Fellow, a research-focussed post in both neuroscience and marine biology. He has contributed to over 300 publications and started and still directs CoralWatch, the world's largest citizen science coral health assessment program.

Allyson O'Brien is a senior lecturer and education-focused academic at the University of Melbourne. She has a PhD in marine biology and a research background in marine pollution and ecotoxicology. Allyson coordinates the Bachelor of Science Marine Biology major program and is passionate about creating authentic learning experiences in tertiary education.

Gretta T. Pecl has a diverse research background, mostly exploring the impacts of climate change on natural systems, and the development of adaptation strategies for conservation, fisheries, and aquaculture. She leads national and international initiatives to understand climate-driven species redistribution, including Redmap Australia and the Species on the Move collaboration.

Laura Torre-Williams holds an MSc in conservation biology and serves on the Society for Conservation Biology board. Since 2013, she has been a visiting scholar at Griffith University, leading the Gold Coast Newborn Calf Study and documenting humpback whale calves. She is passionate about making marine science accessible to all.

Sophia Volzke is a German-Australian marine and Antarctic ecologist. She excels in ecological modelling and her research investigates external influences and anthropogenic disturbances on population dynamics of threatened marine mammals in Australia and the Southern Ocean. Sophia integrates science communication and public engagement to elevate marine conservation issues globally.

Yolanda Waters is a marine social scientist and founder of Divers for Climate. She specialises in climate change communication, environmental psychology, and transformative tourism. Yolanda integrates research, industry engagement, and community advocacy to drive systemic change for ocean conservation and climate justice.