4. Transformation through participation: democratising the human-ocean relationship

Pamela M. Buchan

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https://orcid.org/0000-0002-3180-877X

Introduction

The consequences of humanity's impact upon the world's physical and biological systems are one of the defining challenges of our generation. The role of the World Ocean in climate change and sustainability issues is coming to the fore, with the COP26 meeting resulting in a 2021 Glasgow Pact that commits to increasing evidence on ocean-based action. The United Nations Decade of Ocean Science for Sustainable Development (2021–2030) outlines ten key challenges, which range from a natural scientific approach of collecting data and developing understanding of ocean systems, through application in practice to reduce pollution and restore ocean ecosystems, and as far reaching as changing humanity's relationship with the ocean, recognising that the human-ocean relationship is a social-ecological system that spans people and the environment via biological, physical, and sociological processes.

Miller et al. (2008) argue that research into social-ecological systems can be limited by the privileging of specific epistemologies according to discipline, and advocate for epistemological pluralism (i.e. interdisciplinarity) to allow a more complete understanding of these complex systems. Epistemological pluralism is embraced by environmental pragmatism, which draws on any tools in the research box that will support the development of effective solutions. Pragmatism is focused on the nature of plural human experience, social institutions, participatory democracy, and the need for continuous reassessment of the moral and ethical principles of society (Parker, 1996), therefore a key concern of environmental pragmatism is "the articulation of practical strategies for bridging gaps between environmental theorists, policy analysts, activists, and the public" (Light and Katz, 1996, p5).

This theoretical context can be plainly understood in real world cases. Take, for example, the problem of marine plastic pollution. There is a requirement to identify and measure the range, scale and dynamics of impacts on water quality and biological life. There is a need also to bring in innovative and technological thinking to filter pollution sources, design plastic alternatives, and clean up environments. The economy must be analysed to understand how it can support or respond to such pressures and changes, and how funding can be delivered to drive innovation. A regulatory

framework might be invoked using environmental law or governmental policy to place pressure on plastic producers and plastic consumers to drive a change.

Such a comprehensive approach is well underway on climate and ocean issues, via substantive international agreements, such as the 1992 Rio Declaration on Environment and Development and the 1997 Kyoto Protocol, and United Nations initiatives including the 2015 Sustainable Development Goals. Yet the trajectory of emissions isn't responding to these measures (IPCC, 2014) and post-COVID-19 pandemic data from Oceanic and Atmospheric Research (2021) indicates that levels of carbon dioxide and methane continue to rise in the atmosphere year on year, threatening catastrophic ocean acidification (Findlay and Turley, 2021). As scholars of the ocean, we should therefore reflect on what is missing in this comprehensive approach.

Historically, there has been insufficient research focus on factors within the social component, with much marine research activity focused on gaining ever more confidence in the 'normal' scientific (Kuhn, 1962) factors relating to the ecological system and its perturbations. In this chapter therefore, I argue that a key missing component is people – their knowledges, values, and rights; and lack of recognition of the political aspect of marine citizenship as an important piece of the transition puzzle. The ever-growing wealth of scientific knowledge, defining the problem and the solutions, has not been matched by an equal wealth of knowledge about how hearts and minds might share the sense of urgency and morality needed to support and contribute to the actions proposed by science. In this chapter, I use my interdisciplinary research into marine citizenship to exemplify how addressing today's most urgent issue of ocean health can be supported by the transdisciplinarity of environmental democracy and holistic conceptualisations.

In the next two sections, I give a brief overview of the development of the definition of marine citizenship, followed by an explanation of the post-normal science (PNS) framework. Subsequently, the two core PNS components of plurality of knowledge and the extended peer community are discussed in detail, drawing on empirical data from marine citizenship research (Buchan, 2021). The empirical data is used to emphasise how marine citizens have an implicit understanding of their value as knowledgeable and as legitimate peers for environmental transformation, aligning with the PNS framework. I then bring together my argument with the contemporary global interest in ocean literacy and encourage ocean researchers to consider how their work can promote transdisciplinarity through widening access to the peer community.

Marine citizenship

Marine (or ocean) citizenship as a concept, when first proposed, brought together the principles that the ocean is a common good, that people have individual impacts upon it, and that people relate geographically to the marine environment (Fletcher and Potts, 2007). In keeping with wider

environmental education research (Schild, 2016), the proposed solution to fostering ocean citizenship was primarily based upon growing ocean literacy, with little interrogation of the relationship people have with the marine environment as a geographical place. Despite the well-known knowledge or value-action gap (Blake, 1999; Owens, 2000), the limited body of marine citizenship research has been dominated by education and awareness raising as tools for behaviour change, in favour of reducing impacts upon the ocean (Buchan, 2021).

These approaches reflect the prioritisation of scientific knowledge by marine practitioners (e.g. McKinley and Fletcher, 2010; Rees et al., 2013). This prioritisation is normative, with environmental education and decision-making typically dominated by technocratic knowledge and solutions (Robottom, 1991). Though definitions have referenced both rights and responsibilities (McKinley and Fletcher, 2010), the research focus has exclusively considered responsibilities: typically as individual, private, pro-environmental behaviours. Pro-environmental behaviours are promoted through the top-down transfer of scientific knowledge via education and psychological techniques such as social marketing, tailored to people's varying value priorities (Owens, 2000; Walker-Springett et al., 2016). Yet research shows that education is not linearly related to environmental concern and actions, and other factors mediate the relationship (e.g. partisan politics: Hamilton and Safford, 2015; education and climate change concern: Kahan et al., 2012; value-action gap: Blake, 1999; values and self-efficacy: Estrada et al., 2017). It has been argued that scientific environmental controversies require political development and that waiting to develop 'enough' scientific evidence will result in policy paralysis (Sarewitz, 2004).

Here then is an opening for a new way of looking at marine (and by extension, environmental) citizenship as an holistic and relational human experience, grounded not in a one-way receipt of knowledge promoting a desired outward action, but in the geography of place and politics. This invokes classical understandings of citizenship as a relationship between citizen and state, in this case in situ in marine environments. If marine citizenship is to be effective as a policy tool for improving marine environmental health (McKinley and Fletcher, 2012), then this much wider conceptualisation of marine citizenship must be explored. Echoing the wider philosophy of Jelin (2000), here, marine citizenship is defined as "exercising the right to participate in the transformation of the human-ocean relationship for sustainability" (Buchan et al., in press).

This view of marine citizenship is as dynamic as the ocean itself, and acknowledges people as both individuals and collectives with agency to shape outcomes. Marine citizenship therefore can be considered a transdisciplinary tool that can contribute to the transformation of the human-ocean relationship. However, this potential for marine citizens to act as agents of change can only be realised if societal systems recognise the right to participate in marine decision-making and make it accessible. From a political perspective, this is democratisation of environmental decision-making.

From an academic perspective, this means recognising the value of marine citizens as holding useful, diverse knowledge, and as legitimate peers in developing future solutions to environmental problems. In essence, this is PNS.

Post-normal science

PNS provides a useful framework for interdisciplinary and transdisciplinary approaches to developing solutions at the science-society interface. Whilst 'normal' science (Kuhn, 1962) relies on positivist mathematical/scientific-based solutions to defined problems, PNS is identified as relevant to complex 'wicked' problems that are high risk, have high stakes and where there is high uncertainty (Figure 4.1) (Funtowicz and Ravetz, 1993, 2003). Climate change and transformation of the human-ocean relationship align with these criteria (e.g. Turnpenny, 2012; Jones, 2002): the risk of a 'do nothing' approach is extremely high at local to global scales; a major intervention is required to mitigate and adapt to these consequences which makes these high stakes issues; and whilst we have a great deal of confidence in scientific forecast, the inherent chaos in climate makes certainty impossible, and we have considerably less evidence and confidence in the social responses to these issues.

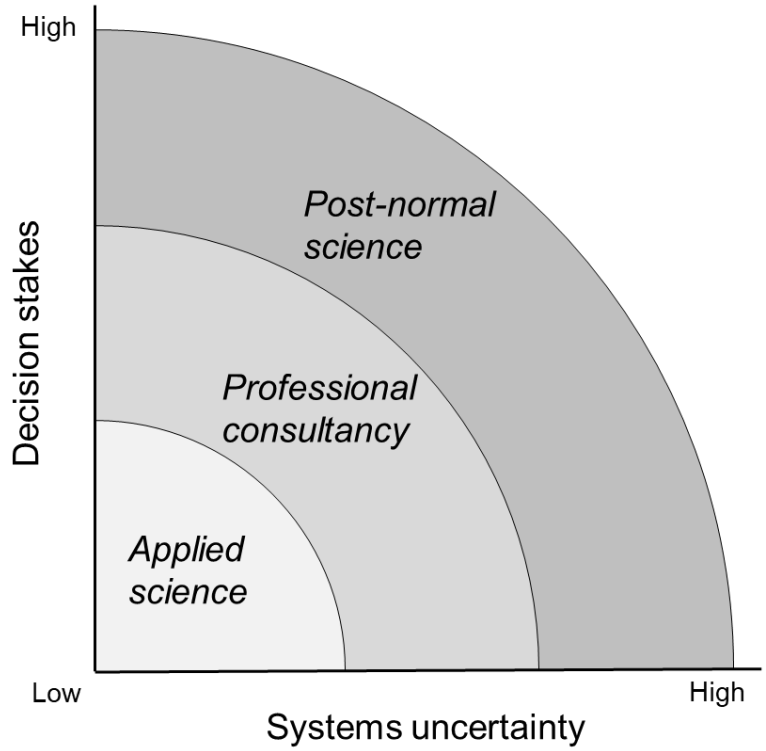

Figure 4.1 Diagram of post-normal science. Source: Funtowicz & Ravetz (1993).

To manage the complexity, uncertainty, and risk, PNS proposes incorporation of a plurality of knowledges and an extension of the peer community. In practice, this means drawing on knowledge beyond that which is obtained through scientific research; sources such as traditional or indigenous knowledge, local knowledge, and socio-political knowledge. PNS embraces transdisciplinarity by

reaching out beyond academics and scholars, towards inclusion of practitioners and communities in the process of identifying problems and developing acceptable solutions. Through this process, scientific knowledge is supplemented with an ethical, moral, and cultural value-base. This is of benefit to participatory decision-making (Lee and Abbot, 2003), and empowers citizens through participatory decision-making processes which are deeper than typical tokenistic consultation (Arnstein, 1969). From a political perspective, this can be understand as a democratisation of science through active citizenship.

Through this post-normal and transdisciplinary lens, this chapter considers, in turn, plurality of knowledge and extended peer communities, in the context of marine citizenship as it is understood by marine citizens themselves. The primary data and analysis which this discussion draws on originates from a wide-ranging interdisciplinary investigation of marine citizenship in the UK setting (Buchan, 2021). The empirical data was gathered from active marine citizens, who were identified through three UK case studies, comprising two marine groups (one local, one regional) and a national citizen science project. A pure mixed methodology was employed, with quantitative and qualitative data obtained through an online survey, and open-ended interview of a purposefully selected sample, representing diversity in key characteristics. Observations of marine citizens participating in a marine citizenship action of their choosing supported researcher understanding of how marine citizenship is understood and practiced by marine citizens (Figure 4.2). (Detailed methodology is described in Buchan, 2021, pp. 90–113.)

Figure 4.2 Example marine citizenship activity, releasing juvenile lobsters to replenish wild stocks. Source: © Pamela M. Buchan

The research investigated internal/psychological factors such as basic human values, environmental identity, environmental attitudes, and emotions; and geographical factors such as ocean proximity/visits, marine place attachment, marine place dependency, place identity, and the physical, material, and cultural qualities of the ocean which underpin such relationships. Of specific pertinence to this chapter, marine citizens were asked to share their marine citizenship actions, and their perspectives on the utility of marine citizenship for decision-making and transforming the human-ocean relationship. The study contributed a novel investigation of marine citizenship participatory rights, through extent and experience of participation in decision-making by marine citizens, in the context of existing procedural participatory rights in law and regulatory frameworks. The inductive and interdisciplinary approach enabled the emergence of evidence that marine citizens conceive a more sophisticated role for knowledge in marine citizenship than linear, knowledge-deficit models.

The next two sections draw on the empirical findings relating to knowledge, marine citizenship actions, and participation in decision making, in order to provide evidence for the utility of applying transdisciplinarity through a PNS lens. Through this, I argue that marine citizens implicitly take a PNS position on developing environmental solutions and transforming the human-ocean relationship: they view themselves as holding useful local and place-based knowledge; and as legitimate members of the peer community wishing to participate in the transformation process. First, I focus on plurality of knowledge, and then I consider the extended peer community.

A plurality of knowledge

PNS places legitimacy on a plurality of knowledges and perspectives, which necessitates a dialogue to navigate interests, values and conflicts, and the production of an agreed outcome. By drawing on a range of knowledges to determine parameters, the pitfalls of too much sensitivity (in statistics a Type I error) or too much selectivity (Type II error) are navigated, in the ‘wicked’ problem condition of insufficient quantitative certainty (Funtowicz and Ravetz, 2003).

Using a PNS framework, I extended the marine citizenship research peer community, which had hitherto been limited to marine practitioners and researchers (e.g. through studies such as McKinley and Fletcher, 2010; Rees et al., 2013), by working directly with active marine citizens themselves (Buchan, 2021). I engaged with a plurality of knowledge, by both testing established areas of sustainability research, such as the Schwartz (2012) theory of basic human values, Clayton’s (2003) Environmental Identity Index, and theories of place (e.g. Devine-Wright, Price, and Leviston, 2015; Devine-Wright, 2013), and listening to marine citizens using an inductive approach which left space for emergent factors. Through this interdisciplinarity and use of pure mixed methods, the research design enabled marine citizens to challenge the prevailing normative view of marine and

environmental citizenship as knowledge-driven, individualistic behaviour change (e.g. Blake, 1999; Hawthorne and Alabaster, 1999; Kollmuss and Agyeman, 2002; Stoll-Kleemann, 2019).

The positivist view of knowledge deficit, in its rawest form, views people as empty vessels who, once filled with information, will behave in the ways intended by those who educate them. In contrast to this, marine citizens demonstrated that they have an intuitive and complex understanding of the role of knowledge in marine citizenship. They described knowledge in three key ways: (i) plurality; (ii) knowledge transfer; (iii) as a citizenship action in its own right.

Plurality of knowledge

Marine citizens acknowledged two key types of knowledge: scientific and local (including place). Scientific knowledge was recognised as valuable in collecting evidence to feed into informed policy-making, implicitly recognising the normative privileging of scientific knowledge, for example, in designating marine protected areas (Pieraccini, 2015). Citizen science, as a way of doing marine citizenship, recognises this relationship between policy and science and provides a vehicle for individuals to support the ocean through the gathering of data.

Figure 4.3 Spending time in nature at the coast, to learn about the local wildlife. Source: © Pamela M. Buchan

Local knowledge was particularly recognised in the context of place: "It's probably about living in a place isn't it, and getting to know the people. And getting to know a bit about the shores and what lives on them and what lives in the waters" (interviewee). Within local place knowledge, there were intersections with other factors, such as basic human values. For example, being more knowledgeable

about the local wildlife (Figure 4.3) and what is safe to eat or touch, and what should be avoided, reduces fear of nature and promotes sense of security; something that is important for those who prioritise this value. Recognising the landscape, or local topography also promotes security through confidence, and increases place attachment. Local knowledge, however, also related to people, and the social capital of the knowledge held by local residents and collectives such as marine groups and its usefulness for marine management: "I think recognising different groups' expertise and knowledge is really important. Giving them respect," (interviewee).

Traditional or indigenous local knowledge is commonly recognised as deserving of more respect, particularly in developing nations and the Global South, where the application of Western environmental management approaches is imposed on more traditional regimes (Rahman, 2020). My study showed that in developed nations also, local communities have local and place-related knowledge that is relevant to marine decision-making, and a desire to meaningfully contribute their knowledge alongside more 'legitimised' scientific knowledge.

Knowledge transfer

Knowledge features widely in the environmental citizenship literature as a promoter of action (e.g. Fletcher and Potts, 2007; Guest et al., 2015; Hawthorne and Alabaster, 1999; Heck et al., 2016; McKinley and Fletcher, 2010, 2012; Potts et al., 2012; Rees et al., 2013 *inter alia*). Through the knowledge deficit model, knowledge transfer is one-way from expert to lay person, equipping them with awareness of environmental issues, information about how to change their behaviour to reduce environmental harm, and seeking to shape their understanding and perceptions.

So pervasive is this model that many marine citizens also expressed the need to educate the wider public so that they would participate in marine citizenship. They lamented the lack of knowledge of the wider public: "I'm also amazed at how little is known" (interviewee). Though marine citizens advocated education when engaging with others, they did not describe their own marine citizenship as motivated by knowledge, but rather by their connection with the ocean as a place (Buchan, 2021). It was evident that when knowledge was lacking, this could be a barrier to efficacy of changes in behaviour, whilst being equipped with more extensive knowledge could enable changes in behaviour, where the motivation to do marine citizenship already exists (Buchan, 2021; Buchan et al., 2022).

However, marine citizens highly valued knowledge transfer in a range of additional ways. Local place-based knowledge, as discussed earlier, connected with important feelings such as pride of place – which itself was believed to promote action to preserve the character of the place. (And certainly the wider study evidenced the importance of place attachment for marine citizenship.) Learning develops skills and tools with which to make informed decisions as a marine citizen. Facilitating these sorts of knowledge transfers in the wider public, alongside sharing of environmental values, was a cornerstone of public-facing marine citizenship. Implicitly recognising the power of multiple voices and

knowledges, the marine group, as a collective of marine citizens with a diversity of knowledges, was highly praised by marine citizens.

The transfer of scientific and local knowledges was also identified by marine citizens as fundamental for evidence-based and effective decision-making in policy, and research supports this view (Foxwell-Norton, 2013; Lazarus, 2009; Steele, 2001). Communities can contribute to local and national processes through the collection of data from citizen science, and support better decision-making by sharing local knowledge via community participation.

Citizenship action

Marine citizens viewed knowledge and knowledge exchange as fundamental to the practice of marine citizenship as a political action. Informing oneself was cited as an act of citizenship, both for personal decision-making, and as a responsibility to learn about what is happening to the world. Lifelong learning has been cited as a political response to an increasingly technocratic and de-collectivised society (Freire, 1972; Martin, 2003); and promotes inclusive, pluralistic, reflexive, and active citizenship (Johnston, 1999). Through one's own learning, citizenship can move away from fulfilling a set of individualised behaviour changes, to a more critically considered civic participation.

For marine citizens, knowledge was integral to the power of collective action: "the more people get together, and the more people talk about things . . . then they have to listen because it's the power of the people" (interviewee). Through the knowledge exchange taking place within the marine group, the collective was granted more legitimacy externally, as embodying expertise. Group members were individually empowered through learning, sharing of opportunities, and the social experience, leading to increased civic participation.

Through these nuanced and complex understandings of the role of knowledge, marine citizens demonstrated an inherently post-normal view of marine and environmental issues. Whilst acknowledging the power of scientific evidence, marine citizens were not satisfied with a procedure which excluded them. They wanted to bring people together to create change within the environmental social movement; to situate marine and coastal decision-making alongside their local place-based lived experience; and, fundamentally, to be part of the process shaping how humanity uses the ocean.

Extending the peer community for environmental democracy

In PNS, the quality of policy-making is ensured through open dialogue with an extended peer community, defined as all those with "a desire to participate in the resolution of the issue" (Funtowicz and Ravetz, 2003, p. 6). As I have argued earlier, marine citizens have the desire to participate in marine sustainability. When and to what extent should the marine peer community be extended? The answer to that question is clearly subjective, and is itself therefore post-normal, and might be best

determined through enhanced democratic and participatory processes engaging with those who wish to participate.

Public participation in decision-making is evidenced as a valuable process across many fields of enquiry. For example, in environmental law, this has been seen to produce better solutions through deliberation of a wider set of voices (Steele, 2001), which are perceived as more acceptable and legitimate (Scharpf, 2003). There is a growing body of research within the science communication, or public engagement with science field, demonstrating the importance of more participatory and deliberative processes for navigating issues at the science-society interface (Smallman, 2014). For many years, there has been debate about the quality of citizen participation, with Arnstein's (1969) classic Ladder of Citizen Participation indicating the relationship between participatory method and how much power is transferred to the citizen.

Participatory processes are in essence an extension of the peer community: scientific experts and knowledge are extended to include multiple actors and perspectives from different stakeholders and the wider public. In the context of marine citizenship, there are two main forms of participation: (i) participation as procedural, via the legislated right to participate in environmental decision-making; and (ii) participation as political, via citizenship activities in the public sphere, aimed at changing the views of fellow citizens and creating grassroots pressure upon decision-makers. Each of these represents an extension of the peer community for marine environmental problem-solving; the first through formal representation on a case-by-case process, and the second through democratisation of the shape of the human-ocean relationship. I will consider each of these in turn.

Procedural participation

The Rio Declaration on Environment and Development, 1992 acknowledges a political and moral responsibility of those with the power to make environmental decisions to include the wider public. In legal terms, the right to participate in environmental decision-making is afforded to the public concerned or affected, which might be interpreted as those with an interest through business or statutory responsibility, or those who live in direct connection with the location of the development. In the United Nations Economic Commission for Europe 1998 Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (the Aarhus Convention), environmental non-governmental organisations (NGOs) are given an explicit role in representing public or nature-based interests in environmental management. This model of public procedural participation is not without criticism, for example, for lack of clarity on who are the public concerned/affected, the role of environmental justice NGOs, and the nature of the participation (e.g. no guidance is given about the spectrum of participatory types, from tokenistic consultation to co-creation); for reinforcing existing power imbalances; and for the ability of environmental NGOs to

adequately represent wider public interests (Holder, 2006; Lee and Abbot, 2003; Nadal, 2008; Steele, 2001).

There are also uncertainties as to how existing legislature responds to contemporary challenges. For example, in the introduction to this chapter, I highlighted the global scale of ocean degradation and climate change, and that the ocean is understood as a common good. The Kyoto Protocol to the United Nations Framework Convention on Climate Change, 1997 recognises differential financial responsibility between developing nations and developed nations in mitigating climate change, due to uneven historical greenhouse gas contributions from industrialisation. There is therefore both scientific and legal acknowledgement of the global scale of the ocean and climate systems, in which causes and impacts might be under different national or regional legislative jurisdiction, or in areas beyond national jurisdiction (ABNJ). Where existing procedural participatory rights are conferred on the public affected or concerned, it becomes clear that these conditions cannot always be meaningfully defined in the context of global environmental challenges (Peters, 2015). The fluid and continuous nature of the world ocean is a challenge for marine citizenship through procedural means.

Furthermore, whilst marine citizens might have the desire, they do not always have the means to participate as they would wish to (Buchan, 2021). For example, individual behavioural choices are limited by the constraints of a society and economy which place uneven expectations and limitations upon individuals, which intersect with their socio-economic circumstances. I found amongst marine citizens, a wide-scale lack of awareness of their procedural rights to access environmental information, participation in environmental decision-making, and environmental justice.

A lack of knowledge about procedural rights is likely to limit access to those rights: “As a diver, I see a number of things that concern me and other members of the diving club I belong to. But I don’t know who to voice these concerns with” (interviewee). Certainly ignorance of law in general is widespread and has implications for compliance (van Rooij, 2020), and it is difficult to see how citizens can effectively hold decision-makers to account if they are unaware of the right to do so.

Whilst formalised means of participation include consultation, citizen science, citizens juries or focus groups which might inform or be considered alongside scientific evidence, the use of local, traditional or place-based knowledge also equips citizens to develop solutions to problems themselves (Funtowicz and Ravetz, 2003). Therefore alongside further democratising environmental decision-making, there is also a case for considering devolution of decision-making, in a way which involved citizens in the places where they live.

Issues about rights, ethics, distribution of resources, and responsibilities are political and need to be debated to reach resolutions. Shove and Walker (2007) argue for explicit illumination of the politics of environmental transition. It is a political process to determine that the contemporary human-ocean relationship is problematic for the future health of nature and humanity, and to consider policy actions

to address the challenge. It is also a political process which determines who are the actors who should be managing or influencing the transition. Green politics emerged to give recognition to an ecological and holistic approach to the environment, which is sustainable and equitable, and which recognises grassroots democracy (Capra and Spretnak, 1984). Whilst scientific calls have reached out to policy-makers to better recognise the role of the ocean in climate (e.g. Laffoley et al., 2022) and whole-ecosystem approaches to marine management (e.g. Rees et al., 2020), they have not yet called for a 'blue' politics to place pressure on policy-makers.

Political participation

If one accepts the premise of PNS – that 'wicked' ocean and climate issues cannot be solved through 'normal' scientific endeavour – then one must also accept the need for interrogation of the political and procedural processes that surround environmental decision-making and transformation of the human-ocean relationship for sustainability. The quality of political decision-making depends upon fair representation of different peoples and communities – at its best, democracy is the most extended peer community. Whilst it clearly is not practical to make all environmental decisions in a fully democratic way across the whole globe, the negotiation about who is represented and how is a construct of political action. In democratic states, political actors need the support of the electorate to enact significant policy directions, and so an active citizenry is required to deliver messages from the grassroots

In my research, marine citizens were very aware of this relationship. They demonstrated a view of marine citizenship that was strongly grounded in civic participation, with higher than average levels of political and civic engagement, and a strong narrative of being champions for the marine environment, through public engagement and political action (Buchan, 2021). Indeed citizenship activities of this sort were much more common than procedural participatory experiences. Although the rights of marine citizenship have not formerly been characterised, marine citizens implicitly felt they should be involved in shaping the human-ocean relationship. In some cases, this involvement extended from voluntary activities into professional choices, where occupation and career trajectory was primarily influenced by environmental aspirations. Citizens viewing their occupation as an act of citizenship have been observed before in the environmental sector (Buchan and Yates, 2019).

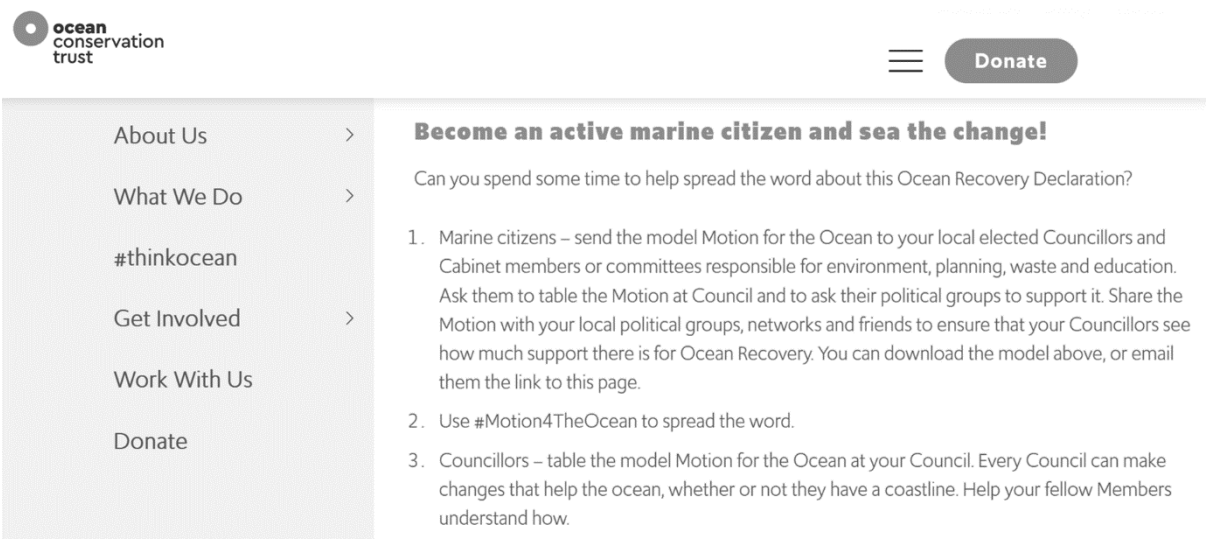

Figure 4.4 The 'Motion for the Ocean' local government Ocean Recovery Declaration is an example of mobilising marine citizens to exercise their marine citizenship rights to ask for transformation of the human-ocean relationship. https://oceanconservationtrust.org/project/the-motion-for-the-ocean/

Marine citizens work to mobilise a grassroots movement, through individual actions to change hearts and minds, and collective actions via place-based marine groups and wider political campaigning (e.g. see the local government Ocean Recovery Declaration, Figure 4.4). Social movements are a collective process (Diani, 1992; Tindall, 2002) and can work across scales from shaping local marine places as communities up to placing pressure of decision-makers to rebalance the benefits for humanity and nature. The potential for marine citizens as activists should not be underestimated by environmental scholars, in favour of simplistic educational approaches to behaviour change (Chawla and Cushing, 2007; Jelin, 2000; Schild, 2016).

Supporting transdisciplinarity

Having laid out how PNS can act as a conceptual framework to support transdisciplinarity through marine citizenship, attention must be given to access and power. Though the sample of marine citizens in my research were quite well-spread, demographically, it was limited to the UK and there was an overrepresentation of higher levels of education. The sample were most typical of those who volunteer. Volunteering has well-established barriers associated with age, gender, education, income and time (Egerton, 2002; Egerton and Mullan, 2008). Barriers to volunteering and civic participation are often rooted in systemic barriers, reinforcing marginalisation and power imbalances in wider society.

What is clear is that there is a need for reform of public participation processes to improve awareness of procedural rights and increase procedural participation opportunities. As scholars of the ocean and its interface with society, we must consider what we can do within our research and practice that will promote transdisciplinarity and PNS activities. One such activity might be to review what we understand ocean literacy to be.

Ocean literacy has tended to focus on natural scientific knowledge about the ocean. For example, the United States' National Marine Educators Association (2019) defines ocean literacy as understanding the following:

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of the Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored.

However, if the goal of ocean literacy is to promote marine citizenship (e.g. Fletcher and Potts, 2007; Fielding et al., 2019), then there is good reason to consider whether ocean educators might wish to include political and procedural literacy in their activities. As noted, the political context of environmental citizenship has not been well-investigated (Schild, 2016), yet it has been known for some time that multiple types of knowledge are associated with pro-environmental behaviours, and action-based procedural knowledge is more influential than scientific, or declarative, knowledge (Kaiser and Fuhrer, 2003). Marine citizens who are equipped only with marine scientific knowledge may be less able to engage in transformative processes than those who additionally understand their rights and the suite of civic participatory procedures potentially available to them. Additionally, those who do not recognise their own power as citizens to promote changed ocean practices may be limited in the choices and actions they engage in.

For some readers, being a marine researcher or practitioner might be a marine citizenship activity, and this chapter will be food for thought about our own practice and methodologies. Within academic institutions and cultures, how far are we prepared to go as activist researchers to drive transformation? By embracing plurality in practice, new insights will be uncovered, illuminating what methodologies are effective in what circumstances, and how the community of marine problem-solving peers can be extended beyond the limitations imposed by existing structures. The methodologies and case studies in this book will no doubt prompt reflections on putting these ideas into practice.

Conclusion

In this conceptual reflection, I have presented a conceptualisation of marine citizenship which acknowledges its political and participatory potential for promoting transformation of the human-ocean relationship (Schild, 2016). I have summarised the PNS framework (Funtowicz and Ravetz,

2003) and its relevance, both for ocean- and climate-based problems (Jones, 2002), and for transdisciplinarity. Through the PNS lens, the views of marine citizens themselves have been set out to understand the relationship between marine citizenship and knowledge, and the potential for marine citizens to extend the peer community in marine decision-making and policy. I have argued that marine citizens are implicitly plural in their use of knowledge, value scientific and local knowledge, and use knowledge acquisition and exchange for citizenship and transformation. I have discussed how marine citizens can extend the peer community by participating procedurally and politically, and touched on some of the challenges and barriers associated with this in practice.

To meet the challenges of navigating transformation of the complex human-ocean, social-ecological system, there is a need for environmental pragmatism that embraces issues such as morality, democracy and the structure of social institutions (Parker, 1996). These issues are debated within political institutions, which are influenced by existing power imbalances and marginalisation, yet are also responsive to social movements for societal change (Diani, 1992). It is in the interest of ocean researchers who wish to mitigate the ocean's crisis, to be as inclusive as possible and support marine citizens access to processes of change through transdisciplinary research evidence. The empirical data demonstrates that marine citizens view themselves as knowledgeable and legitimate actors but that they are held back by institutional biases about knowledge legitimacy, and awareness of and access to their existing participatory rights.

Transdisciplinarity can be rooted right through problem-solving from the earliest co-production of knowledge, perhaps via citizen science; employing inductive research that amplifies the voices of participants (as in my research presented here); co-designed and co-produced research which directly integrates an extended peer community into a problem-identifying/solving process; through to informing and improving the democratic processes of decision-making. Recognition of the public and political faces of marine citizenship responsibilities, and the rights of marine citizenship as the right to participate, is the first step to developing a transdisciplinary transformation.

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