



## OPEN ACCESS

## EDITED BY

Jonathan Y.S. Leung,  
University of Adelaide, Australia

## REVIEWED BY

Ruth Brennan,  
Trinity College Dublin, Ireland

## \*CORRESPONDENCE

Geraint Rhys Whittaker

✉ geraint.whittaker@hifmb.de

RECEIVED 05 June 2023

ACCEPTED 19 June 2023

PUBLISHED 30 June 2023

## CITATION

Whittaker GR (2023) Creatively connecting science, society and the sea: a mini-review of academic literature focusing on art-science collaborations and the ocean. *Front. Mar. Sci.* 10:1234776. doi: 10.3389/fmars.2023.1234776

## COPYRIGHT

© 2023 Whittaker. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

# Creatively connecting science, society and the sea: a mini-review of academic literature focusing on art-science collaborations and the ocean

Geraint Rhys Whittaker<sup>1,2\*</sup>

<sup>1</sup>Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven, Germany, <sup>2</sup>Helmholtz Institute for Functional Marine Biodiversity (HIFMB), Oldenburg, Lower Saxony, Germany

Collaborations between artists and ocean scientists are becoming increasingly frequent. As the UN Ocean Decade (2021-2030) stresses the importance of engaging with the public, there is a growing interest in using art as a tool for communication as well as for scientific exploration and experimentation. This mini-review charts the current academic research on art-science collaborations and the ocean, focusing on literature where artists and scientists work together to produce something based on scientific research. The study finds that these relationships are never apolitical, are complex and develop differently depending on each project. In sum the paper will highlight that although the academic literature is limited, its diversity has the potential to reach numerous academic disciplines and that focusing on process and engagement should be a direction for further research to help broaden the academic reach of these important oceanic knowledges.

## KEYWORDS

ocean, art, art-science collaboration, UN ocean decade, art-science

## Introduction: artists, scientists and the ocean

From the wood carvings produced in Oceanic Island communities (Kjellgren, 2014), to the surfer rock music of Dick Dale and the Del-Tones (Crowley, 2011), to Katsushika Hokusai's print *The Great Wave off Kangawa* which has been described as one of the most famous images in Japanese art (Cartwright and Nakamura, 2009), the ocean has been a site of inspiration for people to express themselves artistically for thousands of years. An intriguing, wonderful, terrifying and spiritual space providing inspiration to feed the artistic curiosity of cultures (Grasskamp, 2021). Equally, for scientists and philosophers, long before the 19<sup>th</sup> century when the academic discipline of Oceanography was established, the Oceans have been a critical space for epistemological thinking. From Sumerian culture, whose depictions of a 'vast' and 'angry' sea helped delineate 'natural',

‘political’ and ‘mythological’ boundaries (Vederame, 2020:89), to Ancient Greece, where Aristotle’s studies of marine animals contributed to early understandings of the behaviours of ocean species (Greene and Depew, 2004), the sea has been continually analysed as fundamental to understanding the world.

Today, as advancements in technology allows humanity to dive deeper and further than ever before, each new discovery encourages scientists and artists alike to further challenge “the limitations of our terrestrially evolved sense” (Adler, 2022:43). In doing so, opening new opportunities to extend ocean imaginaries beyond current understandings, and reconceptualise the ways oceanic space is understood and experienced (Peters and Steinberg, 2019). One such way that thinking *under*, *through* and *with* the oceans is being advanced in novel ways, is through the combination of the artistic and scientific worlds. Art has become an important tool in understanding coastal and marine sustainability (Matias et al., 2023) and so the coming together of artists and marine scientists has seen a rise in the past few decades, and with it, so has the number of academic articles and books published on the subject (Probyn et al., 2020; Jung et al., 2022).

This increase in oceanic art-science collaborations is particularly critical today due to the UN ocean decade (2021–2030) emphasising that creating an ‘engaging’ and ‘inspiring’ ocean is one of their key priorities. As such, when it comes to engaging with non-scientists, this review comes at a time when it is increasingly being acknowledged that scientific data alone is not enough, and that art is increasingly being utilised as an effective and necessary way to approach engagement beyond academia (Brennan, 2018; Whittaker, 2023). Engaging people is as much an emotional endeavour as anything else, with current research on climate change attitudes suggesting that engagement which utilises emotions through using the creative arts is more effective than not doing so (O’Neill et al., 2013; Burke et al., 2018; Bennett and Roth, 2019; Gallardo et al., 2021). In other words, emotion is critical for engagement, and so a medium like art (be it music, film, sound, performance, storytelling, photography and so on) which by its very nature is about provoking an emotional reaction from an audience, can provide fluidity to static understandings of ocean worlds (Whittaker, 2023). And so, developing new ways of understanding, expressing and experiencing the ocean through art-science collaborations allows researchers to explore the numerous ways that the ocean exists as ‘a multiplicity of spatialities’ that ‘exceed liquid encounters alone’ (Peters and Steinberg, 2019:10).

## What’s in a name? art-science collaborations

The focus of the article is not to analyse long standing (and important) debates on pondering what is art and what is science and where the border between the two begins and ends (see Jones and Galison, 1998; Miller, 2014; Yang, 2015). Saying that, I will emphasise that scientific research is not devoid of creativity, imagination or storytelling, and that a desire to be curious is inherent in both artistic and scientific endeavours (Whittaker,

2023). As Crawley et al. (2022: 295) highlight, artistic expressions produce imaginaries of the ocean in order to ‘know’, ‘understand’ and ‘capture’ it for the purpose of ‘redefining’ it for various audiences, which can be said the same for the scientific tradition. Because of this, it is important to have in mind that the boundaries between art and science are sometimes blurred and not so easily discernible (Schnugg, 2019). This article will focus less on these philosophical debates, however, and instead on reviewing what academic articles and books have been written on art-science collaborations and the ocean and what they say.

A useful categorisation of the ways artists and scientists have worked together in the past can be summarised by Jung et al. (2022:3). Here they split the relationship into three dimensions; Dimension A – what they call SciComm – where scientists recruit artists to help them communicate their research to the public – Dimension B – SciArt – where artists interact with scientists for unique access to data and media, and Dimension C – ArtScience – where transdisciplinary teams find creative ways to ask questions and design new experiments. A fourth dimension also exists, the *Artist-researcher* where individuals are both researchers and artists themselves and have the skills to interpret and merge both worlds in the displaying of their own work (Stevens et al., 2019). This is not a new phenomenon as the distinction between the art and science worlds have often been combined, particularly by individuals who have embodied both to inform their work. From Maria Sibylla Merian (1647–1717) the naturalist who used illustrations to convey her research on insects, to Leonardo Da Vinci (1452–1519) whose scientific research informed and influenced his drawing and painting (Schnugg, 2019). This review however is focused on academic literature which explores more recent and clearly defined examples, where scientific institutes, scientists and artists actively collaborate on ocean related projects, then have written about such processes in academic journals and books.

## Review methods

The mini-review began with a search for key terms on the global database Web of Science. These key terms were chosen to reflect the focus on art-science collaborations and the ocean (see Table 1). For each paper found, the abstracts were read and those that were deemed relevant were filtered for further full reads (Gadsden et al., 2022). I excluded those articles which did not have any art-science collaboration element, any grey literature such as policy reports, pamphlets or websites and only reviewed articles written in the English language. I also excluded articles which although had elements of art, ocean, scientists or public engagement, were not collaborations directly between a scientist(s) and artist(s) (column titled *Related Articles* in Table 1). I thus excluded articles from projects which use creative methods but did not mention any art-science collaboration directly (see Gebbels et al., 2012; Neilson et al., 2016), reflections on historical ocean art (Berta, 2021), ocean art reviews which focus on general ocean art rather than specifically on art-science collaborations (Radstone, 2017; Helmreich and Jones, 2018; Matias et al., 2023), articles which analyse art projects but the researchers who wrote the article were not involved with the project

TABLE 1 Web of knowledge/science search results.

Source	Key words	Articles found	Related Articles	Relevant Articles for review
Web of Knowledge/Science	Art Science Ocean	3,569	22	5
Web of Knowledge/Science	Art Science Sea	3,329	15	5
Web of Knowledge/Science	Art Science Marine	4,289	12	1
Web of Knowledge/Science	Art Science Collaboration Ocean	92	4	2
Web of Knowledge/Science	Art Science Collaboration Sea	88	4	2
Web of Knowledge/Science	Art Science Collaboration Marine	115	5	3

(Van der Vaart et al., 2018), individual reflections by ocean artists which do not mention any scientific collaboration (Nobel, 2015) and those projects that have yet to happen (see Parsons et al., 2021). In addition to these papers, others were read either from reviewing the bibliographies of those papers discovered through the web of science review, prior knowledge of research papers and books, as well as also what was recommended by colleagues and others in the field.

## Deep diving through the literature

What is evident in the current literature is the heterogeneity of approaches taken to art-science collaborations and the ocean. The subject matters range from exploring the artistry of dinoflagellate bioluminescence (Latz, 2017), to understanding attitudes towards marine protected areas in small island communities (Brennan, 2018), from communicating the importance of krill in human-climate networks (Roberts and Nicol, 2011) to expressing the various ways that plastic waste harms ocean environments (Belontz et al., 2019). The medium of art employed has also been extremely varied from project to project. Whether it be creating glass sculptures to communicate sea-level rise (Paterson et al., 2020), using singing and song writing as a tool to remap islands on a coral reef (Williams et al., 2020), employing prose, poetry, and drawings to investigate the ecological effects of the trawling industry (Magrane and Johnson, 2017), using experimental theatre to explore human adaptations to sea-level rise (Wake et al., 2020), creating emojis with students to improve creative problem solving in fisheries education (Jacobson et al., 2020) or employing photography as a means to explore ice crystals at the cryosphere ocean interface (O'Connor and Stevens, 2018; Stevens et al., 2019), the diversity of approaches taken reflects the possibilities that pairing academics and artists brings to the input and output of a research project.

In most cases the collaboration is either initiated from the side of the scientific or academic institution, from pre-existing relations between the scientific authors and artists, or it is not mentioned. Who participates also varies. Some projects do not extend beyond the artist(s) and scientist(s) relationship, others stem from collectives of artists and academics (Belontz et al., 2019), some are projects which involve action research or citizen science with multiple stakeholders, including the general public (Murray and Tilley, 2006; Griffiths et al., 2017; Da Cunha et al., 2020; Vergés

et al., 2020) whereas others involve art research centres like *TBA21 Academy* and *Cape Farewell* who focus on bringing artists and scientists to work exclusively together on ocean and climate art science projects (Straughan and Dixon, 2014; Hessler, 2018).

The purpose of art-science collaborations and the ocean is multidimensional. Although most articles mention public communication as a primary motivation with a focus on creating a bridge between science, society and the sea, others also emphasise value beyond only public communication and stress the importance of art-science collaborations for the co-creation of knowledge which offer new perspectives and ways to investigate science and art and shed light on otherwise unexplored relationships (O'Connor and Stevens, 2018; Jung et al., 2022). In other words, these articles stress the value in process and experimentation as much as the final output (Whittaker, 2023). Whilst others, highlight the potential of art-science collaborations to transcend the parameters of a project to influence policymakers' decisions when for example, planning and managing marine environments (Brennan, 2018).

Where these collaborations occur are not only in what would be considered traditional art spaces like galleries and museums. Some have involved the formation of scientific-cultural festivals (Lycka and Elster, 2020), others involve working collaborations on-board ships as part of a project exploring issues of sustainability and resource management (Straughan and Dixon, 2014), whilst others involve *in situ* practice such as the sonic kayak project where kayaks rigged with sensors and music making equipment allowed volunteers to make music on the ocean to create art but also collect scientific data (Griffiths et al., 2017). Where the articles are published is also varied. Not only do they appear in journals dedicated to art-science such as the journal *Leonardo* (O'Connor and Stevens (2018) or science communication such as *Journal of Science Communication* (O'Connor and Stevens, 2015), but also in human geography, *Mobilities* (Straughan and Dixon, 2014) and *cultural geographies* (Magrane and Johnson (2017), studies in environment and society such as *Ambio* (Belontz et al., 2019), *Climate Risk Management* (Da Cunha et al., 2020:10), and *Acta Astronautica* (Casasanto et al., 2018), ecology, *Frontiers in Ecology and Evolution* (Roberts et al., 2021), biosciences, *Bioscience* (Clark et al., 2020), *PLOS BIOLOGY*, (Griffiths et al., 2017) marine and ocean sciences, *Frontiers in Marine Science* (Jung et al., 2022), *Journal of the Marine Biological Association of the United Kingdom* (Dupont, 2017), *Oceanography* (Dybas, 2019) and *Oceanologia* (Lycka and Elster, 2020), and even in polar research journals, *Polar Record* (Stevens et al., 2019), *the Polar Journal* (Roberts and Nicol, 2011).

## Discussion and future directions: process, publications and engagement

Overall, although the literature is growing, it is limited, and so more needs to be published to share the valuable knowledge that can be created through such work. Numerous art-science collaborations on the ocean exist beyond what is covered in this article, but these do not always result in academic publications (for a good example of a non-academic publication see [Griffith, 2014](#)). Anecdotally, based on conversations with colleagues and experienced experts in the field, this paper suggests that this is because of two primary factors.

The first factor is that those who participate in art-science collaborations are not always aware that their reflections on the process is invaluable academic knowledge. In particular, when in conversation with colleagues from the natural sciences who have engaged in art-science collaborations and the ocean in the past, but did not publish their reflections, they have stressed that they did not realise that the process and journey of an art-science project is as valuable as the art that is produced. I would always contest that the meeting of the two, is itself a success. And for some, the purpose of art-science collaborations is to communicate outwards to the public and not inwards back at the academic community. However, without a reflection on process, including what worked, what didn't, how the relationship developed and so on, much invaluable knowledge is lost which can contribute towards developing a more informed oceanic academic canon.

The second influential factor that can be an obstacle and is related to the previous point, is knowing where to publish. Art-science collaborations by their nature are transdisciplinary. This means that on the one hand they have the potential to appeal to various academic spheres, whilst on the other hand be too broad to appeal to any. Although there is diversity in the journals that ocean related art-science projects are published in, which shows the flexibility and potential academic reach such literature has, as this review has shown, the scope is limited. This paper, for example, failed the initial validation because the algorithm detected that it was outside the scope of *Frontiers in Marine Science*, although previous papers on art-science collaborations and the ocean have been published in this journal (see [Jung et al., 2022](#)). This suggests that art-science collaborations and the ocean are lost at sea due to structural limitations and inflexible definitions of what is considered important oceanic knowledge, which can marginalise important and unique perspectives.

This article therefore encourages that when initiating an art-science collaboration project on the ocean, at the beginning stage, it should at least be considered how a project can also result in the publication of an academic reflection. Also, it encourages all ocean related journals in both the natural and social sciences to be flexible and encourage art-science reflections to be published as they are an integral tool for connecting science, society and the sea.

On this point, although almost all projects stress the importance of art-science collaborations and the ocean being good for public communication and engagement, an avenue that needs further investigation is to reflect on the intricacies of what engagement

means for ideas of behavioural change and how this can feed into more diverse marine governance. Engagement itself is a complex thing to explore and it is not the purpose of this paper to analyse it in any depth. However, what is not apparent in much of the literature is deliberation over why engage to begin with? With whom? How best to engage? Where to engage? and also how is the success of that engagement measured and under what conditions? This is not to say that there is not value in a project that does not consider these aspects, there is always value in collaboration alone and not every project will have an element of public engagement, however, understanding how ordinary people engage with ocean related art is critical for understanding wider public attitudes and how engagement can possibly influence behavioural change ([Marks et al., 2014](#); [Stoll-Kleemann, 2019](#); [Van Boven and Sherman, 2021](#)). This of course comes with the caveat that behavioural change is not apolitical and is complex, requiring asking is change even within people's power ([Whittaker, 2023](#)). When analysing behavioural change in the general public it is important to note that once information has transferred to them, there shouldn't be the assumption that the public have the ability and power to do something about it. The focus on individuals ignores structural and institutional reasons which impact individuals' ability to adapt to change ([Eagle et al., 2016](#)). However, with the gap between scientific knowledge and policy growing increasingly more complex ([Cvitanovic and Hobday, 2018](#)), understanding how a project lives on beyond the initial to an art-science project phase can reveal marginalised perspectives by showing who gets to participate and have a voice but also who is excluded from ocean narratives, which can be informative for future knowledge building which can feed into more inclusive governance of the oceans.

One way that this can be improved upon from reflecting on the current literature, is through further measurement of how an ocean related art-science collaboration is perceived by the artists, scientists and the public before, during and after the event. There are some useful articles which include measurement for example, when engaging with students to understand their reactions to a project ([Casasanto et al., 2018](#)), or when investigating audience members' perceptions of various artworks ([Wake et al., 2020](#); [Jung et al., 2022](#)). It is insightful to also reflect on those projects which use public and community involvement from the outset to understand how an art-science ocean collaboration can produce tangible feedback over time. Whether this be in the form of artists and scientists becoming co-constructors with local populations to take ownership on the question of climate change in coastal towns through using artworks as an 'effective way to convey messages of future narratives' ([Da Cunha et al., 2020:10](#)), or initiatives to increase local awareness of a large-scale project of seaweed extinction reversal which involved a collaboration to create sculptures which also involved local children from public schools ([Vergés et al., 2020](#)) or through using local drama, music and associated arts-based activities designed to promote safety awareness in fishing communities ([Murray and Tilley, 2006](#)). In such projects the long-term engagement, which has many actors from the beginning, allows more space for reflection on how a project lives on beyond the initial creative output.



The common denominator for limited measurement of the process of art-science collaborations is time (Jung et al., 2022). For an art-science project to be able to consider engagement in any depth, having the time to develop meaningful relationships and trust is key, or as Yang (2015) puts it, the longer the ‘lifespan’ of a project, the more likely it will be deemed as positive. As is highlighted by Vesna et al. (2019), the importance of relationships being given the time to develop, is fundamental to better understanding, and so this needs to be considered when institutions plan how an art-science collaboration will look like. Thus, focusing on the reflections of the artists, scientists, the institution, the public response and also reflecting on what worked and what didn’t, can contribute to better understanding the many ways the futures of our oceans can be imagined through creativity and how this is perceived beyond the initial output (Merrie et al., 2018).

Through this mini-review then, I have highlighted the diversity of approaches that is currently available in academic literature concerned with art-science collaborations and the ocean. Although the number of articles is limited, the variety and their applicability to a range of disciplines shows their unique potential to access numerous academic audiences on a variety of ocean topics which can be utilised to inspire action and discover and share new oceanic knowledges. As such, this paper encourages ocean academia to broaden the silos that academic publications are sometimes guilty of staying safely within, so that invaluable ocean perspectives at the forefront of knowledge transfer, can extend throughout the

scientific community to inspire more collaborative endeavours and reach further audiences.

## Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher’s note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

## References

- Adler, A. (2022). “Science: histories, imaginations, spaces,” in *The routledge handbook of ocean space*. Eds. K. Peters, J. Anderson, A. Davies and P. Steinberg (London: Routledge), 34–45.
- Belontz, S. L., Corcoran, P. L., Davis, H., Hill, K. A., Jazvac, K., Robertson, K., et al. (2019). Embracing an interdisciplinary approach to plastics pollution awareness and action. *Ambio* 48 (8), 855–866. doi: 10.1007/s13280-018-1126-8
- Bennett, N. J., and Roth, R. (2019). Realizing the transformative potential of conservation through the social sciences, arts and humanities. *Biol. Conserv.* 229, A6–A8. doi: 10.1016/j.biocon.2018.07.023
- Berta, A. (2021). Art revealing science: marine mammal palaeoart. *Historical Biol.* 33 (11), 2897–2907. doi: 10.1080/08912963.2020.1834541
- Brennan, R. E. (2018). Re-storying marine conservation: integrating art and science to explore and articulate ideas, visions and expressions of marine space. *Ocean Coast. Manage.* 162, 110–126. doi: 10.1016/j.ocecoaman.2018.01.036
- Burke, M., Ockwell, D., and Whitmarsh, L. (2018). Participatory arts and affective engagement with climate change: the missing link in achieving climate compatible behaviour change? *Global Environ. Change* 49, 95–105. doi: 10.1016/j.gloenvcha.2018.02.007
- Cartwright, J., and Nakamura, H. (2009). What kind of a wave is hokusai’s *Great wave off kanagawa*? *Notes Rec. R. Soc* 63, 119–135. doi: 10.1098/rsnr.2007.0039
- Casasanto, V. A., Campbell, B., Manrique, A., Ramsayer, K., Markus, T., and Neumann, T. (2018). Lasers, penguins, and polar bears: novel outreach and education approaches for NASA’S ICESAT-2 mission. *Acta Astronautica* 148, 396–402. doi: 10.1016/j.actaastro.2018.04.011
- Clark, S. E., Magrane, E., Baumgartner, T., Bennett, S. E. K., Bogan, M., Edwards, T., et al. (2020). 6&6: a transdisciplinary approach to art-science collaboration. *Bioscience* 70 (9), 821–829. doi: 10.1093/biosci/biaa076
- Crawley, G., Critchley, E., and Neudecker, M. (2022). “Imaginarities: art, film and the scenography of oceanic worlds,” in *The routledge handbook of ocean space*. Eds. K. Peters, J. Anderson, A. Davies and P. Steinberg (London: Routledge), 277–297.
- Crowley, K. (2011). *Surf beat: rock ‘n’ roll’s forgotten revolution* (Milwaukee: Hal Leonard Corporation).
- Cvitanić, C., and Hobday, A. J. (2018). Building optimism at the environmental science-policy-practice interface through the study of bright spots. *Nat. Commun.* 9, 3466. doi: 10.1038/s41467-018-05977-w
- Da Cunha, C., Farias Rocha, A. P., Cardon, M., Breton, F., Labeyrie, L., and Vanderlinden, J.-P. (2020). Adaptation planning in France: inputs from narratives of change in support of a community-led foresight process. *Climate Risk Manage.* 30, 1–14. doi: 10.1016/j.crm.2020.100243
- Dupont, S. (2017). I Am the ocean – arts and sciences to move from ocean literacy to passion for the ocean. *J. Mar. Biol. Assoc. United Kingdom* 97 (6), 1211–1213. doi: 10.1017/S0025315417000376
- Dybas, C. L. (2019). A new wave: science and art meet in the sea. *Oceanography* 32 (1), 10–11. doi: 10.5670/oceanog.2019.104
- Eagle, L., Hamann, M., and Low, D. R. (2016). The role of social marketing, marine turtles and sustainable tourism in reducing plastic pollution. *Mar. Pollut. Bull.* 107 (1), 324–332. doi: 10.1016/j.marpolbul.2016.03.040
- Gadsden, G., Peters, K., and Dajka, J. C. (2022). Academic engagement with wadden Sea stakeholders: a review of past foci and possible futures. *Front. Mar. Sci.* 9. doi: 10.3389/fmars.2022.816609
- Gallardo, V. I., Boero, D. L., and Tzanopolous, J. (2021). Climate change and emotions: analysis of people’s emotional states in southern Ecuador. *Front. Psychol.* 12.
- Gebbels, S., Hunter, J., Nunoo, F., Tagoe, E., and Evans, S. M. (2012). Schoolchildren’s use of poetry and paintings in conveying environmental messages. *J. Biol. Educ.* 46 (2), 93–102. doi: 10.1080/00219266.2011.583667
- Grasskamp, A. (2021). *Art and ocean objects of early modern Eurasia: shells, bodies and materiality* (Amsterdam: Amsterdam University Press).
- Grene, M., and Depew, D. (2004). *The philosophy of biology: an episodic history (The evolution of modern philosophy)* (Cambridge: Cambridge University Press).
- Griffith, D. (2014). *Imagining natural scotland. creative Scotland: Edinburgh and Glasgow*.
- Griffiths, A. G. F., Kemp, K. M., Matthews, K., Garrett, J. K., and Griffiths, D. J. (2017). Sonic kayaks: environmental monitoring and experimental music by citizens. *PLoS Biol.* 15, 11. doi: 10.1371/journal.pbio.2004044
- Helmreich, S., and Jones, C. (2018). Science/Art/Culture through an oceanic lens. *Annu. Rev. Anthropology* 47 (1), 97–115. doi: 10.1146/annurev-anthro-102317-050147
- Hessler, S. (2018). *Tidalectics: imagining an oceanic worldview through art and science* (Cambridge, MA: MIT Press).

- Jacobson, S. K., Seavey, J., Goodman, J., Nichols, O. C., Williams, L. C., Marquez-Garcia, M., et al. (2020). Integrating entrepreneurship and art to improve creative problem solving in fisheries education. *Fisheries* 45 (2), 84–89. doi: 10.1002/fsh.10351
- Jones, C., and Galison, P. (1998). *Picturing science producing art* (London: Routledge).
- Jung, J., Gupa, D., Colton, H., Thoms, J., Owens, D., Threlfall, J., et al. (2022). Doubling down on wicked problems: ocean ArtScience collaborations for a sustainable future. *Front. Mar. Sci.* 9. doi: 10.3389/fmars.2022.873990
- Kjellgren, E. (2014). *How to read oceanic art* (New York: Metropolitan Museum of Art).
- Latz, M. (2017). The artistry of dinoflagellate bioluminescence. *Materials Today: Proc.* 4 (4), 4959–4968. doi: 10.1016/j.matpr.2017.04.102
- Lycka, Z., and Elster, J. (2020). Punk's not dead, even at the Czech Arctic scientific station in Svalbard. *Oceanologia* 62 (4), 622–627. Conference on Societal Relevance of Polar Research. doi: 10.1016/j.oceano.2020.03.007
- Magrane, E., and Johnson, M. (2017). An art-science approach to bycatch in the gulf of California shrimp trawling fishery. *Cultural Geographies* 24 (3), 487–495. doi: 10.1177/1474474016684129
- Marks, M., Chandler, L., and Baldwin, C. (2014). Re-imagining the environment: using an environmental art festival to encourage pro-environmental behaviour and a sense of place. *Local Environ.* 21 (3), 310–329. doi: 10.1080/13549839.2014.958984
- Matias, A., Rita Carrasco, A., Pinto, B., and Reis, J. (2023). The role of art in coastal and marine sustainability. *Cambridge Prisms: Coast. Futures* 1. doi: 10.1017/cft.2023.13
- Merrie, A., Keys, P., Metian, M., and Österblom, H. (2018). Radical ocean futures-scenario development using science fiction prototyping. *Futures* 95, 22–32.
- Miller, A. (2014). *Colliding worlds: how cutting-edge science is redefining contemporary art* (New York: W. W. Norton & Company).
- Murray, M., and Tilley, N. (2006). Promoting safety awareness in fishing communities through community arts: an action research project. *Saf. Sci.* 44 (9), 797–808. doi: 10.1016/j.ssci.2006.05.001
- Neilson, A., L., Pato, C. D., Gabriel, R., Arroz, A., Mendonca, E., and Picanco, A. (2016). In the Azores, looking for the regions of knowing. *Island Stud. J.* 11 (1), 35–56. doi: 10.24043/isj.334
- Nobel, A. (2015). On the representation of the island in my artwork. *Island Stud. J.* 10 (1), 111–122. doi: 10.24043/isj.323
- O'Connor, G., and Stevens, C. (2015). Combining art and science in a primary school setting: paper and ice. *J. Sci. Communication* 14 (04), A04. doi: 10.22323/2.14040204
- O'Connor, G., and Stevens, C. (2018). Studio Antarctica: embedding art in a geophysics sea ice expedition. *Leonardo* 51, 57–58. doi: 10.1162/LEON\_a\_01556
- O'Neill, S. J., Boykoff, M., Niemeyer, S., and Day, S. A. (2013). On the use of imagery for climate change engagement. *Global Environ. Change* 23 (2), 413–421. doi: 10.1016/j.gloenvcha.2012.11.006
- Parsons, E. C. M., Scarlett, A., and Kornblatt, A. (2021). FantaSEAS project: incorporating inspiring ocean science in the popular media. *Mar. Technol. Sci. J.* 55 (3), 110–111. doi: 10.4031/MTSJ.55.3.34
- Paterson, S., Le Tissier, M., Whyte, H., Robinson, L. B., Thielking, K., Ingram, M., et al. (2020). Examining the potential of art-science collaborations in the anthropocene: a case study of catching a wave. *Front. Mar. Sci.* 7, 1–13. doi: 10.3389/fmars.2020.00340
- Peters, K., and Steinberg, P. (2019). The ocean in excess: towards a more-than-wet ontology. *Dialogues Hum. Geogr.* 9 (3), 293–307. doi: 10.1177/2043820619872886
- Probyn, E., Johnston, K., and Lee, N. (2020). *Sustaining Seas: Oceanic Space and the Politics of Care* (London: Rowman and Littlefield).
- Radstone, S. (2017). Sea Passages: trauma, arendtian thinking and what dialogues with art can do. *Continuum-Journal Media Cultural Stud.* 31 (5), 648–659. doi: 10.1080/10304312.2017.1357341
- Roberts, L., Kutay, C., Melbourne-Thomas, J., Petrou, K., Benson, T. M., Fiore, D., et al. (2021). Enabling enduring evidence-based policy for the southern ocean through cultural arts practices. *Front. Ecol. Evol.* 9. doi: 10.3389/fevo.2021.616089
- Roberts, L., and Nicol, S. (2011). Krill looks and feelers: a dialogue on expanding perceptions of climate change data. *Polar J.* 1 (2), 251–264. doi: 10.1080/2154896X.2011.626628
- Schnugg, C. (2019). *Creating ArtScience collaboration: bringing value to organizations* (London: Palgrave Macmillan).
- Stevens, C., O'Connor, G., and Robinson, N. (2019). The connections between art and science in Antarctica: activating Science\*Art. *Polar Rec.* 55 (4), 289–296. doi: 10.1017/S00332247419000093
- Stoll-Kleemann, S. (2019). Feasible options for behavior change toward more effective ocean literacy: a systematic review. *Front. Mar. Sci.* 6. doi: 10.3389/fmars.2019.00273
- Straughan, E., and Dixon, D. (2014). Rhythm and mobility in the inner and outer Hebrides: archipelago as art-science research site. *Mobilities* 9 (3), 452–478. doi: 10.1080/17450101.2013.844926
- Van Boven, L., and Sherman, D. (2021). Elite influence on public attitudes about climate policy. *Curr. Opin. Behav. Sci.* 42, 83–88. doi: 10.1016/j.cobeha.2021.03.023
- Van der Vaart, G., van Hoven, B., and Huigen, P. (2018). The role of the arts in coping with place change at the coast. *Area* 50 (2), 195–204.
- Vederame, L. (2020). The sea in Sumerian literature. *Water History* 12, 75–91. doi: 10.1007/s12685-020-00244-6
- Vergés, A., Crawford, M., Kajlich, L., Marzinelli, E., Söderlund, A., Steinberg, P., et al. (2020). "Operation crayweed merging art and science to restore underwater forests," in *Sustaining seas: oceanic space and the politics of care*. Eds. E. Probyn, K. Johnston and N. Lee (London: Rowman and Littlefield International), 237–252.
- Vesna, V., Campbell, B., and Samsel, F. (2019). Victoria Vesna: inviting meaningful organic art-science collaboration. *IEEE Comput. Graphics Appl.* 39 (4), 8–13. doi: 10.1109/MCG.2019.2916962
- Wake, C., Kaye, D., Lewis, C. J., Levesque, V., and Peterson, J. (2020). Undercurrents: exploring the human dynamics of adaptation to sea-level rise. *Elementa: Sci. Anthropocene* 8 (1). doi: 10.1525/elementa.2020.060
- Whittaker, G. R. (2023) *Creating a Sea 'We' all care about? art-science collaborations the ocean and public engagement, society + space*. Available at: <https://www.societyandspace.org/articles/creating-a-sea-we-all-care-about-art-science-collaborations-the-ocean-and-public-engagement>.
- Williams, K., Hamylton, S., Ihlein, L., and Gibbs, L. (2020). "Sustaining the seas through interdisciplinary songwriting," in *Sustaining seas: oceanic space and the politics of care*. Eds. E. Probyn, K. Johnston and N. Lee (London: Rowman and Littlefield), 281–292.
- Yang, A. (2015). That drunken conversation between two cultures: art, science and the possibility of meaningful uncertainty. *Leonardo* 48 (3), 318–321. doi: 10.1162/LEON\_a\_00705