Corals, Geo-Sociality, and Anthropocene Dwelling

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Funding: See Acknowledgements.

Peer review: This article has been subject to a double-blind peer review process

Abstract

Foreboding reports of the Australian Great Barrier Reef's peril signal not only a fraught politics but the site's significance as a potent global environmental imaginary and Anthropocene signifier. In this paper I draw on the site's ecological emergency and consider what humans could learn from coral life through its evolved fluid-dynamic and planetary relationships. Corals, I argue, offer novel insight into more-than-human ontologies, revealing constitutively solid-fluid ways of being responsive to planetary flux and churn. The research responds to increased interest with multi-disciplinary more-than-human investigation of the ways in which human and nonhuman are inextricably connected, as well as work taking Anthropocene ideas as a generative epistemological and ontological opening.

Drawing on fieldwork in Cairns and on the Great Barrier Reef itself, I use embodied methods to trace encounters both above and below the water. The properties of water and fluidity lead me to contemplate further qualities that liquid and ocean phenomena bring to understanding planetary sociality, revealing a dimensionality and relationality beyond surface and fixed readings. Paradoxically, whilst corals and the Great Barrier Reef are commonly framed as needing our protection, they demonstrate enduring structural resilience and tenacity. Such qualities are highly relevant in contemplating strategies responsive to Anthropocene instability and flux.

Keywords: Great Barrier Reef; corals; geo-sociality; Anthropocene

Introduction

Foreboding reports of the Australian Great Barrier Reef's peril signal not only a fraught politics but the site's significance as a potent global environmental imaginary and Anthropocene signifier. Threats such as pollution, overuse, invasive species, and warming ocean temperatures have severely impacted Reef health. Where public discussion focuses on alarming reports of the Reef's 'death' (**Jacobsen, 2016; Wright & Watson, 2018; Purkis, 2021**), marine scientists argue the need for transformative marine ecosystem thinking and governance responsive to unprecedented Anthropocene conditions (**Morrison et al., 2020**). In this paper I focus on the Great Barrier Reef's disturbance with a different aim, drawing on more-than-human ontologies and the mutable qualities of corals and pelagic life as a way to think through ideas of solid-fluid materialities and planetary geo-sociality.

The Anthropocene is a proposed geological epoch superseding the Holocene, in which the activity of some humans is argued to have significant planetary influence (**Crutzen & Stoermer, 2000; Crutzen, 2002**); disrupting biochemical cycles, altering the distribution of living organisms, impacting biodiversity, and creating material shifts in the stratigraphic record. This idea importantly brings earth system thinking into relationship with planetary-scale human activity. Beyond its geo-physical ambit, the Anthropocene has profound implications for social thought both unsettling and provocative. It poses profound questions for the figure of the human, 'its composition, its presence, its figuration' (**Latour, 2018, 85**), challenging conceptions of what humans are and what they are capable of as 'planetary creatures' (**Spivak, 2003: 73**) – able to induce geological-scale impacts. However, it is argued that 'we lack the stories, theories or concepts fit for the task of what it means for human agents to find themselves behaving like Earth or cosmic forces' (**Clark & Szerszynski, 2020, 16**). The Anthropocene, therefore, presents both a provocation and opportunity to think life through the Earth and to rethink and reimagine ways of human being, and with reconfiguring the human relationship with the non-human world.

This research responds to cultural dimensions of Anthropocene inquiry, taking critical interest in wider philosophical, cultural, and political implications. It does so by engaging with environmental humanities, a field of investigation which operates across disciplinary boundaries focusing on the human relationship with the non-human world encompassing modes of perception, cultural framings, systems and measures of value, imaginative and creative production, and emotional and affective responses (**Castree, 2014: 234**). Within this field, Anthropocene disturbances are further evidence for challenging dominant modes of

thinking about and investigating the world, serving as reminder of the significant more-than-human agencies and constitutional relationships (**Instone & Taylor, 2015: 139**; **see also: Whatmore, 2002; Haraway, 2008**). Influenced by feminist ideas drawn into ecological concerns (**Murphy, 2011: 580**), environmental humanities work returns an epistemological efficacy to the body and to affective qualities of being human in a world which seeks to render it precarious; as well, seeking to better elucidate fundamental relations between humans and the more-than-human world (**Mickey, 2016; Adams, 2019**).

More specifically, this article draws on cultural-geographic engagement with vital materialisms, the more-than-human, and the geo-planetary. Such a combination is due to the unique and hybrid qualities of coral life. Corals have a fundamental relationship with water and ocean currents, and it is in aquatic environments that they collectively fabricate huge reef assemblages which serve as significant ecological sites. However, reefs are substantively *geological*: large and durable enough to become topographical features. Reef ecosystems are also highly sensitive to planetary climate fluctuations – hence concern for the Great Barrier Reef's health alongside other reef systems around the globe.

Vitalism is a philosophy that recognises the intrinsic matter-energy of the nonhuman world. Inspired by the material turn, which focused attention on objects and materiality, geographers have attended to the vibrant, creative, and inventive qualities of matter (**Braun, 2008; Bennett, 2009; Whatmore, 2006; Bingham & Hinchliffe, 2008; Anderson and Wylie, 2009**), and its capacity to actively contribute to the constitution of the world (**Greenhough, 2010**). The Anthropocene's formal definition is predicated on human planetary mattering, that is through significant distribution of carbon, concrete, plastics, or radioactive isotopes and the like serving as geological indicators. More profoundly, though, Anthropocene ideas decentre the figure of the human from any presumed exceptionalism through agency or composition. Constitutively humans are not *just* human but entangled with webs of non-human life, matter and agencies.

The 'more-than-human' proposal was intended to capture those worlds both encompassing and surpassing human boundaries, integrating complex webs of interdependencies between innumerous beings that share terrestrial dwelling (**Abram, 1996**); ultimately expanding and reconfiguring the human-nature dichotomy prevalent in Western intellectual thought. More-than-human research is broad and influenced by ideas that cut across disciplinary boundaries, including, for example, post-phenomenology (**Ash & Simpson, 2016**), actor-network theory (**Latour, 2005**), non-representational theories (**Thrift, 2008**), assemblage

theory (**DeLanda, 2006**), new and vital materialism (**Coole & Frost, 2010; Bennett, 2009**); eco-feminisms (**de La Bellacasa, 2017; Tsing, 2015**), and post-humanisms (**Haraway, 2008; 2016**). Such interest in the 'livingness' of the non-human world (**Choi 2016**) has resulted in wide engagement with the more-than-human, leading geographers to challenge prevalent humanist approaches to nature-society relations. Themes have included biosecurity (**Bingham, 2006; Buller, 2008; Hinchliffe and Bingham, 2008; Greenhough, 2012**), food (**Stassart & Whatmore, 2003; Hayes-Conroy and Martin, 2010**), animal geographies (**Cloke and Perkins, 2005; Bear and Eden, 2011; Barua, 2014**) and conservation (**Hinchliffe, 2008; Lorimer and Driessen 2013; Lorimer 2015**).

Significant for this article is a parallel strand of more-than-human Anthropocene inquiry concerned with essential *planetary* relationships. As Nigel Clark and Bronislaw Syzersynski (**2020**) argue, humans, fundamentally, are *geo-social* subjects not just dwelling on the planet's surface but intimately enmeshed within geo-material and -temporal dynamics. The Earth, they remind us, possesses a *planetary multiplicity*: is highly dynamic, with real-world physical systems having the potential to shift between wide-ranging operating states. To better understand human nature, and to formulate alternative strategies for navigating inconstant Anthropocene conditions, we must look 'beyond conventional terrain of the social, through the contact zone of human and nonhuman process, and deep into the times and spaces of the Earth itself.' (**Clark & Syzersynski, 2020: 4**)

The Anthropocene therefore foregrounds deceptively dynamic qualities of the world, prompting a re-evaluation of 'fixed' conceptual attachments to linear and solid-state Western modernist logics, urging attunement to ineffaceable uncertainty, volatility and flux. Far from static, the world has a deceptively 'solid-fluid' constitution (**Ingold & Simonetti, 2021**), always in a state of perpetual becoming: neither solid nor fluid, but rather solid-becoming-fluid or fluid-becoming-solid (**Serres, 2018**). The recent stable climatic period of the Holocene is merely a brief intermission within the planet's mercurial chronology, yet geological changes are obfuscated by such large timescales. Consequently, continents drift and are reshaped over eons; mountain ranges rise and are eroded; glaciers expand and retreat.

Corals, with both liquid-oceanic and geological associations, offer pertinent insight into solid-fluid materialities. Their pelagic attachment invites us to expand fixed and terrestrial-based thinking (especially for geographers), and draw on developing interest with liquid and fluid ontologies (**Anderson & Peters, 2014; Steinberg and Peters, 2015**). Thinking 'from' or 'through' the ocean – it's three-dimensionality, its

dynamic and liquid qualities – opens up spatial conceptions of the world that, far from being static and bounded, is rather fluctuating, changeable, processual, and in a constant state of becoming.

An 'oceanic turn' emerged post WWII as global interests in the territorialisation of ocean space expanded. Later, the 1970's 'spatial turn' saw the loosening of nationally-bounded modes of thinking about capital and space as ideas of globalisation materialised. During the 1990s, postcolonial thinking took interest with the material-historical dimensions of the oceans, and with flows outside the territorial and legislative of limitations of the state (**see Steinberg, 2001; DeLoughrey, 2007: 22**). In the 21st Century oceans have become an important focus prompted not only by threats of climate change and forecasts of global sea-level rise, but with expanded appreciation of significant multispecies entanglements between oceans and planetary life. Within the environmental humanities, 'ocean studies' (**DeLoughrey, 2019**) or 'blue humanities' (**Alaimo, 2019**) has emerged, influenced by feminist posthumanities and the nonhuman turn (**Giffney & Hird, 2008**). Such study brings focus to the political ontologies of the sea and its implication for multispecies temporalities, aesthetics, and expanded more-than-human ethics in the Anthropocene. Influences on such research trace back to Rachel Carson's (**1951, 1955**) forward-thinking biomarine writings, anti-colonial work incorporating cultural dimension of ocean space such as Paul Gilroy's *The Black Atlantic* (**1993**), and feminist multispecies thinking such as that by Anna Tsing (**2015**) and Donna Haraway (**2016**). Drawing on a range of geographical, historical, and cultural thinking, a key focus for blue humanities work has been with understanding the oceans as a *force* rather than a *place* to be managed (**see Steinberg & Peters, 2015; DeLoughrey, 2017**). Emerging work led by feminist and decolonial thinking applies embodied approaches and indigenous frameworks to further expand thinking, perception, and relationship with oceans (**see Ingersoll, 2016; Neimanis, 2019; Jue, 2020; Gumb, 2020**).

This research draws on these overlapping oeuvres of environmental humanities and feminist posthumanities seeking to unsettle divisions between land and ocean, solid and fluid, and offer conceptual insight into relational dwelling responsive to planetary flux and churn. I focus on the Great Barrier Reef not only because of its role as a significant environmental imaginary threatened by both anthropogenic and Anthropocenic hazards, but because of its unique constitutive qualities as a complex multi-species organism both biological and geological. It is an assemblage which unsettles fixed and fluid categories. As such, coral life may offer apposite insights for thinking about qualities of resilience and endurance, and being differently as humans grapple with reimagining and renarrating strategies of dwelling on and with a changing planet.

To begin, I outline the methodological approach undertaken which draws on ethnographic and embodied methods. I then introduce the Great Barrier Reef, its composition, as well as the current plight of corals before moving to in-field experiences which document encounters above and below the water as a way to 'flesh out' and bring depth to this expansive structure and wider relational mesh. Qualities of water and fluidity lead me to contemplate ontological unsettling that ocean phenomena bring to understanding planetary being, revealing a dimensionality and relationality beyond surface and fixed readings. I then return to consider conceptual insights that coral's constitutive qualities bring to contemplating and configuring human response to Anthropocene dwelling.

Approach and Methodology

This article draws on work undertaken for doctoral research. The larger project itself was couched in both experimental and non-representational geographies, taking interest with phenomenological dimensions of Anthropocene experience. Within experimental geographies researchers undertake conceptual and methodological experiments with the aim of exploring new modes of doing geography, which includes mixed-method and transdisciplinary approaches (**see Paglen, 2009; Instone, 2010; Last, 2012**). Non-representational research, while diverse in scope, encompasses work that 'seeks to better cope with our self-evidently more-than-human, more-than-textual, multisensual worlds' (**Lorimer, 2005: 83**), and with registers often exceeding representation (**Longhurst et al., 2009**).

Donna Haraway's (**2016**) invocation of 'staying with the trouble' serves as guiding provocation: taking the Anthropocene's unsettling as a prompt to re-think and re-imagine what it is to be human and reassemble our relationships to each other and to other forms of life. Such an approach aligns with existential philosophical ideas exhorting moral responsibility against life's difficulties. Existentialism is not a unified school of thought but rather a collection of connected attitudes and approaches that grapple with individual choice in how to live a good and authentic life, especially in the face of worldly troubling (**Aho, 2014**). Apposite themes of disturbance and unsettling pervade environmental humanities, especially multispecies studies (**van Dooren et al., 2016**), extinction studies (**Rose et al., 2017**) dark ecology (**Morton, 2016**), and geo-philosophy (**Clark, 2011; 2017**). Within the Anthropocene and the figuration of a post-human condition such ecologically-focused work expands existentialism's scope giving rise to 'coexistentialism' which more effectively reintegrates humans within the wider relational mesh of planetary life and 'inter-being' (**see Mickey, 2016**).

Staying with such adversity is not an invocation to put up with it or acclimatise but rather to allow oneself to be affected and changed by the experience. Such a stance is described in non-representational terms as a mode of 'witnessing': allowing a researcher to be 'in tune [with] the vitality of the world as it unfolds' (**Dewsbury, 200: 1923**). Being witness to events in the world requires attentiveness not only to external phenomena but internal and affective registers which are just as important in providing insight about the world (**Anderson & Smith, 2001: 8**). Within the emergency of the Anthropocene Jean-Luc Nancy (**2015**) calls this remaining 'exposed': allowing ourselves to endure encounters of catastrophic loss by allowing ourselves to sense it.

The experimental, consequently, has affinities with the existential: opening one up to the world as messy and contingent; asking the researcher to remain open to emergent possibilities – as well as their own ignorance. A politics of experimentation is argued to be a necessary background concern under conditions of the Anthropocene (**Battistoni, 2013**); a requirement for leveraging 'cracks' of possibility, and opening up new political imaginaries. In practical terms this led to an interest in sites with capacity to disturb modern and Holocene perspectives and illuminate unsettled, relational, and coexistential qualities. Visiting the Great Barrier Reef during a severe coral bleaching event served as a case study. Ongoing threats to the Reef's ecology have led to the aforementioned claims of its 'death', and continued ocean warming will threaten the ability of corals to survive under such conditions.

Fieldwork was ethnographic in style, drawing from anthropologist Timothy Ingold's (**2007; 2011; 2015**) approach to mobile ethnography. This takes interest with dynamic qualities of being in the world and with tracing the *movement* of things through it. 'Wayfaring' for Ingold (**2011**) is an extension of Heidegger's more static conception of dwelling. A focus on movement brings a vitality to dwelling where *pathway* becomes the primary condition of being rather than *place*. This approach opens investigation up to the fluid and dynamic constitution of phenomena (**Sheller & Urry, 2006**), including subjects' movements in the world, but also the researcher's 'co-present immersion' where they not only observe what is happening but are also required to attend to their own experiences and feelings (**Novoa, 2015**). Such embodied experience has been a focus within geographical research following interests with everyday life (**Lefebvre, 1958**) and corporeality (**Merleau-Ponty, 1962**). 'Embodiment' is not just about the body, but rather brings focus to culture and experience from the standpoint of bodily being-in-the-world (**Strathern & Stewart, 2011: 389**).

The turn towards embodied research in human geography and related disciplines has followed wider engagement with participatory approaches (**Mason, 2015**) and calls for the co-production and decolonisation of knowledge (**Denzin & Lincoln, 2008**). Embodied research does not in itself challenge forms of racism, ablism, and sexism or suppressed knowledges, yet it provides multiple ways of sensing and knowing the world enabling both researchers and participants to interrogate dominant ideas about knowing and being (**Pierre et al., 2019**).

Environmental humanities scholars have employed embodied and autoethnographic methods to bring novel insight to relational ontologies and concomitant intersections with water and liquid ontologies. This includes Kate Wright's (**2017**) work tracing her own movements through, and seeking to decolonise her relationship to, country ('home-place'). Pauline Couper (**2018**) explores blue urban natures drawing on her experience of learning to sail. Michael Adams (**2017**) dives deeply into water, using the bodily experience of freediving to contemplate personal histories and relationship with his father. Olga Cielemecka and Cecilia Åsberg **(2019)** explore embodiment at the micro level focusing on water contamination and the ways that it leeches into and affects human bodies. Astrida Neimanis (**2019**) proposes a hydro-feminist philosophy, rethinking embodiment as watery and as more-than-human hydrocommons. Karin Amimoto Ingersoll (**2016**) draws on indigenous Hawaiian ways of knowing, developing the concept of seascape epistemology to articulate a sensorial, intellectual and embodied literacy of the ocean. Alexis Pauline Gumbs (**2020**) brings Black feminist insight to oceans, and to the wisdom that marine mammals might reveal to us. While my own research shares methodological affinities, my aim of experiencing unsettledness through more-than-human oceanic encounters is undertaken to galvanise conceptual insight into aforementioned geo-social dimensions of Anthropocene dwelling.

I undertook fieldwork in late-2017 – springtime in Australia, and at the end of the busy winter tourism season in the tropical north given cooler, drier, and more settled conditions. Based in Cairns, a key access point to the Great Barrier Reef, I spent a week undertaking activities both on land and water. Such an approach commonplace within geographic research where brief periods of 'ethnographic contact' are undertaken followed by detailed analysis of data gathered (**see Garrett, 2012: 42**). This wayfaring approach was both planned and unplanned. I had pre-arranged to undertake interviews with local knowledge experts, however activities such as a tourism trip further up the Queensland coast, Reef diving and attending local events, including a Reef education presentation, were organised on the fly. These unplanned activities offered opportunities to move through the landscape, providing a range of experiences though

which I was able to develop a wider understanding of Cairns, the coastal area, and the Reef itself. Acting as participant observer in such instances I was able to interact with a variety of people, both locals and visitors, taking field notes to record observations, thoughts and feelings, as well as employing photography.

Such an experimental research approach has both benefits and limitations. This approach can be effective for following 'vague' research strands where the investigative focus is unclear at the outset. Similar to grounded theory (**Ralph et al., 2015**) that invites emergence though the investigative process, a wayfaring ethnography allows for unplanned and surprising themes to be revealed. Of course, success is not guaranteed, and neither are outcomes anywhere close to those anticipated. The investigative process also requires the researcher to be sensitive to process; to detect potentially weak but interesting signals. In doing so, it makes this methodology highly subjective and sensitive to the orientation and proclivities of the individual researcher.

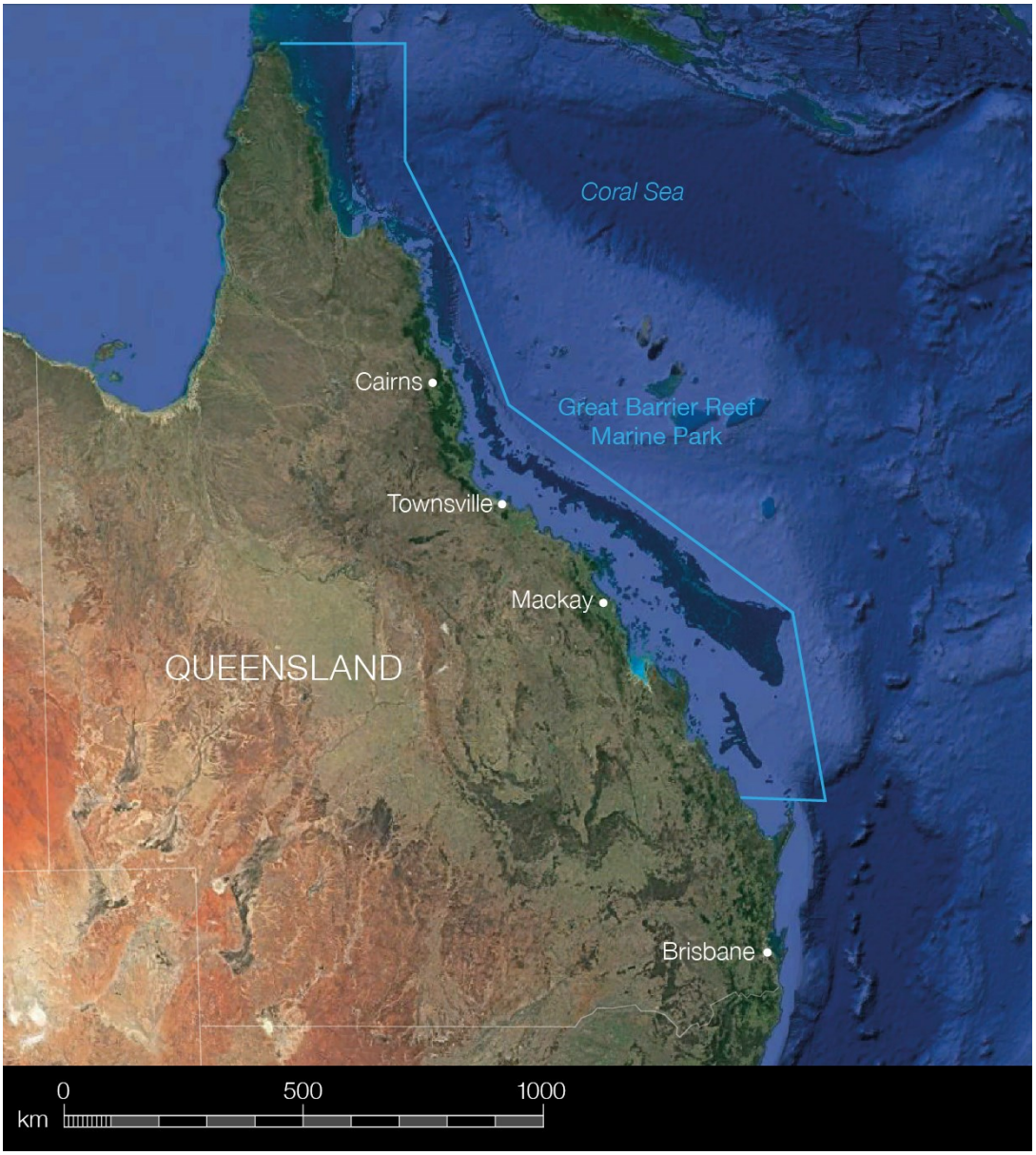
For this research I am cognisant of my own affinities and positionality. My experience of being human is informed by my subjectivity as a European cis-gender male, middle-aged, and well-educated. Additionally, where previous research (**Westgate, 2016; 2020**) has drawn on an enduring relationship to place, including knowledge of indigenous worldview, in Australia I have shorter-term attachments having been resident for only some eight years.[i] However, such experience is informed by longstanding engagement both personally and professionally with global environmental issues, as well as formative experience growing up around marine environments, and being both a long-time scuba diver and surfer. Research which draws on introspective methods such as this can be at risk of having narcissistic and solipsistic tendencies (**Pile & Thrift, 1995; see also Steingo, 2021**). In this case I seek to apply critical and reflexive process, aiming to avoid inflating my own experience and interpretation, or misrepresenting other perspectives. Alongside such personal attachments and the foregrounded openness to being 'exposed', I bring an allegiance with creative possibilism: creative and conceptual potentials responding to the Anthropocene (**Davis & Turpin, 2015**), particularly those that work to re-story the world (**Davidson, 2015**) and amplify ideas of geo-social dwelling (**Clark & Syzersynski, 2020**).

Locating the Great Barrier Reef

The Great Barrier Reef is the largest of the world's coral reef ecosystems, made up of more than 2,900 individual reefs and some 900 islands that border the coast of north-eastern Australia (**see Figure 1**), spanning over 2,300 kilometres and covering some 344,000 square kilometres (**GBRMPA, 2021a**). The Reef is big – hence the name – and accounts for 70 percent of

the world's designated World Heritage reef area. It is also the single largest structure made by living organisms.

Figure 1: Map of north-eastern Australia showing the location of the Great Barrier Reef Marine Park. The reef systems show as dark against the blue of the ocean. Satellite imagery: Google Earth/CNES/Astrium Image Landsat/Copernicus.



Coral reefs are biologically diverse, supporting more species per unit of area than any other marine environment. While they occupy less than one percent of our oceans, they are home to nearly one-third of all marine species, including an estimated 4,000 species of fish, 800 species of hard corals, and hundreds of other marine animals (**Mulhall, 2009; Fuchs, 2013**). Reefs are also important for sea and marine birds, as well as reptiles such as snakes, crocodiles, and turtles. Crucially, reef formations serve as a protective breeding ground for many ocean-going fish and marine life.

Corals are found predominately in tropical regions, growing in warm shallow waters. Corals are colonies of small animals that live in calcium

carbonate shells formed for protection. Over time, accretion of limestone forms unique shapes distinctive to particular coral species. Reefs are formed over long time periods as corals slowly form layers of sedimentary limestone. Depending on size, reef formation can take anywhere between 100,000 and 30 million years (**Barnes & Hughes, 1999; Veron, 2017**).

The Great Barrier Reef has formed over hundreds of millions of years in different stages, with the current configuration emerging approximately 2.6 million years ago (**Veron, 2008**). Human interaction with the Reef environment began some 60,000 years ago when Australian Aboriginal and Torres Strait Islander peoples settled the region, taking advantage of the site's natural resources (**GBRMPA, 2021b**). European explorers characterised the Reef environment as 'wild' and 'unnavigable' (**see McCalman, 2013**), with utilisation of the area's natural amenities being only a recent endeavour. Recreational use began only in the latter half of the twentieth century and is governed by the Great Barrier Reef Marine Park Authority (GBRMPA) which now manages the marine park in conjunction with the Government of Queensland.

The Great Barrier Reef has become a significant environmental imaginary and tourist destination. Being awarded UNESCO World Heritage Site status in 1981, conferred 'as being important to the collective interests of humanity' (**UNESCO, 2016**), set the Reef on a global stage alongside other landmark sites including the Giza Pyramids in Egypt, Machu Picchu in Peru, and the Taj Mahal in India. The Reef has become a 'bucket-list' travel destination (**Condé Nast Traveller, 2020**), and is highly significant to Australian tourism – being worth some A$6.4 billion to the Australian economy, and generating over 64,000 jobs (**O'Mahoney et al., 2017**).

Concerns with Reef health and management began in the early twentieth century and were amplified by rising environmental awareness during the 1960s and 70s. Even with a unified Reef management plan and instigation of the GBRMPA, the conservative tenor of Queensland politics has continued to undervalue environmental concerns, support resource exploitation, as well as expanded Queensland coastal development.

Such exploitation, however, poses a threat to the Reef's World Heritage status, and at multiple times over the last decade an 'in danger' reclassification has been assessed and only narrowly avoided – controversially due to Australian Government lobbying tactics (**Readfearn, 2021**). The Reef remains officially under watch, with the World Heritage Committee requiring updates on the Reef's condition.

However, more concerning over the last few decades is the global threat of planetary warming. Increased ocean temperatures have led to a series of severe coral bleaching events during summer months. 'Bleaching'

describes a condition where coral tissue turns pale or white. It is not a disease but a stress response where the coloured zooxanthellae photosynthetic algae that live in the coral wall are expelled. Under adverse conditions, such as increased water temperature, the algae produce excess oxygen which is toxic to the coral. Bleached coral is not dead: coral can survive for a short period in a bleached state and recover if the stress is removed (**Dove & Hoegh-Guldberg, 2006**). However, prolonged bleaching will kill the coral. Coral bleaching is not unique to the Great Barrier Reef, all corals experience bleaching under adverse conditions. The phenomenon was first recorded in the Caribbean in the early 1980s, with bleaching events at the Great Barrier Reef occurring during 1980, 1982, 1992, 1994, 1998, 2002, 2006, 2016–2017 (**AIMS, 2016**) – as well as 2020. Coral bleaching appears to be a recent (and anthropogenic) phenomenon given that bleaching events have killed coral shown to be up to 500 years old (**Veron, 2008: 58**). Reef recovery from coral bleaching die-off takes decades, but with bleaching events forecast to become an annual occurrence (**Bleuel et al., 2021**) the prognosis for the Great Barrier Reef looks grim. And it was such forecasts that have prompted alarming reports of the Reef's 'death' (**see Jacobsen, 2016**).

Seeing it Before it's too Late

Upon arriving in Cairns, I spent my first few days orientating myself by undertaking land-based activities, which included a day trip up the Queensland coast, attending a Reef educational event, as well as undertaking interviews with Reef and oceans knowledge experts. In this article, for brevity, I focus attention on my Reef-based experience, however this reconnaissance work was useful in providing me with a sense of broader, popular Reef narratives. Somewhat surprisingly, everything appeared normal. The Reef was the key drawcard for tourism visitors, who talked eagerly about their experiences. Locals extolled the Reef's features, making suggestions on different activities to undertake. The tourism marketing I encountered invited visitors to have an amazing experiences swimming, snorkelling, diving, and holidaying on the Reef. However, this was at a time of one of the most severe coral bleaching events to date, yet the only public evidence of this was through occasional news articles. And it was only academic experts that I spoke with who discussed the coral bleaching issue at all.

Booking a multi-day trip on a Reef dive boat allowed me to spend time on and in the water, as well as developing additional insight into people's perceptions. I found that visitors to the Reef were aware of what a unique marine environment it was – a 'must do' when visiting Australia. However, there appeared to be a lack of understanding of the Reef's ecological significance or indeed the specific threats faced. Ironically, though, many I

spoke with revealed subconscious anxieties. One well-travelled Brit living and working in Sydney half-jokingly admitted she would 'like to see the Reef before it's too late!' Another young visitor had been gifted a diving trip by her father – a keen scuba diver – but admitted she felt somewhat uneasy because of the environmental impact. Such anecdotes are reflective of increasing 'last-chance tourism', which has become a key motivator for visiting the Reef (**Piggott-McKellar & McNamara, 2016**).

The Reef landscape above is deceptively barren, giving little indication of the complex topography below the water line (**see Figure 2**). Boats dot the horizon, some still, fixed to the reef below as permanent on-water accommodation; others move slowly across the water, making their way to designated dive sites or shuttling visitors to and from Cairns. The calm above is occasionally interrupted by the sound of a helicopter ferrying well-heeled visitors across the Reef.

Figure 2: The stark above-water landscape. A crew member watches over snorkelers. Another dive boat is visible in the background. Source: Author.

Dive boats operate to a tight schedule, receiving new passengers, navigating a set pattern of dive spots, providing food and dive briefings. My boat ran five dives per day for stay-on visitors and received boatloads of day-visitors every morning who were ferried back to the mainland later that afternoon (**see Figure 3**).

The crew were familiar with each dive site, able to point out individual features for divers to investigate: a hidden channel; a large clam; the site where clownfish could be found; the habitual swimming path of a sea turtle. Animated post-dive discussion centred largely around notable encounters with charismatic marine fauna – fish, turtles, sharks – and crossing these off a diver's wish list.

I noticed that for all the concern with seeing particular species of marine life there was no formal time spent discussing any aspect of marine biology or the Reef ecosystem. During our introductory tour we were shown the

location of the boat's 'library', a small collection of reference books which could be used to identify marine species if needed. Echoing my previous experience, there was any absence of any discussion had about issues affecting the Reef, nor any mention about current coral bleaching.

Figure 3: Reef visitors snorkelling over a coral bommie, with dive boat in the background. Source: author.

A Fluid Marine Mesh

During my time on the Reef I had the opportunity to dive multiple times. For simplicity (and to the bewilderment of other divers), I opted to free dive – 'snorkel' – rather than scuba dive. Although I have previous scuba diving experience, being underwater without technological constraints and air supply limitations afforded me a more unencumbered freedom where I could take my time and focus on bodily awareness.

Conditions at the time were perfect: a pleasant 24 degrees Celsius, slight overhead cloud, and still. The ocean temperature was as warm as the air. The water was a deep hazy blue, which limited visibility to about 20 metres before details blurred into a bluish nothing. Very otherworldly.

Each dive site is a unique assemblage formed by layers of accreted calcium carbonate covered by living coral and other marine life. A coral outcrop is referred to as a 'bommie'. In shallow water this can be a small or large mound and in deeper water can rise like a column from the sea floor below. The average depth of the Great Barrier Reef is just 35 meters, and it is this shallow coastal topography that allows corals to form.

For each dive location I focused on a single bommie, swimming around the site first and then literally floating above it, remaining still to observe activity. Watching the mesh of life was fascinating. It felt very alien to me being both a land-based creature and schooled largely in terrestrial geographical concerns. In this instance, of course, I was very much the alien (**see Figure 4**).

Figure 4:View of coral assemblage, top of bommie. Source: Author.

And even though observations were made during the day, which is not a particularly active time for reef life, I became enthralled in watching quotidian reef dynamics. Small fish manoeuvred themselves close to coral, likely for safety, while larger fish slowly cruised the underwater landscape indifferent to my presence. I watched sharp-beaked Parrot fish snack on living coral, hearing muffled crunching sounds. I observed smaller fish perform what seemed to be territorial behaviour, chasing away encroaching intruders. I floated over corals of myriad shapes and colours lit by dappled sunlight. Observing such activity, I began to see each coral bommie as a community of creatures, some making permanent homes amongst labyrinthine coral formations, others just passing through.

I remained vigilant for signs of bleached and dead coral, although sighted only one small patch during my dives (**Figure 5**). This may have been because the worst bleaching had occurred in the Reef's northern reaches north of Cairns, but also dive boats might have adjusted tours to avoid heavily impacted areas.

Figure 5: A small patch of bleached and possibly dead branching coral (Acropora species) encountered during one of the author's dive sessions. Source: Author.

My short sampling of Reef-related activity both human and non-human left me with fuller appreciation of the complex dynamic assemblage of life that constitutes this distinctive ecosystem. Witnessing the everyday activities of marine life left me with expanded empathy for the delicately entangled lines that constitute the ecological mesh of Reef life. While it is

all too easy to think of marine life as 'alien' (**Jameison et al., 2021**), by focusing on those recognisable and relatable 'fleshy' constituencies that humans have in common with other beings makes shared vulnerabilities to insidious environmental threats more tangible. I am better able to conceive my entangled relationship with the lives of these beings amidst the larger delicate Reef-mesh; and I am struck by how fragile and precarious this fabric seems.

Additionally, is a sense of intimate dimensionality. By this I mean that within the marine – water – environment the liquid medium affords a more immersive, embodied experience than that of terrestrial space. That is, one has a sense of physically entering *into* and engaging *with* environmental space, subsequently extending one's relationship with others through the more substantial surrounding medium. For instance, I became mindful that the sunscreen applied to my skin may well leach into the water and affect other marine life. A small concern on the scale of impacts to be sure, but one which foregrounded a sense of intimate entanglement. Indeed, the challenged status of the Great Barrier Reef – and indeed all coral reef ecosystems – reflect such planetary enmeshment. In this way we don't have to visit the site in person to impact it, any activity undertaken will have some small influence on planetary systems. Consequently, we can't *not* visit the Reef.

Such observations reveal the Reef's multi-species interconnectedness, but also gesture towards its significant material and geological associations. Coral life has successfully navigated epochal planetary fluctuations across hundreds of millions of years, adapting to and being shaped by planetary multiplicities which have engendered sold-fluid constitutive qualities.

Adaptive Solid-Fluidity

With both liquid-oceanic and rocklike geologic constitutive qualities, corals are a unique example of organic solid-fluid enfoldment. Such attributes are admittedly difficult to discern *prima facie* and require a broader understanding of coral biology and its evolution. To better appreciate the solid-fluid character of both corals and the assemblage of the Great Barrier Reef, it is necessary to look beyond the visible present and examine wider pelagic and geologic entanglements through deep time.

The Reef modern humans know today has been shaped by ongoing geological processes also responsible for current continental land formations and oceans (**Veron, 2008**). Fossil remains of corals that grew from 120 to 30 million years ago can be found in the Reef's present location. Such corals formed during geological epochs with favourable warm conditions but were interrupted by glacial climatic periods. Stable conditions only returned 2.6 million years ago at the beginning of the

Pleistocene, allowing corals to grow and again form reef structures. Formation of the Great Barrier Reef we are familiar with today appears to have begun around some 600,000 years ago (**Pandolfi & Kelley, 2008: 40**).

Even within the recent stable period ongoing natural oscillations have altered the shape of the Reef. Climatic fluctuations – notably ice ages – impacted the Reef's biological composition due to cooler water temperatures but, more dramatically, changes in sea levels forced coral formations to relocate (**Pandolfi & Kelley, 2008: 41**). For around 50 percent of this recent period sea levels were much lower, and the area of the Great Barrier Reef now covered with shallow water was dry, existing as scrub-covered plain. The coast lay further east than present with corals surviving in coastal waters. As sea levels subsequently rose over thousands of years and reclaimed the plain, corals re-established themselves. For the other approximately 30 percent of time, the Reef site was a mix of coral reefs and islands in an interstitial state. For only 10–20 percent of the Reef's recent history would it have looked like it does now.

Thus, the Reef we see today is the result of very recent sea level stabilisation. Sea levels reached their most-recent low 20,000 years ago: some 130 metres below today's levels. It then took over 10,000 years for sea levels to return to present-day height (a level that last existed some 120,000 years ago) and thousands of years for current coral formations to re-establish themselves (**Veron, 2008: 156**). The present configuration of the Great Barrier Reef is, therefore, very recent in geological terms – only some 6,000 years old (**Wallace, 2008**) – and, significantly, it is far from being either stable or permanent.

Importantly, coral life possesses resilient qualities shaped by adaptation to a fluid and ever-changing ocean environment. Over their 500-plus million years of existence corals have had to cope with highly varied conditions. Long favourable periods have been followed by mass extinction events during which many species did not survive. Corals existing today are the survivors of half-a-billion years of extreme planetary fluctuations and have managed to do so only because of an evolved genetic plasticity. And, beyond such climatic influences, corals have been constitutively shaped by the fluid medium in which they live, relying on ocean currents for reproductive dispersal (**Todd, 2008**). A coral species may 'break apart' if currents are insufficient to disperse coral spawn widely enough, having the ability to become many different species due to a hybrid genetic composition. Conversely, a species may also 'reform' when currents are favourable, bringing together spawn of the same species. This genetic re-packaging process is termed reticulate evolution and differs markedly from traditional Darwinian evolution. While such hybridisation is not completely unique it provides a mechanism by which a bounded

population is able to make the most of a limited genetic pool and adapt to new conditions more effectively than by random mutation alone (**Arnold, 1997**). [ii] The mechanism has allowed corals to survive ongoing fluctuations by, in effect, mimicking the unstable and fluid qualities of their environment, meaning that, if stressed, corals are able to respond to changing conditions and, over time, adapt.

Such biological fluidity has not been lost on those concerned with marine life and coral reef health. Researchers are actively investigating coral's genetic plasticity, aiming to increase resilience to adverse environmental conditions. Human-assisted evolution seeks to accelerate corals' ability to hybridise and adapt given that environmental changes are occurring at a much faster rate than normal, including such mechanisms as coral stress conditioning, assisted gene flow, hybridisation, and symbiont algal modification (**Cornwall, 2019**). Additionally, those tasked with managing marine ecosystems are exploring multi-faceted interventions such as multiscale governance which calls for multiple governing authorities at different scales to engage in self-organisation and mutual adjustment (**Morrison et al., 2020**). Yet, even if such management approaches, along with coral hybridisation, prove effective the Great Barrier Reef will be dramatically changed, becoming compositionally altered. The shape and location of the Reef will also adjust in response to circumstances beyond control: climate and weather fluctuations, rising sea levels, and unanticipated ecosystem interactions.

An environmental imaginary of the Great Barrier Reef as vibrant and lively yet *stable* is therefore misguided. Corals and coral reefs are anything but static or fixed. Corals demonstrate an intimate geo-planetary relationality that has served to shape not only where they assemble, but their very constitution. The genetic fluidity of corals is perhaps their most surprising feature. While not fully oceanic – that is, free within the ocean's medium – corals make use of hydrographic movements and dynamics, and in turn are shaped by them. Far from existing in a world that is fixed they have resourcefully navigated their way through the rhythmic turbulence of an inherently dynamic planet. Within an Anthropocene world, corals serve as a reminder of life's wider geo-sociality. Beyond qualities of interdependence and interbeing, the fluid resilience and constitutional malleability may offer insight for how human life can best dwell through ongoing planetary dynamism and flux.

Inventive Geo-Sociality and Anthropocene dwelling

With foreboding planetary shifts forecast, there is an increasing need to re-story or re-narrate human dwelling within and through unfamiliar and precarious Anthropocene terrain. Looking outside of conventional – and dominant Western – narratives that have shaped modern planetary

conditions, we might look to cases, such as corals, that expand understanding of more-than-human inter-being and opens up generative geo-social insight.

In the case of the Great Barrier Reef, I am also mindful of the longstanding relationship Aboriginal peoples have had with the region and feature. During my fieldwork I noted of an absence of Aboriginal histories or perspectives – a marked difference to more familiar ground in Aotearoa New Zealand where mātauranga Māori (knowledge) and tikanga (practices) make up an expanding segment within the tourism sector (**Statistics New Zealand, 2015**). For the Great Barrier Reef, stories collected from the region, such as those of the Yidindji people of the Cairns area, recalls a time when the ancestors of these people lived at the coast where the Reef now stands, chronicling the land being inundated by the ocean. A study by Nunn and Reid (**2016**) examined such oral histories, suggesting these document changes brought about by the end of the last ice age, some 13,000 years ago, and subsequent coastal transformation. Such narratives reveal a consistent pattern of adapting and sense-making, living amidst uncertainty on an ever-changing earth-ocean interface over thousands of years, and is a reminder that there are humans in this very place who have already shown how to dwell with oceanic unease across the longer term.

From an Anthropocene geologic perspective, geologist Jan Zalasiewicz (**2008**) reminds us that humans and corals share a key similarity: they are both forms of biological life fabricating rock or Earth strata. Coral life, however, has prevailed over millions of years evolving an enduring resilience, having been changed by and adapting to ongoing planetary flux – and from which humans may be able to learn. This could be, in the first instance, attuning sensibilities to dimensionality, fluidity, and deep time; enfolding such qualities into the production of new forms and structures that have capacities beyond those with linear, surface and fixed attachments. Additionally, corals demonstrate efficacies of collectivism through both their symbiotic biology and capacity to work with other corals and marine life assembling enduring reef formations. As Clark and Syzersynski (**2020: 98**) discuss, such qualities illuminate the potentials of collective and participatory process and through creative trial and error. Indeed, strategies of 'emergent design' apply ideas of simple iterative creative processes in responding to the vacillating conditions of a 'white water' world (**see Pendleton-Julian & Seely Brown, 2018**). Drift is another apposite quality utilised by corals through oceanic currents. Working *with* natural flows, agencies and differentials (**see Syzersynski, 2019**) offers both conceptual and practical avenues in exploring alternatives, for example with power and mobility which in the modern era have been energetically forced and controlled. Returning conceptual thinking to

dimensional and dynamic planetary capacities, reengages humans and human activity with intrinsic geo-sociality – underscoring vicissitudes of Anthropocene dwelling which repudiate notions of human dominion and call for relational reattunement to vital flux, flows and agencies of a planet in a constant state of becoming.

Conclusion

In this paper I have taken the ecological emergency of Australia's Great Barrier Reef as a prompt for interrogating wider planetary Anthropocene disturbance, employing ideas from more-than-human ontologies, vital materialisms and geophilosophy. An existentially informed methodological approach sought to engage distressed conditions and sensations. Ethnographic and embodied methods were used for in-filed investigation as a means of bearing witness to events, allowing bodily and affective qualities to inform research. Such methods helped with the project's conceptual development, illuminating shared precarities and intimate coexistentiality between humans and reef life, as well as expanding thinking though more-than-human material dimensions via coral's micro and macro solid-fluid attachments.

Coral's liquid-oceanic and geological constitutive properties challenge conventional fixed and terrestrial-based thinking. Rather, thinking through the ocean's dimensionality and dynamic-liquid qualities invites apposite fluid and liquid conceptions of the world that, far from being static and bounded, is conversely fluctuating, changeable, processual, and in a constant state of becoming. Furthermore, corals are an amalgamation of both solid and fluid – structurally and biologically – affording them an advantageous malleability. They have survived over 500 million years by adapting to ever-changing planetary conditions, evidencing a geo-sociality responsive to geological and -temporal dynamics. Humans might draw insights form such planetary geo-sociality. The solid-fluidity of corals and reef assemblages is conceptually useful in expanding linear and solid-state Western modernist logics as humans grapple with changing Anthropocene-effected planetary conditions.

Returning to the article's entry point and concern with the Great Barrier Reef's impending 'death', this can be read in a more nuanced and generative light. Such demise relates more to an imagined state of the world – namely that built upon fixed and stable Holocene attachments. While modern humans might construe the Reef as a large solid and static feature, this belies its relational complexity and fluidity: coral reefs are anything but fixed. Ultimately, the Reef of today is different from yesterday, and will be different again tomorrow. This is not to trivialise deleterious anthropogenic impacts but rather expand analysis through wider material, geo-temporal and relational attributes. Coral life possesses

a constitutional resilience and tenacity, serving as an illuminating example of more-than-human geo-social life both adaptive and resourceful, and which offers percipient insight into sensibilities and strategies for human living and dwelling with and through vicissitudes of ongoing planetary flux.

I'm a transdisciplinary research and creative practitioner. My professional work has focused on social and political design and creative projects. Recent research focuses on the human-nature nexus, post-natural dwelling, as well as planetary and exo futures.

Acknowledgments

I would like to thank Steve Turton, Richard Kenchington, and Quentin Hanich for time taken to discuss this topic with me, as well as those I met diving on the Reef. Thanks also to doctoral supervisors, Chris Gibson, Lesley Head, and Anja Kanngieser. This research was conducted with the support of an Australian Government Research Training Programme Scholarship.

List of Illustrations

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Figure 2: The stark above-water landscape. A crew member watches over snorkelers. Another dive boat is visible in the background. Source: Author.

Figure 3: Reef visitors snorkelling over a coral bommie, with dive boat in the background. Source: Author.

Figure 4: View of coral assemblage, top of bommie. Source: Author.

Figure 5: A small patch of bleached and possibly dead branching coral (*Acropora* species) encountered during one of the author's dive sessions. Source: Author.

References

Abram, D., 1996. The Spell of the Sensuous: Perception and Language in a More-Than-Human World. New York, NY: Penguin Random House.

Adams, M., 2017. 2017 Calibre Essay Prize (winner): Salt Blood.

Adams, M., 2019. Indigenizing the Anthropocene? Specifying and situating multi-species encounters. International Journal of Sociology and Social Policy, 41(3/4), pp. 282-297.

Aho, K., 2014. An introduction to Existentialism. Cambridge, Polity Press.

AIMS., 2016. Coral bleaching events. Australian Institute of Marine Science. Available at: http://www.aims.gov.au/docs/research/climate-change/coral-bleaching/bleaching-events.html [Accessed: 26 October 2021].

Alaimo, S., 2019. Science studies and the blue humanities. Configurations, 27(4), pp. 429-432.

Anderson, K. and Smith, S.J., 2001. Emotional geographies. Transactions of the Institute of British geographers, 26(1), pp. 7-10.

Anderson, B. and Wylie, J., 2009. On geography and materiality. Environment and planning A, 41(2), pp. 318-335.

Anderson, J. and Peters, K., 2014. 'A perfect and absolute blank': Human Geographies of Water Worlds. In: Anderson, J. and Peters, K., eds., Water Worlds: Human Geographies of the Ocean. London: Routledge, pp. 3-22.

Arnold, M., 1997. Natural Hybridisation and Evolution. Oxford: Oxford University Press.

Ash, J. and Simpson, P., 2016. Geography and post-phenomenology. Progress in Human Geography, 40(1), pp. 48-66.

Barnes, R. and Hughes, R., 1999. An Introduction to Marine Ecology. Malden, MA: Blackwell Science.

Barua, M., 2014. Volatile ecologies: towards a material politics of human-animal relations. Environment and Planning A, 4 (6), pp.1462-1478.

Battistoni, A., 2013. Back to no future. Jacobin 10, 18 June, 2013. Available at: http://jacobinmag. com/2013/06/back-to-no-future [Accessed: 20 June 2017].

Bear, C. and Eden, S., 2011. Thinking like a fish? Engaging with nonhuman difference through recreational angling. Environment and Planning D: Society and Space, 29(2), pp. 336-352.

Bennett, J., 2009. Vibrant matter: A political ecology of things. Durham, NC: Duke University Press.

Bingham, N., 2006. Bees, butterflies, and bacteria: Biotechnology and the politics of nonhuman friendship. Environment and Planning A, 38(3), pp. 483-498.

Bingham, N., and Hinchliffe, S., 2008. Reconstituting natures: Articulating other modes of living together, Geoforum, 39(1), pp. 83-87.

Bleuel, J., Pennino, M.G. and Longo, G.O., 2021. Coral distribution and bleaching vulnerability areas in Southwestern Atlantic under ocean warming. Scientific reports, 11(1), pp.1-12.

Braun, B., 2008. Environmental issues: Inventive life. Progress in Human Geography, 32(5), pp. 667-679.

Buller, H., 2008. Safe from the wolf: Biosecurity, biodiversity, and competing philosophies of nature. Environment and Planning A, 40(7), pp. 1583-1597.

Carson, R., 1951. The Sea Around Us. Oxford: Oxford University Press.

Carson, R., 1955. The Edge of the Sea. Boston, MA: Houghton Mifflin.

Castree, N., 2014. The Anthropocene and the Environmental Humanities: Extending the Conversation. Environmental Humanities 5, pp. 233-260.

Choi, M., 2016. More-than-human geographies of nature: Toward a careful political ecology. Journal of the Korean Geographical Society, 51(5), pp.613-632.

Cielemecka, O. and Åsberg, C., 2019. Toxic Embodiment and Feminist Environmental Humanities Introduction. Environmental humanities, 11(1), pp.101-107.

Clark, N. and Szerszynski, B., 2020. Planetary social thought: The Anthropocene challenge to the social sciences. Hoboken, NJ: John Wiley & Sons.

Clark, N., 2011. Inhuman nature: Sociable life on a dynamic planet. London: Sage Publications.

Clark, N., 2017. Politics of strata. Theory, Culture & Society, 34(2-3), pp. 211-231.

Cloke, P. and Perkins, H. C., 2005. Cetacean performance and tourism in Kaikoura, New Zealand. Environment and Planning D: Society & Space, 23(6), pp. 903-924.

O'Mahoney, J., Simes, R., Redhill, D., Heaton, K., Atkinson, C., Hayward, E. and Nguyen, M., 2017. At what price? The economic, social and icon value of the Great Barrier Reef. Brisbane, QLD: Deloitte Access Economics.

Condé Nast Traveller., 2020. The ultimate travel bucket list. Condé Nast Traveller, 20 November 2020. Available at: https://www.cntraveller.com/gallery/travel-bucket-list-ideas [Accessed: 10 December 2021].

Coole, D. and Frost, S., 2010. Introducing the new materialisms. In: Coole, D. And Frost, S., eds., New materialisms. Durham, NC: Duke University Press. pp. 1-44.

Cornwall, W., 2019. Researchers embrace a radical idea: engineering coral to cope with climate change. Science, 21 March 2019. Available at: https://www.science.org/content/article/researchers-embrace-radical-idea-engineering-coral-cope-climate-change [Accessed: 10 December 2021].

Couper, P.R., 2018. The embodied spatialities of being in nature: encountering the nature/culture binary in green/blue space. Cultural geographies, 25(2), pp.285-299.

Crutzen, P. and Stoermer, E., 2000. The Anthropocene. Global change newsletter, 41, pp. 17-18.

Crutzen, P., 2002. Geology of mankind. Nature, 415 (6867), pp. 23-23.

Davidson, A., 2015. Beyond the Mirrored Horizon: Modern Ontology and Amodern Possibilities in the Anthropocene. Geographical Research, 53(3), pp. 298-305.

Davis, H. and Turpin, E., 2015. Art and Death: Lives Between the Fifth Assessment and the Sixth Extinction. In: Davis, H. and Turpin, E., eds., Art in the Anthropocene. London: Open Humanities Press, pp. 3-22.

de La Bellacasa, M.P., 2017. Matters of care: Speculative ethics in more-than-human worlds (Vol. 41). Minneapolis, MN: University of Minnesota Press.

DeLanda, M., 2006. A new philosophy of society: Assemblage theory and social complexity. London: Continuum.

DeLoughrey, E., 2007. Routes and roots: Tidalectics in Caribbean literature. In: Paul, A., ed., Caribbean Culture: Soundings on Kamau Brathwaite, pp.163-75.

DeLoughrey, E., 2017. Submarine futures of the Anthropocene. Comparative Literature, 69(1), pp.32-44.

Deloughrey, E.M., 2019. Toward a Critical Ocean Studies for the Anthropocene, English Language Notes 57: 21-36.

Denzin, N. K., and Lincoln, Y. S. eds., 2008. The landscape of qualitative research: Theories and issues. 3rd edn. Thousand Oaks, CA: Sage.

Dewsbury, J.D., 2003. Witnessing space: 'knowledge without contemplation'. Environment and planning A, 3 (11), pp. 1907-1932.

Dove, S. and Hoegh-Guldberg, O., 2006. Coral bleaching can be caused by stress: The cell physiology of coral bleaching. In: Hoegh-Guldberg, O., Phinney, J., Skirving, W. and Kleypas, J., eds., Coral Reefs and Climate Change: Science and Management. Washington, WA: American Geophysical Union, pp. 1-18.

Ettinger, B., 2004. Weaving a Woman Artist with-in the Matrixial Encounter-Event. Theory, Culture, and Society, 2 (1), pp. 69-94.

Fuchs, T., 2013. Effects of habitat complexity on invertebrate biodiversity. Immediate Science Ecology, 2, pp. 1-10.

Garrett, B., 2012. Place Hacking: Tales of Urban Exploration (doctoral thesis). Department of Geography, Royal Holloway, University of London, London.

GBRMPA., 2021a. Reef facts. Great Barrier Reef Marine Park Authority, Australian Government. Available at: https://www.gbrmpa.gov.au/the-reef/reef-facts [Accessed 12 April 2021].

GBRMPA., 2021b. Traditional owners of the Great Barrier Reef. Great Barrier Reef Marine Park Authority, Australian Government. Available at: http://www.gbrmpa.gov.au/our-partners/traditional-owners/traditional-owners-of-the-great-barrier-reef [Accessed: 12 April 2021]

Giffney, N. and Hird, M.J. eds., 2008. Queering the non/human. Farnham: Ashgate.

Gilroy, P., 1993. The black Atlantic: Modernity and double consciousness. Cambridge, MA: Harvard University Press.

Greenhough, B., 2010. Vitalist geographies: Life and the more-than-human. In: Harrison, P. and Anderson, B., eds., Taking-Place: Non-representational theories and geography. Surrey: Ashgate, pp. 37-54.

Greenhough, B., 2012. Where species meet and mingle: Endemic human-virus relations, embodied communication and more-than-human agency at the Common Cold Unit 1946-90. Cultural Geographies, 19(3), pp. 281-301.

Gumbs, A.P., 2020. Undrowned: Black feminist lessons from marine mammals. Oakland, CA: AK Press.

Haraway, D., 2016. Staying with the Trouble: Making Kin in the Chthulucene. Durham, NC: Duke University Press.

Haraway, D., 2008. When species meet. Minneapolis, MN: University of Minnesota Press.

Harvey, C., 2017. 'It's going to be grim, but there will still be coral': Scientists call for realism about reefs. The Washington Post, 1 June, 2017. Available at: https://www.washingtonpost.com/news/energy-environment/wp/2017/06/01/its-going-to-be-grim-but-there-will-still-be-coral-scientists-call-for-realism-about-reefs/ [Accessed: 26 October 2020]

Hayes-Conroy, A. and Martin, D. G., 2010. Mobilising bodies: Visceral identification in the Slow Food movement. Transactions of the Institute of British Geographers, 35(2), pp. 269-281.

Hinchliffe, S. and Bingham, N., 2008. Securing life: The emerging practices of biosecurity. Environment and Planning A, 40(7), pp. 1534-1551.

Hinchliffe, S., 2008. Reconstituting nature conservation: Towards a careful political ecology. Geoforum, 39(1), pp. 88-97.

Ingersoll, K. A., 2016. Waves of Knowing: A seascape epistemology. Durham , NC: Duke University Press.

Ingold, T., 2015. The Life of Lines. London: Routledge.

Ingold, T. and Simonetti, C., 2021. Introducing Solid Fluids. Theory, Culture & Society. DOI: 10.1177%2F02632764211030990 [Accessed: 10 January 2022].

Ingold, T., 2007. Lines: A Brief History. New York, NY: Routledge.

Ingold, T., 2011. Being Alive: Essays on Movement, Knowledge and Description. Abingdon: Routledge.

Instone, L. and Taylor, A., 2015. Thinking About Inheritance Through the Figure of the Anthropocene, from the Antipodes and in the Presence of Others. Environmental Humanities, 7, pp. 133-150

Instone, L., 2010. Encountering Native Grasslands: Matters of Concern in an Urban Park. Australian Humanities Review, 49. Available at: http://australianhumanitiesreview. org/2010/11/01/encountering-native-grasslands-matters-of-concern-in-an-urban-park/ [Accessed 10 April 2021].

Jacobsen, R., 2016. Obituary: Great Barrier Reef (25 Million BC-2016). Outside Magazine, 11 October, 2016. Available at: https://www.outsideonline.com/2112086/obituary-great-barrier-reef- 25-million-bc-2016 [Accessed: 26 October 2020].

Jamieson, A., Singleman, G., Linley, T. and Casey, S., 2021. Fear and loathing of the deep ocean: why don't people care about the deep sea?, ICES Journal of Marine Science, 78(1), pp. 797-809.

Jue, M., 2020. Wild blue media: Thinking through seawater. Durham, NC: Duke University Press.

Last, A., 2012. Experimental geographies. Geography Compass 6, pp. 706-724.

Latour, B., 2018. Down to earth: Politics in the new climatic regime. Hoboken, NJ: John Wiley & Sons.

Latour, B., 2005. Reassembling the Social: An Introduction to Actor-Network Theory. Oxford: Oxford University Press.

Lefebvre, H., 2014 (1958). The critique of everyday life: The one-volume edition. London: Verso Books.

Lorimer, H., 2005. Cultural geography: the busyness of being 'more-than-representational'. Progress in Human Geography, 29(1), pp. 83-94.

Lorimer, J. and Driessen, C., 2013. Bovine biopolitics and the promise of monsters in the rewilding of Heck cattle. Geoforum, 48, pp. 249-259.

Lorimer, J., 2015. Wildlife in the Anthropocene: Conservation after nature. Minneapolis, MN: University of Minnesota Press.

Mason, K., 2015. Participatory action research: Coproduction, governance and care. Geography Compass, 9(9), pp. 497-507.

McCalman, I., 2013. The Reef: A passionate history. New York, NY: Scientific American/Farrar, Straus and Giroux.

Merleau-Ponty, M., 1962. Phenomenology of Perception. London: Routledge and Kegan Paul.

Mickey, S., 2016. Coexistentialism and the Unbearable Intimacy of Ecological Emergency. London: Lexington Books.

Morrison, T.H., Adger, N., Barnett, J., Brown, K., Possingham, H. and Hughes, T., 2020. Advancing coral reef governance into the Anthropocene. One Earth, 2 (1), pp.64-74.

Morton, T., 2016. Dark Ecology: For a Logic of Future Coexistence. New York, NY: Columbia University Press.

Morton, T., 2010. The Ecological Thought. Cambridge, MA: Harvard University Press.

Mulhall, M., 2009. Saving rainforests of the sea: An analysis of international efforts to conserve coral reefs. Duke Environmental Law and Policy Forum, 19, pp. 321-351.

Nancy, J., 2015. After Fukushima: The Equivalence of Catastrophes, translated by Mandell, C. Fordham. New York, NY: University Press.

Neimanis, A., 2019. Bodies of water: Posthuman feminist phenomenology. London: Bloomsbury Publishing.

Novoa, A., 2015. Mobile ethnography: emergence, techniques and its importance to geography. Human Geographies – Journal of Studies and Research in Human Geography, 9(1), pp. 97-107.

Nunn, P. and Reid, N., 2016. Aboriginal Memories of Inundation of the Australian Coast Dating from More than 7000 Years Ago. Australian Geographer, 47(1), pp. 11-47.

Ogborn, M., 2002. Writing travels: Power, knowledge and ritual on the English East India Company's early voyages. Transactions of the Institute of British Geographers, 27(2), pp. 155-71.

Paglen, T., 2009. Blank Spots on the Map: The Dark Geography of the Pentagon's Secret World. NewYork, NY: Dutton.

Pandolfi, J. and Kelley, R., 2008. The Great Barrier Reef in Time and Space: Geology and Paleobiology. In: Hutchings, P., Kingsford, M, and Hoegh-Guldberg, O., eds., The Great Barrier Reef: biology, environment and management. Collingwood: CSIRO Publishing, pp. 39-52.

Pierre, B., Petigny, N., Nagar, R., and Shakhsari, S., 2019. Performing embodied translations: Decolonizing methodologies of knowing and being. Commoning Ethnography, 2(1), pp. 113-131.

Piggott-McKellar, A. and McNamara, K., 2016. Last chance tourism and the Great Barrier Reef. Journal of Sustainable Tourism, 25(3), pp. 1-19.

Pile, S. and Thrift, N., 1995. Mapping the Subject: Geographies of Cultural Transformation. Routledge, London.

Purkis, S., 2021. Coral reefs are dying as climate change decimates ocean ecosystems vital to fish and humans. The Conversation, 6 October 2021. Available at: https://theconversation.com/coral-reefs-are-dying-as-climate-change-decimates-ocean-ecosystems-vital-to-fish-and-humans-164743 [Accessed: 10 December 2021]

Ralph, N., Birks, M. and Chapman, Y., 2015. The methodological dynamism of grounded theory. *International Journal of Qualitative Methods*. 14(4): doi:10.1177/1609406915611576.

Readfearn, G., 2021. World Heritage Committee agrees not to place Great Barrier Reef on 'in danger' list, The Guardian, 23 July 2021. Available at: https://www.theguardian.com/environment/2021/jul/23/world-heritage-committee-agrees-not-to-place-great-barrier-reef-on-in-danger-list [Accessed: 3 Feb 2022].

Rose, D., van Dooren, T. and Chrulew, M., eds., 2017. Extinction Studies: Stories of Time, Death and Generations. New York, NY: Columbia University Press.

Serres, M., 2018. The birth of physics. Lanham, MD: Rowman & Littlefield.

Sheller M, and Urry J., 2006. The New Mobilities Paradigm. Environment and Planning A: Economy and Space. 38(2), pp. 207-226.

Simonetti, C. and Ingold, T., 2018. Ice and concrete: solid fluids of environmental change. Journal of Contemporary Archaeology, 5 (1), pp.19-31.

Spivak, G., 2003, 'Planetarity'. In: Spivak, G., ed., Death of a Discipline. New York: Columbia University Press, pp. 71-102.

Stassart, P. M. and Whatmore, S., 2003. Metabolising risk: Food scares and the un/re-making of Belgian beef. Environment & Planning A, 35(3), pp. 449-462.

Steinberg, P., 2001. The Social Construction of the Ocean. Cambridge: Cambridge University Press.

Steinberg, P. and Peters, K., 2015. Wet Ontologies, Fluid Spaces: Giving Depth to Volume through Oceanic Thinking. Environment and Planning D: Society and Space, 33(2), pp. 247-264.

Steingo, G., 2021. Learning from Alexis (Review of Alexis Pauline Gumbs's Undrowned: Black Feminist Lessons from Marine Mammals), boundary 2, May 5, 2021. Available at: https://www.boundary2.org/2021/05/gavin-steingo-learning-from-alexis-review-of-alexis-pauline-gumbss-undrowned-black-feminist-lessons-from-marine-mammals/ [Accessed: 7 July 2022].

Strathern, A.J. and Stewart, P.J., 2011. 'Personhood'. A Companion to the Anthropology of the Body and Embodiment. Hoboken, NJ: Wiley, pp. 388-403.

Szerszynski, B., 2017. Gods of the Anthropocene: Geo-spiritual formations in the Earth's new epoch. Theory, Culture & Society, 34(2-3), pp. 253-275.

Syzersynski, B., 2019. Drift as a planetary phenomenon. Performance Research, 23(7), pp. 136-144.

Thrift, N., 2008. Non-representational theory: Space, politics, affect. London: Routledge.

Todd. P., 2008. Morphological plasticity in scleractinian corals. Biological Revues of the Cambridge Philosophical Society, 83(3), pp. 315-37.

Tsing, A., 2015. The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins. Princeton, NJ: Princeton University Press.

UNESCO., 2016. World Heritage Commission, The United Nations Educational, Scientific and Cultural Organisation website. Available at: http://whc.unesco.org/en/about/ [Accessed: 20 October 2020].

van Dooren, T., Kirksey, E. and Münster, U., 2016. Multispecies Studies Cultivating Arts of Attentiveness. Environmental Humanities, 8(1), pp. 1-23.

Vernon, J., 2017. Coral Fact Sheets: Modern coral reefs. Australian Institute of Marine Science. Available at: http://coral.aims.gov.au/info/reefs-modern.jsp [Accessed: 5 April 2019].

Veron, J., 2008. A reef in time: the Great Barrier Reef from beginning to end. Massachusetts, MA: Harvard University Press

Veron, J., 2009. Is the Great Barrier Reef on Death Row? Presentation to The Royal Society, 6 July 2009. Available at: https://www.youtube.com/watch?v=xHo4vb-lPDQ [Accessed: 25 October 2020].

Wallace, C., 2008. Hexacorals 2: Reef-Building or Hard Corals (Scleractinia). In: Hutchings, P., Kingsford, M, and Hoegh-Guldberg, O., eds., The Great Barrier Reef: biology, environment and management. Collingwood: CSIRO Publishing, pp. 208-220.

Westgate, J. 2017. Crossing Rivers, Revisiting Trauma, and Contemplating the Geo: Thinking into the Anthropocenic. GeoHumanities 3(1): 233–245.

Westgate, J. 2020. Anthropocene dwelling: lessons from post-disaster Christchurch, New Zealand Geographer 76(1): 26–38.

Whatmore, S., 2002. Hybrid geographies: Natures cultures spaces. London: Sage.

Whatmore, S., 2006, Materialist returns: Practising cultural geography in and for a more-than-human world. Cultural Geographies, 13(4), pp. 600-609.

Wright, K., 2017, Transdisciplinary Journeys in the Anthropocene: More-than-Human Encounters. London: Routledge Environmental Humanities Series.

Wright, R. and Watson, I., 2018. Great Barrier Reef headed for 'massive death'. CNN, August. Available at: https://edition.cnn.com/interactive/2018/08/world/great-barrier-reef/ [Accessed: 10 December 2021].

Zalasiewicz, J., 2008. The Earth After Us: What Legacy Will Humans Leave in the Rocks? Oxford: Oxford University Press.

To cite this article:

Westgate, J., 2023. Title Corals, Geo-Sociality, and Anthropocene Dwelling. *Exchanges: The Interdisciplinary Research Journal*, 10(2), 74-105. Available at: https://doi.org/10.31273/eirj.v10i2.979.

Endnotes

[i] Having grown up in Aotearoa New Zealand, I have formed an understanding of te ao Māori (worldview) through both personal and professional engagement.

[ii] Such hybridisation also comes with negative consequences to a genetic pool: it can allow undesirable genes into the pool, or reproductive sterility.