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ARTICLE

An Anthropologist Fails to Become a Fish: Multispecies Sensing in the Anthropocene

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Abstract

How well do we know how non-humans experience environmental stressors and how do we communicate that knowledge as educators? This paper addresses these questions by way of an auto-ethnographic account of the author's experience of attempting to listen to the Great Barrier Reef, off the Queensland coast. Through a series of methodological failures and roadblocks, this paper discusses the difficulties in understanding non-human sensory worlds. Following the auto-ethnographic account, the paper explores how anthropological pedagogies can contribute to environmental education of non-human experiences more broadly. The paper uses anthropological pedagogy to draw an analogy between ethnocentrism/cultural relativism and anthropocentrism/ecocentrism. Utilising practices of "third place" then demonstrates how the latter terms of these relationships are correctives to the former terms rather than oppositions. This paper concludes by suggesting ways in which the lessons learned can be applied to environmental education. It recommends creating a third space environmental curriculum which defamiliarises human experience and creates a zone of contact between humans and non-humans. The use of mediating technologies and artistic practice in conjunction with scientific education is recommended to maintain a critical perspective of human knowledge and biological limitations in creating experiential relationships with the environment.

Keywords: Culture; epistemology; ontology; qualitative; technology; understanding; wildlife

Introduction

Environmental education in the Anthropocene faces significant pedagogical challenges in teaching about the effects that environmental changes have on non-human worlds. In this article, I utilise an auto-ethnographic approach based on fieldwork on the Great Barrier Reef to explore the boundaries of multispecies relationality. In my failure to listen like a fish, I will critique standard common approaches to environmental teaching and research. Finally, I draw on anthropological pedagogy (among others) to suggest new pathways for educators.

Environmental educators have found it important to shift education from an anthropocentric model to an ecocentric one which decentres humans and acknowledges the intrinsic value of beings in the ecosystem (Bonnett, 2019; Cocks & Simpson, 2015). As a part of this shift, environmental education pedagogy and research have incorporated more (posthuman) phenomenology and radical relation-making (Bonnett, 2019; Davies, 2021; Rautio et al., 2022a), which also draws from a longer tradition of aesthetics and environmentalism (Harries-Jones, 2005; Smith & Smith, 1970). Significantly, these posthuman practices deviate from

traditional phenomenology by moving away from practices of observation and towards practices of multispecies and multi-material entanglements (Barad, 2007).

Such changes are necessary to comprehend the ways in which human action escape human intent, which Tsing, Deger, Keleman Saxena, and Zhou (2021) call feral entities. Not to be confused with feral animals, "feral entities" refers to the unexpected by-products of human action which "assumes a trajectory beyond human control" (Tsing et al., 2021, "Introduction to Feral Atlas" section). While feral entities may include non-human species such as cane toads or kudzu which are moved around the globe due to human industry, it also includes non-living entities such as microplastics, radioactive fallout and induced mud volcanoes. Feral entities can escape because they are often able to proliferate outside of human experiences. How well do environmental education practices hold up when feral entities escape human perception?

Rautio et al. (2022b) argue for a posthumanist environmental education which "seeks to consider the experiences of all beings, both human and nonhuman" (p.774), and so address those experiences which escape us humans. But as the CitiRats project demonstrates, students struggle with shedding their sense of the world in order to inhabit the world of non-human animals (Kervinen et al., 2024; Rautio et al., 2022b). As Despret (2013) explains, humans shedding their sense of the world is also a persistent issue in animal studies research. Jukes and Reeves (2020) and Stewart (2018) both explore more-than-human relationality via extension through assemblages in their place-responsive pedagogies, although both note the friction in thinking through other bodies. This suggests to me a fundamental epistemological issue in how our perceptual biases influence our interpretations of non-human experiences. It is the same issue I ran into during my own research. In attempting to use traditional phenomenological techniques, I quickly ran into my human boundaries. When I shifted to more posthuman thinking about my research practices, I became more enmeshed in human-animal-technical networks. Still, I struggled with perceiving non-human worlds. It is in this struggle that I came to know the limits of phenomenological practice and the challenges of communicating posthuman ontologies.

Writing as method

Before exploring feral entities and perception, I would like to take a moment to elaborate on the methodology used in this article: auto-ethnography. Firstly, I use auto-ethnography because I am trained as an anthropologist, and ethnography is core to our discipline's practice of communication. Ethnography is our way of presenting and discussing a culture as well as to structure and examine our own thoughts. Ethnography, though, is often writing about other people where the anthropologist acts as a bit player to enliven a scene. I, on the other hand, am seeking to explore a subjective experience, so I am employing auto-ethnography. Through auto-ethnography, I can communicate about events centred on my own participation and use those stories to interrogate the cultural phenomena that structure my experience and way of knowing. Posthuman and multispecies anthropologists are particularly fond of using this methodology (in whole or in part) because it allows them to probe the nature of their intertwined relationships with materials and lifeforms (Helmreich, 2007; Tsing, 2015).

Secondly, I use auto-ethnography because I believe that it can be a tremendous tool for academic communication in environmental education. As educators, we are often at the centre of experiments of our own design. We are both the subject and observer of our educational interventions, and we cannot be removed from the data we collect. As Barad (2007) argues, we are "not outside [the world] looking in" (p.6); we are making and being remade by our interactions with the world. Auto-ethnography allows the researcher to include themselves in the analysis and acknowledge their own experiences as valid data.

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Diving in

I began my fieldwork in 2017 onboard *Passions of Paradise III*, a dive boat running day trips out of Cairns to several sites on the outer Great Barrier Reef. My intent was to study how recreational and professional divers related to the Reef and its denizens through—among other things—sound, and how this contributed to their understanding of underwater noise pollution. I also started diving for my own phenomenological investigation. I had the sense that if I were to write about the Reef, I should immerse myself in it. What does it sound like and feel like to be in the marine environment?

Phenomenology forms the basis of many methodologies of sound studies. Schafer's (1977) soundwalks, which require the practitioner to move through an environment while listening closely to the changes in sound, have been an inspiration for many sound studies. Another commonly employed auditory method is the practice of deep listening, as developed by composer Pauline Oliveros. According to Oliveros (1998), "deep listening is listening in every possible way to everything possible to hear no matter what you are doing" (p. 3). The practitioner listens intently and tries to identify the various qualities of the soundscape and the effect the environment has on those qualities. Even Helmreich (2007), the most science focused of the sound anthropologists, relies on phenomenological techniques when discussing sound in submersibles, although he does place more emphasis on the role of technological mediation in perception.

Armed with these methods, I attempted a phenomenological approach to listening. Phenomenological methods in anthropology (particularly in the anthropology of sound) focus on using the body as instrument to sense, record and analyse experiences to explore how body and culture shaped those experiences (in the tradition of Schutz [1962]) (Bernard, 2006). I chose to start off with some soundswims which combines Schafer's (1997) soundwalks with Oliveros' (1998) deep listening. I would participate in a dive and take notes on sound experiences and changes in the soundscape in a waterproof notebook.

Helmreich's (2007) work on the anthropology of sound and ocean space points towards the need to recognise the (cyborgic) relationship between humans and technology:

> attend to the earache, to imbalance, to all the **embodied capacitances** of the ethnographer—and to the work necessary **to place oneself in particular networks**, machinic and social . . . pay attention to **impedance and resistance** in **cyborgic circuits**, to **the work that needs to be done** so that signals can link machines and people together, at a range of scales, from the private to the public. (emphasis mine, p. 633)

Although enmeshed in cyborgic circuits, the ethnographer is still engaged in phenomenological work. Based in posthumanism, cyborg theory emphasises the embodied relationship between humans and technology (Haraway, 1991) and therefore encourages sensual exploration. Helmreich (2007) shifts attention to how phenological experience emerges from material relationalities that reconfigure interrelated subjects. Importantly, posthuman anthropology values phenomenology as being fundamental to our methodology (something environmental educators should take into consideration when using anthropological works) (Howard, 2017).

Although scuba may offer the possibility of a new ear, in practice, the equipment does little to amplify the sensorial experience and can even encumber auditory sensing. As Picken and Ferguson (2014) note in their sensual ethnography of novice divers, most listening is oriented towards monitoring internal states rather than external sources. Most new divers concern themselves with monitoring their breathing rates to best conserve air and ensure that the supply system is working correctly. The internal soundscapes of a novice diver are so powerful that they mask environmental soundscapes. New divers are unlikely to be aware of what a healthy reef soundscape should sound like and are probably not going to learn it through diving.

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The crew of *Passions* fare better at perceiving the Reef's soundscape. Through training and experience, they have learned to listen beyond their internal states. Sound, for them, has become another tool for monitoring their surroundings and for navigation. An experienced diver can begin to recognise the sizzle of rain hitting the surface, the munching of parrot fish and triggerfish or the respirations of another diver just outside of the field of view. The divemaster may even signal these audio cues to the rest of the group, but it is unclear if the other divers actually hear it.

Intriguingly, one sonic experience was independently reported to me by multiple divers. A diver is underwater when they suddenly experience a strong increase in noise and a strong vibration. The diver is unnerved enough by the noise that they surface only to notice that a large ship was passing by several kilometres away! Even though this story was not uncommon, what was striking was that almost none of the divers I worked with connected that experience to underwater noise pollution. Shipping was visibly occurring within the Reef and those ships were most likely making noise, but no one was making a link between that noise and the health of the ecosystem. The frequency and location of these experiences might be partially responsible since they were rarely reported occurring at tourist dive sites on the Reef.

Living in

In the process of conducting my fieldwork, it became clear that the divers' experiences with underwater noise were not reflecting the experience of marine creatures. While divers were regularly visiting the reefs, they did not know what it was like to *live in* the reefy environment.

For many creatures living in the waters of the Great Barrier Reef, from coral polyps to humpback whales, sound is an important medium for how they interpret their environment. From the moment the larvae of a variety of marine species including fish (Tolimieri et al., 2000), crustaceans (Montgomery et al., 2006) and coral polyps (Vermeij et al., 2010) decided to leave the miasma of the plankton and settle closer to shore, they begin to listen out for the sounds of the reef. All that sound is being produced by their aquatic kins as they search for food, fight for territory and maintain their schools, which crescendos each morning into the dawn chorus (McCauley & Cato, 2000). A reef's health depends on the soniferous activity of its denizens (Rossi et al., 2016).

Unfortunately, the sound world of the reef is being eroded away by increased human activity. The ambient noise level of the world's oceans has been increasing as much as 3 dB per decade (a doubling in volume) (Ross, 1993) although that rate has slowed in recent years and varies by region (Miksis-Olds & Nichols, 2016). Most of this increase in noise is coming from shipping traffic with other sources including naval sonar, petroleum exploration and coastal development (Ross, 2005). Small vessel noise has also been indicated as a problem for reefs (Holles et al., 2013).

This increase in noise has a major impact on marine species. The long exposure of increased noise to fish and other marine animals has the possibility to greatly reduce the health of marine ecosystems (Slabbekoorn et al., 2010). In fish, the increased noise has been shown to increase stress, resulting in impaired growth, lower reproductivity and impaired immune systems (Wysocki et al., 2006). Noise can also impair predator avoidance responses, leading to increased fish mortality (Simpson et al., 2016). Little is known about the effects of noise on invertebrates.

The divers aboard *Passions* had no experiential knowledge of these things and did not connect their experiences with those living on the reef. Although there might be sonic experiences that disturb human divers, the divers are often unable to translate that to the fishes' experience. Nagel (1974) has previously argued that the conscious experience of one species is not fully accessible to another. While others have worked to further develop the argument for non-human agency and how to identify that agency (Dawkins, 2000; Morton, 2017; Wadiwel, 2016), they still struggle with

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the sensual divide between species. The further away one gets from primates, mammals or terrestrial fauna, the harder it is for one to comprehend the life of another being which further limits one's ability to imagine alternative ways of being. This provides opportunities for humans to ignore potentially harmful experiences which exist outside of our sensorium (Almiron, 2016; Puig de la Bellacasa, 2017). For divers, it is easier to assume that the fish are deaf to most noise than it is to comprehend how a being can hear in a manner completely different to the human experience.

Multispecies listening

Given Nagel's (1974) quandary, would more marine education spark a sympathetic affect among divers? So far, I have outlined how divers might use sound and are affected by it in the practical activities of diving. These experiences build up a knowledge set of sounds for diving and indicate an aural phenomenological experience of diving. But when considering sound in relation to the experience of other beings (thus, detecting noise experiences beyond the human), does a human phenomenology overlap with a fish phenomenology?

The human animal is, fundamentally, terrible at hearing underwater. Our reduced hearing capabilities are a result of biology and physics (Hollien & Feinstein, 1976). The structure of our ears is designed to channel the vibration of the air through the ear canal to the tympanic membrane and transmit it to the cochlea via the ossicle bones. Unfortunately, soft tissue of the human body is approximately the same density as seawater and acoustic waves mostly bypass the aural system (Hollien et al., 1976). Instead, those waves are picked up by the bones of the skull and channelled to the cochlea in a process called bone conduction. Because of the rigidity of bone, hearing sensitivity and range are greatly reduced and favour lower frequencies. In addition, the speed at which sound travels through water (about five times faster than through air) disrupts the listener's ability to tell from which direction the sound came. While some localisation is possible (Bovet et al., 1998), the human brain's capacity to detect the delay between the two ears is greatly limited and decreases as the frequency rises.

While my frequency sensitivity and sense of directionality were deadened, I did start to sense the haptic qualities of sound. The whine of the dive tender as it passed overhead or the rumble from *Passions'* bilge pumps when close to the hull would vibrate my entire body. Due to the higher density of water, sound could be felt more readily. For the divers who experience a cargo ship pass by, it was as much the bodily vibrations as the loud sound of the vessel that sent them to the surface. For me, the haptic qualities of sound were the first indication that I might do better approaching underwater sound and its haptic qualities' relational potentiality by figuring it as acoustic energy. After all, it is these energetic properties of sound that also enable a fish to hear.

There is no one structure for the fish ear, but generally speaking, all fish sense sound through particle motion (Popper & Fay, 2011). Since the fish's flesh has a similar density to water, it moves in sync with the liquid as sound waves pass through it. Inside the fish's head are small, hard objects called otoliths which are denser than the fish's body and cause it to vibrate out of sync with the soft flesh. The otolith pushes and pulls on the sensory hairs inside the fish's ear, causing the fish to hear. Fish can also sense particle motion through their lateral line, a string of sense organs running down a fish's side.

Humans can only gain an inkling of how marine creatures experience sound. In this project, I had set out to understand how people grasped the sonic worlds of marine beings, but the phenomenological approach can only examine how *people experience* the sonic worlds *containing* marine beings. The cyborg circuits of the dive apparatus could only afford me to be immersed *in* the environment. Rather than a posthuman listening, diving was more *peri*-human – attending the experiences only at the border of the human body. It is unlikely that diving could ever allow a human to develop a complete empathy for non-human sonic experiences. I would need to find a new way of listening.

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Learning to hear

To overcome my physiological limitations, I turned to other technologies of listening. I had acquired a hydrophone—underwater microphone—and I listened in from the bow of the boat after dives. This device could pick up acoustic energy and transduce them into audible sound. The hydrophone forced me to consider the various mechanical energies interacting in the surrounding water including the reflection of acoustic waves on the surface and the movement of water particles against the instrument. Once I put on my headphones, a new sonic world opened. This cyborgic configuration more fully entangled me in a network of material relationships allowed for greater acoustic clarity.

Everything above 500 Hz in the audible range was dominated by the crackle of snapping shrimp. Occasionally, I had the opportunity to hear the grunts and chirps of fish. Or at least I thought I heard them. The primary deficit of using a hydrophone is that the listener is only partially transported underwater. While I could listen in, I rarely was able to see what I heard. Later, I learned that this was a perpetual problem in underwater bioacoustics. Unlike bird calls, there is no generally available resource to learn fish communication. There are limited databases of fish sounds and most focus on ecologies of the Northern temperate oceans or freshwater ecosystems. Without a functioning database, marine auditors must rely on visual confirmation to identify most sources. The only time I could be certain of the origin of a call was when a trio of batfish took interest in my hydrophone and auditioned before it.

Mostly, I would hear the sounds of human activity. The respirations of introductory divers, the whine of a buoyancy control devices (BCD) inflating, or the *clang clang clang* of a tank banger were common. Then there was the dive tender: a small rubber dinghy that would patrol the area and assist any passengers needing aid or occasionally tow divers to remote dive sites. The whine of the motor could be obnoxiously loud. I had experienced the noise while diving, but it was even worse with the hydrophone. Yet the fish did not seem to mind, at least as far as I could tell from listening in. On the few occasions when I did continuously hear fish grunting, the presence of the dive tender did not appear to affect their behaviour.

Apart from the dive tender, little anthropogenic noise pollution could be detected. It was not just the deadened sense of the divers; noise was not seeping into these dive sites. There was one exception: Towards the end of August, on Flynn Reef, one of the larger dive boats in the area left and came back to its mooring while I had my hydrophone in the water. Its departure from and return to the reef were gradual but noticeable above the typical reefy soundscape. Its manoeuvres to position itself at the mooring were the largest sources of noise. For each manoeuvre, the boat's propellers would spring to life and explode with sound, producing noticeably higher sound levels in the lower frequencies.

Hearing does not have to be in the moment of listening in. Most of the time I was recording off the boat, I was too concerned about maintaining the equipment or monitoring what was going on around me. Many sounds I could not hear until I listened to the recordings again back at my desk. The day or so after a trip out to the Reef, I would replay my recordings using Adobe Audition. Not only would the acousmatic (sound without a visible source) listening allow me to focus on individual elements, but the computer program also generated a spectrogram, allowing me to *see* sound (Figure 1).

A spectrogram is a temporal graph with frequency on the vertical axis and duration on the horizontal. Each sound is colour-coded for intensity with purple being the least intense, reds and oranges in the middle and yellow the most intense. The low sounds of *Passions* form a thin yellow base to the spectrogram and the clicks from the snapping shrimp striate the graph in thin, broadband lines of varying colours. Upon this background, other sounds begin to appear. A BCD inflating takes the form of a gradually ascending line while tank bangers form decaying triangles. Most fish sounds produce a percussive series of dots near the bottom. Here, the effect of noise

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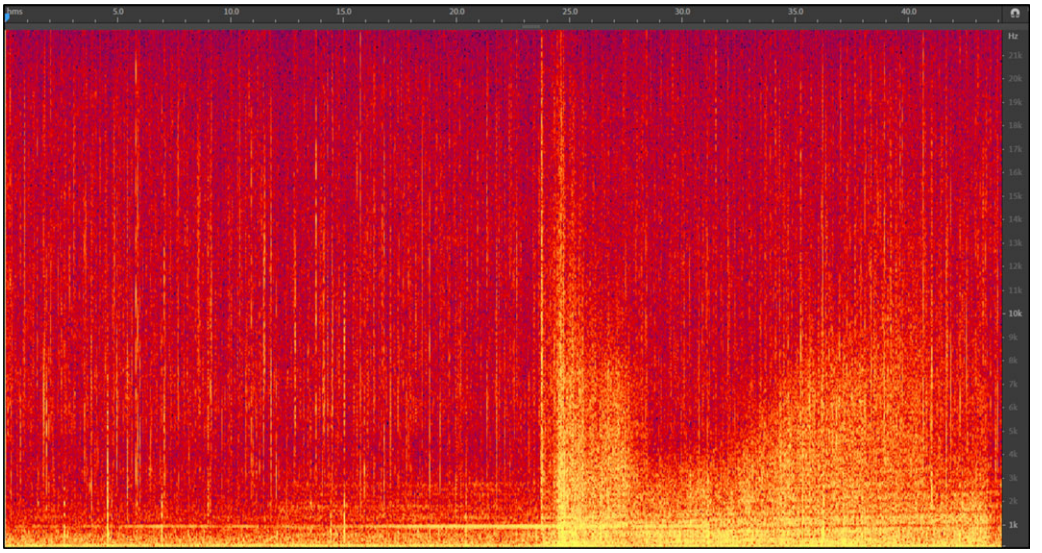

Figure 1. Spectrogram from recording of moving dive boat. Tim on top axis, frequency on right axis.

becomes visible. As anthropogenic noise increases, the fish chortles and grunts begin to blend in and become indistinct from the sounds of engines as they become masked.

Making others hear

Integrating sound into the tourist Reef experience is a constant challenge. Among all the other stressors to the ecosystem and the demands from tourists, noise does not seem so important. The average Reef visitor has a superficial level of knowledge about the Reef ecosystem mostly drawn from popular documentaries, news reports and guidebooks, few of which seriously consider the soundscape. Noise, to most visitors, blends into all the other bits of information about the aquatic environment. It was less notable because it was less noticeable, say compared to coral bleaching. The crew must cater to the educational needs of the passengers and so they focus on more approachable topics of identification and the life cycles of popular creatures.

Heading home from the Reef, the crew would hold their daily marine life talks. It is a brief lesson on coral, reef ecology, key reef species and conservation. As part of my agreement with *Passions*, I added my own segment about sound. This was the final attempt of the crew to drive home any environmental or educational message and my last opportunity to get the passengers to hear noise.

Using iPad tablets, one of the divemasters started to explain the size of the marine park, the anatomy of coral and how to identify various types. Using my own Surface tablet and a portable speaker, I introduced the audience to the sounds of the Reef, playing either that day's recording or another recent one. Passengers were often shocked that the crackle of the Reef is not produced by foraging fish, but by little shrimp. They also enjoyed recordings of fish choruses and whale songs. Closing out the marine life talk, the instructor promoted *Passions of Paradise*'s conservation efforts and allied programmes.

Making things weird

Anthropologists are known for making things weird. It is central to our pedagogy. One of the first obstacles we must tackle in every introductory course is to dismantle our students' ethnocentrism—their bias towards their own cultural practice—and introduce a doctrine of cultural relativism—a

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framework that states all cultures are qualitatively different and therefore cannot be ranked. We accomplish this, in part, by challenging our students' sense of what is "normal" through a process of defamiliarisation, or "making the familiar strange" as the saying goes in our profession. Defamiliarisation coupled with exposure to other cultures guides our students towards evaluating cultural practices through a lens of cultural relativism.

The practice of defamiliarisation has its limits. Anthropologists have acknowledged that ontological gaps between them and the cultural representatives persist due to varied life histories (Paleček & Risjord, 2013). Hastrup (1995) identifies in her work with Icelanders that anthropological research happens at a "third space" in which the anthropologist and representative of the culture under investigation come in contact. The anthropologist cannot fully experience another culture, nor can a representative fully indoctrinate the anthropologist. The third space is a zone of contact where understanding is imperfect, but where understanding can occur. The third space in anthropological research exists because the dichotomy between ethnocentrism and cultural relativism is partly false. Given that the anthropologist is unable to fully remove themselves from their own culture, complete cultural relativism becomes impractical (Eriksen, 1995). Anthropologists are trained to be consistently critical of their own subjective position in the contact zone, not just to defend against bias but to also to ensure that important domains of knowledge are not missed (Bernard, 2006).

Contact zones are also utilised in multispecies ethnographies (Helmreich, 2009; Tsing, 2015), philosophy (Haraway, 2008; Isaacs & Otruba, 2019) and education (Lussier & Ruitenberg, 2022; Taylor & Pacini-Ketchabow 2015) as a means of reorienting to an ecocentric perspective. Contact acts "as a lens for better appreciating the complexity of entanglement in our more-than-human world" (Isaacs & Otruba, 2019, p.700). The use of contact zones in environmental research and environmental education calls participants to check cultural and value biases (Payne & Wattchow, 2009) thus correcting for the general view of anthropocentrism that is rightly decried by environmental scholarship (Kopnina et al, 2018; Kopnina, 2012). This still does little to address the *cognitive* anthropocentrism which is "the tendency to reason about unfamiliar biological species or processes by analogy to humans" (Coley & Tanner, 2012, p.209) as participants are not asked to critically interrogate their innate human subjectivity. Additionally, as Haraway (2008) points out, contact zones are not without their politics as humans often have the privilege of deciding where contact takes place and even who lives and dies within those zones. To further illustrate this point, let me provide one more ethnographic account.

In the winter of 2018, I was invited onto the crown-of-thorns starfish (COTS) control boat as part of a group at the Reef Restoration Symposium. COTS are a significant stressor on the Great Barrier Reef. The large, spiky sea stars eat coral polyps and can destroy entire reef ecosystems if their populations become too large (De'ath et al., 2012; Milne et al., 2023). The COTS Control Program is an attempt to reduce the number of mature COTS in the marine park to prevent a destructive outbreak. COTS Control divers inject each animal with a substance that causes an allergic reaction resulting in the sea star breaking apart. On that day, we were given a live demonstration of the process. One COTS diver removed a large specimen from its plastic container and then proceeded to inject the creature. My fellow guests watched in fascination, but I felt sickened by the execution. I was horrified for the sea star even if it did not know what was happening to it. Fortunately, we were spared the sight of the animal breaking apart, but I wondered what it would be like to slowly disintegrate.

I know I am anthropomorphising. The lived experience of a COTS is relatively simple. It does not have a centralised brain for higher-order thought, and it probably does not feel pain as we think of it (Smith et al., 2023). I know these things, but I still want to project onto it my own way of sensing. I have been warned against the dangers of anthropomorphising, yet I cannot fully prevent myself from doing it.

To be clear, anthropomorphism is a consequence of anthropocentrism. If the entire world is only understood through human experience, then radically other beings must be transformed

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into near-humans for us to make sense of their experiences. When uncritically engaged, these become ethically dubious practices which set up a faulty substitute for the organism itself. Rather than creating a representation of the creature, we have "humans in animal drag" (Toadvine, 2007, p. 39).

But we cannot seem to stop from anthropomorphising. Even among the most careful scientists, non-human experience is often described through analogy (Coley & Tanner, 2012). In part, it is a result of the shortcomings of human language to describe non-shared experience. But the issue is more deeply rooted. Even non-linguistic forms of communication transform non-human experience into anthropocentric formats. Whale songs are sped up to be made audible to human researchers (Payne, 1995) and infrared light is made visible so that researchers might "see" a snake's ability to perceive heat (Schraft et al., 2019). Those who attempt to remove any trace of anthropomorphism through purely technical language threaten to succumb to mechano-morphism (Karlsson, 2012), an equally dubious position. Some researchers, partially those advocating for animal welfare, suggest utilising anthropomorphism as a means to rethink animal research, participation and sources of harm (Hayward, 2010; Karlsson, 2012; Morton et al., 1990).

Anthropomorphism creates a double bind. Removing anthropomorphism risks creating a subject/object relationship while engaging with it risks ignoring vital differences between multispecies subjectivises. The third way out could be to engage in a critical anthropocentrism which recognises that all representations of non-human experiences are *attempts* to escape our own subjectivity which must continuously fail in some manner. Critical anthropocentrism in multispecies activities requires the practitioner to critically reflect on how their human subjectivity and capacity inform their experiences and how they are coming to know other subjectivities. Critical reflection is not limited to the directly experienced, but also examines how nonhuman experiences must be transformed for our understanding. It makes the human experience weird so as to better understand subjective differences in multispecies contact zones.

Without critical anthropocentrism, ecocentrism risks introducing unexamined biases into multispecies relationships, particularly for experiences outside of the human sensorium. From an environmental education perspective, inclusion of critical anthropocentrism in immersive and contact-oriented pedagogies may allow students to better examine the boundaries of the experience, understand more fully the impact of human action on the environment and become more critical of their own actions and interventions.

Mediating contact zones in environmental education

The struggle to understanding fishy sound worlds for the divers and for myself were the result of insufficient engagement in the contact zone of the Reef because engagement relied on the uncritical use of human-centred phenomenology. Once I critically examined my own bodily capacities, I was able to reorient myself in the contact zone so that fish and noisy machines could be heard. That reorientation required mediation. By mediation, I mean this in the strong sense of utilising technology and media. Mediation was also required to let others hear.

While there are strong arguments in environmental education for immersive experience (Riley & White, 2019; Whitehouse et al., 2017), as I stated at the beginning of this article, the feral entities of the Anthropocene often escape our ability to perceive them. Where our embodied capacitances fail, we must then enrol other sensing technologies. In my research on underwater sound, I used hydrophones, speakers and specialised software (as well as fins, snorkel, mask and dive gear). These technologies extended my sensory capabilities by compensating for my physical limitations or enrolling new senses to assist when my ears reached their limit. To remain critical of our mediated experience we once again pay attention to the "cyborgic circuits" as Helmreich (2007) requests. In the case of underwater listening, paying attention to the hydrophone technology helps me to learn the differences between my hearing as a land-based mammal and that of a fish.

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Posthumanism asks us to reconfigure human/non-human relationality, but we may still need phenomenological practices to help us identify our own physical limitations and biases. While I can no longer create a one-to-one relation through shared experience, I learn that I cannot base my relationship with environmental stressors solely through my own sensory experience.

Those who study environmental sounds often turn to artistic practice to gain a better understanding of their field and the sense of difference between them and other beings (Bandt & Barclay, 2017; Westerkamp, 2002). Interpreting scientific and environmental knowledge through art helps practitioners and observers to develop understanding through alternative routes such as through the affective domain (Friedman, 2013). Incorporating artistic practice into education activities in contact zones may assist students in analysing mediated experiences by engaging effective responses.

I encourage environmental educators to explore how critical anthropocentrism and mediation can be incorporated into curriculum to make feral entities more apparent. A mature environmental education pedagogy needs to pay more attention to the subjective differences between human and non-human experience. Curriculum that does not address experiences beyond the human sensorium risks allowing anthropogenic disturbances like underwater noise pollution to continue to propagate. In my failure to become a fish, I learned more about what it means to be a human trying to live in and with the Anthropocene.

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