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# Fathoming postnatural oceans: Towards a low trophic theory in the practices of feminist posthumanities

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## Abstract

As the planet's largest ecosystem, oceans stabilise climate, produce oxygen, store CO<sub>2</sub> and host unfathomable biodiversity at a deep time-scale. In recent decades, scientific assessments have indicated that the oceans are seriously degraded to the detriment of most near-future societies. Human-induced impacts range from climate change, ocean acidification, loss of biodiversity, eutrophication and marine pollution to local degradation of marine and coastal environments. Such environmental violence takes form of both 'spectacular' events, like oil spills and 'slow violence', occurring gradually and out of sight. The purpose of this paper is to show four cases of coastal and marine forms of slow violence and to provide counter-accounts of how to reinvent our consumer imaginary at such locations, as well as to develop what is here referred to as 'low-trophic theory,' a situated ethical stance that attends to entanglements of consumption, food, violence, environmental adaptability and more-than-human care from the co-existential perspective of multispecies ethics. We combine field-philosophical case studies with insights from marine science, environmental art and cultural practices in the Baltic and North Sea region and feminist posthumanities. The paper shows that the oceanic imaginary is not a unified place, but rather, a set of forces, which requires renewed ethical approaches, conceptual inventiveness and practical creativity. Based on the case studies and examples presented, the authors conclude that the consideration of more-than-human ethical perspectives, provided by environmental arts and humanities is crucial for both research on nature and space, and for the flourishing of local multispecies communities. This paper thus inaugurates thinking and practice along the proposed here ethical stance of low-trophic theory, developed it along the methodological lines of feminist environmental posthumanities.

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Feminist environmental humanities, oceanic studies, feminist posthumanities, environmental violence, low-trophic theory

## Introduction

Along with ecological catastrophes, like Deepwater Horizon oil spill in the Gulf of Mexico in 2010, threats and murders of activists – primarily from the Global South – striving to protect waters, natural resources and landscapes, are some of the often-mentioned examples of direct environmental violence taking toll on both human and nonhuman lives. Drawing on insights from marine science, environmental art and cultural practices in the Baltic and North Sea region, as well as feminist posthumanities, this article aims to develop the concept of *low-trophic theory*, understood as a set of situated approaches that attend to the entanglements of consumption, violence, more-than-human care and co-existential multispecies ethics.

As the planet's largest ecosystem, oceans stabilise climate, produce oxygen, store CO<sub>2</sub> and host unfathomable biodiversity at a deep time-scale. In recent decades, scientific assessments have indicated that the oceans are seriously degraded to the detriment of most near-future societies.<sup>1</sup> At large, it becomes increasingly clear that climate change, environmental destruction and diminishing biological diversity form the key pillars of the present ethico-political crisis of planetary proportions. Here, the oceans play a major part as they cover 71% of the surface of the 'blue planet.' And still, a lot remains unknown and unfathomed at the levels of oceanic depths, shallow waters and along coastlines. Simultaneously, in the cultural imaginaries, the ocean and the sea stand for that which washes away, neutralises, conceals and hides in their limitless volume 'under the surface.' They are culturally marked as the spaces of 'forgetting': out of sight, out of mind.

In the Anthropocene, human as a species – in its undifferentiated understanding (MacCormack, 2020b) – becomes a force irreversibly altering all Earth's systems and spheres. Looking at the seas and oceans, with their presents, pasts and futures, shows that not all forms of environmental violence are immediate or 'spectacular' (Nixon, 2011), but rather perilous in a clandestine way, geographically dispersed and unfolding on a long-term scale. Some are not even spectacular on the relatively short-term scale of the UN Ocean Decade 2021–2030, which declared a window of opportunity for providing a unifying framework to enable countries to achieve their ocean-related Agenda 2030 priorities. A type of violence that comes to the fore in the context of the discussion on marine ecosystems is what environmental humanities scholar Rob Nixon calls 'slow violence' that 'occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all' (2011: 2). Slowly unravelling and frequently overlooked violence 'out of sight' extends through Earth's geosphere, biosphere, hydrosphere and atmosphere, all being affected through climate change, deforestation, the loss of biodiversity, plastic pollution, wars' toxic and radioactive aftermath and ocean acidification, among others, but not without consequences for human and nonhumans alike at various planetary positions (Alaimo, 2016; Lykke, 2019)

In this article, we turn our attention to the oceanic and the coastline sites of environmental science, art and feminist posthumanities (Åsberg and Braidotti, 2018; Radomska and Åsberg, 2020), partly submerged in on-going empirical work by the edge of the sea. We zoom in on how environmental exposures get storied, how values and social imaginaries get

shared, and new communities forged, and how it all matters in the Baltic and the North Sea, which are our own environmental ‘backyards.’ We bring together insights from marine science and species biology, environmental art and cultural initiatives, history and feminist field philosophy in order to examine prospective multispecies futures of coexistence and care at sites of slow, oceanic environmental violence. More specifically, we focus on four cases: submerged chemical weapons, so-called dead zones, invasive species and high-/low-trophic marine ecosystems in the Baltic and North Sea regions.

Taking these four select cases of marine environed bodies (Alaimo, 2010) as our entry points, we venture to explore more sustainable relations to the sea and the shoreline, as well as practices of local coastal communities that we have encountered in the process. These encounters catalysed questions of care and hospitality in the Baltic and North Sea. It is from there that we aim to unfold what we call *low-trophic theory*, understood as a set of theory-practices that draw on insights from feminist posthumanities, environmental humanities and environmental art.

More specifically, the concept of low-trophic theory refers to the situated naturalcultural research on the entanglements of consumption, violence, complicity, more-than-human care and co-existential multispecies ethics of environmental adaptability. Originally, the term ‘trophic’ stems from the Greek term *trophē*, meaning ‘nourishment, food’ (Harper, n.d.). In the context of ecology, the notion of ‘trophic level’ describes the group of organisms occupying the same level in a food chain, i.e. having the same ‘distance’ in relation to the primary energy source (the Sun). Organisms that photosynthesise: algae and plants are qualified as autotrophs, and those who consume either autotrophs or other consumers are called heterotrophs. What this ecological classification brings to the fore is the very question of nourishment and consumption, which all the living depends on. It is the matter of consumption that permeates both slowly and abruptly developing anthropogenic violence (also exemplified in the four cases we analyse below): the consumption of other creatures, of biomass, of space and potential futures.

Taking an in-depth look at the low-trophic practices of local coastal communities, like seaweed foraging done in thoughtful, attuned with the processes and capacities of the ecosystems they are involved in, ways, we ask what can the concept of the low-trophic do in terms of theory and ethics? How can we theorise in ways cognizant of our own patterns of consumption, potential violence, complexity and ecologies in which we as subjects, living beings, creators and knowledge producers are implicated in? How can we – through our practices as thinkers, scholars, educators, activists, artists but also, plainly, humans – account for not only relations we enter or connections we cultivate, but also exclusions being made (Giraud, 2019)?

In the following sections, we first look at the environmental humanities and feminist posthumanities as the interconnected forms of critical ‘rewriting’ (Lyotard, 1991) or revising of conventional humanities, which has traditionally been anchored in the hegemonic notion of the autonomous and bounded human subject. Subsequently, we zoom in on the stories of environmental violence unfolding in the Baltic and North Sea regions, encapsulated in four case study-based sub-sections. Building on these four cases as well as critical-creative theory-practices of feminist posthumanities and environmental arts, we further develop the concept of low-trophic theory as situated ways of attending to ‘more-than-human’ (Rose et al., 2012; Whatmore, 1999) complexities of environmental violence, consumption, complicity but also care and hospitality inherent in the daily practices of being in and ‘of the world’ (Barad, 2007). Finally, we close the article with an outro, a meditation that links our ethico-political proposal of low-trophic theory to environmental humanities scholar Deborah Bird Rose’s reflection on multispecies ethics and temporality.

## Environmental humanities and feminist posthumanities

In the context of present-day science, science and technology studies (STS) and more-than-human humanities, the conventional concepts of nature and culture, as dichotomous, hierarchically arranged entities, are simply obsolete (Åsberg, 2018; Haraway, 1991). As humans, we are deeply entangled in the (nonhuman) environment: for instance, our physical and mental health, our brains, well-being and behaviour are affected by our gut microbiome (Galland, 2014; Willyard, 2021). But also, as differentially situated agents, we alter ecosystems both nearby and afar. It is no longer tenable to picture nature as completely detached from culture; quite on the contrary, their enmeshment should be seen as a mundane site of contestation for societal power, violence and also, for care and co-existence (Åsberg et al., 2020). Not only does this situation have theoretical and disciplinary consequences (nature can no longer be regarded as solely ‘reserved’ for scientists), but also, the stakes are high for ethics and politics at large. It *matters* which naturecultures get *materialised* and get to flourish, and which ones get to suffer and die (cf. Haraway, 2016). The management of invasive species might be one example close at hand, invoking geopolitical notions of territoriality and otherness. Importantly, we all inhabit, embody and embed the world differently, as variously situated people, divided by national, sexual, religious, bodily and economic status, and as *very* variously situated nonhumans in an increasingly anthropogenic world (MacCormack, 2020a).

The environment as a concern for multi- and interdisciplinary science, emerged only approximately 50 years ago, catalysed – at least to some extent – by growing public awareness of major environmental issues, such as Santa Barbara oil spill in 1969, and the publication of marine biologist Rachel Carson’s *Silent Spring* (1962), a trail-blazing book on the ecological effects of pesticides. In natural science research, the environment has been defined by biophysical indicators. Yet, common understandings and dominant Western cultural imaginaries of the environment as a passive background or playground for men, find their ways into environmental policy and practices of the environment as a resource to be managed, mastered and exploited.<sup>2</sup> This modern notion (akin to ‘nature’) makes the environment other to culture and positions it as a resource or a repository for human nostalgia, fear or tranquillity (Merchant, 1980). Such positioning, making the environment other to everyday life and siloed into expert domains, has resulted in prolonged nature-culture divide in our institutions and imaginations, causing many in the global North to feel alienated from nature and apocalyptic about its environmental future (Neimanis et al., 2015), or to consider human matters as entirely divorced from environmental issues. For instance, climate change has mostly been represented as a scientific problem in need of technological solutions. However, that state of affairs is slowly changing with new research; environmental humanities begin from the position where climate change and environmental degradation are seen as social problems in need of diversified solutions. Science has explained these problems and their impacts, but the humanities and the arts are needed to help us understand how to live with, adapt to and mitigate the social crises and emerging anxieties.

Environmental humanities works for societal transformation from the proposition that we have entered a geological era of humanity’s own making that requires attention to accountability, social justice and equitable sustainability, to ethics, values and sense-making that expand and foster new environmental sensibilities in people. It is a new generation of environmental research that methodologically aims to enliven ecological imaginations, extend reparative possibilities and explore alternative futures (Åsberg et al., 2013; Gibson et al., 2015; Radomska, 2017, 2018; Rose et al., 2012). To address perceptions and knowledge, it often relies on the related insights of cultural and historical research and on

STS, while retaining various degrees of its more disciplinary origins in literary eco-critique, environmental history and philosophy, and in the eco-feminist postdisciplinarity emerging around philosopher Val Plumwood's work. Today, it meets up more generously than it used to with feminist theory, examining values, aesthetics, materiality and the nonhuman.

However, rising to the entangled challenges of today's planetary situation, such as political polarisation, global epidemics, synthetic biology, AI and other technological advancements, requires an integrative approach and an enlivened field of humanities, so-called posthumanities (Åsberg, 2008, 2014, 2018; Halberstam and Livingston, 1995; Wolfe, 2003). Such multi-targeting 'thicker' forms of more-than-human humanities (Rose, 2015) bridge the arts and science divide. Driven by feminist epistemologies of societal accountability, situated knowledge (Haraway, 1991) and the politics of location (Rich, 1984), posthumanities adapts the relevant methodologies of the environmental humanities subfields, such as multispecies studies (Tsing, 2015) or blue humanities (BH) (Alaimo, 2019; DeLoughrey, 2019), to the cases at hand.

BH are a rather new branch of environmental humanities and feminist posthumanities, corresponding to a sea change in the arts and humanities, namely *the nonhuman turn* (Giffney and Hird, 2008). Often inspired by the theoretical concepts from feminist STS, BH involves a turn to the political ontologies of the sea, their implications for multispecies temporalities and aesthetics, human communities and more-than-human ethics in the Anthropocene. Influences on the rise of this research are the pioneering biomarine writings of Rachel Carson. Yet, its feminist and decolonial ambitions are more evident in influences like Paul Gilroy's *The Black Atlantic* (1993) or Anna Tsing's (2015) and Donna Haraway's (2016) multispecies works. In effect, it draws on a range of geographical, historical and cultural works for the understanding of *the oceans as a force rather than a place to be managed* (Helmreich, 2008; Neimanis, 2017; Oreskes, 2014; Povinelli, 2014; Steinberg and Peters, 2015). This article draws on the appeal of these overlapping oeuvres of environmental humanities and feminist posthumanities, and yet focuses on slow oceanic violence and the less explored potential for low-trophic thinking with sea ecologies.

## Postnatural violence: Writing from the field

In the context of the Baltic Sea, deemed one of the most environmentally exposed and researched marginal seas in the world (HELCOM, 2018), the differences between people, and between human and nonhuman inhabitants unfold as multispecies politics that mould the region's futures to come. With intensified shipping and migration, waning fish stocks, oil pipes, submerged chemical weapons, historical and contemporary militarism, eutrophication, pollution and invasive species, the Baltic Sea transforms presently as a naturecultural domain of revived territorialism.

The Baltic is connected to the North Sea through two straits: Kattegat and Skagerrak. Simultaneously, the North Sea is also exposed to substantial pressures from industry and agriculture, extensive fisheries, intensive shipping and increasingly expanding forms of mariculture, like Norwegian salmon farming. Ship ballast water and transport of fish and shellfish are also considered as primarily responsible for the introduction of alien species into the connected waters of the Baltic and North Sea.

Since the end of the Second World War major military powers dumped chemical warfare agents such as mustard gas, tabun and Lewisite in the planet's oceans (e.g. Greenberg et al., 2016). It was planned as a peaceful 'farewell to arms' and yet, as munitions, chemical warfare agents and whole ships with military waste were deliberately sunk, it revealed a view to the oceans as an endless 'medium of purification.' But the human and nonhuman

ecosystems of both the Baltic and North Sea are being refigured not only by the military waste purposefully placed in its depths, also by invasive chemicals from pharmaceuticals and fertilisers, as well as new species testing the waters. As HELCOM and Commission of the European Communities report, ‘Invasive alien species are listed among the most important factors threatening the aquatic biodiversity in the Baltic Sea, together with eutrophication, contaminants, overfishing and destruction of habitats’ (EC Communication, 2009). Furthermore, the Baltic Sea is listed as the largest ‘dead zone’ area in the world (Diaz and Rosenberg, 2008). The term ‘dead zone’ refers to a body of water where oxygen levels have been depleted, resulting in the disappearance of marine life. While hypoxia (low oxygen levels) may occur naturally, during the past century it has been significantly induced by nutrient pollution: the disposal of sewage, wastewater and dispersed nitrate agents into the sea. The warming waters of climate change effectuate a plethora of ecological shifts also in north and south polar seas, for instance species migrations. Oceanic algae, once terraforming the Earth into a breathable planet, still produce most of our oxygen. Yet, not all algae are feeding off and flourishing in anthropogenic environmental alterations. Macro-algae, like kelp and bladderwracks, providing forest-like sanctuary for numerous species and in fact mitigating the eutrophication of the sea, perish with warming temperatures. Whole underwater kelp forests and mussel beds seem to recede with the warming waters of climate change (Aksnes et al., 2017). These macro-algae and their low-trophic ‘companion species’ (Haraway, 2003) – sometimes called the environmental engineers of the sea – take their species sheltering, carbon-sinking, eutrophication and military waste mitigating functions with them. In the following sub-sections, we delve into each of the above-mentioned cases of naturecultural violence in the Baltic and North Sea, with the hope that each story sheds light on the questions of complicity in violence and care for more-than-human worlds that also form the ground for low-trophic theory.

### *Out of sight, out of mind: On military waste at sea*

After the Second World War between 1946 and the 1960s, several hundred thousand tons of chemical and conventional weapons were dumped and scattered in the waters. The density of military waste, including sunken, decommissioned ships filled with munitions, is particularly large outside Bornholm and south-east of Gotland in the Baltic Sea, in the Gulf of Finland, and in the Skagerrak Strait of the North Atlantic, for instance outside Måseskär on the Swedish west coast and outside Arendal in Norway. Tons of metallic canisters and containers have since been corroding for some time and leaking their toxic contents into the aquatic habitat, forging a sinister heritage of military waste at sea. Although no precise records of the clandestine operations exist, estimates suggest that after the Second World War around 10,000 tons of munitions were dumped near the Gotland basin in the Baltic Sea (CHEMSEA, 2014). The allied forces and militaries across the world often disposed of the munitions and chemical weapons in deep ocean waters (cf. Neimanis, 2020).

In the shallow waters of Baltic Sea, outside Bornholm, the military dumping occurred in 1946 and 1956, according to eyewitnesses, and submerged 15,000 tons of chemical munitions and over 2000 tons of chemical agents. Research on the microbiota and fish in the area reveals significantly higher levels of mustard gas tolerance (Hellström and Ödalen, 2013). In fact, a majority of these chemical weapons consists of mustard gas, which despite its name actually is more of a viscous and gummy, orange-coloured liquid than a gas. Fishermen are on a regular basis hurt by the mustard gas as it gets trapped in or stick to their nets or trawling tools. The mustard gas, modified to better fit the colder climes of the north, is often laced with arsenic, adding to the toxic pollution and environmental violence at the dumping

sites. Recently, through studies of the toxic bioburden or accumulation of toxins in the nonhuman inhabitants of the areas, it has been concluded that also other chemical warfare agents like Clark I and Clark II were added to the mix to increase the poisonous effects of the mustard gas. Finfish and other species embody these heightened levels of toxicity, in the existing measurements done by scientists in EU projects like DAIMON (Decision Aid for Marine Munitions). They are living archives of military waste and slow oceanic violence, occurring on a planetary scale.

While the occasional resurfacing of these chemical agents poses a toxic threat to human and nonhuman bodies, the dominant scientific opinion has been to let these munitions containing a variety of hazardous substances lie *in situ* (Ahlsén, 2018; CHEMSEA, 2014). Considering the increased use of the seabed for pipelines, electric cables and offshore wind-farms, the risks of human and wildlife exposure are snowballing with the corrosion rates of the metallic canisters. Today, it may seem easy for us to criticise the dumping as stemming from anthropocentric attitudes that ‘completely ignor[ed] the consequences for the environment’ (Missiaen and Henriët, 2002: 2), but these actions may well hinge on the common cultural phantasy of the dilutive power of massive amounts of water. Toxic agents *can* dissolve and hydrolyse in massive amounts of seawater, and the ocean’s capacity at that time was imagined to be ‘limitless’ (Alaimo, 2012; Greenberg et al., 2016). And yet today, the strains on the oceans accumulate manifold. How much can the sea take? With regard to this military waste, the imagined future of chemical dilution into harmless seawater has of course not arrived. It will take a few human generations, and the consumption of the ‘enriched’ wild capture seafood by multiple consumers, including people. Here, low-trophic theory draws attention to the interconnectedness of human and more-than-human life in the Baltic and North Sea, as well as questions of care that extend beyond both our generation and species.

### *Dead zones and the Baltic Sea*

Oxygen is crucial for the survival and flourishing of different organisms both on the land and in the sea. For a body of water and its marine life to thrive, the level of dissolved oxygen should reach approximately 80% saturation. Low levels of oxygen lead to the migration and die-offs of fish, shellfish, aquatic plants and other organisms, which in turn may result in the disappearance of marine birds forming part of the affected ecosystems. Hypoxia is seen as a cause of major-scale mortality, behavioural responses, variations of species distributions, physiological stress and the loss of biodiversity (Zhang et al., 2013). It may occur due to ‘natural’ reasons, i.e. specific physical characteristics of a given aquatic environment, like the shape of the water body, its depth, salinity, temperature, the inflow and mixing of water, the strength and direction of wind, and whether or how it is connected with other water bodies. Yet, since 1970s oceanographers have drawn attention to the anthropogenic causes of oxygen depletion in water bodies leading to large-scale ‘dead zones,’ especially occurring along the coastlines, where marine life is particularly concentrated, on the one hand, and where waste from agriculture, factory farming and other industries often ends up, on the other. Thus, the other and dominant cause of hypoxia and dead zones, is pollution: the inflow of nutrients from fertilisers, detergents and other substances containing high amounts of nitrogen and phosphorus. Some of the most frequently cited examples – along with the Baltic Sea – are the Chesapeake Bay and the Gulf of Mexico, where urbanisation, poultry industry, industrial and factory farming waste and sewage are primary sources of nutrients pumped into the sea. High levels of nitrogen and phosphorus lead to algal blooms (eutrophication). In the context of the Baltic region, nitrogen oxides are produced in common

agriculture from where they trickle to the sea, and in coal power plants in Germany and Poland from where the nitrogen oxides are carried on the wind and fall out over countryside in the form of nitrates that over-enrich both the land and the sea. Local sewage systems, leaching from industry, forestry, agriculture and tourist sites, add to the resulting green soup of filamentous algae. While during daylight algae produce oxygen, at night they use dissolved oxygen for breathing. As they die, they are decomposed by bacteria, which further contributes to the consumption of dissolved oxygen in the water, and through the processes of eutrophication, to hypoxia.

Although periods of hypoxia occurred in the Baltic Sea – especially in its central deep basins – throughout the entire Holocene history, it is since early 1900s and especially 1950s that anthropogenic eutrophication and hypoxia have intensified in the coastal areas of the Baltic, leading to ‘unprecedentedly’ acute ‘complete deterioration of the macrobenthic community’ (Jokinen et al., 2018: 3994). While some scientists search for geoengineering solutions to hypoxia in the Baltic Sea (e.g. Stigebrandt, 2012), others emphasise the potential detrimental effects of such a solution on other ecosystems and advocate for much stricter measures concerning human-induced nutrient input into the sea (European Geosciences Union, 2018). Some environmental humanities scholars also draw attention to the very discourse surrounding the question of dead zones in the Baltic Sea, pointing at ways in which the ‘health’ of the sea is defined in relation to the presence of fish species important for the economy rather than local ecosystems as such (Peterson, 2018). What the question of dead zones reveals is both the complexity of relations, processes and interests pressing the thresholds of liveability of the sea and the pertaining imaginaries of the oceanic as that which washes away, hides and allows to forget. Anthropogenic eutrophication and dead zones are a direct outcome of capitalist overconsumption with its industrial waste and pollution; looking at them through the lens of low-trophic theory shifts our attention and imagination from the consequence of the phenomenon to its very source.

### *Invasive ‘others’ in marine ecosystems*

Alien (non-indigenous) species are organisms, deliberately or not, introduced to a new habitat, where they are able to survive and reproduce. They become classified as ‘invasive’ if they demonstrate a potential for spreading elsewhere and have a damaging effect on ecosystems they form part of, cause economic losses, or impact human health. In the marine contexts, non-native species are introduced not only through ship traffic (in the ship’s ballast tank or through biofouling), but also as a means of modifying local aquaculture (EEA, 2015). As the data from 2012 indicates, there are 118 non-indigenous species observed in the Baltic Sea, 90 of which are classified as ‘established,’ and only one as endemic (HELCOM, 2012). The increased number and size of ships, their speed, the use of separate tanks for ballast water and introduction of new trade routes are the key factors that facilitate the voyage for non-indigenous newcomers. While some researchers suggest that in contrast with many other seas, the invasion of alien species has increased both species and functional diversity of the Baltic Sea (Olenin and Leppäkoski, 1999; Ojaveer et al., 2010), others emphasise the fragile character of the Baltic’s ecosystems resulting from its semi-enclosed nature and relatively low species diversity (Littfass, 2019).

In the already polluted waters of the Baltic Sea, the non-indigenous newcomers<sup>3</sup> often appear to have higher tolerance and adaptability to the demanding conditions than the native inhabitants of the area. Once they get established, it is practically impossible to revert their introduction (Littfass, 2019). Experts argue that the best way to prevent potential damaging effects of alien species on local ecosystems is by precluding them from



entering the Baltic basin. While the management of ship ballast water has been regulated by International Maritime Organisation's Convention for the Control and Management of Ships' Ballast Water and Sediments since 2017,<sup>4</sup> the question of biofouling remains unresolved. Various anti-fouling means proved to be unsafe for the environment (like Tributyltin used in ship paints, remaining in food chains for longer periods). Yet, with the ever-increasing number of shipping routes and velocity of climate change, the issue of accidental species introduction to new habitats and their potential for altering these ecosystems becomes a concern for different legal bodies and institutions focused on marine environment protection. Simultaneously, discourses dealing with the presence of 'foreign' organisms in the Baltic and formulations they employ are reminiscent of cultural narratives and metaphors framing global migration and hospitality, as well as valuation of different stakeholders involved in these processes. What seems to remain insufficient in both cases (the nonhuman and human Baltic migration alike) is a new ethical imaginary that the marine naturecultures require. Needed are new ways of making sense of our impure selves as blue-green planet inhabitants and companion species, on the move. Low-trophic theory responds to this challenge: with its more-than-human sensibilities and care, it directly addresses the issues of multispecies ethics, co-existence and environmental adaptability. How can we learn to eat well with the newcomers?

### *Farming the sea: Between high and low trophic maricultures*

Today salmon consumption is three times higher in the US, Europe and Japan than it was in 1980 and the demand is growing fast, the WWF reports. Salmon farming, a form of aquaculture that entails raising a specific strain of Atlantic salmon 'from egg to market' and keeping the fish in net cages in marine settings along e.g. the Norwegian, Irish and Scottish coasts, is the fastest growing food production system in the world. While capture-fishery landings have been stagnant since the 1990s and while wild populations of finfish have been dwindling fast, the increasing demand for seafood has been met by intensified marine and land-based aquaculture, especially salmon farming. Without adding land-based stresses to soil, land and freshwater supplies, the increasing demand for food for the planet's growing human populations have put such aquaculture on centre stage. In the spotlight there is mainly the Atlantic salmon, a species genetically bred from a few Norwegian strains for faster growth and economic gain (Schiermeier, 2003). Like flamingos turning pink, the iconic salmon pink hues come from wild salmon eating shrimps and krill, ingesting the colouring compound astaxanthin. Farm-raised salmon would have a naturally grey-coloured flesh were it not for their chemically engineered feed, adding the pink colour to custom-made and desired degree. The artistic duo Cooking Sections' project on *salmon as a colour oddity* generated by the metabolisation of man-made substances in nonhuman bodies, describes salmon as 'the colour of wild fish which is neither wild, nor fish, nor even salmon' (Tate Britain: Art Now: 'Salmon – A Red Herring' by Cooking Sections).

A postnatural species *par excellence*, farmed salmon hosts an array of negative impacts on the ocean and contributes to environmental violence. It adds to eutrophication and biodiversity loss as the chemicals, antibiotics and excess nutrients from food and faeces from the over-crowded net cages disturb the oceanic flora and fauna directly under and around the farms. In fact, the excessive use of chemicals, including anti-foulants and pesticides that are banned in some countries, are to have unintended consequences for marine organisms and human health for futures to come. Parasites, like salmon lice, and viruses transfer easily inside the pen and between farmed and wild fish populations. While escaped

from its heavily regulated regime, and often weirdly disoriented, designer salmon interbreed with wild populations to alter and diminish genetic diversity (Schiermeier, 2003).

In essence, this is the unsustainable cultivation of high-trophic marine species that are equivalent to lions and wolves – top predators of their ecosystems – which, as sustainability science shows, implies significant energy inefficiencies and a far greater environmental footprint than is needed from a nutrition perspective. In sum, such high-trophic sea farming depends on chemicals, the suffering of fish, and contributes greatly to eutrophication and toxic pollution. From the human-centred viewpoint of sustainability, there is an urgent need to find new ways of producing nutritious food and biomass, to provide for growing populations with minimal environmental footprint (Alexandratos and Bruinsma, 2012). Land, soils and freshwater resources are already hard-pressed by agriculture (EASAC, 2017). One pathway to reducing pressures on land involves looking to our oceans for answers, but in a rather different register of consumption.

Unfed and unfertilised low-trophic mariculture, the farming and practices of making-flourish of species, such as seaweeds, mussels, oysters, tunicates and sea urchins, is seen by scientists as a potential game-changer in terms of the sustainable provision of food, materials and biomass (Aksnes et al., 2017). The low-trophic registers of oceanic ecologies mitigate, unlike salmon aquaculture, eutrophication and may even act as CO<sub>2</sub> capturing carbon sink. Low-trophic marine companion species, like those of the kelp forests or the algae-rich intertidal zones, have in fact for eons served as environmental engineers of the blue planet. The low-trophic marine zones offer a host of benefits to various organisms, humans included, in providing many species with sanctuary and shelter while mitigating the eutrophication and diminishing species diversity of the sea.

Comparing this zone to the forests on land, already Charles Darwin (*Voyages*, 1839) observed the sheer ‘number of living creatures of all Orders whose existence intimately depends on kelp.’ And he warned of the insurmountable effects should it perish (Filbee-Dexter et al., 2016; Filbee-Dexter and Wernberg, 2018). Today, kelp forests and mussel beds *are* gradually receding with the warming waters of climate change. With the accumulation of environmental violence, they seem to in fact slowly perish (Aksnes et al., 2017). In dire times of environmental disruption, it is about time we turn our attention and appreciation to low-trophic creatures and what they can teach us in the feminist posthumanities.

## Low-trophic theory and practices of postnatural care

Food and cultural practices of eating have long been examined within e.g. anthropology, sociology and food studies. However, eating as such is less popular a subject of philosophical investigation. Some of the key interventions are: French philosopher Jacques Derrida’s (1991) acute question of what it means to eat well (with the following discussions on ethics, veganism/vegetarianism, subjectivity and incorporation, e.g. Birnbaum and Olsson, 2009; Calarco, 2004; Wood, 1999), and Dutch STS scholar Annemarie Mol’s (2021) investigation of what practices constitutive of eating mean in philosophy and theory.

More specifically, for Derrida, ‘eating’ operates in both literal and figurative ways; it refers to the physical consumption of food, and also stands for the assimilation or incorporation of others: humans and nonhumans, texts, ideas, cultures. As he writes, “‘One must eat well’ does not mean above all taking in and grasping in itself, but learning and giving to eat, learning-to-give-the other-to eat. One never eats entirely on one’s own’ (1991: 115). The question is not only *what* we eat, but very much so *how* we eat. These two components are always already intertwined. Eating becomes an issue of relation. How do we eat and thus relate respectfully and ethically to the one(s) we assimilate in literal and figurative ways?

As Derrida emphasises, it always goes back to ‘determining the best, most respectful, most grateful, and also most giving way of relating to the other and of relating the other to the self’ (Derrida, 1991: 114).

In her recent work, Mol (2021) focuses on eating, in all its aspects of tasting, chewing, digesting and excreting, as a key mode and practice of being, knowing, doing and relating in and to the more-than-human world. For her, eating – a fundamentally multidimensional, multispecies and material affair of interdependence – lays at the very core of what it means to be human. And it matters against the backdrop of sustainability and environmental crisis.

Our proposal for low-trophic theory is inscribed in this ‘minor’ (Deleuze and Guattari, 2004) tradition of theorising surrounding the questions of consumption. Yet, in the context of human cultures, consumption – in both its narrow sense of food and broader understanding of consuming the world in its every aspect (Catts and Zurr, 2013; Radomska, 2017, 2020) – is not only about nourishment and material survival. It also amplifies and is amplified by one’s identity, belonging, culture, belief and habit, among others. Furthermore, none of these factors remains fixed, immutable, independent from its surroundings, or innocent. We do not live in a vacuum. Traditions or habits of behaviour or thought, even if cherished and preserved, are always performed and entangled in the social, cultural, economic and ethico-political conditions of a given time and place. Some of these factors are challenged every day in a world where, as consumers, by way of making choice, we also choose to remain complicit, or to resist the structures of environmental violence and injustice. Those choices are not only about the food we eat, its cost in terms of both the carbon footprint and the suffering it may have caused, but also every product or service we decide to buy, out of need or habit, as well as knowledges and stories we prefer to recognise, nourish ourselves with, digest and consume. To paraphrase Derrida, the boundary between the consumer and the consumed is not immutable or impermeable; and yet, it is crucial to remain vigilant in ‘continually asking [oneself] how what feeds us becomes imbricated in relations of power and domination’ (Olivier, 2014: 464). There is no ‘outside’ or ‘elsewhere’; we are all differentially situated and differentially responsible inhabitants of this planet and the inquiry is rather: how can we imagine this world (from within) otherwise? Inside, and with no exit from ‘field work’ ever possible, how can we inhabit our earthly companionship with less of slow violence and domination hinged on human ignorance and supremacy? These are also some of the questions that accompany groundbreaking and crucial intersectional work in such fields as, for instance, critical animal studies (e.g. Nocella, 2014), critical veganism (e.g. MacCormack, 2020b) and indigenous and decolonial approaches (like ‘Two-Eyed Seeing’) to environmental science and humanities (e.g. Reid et al., 2020; Todd, 2015).<sup>5</sup>

In the context of mariculture, the cultivation of low-trophic species is seen as beneficial to sea ecologies as it circumvents many disadvantages of land-based food and biomass production such as the need for fertilisers, chemical agents and irrigation (Nixon, 2011). Such sustainable sea farming counteracts coastal eutrophication, stimulates biodiversity and acts as a carbon sink. Coastal villages may gain value by a (re)development of maritime enterprise (e.g. Mirera et al., 2020). What is needed is also a cultivation of the sense of wonder and ecological belonging, the merits of seaside dwelling to mental well-being, and a deeper understanding of how the development of sustainable low-trophic mariculture may influence our common future and interact with society.

These were also some of the concerns that accompanied The Kelp Congress, a series of events forming part of Lofoten International Art Festival (LIAF: <https://2019.liaf.no/en/programme/kelp-congress/>) that took place in September 2019 in Svolvær, Norway. The congress formed a curious cultural response to discourses surrounding seaweed within the industries of energy, nutrition, agriculture, cosmetics and medicine – as the

curators noted – and yet, redirected the synergy between artists, researchers and activists towards the performative, narrative, conceptual and material engagements with kelp as a partner, companion and perhaps even a collaborator. Along with three artistic research strands/workshops, in one of which we had a chance to participate (entitled ‘Kelp Curing’),<sup>6</sup> the public programme included: open studio visits; lectures and talks; artistic research process presentations; kelp-related performances; and commissioned artworks: The Kelp Medal of Honour by Signe Johannesen (SE), Common Notions by Sabine Popp (DE/NO), Intertidal Shelter I and II by Devil’s Apron (NO) and Sea Ceremony by Julia Lohmann (FI). Staying with the trouble of challenges surrounding ecological sustainability, the Kelp Congress as a project, including the artworks and cultural and artistic research processes, formed a space of reflection, thinking-by-doing and thinking-with the questions of resilience, multispecies care, concern and more-than-human kinship, slowing down, resilience and curiosity, yet refusing both the mindset of capitalist extractivism and exploitation, and the illusion of innocence. In this way, the congress embodied issues that come to the fore in low-trophic theory: questions of consumption, complicity (in) violence and care.

Cultural studies taught us to pay attention to the mundane matters of life, to look at them with curiosity, and see everyday life, popular culture and consumption patterns not as low culture unworthy of study, but as the very essence of how we become who we are. If we now see BH as a form of cultural studies in the nonhuman turn, and add the academic activism and societal relevance of feminist posthumanities, we may also consider low-trophic mariculture as sustainability practices of eating, socialising and thinking better together through an ethics of cohabitation and mutual flourishing. Thus understood low-trophic mariculture points us in a direction beyond the ‘twin spectres of sacralizing and cannibalizing’ (Bryld and Lykke, 2000: 203) nature and its resources (of which we are part); it seeks to conceive consumption in the sustainable registers of multispecies flourishing and in an accountable response to environmental change, exploring how to flexibly adapt to climatic seasons and polluted periods of land and oceans. Looking closer at the entangled ecologies of low-trophic ecosystems of seaweeds, oysters and sea urchins reconnects us with humble origins in deep-time settings without a detour to a mythic natural paradise (lost).

Low-trophic ecosystems are also in the centre of another artistic initiative, the long-term project CLIMAVORE ([www.climavore.org/](http://www.climavore.org/)) by Cooking Sections (CS). CS is a London-based duo of spatial practitioners: Daniel Fernández Pascual and Alon Schwabe, exploring the systems that organise the world through food ([www.cooking-sections.com](http://www.cooking-sections.com)). Their work includes installation, performance and research-based practice at the crossroads of visual arts, geopolitics and architecture. CLIMAVORE, realised since 2015 in the Isle of Skye, Scotland, looks at how our diet may address and respond to climate change, while taking into account locally specific approaches to promote environmental regeneration. The project includes, among others: ‘the multispecies oyster table,’ an underwater installation (inhabited by bivalves and seaweeds filtering water), which directly responds to the issues of pollution related to salmon farming; educational programmes with schools; and collaborations with local communities, lawyers, scientists and other stakeholders with the aim to protect local marine environment, rethink multispecies inhabitation of the coast and simultaneously develop more ecological, low-impact aquaculture practices.<sup>7</sup> In CLIMAVORE, the questions of marine environmental violence (salmon farming, pollution, toxicity, etc.), consumption, complicity, multispecies relationality and staying with the trouble of anthropogenic climate change, emerge as some of the central themes, converging thus with our field-philosophical efforts of articulating low-trophic theory as a set of situated approaches to consumption, violence and multispecies ethics of environmental adaptability.

## Outro: Theory-practices when not getting out of the field

Inspired by low-trophic marine ecosystems, while remaining accountable for the potential violence it may be complicit with, and without an illusion of originary innocence, low-trophic theory strives to find ground in the here and now, and respond to the present as well as its potential futures. Low-trophic theory is thus a practice of thinking and theorising that requires creativity and imagination; that takes more-than-human hospitality and responsibility seriously; that is aware and accountable for the patterns of consumption it draws in both their material and epistemological sense; and last, but not least, accountable to the complexities, entanglements and exclusions in which it is implicated. Although low-trophic theory cannot undo the ongoing assault on the ‘natural’ worlds, even more so when these are ‘hidden’ and ‘out of sight’ or partly hydrolysed like in the marine ecosystems of the Baltic and North Sea, it nonetheless opens us up towards a better understanding of our own situatedness as both individuals and entities inscribed in various institutions and systems (of oppression and affordance), complicity and complexities in which we are implicated, patterns of consuming the world and ethical imagination. Our meditation on four different instances of marine environmental violence seemingly slowly unfolding, submerged and ‘out of sight,’ moves us in this piece towards thinking and theorising from within and transformed by the empirical ‘field’ (Buchanan et al., 2018).

However, this conclusion also brings us to another thread of reflection, with which we would like to leave the reader, while exiting the text. It concerns entangled bodily materialities as much as temporal scales, ranging from deep pasts to deep futures. Typical life processes unfold cyclically, with organisms living and dying, returning to particles that are reabsorbed by bacteria and other microfauna, and ultimately transformed into new life (Radomska, 2020). Drawing upon James Hatley’s concept of ‘aenocide,’ Deborah Bird Rose looks at the Anthropocenic conditions whereby these life-death processes are amplified and where the balance between ‘living’ and ‘dying’ is tipped, and names it ‘double death.’ When these amplify further – such that the death of individuals threatens the future existence of a species or of multiple species – we have what Rose, together with Hatley, identifies as ‘ecological aenocide, or the multispecies “murder of ethical time”’ (Rose, 2012: 128). Ethical time describes the continuity of generations beyond our own (whether human or not) and all that entails about the passing on of history, stories, and even evolutionary adaptations. The amplification of the amplification that Rose describes is one that radiates beyond the individual species to affect an entire ecological network.

Rose argues that we can understand this kind of multispecies amplification of an amplification as another kind of time process, one that is ‘embodied and embedded’ rather than chronological, linear, and Newtonian Rose (2012: 128). In the light of the four cases we discussed earlier, this frame anchors the folded temporalities of the Baltic Sea weapon dumps in the bodies of the nonhuman and human animals that bear their traces, creating an ethical obligation to the deep time future(s) of the multispecies communities of the Baltic. As she writes:

[...] embodied time is always a multispecies project. It follows that life depends both on the sequential processes of generational time/gift and on the synchronous processes of multispecies nourishment. These processes and patterns intersect to form dense knots of embodied time. (2012: 130–131)

Such a knot of ‘embodied time’ might also encompass the multivalent threats to the Baltic we note above. The dumped weapons themselves might not have the capacity (yet)

to murder generational time, but taken together with the aenocidic potentials of dead zones, eutrophication and warming waters, that we have already introduced and amplified in the North and Baltic Sea, they might very well play a role in doing so in the future.

Rose's concept instills an ethical obligation to the multispecies communities, also the ones with whom we share the Baltic and North Sea. This obligation exists not because the death of other species could signal, like the archetypal canary in the coal mine, our own collective death as *Homo sapiens*, but because we share responsibility for all the bodies, stories and temporalities we inhabit and consume. Their suffering and death matter, irrespective of our own, and, as Rose argues, 'if suffering does not matter, then it is difficult to assert that anything' does (2012: 139).

The living animals in the North Sea that embody military chemical compounds enact a transcorporeal spectral return of the weapons that calls for our attention. The toxic embodiment of these chemicals in the bodies of oceanic animals does not allow us merely to theorise folded, nonlinear temporalities: they allow us to fully ingest, in theory and corporeal practice, the absence of purity. The presence of the chemical weapons in these animal bodies, and in our own, mixes past, present, and future, making multiple temporalities material in our own embodied time and flesh. The chemicals – long left for the dead – are instead very much alive, ghosting the bodies of the human and nonhuman animals whose DNA they may slowly be altering or whose cells they may slowly be killing. As the amassed stuff of environmental violence gain new life in attracting new, unintended victims, we ask: what are our ethical obligations to our fellow species to right this wrong intragenerational scope? The living ghosts of futures to come ask us to confront our past mistakes, our current violences, our voracity, and the unknown harms we may be inflicting.

## Highlights

- Authors introduce feminist environmental humanities research in ocean studies (blue humanities) and feminist posthumanities; discuss the anthropogenic environmental alterations to seas and oceans, which should be regarded as planetary forces rather than places.
- Authors discuss four instances of environmental 'slow violence' (Nixon) of the Baltic and the North Sea, and suggest alternative ethics and practices informed by multispecies flourishing.
- Authors venture to explore such practices, at the intersection of art and science, as low trophic humanities, based on the more-than-human practices of low trophic mariculture of seaweeds, and low trophic species.


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## Notes

1. For example, bottom-trawling is just one of the most recent discoveries of excessive, human-induced releases of CO<sub>2</sub> from the sea floor (Sala et al., 2021).
2. We write ‘men’ and not ‘humans’ since the traditional, grounded in enlightenment humanism, concept of the human as an autonomous being and subject of rights, has in fact been based upon the idea of white, heterosexual, able-bodied and capital-owning man, as many a critical scholar emphasises (e.g. Braidotti, 2006; Haraway, 1989; Jackson, 2020).
3. For example, the round goby (*Neogobius melanostomus*); the American comb jelly (*Mnemiopsis leidyi*) and *Cercopagis pengoi*, a predatory water flea (HELCOM, n.d.; Littfass, 2019) in the Baltic, or the Pacific oyster (*Magellana gigas*) on the Swedish West Coast (the North Sea).
4. See: [www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-\(BWM\).aspx](http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx) (accessed 1 May 2020).
5. Authors in these fields particularly scrutinise the ways the oppression, exploitation and killing (understood as both immediate, direct slaughter and ‘slow death’) of both human and nonhuman others intersect, and how these processes form part of the capitalist machinery of consumerism, extractivism and violence. Studies looking at both discourses and material practices of, for instance, industrial farming and related ‘meatsplaining’ (Hannan, 2020), or war (e.g. Nocella et al., 2013), show it in especially evocative ways. See also, Breeze Harper (2010), Kemmerer (2011), Torres (2007).
6. ‘Kelp Curing’ focused on artistic/research engagements with macroalgae-related lifeforms and habitats, the carbon cycle in intertidal encounters, and entangled processes of digestion, composition and decomposition (<https://2019.liaf.no/en/participants/kelp-curing/>). Two other workshop strands were: ‘Coast, Line,’ looking into the biopower of the nonhumans, questions of cohabitation and cross-species kinship and politics of the seaweed and the sea (<https://2019.liaf.no/en/participants/coast-line/>); and ‘Kelp Diagram Collective,’ which – through subsurface encounters with ‘the other’/exploration of low-impact kelp harvesting in artistic and scientific ways – explored questions related to more-than-human agency and materiality (<https://2019.liaf.no/en/participants/kelp-diagram-collective/>).
7. See: [www.climavore.org/seasons/on-tidal-zones/](http://www.climavore.org/seasons/on-tidal-zones/) (accessed 30 March 2021).

## References

- Ahlsén J, et al. (2018) Undersökning av biota i anslutning till dumpade fartyg med kemisk ammunition. Havs-Och Vattenmyndighetens Rapport, 2018, p. 21.
- Aksnes DL, et al. (2017). *Food from the Oceans – How Can More Food and Biomass be Obtained from the Oceans in a Way that does not Deprive Future Generations of their Benefits? SAPEA Evidence Review Report No.1*. Berlin: SAPEA.
- Alaimo S (2010). *Bodily Natures: Science, Environment and the Material Self*. Bloomington, IN: Indiana University Press.
- Alaimo S (2016) *Exposed: Environmental Politics and Pleasures in Posthuman Times*. Minneapolis, MN: University of Minnesota Press.
- Alaimo S (2019). Intro: Science studies and the blue humanities. *Configurations* 27: 429–432.
- Alaimo S (2012) States of suspension: trans-corporeality at sea. *Interdisciplinary Studies in Literature and Environment* 19(3): 476–493.
- Alexandratos N and Bruinsma J (2012) World agriculture towards 2030/2050: the 2012 revision. ESA Working paper no. 12-03, Rome, FAO.
- Åsberg C (2008) A feminist companion to posthumanities. *NORA: Nordic Journal of Feminist and Gender Research* 16(4): 264–269.
- Åsberg C (2018) Feminist posthumanities in the Anthropocene: Forays into the postnatural. *Journal of Posthuman Studies: Philosophy, Technology, Media* 1(2): 185–204.
- Åsberg C (2014) Imagining posthumanities, enlivening feminisms. In: Blaagaard B and Van der Tuin I (eds) *The Subject of Rosi Braidotti: Politics and Concepts*. London: Bloomsbury, pp. 56–64.

- Åsberg C, et al. (2013) The Seed Box application to MISTRA-Formas.
- Åsberg C and Braidotti R (2018) *A Feminist Companion to the Posthumanities*. Dordrecht: Springer.
- Åsberg C, et al. (2020) Methodologies of Kelp: Transversal knowledge production and multispecies ethics in an age of entanglement. In: Cahoon N, Mehti H and Wolfsberger A (eds) *The Kelp Congress*. Svølør: NNKS, pp. 11–23.
- Barad K (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC; London: Duke University Press.
- Birnbaum D and Olsson J (2009) An Interview with Jacques Derrida on the Limits of Digestion. *E-flux* 2. Available at: <https://www.e-flux.com/journal/02/68495/an-interview-with-jacques-derrida-on-the-limits-of-digestion/> (accessed 1 March 2021)
- Breeze Harper A (2010) *Sistah Vegan*. London: Lantern Books.
- Bryld M and Lykke N (2000) *Cosmodolphins: Feminist Cultural Studies of Technology, Animals and the Sacred*. Chicago, IL: University of Chicago Press.
- Buchanan B, et al. (2018) Introduction: Field philosophy and other experiments. *Parallax* 24(4): 383–391.
- Calarco M (2004) Deconstruction is not vegetarianism: Humanism, subjectivity, and animal ethics. *Continental Philosophy Review* 37: 175–201.
- Carson R (1962) *Silent Spring*. Greenwich: Fawcett Publications.
- Catts O and Zurr I (2013) Disembodied livestock: The promise of a semi-living Utopia. *Parallax* 19(1): 101–113.
- CHEMSEA (2014) *CHEMSEA Findings: Results from the CHEMSEA Project – Chemical Munitions Search and Assessment*. Gdansk: Institute of Oceanology Polish Academy of Sciences.
- DeLoughrey E (2019) Toward a critical ocean studies for the Anthropocene. *English Language Notes* 57: 21–36.
- Diaz RJ and Rosenberg R (2008) Spreading dead zones and consequences for marine ecosystems. *Science* 321(5891): 926–929.
- Deleuze G and Guattari F (2004) *A Thousand Plateaus*. London: Continuum.
- Derrida J (1991) ‘Eating well’, or the calculation of the subject. In: Cadava E, et al. (eds) *Who Comes After the Subject?* London: Routledge, pp. 96–119.
- EASAC (2017) *Opportunities and challenges for research on food and nutrition security and agriculture in Europe*. European Academies’ Science Advisory Council (EASAC).
- EC Communication (2009) Commission of the European Communities, Brussels, 10.6.2009 Sec (2009) 712. Commission Staff Working Document.
- European Environment Agency (EEA) (2015) Regulation on invasive alien species. Document number: 1143/2014/EU.
- European Geosciences Union (2018) New study: Oxygen loss in the coastal Baltic Sea is ‘unprecedentedly severe’. *EurekaAlert! Science News*. 5 July 2018. Available at: [www.eurekaalert.org/pub\\_releases/2018-07/egu-nso070318.php](http://www.eurekaalert.org/pub_releases/2018-07/egu-nso070318.php) (accessed 1 May 2020).
- Filbee-Dexter K, et al. (2016). Large-scale degradation of a kelp ecosystem in an ocean warming hotspot. *Marine Ecology Progress Series* 543: 141–152.
- Filbee-Dexter K and Wernberg T (2018) Rise of turfs: A new battlefield for globally declining Kelp forests. *BioScience* 68(2): 64–76.
- Galland L (2014) The gut microbiome and the brain. *Journal of Medicinal Food* 17(12): 1261–1272.
- Gibson K, et al. (2015) *Manifesto for Living in the Anthropocene*. Ann Arbor, MI: Punctum.
- Giffney N and Hird M (2008). *Queering the Non/Human*. London: Palgrave.
- Gilroy P (1993) *The Black Atlantic: Modernity and Double Consciousness*. London: Verso.
- Giraud EH (2019) *What Comes After Entanglement? Activism, Anthropocentrism, and an Ethics of Exclusion*. Durham, NC: Duke University Press.
- Greenberg MI, et al. (2016) Sea-dumped chemical weapons: Environmental risk, occupational hazard. *Clinical Toxicology* 54(2): 79–91.
- Halberstam J and Livingston I (1995) *Posthuman Bodies*. Bloomington, IN: Indiana University Press.
- Hannan J (2020) *Meatplaining: The Animal Agriculture Industry and the Rhetoric of Denial*. Sydney: Sydney University Press.



- Haraway DJ (1989) *Primate Visions: Gender, Race and Nature in the World of Modern Science*. London: Routledge.
- Haraway DJ (1991). *Simians, Cyborgs, and Women: The Reinvention of Nature*. London: Routledge
- Haraway DJ (2016). *Staying with the Trouble: Making Kin in the Chthulucene*. Durham, NC: Duke University Press.
- Haraway DJ (2003) *The Companion Species Manifesto: Dogs, People and Significant Otherness*, Chicago, IL: Prickly Paradigm Press.
- Harper D (n.d.) Trophic. *Online Etymology Dictionary*. Available at: [www.etymonline.com/word/trophic#etymonline\\_v\\_39458](http://www.etymonline.com/word/trophic#etymonline_v_39458) (accessed 1 May 2020).
- HELCOM (2012) Observed non-indigenous and cryptogenic species in the Baltic Sea. HELCOM Baltic Sea Environment Fact Sheets. Available at: [www.helcom.fi/baltic-sea-trends/environment-fact-sheets/](http://www.helcom.fi/baltic-sea-trends/environment-fact-sheets/) (accessed 1 May 2020).
- HELCOM (2018) State of the Baltic Sea – Second HELCOM holistic assessment 2011-2016. Baltic Sea Environment Proceedings 155.
- HELCOM (n.d.) Alien species. Available at: [http://archive.iwlearn.net/helcom.fi/environment2/biodiv/alien/en\\_GB/alienspecies/index.html](http://archive.iwlearn.net/helcom.fi/environment2/biodiv/alien/en_GB/alienspecies/index.html) (accessed 1 May 2020).
- Helmreich S (2008) Species of biocapital. *Science as Culture* 17(4): 463–478.
- Hellström T and Ödalen M (2013) *Long-time Behaviour of Mustard Gas Dumped in the Bornholm Basin*. Technical report no. 6. Gothenburg: Gothenburg University.
- Jackson ZI (2020) *Becoming Human: Matter and Meaning in an Antiblack World*. New York: New York University Press.
- Jokinen SA, et al. (2018) A 1500-year multiproxy record of coastal hypoxia from the northern Baltic Sea indicates unprecedented deoxygenation over the 20th century. *Biogeosciences* 15: 3975–4001.
- Kemmerer L (2011) *Sister Species: Women, Animals and Social Justice*. Urbana, IL: University of Illinois Press.
- Littfuss D (2019) Biofouling: Aliens in the Baltic Sea. Research & Innovation News. Open Access Government. Available at: [www.openaccessgovernment.org/aliens-in-the-baltic/67537/](http://www.openaccessgovernment.org/aliens-in-the-baltic/67537/) (accessed 1 May 2020).
- Lykke N (2019) Making live and letting die: Cancerous bodies between Anthropocene Necropolitics and Chthulucene Kinship. *Environmental Humanities* 11(1): 108–136.
- Liotard JF (1991) *The Inhuman: Reflections on Time*. Cambridge, UK: Polity Press.
- MacCormack P (2020a) Embracing death, opening the world. *Australian Feminist Studies* 35(104): 101–115.
- MacCormack P (2020b) *The Ahuman Manifesto: Activism for the End of the Anthropocene*. London: Bloomsbury.
- Mirera DO, et al. (2020) Societal and environmental impacts of seaweed farming in relation to rural development: The case of Kibuyuni village, south coast, Kenya. *Ocean & Coastal Management* 194: 105253.
- Missiaen T and Henriët J (2002) *Chemical Munition Dump Sites in Coastal Environments*. Brussels: Federal Office for Scientific, Technical and Cultural Affairs.
- Mol A (2021) *Eating in Theory*. Durham, NC: Duke University Press.
- Neimanis A (2017) *Bodies of Water: Posthuman Feminist Phenomenology*. London: Bloomsbury.
- Neimanis A (2020) ‘The chemists’ war in Sydney’s seas’: Water, time and everyday militarisms. *Environmental Planning E: Nature and Space*. DOI: 10.1177/2514848620904276.
- Neimanis A, et al. (2015) Four problems, four directions for environmental humanities: Toward critical posthumanities for the Anthropocene. *Ethics & the Environment* 20(1): 67–97.
- Nixon R (2011) *Slow Violence: Environmentalism of the Poor*. Cambridge, MA: Harvard University Press.
- Nocella AJ II, et al. (2013) *Animals and War: Confronting the Military-Animal Industrial Complex*. New York: Lexington Books.
- Nocella AJ II, et al. (2014) *Defining Critical Animal Studies: An Intersectional Social Justice Approach for Liberation*. New York: Peter Lang Publishing.

- Ojaveer H, et al. (2010). Status of biodiversity in the Baltic Sea. *PLoS One* 5(9): e12467.
- Olenin S and Leppäkoski E (1999) Non-native animals in the Baltic Sea: Alteration of benthic habitats in coastal inlets and lagoons. *Hydrobiologia* 393: 233–243.
- Olivier K (2014) Derrida and eating. In: Thompson PB and Kaplan DM (eds) *Encyclopedia of Food and Agricultural Ethics*. Dordrecht: Springer, pp. 459–465.
- Oreskes N (2014) Scaling up our vision. *Isis: A Journal of the History of Science Society* 105: 379–391.
- Peterson J (2018) Are dead zones dead? Environmental collapse in popular media about eutrophication. In: Vogelaar A, Hale B and Peat A (eds) *The Discourses of Environmental Collapse: Imagining the End*. London: Routledge.
- Povinelli E (2014) Theorizing the contemporary. *Fieldsights*. January 13. Available at: <https://culanth.org/fieldsights/geontologies-of-the-otherwise>
- Radomska M (2017) Non/living matter, bioscientific imaginaries and feminist technoecologies of bioart. *Australian Feminist Studies* 32(94): 377–394.
- Radomska M (2018). Promises of non/living monsters and uncontainable life. *Somatechnics* 8(2): 215–231.
- Radomska M and Åsberg C (2020) Doing away with life: On biophilosophy, the non/living, toxic embodiment, and reimagining ethics. In: Berger E, Mäki-Reinikka K, O'Reilly K and Sederholm H (eds) *Art As We Don't Know It*. Helsinki: Aalto ARTS Books, pp. 54–63.
- Radomska M (2020) Deterritorialising death: Queerfeminist biophilosophy and ecologies of the non/living in contemporary art. *Australian Feminist Studies* 35(104): 116–137.
- Reid I, et al. (2020) 'Two-eyed seeing': An indigenous framework to transform fisheries research and management. *Fish and Fisheries* 22(2): 243–261.
- Rich A (ed.) (1984) Notes toward a politics of location. In: *Blood, Bread and Poetry: Selected Prose 1979-1985*. London: Virago Press, pp. 210–231.
- Rose DB (2012) Multispecies knots of ethical time. *Environmental Philosophy* 9(1): 127–140.
- Rose DB (2015) The ecological humanities. In: Gibson K, Rose DB and Fincher R (eds) *Manifesto for Living in the Anthropocene*. New York: Punctum Books, pp. 1–6.
- Rose DB, et al. (2012) Thinking through the environment, unsettling the humanities. *Environmental Humanities* 1: 1–5.
- Sala E, et al. (2021) Protecting the global ocean for biodiversity, food and climate. *Nature*. DOI: 10.1038/s41586-021-03371-z
- Schiermeier Q (2003) Fish farms' threat to salmon stocks exposed. *Nature* 425: 753.
- 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): 247–264.
- Stigebrandt A (2012) Evaluating geoengineering as a method to revive Baltic Sea dead zones. *Sea Technology* 2012(12): 89.
- Todd Z (2015) Indigenizing the Anthropocene. In: Davis H and Turpin E (eds) *Art in the Anthropocene*. Ann Arbor, MI: Open Humanities Press, pp. 241–254.
- Torres B (2007) *Making A Killing: The Political Economy of Animal Rights*. Oakland, CA: AK Press.
- Tsing A (2015) *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton, NJ; Oxford: Princeton University Press.
- Whatmore S (1999) Human geographies: Rethinking the 'human' in human geography. In: Massey D, Allen J and Sarre P (eds) *Human Geography Today*. Cambridge: Polity Press, pp. 22–39.
- Willyard C (2021) How gut microbes could drive brain disorders. *Nature* 590: 22–25.
- Wolfe C (2003) *Zoontologies: The Question of the Animal*. Minneapolis, MN: University of Minnesota Press.
- Wood D (1999) Comment ne pas manger – Deconstruction and humanism. In Steeves P (ed.) *Animal Others: On Ethics, Ontology and Animal Life*. Albany: State University of New York Press, pp. 15–35.
- Zhang J, et al. (2013). Hypoxia in a changing marine environment. *Environmental Research Letters* 8(015025). DOI:10.1088/1748-9326/8/1/015025