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TURBULENT WATERS IN THREE PARTS

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Abstract

While scientific accounts of ocean dynamics draw public attention to the *turbulence* of earthly matter, the science alone tells a truncated story. The ocean's *turbulent materiality* is more than material: practices of scientific knowledge and historically embedded meanings and metaphors also constitute how we know, understand, and attempt to govern ocean and land alike. Indeed, planetary ocean science is always located within a history and politics, embedded within Western epistemic structures and tied to extraction and colonialism. Additionally, as ocean ecologies and human food systems are recognized as ever more fragile and as the ocean increasingly is understood as “up for grabs” as a site of investment, extraction, and production, there is much at stake in how and where we locate the turbulence of marine systems.

In this essay, we invite turbulence into our writing practices by bringing together three perspectives on the complex relationship between metaphor and materiality with regard to oceanic worlds. Each co-author writes on the ocean from a different perspective: the lines and laws of the ocean (Steinberg); the governance and epistemic cultures of ocean life (Johnson); and practices of marine historical knowledge production (Lehman). Throughout this essay we experiment with bringing those perspectives together to consider how *turbulence* matters differently when read through different lineages of theory and ocean scholarship: How do legal infrastructures, scientific apparatuses, human histories, and marine lifeforms tell different stories of the ocean and its processes? We further consider how thinking across our different projects might bring to light not only the turbulence of ocean matter, but also practices of knowledge production and meaning as we envision various futures *of* and *with* the ocean.

Introducing turbulence

Scholarship on oceans in social sciences and humanities has proliferated over the past two decades.¹ It seems, perhaps, that no concept more accurately encapsulates both the impetus and result of this turn to the sea than that of turbulence. The turbulence of the ocean's materiality has become increasingly apparent due to extreme weather, changes to ocean life, and shifting ocean circulation patterns. At the same time, turbulence suggests the difference that the ocean makes to some of the land-based foundational principles that underpin social analysis, including *nature*, *society*, *humanity*, and *space*. In this essay, we offer three different considerations of turbulence as it relates to the matter and metaphors of new ocean scholarship.

As the articles in this special issue illustrate, matter suggests metaphor, and metaphors matter. Turning away from the land that so often 'grounds' our metaphors, matter and metaphor significantly shape the worlding of the ocean and the 'oceaning' of the world. Each of us is a geographer who has, at different registers, engaged for the past several years with oceanic matters. Jessica Lehman examines how history can be read in and through engagement with marine processes for different futures. Philip Steinberg studies the materiality of ocean space and how it shapes legal and political frameworks at sea and beyond. Elizabeth Johnson queries epistemologies and economies of nonhuman marine life and what they can tell us about contemporary environmental politics. In plying lines between matter and metaphor, we are collectively compelled to equally account for how we produce structures of knowledge and governance about it. Even more, we are attentive to the ongoing and iterative relationships between matter and metaphor, nature and knowledge, law and liminality, none of them being simply one-way processes of capture.

In the following interventions on matter and metaphor *in* and *with* the ocean, we home in on the concept of *turbulence*. Turbulence has been defined by the International Science Council's Scientific Committee on Oceanic Research as "a condition of fluid flow in which each of the

components of velocity and vorticity is irregularly and aperiodically distributed in both space and time.”² However, this definition is itself turbulent. Since the rise of modern oceanography in the mid-19th century, scientific understandings of turbulence have ranged from broad recognition of complex oceanic mobilities to more precise statistical measures of the forces and processes that underpin oceanic mixing.³ Turbulence conjures notions of change, motion, and chaos. This is indeed part of why it is so compelling to scholars of the sea. However, it also has been taken up by critical theorists who have engaged the concept of oceanic turbulence to highlight “a dynamic pattern of repetition and reformation that provides stability and texture in an environment of underlying instability.”⁴ It is testament to the evolving complexity of academic work on the marine world that, in our individual interventions that follow as well as in our broader bodies of work, we each caution against understanding ocean turbulence as simply unmediated, constant flux. While the ocean’s unique materialities deserve attention, they cannot be simply counterposed to those on land, and ocean turbulence cannot be simply understood as the opposite of the stability of land (which itself is of course an illusion). Rather, we note the ways in which patterns adhere in and emerge from turbulence, and the ways that turbulence itself is transformed across different registers, scales, and types of matter, raising the specter of radical indeterminacy.

Despite these cautions, or maybe even because of them, we find *turbulence* interesting and productive to think with and reshape as a *matterphorical* concept, just as we are compelled to produce better engagements with the ocean’s turbulent matter. Indeed, turbulence can also refer to the meeting and intersection of ideas, including in the collaborative practice that has given rise to this intervention. More than an overarching theory or structuring concept, then, we each find that turbulence suggests a set of questions. These questions are best thought through in specific places and cases even as they suggest networks that jump scales, stretching across spatial, temporal, and embodied differences. Our turbulences are anchored—to institutions, legal documents, histories,

and bodies—even as they make and mark movement. Turbulence itself evolves as a concept throughout this collaborative intervention. Some of the questions provoked by our engagement include: How does the ocean introduce turbulence into historical narratives? How is turbulence both disruptive of and encoded in the legal territorialisation of the ocean? What are the linkages between turbulent knowledge and turbulent nature? What does turbulence have to do with the relationship between living on and with the sea? At what scales does turbulence matter? And, ultimately, how can a turbulent approach to oceanic knowledge teach us about ourselves as (partially) marine creatures?

Turbulent histories • *Jessica Lehman*

In much of Western scholarship, the ocean has been considered to be outside history and even outside time itself. Not simply unchanging, the sea also has been understood as unwritten and unwritable, holding no traces of human activity and thus both impossible and uninteresting to ‘read,’ except, perhaps, in esoteric scientific disciplines, or as an undifferentiated surface of romantic alterity.⁵ As attention to the ocean has heightened in recent decades, this mythology has been challenged by scholars in a range of disciplines. Perhaps most notably, scholars in diverse fields, from legal studies to Black feminist theory, work with marine histories to show that an historic blindness to the sea has obscured, sometimes intentionally, minor histories of capitalism and imperialism.⁶ Many of these scholars draw on and renew Caribbean scholarship which has long resisted European notions of the ocean as the ‘outside’ of history and as inferior to the terrestrial.⁷ For scholars of the subaltern, broadly conceived, the ocean has become a referent and resource for alternative histories. In this section, I show how thinking history with and through the ocean both disrupts hegemonic narratives and poses fundamental challenges to notions of knowledge and legibility. Ultimately, marine histories may become stuck between polarized notions of fixity and flux, chaos and linearity, knowledge and opacity. The concept of turbulence suggests a way out of

this impasse, by drawing attention to patterns emergent from chaos and complexity, and moreover to the acts of careful attention that refuse binaries between complete knowledge and the unknowable. I explore here the implications of understanding turbulence not as that which is inherently unknowable but as that which can be partially known; dynamics of movement and memory that we are not yet sure if we can know, or to what degree. This at times tentative or halting gesture toward knowledge raises ethical and political questions that amplify what engagements with marine histories *can do*.

Thinking through history with the ocean exposes the falsehoods of linear and teleological narratives. Capitalist labor time relies upon a notion of time as rational, linear, and divisible into precise units for which one can account. Imperialism adds to this a teleology of progress, even beyond economic growth. Yet, Marxist historians, among others, point out that capitalist-imperialist modernity is in fact characterized by contradiction, revolution, and rupture.⁸ Black feminists and Native studies scholars would add that these conditions of crisis are spelled out violently on the bodies of Black and Native subjects.⁹ Take for instance the Middle Passage, which brings together the brutal contradictions of imperialism and capitalism, at a formative moment for both processes. These contradictions, whether between labor power and its suppression under capitalism, or between the commodification of enslaved people and their persistence and resistance, are put into sharp relief in the space of the sea.

In this sense, marine histories reveal the ocean as a theatre for processes and events that demonstrate the contradictions of capitalist and imperialist modernity. For instance, Cesare Casarino analyzes sea narratives in and beyond literary texts to show that “during the emergence and consolidation of industrial capitalism, the sea became an increasingly turbulent, contradictory, and contested terrain.”¹⁰ Even as the oceans have been, and remain, essential spaces for historic and contemporary capitalism and imperialism, they also foster relations that challenge these processes, or

that challenge their totalizing tendencies. Linebaugh and Rediker use the figure of a mythical Hydra as a heuristic for the ways in which acts of resistance continually re-emerged from marine spaces of the revolutionary Atlantic.¹¹ To give another example, Omise'eke Natasha Tinsley argues for the recognition of vital forms of intimacy that emerged from the brutality of the Middle Passage, showing that these relations fundamentally challenge the dehumanising violence of slavery and create interstices of resistance and belonging.¹² Marine histories, if attended to carefully, show the violence of capitalism and imperialism as well as their contingency and contradictions. As Elizabeth DeLoughrey writes, "Atlantic inscriptions rupture the naturalizing flow of history, foregrounding a now-time that registers violence against the wasted lives of modernity in the past and the present."¹³

The ocean's materiality, however, challenges temporality and legibility in more fundamental ways. The ocean's movements suggest a non-linear time; a temporality that may be cyclical, that may drift, that may accrete in unseen ways, that may become stuck or slowed and then rapidly dislodged. Indeed, contemporary scholars from a range of disciplines have mined the potentials of crosscurrents, shoals, suspension, and submergence, among other phenomena, to disrupt hegemonic narratives of history and politics.¹⁴ As many of these authors recognize, these features and forces are not just metaphorical; their materiality binds Earthly temporalities and historiographical knowledge. For example, Tiffany Lethabo King uses the metaphor of the shoal to "interrupt and slow the momentum of long-standing and contemporary modes and itineraries for theorizing New World violence, social relations, Indigeneity, and Blackness in the Western Hemisphere."¹⁵ At the same time, in the histories and literature with which King engages, the shoal serves as a material "place and time of liminality" and an "alternative space always in formation," a hazard for ships, a place to rest, a space between land and sea.¹⁶ For Astrida Neimanis, the suspension of chemical weapons in ocean water should be understood as "not a nonhappening, but a lively, temporal collision, where times make matters just as much as matters make times."¹⁷ For these authors and others, the ocean

itself blurs the lines between metaphor and materiality to suggest different ways of understanding not simply specific histories but temporal relations themselves.

At the same time, the materialities of the ocean call into question the legibility of historical traces and the very possibility of narration. Marine materialities, and humans' incomplete attempts to interpret them, are inseparable from the possibilities (and pitfalls) of oceanic histories. The ocean cannot be 'read' as an archive in the traditional methodology of historical knowledge production; nor does it lend itself to notions of stratified geological time popularized in Anthropocene narratives. Indeed, it is by examining the differences between conventional ideas of geologic time and the geophysical forces of the ocean that Philip Steinberg and Kimberley Peters ultimately argue that "the ocean suggests that we think with a different, nonlinear, nonmeasurable notion of time."¹⁸ Even scientific efforts tailored to producing oceanographic knowledge come up against great difficulty. The ocean's materialities – salinity, temperature, pressure, darkness – defy much of both embodied knowledge and technological measurement, to both human and machine sensors.¹⁹ When the ocean does yield information about its physical nature, it is overwhelmingly found to obey nonlinear dynamics, further challenging knowledge and computational capacity on a variety of fronts. The methodologies of thinking history through the ocean amplify, certainly not unproblematically, a sense of unknowability, that some things are simply lost to the currents of time. Neimanis writes, "the sea becomes both a symbol and a material repository for a past without definite origin – a past swimming backwards beyond our grasp."²⁰

As Maeve Tynan has pointed out, these two valences of oceanic histories pose a potential paradox.²¹ On one hand, the ocean offers spatial dynamics that suggest alternative narratives of capitalism and imperialism. While these histories may have been hidden, perhaps intentionally, they frequently suggest a drive toward knowledge and the creation of new and more emancipatory stories. However, even as turbulence can be used to support *alternative* and *emancipatory* narratives, it

also may be seen as a challenge to historical knowledge production and even the very possibility of knowability. The paradoxical relationship between ocean materiality, knowledge, and narrative is further interrogated by DeLoughrey, who cautions against tropes of the ocean that reduce it to a place of constant motion.²² Rather, she notes, even amidst its churn, the ocean is a space where matter and concomitant violence accumulate and ultimately refuse to be washed away.

DeLoughrey's caution points to the critique that designating the ocean as a space of radical unknowability may be no less perilous than elevating it as a space of structure and knowledge. Indeed, there are two specific dangers associated with the designation of the ocean as unknowable. First, the declaration that oceanic histories are illegible, unknowable, and ruled by chaos, that is, an apparent absence of structure, can serve as an excuse for turning a blind eye to alternate histories of capitalism and imperialism, with social and material consequences. The investigation and excavation of underwater cultural traces, an expensive and historically piecemeal endeavor, provides an instructive example of how this dynamic might unfold. Historically, it was military wrecks and ships thought to have been carrying valuable 'treasure' that gained significant attention, due alternately to national budgets or opportunistic salvage enterprise. As maritime archaeology has shifted to an academic discipline in recent decades, many archaeologists have nonetheless "been reluctant to engage with what they see as 'negative' history, in comparison with the more obvious appeals of naval battles, pirate treasure, and sunken cities."²³ Thus, these investigations garner financial resources and expertise, and emphasis remains on excess and luxury, conquest, and military might. Wrecks that would be more likely to tell explicitly subaltern stories, and stories of capitalism's brutality, such as slave shipwrecks, remain unexplored, and their stories, as painful or ultimately liberating as they may be, untold. If we are to accept that these submerged histories are inherently unknowable, washed away by tides and history, we risk giving license to practices that deny financial

and technological resources to investigations that would tell of capitalist-imperialism's violences rather than its victories.

In an epistemological sense, too, positing a wide chasm between order and disorder, between hegemonic knowledge and the unknowable, reproduces colonial epistemologies that cast the world in such binary terms, and that posit 'unveiling' and 'discovery' as linear and teleological processes. Materialist understandings of turbulence suggest a way out of the impasse that is created by a neat opposition between disorder and structure, between chaos and knowledge, between stasis and movement, or between dominant narratives and resistance. Efforts to grasp turbulence have revolutionized the field of oceanography and fluid mechanics. As Monin and Ozmidov write of large-scale oceanography projects in the 1970s, "[t]he universally accepted notion of the ocean as a nearly stationary system with a pattern of steady-scale gyres had to be replaced by a new conception, which admits that most of the energy in the motion of the ocean is contained in vortices having various sizes and lifetimes, rather than in the average circulation."²⁴

While Western science, including oceanography, inarguably emerges from the same imperial structures that construct an ocean separate from society, it also has within it potential for its own subversion. One operation of Western science (amongst, of course, other ways of knowing) is to refuse a fixed distinction between the knowable and the unknowable. Turbulence, for oceanographers and others who study fluid dynamics, does not suggest unknowability, but rather a complexity that calls for more careful attention. This is not to assert, of course, that scientific or even materialist understandings should be prioritized over other ways of knowing. Yet in attending to these notions of turbulence, one is encouraged to 'stay with the trouble' of what is knowable, and confront the ethical decisions required by efforts to know.²⁵ Donna Haraway argues that caring for human and nonhuman others means becoming implicated in relationships of curiosity, which "requires knowing more at the end of the day than the beginning."²⁶ As enthusiasm for telling

histories through the sea grows, due in no small part to a non-innocent curiosity about the stories it holds, the material specificity and metaphorical power of turbulence can call attention not simply to whose narratives are told, but also to how they are told, and to the role of knowledge in the telling.

For oceanographers, turbulence is characterized by chaos, but also by structure and exchange that can be modeled and subjected to statistical analysis. This understanding of turbulence as constituting not simply disorder but also re-ordering has been picked up in philosophy by the materialist theorists Manuel DeLanda and Michel Serres.²⁷ Geographers Tim Cresswell and Craig Martin adopt DeLanda's and Serres' interpretations thus: "within eddies of turbulent flows lie highly ordered formations. It becomes difficult to discern order from disorder."²⁸ This point is illustrated further in the second component of this intervention, where Philip Steinberg explores the delimitations of space and nature that are used to construct the ocean as a space of law.

Turbulent laws • *Philip Steinberg*

To consider the ocean as turbulence, it is useful to turn to Deleuze and Guattari's extended meditation on the ocean as a space of deterritorialization and reterritorialization.²⁹ In referencing the ocean as the "smooth space par excellence,"³⁰ Deleuze and Guattari appear to align themselves with other political theorists who have cited the ocean's physical alterity to explain its position outside normative political institutions (most notably, territorial states). One might, for instance, observe a resonance between Deleuze and Guattari's highlighting of the ocean's "smoothness" and the statement by Carl Schmitt that "on the waves there is nothing but waves,"³¹ a denigration of the ocean's "character" that Schmitt uses to illustrate and explain the ocean's status as immune to inscriptive bordering, and thus to sovereign formations of power. However, as is always the case with Deleuze and Guattari's neologisms, the ocean's "smoothness" – its resistance to inscription through the drawing and communication of static boundaries – is only part of the story. At the most

basic level, even if the ocean *is* “nothing but waves,” these waves are hardly “smooth.” Waves are differentiated and generic, they are repetitive yet ever changing, they are associated with both separation and connection, in both time and space. Indeed, waves both reflect and produce striation as much as they reflect and produce smoothness, and in this sense, waves embody the de/reterritorialization of the ocean as a whole. In this light, a number of theorists have likened the ocean wave – and, more broadly, the dynamic nature of the ocean as a perpetually mobile space of forces, patterns, and chaos – to other vectors and patterns (e.g. soundwaves, earth-atmosphere-ocean interactions) in an effort to untangle the ocean’s politics and to posit the ocean as a space for understanding the wider world.³²

Despite the growing body of work exploring the ocean as a space of waves (and, more broadly, mobilities), less critical attention has been devoted to the ocean as a space of *lines*.³³ Of course, just as the wave lacks a singular association with smoothness and deterritorialization, the line lacks a singular association with striation and reterritorialization;³⁴ indeed, Deleuze and Guattari draw our attention to “lines of flight.”³⁵ Ethnographies and histories of lines drawn in the sea, from the Middle Passage³⁶ to modern-day traffic separation schemes,³⁷ illustrate how, just as the putative “physical” ocean of waves, volumes, and currents is not simply “smooth”, the putative “social” ocean of lines, routes, fishing grounds, and burial grounds is not simply “striated.” This is the larger lesson of Deleuze and Guattari’s meditation on the ocean: navigation across the waves requires the reduction of the ocean to an abstract (smoothing) set of points, even though this abstraction itself involves the construction of a striating grid. Furthermore, the crossing of the ocean, which appears to be a realization of the ocean’s smoothness, itself is an act of striation (the marking of routes) which facilitates the further striation of the globe (through the projection of power across space and time). In other words, it is not that the ocean is “naturally” smooth and that society (unsuccessfully) attempts to striate in order to construct order. Rather, there is continual turbulence in attempts at

constructing social order and exerting social power at sea, through smoothing *and* striation, and in the interplay between the two.

Although Deleuze and Guattari do not apply the term “turbulence” in their metaphysics of de/reterritorialization, it is a particularly evocative concept because of the way that it references not just the complex web of ontological and epistemological functions performed by a smoothed and striated (and a smoothing and striating) ocean but also the ways in which these tendencies reflect and reproduce the ocean’s materiality and the ways in which that materiality is experienced by human (and non-human) beings. Thus, a highlighting of turbulence ensures that, even as we turn to the ocean as a source of metaphor and as an epistemological wedge for upending landed norms (e.g. the seeming permanence of land-based places or the seemingly natural boundaries of land-based regions or political entities), we also remain cognizant of both the materiality of the ocean and the experience of the ocean encounter. Indeed, just as the ocean lies at the turbulent intersection of the smooth and the striated, it also lies at the turbulent intersection of the line and the wave, two tendencies that themselves lie at the (turbulent) intersection of a turbulent geopolitics and a turbulent geophysics.

This can be explored further through an investigation of what appears as one of the most straightforward features in the contemporary ocean: the legal division of ocean space into seemingly clearly delimited zones. International law of the sea textbooks typically begin with a map depicting the ocean as divided into both horizontal zones (the territorial sea out to 12 nautical miles, the exclusive economic zone out to 200 nautical miles, etc.) and vertical zones (the division of the international seabed from the high seas water column).³⁸ These divisions, in turn, rest upon a binary and stable boundary between ocean and land (or, in some instances, between ocean and internal waters), as demarcated by baselines. This drawing of legally meaningful lines and boundaries appears to be a straightforward case of social inscription in the ocean, seemingly overriding water’s mobile

materiality. Indeed, the act of line-drawing in the ocean at first glance appears as a direct rebuttal to Schmitt's assertion that the ocean is beyond inscription.

And yet, as so often happens when one takes a close look at the law, what appears to be a simple act of social striation in fact reflects and reproduces turbulent knowledges of turbulent natures. Indeed, rather than rationalizing a complex environment, these lines and laws add new dimensions of turbulence. To develop this point, the remainder of this section will explore the techniques and principles that have evolved over the past sixty years for defining and delimiting the continental shelf.

The 1958 United Nations Convention on the Continental Shelf defined the “continental shelf” as:

...the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 metres or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said area.³⁹

This is an exceptionally vague statement for what should be a fundamental definition. The reader attempting to apply this definition is left with a number of foundational questions: Must the “exploitation” referred to in the article be commercially viable, or is it enough for it to be hypothetically (or technically) possible? Do lines need to be redrawn if extractive technologies or demand change? How can one operationalize the criterion “outside the area of the territorial sea” when the companion Convention on the Territorial Sea and the Contiguous Zone⁴⁰ never identifies the territorial sea's outer limits? Underlying all this uncertainty is the fact that in the 1958 Convention the continental shelf is defined as a *social* space (a space that is *used* in a certain way) rather than as a *physical* space (a space with certain geophysical properties vis-à-vis the state that might claim authority there).

This uncertain definition of the continental shelf is paired with unclear guidance for how the boundary between two states' continental shelves should be delimited. The Convention states that "unless another boundary line is justified by special circumstances, the boundary shall be determined by application of the principle of equidistance."⁴¹ However, "special circumstances" are never defined.

Taking advantage of this vague definition of what the continental shelf is as well as the Convention's open-ended invitation to adjust its boundaries in response to "special circumstances," the Federal Republic of Germany appealed to the International Court of Justice (ICJ) in the 1960s, challenging the equidistance lines that otherwise would be drawn in the North Sea. Germany noted that the concave shape of the coastline, indented by the Elbe delta, effectively was creating a situation where, if normal equidistance lines were applied, the Netherlands and Denmark would crowd Germany out of the petroleum rich areas in the central North Sea. In 1969, the International Court of Justice largely found in Germany's favour. In the process, the ICJ introduced several new principles into the legal status of the continental shelf and its delimitation.

...delimitation is to be effected by agreement in accordance with *equitable principles*, and taking account of all the relevant circumstances, in such a way as to leave as much as possible to each Party all those parts of the continental shelf that constitute a *natural prolongation of its land territory into and under the sea*, without *encroachment* on the natural prolongation of the land territory of the other...[An equitable delimitation requires] a reasonable degree of *proportionality*...between the extent of the continental shelf areas appertaining to the coastal State and the length of its coast measured in the general direction of the coastline. ⁴²[emphasis added]

Crucially, with this Judgment, the ICJ effectively redefined the continental shelf as a juridical object. Following the ICJ Judgment, the continental shelf is now no longer defined functionally – as the area adjacent to a state where a state finds it profitable to engage in resource extraction activities – but geo-physically – as “a natural prolongation of [a state’s] land territory.” It is no longer an external space *used* by the state but rather is a fundamental part *of* the state. It follows from this redefinition that a state should have the same rights on “its” continental shelf as it has on land, since, under international law, “territory” (whether underwater or not) is essential for constituting the legitimacy of a state’s sovereignty.⁴³ Other innovations of the ICJ Decision flow from its redefinition of the continental shelf as a physical object. Since the continental shelf is a physical (or “natural”) feature, and since “nature” is beyond the control of society, it is entirely appropriate to adjust lines with a consideration for equity (with proportionality being used as a measure of equity). After all, since differential access to the continental shelf is due to “natural” causes (in the case, the shape of the coastline), the aggrieved party’s misfortune is simply due to “bad luck” and can be adjusted in the interest of equity without fundamentally challenging principles of sovereignty that limit the capacity for states to engage in inter-state distributional justice. Additionally, since the continental shelf, post-1969, is understood as a “natural prolongation” of a state’s land territory, it makes sense that any adjustment to equidistance lines should occur in a way that minimizes encroachment onto another state’s “natural prolongation.” As it happened, this interpretation suited Germany particularly well because it led to Germany’s additional continental shelf being granted near the centre of the North Sea, where most of the oil and gas resources are located.



Figure 1. North Sea Continental Shelf delimitation. Dashed grey lines depict the delimitation that would have been implemented based solely on equidistance principles. Colored zones depict delimitations that were eventually implemented, based on equitability principles introduced in the ICJ decision. Copyright: Durham University/IBRU

The innovations of the ICJ’s decision on the North Sea Continental Shelf case have been further specified through case law, and have been maintained in subsequent conventions. Thus, for instance, the United Nations Convention on the Law of the Sea (UNCLOS) advances the definition of the continental shelf as a physical object even further, providing a series of technical means for defining the shelf and its outer limits.⁴⁴ This designation of the continental shelf as a distinct, bounded object also facilitates the distinction between the seabed from the water column that, in turn, underpins UNCLOS’ regime for facilitating seabed mining.⁴⁵

Crucial to this entire story of the evolution of the continental shelf /seabed as a juridical object is how laws and lines have been used to extend the logic of state power to a stratum of the ocean with newfound political-economic significance. Taking as a given the understanding that a state’s essence lies in the physical territory that it controls, the progression from the North Sea

Continental Shelf Judgments through UNCLOS and on to various instances of case law have effectively produced a new understanding whereby territory is extended to the seabed, marking the seabed less as a stratum of the ocean and more as an extension of land. This naturalization of state power, in turn, is facilitated by an extension of the idea, inherited from land, that space is permanent and objective (and fundamentally pre-social) and that its control (and its limits) can be enabled through a calculative rationality of fixed definitions and determinate limits, a seemingly “dry ontology” that diverges sharply from one that might be derived from a consideration of the ocean’s physical properties.⁴⁶ Indeed, in contrast to my proposal (with Kimberley Peters) for theorizing with an “excessive” ocean,⁴⁷ this construction of the continental shelf might well be seen as an example of “land in excess.”⁴⁸

At one level, this physical (and social) construction of the ocean, where the categories and social affordances of land are imported into ocean space and employed with little regard for the ocean’s complex materiality, might be seen as a *denial* of turbulence. However, the language of “denial” is too simple, as is any assertion that the extension of land-based notions of territory to the continental shelf simply represent an extension of a “dry ontology” to the sea. For if Deleuze and Guattari teach us anything it is that dialectics do not exist as declarations of denial: an act of striation is not a refusal of a space’s smoothness so much as it facilitates (and, indeed, embodies) a further round of smoothing, in an ongoing relationship of “interdependence,” “simultaneity,” and “translation.”⁴⁹ Thus, to echo Jessica Lehman’s intervention, the turbulence of the ocean exists not *just* in the complexity of its geophysics, as important as this is if we are seeking to build an ontology based on oceanic affordances, instabilities, and seepages. It also exists in our (unsuccessful) attempts to pin down this geophysics, and it exists in how both the ocean *and* our categories for understanding it complicate efforts at regulating extraction, governing mobility, or fixing histories.

Ultimately, the ocean's turbulence exists in how we both attempt to understand ourselves as, and deny our existence as, oceanic creatures.

Turbulent lives • *Elizabeth R. Johnson*

As Philip Steinberg writes above, ocean turbulence exists in how—and perhaps whether— we understand ourselves as oceanic creatures. But how might we consider turbulence in relation to those oceanic creatures that actually live in the sea? As we note in the introduction, ocean turbulence has been most often considered in terms of geophysical properties, including the saltwater pump, thermal and fluid dynamics, and the wind patterned repetition of waves. These epistemologies and visualizations offer up the turbulence of the sea as a site of dynamism, but they are viewed as universal, planetary properties. In exploring the potential for a conversation between geophysically-inspired and biologically-inspired ocean theorizing I, and indeed the three authors of this article, take up Steinberg and Peters' assertion that “there is ample room for perspectives focused on geophysical and biological liveliness to productively cross paths and for conceptual hybrids to emerge.”⁵⁰ In this section, I consider how understandings of turbulence shift when our attention is turned away from oceanography to consider marine lives through bio- and ecological sciences.

From the view of ecologists and biologists, ocean turbulence is differently animated and often more particular than planetary. Consider, for example, how the ocean is transformed when scientists turn attention away from the saltwater pump and toward the “whale pump.”⁵¹ For much of human history, the metabolic demands of whales and other cetaceans have been viewed as a net drain on fisheries. Many who make a living off the life of the sea have viewed cetaceans as competitors in a zero-sum game of predatory extraction. Associated debates have raged over cetacean culls to limit predation on other “lucrative” organisms.⁵² In 2010, however, biologists Joe Roman and James McCarthy published a paper that would shift scientific understandings of whales and their

significance not only to the life, but also to the matter of the seas. Roman and McCarthy followed humpbacks as they moved around the Gulf of Maine, collecting samples of the fecal plumes left in their wake. Whales, Roman and McCarthy described, dive deep to hunt. But they defecate when returning to the surface for air. In doing so, whales move matter, rich with iron and nitrogen, from deep to shallow waters. This mixing of matter, Roman and McCarthy argued, promotes the growth of phyto- and zooplankton on the surface of the sea. And by expanding this basal trophic layer, whales produce resources for other organisms with every wasting event. Recent research into whale falls—the slow descent of whale carcasses through the layered substrate of the ocean—shows a similar pattern of nutrient mixing in the opposite direction: every event of a whale’s passing not only feeds organisms across the vertical column, but also creates novel “islands” of diverse life on the sea floor.⁵³ This body of ecological literature suggests that, if whales are to be seen within a framework of loss and gain, far from draining life in the oceans, they enhance abundance.

Paying attention to ocean life through the lens of bio- and eco-scientists bears not only on how we understand ocean resources, but how we consider the temporal and geographic relatedness of earthly processes. These studies make clear that the kinds and quantities of ocean resources—and patterns of ocean turbulence—are unstable, and constantly in flux. They exist in relation to the temporal rhythms of metabolic processes, including life, death, and bowel movements.

These studies of marine ecology also bring to light unique geographies, suturing specific bodies and events to planetary process. While heavily patterned according to seasons and migration routes, the ecological networks produced in the wake of whales are particular and emergent. Indeed, scientists speculate that each event of a whale fall likely produces singular ecological communities and species specific to a single whale carcass. But, as Roman and McCarthy have noted, ocean waters and lives circulate. Thinking with marine ecologies therefore encourages meditation on the interconnections and indeterminate links among bodies and planetary processes. Rather than a

repository, space, or medium upon and within which human systems of governance overlay and play out, the lively ocean is inter- and intra-active.

Like zooplankton in a well-fertilized ocean, scholarship on marine life in the humanities and social sciences is now in abundance. Research into the science of nonhuman marine organisms reveals how slippery and even “alien” elements of life shake up not only the sea and its properties, but human relationships to it.⁵⁴ Critical engagements with marine creatures have picked up on these inter (or intra-) connections, raising questions about “life itself” and Enlightenment narratives about the role of humans in the universe. But life—marine and terrestrial—is never known by “itself.” Rather, it is known through the practices and meaning-makings of knowledge (scientific or otherwise). Efforts to engage with marine organisms therefore open up questions of the turbulent relationship between matter, life, and language as it emerges in scientific practice. In what follows, I trace some of the genealogies that have animated the turn to nonhuman marine science as a matter of philosophical importance. I begin by following Steinberg’s account to the work of Deleuze and Guattari and their influence on STS and Actor Network Theory. But I also suggest an alternative genealogy that extends from Donna Haraway and Karen Barad and toward a meditation not only on materiality and life, but also on indeterminacy. Engaging with their work as well as that of Eva Hayward and Astrid Schrader, I consider some of the ways that marine life-science requires thinking with the radical indeterminacy of these relations in ways that transform how we understand and categorise life and its divergent potentials.

Seaward: Toward a Multi-Agential World

Like Steinberg’s lines and laws of ocean governance, social science and humanities scholarship on the lively ocean carries a debt to the work of Deleuze and his collaborations with Guattari. Deleuze and Guattari’s writing on assemblages (*agencement*) and becoming in particular spurred new

waves of anti-essentialist scholarship that would highlight impermanent interrelations.⁵⁵ Beginning in the 1980s, Michel Callon, John Law, Annamarie Mol, and Bruno Latour, for example, drew on these concepts to systematically repattern sociological research. In doing so, their work has reconfigured what matters to socio-political analysis. Rather than histories, global processes, or pre-determined hierarchies, their early work looked to the engineers and scientists who created knowledge that would condition the material and technological worlds of Europe. Accordingly, they brought nonhuman life, technology, and bodies into socio-political analysis. Scallops and the scientists who would breed them;⁵⁶ aircraft and the multiple political and technological histories that built them;⁵⁷ bodies and the multiplicity of disease;⁵⁸ and transportation technologies and the organizational networks that failed to bring them into being all animated their early accounts of bio-socio-technical worlds.⁵⁹

Following Deleuze's rejection of essentialism, actor-network theory (ANT) presented actants as partial and multiple rather than singular, embedded within the discursive framings into which they have been "translated." Callon's scallops acted in relation to the assemblages of knowledge, technology, and language that constituted them as singular entities: the scallops themselves might have been or acted otherwise in a different set of circumstances.⁶⁰ ANT has also worked to demonstrate how modernity's epistemic perspectives are as much a part of historical fictions and ideologies than of material practices. As Latour's *We Have Never Been Modern* patiently demonstrates, societies have tied themselves ever more tightly to nonhuman natures as scientific knowledge has driven a conceptual wedge between nature on one side and technology on the other.⁶¹ Acknowledging and mapping the roles and agencies of nonhumans ostensibly has unsettled the grip of those modernist narratives of history. In the decades since ANT's emergence, attention to the action of nonhuman agencies has proliferated in fields of animal studies and so-called "new materialism".⁶²

Of course, ANT has not been immune to the limits of its own linguistic framing. Its vocabulary of networks, nodes, translations, hybridities, and actants reflects the techno-scientific worlds that its authors have studied. And while it has described assemblages as impermanent and ephemeral, its language often suggests something more machinic, particularly when nodes and networks are described as static concretizations of moments in time. Even more, in an effort to avoid reconstructing metanarratives, its authors have often failed to account for wider historical tendencies, transformations, and, indeed, turbulences.

Lively Turbulence, Indeterminate Worlds

The work of both Donna Haraway and Karen Barad has created a language of multi-agential becoming rooted in livelier matterphors.⁶³ In her interview with Tyrza Nichols Goodeve published as *How Like a Leaf*, Haraway describes bioscience as a discipline riven with tensions between matter and metaphor as well as historical conditions and the potential emergence of new forms and relations. We live, she writes, both “as and in a biological world,” in which biology is part of a discursive and material knot of matter and meaning.⁶⁴ Haraway’s emphasis on being “as and in” the knotty world of life and bioscience also invites scholars to view nonhuman organisms not only as actors, but as co-producers of concepts and theoretical interventions (I have followed Haraway’s lead here in placing whale bioscience before philosophy in this account of lively matter).

Barad’s work similarly weaves together stories and histories of knowledge production with a focus not only on life as such, but on the most fundamental elements of matter. For Barad, our worlds are the product not of the interaction of language and matter, but the agential and often turbulent *intra-action* of phenomena. Intra-action, central to Barad’s ethico-onto-epistemology of agential realism, upends Cartesian understandings of causality based on a “metaphysics of individualism.”⁶⁵ Rather than describing the *interaction* of pre-existing individuals and objects, *intra-*

action names the processes in which subjects, objects, apparatuses of knowing, and forces collectively materialize—and materialize as “things-in-phenomena.”⁶⁶ For Barad, phenomena are what we might consider conditioned by a kind of turbulence that Barad refers to as “diffraction.” In quantum physics, diffraction names the bending of light waves around an object. Diffraction thus describes not only the wave properties of light, but also the act of observing light as a wave (and not as a particle). Unlike reflection, which attends to the likeness between things, diffraction requires acknowledging the entanglement of matter, observer, and apparatus.

Following Haraway, Barad adopts diffraction as a metaphor for ethical inquiry.⁶⁷ This mode of inquiry requires recognizing that observable things are the result of what Barad refers to as “agential cuts” that give definition to the overlapping and indeterminate edges among things, objects, bodies, and their “heterogeneous histories.”⁶⁸ With connection to Jacques Derrida’s concept of the trace, Barad’s agential realism has implications for ethics and politics. Through it, the world is approached not as a collection of pre-existing entities to be interpreted by conscious thought, translated into language, or ‘given voice’ through prosthetic technologies. Instead, objects, analytic apparatuses, and the subjects that analyze and use them are indeterminate in advance of their collective constitution through intra-action. What is object and what is subject is (always) held in question rather than predetermined. Such a world demands accountability to those strangers (within) that are absent, distant, and past—as well as present—in part because they collectively are “sedimented out of particular practices that we have a role in shaping.”⁶⁹ Thus, agential realism is an *ethico-onto-epistemology*.

For both Haraway and Barad, an abiding concern has been not only to describe the worlds produced through scientific practice, but to understand how those worlds and their discursive framings are part of deep tendencies of patriarchy, capitalist enclosures and colonial, Eurocentric hierarchies.⁷⁰ For Haraway, nothing can unsettle these sedimented tendencies more effectively than

thinking “as and in” lifeforms that seem to exist in excess of Enlightenment categories, languages, and narratives. And, while Barad’s writings on quantum mechanics effectively demonstrate that diffraction is always a “lively affair,” both Barad and Haraway look to oceanic tentacular organisms to serve as figures of a more plural—and, indeed, turbulent—worlding. Haraway’s naming of the Chthulucene as an alternative to the Anthropocene, for example, suggests a world that is not accomplished or settled, but is rather “unfinished” and in a perpetually “troubled” process of becoming.⁷¹

In Barad’s later work, the brittlestar, a relative of the starfish, has become a central figure in the articulation of this ethico-onto-epistemological worldview. Studied for its uniquely distributed visual system, the brittlestar expresses a morphology in which “being and knowing, materiality and intelligibility, substance and form” are intimately entangled.⁷² In short, the brittlestar “does not suffer the Cartesian doubts of an alleged mind-body split.”⁷³ Through its tentacular being, Barad understands the relationship between matter and meaning to take place through the body and its relationship to the world. Barad returns time and again to the *lack* of clear limits around bodily boundaries: “The ongoing reconfiguring of [the brittlestar’s] bodily boundaries and connectivity are intra-active material-discursive practices through which the agential cut between ‘self and ‘other’ (e.g. ‘surrounding environment’) is differentially enacted.”⁷⁴ Rather than awaiting humans to render it intelligible, the brittlestar and its “inherent indeterminacy of bodily boundaries” *articulates itself* through differentiation within (not only from) its environment. Like Haraway’s Chthulucene, the brittlestar figures a world that is unfinished and “always already opening up-to-come.”⁷⁵ It is a world riven with indeterminacy and subject to “the surprise, the interruption, by the stranger (within) returning unannounced.”⁷⁶

Tentacles Across Abyssal Relations

Haraway's and Barad's thinking "with and as" marine creatures has extended, tentacularly, to others concerned with the diffractive patterns of matter and meaning in the ocean. Stefan Helmreich's *Alien Oceans*, for example, shows how human life is permeated by other life forms—and therefore alien to its very self. Across this work, the matters and metaphors of marine life are deeply entwined, spanning geographic locations, bodies, and temporal scales. As Helmreich notes, "*life* these days is being distributed into material and semiotic networks that scale from the fidgeting and floating gene to the Gaian globe, with lots of baroque curlicues in between."⁷⁷ The lively legacies of Haraway's and Barad's writings "as and in" marine creatures are perhaps best exemplified in the work of two feminist STS scholars who have worked and studied alongside them: Eva Hayward and Astrid Schrader. Both carefully work to unravel the implications of thinking with life between matter, language, and the political and cultural infrastructures within which these worlds interweave. As they do so, both make a crucial intervention in the trajectory of lively more-than-human studies: they take readers away from the identification of action and agency to confront the radical indeterminacy of living "as and in" marine biology.

Hayward's work has featured the "finger eyes" of cup corals, the pulsating light shows of ctenophores, and the regenerative capacities of starfish to animate interstitial spaces between forms of flesh, metaphor, meaning, and matter.⁷⁸ Her essay "More Lessons from a Starfish" begins with the lyrics of Antony and the Johnson's song, "The Cripple and the Starfish."⁷⁹ It is a song about violence and regeneration. In it, the starfish stands in as a referent to the possibility of renewal after injury. The song leads Hayward to a mediation in which the starfish in the song ceases to be merely a metaphor and becomes a material and semiotic artifact through which to consider metamorphosis. She connects the lyrical starfish to scientific knowledge of starfish capacities for metamorphosis and regeneration, bridging observation and meaning. The song's starfish becomes the product not only

of lyrical construction, but of decades of scientific inquiry. The language of starfish bodies, of metamorphosis and regeneration, are not simply known, but felt: “When I say ‘Starfish,’ or describe their lifeways,” Hayward writes, “how do these words retain the presences, properties, and behaviors of invertebrates undergoing metamorphosis? Perhaps it is a frivolous desire on my part, even ridiculous, to want to understand how words focus our attention, leading us to see/hear/feel interactions, requiring us to attend to a perpetual, worldly motion.”⁸⁰ Through that attention, Hayward meditates on the embodied experience of transitioning, highlighting the turbulence of bodies, matter, and metaphor, all of which are in the making.

Hayward’s work draws on Barad’s notion of diffraction to bridge apparent abysses between human and nonhuman bodies as well as matter and metaphor. Perhaps most importantly, however, her work highlights the ongoing abyssal conditions produced through metamorphosis. For Hayward, gender is not only a troubled category, but a troubled condition, as bodies are, like Barad’s brittlestar and Antony and the Johnson’s starfish, not bounded by the limits of flesh, but radically indeterminate. By paying attention to the language used to describe their always unfinished becomings, Hayward draws her readers’ attention to the relationship between words and worlds in recognition of a shared mutuality across oceanic and terrestrial corporealities. Her work shows how we—our bodies and those of the starfish—are unsettling as “specific parts of the world’s ongoing refiguring.”⁸¹

Schrader’s work on marine microbes similarly speaks to the radical indeterminacy of life by troubling distinctions between individual and population, scientific observer and biological object, and life and death.⁸² Schrader investigates the science of cyanobacteria’s circadian rhythms and programmed cell death, or apoptosis. According to scientists, populations of cyanobacteria regulate their functions according to the rising and setting of the sun. But their life spans are often shorter than the length of a day. For the scientists, this presents a compelling question: how do their

populations ‘know’ of the sun’s movements if the individuals within them have never experienced the rising and setting of the sun? As Schrader describes it, scientists have concluded that cyanobacteria manifest “a memory, a transgenerational communication, or an inheritance”.⁸³ Attempts to demonstrate this memory, however, confound scientists, as the temporal knowledge of time cannot be observed within an individual of the population. This knowledge of the earth’s movements, therefore, is seemingly collective. And, as Schrader argues, this is a behavioral knowledge that is not only shared among living members of the population, but also by those that have passed from it. Drawing on the work of Derrida, Schrader refers to the life-times of marine microbes as haunted, a characteristic of being that defies “the opposition between presence and non-presence, actuality and in-actuality, life and non-life”.⁸⁴ For Schrader, the indeterminacy of these microbial lives—like the whale falls mentioned above—counters the conception that death is a limit to life. Instead, the haunting of marine microbes demonstrates that death is internal to life—and part of its ongoing, always unfinished unfolding.⁸⁵

For Schrader, this condition of haunted life is not limited to microbial populations themselves: bioscience is also an intimate part of this unfolding. Much like quantum mechanics, “haunted microbes exist only with the help of science.”⁸⁶ Through these scientific descriptions, not only is the individuality of cyanobacteria called into question, so too are divisions between laboratory science and ocean life as well as microbe and human. This presents a radical undecidability—or, perhaps, endless turbulence—between descriptive practice of science and the materiality of ocean life. Accordingly, the agencies of life or matter and the agencies of observers are indecipherable. This suggests that scientific research and representations neither precede nor follow life, but that they are mutually constitutive.

As Schrader describes, this indeterminacy has important implications for political norms and political practices. Knowledge that cyanobacteria “anticipate and respond to environmental

conditions without...requiring autonomy or individuality” disrupts anthropocentric notions of biopolitics that hold the preservation of autonomous liberal life at their center.⁸⁷ For her, conditions of governance cannot be thought to follow either science or life. Rather, all three must be decided in the indeterminate and turbulent space of knowledge production practices.

As my initial example of the whale pump suggests, living and thinking “as and in”—rather than merely “on or about”—life in the oceans requires more than the accumulation of knowledge. As the work of Haraway, Barad, Hayward, and Schrader collectively demonstrates, taking the world and ourselves seriously as creatures as and in a state of turbulence requires simultaneously recognizing the abyssal gaps between matter and meaning, human and nonhuman, particular and planetary, while also acknowledging the radical intimacies and interconnections among and across those scales and realms. Schrader refers to this as “abyssal intimacy”.⁸⁸ It is in these spaces of abyssal intimacy that we conjure worlds through matterphorical intervention.

Making sense of turbulence (or not)

All three contributors to this intervention on the turbulence of oceanic matterphors – and the matterphor of oceanic turbulence – have given a privileged place to Deleuze and Guattari philosophy. Steinberg employs Deleuze and Guattari explicitly in his discussion of the smooth and the striated, as does Johnson in her discussion of relationality and assemblages. The links to Deleuze and Guattari are less explicit in Lehman’s contribution, but she too relies on their thought as she employs a non-essentialist sense of the material to question linear narratives. Although this theoretical congruency was not by design, it is, in retrospect, not surprising as Deleuze and Guattari thought is particularly suited for interpreting the concept of turbulence as a relationality between matter and metaphor. Even more, turbulence illuminates matterphors’ indeterminacies. Turbulence challenges processes that would striate, such as measurement, gridding, and boundary policing. At

the same time, it disrupts smoothness through mixing, churning, and other patterns of movement. While we are all three drawn to different elements of Deleuze and Guattari's philosophy, such as emphasis on relations rather than essences, notions of immanence, and a methodological promiscuity that draws from science, literature, and art, it is perhaps this attention to movements between fixity and fluidity, force and disruption, that interests us all most here. Rather than understanding turbulence as confounding Deleuze and Guattari's discussion of smoothness and striation, we see it as a way to point out the complexities of their thought and the useful directions a more careful reading can indicate.⁸⁹

That said, in the spirit of Deleuze and Guattari, we need to conclude by querying whether our focus on a single concept – turbulence – might itself be limiting. After all, any specific focus will 'crowd out' others, no matter how expansively it is positioned. In emphasizing fluidity and disruption, we risk losing sight of the material and discursive patterns that persist in spite of turbulence. And yet, we find turbulence to be particularly provocative because, even as it challenges our understanding of knowledge, chaos, stasis, and mobility, it also challenges our notions of scale. Indeed, turbulence prods us to think across, and outside, scale. Historian of science Naomi Oreskes has suggested that studying the practices of oceanography entails "scaling up our vision."⁹⁰ But even more, turbulence is alluring because it permits scale jumping. Turbulence can refer to fluid dynamics that occur on the microscale and yet through complex mechanisms influence the world climate. Turbulence can also name a defining characteristic of contested and unstable legal and political regimes at numerous scales. In short, turbulence upends notions of scale not simply by permitting us to trace its effects across scales, but by challenging us to use it as what Gabrielle Hecht has called an "interscalar vehicle."⁹¹ That is, we can put the concept to use to make links across scales, revealing connections that have real political and material implications but that could not previously be seen. Ultimately, this use of turbulence as an 'interscalar vehicle' can inspire consideration of how scale is

a social and material product, at sea as on land. Hecht writes, “What makes something an interscalar vehicle is not its essence but its deployment and uptake, its potential to make political claims, craft social relationships, or simply open our imaginations.”⁹² By engaging in this three-way discussion of turbulence, we hope we have opened further conversation of the connections and disconnections between matter and metaphor, not simply as they pose potential problems but also as they produce different possibilities for how we think from, with, and in relation to the sea.

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- ¹ For reviews and bibliographies of recent scholarship, see Steven Mentz, “Toward a Blue Cultural Studies,” *Literature Compass* 6, no. 5 (2009): 997-1013; Kimberley Peters, “Future Promises for Contemporary Social and Cultural Geographies of the Sea,” *Geography Compass* 4, no. 9 (September 2010): 1260-1272; Kimberley Peters, “Oceans and Seas: Physical Geography,” in *The International Encyclopedia of Geography*, ed. Douglas Richardson (New York: John Wiley and Sons, 2017); Philip Steinberg, “Oceans and Seas: Human Geography,” in *The International Encyclopedia of Geography*, ed. Douglas Richardson (New York: John Wiley and Sons, 2017); Philip Steinberg, “Oceans,” in *Oxford Bibliography of Geography*, ed. Barney Warf (New York: Oxford University Press, 2013); and Philip Steinberg, “Oceans,” in *International Encyclopedia of Human Geography* 8, ed. Rob Kitchen and Nigel Thrift (Oxford: Elsevier, 2009): 21-26. See also Jon Anderson and Kimberley Peters, ed., *Water Worlds: Human Geographies of the Oceans* (London: Routledge, 2014); Jerry H. Bentley, Renate Bridenthal, and Kären Wigen, ed., *Seascapes: Maritime Histories, Littoral Cultures, and Transoceanic Exchanges* (Honolulu: University of Hawai'i Press, 2016); Irus Braverman and Elizabeth R. Johnson, ed., *Blue Legalities: The Life and Laws of the Sea* (Durham, NC: Duke University Press, 2020); Special section on oceanic studies, *PMLA* 125, no. 3 (May 2010): 657-736; Special section on knowing the ocean, *ISIS* 105, no. 2 (June 2014): 335-391; Philip Steinberg and Kimberley Peters, “Wet Ontologies, Fluid Spaces: Giving Depth to Volume through Oceanic Thinking,” *Environment and Planning D: Society & Space* 33, no. 2 (April 2015): 247-264; Kimberley Peters and Philip Steinberg, “The Ocean in Excess: Towards a More-than-Wet Ontology,” *Dialogues in Human Geography* 9, no. 3 (November 2019): 293-307.
- ² J.C.J. Nihoul and B.M. Jamart, “Small-Scale Turbulence and Mixing in the Ocean: A Glossary,” in *Small-Scale Turbulence and Mixing in the Ocean: Proceedings of the 19th International Liege Colloquium in Ocean Hydrodynamics*, J.C.J. Nihoul and B.M. Jamart, ed. (Amsterdam: Elsevier, 1988): 3-9.
- ³ Robert Stewart, *Introduction to Physical Oceanography* (Gainesville: University Press of Florida, 2009).
- ⁴ Steinberg and Peters, “Wet Ontologies, Fluid Spaces.”
- ⁵ Stefan Helmreich, “Reading a Wave Buoy,” *Science, Technology, & Human Values* 44, no. 5 (June 2019): 737-761; Maeve Tynan, “Polyps, Plankton, and Passages: Mythopoetic Islands and Long-Memored Seas,” *Space and Culture* 13, no. 2 (April 2010): 144-153.
- ⁶ See for example Ian Baucom, *Specters of the Atlantic: Finance Capital, Slavery, and the Philosophy of History* (Durham, NC: Duke University Press, 2005); Cesare Casarino, *Modernity at Sea: Melville, Marx, Conrad in Crisis* (Minneapolis: University of Minnesota Press, 2002); Tiffany Lethabo King, *The Black Shoals: Offshore Formations of Black and Native Studies* (Durham, NC: Duke University Press, 2019); Peter Linebaugh and Marcus Rediker, *The Many-Headed Hydra: Sailors, Slaves, Commoners, and the Hidden History of the Revolutionary Atlantic* (Boston: Beacon Press, 2000); Renisa Mawani, *Across Oceans of Law: The Komagata Maru and Jurisdiction in the Time of Empire* (Durham, NC: Duke University Press, 2018); Christina Sharpe, *In the Wake: On Blackness and Being* (Durham, NC: Duke University Press, 2016); Stephanie Smallwood, *Saltwater Slavery: A Middle Passage from Africa to American Diaspora* (Cambridge, MA: Harvard University Press, 2008).
- ⁷ Elizabeth DeLoughrey, *Routes and Roots: Navigating Caribbean and Pacific Island Literatures* (Honolulu: University of Hawai'i Press, 2007); Tynan, “Polyps, Plankton, and Passages.” For examples of primary Caribbean texts see Antonio Benítez-Rojo, *The Repeating Island: The Caribbean and the Postmodern Perspective* (Durham, NC: Duke University Press, 1997); Édouard Glissant, *Poetics of Relation*, trans. Betsy Wing (Ann Arbor, MI: University of Michigan Press, 1997).
- ⁸ Wee especially Linebaugh and Rediker, *The Many-Headed Hydra*; Casarino, *Modernity at Sea*.
- ⁹ King, *The Black Shoals*. See also Lisa Lowe, *The Intimacies of Four Continents* (Durham, NC: Duke University Press, 2015).
- ¹⁰ Casarino, *Modernity at Sea*, 4.

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- ¹¹ Linebaugh and Rediker, *The Many-Headed Hydra*.
- ¹² Omise'eke Natasha Tinsley, "Black Atlantic, Queer Atlantic: Queer Imaginings of the Middle Passage" *GLQ* 14, no. 2-3 (June 2008): 191-215.
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- ¹⁵ King, 2.
- ¹⁶ King, 8, 9.
- ¹⁷ Neimanis, "Queer Times and Chemical Weapons," 68.
- ¹⁸ Steinberg and Peters, "Wet Ontologies, Fluid Spaces," 255.
- ¹⁹ Stefan Helmreich, "Intimate sensing" *Simulation and Its Discontents*, Sherry Turkle, ed. (Cambridge, MA: The MIT Press, 2009): 129-150.
- ²⁰ Neimanis, "Queer Times and Chemical Weapons," 73.
- ²¹ Tynan, "Polyps, Plankton, and Passages."
- ²² DeLoughrey, "Heavy Waters."
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- ²⁵ Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press).
- ²⁶ Donna Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008), 36.
- ²⁷ See especially Manuel DeLanda, *War in the Age of Intelligent Machines* (New York: Zone Books, 1991); Michel Serres, *The Birth of Physics* (Manchester: Clinamen Press, 2000).
- ²⁸ Tim Cresswell and Craig Martin, "On Turbulence: Entanglements of Disorder and Order on a Devon Beach," *Tijdschrift voor Economische en Sociale Geografie* 103, no. 5 (May 2012): 516-529.
- ²⁹ Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (London: Athlone, 1988).
- ³⁰ Deleuze and Guattari, 479.
- ³¹ Carl Schmitt, *The Nomos of the Earth in the International Law of the Jus Publicum Europaeum* (New York: Telos, 2003), 43.
- ³² Stefan Helmreich, "Waves: An Anthropology of Scientific Things," *Hau: Journal of Ethnographic Theory* 4, no. 3 (2014): 265-284; Stefan Helmreich, *Sounding the Limits of Life: Essays in the Anthropology of Biology and Beyond* (Princeton: Princeton University Press, 2016); Kimberley Peters, "Manipulating Material Hydro-Worlds: Rethinking Human and More-than-Human Relationality through Offshore Radio Piracy," *Environment and Planning A* 44 (2012): 1247-1254; Kimberley Peters, *Sound, Space, and Society: Rebel Radio* (Berlin: Springer, 2017); Peters and Steinberg, "The Ocean in Excess"; Steinberg and Peters, "Wet Ontologies, Fluid Spaces."
- ³³ But see Henry Jones, "Lines in the Ocean: Thinking with the Sea about Territory and International Law," *London Review of International Law* 4, no. 2 (2016): 307-343.

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- ³⁴ Tim Ingold, *Lines: A Brief History* (London: Routledge, 2007).
- ³⁵ Deleuze and Guattari, *A Thousand Plateaus*.
- ³⁶ Linebaugh and Rediker, *The Many-Headed Hydra*.
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- ³⁸ See, for example, Yoshifumi Tanaka, *The International Law of the Sea, 3rd Edition* (Cambridge: Cambridge University Press, 2019).
- ³⁹ *Convention on the Continental Shelf*, Geneva, 29 April 1958, *United Nations Treaty Series*, vol. 499, no. 7302, art. 1, p. 312, available from <http://treaties.un.org/Pages/showDetails.aspx?objid=08000002800338fb>.
- ⁴⁰ *Convention on the Territorial Sea and the Contiguous Zone*, Geneva, 29 April 1958, *United Nations Treaty Series*, vol. 516, available from <http://treaties.un.org/Pages/showDetails.aspx?objid=0800000280033c69>.
- ⁴¹ *Convention on the Continental Shelf*, art. 5, p. 314.
- ⁴² International Court of Justice. *North Sea Continental Shelf Cases, Judgment of 20 February 1969*. The Hague: International Court of Justice, 1969, para. 101(c)(1), 101(d)(3), available from <https://www.icj-cij.org/files/case-related/51/051-19690220-JUD-01-00-EN.pdf>. For more on this Judgment, see Alex Oude Elferink, *The Delimitation of the Continental Shelf between Denmark, Germany and the Netherlands: Arguing Law, Practicing Politics?* (Cambridge: Cambridge University Press, 2016).
- ⁴³ For instance, Article 1 of the 1933 Montevideo Convention on Rights and Duties of States lists having a defined territory as one of four necessary qualifications for recognition as a state, with the other three being possession of a permanent population, having a functioning government, and maintaining the capacity to enter into relations with other states. See <http://www.oas.org/juridico/english/treaties/a-40.html>.
- ⁴⁴ *United Nations Convention on the Law of the Sea*, Montego Bay, 10 December 1982, *United Nations Treaty Series*, vol. 1833, arc. 76, p. 428, available from <https://treaties.un.org/Pages/showDetails.aspx?objid=0800000280043ad5>.
- ⁴⁵ Surabhi Ranganathan, “Ocean Floor Grab: International Law and the Making of an Extractive Imaginary,” *European Journal of International Law* 30, no. 2 (May 2019): 573-600.
- ⁴⁶ Contrast with Steinberg and Peters, “Wet Ontologies, Fluid Spaces.”
- ⁴⁷ Peters and Steinberg, “The Ocean in Excess.”
- ⁴⁸ The continental shelf example upends some of my earlier ocean theorising in other ways as well. In my earlier forays into oceanic theorising, I might well have summarised this process by which the continental shelf became a legal object as a social construction of the ocean; see, Philip Steinberg, *The Social Construction of the Ocean* (Cambridge: Cambridge University Press, 2001). However, it is equally a *physical* construction of the ocean. Indeed, it seems, in this case at least, but quite possibly more generally, that social constructions of the ocean are dependent on physical constructions of the ocean, as a certain kind of space, with a certain kind of “nature.”
- ⁴⁹ Jones, “Lines in the Ocean,” 317.
- ⁵⁰ Steinberg and Peters, “Cross Currents and Undertows: A Response,” *Dialogues in Human Geography* 9, no. 3 (November 2019): 336.
- ⁵¹ Joe Roman and James J. McCarthy, “The Whale Pump: Marine Mammals Enhance Primary Productivity in a Coastal Basin,” *PLOS ONE* 5, no. 10 (October 11, 2010): e13255.
- ⁵² For an extended discussion of this controversy, see, for example, Peter J. Corkeron, “Whale Watching, Iconography, and Marine Conservation,” *Conservation Biology* 18, no. 3 (2004): 847–49; Joji Morishita, “Multiple Analysis of the Whaling Issue: Understanding the Dispute by a Matrix,” *Marine Policy* 30, no. 6

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- (November 2006): 802–8; Phillip J. Clapham, Simon Childerhouse, Nicolas J. Gales, Lorenzo Rojas-Bracho, Michael F. Tillman, and Robert L. Brownell, “The Whaling Issue: Conservation, Confusion, and Casuistry,” *Marine Policy* 31, no. 3 (May 2007): 314–19.
- ⁵³ Craig R. Smith, Adrian G. Glover, Tina Treude, Nicholas D. Higgs, and Diva J. Amon, “Whale-Fall Ecosystems: Recent Insights into Ecology, Paleoecology, and Evolution,” *Annual Review of Marine Science* 7, no. 1 (2015): 579.
- ⁵⁴ Stefan Helmreich, *Alien Ocean: Anthropological Voyages in Microbial Seas* (Berkeley: University of California Press, 2009).
- ⁵⁵ Deleuze and Guattari, *A Thousand Plateaus*.
- ⁵⁶ Michel Callon, “Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay,” *The Sociological Review* 32, no. 1 (1984): 196–223.
- ⁵⁷ John Law, *Aircraft Stories: Decentering the Object in Technoscience* (Durham, NC: Duke University Press, 2002).
- ⁵⁸ Annemarie Mol, *The Body Multiple: Ontology in Medical Practice* (Durham, NC: Duke University Press, 2002).
- ⁵⁹ Bruno Latour, *Aramis, or the Love of Technology* (Cambridge, MA: Harvard University Press, 1996).
- ⁶⁰ Callon, “Some Elements of a Sociology of Translation.”
- ⁶¹ Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993).
- ⁶² See, for example, Nicole Shukin, *Animal Capital: Rendering Life in Biopolitical Times* (Minneapolis: Univ Of Minnesota Press, 2009); Katherine Gillespie, *The Cow with Ear Tag #1389* (Chicago: University of Chicago Press, 2018); Irus Braverman, *Animals, Biopolitics, Law: Lively Legalities* (London: Routledge, 2015); Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press Books, 2010).
- ⁶³ Karen Barad, *Meeting the Universe Halfway* (Durham, NC: Duke University Press, 2007).
- ⁶⁴ Donna Haraway and Thyrza Goodeve, *How Like a Leaf: An Interview with Donna Haraway* (New York: Routledge, 1999), 25.
- ⁶⁵ Adam Kleinman and Karen Barad, “Intra-actions” *Mousse Magazine* 34 (2012), 81.
- ⁶⁶ Kleinman and Barad, “Intra-actions,” 77. See also Barad, *Meeting the Universe Halfway*.
- ⁶⁷ For Haraway, diffraction names the processes of differentiation and “relations of difference among people and among humans, other organisms, and machines.” Haraway uses diffraction to rethink selves not as stable entities or the products of their forebearers, but rather as “monstrous artifactualisms” capable of differentiation. In “The Promise of Monsters,” Haraway turns to diffraction to think difference beyond “hierarchical domination, incorporation of parts into wholes, paternalistic and colonialist protection, symbiotic fusion, antagonistic opposition, or instrumental production from resource,” see Donna Haraway, “The Promise of Monsters,” *The Donna Haraway Reader* (New York: Routledge, 2004), 70. In *Modest Witness*, Haraway turns to diffraction to complicate the feminist practice of reflectivity, arguing that diffraction provides a more useful concept with which to acknowledge the situatedness of knowledge production.
- ⁶⁸ Haraway, *Modest Witness*, 273.
- ⁶⁹ Barad, *Meeting the Universe Halfway*, 203.
- ⁷⁰ Donna Haraway, “Teddy Bear Patriarchy: Taxidermy in the Garden of Eden, New York City, 1908-1936” *Social Text*, no. 11 (1984): 20–64; Donna Haraway, *Modest_Witness@Second_Millennium.FemaleMan_Meets_OncoMouse: Feminism and Technoscience* (New York: Routledge, 1997).
- ⁷¹ Haraway, *Staying with the Trouble*.
- ⁷² Karen Barad, “Invertebrate Visions: Diffractions of the Brittlestar,” in ed. Eben Kirksey *The Multispecies Salon*

(Durham, NC: Duke University Press, 2014), 227.

⁷³ Barad, “Invertebrate Visions: Diffractions of the Brittlestar,” 227.

⁷⁴ Barad, “Invertebrate Visions: Diffractions of the Brittlestar,” 228.

⁷⁵ Karen Barad, “Diffracting Diffraction: Cutting Together-Apart,” *Parallax* 20, no. 3 (2014): 168-187.

⁷⁶ Barad, “Diffracting Diffraction: Cutting Together-Apart,” 178.

⁷⁷ Helmreich, *Alien Oceans*, 278.

⁷⁸ Eva Hayward, “Fingeryeyes: Impressions of Cup Corals,” *Cultural Anthropology* 25, no. 4 (November 2, 2012): 577–99; Eva Hayward, “Sensational Jellyfish: Aquarium Affects and the Matter of Immersion,” *Differences* 23, no. 3 (December 1, 2012): 161–96.

⁷⁹ Eva Hayward, “More Lessons from a Starfish: Prefixial Flesh and Transspeciated Selve,” *WSQ: Women’s Studies Quarterly* 36 (January 1, 2008): 64–85.

⁸⁰ Hayward, 76.

⁸¹ Hayward, 67.

⁸² Astrid Schrader, “Microbial Suicide: Towards a Less Anthropocentric Ontology of Life and Death,” *Body & Society* 23, no. 3 (September 1, 2017): 48–74; Astrid Schrader, “Marine Microbiopolitics: Haunted Microbes Before the Law,” in ed. Irus Braverman and Elizabeth R. Johnson, *Blue Legalities: The Life and Laws of the Sea* (Durham, NC: Duke University Press, 2020): 255–73.

⁸³ Schrader, “Marine Microbiopolitics,” 256.

⁸⁴ Jacques Derrida, quoted in Schrader, “Marine Microbiopolitics,” 256.

⁸⁵ Schrader, “Marine Microbiopolitics.”

⁸⁶ Schrader, “Marine Microbiopolitics,” 260.

⁸⁷ Schrader, “Marine Microbiopolitics,” 263.

⁸⁸ Astrid Schrader, “Abyssal Intimacies and Temporalities of Care: How (Not) to Care about Deformed Leaf Bugs in the Aftermath of Chernobyl,” *Social Studies of Science* 45, no. 5 (September 2015): 665-690.

⁸⁹ It is also crucial to note that while Deleuze and Guattari are a touchstone, our engagements with them are not uniform. And the other thinkers who animate these meditations on emergence—from DeLoughrey to Haraway and Schrader—are indebted to other philosophical traditions.

⁹⁰ Oreskes, “Scaling Up Our Vision.”

⁹¹ Gabrielle Hecht, “Interscalar Vehicles for an African Anthropocene: On Waste, Temporality, and Violence,” *Cultural Anthropology* 22, no. 1 (2018): 109-41.

⁹² Hecht, “Interscalar Vehicles for an African Anthropocene,” 115.