THESIS

RECONFIGURING DISCOURSE TO ATTEND TO INTERRELATION: A RHETORICAL ANALYSIS OF KELP AGENCY IN SCIENTIFIC TEXTS

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ABSTRACT

RECONFIGURING DISCOURSE TO ATTEND TO INTERRELATION: A RHETORICAL ANALYSIS OF KELP AGENCY IN SCIENTIFIC TEXTS

The purpose of this thesis is to consider how thinking-*with* kelp ecologies in knowledge-making practices opens opportunities for attending to the co-becoming of species through interrelations. In this thesis, I consider how scientific discourse practices constitute relations with kelp forests and how constitutions can change to think-with kelp forests as actors in knowledge-building. I argue this reconstitution is important for changing asymmetries in power over and cognitive distance from kelp ecosystems. Using critical discourse analysis, this thesis considers how scientific discourse practices constitute power hierarchies between kelp ecosystems and humans. Then, this thesis reads the power hierarchies through an ecological approach to rhetoric to trace how kelp forests produce relations through interactions with environmental processes and a diverse range of species actors. Through the rhetorical analysis, this thesis considers how thinking-with kelp forests can open opportunities for research and discourse practices to attend to co-constituting webs of interrelations. Finally, this thesis considers how embodied experiences with kelp forests open opportunities for researchers to notice and to respond to—to think-with—what matters for a kelp forest. This thesis responds to the modernist bifurcation of language and materiality, subject and object, mind and body. It considers how communication and knowledge-building can make-with the world today by attending to how all planetary actors are of the world through interrelationships with it.

TABLE OF CONTENTS

Introduction

From 2013 to 2016, a "perfect storm" of ecological events causes bull kelp ecosystems to collapse along the Oregon and northern California coastlines. A wasting disease decimates sea stars, the main predator of the purple sea urchin. El Niño events and a marine heatwave plaguing the North East Pacific Ocean cloak the nearshore ecosystems in nutrient-poor waters. In 2015, a toxic algae bloom spreads from central California to the Alaska Peninsula. Without the sea star, purple sea urchin populations multiply and eat the bull kelp, reducing their canopies by ninety percent along 350 kilometers of coastline (Rogers-Bennet and Catton). When I learn of the kelp forests turned to sea urchin barrens, my reaction is biophysical. I feel guttural emptiness swell into nausea.

I feel the heft of entangled wracks of stipes and gas bladders washed up on beaches from winter storms. I feel the slippery smooth texture of fronds glide through my fingers. I see submarine blue-green light scatter and refract through blades as my body learns the buoyancy of saltwater floating, diving with my dad.

To learn of the loss of the underwater canopies was to learn of the loss of what first cast me in whole-body wonder. Kelp forests off the Mendocino coastline, of which there are now only a scattered few, but which once thronged nearshore waters in spirals of brown radial blades, first showed me all the ways I was inured to land. Watching canopies lift with the pulse of swell and anemone tentacles and fish gills open and close with the rise of water too, reoriented my perceptions, shifted my framework to see more mobility, more flux, more gesture. Kelp first showed me how the planet was vastly different than I had thought it to be. Learning of the

entangled fronds turned to “marine deserts” showed me the world was vastly different than I had thought it to be again.

From Alaska and Canada to Baja California, the dimensions of kelp forests create habitat structure and food resources for myriad marine species, they modify light and sedimentation, and they mediate nutrient dynamics and water flow along the coastline (Rogers-Bennet and Catton). Growing from holdfasts that attach to rocky substratum, kelp thrive in ocean depths ranging from about two to more than thirty meters and can grow twenty-five to thirty centimeters in a day (Schiel and Foster xv). Kelp forests are described as one of the most species-rich, productive, and widely distributed ecological communities on earth (Schiel and Foster xv). From Alaska to Baja California, kelp forests are facing stressors from integrated changes to ocean chemical properties, wind patterns, and correlating nutrient fluxes (Rogers-Bennet and Catton).

In eastern Australia and Tasmania, in southern Norway, on the coast of Hokkaido, and the Aleutian Islands, kelp forests have experienced similar “perfect storms” that have transitioned biodiverse marine ecosystems to urchin barrens and what marine scientists describe as a state or phase shift (Bland; Rogers-Bennet and Catton). Kelp forests in northern California could take decades to recover, but marine heatwaves in the North East Pacific are projected to increase in frequency and intensity due to climate change (Rogers-Bennet and Catton). The heatwaves apply stressors to the environmental factors kelp forests need to grow (Rogers-Bennet and Catton).

To haunt is to visit often, to frequent, to continually seek the company of. When something is haunting, it is difficult to ignore or forget, it persists, recurs, reappears. The etymology of the word haunt comes from the old Norse heimta, which means to lead home, to pull, to claim.

A surfer, I haunt intertidal coves every early morning possible in the company of kelp and their myriad companion species. Most mornings I am in the ocean with otters cracking open shells, with harbor seals in seagrass beds, and with pelicans gliding above in Vs. Some mornings dolphins dart through the water around the legs, casting the morning in sonar clicks as they feed. Grey and humpback whales breach offshore during winter and spring, launching their bodies along thousand-mile migrations. These are a few species I can see and hear, who make me sensitive to what the world becomes with them. I see kelp forests entangling us all together, orienting us to where we are in relation with land, in relation with the continental shelf, in relation with surface and depth, in relation with each other. In my memory, masses of brown bull and giant kelp stretch along the foggy margins where land meets with sea, encompassing the edges of much of the western coastline.

During the span of warm-water years, I stay out of the ocean, instead haunting crags of mudstone stretching above reefs awash in tepid waters, acrid with algae, acrid with decomposition. I watch as Humboldt squid wash up in droves, covering inlets in long fans of grey tentacles. Another season, anchovies asphyxiate, their mouths opening and closing at the surface of the water. Meters deep, their bodies shimmer silver and blue. In inlets, I find the bodies of sea lions, cormorants, pelicans. One afternoon, I stumble upon the enormity of a stranded grey whale, with its stranded companion barnacles.

When I search for accounts of why the marine die-offs are happening, I become troubled by how discourse constitutes the marine changes and losses. For instance, the losses of kelp forests in northern California are largely articulated through correlating closures of the red abalone and red urchin fisheries and their correlating monetary values. Reading articles reduce kelp forests to something humans profit from is viscerally discordant with the way they have

imbued my senses and discordant with the diversity of relations kelp forests foster. The discourse perpetuates a dominant paradigm of exploitation and domination over living systems for human benefit. It is difficult to imagine these constitutions of kelp forests inspiring a sense of care or responsibility for kelp ecosystems, especially for people who have not spent time with them. During this time, I begin to wonder how discourse practices constitute a reality wherein humans can understand themselves separate from living ecosystems and thus able to be inattentive to other living organisms' ability to co-become with each other.

Scholars in rhetoric and composition and science and technology studies (STS) are studying how technologies, sites of knowledge-building, and discourse practices structure relationships with other species. Susan Leigh Star, a feminist science studies scholar, asks one to consider "what it means to be enrolled by a network, or not, and how one is defined by it" (Myers 12). When I read through literature about marine stressors, about kelp losses, "a vast array of social and technical forces" seem to deny that parts of kelp, and the myriad species their canopies provide habitat and foraging grounds for, exist (Myers 12). In response to planetary degradation and species loss, scholars in rhetoric and composition and science and technology studies are considering how other species can be included in networks of knowledge production and figured as key actors. Kelp forests have acted on me throughout my life, and the above experiences guide the research questions for this paper in two central ways. First, this thesis considers how, as rhetorical actors, kelp ecosystems can make others sensitive to the co-constitutive nature of interrelationships. Second, this thesis considers how discourse shapes abilities to understand interrelations with kelp ecosystems. Drawing from scholarship in rhetoric and composition and science and technology studies, this thesis examines the following research questions:

1. How does thinking-with with kelp ecologies in knowledge-building practices open possibilities for attending to interrelation?
2. How do discourse practices constitute relations with kelp?

To examine these research questions, this thesis conducts two steps of analysis. First, this thesis uses critical discourse analysis to examine how kelp are constituted in scientific discourse. In this analysis, I consider how power hierarchies are drawn between humans and kelp ecosystems. I also consider the discourse features that hinder a kelp forest's ability to participate in knowledge-production and that hinder a kelp forest's ability to draw others into association. Next, this thesis uses an ecological approach to rhetoric to trace the actors who co-constitute a kelp ecosystem and to ask how the interactions between actors change what a kelp forest becomes. Through this tracing, this thesis considers how research practices and scientific discourse can attend to the co-constituting relationships which co-compose a kelp forest. I consider how, as rhetorical actors, kelp forests draw attention to the importance of attending to interrelationship in knowledge-building practices.

I also read the analysis of scientific discourse through my embodied experiences with kelp ecologies to consider where sensory interactions open possibilities for thinking-*with* kelp in knowledge-making practices instead of thinking *about* kelp as an object of study. Many marine scientists dive with kelp to conduct research studies, but their material interactions with kelp ecosystems are not present in scientific discourse. In this thesis, I experiment with how including material exchanges in research opens possibilities for constituting a responsive world where actors are always changing what the other becomes.

The central exigency guiding this research is the need to cultivate attentiveness to interrelations with other species to change practices of domination over and cognitive distance

from them. Key marine habitat-forming species are facing declines around the world (Rogers-Bennet and Catton). Attending to the relations and environmental processes which co-produce habitat-forming species might open possibilities for creating more habitable worlds again for a greater range of actors. A modernist paradigm constitutes a division between materiality and language, nature and culture, subject and object, mind and body. Making meaning across these binaries might change how a greater range of people understand themselves to be *of* the world and might open opportunities to place value on the ways ecologies and environments produce relations and meaning.

Diane Keeling and Jennifer Prairie write that "Conceptualizing our communication processes as a making-with the world rather than as a representation of the world is one potential...that would emphasize how humans affect and are affected by their environments" (54). This research similarly considers how communication processes can make-with the world today. It considers how language and research practices can constitute materiality to illustrate how environments and other species produce relations important to listen to and build-knowledge with.

This thesis is divided into six chapters. The first chapter is a synthesis of the theoretical scholarship guiding this paper. The second is a methodology of the processes undertaken to answer the research questions. The third chapter considers how kelp forests have made me sensitive to interrelations with marine ecosystems. It is through these sensitivities that I position kelp as a rhetorical actor to consider how their ecosystems can orient research practices and discourse to attend to interrelation. The fourth chapter is a critical discourse analysis of scientific texts about kelp ecology and about the stressors applied to kelp ecosystems during the 2014-2016 marine heatwave. The fifth chapter is a critical discourse analysis of conservation documents

about kelp ecosystems and marine health. Finally, the sixth chapter synthesizes the main conclusions from the analysis and addresses limitations and future implications for this research.

Review of Literature

Rhetorical Ecologies

This thesis argues that making meaning with other species is an especially important turn for scholarship in rhetoric and composition. Historically, rhetoric, as a Western and linguistic reasoning capacity, has been used to draw divisions between humans and other living beings (Wells et al. 8). The ability to hone logic and rational thought processes through Western literacy practices has been regarded as superior to other ways of making meaning and especially to ways of making meaning through relationships with other species and the earth. Decolonial scholars today are working to bring awareness to the exclusionary practices of the field, and they are working to bring recognition to the range of rhetorical practices myriad cultures have employed beyond Western traditions (Driskill; Ríos; Powell; Haas; Baca; Villanueva). For thousands of years, indigenous people have made meaning through relationships with their local ecosystems, and for hundreds of years, colonial practices have worked to devalue and eradicate those forms of knowledge, often in the name of alphanumeric logics (Driskill; Ríos; Powell; Haas; Baca; Villanueva).

In this thesis, I take an ecological approach to rhetoric rather than a decolonial one to argue the importance of including other species in meaning-making practices. I want to acknowledge that traditional ecological knowledge has regarded and made meaning with other species for thousands of years. Attuning to how other species build relationships is not a new source of knowledge, but it is a commonly disregarded one in rhetorical practices. Opening the range of rhetorical practices valued is exigent to creating possibilities for more just relations on earth across differences. I choose to draw from the scholarship of ecological scholars in rhetoric

and composition with the intention of being respectful to the people who have been practicing knowledge production through relationships with living systems for thousands of years.

Since the 1980s, ecological approaches to rhetoric and composition have focused on examining the networks of scholarship and the social concerns which contribute to a piece of writing (Cooper; Edbauer). Writing is approached as a collective process instead of an individual one and as a process embedded in place. Ecological approaches to rhetoric take into account social context, tools, technologies, as well as objects and materiality, and they consider how "writers interact to form systems" which are "inherently dynamic" and "constantly changing" (Wells et al. 14). This thesis draws from scholarship which constitutes multispecies ecologies as rhetorical actors, as co-participants in writing and research processes.

In addition to the analysis of texts, arguments, tools, and technologies, an ecological approach to rhetoric looks at places where persuasion happens in "connections among species through distribution patterns, migrations, trophic relationships, energy fluxes...and how those connections are stitched together and held apart in various places and times" (Druschke and Rai 198). This approach is useful to answering the questions for this thesis because it permits considering the relationships of a living ecology and how human language practices impact those relationships in situated places and times. This approach to rhetoric opens the possibility to examine—and to think-with—the systems-thinking work of biological, chemical, and material living processes. A focus on the agentive forces material interactions create illustrates how knowledge is not only elicited in the brain—and the human brain—but through evolved biological and earth systems interactions too. The transition from analysis of linguistic social networks to material and linguistic networks shifts a focus from human relationships to the importance of interspecies relationships. The focus becomes how we build meaning, places,

ways of inhabiting and relating, together. Instead of considering how a singular work of writing, language, or speech is persuasive, rhetoric here draws from new materialisms to focus on the associations which draw an assemblage together.

Caroline Druschke and Candice Rai describe an assemblage as "a dynamic coming together of heterogeneous elements—semiotic and material, human and other-than-human, natural and built—into a multiplicity of relational ties" (198). For Druschke and Rai, these relational ties "establish particular orders, ways of being, strata, territories, and social imaginaries within places and times, all the while undergoing constant movement, reordering, mutation, and disintegration" (198). An ecological approach to rhetoric informed by new materialisms examines the associations that co-produce an assemblage and what causes associations to change in certain places and times. New materialisms consider how the actors of an assemblage are mobilized into relation and the factors which reorder or change those relations over time. An ecological approach to rhetoric informed by new materialisms works to resist the "modernist paradigm" that divides "the world into opposing spheres with humans/subject/culture on one side and things/objects/nature on the other" (Gries 5). Instead, ecological rhetorics investigate relations between objects, species, tools, human actors, to consider how associations enact or disjoin an assemblage, a collective, an event, and for the case of this thesis, an ecology. An ecological approach to rhetoric informed by new materialisms considers how humans, culture, things, objects, and nature are present in and compose each other's worlds.

By including actors who have historically been excluded from rhetorical practices, an ecological approach opens possibilities for mobilizing change around a greater range of actors' interests. This approach is important today to attend to asymmetries in power between humans and other species enacted through language practices and dominant value systems. A focus on

associations and relationships reorders the exigence of rhetorical scholarship to attend to webs of relations and how a multiplicity of ways of knowing and being interact. Moreover, an ecological approach to rhetoric opens opportunities for recognizing the agency of species to act upon humans, and it opens opportunities for changing where and how knowledge is made and who is excluded, included, and rendered important in knowledge-building. An ecological approach to rhetoric is important to employ today in that it opens possibilities for building knowledge with other species and for attending to the relationships which co-constitute a livable world.

Employing a rhetorical approach informed by new materialisms allows me to consider the rhetorical activity and co-becoming of humans and kelp forests and to trace kelp's ability to produce and be impacted by multispecies relations. Rhetorical inquiry approached through new materialisms considers how actors are in a constant state of becoming through relations with other actors. In his article "On Sociology and STS," John Law explains that new materialisms analyze how "elements in a system are significant—and indeed achieve their form and character—only in relation to one another" (631). An actor is not fixed before interaction but is always becoming through interactions. Law continues describing a new materialist approach to social analysis by stating that "People, technologies, 'natural' phenomena, documents, non-human life forms, knowledges, social facts, collectivities and phenomena—all of these are relational effects, materials, being done in interaction" ("On Sociology" 632). As actors interact, they transform each other, rearrange space, alter what the other becomes and/or how the other understands. Drawing from new materialisms enables me to employ rhetoric to question how interactions in a kelp forest assemblage change what a kelp forest becomes and how kelp forests change what other actors become also.

New materialisms also change the scope of time a rhetorical event is understood within. By attending to the interacting nodes of a network, Jenny Edbauer describes rhetoric as unfolding, as "emergent," "contingent," and "distributed processes" (12-13). Tracing the actors in a multispecies assemblage entails considering a multiplicity of time frames distributed processes happen through. Anna Tsing writes about how, in a multispecies assemblage, "Each living thing remakes the world through seasonal pulses of growth, lifetime reproductive patterns, and geographies of expansion. Within a given species, too, there are multiple time-making projects, as organisms enlist each other and coordinate in making landscapes" (21). Thinking-with kelp forests in discourse practice opens opportunities for attending to seasonal pulses of growth, lifetime reproductive patterns, and the processes through which organisms interact to co-compose landscapes. An attention to a multiplicity of temporal patterns in discourse practice opens room for thinking-with and holding regard for a multiplicity of ways of engaging with and forming relations in the world. For the rest of this thesis, I use the phrase an ecological approach to rhetoric, which is meant to suggest an approach informed by new materialisms.

The scholarship this thesis draws from and works to add to in rhetoric and composition distributes agency among other species and humans to consider how other species and humans influence and are present in each other's lives. Additionally, to inform my analysis of conservation documents, this thesis draws from scholarship that asks how including other-than-human actors in conservation efforts can enact changes important for a greater range of actors in an ecology. In the article "Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay," Michel Callon foregrounds the agency of scallops in resource decisions in a fishery in France. Callon examines power structures interlaid in social-science methods of analysis and considers where knowledge produced in interactions between

local fishermen and scallops can change the outcomes of decision-making processes (Callon). In their analysis of a coastal dam removal in New England, Caroline Druschke et al. also foreground the agency of migratory and resident fish in restoration decisions. This thesis draws from their analysis of how herring and brook, rainbow, and brown trout "are constrained to particular human-defined roles in dam removal" and how these constraints "fail to allow for [their] agency outside of human-trout relations" (Druschke et al.). Their analysis examines how fish are framed in documents, and they suggest the importance of opening possibilities for restoration managers to "co-create dam removal projects...through co-production of practices with fish themselves that allow for stochasticity and slipperiness" (Druschke et al.). The article traces an assemblage of actors to focus on "distributed agency and emergent practice: a making visible of the distribution of agency throughout a network to fish, other aquatic species, and rivers themselves who participate in, co-produce, and are co-produced by the practices that emerge from connections between fish, humans, rivers, institutions, policies, and more" (Druschke et al.).

This thesis draws from both articles to examine power relations enacted in the framing of kelp ecologies in scientific and conservation documents. Like these scholars, this research considers how centering kelp forests' agency can change the framing of marine conservation concerns to include associations between a greater range of human and other than human actors.

Embodied Orientations to Rhetorical Inquiry

To respond to the myriad climate changes happening today, scholars are also asking how embodied research practices open possibilities for building knowledge with living ecosystems. Bridie McGreavy works with clammers on the coast of Maine who are experiencing species shifts due to warming ocean temperatures and whose everyday engagements with the intertidal

zone attune them to these material changes. McGreavy writes that she observes how clammers' "sense-making" attunes them to "the variation in the fine-grained texture of the mud and how this composition and variation affects the clams" (89). Her research also attends to "the smell of the mudflat and the sounds that the mud makes" when the clammers move their hoes into "the mixture of rock, clay, sand, silt, shell, and organic matter" (89). These bodily attunements, for McGreavy, can help people remember relationships with ecologies and move people to mobilize around and with them. Similarly, in their fieldwork with river herring on the Missituk River, Caroline Druschke and Candice Rai write that sensing temperature flux, movement of tides, the smells of sediment change, and the feel of fish scales in their hands, opens opportunities for "co-participation" and opens opportunities to include a "more expansive array of co-creators" of knowledge (199). They suggest the importance of a "biophysically grounded" rhetoric that takes "an immersive orientation toward seeing, sensing, knowing in multiple, and perceiving the places and ways things, people, and events fold into and create each other" (216). These scholars include embodied attunements as meaningful components of knowledge production.

Forming rhetorical inquiries and developing meaning through sensory exchanges foregrounds the ability of species and environments to produce relations. These scholars note that embodied engagement with river herring and clams, with their changing environments, helps them to notice when, why, and how to form questions as researchers (Druschke and Rai 217). As a researcher, embodied interactions with kelp ecologies and ocean changes led me to ask questions about the actors who co-produce kelp forests and to ask questions about how humans are impacting those environmental factors. Embodied attunements to kelp forests made me remember relationships with marine ecologies and influenced when, why, and how I formed questions as a researcher. In this thesis, I experiment with how including the body in research

inquiries opens opportunities for thinking-with kelp ecosystems in knowledge-making and for attending to the needs of the myriad actors who co-compose a kelp ecosystem.

An Ecolinguistic Approach to Critical Discourse Analysis

This thesis uses critical discourse analysis (CDA) as a tool to examine how power hierarchies are created between humans and kelp ecologies in scientific discourse. For Norman Fairclough, CDA analyzes how "semiosis figures in the establishment, reproduction and change of unequal power relations (domination, marginalization, exclusion of some people by others) and in ideological processes, and how in more general terms it bears upon human 'well-being'" (231). This thesis extends analysis to include how ideological processes bear upon the planet's living ecologies and myriad living organisms beyond the human. It considers how language features enact unequal power relations between human beings and kelp ecologies.

Like an ecological approach to rhetoric, CDA "is a relational form of research in the sense that its primary focus is not on entities or individuals (in which [Fairclough] includes both things and persons) but on social relations" (3). Fairclough explains that discourse cannot be defined as an individual entity but must be approached through analysis of the relations influencing how it occurs. Discourse is informed by relations with "objects in the physical world, persons, power relations and institutions, which are interconnected elements in social activity or praxis" (3). Like an ecological approach to rhetoric, this approach to analysis considers the myriad social factors which influence what a text becomes. It also asks how discourse structures living conditions and social practices; it asks what discourse does for structuring relations in the world. Fairclough writes that by analyzing how asymmetrical power relations are enacted through discourse, CDA seeks to "contribute to changing" those social relations and discourse features (9). Its aim is to "transform aspects of social life" (9).

Fairclough outlines four main steps to doing critical discourse analysis. The first is analyzing "relations between semiosis and other social elements: between orders of discourse and other elements of social practices, between texts and other elements of events" (237). The second step is to select texts for analysis and to identify social obstacles to addressing the social wrong (237). The third step is to do interdiscursive and semiotic analysis of the texts (237). The fourth step identifies possibilities for changing the social wrong (237). This thesis draws from an ecolinguistic approach to CDA, which takes as its primary focus of analysis discourse impacting relations between humans and larger ecological systems (Stibbe 4). Arran Stibbe describes an ecolinguistic approach "which takes ecology literally, as the life-sustaining interactions of organisms (including humans) with other organisms and the natural environment" (4). Texts for analysis can be conservation documents and ecological studies, but they can also be any text which "through its omission of ecological consideration, can encourage people to behave in ways that are ecologically destructive" (4). This application of CDA is important today in that it seeks to enact social change by raising awareness about the role of language in ecological degradation.

Two articles structure this paper's use of an ecolinguistic approach to CDA. The articles consider how discourse features in conservation documents articulate agency and spatiotemporal scale. An analysis of agency and spatiotemporal scale are important to considering how each structures relations with kelp ecosystems and shapes conservation efforts. Katarzyna Molek-Kozakowska uses critical discourse analysis to examine "the lexical choices that are used to (under)specify and (under)present details of phenomena, agency and institutional practices" in popular scientific articles about climate change (73). She analyzes the linguistic choices that obscure the range of human and other-than-human actors responsible for and impacted by ecological events. In the articles, she notes how the agency to combat climate change is given to

scientific progress while individual actors are excluded from the texts as agents responsible for change. Fairclough ‘‘encourages analysts to be sensitive to absences from the text—the choices that were not made but might have been—as well as presences in it, as well as to weigh presences against possible alternatives” (237). To identify exclusions from a corpus of scientific reports, Molek-Kozakowska compares the articles with information from the World Meteorological Organization's “Statement on the status of the global climate in 2014” (3).

Drawing from Molek-Kozakowska’s work, this thesis analyzes language features that obscure the agency of actors in scientific and conservation discourse about kelp forests. Particularly, this thesis focuses on how the agency of kelp species are enacted or silenced through lexical features. From a network and process approach to an assemblage or text, myriad actors produce an event and are responsible for its becoming. Out of the many actors responsible for the loss of kelp forests and responsible for the co-becoming of kelp forests, I analyze which are featured or obscured and to what effect. I also analyze how discourse brings actors into association with each other or divides their connections. This is important to considering how discourse features enact relations between a kelp forest and other actors and important to considering how discourse features constitute interdependencies. To understand which actors are being included in or excluded from scientific and conservation discourse, I compare scientific articles about kelp deforestation with scientific texts about kelp ecology. To understand the actors responsible for the losses of kelp forests, I draw from scientific articles about the causes of the 2014-2016 North East Pacific marine heatwave. I also draw from embodied experiences with kelp ecologies to consider how sensory sign signals are excluded from texts and the implications of such erasure for drawing audiences into relation with kelp forests and for the ways responses to kelp deforestation are mobilized.

The second article important for this research guides an understanding of an analysis of spatiotemporal scale. This analysis is important to answering this paper's research questions in that it considers how spatiotemporal orientations constitute the scale and scope of restoration efforts. In "Climate Change and Transboundary Waters: A Study of Discourse in the Mekong River Commission" Andrea Gerlak and Susanne Schmeier analyze how scale is articulated in "short-term, immediate temporal horizons that are human-dominated and regionally based" (358). They define scale as "the spatial, temporal, quantitative, or analytical dimensions used to measure, rank, or study a phenomenon," and they study how scale is used to "frame problems and solutions, incorporate or exclude actors, and challenge or legitimize power asymmetries" (359). The authors ask how these framings of scale impact the actions taken around riparian conservation and the actors considered important in discussions of conservation. When conservation happens in "immediate temporal horizons," future generations and distant actors implicated in decision-making processes are excluded. Analyzing temporal scales through an assemblage approach draws associations between actors at "various spatial and temporal scales" (363). It asks for a more nuanced attention to temporal scales to include greater multiplicity of actors and to draw attention to interacting webs of connection.

Like Gerlak and Schmeier, this thesis considers how discursive framings of temporal scale structure and organize how kelp forest and marine conservation is understood. In conservation documents especially, scale constitutes the scope of restoration efforts and the frames of time actions are taken within. Temporal framings constitute associations in a web of relations, both foregrounding who is important and who is obscured from concern. Scale can attend to connections between living systems, or it can divide a component of a living system from the rest of its connected parts. Drawing from Gerlak and Schmeier, this research considers

how discursive features structure temporal scales in scientific and conservation documents with the purpose of examining how these features organize relations between present and future, between humans and kelp ecologies, between kelp ecologies and marine climate changes.

Thinking-With Multispecies Studies

Like an ecological approach to rhetoric, multispecies studies consider how actors are always co-becoming through relation, but multispecies scholarship foregrounds the importance of attending to practices that enable organisms to continue co-becoming. Multispecies scholarship responds to ecological degradation by focusing research on relationships between species and between humans (and social practices, cultural practices, histories, power structures) and other species. A focus on the precarity of co-becoming today evokes the importance of practicing attentiveness to the assemblages which co-constitute others' wellbeing. For Thomas Van Dooren, Eben Kirksey, and Ursula Münster, "Multispecies relationality tuned to the temporal and semiotic registers makes evident a lively world in which being is always becoming, becoming is always becoming-with" (2). To an ecological approach to rhetoric, multispecies scholarship adds a consequentiality to concerns of co-becoming and a focus on relational practices which cultivate ongoing life for a diversity of species. This research draws from multispecies studies' focus on how living organisms "bring one another into being through entangled relations" and how human practices are entangled with these relations (Dooren, Kirksey, and Münster 3).

Multispecies approaches to research arise from the intersections of feminist science and science and technology studies (STS), where research critically examines how epistemic nature-culture boundaries are drawn (Kirksey and Helmreich). Maria Puig de la Bellacasa writes that "social studies of science and technology were established on the idea that sciences and

technologies are not simply used or misused by socio-political interests *after* the hardware is stabilized in aseptic 'neutral' labs" ("Matters of Care" 86). Science and technology studies examine how methods, theories, and technologies used in research produce relations and produce power structures. In considering a body of research, a study, or a fact, STS scholars highlight the importance of asking "what kind of social relations are assumed to be desirable...whose interests are represented, whose labours are erased, and who or what is or is not counted or assembled here and why?" ("Matters of Care" 93). By asking these questions, researchers consider whose needs are accounted for in a study and the power structures which shape inclusions and exclusions. This thesis considers who is assembled in scientific discourse and research practices and what social relations are assumed to be desirable. It also asks how including kelp forests in knowledge production can change social relations to account for the interests of a broadened assemblage of actors.

Multispecies scholars consider how changes in research practices might attend to the ongoing livability of the planet for a more diverse range of actors. One of the ways they change research practices to engage a greater range of actors is to collaborate with other species in forming research inquiries and in forming methods to do analysis work. In response to planetary climate concerns, multispecies scholarship not only illuminates the repercussions of objectifying living beings in research, it centers relations between species as openings for questions to be posed, for research inquiries to begin. Researchers form inquiries by asking questions about interspecies relations and by posing questions through attention to how bodies are responsive to each other (Despret; Haraway; Tsing). Collaborating with other species expands the range of lives who benefit from a research study, and this is exigent today to build solutions which recognize and value the importance of biodiverse flourishing. For Donna Haraway, these

collaborations are important in that they strengthen responsibilities between actors. Strengthened responsibility is especially important for human actors, who wield a disproportionate ability to cause damage to living systems. For Haraway, collaborations create stories which strengthen "a muscle critical for caring about flourishing" (*Staying with* 29). Similarly, this thesis asks how positioning kelp forests as rhetorical actors in discourse practice opens opportunities for thinking-with kelp forests and for strengthening muscles critical for caring about their multispecies flourishing.

Multispecies studies focus on the exigence of fostering interspecies interrelations important to ongoing life on earth. Haraway's term *becoming-with* offers a tool to think-with these interrelations. Becoming-with happens when "partners" are "rendered capable" as they "become who and what they are in relational material-semiotic worlding" (*Staying with* 13). Becoming-with others highlights how no one entity exists outside of complex systems of interrelations. Through time, actors do not and cannot become separate from others; they become-with others and through others. A focus on *with* highlights a conjunction, a partnership, and it shifts the ability for individual becoming or growth. In the face of climate change, in discourse practice, placing value on processes of co-becoming is important to engaging audiences with practices of regard for interrelationship. Recognizing how humans become-with also entails questions of how humans render other species capable, agentive, exigent to ongoing life. Attention to the connections which enable life to be ongoing can also show where human actions block networks of ongoing life.

Thinking-with is a component of becoming-with, which means to think in a way that "stay[s] with the naturalcultural multispecies trouble on earth" (*Staying with* 40). Thinking-with does not mean thinking for but rather thinking with regard for what matters for another in mind.

Haraway writes that "what used to be called nature has erupted into ordinary human affairs, and vice versa, in such a way and with such permanence as to change fundamentally means and prospects for going on, including going on at all" (*Staying With* 40). To think-with means thinking about how actors become-with and how actors render each other capable of ongoing living or not. An ecological approach to rhetoric is a useful way to think-with the range of actors who "compose and sustain what is and will be" in a situated ecology or assemblage (*Staying With* 42). An ecological approach to rhetoric opens opportunities to examine how a range of "naturalcultural" actors together change opportunities for situated and dispersed ongoing life.

Multispecies studies add to this research with its attention to the relations that enable life to continue co-becoming. Thinking-with kelp forests in research practices and scientific discourse opens opportunities for attending to the co-becoming of kelp and the many actors who co-become with and co-compose a kelp forest. Attending to interrelationship within a kelp forest opens opportunities for thinking-with interrelations, for noticing how all co-becoming is emergent from multispecies interactions.

Umwelt and Living Thought: Tools to Attune to More than Human Communication

While communication practices across species are necessarily different, recognizing that all organisms also create meaning through environmental interactions is important for the field of rhetoric in particular. The field of rhetoric has historically excluded non-linguistic forms of knowledge-making. This has implications for what types of knowledge are valued and *whose* knowledge-building practices are valued. Valuing Western literacy and the reasoning capacities of the human mind over all other means of knowledge production devalues ways of knowing developed through relationships with the earth. Of research practices with other species, Despret writes, "Observers keep distance: distance, of course, cannot be measured in feet and inches; it is

a cognitive and relational perspective" (67). Attuning to material, chemical, and sensory exchanges between species as communicative exchanges opens opportunities for researchers to notice what matters for other species, to build multispecies connections through listening in different ways. Learning to value how others build relations can help humans recognize how to act to attend to consequential co-becoming with others. This section considers how biosemiotics is important to recognizing the agency of other species to create relations and how it offers tools for attending to what matters for other species' co-becoming.

Biosemiotics is the understanding that all life is constituted through exchanges of signs. Dorion Sagan suggests the importance of recognizing the role of interspecies biocommunication within a thermodynamic context (Uexküll 19). By recognizing the nuances of olfactory, tactile, sensory, and embodied interactions between species as acts of communication, Sagan suggests one can notice how the earth's systems work together towards an interconnected regulating whole (Uexküll 19). While each species perceives through their own spatiotemporal understandings, each also understands the world through registers of light, space, smell, movement, touch, through engagement with an environment. Species make meaning and respond through signifying exchanges with an environment. Sagan suggests that recognizing exchanges of signs as acts of meaning-making is important to expanding Western capacities for understanding the planet we inhabit and how to form relations in it in less destructive ways.

Understanding biosemiotic interactions as productive of ecologies is important to deepening understandings of place. Jakob Johann Freiherr von Uexküll was a biologist who studied animal behavior studies and the cybernetics of life, and who created the notion of umwelt, "a given animal's perceptual life world" (2). Umwelt emphasizes the subjectivity of each part of an ecosystem, illuminating how purposeful behaviors and sensory data create

relationships within an environment where meaning is made to produce a larger working system. Each species' umwelt, "in which it evolves and learns to interpret the signs relevant to its interactions with its environment," is a part of a larger semiotic web which is the planet (Adams 57).

Uexküll delineates perception into different signaling registers: effect space, tactile space, and visual space. Each species forms relations through and perceives effect, tactile, and visual space through different registers. The spatial coordinates through which bodies move directionally, the registers through which one touches and senses place, and how one visually registers color, light, depth, and surfaces all vary between species and environmental interactions. As well, Uexküll shows how time is environmental and produced by subject understanding. Each living organism registers time within their own frame, depending on the signaling registers above. Recognizing the variety of visual, tactile, and olfactory perception marks and coordinate systems through which living beings respond to and interact with their environment illuminates how place "emerges out of dynamic interconnections among different scales" (Adams 55). Place is also co-composed through these interacting signaling registers.

An example of umwelt Uexküll describes is the perceptual world of a tick. When a tick smells the butyric acid given off by the skin gland of a mammal, a chemical perception sign signals for the tick to release its legs from its perch (50). When a tick lands on a mammal, it responds to the tactile body and knows to search for a spot of hairless skin where temperature signals for the tick to puncture skin (50). Uexküll uses this example to illustrate how "among the hundreds of effects that emanate from the mammal's body, only three become feature carriers for the tick" (50). Three features and three effect marks make up the tick's environment and they are engendered through "the subject's perception signs and the object's stimulus" (51). This example

illustrates the possible heterogeneity of the subjectivity of every living organism. In this thesis, Uexküll's concept of umwelt offers a tool to consider the perceptual world of a kelp forest—the sign signals it responds to in order to co-become. Understanding the sign exchanges kelp forests produce for other species as meaning-making interactions also shows how kelp generate relations, how they are agentive in creating perceptual worlds and signifiers of response in marine ecologies.

Eduardo Kohn similarly considers semiosis as living processes of interaction, and he illustrates how recognizing what he describes as living sign systems, or "living thoughts," changes how one understands the world around them. He writes that "the origins of life...also necessarily marks the origins of semiosis and of self," as well as the "origins of thought" (77). He highlights how living organisms are emergent from responses to environmental factors and writes "selfhood emerges from within this semiotic dynamic as the outcome of a process that produces a new sign that interprets the prior one" (75). Living thought adds dimension to ecological and multispecies approaches to rhetoric in that a kelp ecology is co-produced through meaning-making exchanges. Kohn writes, "The semiotic quality of life—the fact that the forms life takes are the product of how living selves represent the world around them—structures the tropical ecosystem" (78). Considering the semiotic quality of a kelp forest similarly illustrates how life thinks in interconnections; it illustrates the diversity of meaning-making exchanges fostered by a kelp forest. The diversity of relations in Kohn's tropical ecosystem and in a kelp forest show how ecosystems think through relationship.

Attuning to how environmental factors matter for other species allows humans to better take "an imaginative leap into the inhuman dimensions of subjectivity and...interrogate what the world is asking of us and how it is asking" (Adams 54). Recognizing that meaning is made

through sensory communication asks humans to listen through embodied practices for what is important in another species' understanding of the world. For Despret, responsibility means "Making the body available for the response of another being" (70). Recognizing communication as tactile and sensory interaction opens room for researchers to think-with other species, to understand how to respond to what another being needs. Attuning to how bodies co-constitute each other through exchanges of living sign systems and how communicative practices produce ecologies can open abilities to understand interdependencies and interrelations. Umwelt and living thought offer tools to think and become-with others in more just ways, to create relational logics which work to sustain connections.

Drawing from Kohn's concept of living thought, I attune to how kelp forests think through movement and ask how this moving thought can reorient the temporal scales research and meaning-making practices are grounded in. In the critical discourse analysis of conservation and scientific texts, I compare the temporal framings of texts with the moving thought of kelp to consider how movement opens possibilities for engaging a wider range of actors in conservation responses and for drawing audiences into relation with kelp in scientific texts. In the rhetorical analysis, I consider how sensory communication is framed or excluded from discourse, and I query how it can be added to discourse to create a more relational "cognitive perspective" with kelp ecologies (Despret 67).

Methodological Approach

This thesis draws from grounded theory methodology to answer the primary research questions for this paper. Anselm Strauss and Juliet Corbin write that grounded theory "is a general methodology for developing theory that is grounded in data systematically gathered and analyzed. Theory evolves during actual research, and it does this through continuous interplay between analysis and data collection" (273). This approach is consistent with the theoretical framework for this research because it also works from an understanding that the world is continually changing through interactions. The data set this paper analyzes and the tools it uses for analysis were developed by reading data in comparison to the research questions and adjusting data use and theoretical tools through comparative analysis.

In the initial stages of this research, I collected data to answer the primary research question for this paper about how kelp ecosystems inform understandings of interrelations and inform knowledge practices. To create a manageable and emplaced scope for this research, I primarily considered conversations about kelp ecosystems happening on the coastline of California. In response to climate changes and the loss of kelp forests north of San Francisco, I was curious to see how actors are mobilizing around care for kelp ecosystems. Some of the data I analyzed and collected in this initial search were art installations about marine concerns and kelp ecology, citizen scientist monitoring of kelp, kelp restoration efforts, and kelp mariculture. Analyzing this set of data showed that few language features express how kelp enact relations with human actors and influence how they engage with the world.

I also looked for information about the cultural uses of kelp in the traditions of the Northern Chumash, the Hopland Band of Pomo Indians, and the Amah Mutsun Tribal Band.

Through this search, I found discussions of the loss of abalone as a cultural and spiritual loss of connection for the Northern Chumash and the Hopland Band of Pomo Indians (Krol; Leskiw). I also learned about a research initiative between the Amah Mutsun Tribal Band and the University of California Berkeley. The initiative is working to dig at archaeological sites to restore information about the Amah Mutsun Tribal Band's practices of traditional marine stewardship through harvesting seaweed and shellfish (Grone). The initiative between Berkeley and the Amah Mutsun Tribal Band is an effort to restore practices lost during the Spanish mission period wherein cultural and spiritual practices with marine organisms and living ecologies were devalued and erased (Grone). I found that further in-depth research and outreach was necessary to learn about traditional ecological knowledge of kelp forests within the emplaced scope of this research. Because of the time frame I was working within and the scope of this research, I decided to change my approach.

Because of these findings, the focus of my research changed to address the second research question for this project, about how discourse impacts relations with kelp ecosystems. To answer this research question, I chose to focus on how scientific discourse constitutes kelp ecologies. Analyzing scientific discourse is important to answering the research questions for this paper because it communicates original studies about kelp and structures foundational knowledge about their ecosystems. Scientific discourse also influences policy and conservation decisions around marine protections and informs everyday understandings about kelp forests. The data set for this paper focuses on scientific discussions around giant and bull kelp on the northern coast of California and particularly on discussions around the bull kelp losses and recovery efforts initiated in 2018. This data set allows me to consider how relationships with kelp are enacted in discourse and how constitutions impact the mobilizations happening to

restore kelp forests. In addition to data about the losses and recovery efforts, I analyze discourse about kelp ecology and biology and a plan to mitigate ocean acidification through the deployment of living systems. Below is a description about each of these texts and why they are important to answering this project's research questions.

The first scientific text I analyze is the *Biology and Ecology of Giant Kelp Forests* by David Schiel and Michael Foster. I analyze sections from this text, published in 2015, because of the breadth of scope it covers as a seminal literature review constructing current discourse about kelp ecologies for its proposed audience of students, researchers, and coastal managers. Because the text is about giant kelp, it offers information about emplaced case studies on the north coast of California where giant kelp is prevalent. This text provides foundational knowledge about scientific studies that can inform further research practices and coastal management decisions. While there are other textbooks about kelp ecology and biology, I chose to analyze this text because of its focus on giant kelp, the breadth of information it covers, and its recent publication date.

The second scientific text I analyze, "Marine heatwave and multiple stressors tip bull kelp forests to sea urchin barrens," was published in October 2019 by Laura Rogers-Bennet and Cynthia Catton, researchers with the University of California Davis Bodega Marine Laboratory. The article describes the climate stressors driving shifts in historically robust kelp forests to urchin barrens in northern California. This article is important to analyze because it is the main research article addressing the kelp forest losses from the 2014-2016 marine heatwave. Rogers-Bennett and Catton's research is also largely cited by popular press articles about the kelp forest losses. Their article structures how audiences understand kelp forests and the myriad actors

impacting the losses. Further, the article structures who the losses are important for and why, thereby influencing how audiences are drawn into association with kelp forests.

The two conservation documents I analyze are the *Sonoma-Mendocino Bull Kelp Recovery Plan* and the *State of California Ocean Acidification Plan*. In 2018, in response to the shift from historically prevalent kelp forests to urchin barrens, a Kelp Recovery Working Group was established in partnership with the California Department of Fish and Wildlife to facilitate management and recovery of bull kelp forests (Hohman et al. 1). The group was a collective of scientists from government agencies and universities, tribal band members, fishery associations, and nonprofit outreach groups. The *Sonoma-Mendocino Bull Kelp Recovery Plan* is a synthesis of their aim to "develop recommendations for monitoring and research, community engagement, and a selection process for restoration sites to facilitate management and recovery of bull kelp forests" (Hohman et al. 1). This text is important to analyze to answer the research questions for this thesis in that its constitutions of kelp forests mobilize certain recovery actions. I chose to analyze this document because it articulates recovery efforts from a range of stakeholders impacted by the losses and illustrates who is involved in the recovery efforts. This document offers a situated constitution of who kelp forests are important to and understandings about what can be done to foster restoration.

The *State of California Ocean Acidification Plan* was created by the California Ocean Protection Council and the California Ocean Science Trust to outline a ten-year plan of conservation actions to mitigate ocean acidification. The plan was "developed within the framework of the International Alliance to Combat Ocean Acidification (OA Alliance), a global partnership founded in 2016 to assist governments in taking meaningful action to anticipate, mitigate, and adapt to the significant changes to the chemistry of the world's oceans that are now

occurring as a result of carbon dioxide (CO2) emissions and other contributors" (Chornesky et al. 1). The proposed audience for the plan is public organizations, members of the private sector, and scientific communities (Chornesky et al. 1). A document about relationships between marine health and kelp forests is important to this research because it shows how kelp forests are understood and valued in relationship to a wider scope of marine concerns. This document constitutes how living systems are valued in relationship to climate changes today. I selected this document to analyze because it shows the importance of living systems to addressing a pressing planetary concern. It is also one of the main contemporary plans I found describing relationships between marine conservation efforts and kelp forests.

Critical discourse analysis is a meaningful tool to analyze these documents with because of its focus on power structures and social relations. In this research, I consider how language features in the scientific discourse community pose challenges to noticing interrelations with other species and ecosystems. The purpose of this analysis is to ask how research practices and discourse can open ways for understanding kelp ecosystems as agentive and relation-building. The purpose is also to query how language can draw audiences into association with kelp forests in more relational ways. The intention of this analysis is not to question scientific research or to say that it is not important but only to ask how it can constitute relations differently with consequences for how marine ecosystems are acted towards. It is reasonable to expect that scientists are constrained by genre expectations that sanitize discourse of personal relations, emotional attachments, and place connections. These conventions are expected by and appeal to other members of a scientific discourse community. It is my hope that a greater attentiveness to the wellbeing of other species and a greater awareness of the violence of human exceptionalism might lead to a shift in discourse conventions over time.

Critical discourse analysis allows me to consider how power hierarchies are enacted between humans and kelp. However, relationships between entities necessarily entail asymmetry. Through this analysis, I do not mean to suggest relations can become symmetrical, rather, I consider possibilities for attending to relations with others through regard and respect for how lives co-become through relationship.

In the analysis of scientific discourse, this thesis draws from Annemarie Mol's scholarship in *The Body Multiple* to consider how discourse and scientific practices produce realities. Then, this thesis considers how an ecological approach to rhetoric draws attention to the multiplicity of realities scientific discourse acts upon and might think-with regard for. In *After Method*, John Law examines how research methods work to produce a singular reality. He writes that "method, as we usually imagine it, is a system for offering more or less bankable guarantees. It hopes to guide us more or less quickly and securely to our destination, a destination that is taken to be knowledge about the processes at work in a single world" (*After Method* 9). Instead, in the text, he works to "subvert method by helping to remake methods...by escaping the postulate of singularity, and responding creatively to a world that is taken to be composed of an excess of generative forces and relations" (*After Method* 9). Drawing from Mol and Law, I consider how changing discourse practices and methods for knowing kelp forests opens opportunities for realities to attend to and value multiplicity and interrelation.

This analysis is not comprehensive. I analyze the discourse features to consider which are representative of the ways discourse impacts relationships with ecosystems. In particular, I consider where cognitive distance and hierarchies are created between kelp and humans and where kelp's agency and sensory forms of making meaning are obscured. These points of analysis are interpretations of patterns of interaction between actors (Strauss and Corbin 280).

This research is largely based in interpretation as I am drawing from my own experiences with kelp forests to consider how they produce relations and draw others (rockfish, seabirds, invertebrates, seals, human actors) into association. Drawing from grounded theory, this thesis works from an understanding that all knowledge is constructed, and in this research, I position myself as a tracer and interpretant of kelp's rhetorical actions and of a kelp forest's networked assemblage. Co-producing knowledge with kelp, or any other species, is always a partial and interpretative process, but co-producing knowledge with other species opens room to "ask how specific worldings come to matter, and to matter differently, for given beings (Van Dooren, Kirksey, Münster 13). Van Dooren, Kirksey, and Münster write that attending to the specificity of other species is important to "multiplying differences and modes of attention" (13). Attending to differences in perspective in knowledge-building opens opportunities for disrupting the singular reality Law suggests certain methodologies produce, which often enact hierarchies over other species.

In addition to critical discourse analysis, this paper applies a sensitizing lens of care to the analysis of scientific discourse features. Feminist science and technology scholars use an ethics of care to trace where what matters for a primary object/subject of care—which here is kelp—is included in or excluded from a text or set of practices (Krzywoszynska 4). Both discourse analysis and an ethics of care consider exclusions and systems of power, but care attunes to practices which "make living better in interdependence, maintaining and repairing a world so that humans and non-humans can live in it as well as possible in a complex life-sustaining web" (Krzywoszynska 4). An ethics of care draws from a relational ethics in feminist science and technology studies, which considers how humans, materialities, and other species are mundanely and consequentially interdependent with each other (*When Species* 71). Attentiveness is a

practice of an ethics of care that traces "a concern for the interrelations between the primary object/subject of care and other entities and processes on which the wellbeing of this primary object/subject depends" (Krzywoszynska 4). This thesis employs an ethics of care to read for the discourse features which obscure the myriad entities and processes which co-produce a kelp ecology. I consider how a reconfiguring of care for kelp forests in discourse practices draws attention to the myriad entities and processes which co-produce a kelp forest and attention to the human practices which impact those needs.

To consider the first research question through a different perspective, I use an ecological approach to rhetoric to trace the myriad actors who co-compose a kelp ecosystem. Through this tracing, I consider how kelp forests illustrate the importance of interrelationship to co-becoming. I read the findings from the critical discourse analysis to consider how thinking-with kelp forests opens opportunities for approaching research and discourse practices with attention to webs of relation. Adding biosemiotics to this tracing attends to the meaning created through material interactions and highlights how a kelp ecology co-becomes through exchanges of meaning. I also read the scientific discourse through my embodied experiences with kelp ecologies to consider where sensory sign exchanges open possibilities for thinking-with kelp in knowledge-making practices instead of thinking about kelp as an object of study. These analytic tools show the importance of interrelationship to habitat, refuge, and foraging grounds.

In places in this thesis, I use a narrative style of writing to experiment with how language can constitute kelp forests through more sensory registers. Configuring kelp forests through sensory description is one way opportunities might open for relating to kelp forests as agentive and relation-building. In these sections, I do not mean to suggest that one style of writing should be used—sensory versus objective—rather, my intention is to ask what possibilities are opened

when the senses are included in constitutions of kelp ecosystems. It is my intention to approach these inquiries with care and caution and with regard for the measures of scientific credibility objectivity allows for.

In this thesis, there are three central ways I consider how kelp forests attune researchers and audiences to interrelations. I suggest their forests attune others to nonlinear spatiotemporal time scales, sensory and material communication, and the co-producing exchanges of assemblages. These attunements might focus discourse and research practices on a multiplicity of perspectives and create opportunities for building worlds livable for a more diverse range of life today. By including the perspectives of a greater range of actors in a scientific discourse community, some of the asymmetries in power it produces might change.

Embodied Attunements and Responses to a Kelp Ecology

In this section, I consider how embodied attention to the ways kelp forests build relations have made me sensitive to interdependencies with marine ecologies. Through embodied experiences with kelp forests, I trace how kelp, as a rhetorical actor, have drawn me into association with nonlinear spatiotemporal scales, sensory forms of building relation, and the co-producing exchanges of assemblages. Throughout the analysis of this paper, I draw on these experiences of kelp as a rhetorical actor to consider how their forests can change ways of knowing, relating to, and building solutions with marine ecosystems.

This section largely draws from Donna Haraway's research about the importance of embodied communication to learning to respond to what matters for other species. Involving the body in this research, and developing its main inquiries from embodied experiences, is a way to resist what Despret describes as the "cognitive and relational perspective" of distance objectivity allows for (67). Haraway writes that what matters in research "is always inside connections that demand and enable response" (*When Species* 71). She writes that embodied encounters open opportunities to develop a capacity to respond to what matters for other species because touch and regard "pepper its partners with attachment sites for world making" (*When Species* 36). Like Haraway, I consider how "Touch, regard, looking back, becoming with—all these make us responsible in unpredictable ways for which worlds take shape" (*When Species* 36).

From the surface of the ocean, and especially within the water column of a kelp ecosystem, one of the first perceptible signs between kelp and environment is the movement of blades, gas bladders, and stipes with the motion of water and wind. Being in the ocean is being in constant movement and being in a kelp forest within the ocean is being cast within

relationships drawn together through constant movement. Stipes constantly lift and fall with surges of water while blades swirl and sway in the water column and where they lace the ocean's surface. This movement of blades shifts refracting light, so that water motion, stipe and blade undulation, and light interact. The movement of blades and stipe with water can be regarded as a living thought, as a way kelp respond to and make meaning through environmental exchanges (Kohn). Spending time in the water column of a kelp forest and watching their canopies constantly rise and fall from the surface of the water attuned my senses to a more rhythmic and cyclical sense of time.

In her fieldwork with clammers in Maine, McGreavy considers how attuning to cycles and rhythms—of tides, seasons, breathing, day, and night—"reconfigures a sense of the body in relation to the world" (109). She asks how attuning to rhythms reorganizes the present (109). In a kelp forest, the surge of canopies and blades in the water column attune one sensorially to the rhythms of the motion of water, the pull and push of tides, reconfiguring "a sense of the body in relation to the world" (109). Reconfiguring the body in relation to rhythm can engage researchers with a recursive attention to a material present. I argue the continual lift and fall of a kelp forest orients one to a recursive present that, in Haraway's terms, asks one to stay with the trouble (*Staying With* 1). Staying with the trouble, for Haraway, "requires learning to be truly present, not as a vanishing pivot between awful or edenic pasts and apocalyptic or salvific futures, but as mortal critters entwined in myriad unfinished configurations of places, times, matters, meanings" (*Staying With* 1). Movement as living thought draws attention to constant change and becoming, to unfinished configurations. The motion of a kelp forest is a continual process of growth and response to environmental factors of light and nutrients. Moving thought can also orient human perceptions to how marine organisms co-become with oceans through movement of water—

which correlates with movement of nutrients, light, and temperature—opening opportunities for thinking-with marine organisms in knowledge-building practices and responses to marine changes. Through sensory immersion in the rise and fall of a kelp forest, one is made aware of a multiplicity of temporal orders and interacting processes.

Throughout this research, I ask how sensory attunements to kelp's movement orient attention to the actions in the present which need to be taken to create possibilities for ongoing living in the face of "threatened absence" (*Staying With* 133). Orienting to how other species make meaning through mobility and in relation to water expands how researchers might ask and develop research inquiries that take what matters for a greater range of lives into account. Movement as living thought offers a way to reconfigure bodily attention to the present and to pose questions to the time frames marine organisms make meaning through. The movement of kelp sensorially orients bodies to rhythm and motion, to relations between kelp blades and wind, tides, and seasons. This temporal orientation offers a way to stay with the co-becoming interactions of the present and to attend to the contingencies of relations in the present.

Being immersed in the multiplicity of interspecies interactions in a kelp community further made me aware of how the ecosystem is a co-becoming and the variety of species kelp habitats are immediately important for. Seeing the biodiversity of life kelp provide refuge, feeding opportunities, and nursery grounds for made me aware of how kelp forests produce relations and the importance of kelp forests to marine life. Seeing the biodiversity of life kelp foster made me aware of the importance of multispecies interrelationship and fostered in me a sense of response-ability for healthy marine ecologies. Kelp forests have never been a singular entity for me but always a web of marine life. On surface canopies, herons, egrets, gulls, cormorants, often perch nearby otters who entangle with fronds, often cracking open sea urchins.

Seabirds dive into canopies to feed on fish. In the water column, rockfish float in the shade of kelp blades, and seals and sea lions feed on fish. Fish feed on kelp and grazers. Snails and abalone graze blades and stipes, and vibrant sea anemones, coralline algae, and coral polyps rise and fall with water motion on the seafloor.

This web of interacting marine life inflected the way I think with the oceans, with the "the myriad forms of relation that hold" together a kelp ecosystem ("A Trophic"). Immersion in a network peppers the perceptions, which imbue ways of understanding with regard for multiplicity. These material encounters with kelp ecosystems inform my understanding of how ecologies can reorient perceptions towards interrelation and how asking questions of material encounters can change research practices and inquiries to include the needs of a greater range of actors.

In addition to the co-producing exchanges of a kelp assemblage, immersion in a kelp forest also attuned me to sensory forms of building relation. In a kelp forest, I notice how fish camouflage with blades and how kelp canopies create shade for marine organisms. I notice how all species in the water column respond to surges in water motion. Kelp forests modify the movement of water, and the variety of species present in a kelp forest shows the habitat the remediation of water creates. Seabirds and otters use a kelp forest's entangled fronds as perches in the ocean. In a kelp forest, one can imagine the perceptual worlds of species who respond to light and water modification, to movement of blades and the smooth hold of their texture. One can see how the sensory changes between water movement, light, and the hold of a kelp blade create meaning species respond to. Moreover, joining a kelp forest changes my sensory and perceptual world. In a kelp forest, I must learn to respond to changes in water pressure, changes in light, to learn to see in a marine environment. Noticing how marine species move in a

saltwater medium and how they respond to shifting light teaches me how to move and to respond in the environment of a kelp forest. Immersion in a kelp forest made me aware of how my habitual perceptual world is one of an unknowable multiplicity.

Haraway writes that "response-ability is about both absence and presence, killing and nurturing, living and dying—and remembering who lives and who dies and how in the string figures of naturalcultural history" (*Staying With* 28). In the ocean in the morning I am often entangled in a kelp forest habitat, running my hands along their smooth blades and watching how wind pulls their fronds directionally. Like rockfish tucked into the shade of their fronds, I feel protected by kelp, encompassed within their canopies from wave energy and the pull of currents. Refracting light in the water column of kelp forests and the quiet in their understory wash me in wonder for noticing. Each morning for a span of years kelp have been a companion species for me, and so sensorially they are kin. Being kin with kelp means sharing kinship with ocean chemicals, nutrient cycling, light availability, grazing snails, fish that eat grazers, sea otters, microbial communities unseen. Learning of the extent of kelp community losses along the north coast was a biophysical response. Kelp made my body able to respond to their losses, to feel responsibility for their living and dying, for the human practices which infiltrate marine ecosystems, getting in the way of sensory signals and relation-building everywhere.

Recognizing sensory sign exchanges as forms of communication opens opportunities for thinking-with other species and for foregrounding the importance of interrelationship in knowledge-building. Embodied forms of relating also open a person to responsibility and care, which Puig de la Bellacasa describes as "the attention required to keep our knowledge aware of its connections and consequences" ("Matters of Care" 212).

Thinking-with Kelp in Scientific Discourse

Reconstituting Kelp Forests as Relation-Building

Including a greater range of actors in knowledge-making practices entails changing and examining the epistemic values linked to historic research standards. Many STS and rhetoric scholars are examining "truth-spots" (Gieryn) or sites where credible knowledge is made to change "the way we do science in pursuit of justice" (Sackey 144). Latour critiques the concept that "for the world to become knowable, it must become a laboratory" (*Pandora's Hope* 43), with selective tools and materials "let inside" which are "filtered, made manipulable, sanitized, and tamed" (Gieryn 5). Here, that which is let into a lab becomes exclusionary, molded to a set of predetermined standards. Gwen Ottinger writes that scientific "standards then become forceful contributors to the structure of power relations; for example, they act to distribute agency among human and nonhuman actors and help determine who can and cannot participate in scientific study and policy debates" (249). Rhetorical scholars argue specialized language is a selectivizing tool that gatekeeps where knowledge is made and by who (Sackey; Ríos). Including embodied communication—between researchers and other organisms and between other organisms and environments—in meaning-making practices might open room to include a greater range of actors in knowledge production and especially other-than-human actors. In order to co-become in ways that are just for a greater range of living beings, researchers might change the spaces where knowledge is created, the actors it is created with, and the communicative devices it is developed through.

In *The Biology and Ecology of Giant Kelp Forests,* the main discourse features I analyze are a lens of objectivity and fixed verb phrases. The first place kelp are identified as an object of

study is in the introduction to the text, which describes historical research about kelp forests. Schiel and Foster frame the context of the book as research observations about giant kelp forests, and they write that the purpose of the book is to describe the giant kelp forest environment to aid "others in studying, understanding, enjoying, and managing giant kelp communities" (xvi). They continue, "With plants reported up to 60m long growing from the seafloor and extending along the sea surface in lush canopies, these forests are true 'biogenic engineers' that provide extensive vertical habitat in a largely two-dimensional seascape, alter the light environment, and dampen water motion" (xv). Describing advancements in research since the advent of scuba diving technologies, Schiel and Foster write that "the considerable amount of research and monitoring in the 69 years since Andrews' time has provided information from which to glean a more comprehensive view of the biology and ecology of giant kelp, and the structuring forces that determine its production and abundance patterns" (xvi).

Using critical discourse analysis to examine power hierarchies in these discourse features shows that kelp forests are largely constituted as an object of study for humans. "With plants reported up to 60m long" frames kelp within the parameters of a report, within human study and observation. Agency is given to scientists here to provide information about kelp growth, and kelp are rendered as the object of the report which have been noted to grow to this length. The phrasing "has provided information from which to glean a more comprehensive view of the biology and ecology of giant kelp" further renders kelp an object of study and gives agency to the scientists researching kelp biology and ecology. This sentence sets up a relationship wherein studies over a period of time have been done for the purpose of learning more *about* kelp. Kelp forests are rendered passive actors to be acted upon and learned about instead of agentive of

relation-building and change. The distance created between kelp and humans through these discourse features enacts relational boundaries between humans and the object of study. Defining habitat-building interactions as machine-like—with the use of the term biogenic engineer—also reduces exchanges between species to means to achieve an end rather than communicative and relational exchanges. While the text follows scientific discourse conventions and while a lens of objectivity allows for less bias to enter knowledge-building, these discourse features also delimit the agency of kelp and humans to influence and be present in each other's lives.

An ethics of care is useful here to consider how relationships can be reconfigured to attend to the interdependencies of life on earth and to render kelp as actors in a responsive world (Krzywoszynska 3). For Puig de la Bellacasa, this re-configuration entails "the re-staging of things as lively" and opens room for actors to "translate what they transport, to redefine it, to redeploy it, and also to betray it" ("Matters of Care" 87). An ethics of care foregrounds how objects, things, other species, "transform the composition of the world" through interdependent relations ("Matters of Care" 88) and attends to "the needs of the Other as the starting point for what must be done" (Krzywoszynska 4). Through these approaches, kelp forests would be constituted as lively, interactive, and generative of knowledge, and the purpose of the text might take as its starting point the "webs of interrelations, connections, and dependencies that affect the life and well-being" of kelp forests (Krzywoszynska 4). Instead of positioning giant kelp as an object of study to learn about and to manage, through a lens of care, kelp would participate in knowledge-building and a text would work to engender relations between kelp forests and audiences.

What is important through an ethics of care becomes relations with kelp ecosystems and practices of attentiveness that enable their interconnections to be ongoing. Not only is care a response to the bifurcation of meaning and matter, it also responds to the bifurcation of affect and knowledge production. Puig de la Bellacasa writes that care entangles researchers with matters of fact and "generates possibilities for other ways of relating and living, it connects things that are not supposed to reach across the bifurcation of consciousness, and transforms the ethico-political and affective perception of things by the way we represent them" ("Matters of Care" 99). A lens of objectivity constitutes a researcher as the observer and a kelp forest as the observed. They are constituted in separate worlds—the world of the sanitized laboratory and the world of a marine environment. Through a lens of care and an ecological approach to rhetoric, both the researcher and the kelp forest change what the other becomes. They are present in and change each other's worlds. Though a researcher necessarily responds to a kelp forest and is impacted by their marine environment, this emplaced site of exchange is excluded from an objective framework.

Positioning kelp forests as the agents of meaning-making and including embodied exchanges between kelp forests and researchers—making explicit how researchers are entangled with their research—in discourse practice might open opportunities for audiences to think-with kelp forests in everyday practices. These re-constitutions might illustrate how kelp forests are integral to co-composing marine and terrestrial environments. They would constitute a responsive reality that is constantly co-becoming through interaction rather than a reality wherein researcher and researched can function separately.

Kohn's concept of living thought also offers a tool to resist the objectification of research subjects in that it foregrounds the ability of all organisms to think and make meaning through

relations with their environments. A kelp forest's most important environmental sign signals are motion of water, salinity, temperature, and light and nutrient availability (Schiel and Foster 37-38). Using living thought as a tool to analyze these discourse features brings attention to how a species-rich community is produced though semiotic interactions. It brings attention to how the kelp stipe's growth to 60m and their lush canopies are a response to how giant kelp "understand the world around them" (Kohn 72). Canopy dimension and length of stipe growth are communicative responses to light, temperature, water motion, and nutrient availability. This approach gives subjectivity to kelp as an entity always co-becoming with other environmental factors. Through living thought, kelp becomes constituted as responsive and relation-building. Living-thought resists mechanistic thinking in that species make meaning through interactions with each other. Through interactions, they build and respond to each other's perceptual worlds.

Embodied research further opens opportunities for care and for attuning to the living thoughts of kelp forests. In her research with cup corals, Eva Hayward considers how touch enables the "senses [to be] amalgamated, superimposed" and how touch enables "cross-species reticulations and sites of solid-arity" (580). She asks how the "interplay of vision and touch" opens potential for knowledge-making between species and positions the senses as "indices of human-animal meetings" (580). Through embodied research practices, one's senses are amalgamated to the dimension of kelp forests and to what matters for them: light, temperature, salinity, water motion, grazers and feeders. In a kelp forest, one is also immersed in webs of interdependency and able to notice how kelp forests create opportunities for foraging and refuge, for nursery and shade. The pliancy of a kelp stipe as it rises and falls with the movement of water illustrates how kelp have evolved through semiotic interactions with water motion. Including these embodied research experiences in scientific discourse places value on the ability of kelp

forests to engender relations and responses in researchers. It would open opportunities for researchers to think-with kelp forests and to foreground how they notice kelp forests building relations and acting agentively to co-compose the world.

Approaching the scientific discourse above through an ethics of care, living thought, and embodied research practices opens opportunities for co-producing knowledge with kelp ecosystems. In discourse, these tools might constitute kelp as relation-building, communicative, as sensory. To conclude this portion of analysis, I consider ways to reconfigure kelp ecosystems as agentive in discourse practice. Schiel and Foster write "With plants reported up to 60m long growing from the seafloor and extending along the sea surface in lush canopies, these forests are true 'biogenic engineers' that provide extensive vertical habitat" (xv). This sentence could be rephrased to state that through interactions with their environment, kelp forests can grow up to 60 meters long. The term biogenic engineer could be replaced with a phrase that shows how kelp create and build an environment important for a range of other species. Haraway's conception of a companion species—"where who is/are to be in/of the world is constituted in intra-and-interaction" (13)—is useful here to configure community members as partners who render each other capable of becoming-with. Schiel and Foster also write that "the considerable amount of research and monitoring…has provided information from which to glean a more comprehensive view of the biology and ecology of giant kelp, and the structuring forces that determine its production and abundance patterns" (xvi). This sentence can be rephrased to state that years of research and monitoring have engendered greater understandings about the webs of relations that interact to co-compose giant kelp biology and ecology. Constituting kelp forests in these ways might change the interconnections through which audiences perceive and act towards marine ecosystems.

Schiel and Foster discuss the communities associated with kelp forests in four biogeographic areas in the text, and for the purpose of this research, I consider the discourse used in their section on Stillwater Cove in the North East Pacific. Because this section of the text introduces the communities which co-compose a kelp ecology, I use CDA to consider how discourse articulates relationships between actors. They write:

> Geniculate coralline algae, *Calliarthron* spp., form dense mats of entangled branches up to 10cm tall on the bottom surrounding the *Pterygophora* canopy and adjacent areas, and over extensive areas of nongeniculate (encrusting) corallines. *Cryptopleura Farlowiana* and other fleshy red algae can be abundant in spring, often as epiphytes on *Calliarthron*. Bryozoans, sponges, solitary corals, and sea anemones are common on steeply sloping vertical walls.
>
> A diverse suite of mobile animals occurs throughout Stillwater Cove. Turban snails (*Tegula* spp.) are extremely abundant, grazing on the benthos and on giant kelp plants throughout the water column and at the sea surface, as they do at other sites around Monterey Bay. High densities of small purple urchins are found in the coralline mats...Sea star diversity is high but only the bat star is abundant. Fish are abundant, especially juvenile rockfish, adult blue and kelp rockfishes, various surfperches, and greenlings.
> (Schiel and Foster 110-111)

They also introduce the presence of cormorants, gulls, herons, egrets, and harbor seals. In this section, I analyze the use of verb phrases describing the presence of species at Stillwater Cove. The phrases in this section I examine are "can be abundant," "are common on," "occurs throughout," "are found in," "is high," and "are abundant." These verbs suggest species occurrence and quantity without ties of relationship or contingency. This constitutes species as present separate from interrelations and environmental factors. Moreover, these verbs divide a species from its agency. The verbs describe the presence of species as fixed rather than evoking the actions and relations through which the species become and are present. A later section in the text describes how kelp forests are important for "settlement, recruitment dynamics, light adaptations, food provision, and habitat use" (163). However, introducing the presence of species

in a kelp forest community without also introducing relationships between species connotes that species occur, or happen to be, instead of elucidating that species *become* through trophic interactions.

An ecological approach to rhetoric attends to how things are always becoming through relation. An attention to becoming and process in discourse might raise audience awareness of the importance of attending to changes in practice which need to happen for interconnections to continue. An attention to co-becoming in discourse might attune audiences to the continual interactions through which life changes and becomes. An ecological approach to the verb phrases above asks *how* species are present in a kelp forest. It asks what species become through interactions with kelp forests. Puig de la Bellacasa suggests the importance of the "constant questioning as to what makes 'one'" ("Matters of Care" 200). An attention to relations between species in a kelp ecology might engender "a curiosity about the connected heterogeneities composing an entity, a body, a world, that troubles boundaries" ("Matters of Care" 200). She asks, "Why should our bodies end at the skin?" ("Matters of Care" 200). Applying this approach to the constitutions of species in a kelp ecology might foreground the heterogenous interactions through which any species becomes. Connecting species presence to trophic relations and environmental factors constitutes a reality where species become-with. Attending to the co-becoming of species draws attention to how light availability, nutrients, salinity, temperature, and water motion are important for kelp and for the species who co-become with kelp. A focus on becoming also highlights how these factors are variable. They are not always already present but are enacted through webs of complex relations. Thinking-with kelp means thinking with the myriad species who co-become with kelp and also thinking about the human ability to impact

nutrient cycling, salinity, temperature, and light availability. None of these variables are separate from each other, but rather in constant association.

For Tsing, "The question of how the varied species in a species assemblage influence each other—if at all—is never settled: some thwart (or eat) each other; others work together to make life possible; still others just happen to find themselves in the same place. Assemblages are open-ended gatherings. They allow us to ask about communal effects without assuming them" (23). Continuing, she writes "Ways of being are emergent effects of encounters...assemblages don't just gather lifeways; they make them" (23). Tsing's focus on open-endedness and emergence changes the above representation of a community through its foregrounding of interaction. A species assemblage is never settled, it is not fixed. She illustrates how constituting relations as fixed poses limitations to how audiences understand the co-constitution of species presence. Through an assemblage approach, species presence is emergent from encounters; an ecology does not gather but rather co-composes lifeways. An assemblage is always in process, and foregrounding process and interaction in discourse changes the multiplicity and dimension through which an audience understands what a kelp ecosystem is.

Using umwelt as a tool to consider how a kelp forest community can be constituted differently extends an assemblage approach further. It foregrounds how a multiplicity of organisms make meaning, and understand the world perceptually, through relations with each other. In the introduction to *A Foray into the Worlds of Animals and Humans*, Dorian Sagan writes that "focusing on one aspect of the environment, as science does to isolate objects for study, presents an abstracted, truncated version of the elements under study" (Uexküll 7). Each species' way of being is separated from the connections which enable it to live. This method of research constitutes individuals rather than relations. Sagan continues, "Uexküll's focus on

perceptions that lead to actions has a thermodynamic context because complex systems...appear only under certain conditions, which they implicitly recognize as signs. They do not appear when those physical conditions, which again act as signs, are not present" (11). An attention to these signs between species as communicative acts shows further how species co-constitute where and how each other are as well as how these interactions constitute and respond to the regulation of thermodynamics on the planet.

Approaching the discourse features through these analytic tools opens room for kelp forests to be rhetorical actors and to orient audiences to the importance of the co-producing exchanges of an assemblage. Instead of using the verb phrases "are common on," "occurs," "are abundant," and "are found," the discourse might highlight the relationships which enable a species to be present in a kelp ecosystem. Verbs which highlight agency and might be used to constitute species presence are grow, flourish, settle, create habitat with. These verbs suggest the liveliness of species and might be positioned in a sentence in relationship to the factors which enable a species to be a part of a kelp forest community. These reconfigurations might open opportunities to think-with kelp in knowledge-building to attend to the interrelationships which co-compose their ecologies.

Remembering Ourselves Ecological

In the article "Marine heatwave and multiple stressors tip bull kelp forest to sea urchin barrens" by Laura Rogers-Bennett and Cynthia Catton, I primarily analyze how kelp forests are constituted through relationships with species of economic value and how the losses are framed within terms of human valuation. These constitutions of kelp forests are important to analyze because they enact a framework of human exceptionalism, which influences how audiences relate to kelp forests and understand their responsibility for attending to interrelations with them.

After introducing the marine heatwave event, the article describes the impacts to kelp forests along the northern California coastline. Rogers-Bennet and Catton write that:

> Temperate kelp forests in northern California were particularly vulnerable to the [marine heatwave] and other concurrent ecological stressors. This region, which was historically very productive, supported robust fisheries including the recreational red abalone, *Haliotis rufescens*, fishery (valued at $44 M yr) as well as the commercial red sea urchin, *Mesocentrotus franciscanus*, fishery (valued at $3 M yr).
> (Rogers-Bennet and Catton 2019)

The two other species associated with kelp forests in the article are the purple urchin and the sunflower sea star, whose local extinction from a wasting disease in 2013 contributed to the increase in purple urchin populations. In the article, kelp forests are referred to as biodiversity hotspots, as habitat-forming species, and ecosystem engineers, but the variety of species who use kelp forests for foraging, refuge, and nursery habitat, are not specifically included or referenced.

Returning to an ethics of care here is helpful in thinking about how inclusions and exclusions shape power hierarchies present in discourse practices. In her work with soil care, Anna Krzywoszynska examines how human understandings of soil are developed through specific needs for land uses. She suggests posing questions to cultural definitions of soil to interrogate the value systems tied up in them (4). Rogers-Bennet and Catton constitute kelp forests in a way that appeals to audiences concerned with local economies dependent on them. While their discourse choices likely appeal to audiences to achieve a specific purpose, the discourse choices also enact hierarchies over kelp forests by constituting their value in terms of human benefit and use. The species whose lives do not have a monetary correlation are excluded from the text. If a reader has not spent time with kelp forests, and their companion seabirds, seals, species of fish, crustaceans, and understory flora, they will understand the losses in limited terms. The species losses correlating with the kelp forest declines are difficult to discern through these discourse features. By constituting kelp forests within an economic framework, the article

largely devalues marine life on its own terms and enacts a reality wherein human concerns are separate from and hold dominance over other living systems. Defining kelp ecosystems in a way that illustrates an expanding network of care might change relationships with kelp ecosystems and especially for those who have not spent time with a kelp ecology.

Like Law's consideration of how methods create a singular reality, discourse practice similarly enacts a singular reality here. A dominant paradigm is upheld in which value is measured through economic benefit. Even in a discussion of marine ecosystem losses, impacts to human concerns are foregrounded. Connections between kelp ecosystems and humans are also obscured in that the fisheries are recognized but not the livelihoods or sources of sustenance associated with them. Upholding this dominant epistemology enables the perpetuation of the devaluation of living organisms and a devaluation of connections between living systems and human wellbeing. An assemblage approach opens opportunities for constituting kelp ecosystems differently because of its focus on associations between actors. Further, in adding a lens of care, one thinks "from the perspective of the maintenance of a web of relations involved in the very possibility of ecosystems rather than only from their possible benefits to humans" ("Matters of Care" 11).

Instead of focusing on the monetary value of kelp forests, or in addition to the monetary value of kelp forests, an ecological approach to rhetoric would highlight how associations between actors co-compose a kelp ecosystem and how a kelp ecosystem produces relations for myriad actors. Kelp forests might be constituted as important for marine health and within a living systems framework in addition to being important for human economies. Constituting a kelp forest from the perspective of the maintenance of a web of relations that contribute to the possibility of an ecosystem would change the focus of the losses to address larger interacting

marine concerns. This perspective might shift the focus from a dominantly human perspective to a perspective which highlights how kelp ecosystems are interconnected with other organisms and ecological processes. Beyond mentioning the ecosystem services kelp forests provide for human actors, it is important to also place value on the interrelationships between kelp forests and marine organisms and ocean health. These inclusions constitute a reality wherein humans are encouraged to act with regard for interspecies relationships.

Another way to reconstitute kelp forests in discourse practice to configure kelp forests as rhetorical actors might be to render the dimensionality of their ecosystems. Constituting kelp forests as sensory and material actors might enact more resonant imagery of the ecosystems for readers. As well, describing the movement and interactions of a kelp forest might engage audiences with more rhythmic time scales. This reconstitution of kelp forests pushes against the objective conventions of a scientific discourse community. For this reason, including sensory language in scientific discourse could be a collaborative effort between scientists and writing studies scholars. McGreavy writes about rhetorical memory, remembering interdependencies with ecological systems, and responsiveness to environmental change in her article "Intertidal Poetry: Making Our Way Through Change." She asks how we can remember our way through planetary change and, in order to attune to "ecology as an ontology," considers the importance of using language that "interrelates with our sense perceptions through which we are drawn to actual experiences within myriad relations" (93). She asks how language can reorient spatiotemporal patternings and movement in ways that heighten chthonic attunements important for memory and understanding kairos, or when to act (93). For her, these language practices are important to disrupting the "aggressive material forgetting" of the present moment (102).

The objectivity and framing of losses within human concern for fisheries obscures the movement of kelp's living thought and the material losses of kelp forests. These framings obscure the ability for kelp to be present in minds and memories. One might argue that the constitutions of kelp forests in relation to monetary values contributes to the aggressive material forgetting McGreavy mentions. Language that interrelates with sense perceptions might evoke the surge and sway of kelp stipes and blades, might evoke their dimension and movement so that audiences can be drawn into experiences with them. Evoking the living thoughts of kelp as moving, as responsive, can help audiences remember the materiality and relation-building qualities of kelp ecosystems. Like McGreavy suggests, these constitutions might help actors remember themselves ecological; they might help actors understand the losses as a "discordant rhythm" (104). Discourse, used in this way, might draw actors into assemblages with kelp ecologies to act with attentiveness towards them. It might help actors recognize kairos and invoke response-ability. The language features above enable audiences to remain fixed on land, separate from. Kelp forests are not brought into the space one reads from.

A focus on associations between kelp and the species their forests provide refuge, foraging, and nursery grounds for, as well as a focus on associations between human cultural practices, sustenance, and livelihoods can alter how kelp forests are constituted and disrupt a dominant paradigm of valuation. In discourse practice, attuning to how kelp forests build relation can help audiences notice the importance of attending to the co-becoming exchanges "involved in the very possibility of ecosystems" ("Matters of Care" 11). An example of how to rephrase the constitutions of kelp forest losses to attend to interrelationship is: The losses of kelp forests along 350 kilometers of coastline are losses of habitat, foraging, and nursery grounds for a diversity of invertebrate, mammal, seabird and fish species. The losses are also losses of cultural connection

for many coastal people including fisher persons, indigenous peoples, divers, kelp harvesters, and more. The losses are not only losses *of* kelp but also losses of connection *to* and connection *with* refuge, sustenance, traditional practices, and sensory sign signals for myriad species. In addition to the losses of kelp forests, the losses can be recognized as an indication of changes to interconnections and interacting factors which co-compose marine relationships.

The article states the research about kelp ecosystem loss is important for addressing similar changes along the coastline where kelp forests are prevalent. The actors included in and excluded from this constitution of losses shape relations between kelp forests and readers, structuring who is mobilized around the losses and who the losses are important for. Rogers-Bennet and Catton write:

> Similar impacts seem to be developing in kelp forests from Baja California to Alaska (*personal communications*), so that the dynamics described from this northern California case will be critical for tracking and understanding the biological responses to these multiple climate-related stressors and resulting degradation of fisheries and other ecosystem services.
> (Rogers-Bennet and Catton 2019)

This discourse draws associations between the kelp forest losses, the studies being conducted about the losses and stressors, similar impacts along the coastline, and scientists and marine managers. The discourse shows that the studies and information about the losses are important for addressing similar changes along the coastline. However, the actors included in addressing the changes are limited by the discourse features in this section of text. If the discourse included steps a larger range of actors can take to respond to marine changes, community members might also be enrolled into a network of action and care. By including a wider range of actors in the text, relationships of care and regard for marine ecosystems might be strengthened. News sites (NPR, KQUED, the San Francisco Chronicle) share the information from this article for lay audiences, but the same constitutions of kelp and actor participation are rendered. The discourse

does not explicitly draw community members into thinking and acting-with kelp ecosystems because agency and concern are allocated to scientists and coastal managers. In addition to these key stakeholders, showing how the data is also important for lay audiences might extend a network of care for kelp forests consequentially.

Multispecies studies consider how collaborating with a multiplicity of actors opens opportunities to address a range of factors influencing a concern. Dooren, Kirksey, and Münster write that what the present moment demands are "detailed practices of attentiveness to the complex ways that we, all of us, become in consequential relationship with others" (3). Some ways they suggest scholars are addressing this concern is by considering how "colonialism, capitalism, and their associated unequal power relations play out within a broader web of life" (3). They also suggest reconsidering what counts as "conservation in our postnatural world" (3). These are concerns which arguably affect the wellbeing of kelp forests and which actors other than scientists and coastal managers might take part in addressing. Human practices—daily actions taken by individuals and collective actions taken by businesses, organizations, policies, and governmental structures—are entangled with the health of marine ecosystems. Encouraging a greater range of actors to think-with kelp ecosystems is arguably another component of marine conservation. Thinking-with kelp ecosystems can also mean thinking critically about ongoing colonial practices, capitalism, and the dominant power structures which support each. As Dooren, Kirksey, and Münster suggest, taking action to change these power structures and exploitive practices might be a postnatural way of enacting conservation efforts.

A way to encourage a greater range of actors to think-with kelp might be to include practical steps community members can take to practice stewardship for the oceans and the marine ecosystems which co-constitute their health. Transdisciplinary collaborations might open

room to address ways to counteract the intersections of capitalism, globalization, and colonial practice, which enact planetary harm and harm to kelp ecosystems. Adding a section which addresses connections between everyday practices, larger power structures, and marine ecosystems, would trace how a multiplicity of human, structural, and living systems actors influence what a kelp ecosystem becomes. This tracing might enroll a more complex network of actors into association with kelp forests and the myriad practices and factors which influence what a kelp ecosystem becomes. Reconfiguring discourse to enroll a greater range of audience members with practices of care for kelp forests might open opportunities for collectively addressing the intersections of environmental and social concerns today.

Opportunities to address systems of power in scientific articles are likely limited because research is linked to funding opportunities and value systems which influence funding. For this reason, again, collaborations between scientists and writing studies scholars might open opportunities for more complex naturalcultural networks to be addressed. Following is an experiment with what this section might look like in an article:

> The losses of kelp forest along the northern coast of California and the predicted increase in marine heatwaves are indicators of interconnected climate changes happening. Individuals, communities, and governments can make a difference in mitigating the advancement and scale of climate change to protect kelp forests and marine biodiversity. In order to mitigate the extent of possible changes, it is important that actors across different sectors of society work together to curb greenhouse gas emissions and to protect forests, oceans, and soil biodiversity to stabilize the earth's carbon cycle. These changes and protections mean critically examining one's own, a community's, a state's, and a country's carbon footprint and asking which sources contribute to that footprint and need to be changed. From renewable energy, to the built and material environments we live in, to transportation, and to agriculture and transport of food, everyday practices contribute to climate change and need to be reconfigured.
>
> Like ecologies, sectors of society are networks also, and individuals and communities can work together with legislatures, CEOs, businesses, farmers, to funnel support and to press for changes to me made. Tracing one's carbon footprint—in transportation and transportation of food, material items, and more—is a meaningful place to begin noting the impact one has on the planet. Tracing one's carbon footprint can also illuminate the

> capitalist, industrial, and globalized systems in place which contribute to fossil fuel consumption and extractive practices. Changes to these systems will require sustained and collective efforts, and so, to protect kelp forests and other marine ecosystems, it is exigent to begin critically examining how and where changes in practice can be made.

This chapter has considered how scientific discourse practices produce a particular reality, and it considered how an ethics of care, recognizing the perceptual worlds of kelp, and an ecological approach to rhetoric can position kelp as a rhetorical actor able to draw others into association with marine ecosystems. These reconstitutions are important to disrupting dominant hierarchies, which perpetuate cognitive distance from marine ecosystems, and they are important to developing practices of attentiveness to the interconnections which enable ongoing life.

Cultivating Response-ability in Conservation Discourse

This section analyzes documents about kelp forest restoration and marine conservation in California. In the analysis for these documents, I focus on how constitutions of restoration efforts shape an audience's response-ability for kelp ecosystems. Reading these documents through a sensitizing lens of care, I consider how discourse features constitute relationships between kelp forests, human actors, and ocean chemistry changes, and I consider how these constitutions shape understandings of and responses to current stressors facing marine ecosystems. For Haraway, cultivating response-ability means cultivating the ability to respond to others with regard and attention (*Staying With*). It also means cultivating the ability to be affected by what matters for others. Response-ability engenders ways of learning how to respond and "opening up possibilities for different kinds of responses" to others' wellbeing (Schrader 299). Despret suggests attunement to embodied encounters affects how we can listen and learn to respond (70). For Haraway, response-ability can be cultivated in the way stories are told and through the inheritance of stories listened to (*Staying With*). For these scholars, response-ability attends to practices that engender more livable multispecies worlds. Conservation discourse, which mobilizes stakeholders to take certain actions, is an important means to engender response-ability today.

Thinking-with Kelp Forests in Recovery Efforts

The *Sonoma-Mendocino Bull Kelp Recovery Plan* introduces and describes six main climatic and ecological stressors contributing to the losses of kelp forests: persistent marine heatwaves, sea star wasting syndrome, purple sea urchin population increase, sea otter extirpation, harmful algae blooms, and anthropogenic stressors. This list divides anthropogenic

stressors from each of the stressors listed before, when each of the events interacts with each other and most of the events are caused by human action. Each stressor is explained further in its own section in the document. Sea otter extirpation and anthropogenic stressors are the only sections which address how human actions have impacted the kelp forests. The section on persistent marine heatwaves reads:

> Extreme climate and weather events are increasing in frequency and duration due to climate change (Di Lorenzo and Mantua 2016). Studies of climate change on terrestrial ecosystems show that these events have dramatic impacts on ecosystem health and the services provided for society. However, there is a significant knowledge gap regarding marine ecosystems and the long-term impacts of persistent intense marine heatwaves. Satellite observations and Earth system model simulations show that the number of marine heatwave days doubled between 1982 and 2016 (Figure 8). In 2013, the Northeast Pacific Ocean (NPO) experienced the greatest Sea Surface Temperature (SST) anomaly, or marine heatwave, since the 1980s (Bond et al. 2015). The magnitude and intensity of this event led to it being termed "The Blob" and it persisted strongly over 711 days...The temperature anomaly was likely the compounding result of the persistent high-pressure ridge over the Northeast Pacific Ocean and the El Niño Southern Oscillation (ENSO) event. Marine heatwaves are predicted to increase in severity, duration and intensity due to climate change in the future (EMB Tools Network 2018). (Hohman et al. 13)

This section of text is useful to examine because it obscures human responsibility in the same way the sections on harmful algae blooms and purple urchin population increases do. The discourse in this section constitutes marine heatwaves as isolated from human action; instead, the East Pacific heatwave is tied to the high-pressure ridge and the El Niño Southern Oscillation event. This concealment of human responsibility from the primary stressor event focuses the scale of restoration efforts to localized actions. Though the audience for the document might be local actors involved in community restoration efforts, this framing of the causes of the losses is significant because it enacts a reality wherein audiences can understand themselves separate from ocean chemistry and the environmental factors which contribute to the health of a kelp forest. I argue this constitution hinders the ability for audiences to mobilize around the main

environmental factors important for kelp health, in addition to the localized efforts to reduce purple urchin populations and to preserve a local spore bank.

From an ecological approach to rhetoric and an ethics of care, restoring kelp ecosystems would also mean attending to a more extensive network of processes and interactions which enable kelp to co-become. Through an ecological approach to rhetoric, restoration efforts might also include attending to changes in ocean temperature, changes in salinity, and changes in nutrient cycling caused by heatwaves and ocean chemistry changes. Attuning to the associations which co-produce kelp forests means attuning to ocean chemistry health as a whole as well as ocean health in situated places. The factors which interact to co-produce kelp ecologies draw attention to interrelations with larger atmospheric cycles and with the interconnections of planetary systems. Addressing these factors would mean thinking-with kelp forests and other marine ecologies in daily practices as well as examining larger power structures, which perpetuate extractive practices, degrading land uses, and emissions. An ecological approach to this discourse shows how humans are impacting what kelp forests become, and it shows the exigence of thinking-with interrelations to enact change. In her article about the nonlinear time frame soil care asks for, Puig de la Bellacasa writes that she is interested in "moves that see soil as a multispecies world because these could affect not only the nature of soil itself but also the ways humans maintain, repair and foster soil's liveliness—that is, the agencies involved in a politics of care" ("Making Time" 12). The "ways humans maintain, repair and foster" kelp's liveliness might also change with more attention to the interrelations which enact kelp ecologies and of which humans are one. Involving a greater range of actors in restoration efforts can change what kelp forests become and their possibilities for co-becoming along other stretches of coastline.

This analysis works from an understanding that discourse constitutes realities. Though the authors of the recovery plan might be appealing to audiences enacting immediate and local recovery efforts, the discourse has implications for how kelp forests and marine life are understood and acted towards. I argue constituting humans as part of, as interconnected with, marine networks is important to a greater range of humans acting towards marine life with regard in everyday practices and thought processes. Highlighting interconnections with marine ecosystems in discourse practice will contribute to a reality wherein more humans recognize themselves intricately interconnected with marine ecosystems. Centering a kelp forest's agency in discourse can change the framing of marine conservation concerns to include associations between a greater range of human and other than human actors.

The next section of text I analyze addresses knowledge gaps and outlines recommendations for further research to be taken to inform recovery management. The section lays out seven strategies to inform kelp recovery management. The strategies are:

> (1) Development of a long-term kelp canopy monitoring program to characterize broad-scale and fine-scale kelp forest dynamics and restoration efficacy, making use of new technologies such as satellites and Unmanned Aerial Vehicles (UAVs); (2) Expedite the processing and analysis of satellite data for bull kelp canopy along the Sonoma and Mendocino counties' coastline; (3) Investigate characteristics that may confer persistence and resilience of kelp beds, such as lower urchin population densities, natural urchin barriers such as sand bars, exposure to waves and currents, and proximity to freshwater outputs; (4) Evaluate the potential for state-designated MPA network monitoring and other ecological monitoring efforts to understand kelp dynamics and recovery; (5) Conduct consistent monitoring to inform all ongoing and future recovery efforts; (6) Coordinate monitoring events and disseminate the information gathered from monitoring studies through existing websites of citizen science organizations such as Reef Check and Citizen Kelp; (7) Implement a kelp spore distribution study with settlement plates to determine extent of dispersal and survival to inform recovery efforts.
> (Hohman et al. xiii)

The discourse laying out these steps configures kelp in a relatively narrow way that limits an audience's ability to think-with kelp as an entity beyond an object to be monitored and

evaluated. These studies are crucial to learning more about how kelp respond to restoration efforts and are crucial to learning more about how to work with kelp in recovery efforts. However, configurations of kelp as an entity to be characterized, analyzed, evaluated, and monitored construct an expectation of "bankable guarantees" about what a kelp forest is and might be (*After Method* 9). The verbs suggest a reality that is assumed to be a "determinate set of discoverable entities and processes…That such is what the world is: a set of possibly discoverable processes" (*After Method* 9). The discourse does not leave or create space for kelp forests to respond in unexpected ways. It does not open room for other ways of knowing and responding to kelp forests. Adding a step or two that acknowledges the agency and indeterminacy of kelp forests would produce a reality wherein it is beneficial for humans to study and monitor kelp forests but wherein kelp forests are also regarded as an agentive and changing species. This small addition might work towards creating a community that understands kelp forests, marine ecosystems, and a greater range of other than human actors as collaborators and participants in knowledge making. Here I consider how making space for indeterminacy in research practices can open room for kelp to be recognized as co-participants in restoration efforts.

To consider how kelp might change decision-making about restoration efforts, I draw from Claire Waterton's research analyzing how posing questions to cyanobacteria and their environmental relations opens possibilities for policy decisions to respond to the needs of the actors present in a lake ecology (2). She references Astrid Schrader's work with *Pfiesteria* dinoflagellates and writes that "the experimental practices that were established to close what was perceived by policy as an uncertainty gap erased the essential ontological indeterminacy of *Pfiesteria*'s ways of being and doing, and so denied both researchers and the organism the

possibility of a response" (9). Here research practices close off the ability to recognize *Pfiesteria* as an actor in decision-making processes. Waterton suggests the importance of engaging with the ontological indeterminacies of actors important to an environmental concern, and she analyzes how a case study in England responds to the indeterminacies of cyanobacteria in forming questions and scientific experiments (3). The ontological indeterminacy of cyanobacteria shapes the research questions formed and the approaches to research about the lake ecology. The indeterminacy of how kelp might respond to the environmental changes in northern California might also shape the research questions formed and the approaches to research about kelp restoration. In the following analysis, I consider two ways indeterminacies can reconfigure research practices to open room for kelp to participate in knowledge-building. I consider how indeterminacy can change how researchers develop understandings with kelp forests and how kelp forests respond to their environment in indeterminate ways.

The guidelines for the watershed restoration project in England are useful to reference here because they provide an example of how discourse can foreground interconnections as the purpose of a research study and because the guidelines provide an example of how to work with indeterminacy in restoration processes. Waterton writes that the project was designed as a forum "where nature is not self-evident…where what is important is the creation of connections between people and things, where doubt and questioning is extended to our own representations" (8). The guidelines here illustrate how the framing of a study can open room for other than human actors to participate in research in unexpected ways, in ways that exceed the limits of representation and established research methods. Space is opened for *Pfiesteria* to be more than what research practices can discern, and the discourse resists the rendering of "nature/bodies/matters mute and incontestable" (*Politics of* 10). The discourse also illustrates

how relations can be foregrounded as a critical component of a study. This constitution of purpose can be seen as quite disparate from a study that seeks to characterize, evaluate, and monitor. The discourse reframes the ways researchers think about and encounter bodies (Waterton 4-5). The discourse laid out in the research forum offers an example of a way to question the stability of representations and a way to question how representations and methods for representing might get in the way of multispecies collaborations. Leaving room for indeterminacy in some aspects of research might open room for kelp to participate in research processes and to alter the scope or focus of efforts.

Water movement is important to all aspects of the "morphology, physiology, demography, and evolution of kelp," affecting the marine light environment, the transport and uptake of nutrients, blade morphology, herbivory, larval dispersal, and their settlement and recruitment dynamics (Schiel and Foster 61). Attuning to the constant rise and fall of kelp stipes and canopies with surges of water as a living thought, or a way kelp understand their environment, can extend the focus of restoration efforts to also attend to cycles, water motion, to salinity, stratification. Thinking-with kelp in these restoration efforts might additionally entail recognizing the indeterminacy of ocean health today and addressing the practices which contribute to warming waters. Attention to movement as a living thought, and engaging kelp as a rhetorical actor in restoration efforts, can open opportunities for restoration to think-with the indeterminacy of the present moment, to think-with the motion of water and also what stalls and changes its movements. Thinking-with the motion of kelp in restoration efforts might change possibilities for kelp and humans to collaborate to engender co-becoming within a longer time frame. In this section, I do not mean to suggest the research studies above should not happen. Rather, my intention is to consider how reconfiguring research practices can open possibilities

for kelp to be collaborated with differently and how this opening might change what kelp become within longer time frames and in less situated scales.

The next section of text I analyze outlines the recommended recovery methods to be taken. In this section, I consider how associations between actors in a kelp ecology are included or obscured from recovery efforts with implications for how restoration is undertaken. The document states that the "primary goal for recovery efforts is to preserve the local nearshore spore bank to facilitate natural recovery of bull kelp forests once ocean conditions improve. The most immediate need is reducing purple urchin grazing pressure" (Hohman et al. ix). Two primary strategies address ways to reduce the grazing pressure of urchins and enhance kelp growth. The strategies include commercial urchin harvest by urchin divers, recreational urchin harvest through community events, sea star reintroduction efforts, and culling of urchins (Hohman et al. ix). To enhance kelp growth, blades with reproductive sori are placed in areas cleared of grazing pressure (Hohman et al. ix).

Considering these recovery methods through critical discourse analysis shows how humans are given agency to act upon the urchins as the central actors in recovery efforts. Through an assemblage approach to this asymmetry in power, myriad environmental actors are excluded from these recovery methods. Instead of attending to all the components of a kelp ecology assemblage, these efforts aim at restoring one part of the assemblage—the kelp forest itself. Attuning to the Umwelt of kelp shows that there are myriad other sign signals a kelp forest responds to in order to grow. Thinking-with a kelp ecology in these restoration plans again would mean thinking-with a greater collective of actors to enact restoration. Thinking-with water motion, salinity, temperature, upwelling of nutrients, light availability, myriad grazers and

feeders, would mobilize restoration efforts in more extensive and relational ways. It would change the "scale and scope of what is being restored" (Goedeke and Rikoon 111).

By focusing solely on reductions in purple urchin grazing and the reintroduction of the sea star, the restoration discourse separates the associations which make up a kelp ecology. However, these actors do not stand alone but are tied to myriad trophic and environmental relationships. This articulation of what matters for a kelp ecology constitutes what kelp is in ways that delimit relationships for audiences with the diversity of life in a kelp ecosystem. These exclusions shape an audience's ability to mobilize around and to respond to the needs of a multiplicity of actors. Applying an ethics of care to these recovery methods shows that "to engage properly with the becoming of a thing, we need to count all the concerns attached to it" ("Matters of Care" 90). Puig de la Bellacasa writes that "care is mobilized to serve a gathering purpose: to hold together the thing" ("Matters of Care" 90). An ethics of care also attends to how the erasure of certain actors can uphold dominant epistemologies. By focusing on a few actors in a kelp forest, a dominant paradigm is upheld that does not place value on co-becoming or the intricacy of webs of life. Applying an ethics of care to these methods for restoration can gather a greater range of actors interdependent with a kelp forest together. It can open opportunities for thinking-with the interdependencies of a kelp ecosystem.

Though many scientists and actors involved in restoration efforts dive with kelp ecosystems, and are likely drawn into networks of care, their sensory experiences with kelp forests are largely eliminated from scientific discourse. Though objectivity establishes a work of research as a "privileged truth-spot" from which knowledge can be reproduced and generalized, objective discourse also obscures the specificity and texture of situated places (Gieryn 5). By including in discourse the ways a researcher is peppered with attachment sites for noticing, a

researcher can extend a network of care to audiences and actors working in restoration efforts (*When Species* 36). Thomas Gieryn writes that in most scientific research, nature "gets repositioned in a technical and cultural environment that gives all power to the investigators" (5). Any site where knowledge is made must first be turned into a "laboratory" where information can be "made manipulable, sanitized, and tamed" (5). In these sanitizing processes, a network of relations can be distilled so that the focus of a study is itemized and perhaps more manageable. However, sanitized discourse practices have repercussions for how audiences understand and act towards the complexity of a concern.

Including sensory exchanges with kelp forests as meaningful data in decisions about kelp management might open opportunities for enacting a world where kelp and researchers respond to each other and for attending to the relations which co-compose a kelp forest. Additionally, including sensory exchanges with kelp forests in management decisions might add kelp-human relations to those that co-compose a kelp forest more meaningfully. Recognizing that embodied knowledge shapes researchers' understandings might open opportunities to change what both kelp and humans become through restoration efforts and research practices. Employed in this way, discourse can enact response-ability between audiences and kelp forests. It can pepper audiences with attachment sites for noticing interdependencies and thinking-with them in restoration practices.

Following is an experiment with how to include embodied knowledge as meaningful data that informs research practices. Diving at the selected restoration sites reveals a drastic change in biodiversity and in sensory immersion. Not only are the dense canopies of kelp forests absent, but purple urchins are devouring the understory anemones, sponges, and calcified coralline algae too. The changes to available habitat are visceral. In addition to the urchin barrens, the water

temperatures in northern California faced another warming anomaly in 2019. This means that in addition to reducing urchin populations, it is important that the working group address ways to enroll community members and legislatures in efforts to mitigate carbon emissions. When one dives at the restoration sites, it is not just kelp that are missing from the waters but biodiverse ecosystems. In forming restoration efforts, it is important to address the interacting factors which co-produce these networks of life.

Thinking-with Kelp Forests to Respond to Marine Changes

In this section, I analyze the *State of California Ocean Acidification Plan* to consider how discourse features constitute kelp as a biogenic tool for human uses and to consider how discourse features might be reconfigured to constitute relations with an attention in interrelationship. While the plan articulates the significance of kelp ecosystems to ocean health and outlines a plan to restore, conserve, and enhance kelp forests along the coastline, I argue an asymmetry in power relations is enacted through the discourse practices in the plan that has repercussions for how audiences relate to kelp forests. The plan outlines six main steps to address the impacts of and to mitigate ocean acidification, and the sixth step is to "deploy living systems to slow ocean acidification and store carbon" (Chornesky et al. 3). The plan states that seagrass meadows, salt marshes, and kelp forests are "being recognized as critical to achieving the state's goals for climate change adaptation and mitigation" in that the "habitats have the potential to protect shorelines from sea-level rise, sequester carbon, and locally ameliorate OA by removing CO2 from ocean waters" (Chornesky et al. 32).

Applying critical discourse analysis to the sixth step in the plan shows how kelp are constituted as a living system that can help the state mitigate impacts of ocean acidification. The phrasing which enacts a power hierarchy over kelp forests is the use of the verb "deploy" and the

phrase “critical to achieving the state’s goals.” Though kelp forests are storing carbon and removing carbon dioxide from local waters, humans are the agents “deploying” the forests here by creating aquaculture opportunities and taking measures to conserve and restore kelp ecosystems. Kelp forests, salt marshes, and seagrass meadows are also constituted as critical to achieving the state’s goals. The phrasing “critical to achieving the state’s goals for climate change adaptation and mitigation” suggests a relational separation between kelp forests who help humans and humans who have the power to utilize a kelp forest’s absorption of carbon. When phrasing suggests that living systems can be put to use to help mitigate climate change or to achieve state goals, the interconnections between kelp forests and ocean health are largely monopolized for human benefit. Relationships with living systems and human action towards them are disregarded. Connections to and connections with are obscured in language that utilizes kelp forests to achieve an end goal.

Throughout the document, ocean acidification is expressed as a threat to local economies, to the health of the oceans, to marine organisms, and more. The use of the word threat and the word deploy connote a militaristic use of a living system for defense. Like the use of “biogenic engineer” to describe kelp forests, the use of deploy constitutes kelp as machine-like. These constitutions fail to place value on how a multiplicity of interspecies ways of making meaning co-constitute the health of the planet. Though kelp forests are recognized as critical to ocean health, value is placed on the ability of kelp forests to achieve a goal that is constituted as important for humans. This is significant because a relationship of dominance over and separation from is perpetuated over kelp ecosystems. The value of acting with regard for interconnections with marine ecosystems is disregarded through this phrasing.

Through an ecological approach to these discourse features, the state's goal would address a larger network of concerns tied to ocean acidification beyond the human. An ecological approach to rhetoric might extend the goal of mitigating ocean acidification to include the health of marine ecologies and the stabilization of carbon cycles. The state's goal would be configured as a network of human and other-than-human relations which co-constitute each other rather than a goal which primarily addresses the needs of human actors. Rather than showing how kelp forests can help human societies, the plan might constitute a reciprocal relationship wherein both humans and kelp forests impact what each other becomes. From a network approach to ocean acidification, the plan could foreground the importance of attending to the actors who influence, mitigate, and are impacted by changes to ocean chemistry. Attention to a network of relations would constitute a reality wherein humans are a part of an interconnected system. I argue this configuration is important to changing how humans act towards and understand themselves a part of the planet. Though the authors of the acidification plan likely wrote it with the additional purpose of conserving marine ecosystems and with a larger network of concerns in mind, including these networks in discourse practice is important to constituting a reality wherein audiences understand themselves interconnected with kelp forests, salt marshes, seagrass beds, and the many species who co-compose and are co-composed by these ecosystems.

Positioning kelp as rhetorical actors who use carbon dioxide for photosynthesis and as actors who make meaning through chemical exchanges with their environment enables audiences to think-with kelp as interactive, lively, and relation-building. Recognizing kelp forests as actors in interacting webs of life which contribute to a stable carbon cycle engages audiences with the consequentiality of interconnection. It allows them to think-with kelp not as a cog in a system but as an actor that produces consequential environmental relationships. An ecological approach

to rhetoric attends to process and constant co-becoming. Through this approach, kelp forests are constantly changing what a marine ecosystem becomes. Through interactions with their environment, they uptake carbon to grow, and through this exchange, change atmospheric and ocean chemistry which produces environmental factors for other species to co-become. Thinking-with kelp in this way in conservation discourse opens opportunities for audiences to think-with regard for interrelationship with kelp forests and marine ecosystems. Configuring kelp forests as rhetorical actors draws attention to co-producing associations.

The use of kelp forests to mitigate ocean acidification continues to be framed for human benefit in the document. Another step in deploying kelp forests is to "continue to develop, evaluate, and refine kelp-farming aquaculture as a way to locally ameliorate OA while producing commercial products, such as food, biofuels, agricultural amendments, and water pollution treatment services" (Chornesky et al. 35). This articulation of kelp-farming further enacts kelp as machine-like, as commodity-producing, and as a resource for human use and benefit. Kelp forests are constituted as important for humans, but the myriad organisms who kelp forests are also important for are not included in the text. This phrasing enables audiences to think with societal concerns in mind without recognizing how societal and ecological concerns co-compose each other. Audiences are not encouraged to think-with kelp in everyday practices or to understand themselves interdependent with marine ecologies. They are not asked to attend to how humans and kelp co-constitute each other's worlds. Instead, they are encouraged to understand the ways kelp forests can benefit human society while also contributing to slowing ocean acidification. I argue the power dynamic enacted in this relationship perpetuates dominance over living systems in a way that enables exploitation. The relationships between kelp and carbon are recognized and used to create knowledge. However, the enactment of kelp as

productive for human benefit reduces the relationship between carbon and kelp as a meaning and world-making project. This constitution also obscures a kelp forest's importance as a species productive of relations for myriad other marine organisms. Marine organisms—rockfish, seals, otters, snails, brittle stars, and myriad more—are devalued in that the text obscures their needs and presence and places value on the commercial products kelp can produce instead. This perpetuates a value system of disregard for and dominance over the species humans are interdependent with.

An ethics of care alters this constitution of kelp forests by attending to the connections and dependencies of a kelp forest and its co-producing species and environmental processes. Creating aquaculture opportunities would not only create biofuels, food, and agricultural amendments, it would also create more habitable spaces for marine organisms and for interconnecting trophic relations. An ethics of care attends to the processes and environmental factors which enable an entity to co-become. This attentiveness in discourse practice might foster an ability to act with regard for intricacies of interrelationship. Amending the discourse above through an ethics of care might draw a network of connections between the benefits of aquaculture for humans and the benefits of aquaculture to more complex networks of marine relations also. Including a more integrated range of actors in the discourse features might constitute a reality wherein marine and terrestrial actors co-constitute each other and where value is placed on attending to the ongoingness of networks of interdependence. Instead of thinking with human benefit in mind, reconfiguring discourse through an ethics of care might engender practices of thinking-with other species and ecologies in daily business, coastal management, and research practices. Configuring discourse through an ethics of care might also enact a reciprocal relationship between humans and kelp, opening opportunities to cultivate a more livable world.

Haraway suggests the importance of narratives which illustrate how "human beings are with and of the earth, and [that] the biotic and abiotic powers of this earth are the main story" (*Staying With* 55). Attentiveness to what is important for kelp and the marine health and life kelp forests foster enacts a reality wherein humans are a part of a complex web of life rather than the main organizing entity. In the acidification plan, kelp forests are helping mitigate what the coastline might become, but an ethics of care is important to valuing the multiplicity of life and the networks of marine health kelp forests foster. Foregrounding networks of relations in discourse practice illustrates how human actors are a consequential part of a web. This constitution of the planet and human presence in it—through relations with other-than-human actors—might change practices of dominance and degradation. Discourse plays an important role in establishing and perpetuating value systems. The more prevalent discourse is that places value on interrelationship and that foregrounds networks of interspecies relation, the more prevalent values based in interrelationship might also become. Constituting kelp forests as relation-building actors can help audiences notice and think-with regard for multispecies interrelationship.

A way to reconfigure the above sections of discourse through an ethics of care and through an ecological approach to rhetoric is: Seagrass meadows, salt marshes, and kelp forests naturally sequester carbon through photosynthesis, and as such, are important ecosystems to conserve, restore, and work with to mitigate ocean acidification. These ecosystems also remove dissolved carbon dioxide from ocean waters and are critical to marine biodiversity and the health of the oceans. They are part of a planetary network of living systems which co-constitute relatively stable carbon cycles. As human practices are destabilizing these cycles, it is important to work with living systems to conserve their health and also to curb emissions to work more

justly to be a part of these networks of co-constituting life. Another step important to ameliorating ocean acidification is kelp-farming aquaculture. Through aquaculture practices, kelp can sequester carbon and provide habitat to a biodiversity of mammals, invertebrates, fish, sea birds, and more. Additionally, kelp-farming aquaculture can open opportunities for kelp harvesting for food items, biofuels, agricultural amendments, and pollution treatment services.

This chapter has considered how discourse features might change to engender response-ability in audiences for kelp ecosystems. These changes might include constituting kelp forests as lively, relation-building, and interconnected with. These changes would open opportunities to think-with kelp in conservation and restoration practices and open opportunities for noticing how we are of the world through interrelationship. I experimented with ways to foreground interrelationship in discourse practice so that audiences and conservation efforts think-with kelp forests as rhetorical actors important to collaborate with.

Conclusion

Synthesis of Findings

This thesis has explored how thinking-with kelp forests in knowledge-building practices opens opportunities for attending to the co-becoming of species through interrelations and to how relations between species are productive of meaning and place. Utilizing multispecies and ecological approaches to rhetorical inquiry has allowed me to explore the ways discourse practices might foreground the co-becoming interactions of an assemblage and how actors are in continual consequential relationships with others (Dooren, Kirksey, and Münster 3). An ethics of care adds to these approaches by highlighting practices of attentiveness necessary to attend to what allows interconnections to be ongoing. These explorations have considered the importance of constituting "communication processes as a making-with the world rather than as a representation of the world" and have considered how including embodied communication practices in knowledge building can open opportunities for thinking and making with (Keeling and Prairie 54). Discourse practices enact realities, ways of knowing, ways of understanding oneself in the world. In this research I have sought to examine how discourse practices constitute a reality wherein humans can understand themselves separate from living ecosystems and thus able to be inattentive to other living organisms' ability to co-become. The degradation of planetary life today shows that the realities Western countries have been enacting need to structurally change to value and engender practices of attention to the interrelations that enable humans to cohabitate the earth.

Haraway writes and shows how storytelling can be a practice of "ongoingness" (*Staying With* 132). She considers the heritage of passing on stories and research, how the researcher can

expand how an audience knows or understands a concern, turning the singular *I* of a researcher into a *we* of listeners also able to attune to. In this research, I question how scientists, who understand and know kelp ecologies in embodied, visceral, ecologically attuned ways, can pass on stories others might inherit to inspire an understanding of interrelation with and response-ability for marine ecosystems. Like an ecology, writing is web-like. It draws interconnections between audiences and a concern. Haraway writes that, from a story, "another heritage emerges and makes claims on anyone listening, anyone attuned" (*Staying With* 131). She writes "It matters what matters we use to think other matters with; it matters what stories we tell to tell other stories with; it matters what knots knot knots, what thoughts think thoughts, what descriptions describe descriptions, what ties tie ties. It matters what stories make worlds, what worlds make stories" (*Staying With* 12). This quote illustrates the importance of nodules in a network and how each changes what the other becomes. Discourse practices are an important node in how associations are drawn between actors in a network. They can knot together or hold actors apart. Today, knotting actors together, showing how humans and living ecosystems are entangled in each other's becoming, might foster actions which attend to repair and maintenance of webs of interconnection.

In her work with soil care, Krzywoszynska considers how socio-technological power structures in agriculture hinder the ability of farmers to practice soil care. Similarly, through this research, I have considered how ways of knowing kelp ecosystems through scientific discourse obscures readers' abilities to care for kelp and to respond to what is important for their wellbeing. The main discourse features I found that limit understandings of how we are with kelp forests in the world are a lens of objectivity, fixed verb phrases, reductions of kelp to economic associations, and thinking of kelp forests within an understanding of human benefit and use.

These ways of knowing reduce an audience's ability to recognize how kelp forests produce relations and produce meaning across marine and terrestrial assemblages. Moreover, they create relational distance between audiences and kelp forests. If kelp's movement can be understood as a living thought, a way of being that thinks-with water motion, this movement is also obscured through an objective lens. These discourse features also obscure the responsiveness of actors to each other. Removing the researcher's body from discourse also removes the ability of the researcher to be affected by and to respond to a kelp forest. The removal of the researcher's body obscures the ability for kelp forests to act on researchers and the ability for researchers to impact what a kelp ecosystem becomes—with the presence of their body and through their research.

An ecological approach to rhetoric informed by new materialisms and multispecies studies offers tools to think-with a kelp assemblage in knowledge building practices. In this thesis, I found that thinking-with kelp in scientific discourse opens possibilities for including a greater range of actors in knowledge building by drawing attention to the interacting processes that compose a kelp ecosystem. Instead of thinking of a kelp forest as a singular entity, an assemblage approach shows the many interacting actors and processes which co-compose a kelp forest. Through an ecological approach to rhetoric, a kelp forest is also the light and nutrient availability, salinity, temperature, and water motion which kelp interact with to grow. A kelp forest is also the grazers who feed on kelp, the myriad fish who feed on grazers, and the marine birds and mammals who feed on fish within a kelp forest. Thinking-with kelp assemblages in restoration efforts and scientific discourse means also attending to ocean chemistry and the myriad fish, invertebrate, and mammal species who co-become with a kelp forest. Attending to the myriad nodes in a kelp forest assemblage illustrates how humans are part of the assemblage in that they interact with kelp through ocean chemistry, fisheries, harvesting, sediment runoff,

cultural practices, and more. This shows that thinking-with kelp asks researchers and audiences to attend to the intricacy of web-like relations which co-produce a kelp forest. Beyond a kelp forest, approaching rhetorical inquiry through an ecological lens encourages attention to the webbed relations which interact to sustain life on earth.

An ecological approach to rhetorical analysis also offers tools to consider how a kelp ecosystem can orient research and discourse practice to nonlinear spatiotemporal scales. By attending to the different actors in a multispecies assemblage, one can notice how myriad temporal rhythms impact what an assemblage becomes. Tsing writes of the importance of cultivating tools for noticing what does not fit within a linear timeline of progress, and she asks how attention to a multiplicity of temporal patterns can disrupt habitual understandings of a timeline of progress (21). She queries how this disruption opens space for humans to remember how they are a part of the earth's temporal patterns (21). Drawing from Tsing, attending to the spatiotemporal rhythms of a kelp forest—which grow through seasonal cycles, tidal surges, and annual indeterminacy—can attune researchers and audiences to what Tsing calls the world-making project of an assemblage. Recognizing how the planet is composed of myriad time-making projects also disrupts what Law describes as the singular reality enacted by an objective research lens. Attuning to the spatiotemporal patterns that are important for kelp forests engages research practices with what matters for a multiplicity of other living organisms. The recursive movement of kelp with water motion can orient restorative efforts and audiences to stay with the trouble of ocean chemistry and to stay with the trouble of attending to changes in practices which impact what kelp and other marine ecosystems become.

The last main finding of this research is how attuning to sensory forms of communication in research practices opens room for responding to what matters for a kelp forest. An ethics of

care and its focus on attentiveness towards other species highlights the importance of embodied exchanges to cultivating response-ability for other species. Through embodied experiences with kelp forests, one can see their movement as living thought and see the interacting exchanges which compose an ecology. Embodied immersions with kelp enable one to feel the surges of water that move their fronds and to sense that that movement is important for them. Immersion in a kelp forest is also an immersion in scattered light, marine temperature, and salinity. Though one can never entirely understand the perceptual world of another organism or being, immersion in the environmental factors that are important for kelp open opportunities for noticing and responding to them. Approaching an embodied exchange through the concept of Umwelt further engages a researcher with environmental exchanges as meaning making processes. One can see how kelp forests inform the perceptual worlds of other species, enabling them to respond and co-become. Including these observations as meaningful data in research might open possibilities for researchers and audiences to respond and to act towards kelp ecosystems with attention to the interrelationships which enable them to co-become.

Implications for Rhetoric and Composition

Recognizing the ability of other species and ecosystems to produce relations and to create meaning is an exigent turn for the field of rhetoric and composition. Historically, rhetoric has been regarded as a linguistic reasoning capacity and has enacted epistemic divisions between those who can produce knowledge and those who do not have the logical toolsets to (Wells et al. 8). Considering other species actors who build ways of knowing in the world and who can change the ways humans make meaning restructures this hierarchy of exclusion. Recognizing how other species build relations opens opportunities to think-with the webs of life humans are interrelated with and interdependent on. Recognizing how other species build relations is

important to recognizing that humans do not always know best and to opening possibilities for asking others questions about how they build meaning in the world, not to exploit that knowledge or use it for the benefits of human wellbeing alone but to build better practices for repairing a world more livable for a greater diversity of beings. Multispecies relation-building is important to cultivating practices of attentiveness to how ecosystems co-become and how a multiplicity of ways of knowing are important to that co-becoming.

Recognizing communication as more than human and including embodied forms of communication in research studies is also important for reconfiguring hierarchies in rhetoric and composition. Recognizing communication as embodied practice and chemical exchange opens opportunities for including ways of knowing beyond linguistic practices in knowledge-building. Attuning to how others make meaning opens opportunities for noticing how humans are intricately webbed with planetary networks. These inclusions in research practices might disrupt prevalent epistemologies which perpetuate relational distance from and dominance over living systems. These inclusions in rhetoric and composition can place value on more relational ways of knowing other species in particular and building knowledge through those relations. These inclusions can also conjoin the bifurcation of materiality and expression to show how each informs the other. This is important to constituting communication as a making-with the world and to recognizing that materiality produces relations important for research practices to attend to and ask questions of.

This research does mean to suggest that rhetoric's focus on reasoning and logic are not important tools for knowledge-building. Rather, this research seeks to ask what opportunities are opened when other forms of knowledge-building are valued in addition to capacities for alphanumeric reasoning and logic.

Doubts and Limitations

Throughout this research, I have been troubled by critiquing scientific practices at a time when their value is as critical as ever. My intent has been to question how research practices and discourse can open ways for understanding kelp ecosystems as agentive and relation-building. This research has sought to query how language can draw audiences into association with kelp forests in more relational ways. Despret writes that "The assumed split between Science…and non-science is drawn along the lines of the old dualisms: the imaginative versus the factual; the subjective versus objective; the autobiographical versus the scientific account; the emotive versus the neutral and…the body versus the mind" (56). A more feasible way to change how kelp are constituted for public audiences in particular might be collaborations between marine scientists, writers, and artists. Together, they might convey the webbed relations and scientific data of a kelp forest through dimension, movement, gesture, texture, and color. They might include imagination and the ability of kelp to act upon responsive bodies. Multispecies scholars consider how multidisciplinary collaborations highlight "the complex and often contradictory ways of knowing, valuing, and living that are always unavoidably at play and at stake in the shaping of worlds" (Dooren, Kirksey and Münster 9). As much as a kelp forest is co-constituted through a multiplicity of perspectives, kelp forests are also encountered and known through a multiplicity of human perspectives. Bringing those angles together might enable kelp forests to be articulated-with more texture and sensory detail, might open possibilities for knowing and valuing kelp differently. In a time when scientific research is enormously critical—as if there were a time it wasn't—perhaps collaborations can open more space for multispecies stories to be constituted differently, for audiences to be enrolled through a range of epistemic access points.

Another limitation of this research is its focus on written texts as a way to understand how kelp forests draw others into relation and influence meaning-making practices. For people whose lives are immersed in the ocean—people who have cultural ties to kelp forests, people who make a living through marine environments—ways of knowing might not be voiced in literature, ways of knowing might be embodied and passed between kelp and humans. It might be that these relationships are not voiced in popular media because Western linguistic traditions have not historically recognized interspecies relations as sites of credible knowledge making. To learn more about how kelp forests produce relations, it would be fruitful to talk with people who often spend time with or around kelp forests. To further this research, I would be interested to learn about the embodied stories and interconnections between kelp forests and fisherpersons, divers, farmers, chefs, and more. I would also be curious to talk with marine scientists about their embodied experiences with kelp and how kelp enact relations for them in ways not readily present in scientific discourse. It is easy to imagine myriad people making meaning with kelp forests in daily practices, however, the knowledge they co-produce might stay situated within bodies or exchanges of localized knowledge. Thinking about the relationship between embodied knowledges and language practices in interviewing some of these people would extend this research further in meaningful ways.

Final Ruminations

Much of this research began with a question about how language contributes to people understanding themselves separate from living systems, with implications for how people act towards them. An additional question driving this research was how ecological losses are constituted in discourse practices. Most people will not dive in or spend time with kelp ecosystems in their lifetime. How, then, can people care about the losses of kelp ecosystems

viscerally, as a "discordant rhythm materialized in diverse ways that pull at our lived and imagined realities"? (McGreavy 110). Before ecosystem losses, how can living webs pull at our lived and imagined realities, even if we have not encountered them viscerally? Photographs, art installations, and video footage of kelp forests evoke their color, dimension, and gesture, their liveliness, habitat, and refuge. Perhaps collaborations between scientists and writers can evoke these features of a kelp forest in similar ways. Perhaps these evocations might inspire and mobilize people around care for the living thought of a kelp assemblage, for its movement, and collaborative meaning-making gestures.

Writing this project has made me think about ties between writing and imagination, about writing as a way to open avenues to think more creatively about responding to the planetary moment we are in. Swimming in kelp forests always rearranges the boundaries of the framework I see through. Color and light move differently. My eyes, lungs, and limbs adjust to the constant movement and pressure of a saltwater medium. I do not have fish scales or seal fur, but float-kicking beneath kelp fronds makes me wonder what it would be like to. This is not theoretical. Kelp forests immerse one in the unfamiliar. They position one's senses to consider what matters in underwater worlds. When the material, sensory, and emotive are separated from language, I wonder how these exclusions close off the ability to connect with material worlds. It is not just scientific language that tends to and is structured to exclude bodies, senses, affect. Much of academic discourse does, structuring relationships between knowledge and bodies, knowledge and relations *with*, knowledge and the planet we co-constitute. As much as these exclusions do to foster critical thinking and critical ontologies, I wonder how these exclusions also apply boundaries to thinking-with and to imagining possibilities for perceiving, understanding, responding differently.

Marine heatwaves are projected to increase in intensity and frequency due to climate change, with many marine organisms projected to experience increasing physiological stress due to a relatively small thermal safety margin (Rogers-Bennet and Catton; Pinsky et al.). I am thinking-with upwelling in spring, with alongshore winds, with the atmosphere, with oxygen, with algae blooms, with El Niño–Southern Oscillations, with fog. I am thinking with how kelp create refuge and foraging grounds for abalone, for otters, for black rockfish and blue rockfish and olive rockfish and kelp rockfish, for red urchins, for brittlestars, sea stars, anemones, crabs, jellyfish, for sea lions, for grey whales, for warblers, starlings, gulls, terns, herons, cormorants. For me. And for you. And microscopic more. I am thinking with dimensions of green where the skin feels the silk of cold, where quiet feels ancient, where kelp gather others into their fronds scattering subdued light. I am thinking-with the rise and fall of kelp stipes and how the recursive pull through water asks "Who are you, and so who are we? Here we are, and so what are we to become?" (*When Species* 221).

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