Decoupling Seascapes

An Anthropology of Marine Stock Enhancement Science in Japan

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■ **ABSTRACT:** The roles played in fishery resource management by the nonhuman species that coevolve with humans are often marginalized in both discourse and practice. Built on existing reviews of the multispecies ethnography of maritime conservation, domestication, and marine biology, this article aims to reconceptualize the politics of difference in stock enhancement. By examining the herring stock enhancement program in Japan as an assemblage of multispecies inter- and intra-action in the context of marine science and seascapeing, this article recontextualizes fisheries management and crosses the methodological and ontological borders in maritime studies. The article shows that multispecies ethnography serves as a heuristic means to describe the co-constitution of seascapes, which are beings, things, and bodies of information and processes that shape marine surroundings, or what fisheries biologists and fisheries resource managers tend to overlook as mere background.

■ **KEYWORDS:** hatchery, herring, Japan, maritime anthropology, multispecies ethnography

Maritime Anthropology: Beyond “Coupled” Systems

Commonly known as hatcheries, the development of stock enhancement as a form of fishery policy reflects the postwar national fetishism of economic growth and a modernist ideology of nature, which humans can dominate with science and technology. (Re)stock enhancement is different from aquaculture and mariculture in that targeted species are often released into the sea, rather than living and growing in an enclosed space. Stock enhancement is referred to as “the release of cultured juveniles into wild population(s) to augment the natural supply of juveniles and optimize harvests by overcoming recruitment limitation” (Bell et al. 2008: 1–2). This became salient in the development of stock enhancement programs in the 1970s when the Japan Sea Farming Association was established and sought a technological fix for the decline of inshore fisheries through “stocking” hatchery-bred fish into seas. The implications of stock enhancement programs were not limited to the introduction of techno-scientifically produced fish released into the ocean. The anthropogenic intervention into marine ecosystem with stocking artificially hatched and released fishery species epitomizes the oceanic politics of difference and the enactment of science and technology in the domestication of aquatic species and fishery resource conservation.

Contemporary fisheries and coastal management are complex and conditioned by the global market economy, international regulations, and climate change. They require anthropologists

to navigate both in and through broadly defined and spatially unbounded fishing communities (e.g., Agrawal and Gibson 1999; Clay and Olson 2007; see also Jentoft 2000). Most anthropological studies on fisheries fall into one of two groups: studies on fishing-based subsistence in small-scale societies (e.g., Firth 1966; Johannes 1981) and applied research on issues in coastal resource management (e.g., Acheson 1988; McCay and Acheson 1990; Ostrom 2007; Takahashi et al. 2006). These themes overlap within discussions on the expansion of the global seafood market economy, neoliberalization, local fishing rights and marine access, and local opposition to top-down regulations imposed by states and international organizations (e.g., Griffith and Valdés Pizzini 2002; Mansfield 2003; McGoodwin 2001; Orbach 1977). In order to conduct research on such complex environmental issues, human ecologists suggest applying contextual and/or interactive approaches instead of assuming an a priori framing of the complexity into a model or theoretical framework (McCay 1978; Walters and Vayda 2009). A related approach, political ecology, focuses on the dialectic relationships between nature and society, though this field devotes more attention to issues of political power and capital (e.g., Black 1990; Mitchell 2002; Robbins 2004; Rudy and Gareau 2005).

Anthropologists are now also using “coupled human-environment-systems” or “coupled nature-society systems” approaches. This is a welcome trend wherein social scientists work toward erasing the nature-society dichotomy in research (e.g., Berkes et al. 2003; Turner et al. 2003). However, it is necessary to discuss the very meaning of the terms coupled and system. “Coupled” implies that the two different domains of human and the environment (or of nature and society) are assumed to preexist their coupling. Meanwhile, “system” assumes an enclosure with boundaries, even if the new school of ecological anthropology has reframed “system” as a nonequilibrium and dynamic ecosystem.

It is in this anthropological context that multispecies, post-humanist approaches emerged and developed further potential for contributing to the reconceptualization of the relationships between nature and society, which scholars call the great domain (Latour 1993) or great divide (Goldman and Schurman 2000). Rather than coupling two distinct domains, post-human, multispecies approaches are based on a more multidirectional, ontologically open form of communication. However, as is the case with human-animal studies, many more-than-human studies still tend to focus on people’s relationships with a given animal, thus more or less maintaining the coupled stance and taking the scientific categorization of species for granted. Nevertheless, by proposing and developing alternative ontological turns, multispecies approaches go beyond the nature-culture, nature-society, wild-domesticate, predator-prey, researcher-researched divides by focusing on the hybridity and multiplicity of both living and nonliving actors in their entangled inter- and intra-action.

Building on existing reviews of multispecies ethnography (Helmreich and Jones 2018; Kopnina 2017; Ogden et al. 2013; van Dooren et al. 2016), this review article aims to reconceptualize the ecologies of seascapes in the era of the Anthropocene, or the AnthropOcean (Brugidou and Fabien 2018), by referring to the politics of difference—both making and blurring distinctions between the natural and the cultural—in fisheries biology and stock enhancement. The review portion of this article weighs in on multispecies maritime ethnographic works, many of which are rooted in science and technology studies. First, I present theories and concepts relevant to the hybridity and multiple realities of seascapeing. I then introduce examples of maritime multispecies ethnography drawn from the literature. Finally, I focus on a specific ethnographic example from my research on the practice and discourse of the herring stock enhancement program in Japan. The examination of stock enhancement as a more-than-human assemblage in the context of marine science and seascapeing crosses methodological and ontological borders in maritime studies. In this article, multispecies ethnography serves as a heuristic tool to describe

the co-constitution of seascapes, understood here as beings, things, and bodies of information and processes that shape the surroundings, or what fisheries biologists and fisheries resource managers tend to overlook as mere background. I argue that multispecies maritime anthropology can be used to explore and recontextualize how humans and other beings and things both bound and extend webs of ocean life.

Species and Kinds in Hybrid Seascapes: Theories and Concepts

Constructing a resource-rich seascape is part of human prehistory and history. Historical ecologists suggest that humans have been modifying the seascape in order to enhance the productivity of the seafood harvest since prehistoric times in many parts of the world (Deur et al. 2015; Groesbeck et al. 2014; Thompson et al. 2013). In fact, anthropogenic impacts on the biomass of aquatic species actually developed much earlier and deeper than generally thought, possibly in the early to middle Holocene (Mannino and Thomas 2002). There is no such thing as a “pristine Holocene” counter to the fantasy that oceans are so vast that the humanity could not alter their conditions, though the impacts of climate change and human exploitation on marine species are complex and cannot be underestimated (Braje and Rick 2011; Thompson and Waggoner 2013). Technological advancement and the expansion of markets have played critical roles in irreversibly changing the lives of aquatic creatures and maritime environments (Roberts 2007; White 1995). Many fish species such as superabundant herring in the Pacific Northwest and cod in the eastern North Atlantic, which was called a kind of “inexhaustible manna,” were overharvested by human fishers, and their regional stocks have not yet recovered (Fagan 2017; Thornton and Moss, forthcoming).

The concept of wild, which is defined by a space that lies outside of human domains, still reproduces categorical boundaries between society and nature and human and animal. Nevertheless, the wild stems from an anthropocentric imagination, and nonhuman beings and things confined in the imaginary wild, or *mare incognitum*, have been influenced and entangled in the multiple webs of human life (Cronon 1996; Whatmore 2002). In the Anthropocene, the introduction of plastics into oceanic nature evinces the inseparability and responsibility of human beings in the unintended consequences on other animals and plants’ lives, such as wild migratory birds starving to death, with their stomachs full of plastic debris. The complexity and dynamics of hybrid seascapeing, such as the plastic waste ingested by oceanic creatures and food web, require us to go beyond the conceptual boundary between nature and culture, the material boundary between life and nonlife forms, all of which coexist and co-constitute seascapes (De Wolff 2017). Nature can now be conceptualized both as coevolving with culture (Ingold 2004) and as a cultural production that incorporates complex relationships between humans and their surroundings constituted by nonhuman beings and things (Braun and Castree 1998; Pálsson 1991; Zerner 2003).

The consideration of the nature-culture and nature-society boundaries relates to the politics of differences. Anthropological discussions on the postmodern cultural politics of differences revolve around discourse and practice of differing identity and place, in the making of the Self and Others (Gupta and Ferguson 1992). As Donna Haraway (2008) elaborates in *When Species Meet*, identities of creatures emerge through their encounters with others. To examine the complexity and hybridity of fisheries management and seascapeing, maritime anthropologists need to pay attention to the oceanic politics of differences without unproblematically accepting the preexisting division between nature and society, nature and culture, and terrestrial and aquatic species.

The modernist divisions of society and nature are problematic because humans and nature are not separate, static structures but instead defined by a fluid, dynamic aggregate of interactions among actors (Barth 1992; Descola and Pálsson 1996; Hannerz 1992). Ecology, as part of the emerging multispecies ethnography, is conceptualized as a complex and processual assemblage that extends beyond the dichotomies between nature and culture, nature and society, human and nonhuman, and even time and space in the making of coastal seascapes. Sarah Whatmore (2002) describes hybrid geographies as spaces where material and ecological assemblages are made and remade with the conflicts of different ecological epistemologies and knowledge systems. Anna Tsing also elaborates how landscapes are “themselves active” as the activities of both human and nonhuman living beings shape and are shaped by *satoyama* (village-mountain) landscapes (2015: 152). Human and nonhuman actors co-participate as core contributors in the construction of a mutual ecological niche, which Agustín Fuentes (2010) calls the natural-cultural contact zone. Challenging the simplified and homogenous view of environments leads many scholars to engage in the hybridity of ecologies (both materially and epistemologically), which are differently referred to as emergent ecologies (Kirksey 2015a), the fabric of social life (Whatmore 2002), and social nature (Castree and Braun 2001), among others. Such studies can lead us to describe and explore seascapes beyond the dichotomous ontological domains.

The emergence of a more-than-human, multispecies ethnography reflects the application of anthropomorphism in exploring new approaches to reconfigure nature-human relationality within our contemporary societies. Some may regard the anthropomorphization of nonhuman beings and things as risky, “unrealistic,” or an overly philosophical interpretation of human-environment interactions without empirical data. Is it unrealistic and overly interpretive to let fish and shellfish think and talk within our research like other human actors such as inshore fishers and fisheries scientists? Human societies, whether indigenous or “civilized,” operate and are operated by systems of symbolic meanings (Sahlins 1976). In indigenous mythologies, animals talk, think, and act—usually in response to what humans do. In animist cosmologies, nonhuman animals are actors that sustain the other half of their social world (i.e., nature) from their “human” social world (i.e., society). Some social scholars have argued a society is inseparable from nature because the boundary of society is merely an analytical framework defined by the human observers, and society and nature are actually intertwined in the dynamism that ecologizes society and socializes ecology (Descola 1992). Studies on indigenous worldviews and environmental stewardship practices indicate that their relation with nonhuman animals has been symmetrically maintained among multiple worlds, including human and nonhuman worlds. Engaging in the multiple realities of fish in her ethnography of indigenous-state relations involving the Inuvialuit of Paulatuuq, fish, and the land in the Arctic Canada, Zoe Todd proposes the idea of “fish pluralities” for capturing “differing understandings and conceptualizations of fish, which were sometimes complementary and sometimes contradictory” (2014: 219). Many societies operate reciprocal relationships through gift exchanges, regardless of whether any differences between humans and nonhumans exist (see also Nadasdy 2007).

Multispecies ethnography can also allow us to maneuver around another practice of anthropocentric ideology concerning the representation of others in the era of post-postmodern anthropology. For example, scientists can use taxonomy to perceive and produce the natural world; for instance, scientific classifications and descriptions have allowed the Pacific herring to exist as *Clupea pallasii*, a group of animals, a species. However, taxonomy provides more than a scientific classification of the Pacific herring as a distinct fish species. Scientific classifications and descriptions allow scientists to construct particular ways of understanding and “performing” nature (e.g., Kirksey 2015b; Lien and Law 2011). “Performance,” then, refers to the embodiment of an idea of fish but not the fish or a thing in itself. The practice of italiciz-

ing *Clupea pallasii* means the words themselves look more sacred than secular, inferring on science an authoritative voice, though it simultaneously objectifies italicized beings as natural (e.g., non-English words and indigenous geographic names in English). In this way, science constructs a practice and reality for herring from an evolutionary perspective.

As its very term suggests, multispecies ethnography takes “species” as a grounding concept for articulating biological differences and similarities (Kirksey and Helmreich 2010: 563). When we conceptualize ourselves as *Homo sapiens sapiens*, we can engage in an analysis of environmental and political issues from differing multispecies perspectives. At the species scale, the Fukushima Daiichi nuclear disaster in 2011 and subsequent and further release of contaminated water into the Pacific Ocean may have a different implication from the perspectives of commercially targeted fish and shellfish species. While local fishers’ fishing activities continue to be restricted, the reduced fishing pressures have led to the increase in some species’ biomass (see Yagi 2019). *Homo sapiens sapiens* is just one of the many species co-constituting seascapes, and understanding the history, present, and future of oceanic environments requires careful examinations of multispecies interactions and of anthropocentric explanation of local and global maritime histories and current settings. In this context, Tsing rightly points out that “the term ‘multispecies’ is only a stand-in for moving beyond human exceptionalism” (2015: 162) for our understanding of the formation of hybrid seascapes. This ontological species turn within multispecies anthropology also gives voice to other ecological actors and makes them more visible as active participants rather than as context background.

Domestication is another major anthropological theme that has never lost its theoretical and applicational importance. Domestication draws attention from multispecies anthropology scholars, who aim to capture what domestication means to both human and nonhuman living beings from the Neolithic period to the Anthropocene (Swanson et al. 2018). The anthropocentric perspective views domestication as the modification of other species “for purposes of profit to a human community that maintains complete mastery over its breeding organization of territory and food supply” (Clutton-Brock 1989: 7). The domestication of nature has also led to the figuration and simplification of fish as objects of anthropocentric and bio-economic management (Holm 1996). Through domestication, human beings manipulate the lives of plants and animals while modifying landscapes and seascapes. However, domestication is conceptualized as a process of mutually coevolving bodies and lives of humans and animals (Leach 2003; Mullin and Cassidy 2007). Domestication greatly matters to the oceanic politics of difference. As the classical anthropogenic ideas of control and spatial confinement of the lives of the domesticated are key to industrial aquaculture, which privatizes fish as property, the practice and discourse of domestication is also in continuity with the development and maintenance of the wild.

Meanwhile, with the development of industrial aquaculture, the category and boundary of species become blurred, which leads to difficulty in capturing the contemporary fisheries and seafood businesses’ complexity. Indeed, multispecies ethnography extends beyond the category of species, because one species can have multiple meanings in their relations with other beings and things. For example, the Atlantic salmon is scientifically taxonomized as *Salmo salar*, but the fish can be wild, farmed, or escaped (from farms). Each form becomes simultaneously semi-otic and material, and all actors form part of the salmon assemblage (Lien 2015). Species as a scientific taxonomy (just one of the epistemological systems of knowing) are not fixed; rather, the notion of species is performed and species are enacted as a scientific taxonomy through the process of forming a multispecies assemblage (Kirksey 2015b).

A multiplicity of perspectives and influences is the key to more-than-human, multispecies ethnography. Classifying and categorizing may not be done exclusively by humans, and non-human beings living in *our* world are doing it from their perspective. Following domesticated

salmon as a biosocial being, which enacts itself and swims through multiple realities of self, Marianne Lien argues that the examination of more-than-human sociality requires “going beyond words” (2015: 19). Conceptualizing multispecies relations and perspectives via Piercian semiotics, Eduardo Kohn also sees human language as just one sign system in the world both making and made with the multiple nonverbal signs involving multiple species. Kohn proposes the semiotic engagement in forests as “ecologies of selves,” which goes beyond the category of species: “all beings, and not just humans, engage with the world and with each other as selves, that is, as beings that have a point of view” (2013: 132).

Though multispecies ethnography has “species” in the term, many scholars extend their research focus with the idea of “kinds”. This is partially derived from the fact that multispecies ethnography has its ancestral root in science and technology studies (STS). Kim De Wolff (2007)’s study on oceanic plastic pollution exemplifies how the concept of kinds, rather than species, may better apply to our sensible understanding of the formation of hybrid seascapes. While only living beings are entitled to a species nomenclature, plastics, which are inorganic synthetic materials, are forms of kinds belonging to the Pacific Ocean, moving with the currents and being taken in by other organic forms of life such as fish, birds, and sea mammals. Various actors, living or nonliving, make and emerge as part of seascapes. In this way, anthropologists describe how material objects perform as actors, whose acts influence or assemble a chain of events that human actors then interpret in multiple ways (e.g., Latour 1996; Lien and Law 2011).

In addition to STS, the approach of material semiotics influences the emergence and development of multispecies ethnography. Material semiotics is a set of concerns, sensibilities, and methods used to describe how actions performed by both beings and things shape and are shaped by a simultaneously semiotic and corporeal web. Performance or productivity in terms of becoming part of an entangled hybrid assemblage of beings and things may also be called “response-ability” (Haraway 2008) based on the performance of other actors. It aims to capture how and where an assemblage is made, what it excludes, and its inter- and intra-power relations, while carefully examining the performativity of actors and the multiple realities that heterogeneous actors enact within the assemblage (Law 2019). Karen Barad (2007: 141) also argues that agency and objects should not be taken as preexisting, because they emerge only through intra-actions. Interaction presumes the existence of objects, and ideas and ideologies (including identities) that participate in action with each other. Meanwhile, intra-action emphasizes agency as “the dynamism of forces” in which nature and society are inseparable and entangled, and beings and things are constantly influencing and materializing with each other.

Material semiotic approaches believe agency does not require intentionality and consciousness because one’s actions without intentionality still influence others, causing them to react. Conceptualization of agency without requiring intentionality and instrumentality is especially salient in the recent development of post-humanist and multispecies ethnography (e.g., Tsing 2015). Material semiotics has led anthropologists to a methodological shift from representation to performance, from being an actor to becoming an actor with other actors, from intention and rationality to association and relationality, through the lens of multispecies, or more-than-human kinds and selves.

Examining fishing and oceanic politics from the approaches of multispecies ethnography shows that potential aquatic actors in the dynamics of maritime environments can be kinds of fishers (which include human bipedal fishers, dorsal fin fishers such as high trophic carnivorous fish, and sea mammal pinniped fishers like seals and sea lions), inorganic travelers and seabed settlers such as microplastic and shipwrecks, and wild, farmed, or hatchery-released fish and shellfishes. I will next introduce some specific examples of fish and fishing politics from

the approaches of multispecies ethnography, followed by my case study on the herring stock enhancement program in Japan.

Ethnographic Explorations of Multispecies at Sea

Many maritime multispecies ethnographies, which concern a variety of tense environmental, food, and identity issues, explore how the ocean can entangle fish and human lives and how multiple conflicting realities emerge. Elspeth Probyn (2016) problematizes the simplified historical view of the biocultural relatedness of oceanic fish and humans thus far. Eating and tasting seafood such as oysters, which is one of the earliest aquatic species domesticated by humans and filters up to 50 gallons of seawater every day, reflects both humans and oysters' entanglement and relatedness to local ecological food webs, environmental histories and changes, and health and sustainability. Taking a variety of fishery-targeted species, including bluefin tuna, herring, and anchovy in addition to oysters, along with migrant human fishers and fisherwomen working ashore, Probyn describes that fish may have one physical body but swim with multiple implications that were created in fishery management involving heterogeneous actors, including human and nonhuman beings and things. Her queer feminist approach shows how more-than-human ethnography and environmental humanities can not only capture the complexity of seafood politics and sustainability but also shed light on the silenced voices of women and nonhuman actors in conservation politics and the discussion on the Anthropocene.

Multispecies ethnography offers an alternative perspective to more "traditional" conservation and fisheries management. For example, as is the case with individually transferable quotas and total allowed catch, most industrial fisheries management in the world tend to persist with bio-economic models, in which the scale and yield of fishing is determined by a scientifically monitored and calculated biomass of the fish populations at sea. However, most fisheries management uses a simplistic model that targets only fishing effort, a symbolic representation of the fish stocks and biomass underwater, while human actors, most notably fishers, are considered external factors (Holm 1996). According to Jahn Johnsen and colleagues (2009: 26) in "The Cyborgization of the Fisheries":

The ontological starting point for ideology formulation and the building up of fisheries management and governance institutions has been the individual, human rational actor and fish understood as members of a single species population. By regarding fishing people as individual harvesters in need of social control and fishing as the removal of surplus production or biomass from single species fish populations, the agency of fish and fishing people as social, relational living beings is completely overlooked.

To avoid this oversight in his discussions of natural resource management, Michel Callon (1986) treats scientists, fishers, and scallops symmetrically as actors that make and are made by networks of interactions. He finds that the consequence of hybrid assembling often ends in an unexpected manner because not all actors, including scallops, perform as expected. Examining how the lionfish perform with a variety of tropes of belonging, Amelia Moore (2012) explores marine conservation management in the Bahamas with special attention paid to the metaphors made about invasive lionfish and overfishing fishers, both of which are often considered threats to environmental health within conservation regimes. Gourmetization enhances the lionfish's edibility, which transforms lionfish from a mere nuisance invasive species to the subject of commercial fishing. These examples show how maritime multispecies ethnographies highlight the limitations of simplified, single-species approaches within anthropocentric resource managerial

paradigms, partially because the performance of aquatic nonhuman actors is not completely visible or sensible to human actors.

Domestication studies that use the multispecies ethnography approach examine the co-species mutuality and multiplicity of realities. In *Becoming Salmon*, Marianne Lien (2015) examines the co-species history of how salmon emerged as a new industrial domesticated food and product, while making the boundary between the domesticated and wild uncertain. Domestication is a coproducing form of world-making through interspecies entanglements. Her demonstration of Atlantic salmon living and creating multiple realities, which is also called “the slipperiness” of salmon (Law and Lien 2012), shows fish-as-beings exist and become simultaneously different entities according to the relationality of heterogeneous human actors. Lien approaches “domestication as sets of relations across species barriers that enable and enact particular biosocial formations, or reproductive practices through which humans and nonhumans mutually inhabit each other’s worlds and (intentionally or unintentionally) make space for one another” (2015: 4). With the metaphors of mutuality and uncertainty, Lien’s multi-sited, multi-species ethnography elaborates an open-ended practice of industrialized aquaculture as forming salmon as a companion species for humans in a processual assemblage of multiple agencies. Her examination of industrial farmed fish as sentient beings also signifies the importance of studying oceans and aquatic species, by blurring general distinctions between fish and animals, and between organic and nonorganic (processed) foods, problematizing the marginality of fish and shellfish in animal welfare discourse (e.g., Kopnina 2017; see also Wallace 2004).

As for the ocean, Elspeth Probyn’s (2018) “ocean multiple” captures how the different forms of the oceanic emerged through the introduction and flow of methylmercury to the spatial and temporal realms of certain oceans and human populations in the uncertain era of the AnthropOcean. Stacy Alaimo (2012) elaborates the trans-corporeality of the sea, discussing the interconnectedness of human bodies, nonhuman bodies, and the material surroundings, through the aquatic origin stories (the ocean is the ancestor of all lives), and the hidden death and destruction of nonhumans and environments behind the global flows of sushi, plastic, and toxic substances such as mercury. These multispecies studies at sea suggest the interconnectivity and inseparability of the human and other beings because they necessarily co-constitute their existence (Haraway 2007). The introduction, flow, and cycle of plastic, methylmercury, and other unnatural things in seawater turns oceans into hybrid seascapes, making the oceanic and its vastness, untouchability, invisibility, wilderness, and frontieriness into an uncertain background and/or backwater in the maritime anthropological studies of fish and fisheries in the Anthropocene.

In *Alien Ocean*, Stefan Helmreich offers a multi-sited, multispecies ethnography of marine biology and its association with other beings and things, describing the pluralities of forms of life, which are “cultural, social, symbolic, and pragmatic ways of thinking and acting that organize human communities” (2009: 6). Examining the entanglement of marine microbiologists, environmentalists, Native Hawaiians, the biotechnological industry, and research tools and technologies and other nonhuman things, he explores the beliefs and actions of marine biologists as ebbing and flowing between dual vision of oceans (i.e., oceans as full of lives with the potential of new knowledge and future life forms, and oceans as realms that are beyond human control). Helmreich describes how various aquatic microbes become meaningful to and with human actors as necessary allies for coproducing marine assemblages.

Multispecies ethnography focusing on oceanic creatures also contributes to the enrichment of research methods. While “becoming with” is the key concept for multispecies ethnography, Eva Hayward and Heather Swanson add “feeling with” and “thinking with” to understand the ways aquatic creatures live in their watery worlds. Using a queer theorist perspective as Probyn

(2016) takes a sensual approach to eating and tasting oysters, Hayward (2010) pays close attention to the cross-species, cross-sensual encounters in perceiving and establishing relations between the cup coral and those who study them. An aquatic creature such as the cup coral can come to matter as an actor in the development of a scientific reality of oceans. The process involves scientists' use of their sensual impressions, in transforming and translating the materiality of aquatic beings into symbolic images and numbers in labs. Hayward explains that impressions through sensual experiences/encounters become mediators in the scientific makings of species differences. Meanwhile, Swanson (2017) proposes methods and tools that natural scientists use in their engagement with nonhuman actors for "non-humanist" and multispecies ethnographic studies. Natural scientists use salmon scale and otoliths (ear bones) to understand individual salmon life histories because analyzing the formation and patterns of crystallized fish scales and otoliths indicates fish migrations. Studies by Hayward and Swanson suggest the potential enrichment of multispecies ethnographic description through engaging with diverse, cross-disciplinary approaches to understand the lives of aquatic species and the oceanic environments they live in.

Stock Enhancement

Such examples of oceanic multispecies ethnographies mentioned are relevant to my studies on herring hatchery and the stock enhancement program in Japan. Stock enhancement is a collective performance of transforming the domesticated fish to the wild. It involves releasing the "cultural" fish into the "natural" oceanic world. Therefore, a hatchery-bred fish is a biosocial being becoming-with other associating actors, blurring the distinction between the wild and the cultured. The multispecies anthropology of stock enhancement examines the differences emerging between the wild, farmed, and hatchery-released fish in the discourse, as well as the practice of fishery resource conservation and how the stocked fish—a kind rather than a species—come to matter as actors in shaping the hybrid coastal seascape.

The development of fish hatchery science and technology has 140 years of history in Japan (Bell et al. 2008; Imamura 1999; Kitada 2001), and Japan accelerated the science and technology for culturing and releasing juvenile aquatic species in the 1970s and 1980s (Honma 1993; Imamura 1999). In the late nineteenth century, there were seedling production and release attempts concerning various fisheries species (in both sea and fresh waters), from finfish to shellfish to crustaceans like lobsters (Cowx 1994; Nicosia and Lavalli 1999). The incipient artificial propagation and release of eggs and larvae proved there are no positive impacts from the increase of fishery landings (Bell et al. 2008; Kitada 2001). However, the interest in artificial seedling production and release of fisheries species grew as the demands for seafood and the pressure on capture fisheries increased. Sea-farming programs emerged as salient components of Japanese inshore fisheries. Today, the release-and-catch "sustainable" fisheries based on the hatchery production of fish fry and juveniles are conducted in many places, including with salmon in the Pacific Northwest (Swanson 2018).

In principle, stock enhancement programs are based on a one-species approach to resource management. The term stocking symbolizes how oceanic environments are economized in a quantifiable reality. Fish are stocked in the ocean as if they are part of an inventory made possible under material and financial circumstances, and oceans are simplified as the storehouse where fishers are expected to remove stocked fish in a manageable manner. However, even with the single-species approach, stock enhancement is an assemblage of kinds. Fishers; marine biologists specializing in fishery-targeted species, wild fish, hatchery-bred cultured fish, beings, and

things to be fed on cultured fish; and technologies of nurturing and marking cultured fish are just some of the actors who shape a particular form of fishery resource conservation paradigm and controversy (e.g., Taylor 2001). At the same time, fisheries biologists also enact themselves as researchers, *becoming* human actors working *with* hatchery-bred fish (e.g., Haraway 2007). Cultured fish perform as scientific specimens in laboratories and as biological beings in coastal environments. As multiple “forms of life are shaped and made possible through a shared heritage” (van Dooren et al. 2016: 2), a multispecies ethnography of stock enhancement reveals how human and nonhuman species coproduce histories of seascaping through entangling and engaging in multiple realities through different perspectives.

I call this cultured, hatchery-bred fish “techno-fish” to indicate it is a set of relations that human actors maintain with the fish through techniques and technologies. I also avoid calling them hatchery-bred fish, because their performance and association with other human and nonhuman beings extends beyond hatcheries (Hamada 2014). The term cultured triggers multiple translations and is understood differently according to disciplinary backgrounds. In certain disciplines, cultured could refer to being educated, refined, and “modernized,” while culture refers to the anthropogenic domestication of other species in anthropological discussions of economic systems. In fisheries sciences, culturing means cultivating aquatic species. By labeling the artificially propagated and reared herring as techno-fish, I emphasize their hybridity and their associations with technology and science rather than with mixed meanings of culture. Stock enhancement unsettles the wild-farmed boundary. Techno-fish come to have different identities through their social life histories: from farmed to released to wild. However, this hatchery-bred fish does not really become wild as a result of release. Techno-fish as wild is just one perspective. For example, the techno-herring is wild but not wild for scientists, as they maintain their relationship by marking the techno-herring with various tagging technologies.

The implications of stock enhancement programs are not limited to the introduction of techno-scientifically produced fish released into the ocean. Along with salmon, the social impact of the history of sea farming in Hokkaido has made the Pacific herring a metaphorical “keystone species” in the discourse and practice of fishery resource management in Japan (Lowe 2004; Moore 2012; Thornton and Moss, forthcoming). Sea-farming programs were normalized in Japan’s fisheries management as a technological fix for aquatic resource issues while avoiding the discussion of the industrialization of coastal seascapes as a cause of the fishery problem. This also marks the emergence of high modernism in fisheries management, with technological development and a new science-based epistemology and phenomenology of nature and economy (O’Byrne 2009). The techno-science-based stock enhancement program simplifies perceptions of seascapes into pools of fishery species rather than a complex ecosystem.

In Japan, *sodaterugyō* (“fishery that nurtures,” SOG hereafter) connotes both the cultivation of targeted fish species and the techno-scientific embodiment of seasapcing through anthropogenic intervention in marine ecosystems. SOG differs from *saibaigyō* (“fishery that cultivates,” generally translated as “restocking program,” SAG hereafter), which narrowly focuses on the seedling production of commercially valued fish and shellfish species in hatcheries. SOG fisheries embrace a broader range of activities than SAG fisheries because they are supposed to include institutional arrangements to coordinate human extractive activities so that the stocked and natural-bred fisheries species are used sustainably. Yet, in both cases, hatchery-bred fish and shellfish are released into the sea and spend the rest of their lives in the sea. As a result, when fishers catch the hatchery-bred fish, the fish is considered wild-grown and caught (*ten’nen*) as opposed to farmed (*yōshoku*). In Japanese seafood markets, aquaculture articulates

the difference between nature and culture (aqua-culture), but the techniques used in the SOG and SAG fisheries make the nature-culture boundary slippery by releasing “cultured” fish into the “natural” environment.

In the case of the Pacific herring (*Clupea pallasii*) stock enhancement program in Japan, techno-herring is a research tool for fishery biologists to study ecological behavior. Fisheries biologists need the cultured herring to collect data for scientific research and in order to present research at conferences, workshops, and in academic journal publications, producing cultural capital in academia. The techno-herring is expected to perform their “herringness,” embodying the development and mobilization of stock enhancement techniques and knowledge on local and global scales.

Fisheries biologists maintain their relationship with the growing techno-herring juveniles by associating themselves with other companion actors such as phytoplankton and brine shrimp that they use to feed the herring. The techno-herring allows them to conduct a series of laboratory and applied field experiments. Yet, as much as fishery biologists influence the life cycle of the techno-herring from fertilized eggs to larva and fry to its juvenile stages, the fish also manipulate researchers to enhance their survivability. Hatchery-bred fish enhance their survival rates by having researchers work for them; for instance, such researchers adjust the water circulation and temperature, clean the fish tanks, feed them nutrition-fortified food, protect them from predators, and so on. Further, if we accept this idea of a mutually beneficial multispecies relationship as a critical part of nature-making, then researchers also become a part of the constituting evolutionary histories of herring fisheries and fisheries science in Japan.

As is the case with the economic-rational models of fisheries management, marine science and stock enhancement programs require that the fish in tanks and pens and those at sea be symbolically represented. Fisheries biologists systematically measure the estimated total number of juvenile herring in fish tanks using average herring weights and sizes. They translate and convert the physicality of the herring into many *kinds* of quantitative data. These include the estimated average lengths and weights of techno-herring fry and juveniles, the estimated return rates, and the estimated ratio of cultured to natural herring in catches. The numbers operate as heuristic devices for researchers to perform nature-making with hatchery-bred fish (e.g., Lien and Law 2011; Verran 2010). Hatchery-bred fish physically swim in fish tanks and then in the Pacific Ocean, but they are also embodied in figurations and stored in fisheries biologists’ computers. Fisheries biologists translate hatchery-bred techno-fish through figuration, and techno-fish as scientific knowledge are mobilized and circulated when fisheries biologists publish them in articles and reports (e.g., Lien 2007).

Fisheries biologists who cultivate and release techno-herring use large-scale marking techniques on fish otoliths with Alizarin complexone (ALC). Otoliths, or fish ear bones, are small pieces of calcium located behind herrings’ brains, functioning to help them balance their bodies. The herring are too small for a tag to be placed on their external bodies, and even if they could be tagged, it would cost too much because so many herring are released. Therefore, fisheries scientists distinguish and differentiate the techno-herring from wild, naturally spawned herring by using marked otoliths. Through the identification of naturally spawning areas and the monitoring of the herring’s homing patterns by tracing them with ALC-tagged otoliths, fisheries biologists produce knowledge for a scientifically systematic understanding of the ecology of the herring, rather than an economically rationalized mass production of fish juveniles. Herring researchers color water in the fish tank with ALC (the chemical is also used as a food coloring additive), and as techno-herring swim in the ALC-administered water for a day, their otoliths absorb the ALC’s dark purplish red color. Fisheries biologists informed me that the fish

remain unharmed when they use this internal pigmentation method. However, because otoliths are located inside the herring, researchers cannot visibly distinguish between cultured and wild herring based on their morphology. Therefore, they must perform autopsies on all sampled herring when examining the foraging juvenile and returning mature fish. The otolith is an important mediator for fisheries biologists to keep their associations with the techno-herring and to mobilize their biological and environmental knowledge as scientific experts.

With techno-fish as a companion kind, rather than a companion species, fisheries biologists conduct stock enhancement research by and for accumulating data, circulating their research, and citing references through various heuristic devices. Researchers perceive the herring via their scientific epistemology, which enacts a particular reality of the herring. In other words, researchers interpret the herring using their cultural model and translate them into various forms—biomass, body weights, images, maps, and texts (Latour 1999). The hatchery-bred fish in the form of numbers not only allow researchers to count (which means they become manageable) but also generate cultural capital for the researchers who raise them.

Meanwhile, through interactions with fisheries biologists, cultured and released fish perform pluralities, or multiple realities. The hatchery-bred fish serve as techno-scientific research tools for human scientists and thus become part of seascaping. They are also a kind of domesticated fish, whose lives are restricted because of environmental constraints (i.e., the size of hatchery fish tanks) and budget planning. While the techno-herring is a companion fish for fisheries biologists, commercial fishers do not and cannot visibly distinguish the hatchery-released techno-herring from other herring they catch with their gillnets and set nets at sea. Therefore, for commercial fishers, the techno-herring is as wild as other beings they encounter at sea, while the techno-herring does not become wild for fisheries biologists as long as they have ALC-tagged otolith inside their heads, whether alive or not. This slippery wildness of the techno-herring leads to the wild-domestic, pure-applied science dichotomies being unsettling.

Conclusion

The more-than-human approaches of multispecies maritime ethnography show that the lives of aquatic nonhuman creatures such as marine microbes, scallops, invasive lionfish, farmed salmon, and techno-herring emerge through complex sets of relations. These studies show us that the ocean can be particularly useful when reconsidering what wild, nature, and culture mean within environmental and food politics. Still inaccessible, invisible, and untouchable for most humans, oceans continue to be sources of wonder—both the potential and limit of our imaginability. Maritime multispecies ethnography offers opportunities to think of the hybridity, inseparability, and significance of oceans from the history, present, and future of human societies.

Fishing requires engaging with fish. The same is true for marine fisheries biology. Without target species, no fisheries research can be conducted. Techno-herring perform as scientific specimens in laboratories and as biosocial beings in coastal environments. Without the development of controlled fish hatching and rearing techniques, hatchery-bred fish would not exist. Simultaneously, without the adaptive responses of hatchery-bred fish to fish-tank environments, many herring researchers would not have these particular jobs and might have to work on different species and systems altogether. Describing how fisheries and seafood embody an assemblage of many different kinds of human and nonhuman actors, a multispecies ethnography of stock enhancement offers us yet another way of understanding the oceanic in conjunction with the human-as-*Homo sapiens*.

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