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Fish, factory trawlers, and imitation crab: the nature of quality in the seafood industry

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Abstract

As the last major food that is primarily wild-caught, fish offers unique perspectives on relationships among nature, quality, and agro-food production. Developing a case study of changing constructions of quality in the global *surimi seafood* industry, this paper explores how ideas about quality are not simply social constructions that have material effects, but are complex interactions between natural inputs and their environments, production techniques and technologies, and foods and their uses. *Surimi* is a fish paste made from a variety of fish species, including Alaska pollock, the largest fishery in the world, and is used to make a variety of seafood products, including both traditional Japanese fish cakes and imitation seafood products (e.g. 'krab'), which is the most common form in the US and Europe. Drawing on recent approaches to relationality, the analysis treats product quality neither as a purely objective measure nor subjective judgment, but instead as an assemblage of interactions at multiple stages of commodity chains. Analysis of how quality in the surimi industry has changed as production and consumption have moved to new places, and how quality then affects patterns of production and consumption, reveals that physical characteristics of the fish, and the environments from which they come, play key roles in quality definitions. Yet at the same time, which characteristics count as quality is defined within the production networks. Rather than focusing on relationships between 'nature' and 'society', analysis of individual production networks elucidates how specific aspects of what we call 'the natural world' participate in specific interactions. The key is not whether natural processes put constraints on economic activities or whether economic actors are able to outflank nature through technical innovation, but rather how specific elements and activities within production networks define each other in their interactions.

1. Nature, quality, and agro-food production

As one of the last 'wild' foods generally available in grocery stores and restaurants, seafood presents an interesting case for examining the relationships between nature, quality, and agro-food production. As a wild-caught food, seafood raises issues about natural variability—over time and space—and its effects on quantity and quality of food supply, as well as the impacts of fishing activity on the ecosystems in which marine organisms live. At the same time, seafood producers are faced with a variety of quality issues, from safety concerns about perishability, to less tangible issues about how production methods affect the final product that reaches the consumer. The relationship between biophysical factors and production have been at the forefront of a number of recent debates about the quality of seafood. Examples include warnings about the safety of seafood for pregnant women and children because of high mercury levels; controversy over whether wild-caught fish can be considered organic or if the organic label should be reserved for aquaculture products in which production is 'controlled;' questions about the use of eco-labeling schemes as an incentive to use sustainable fishing practices; and industry efforts to produce specialty products through more careful handling of the fish at all stages of production and distribution.

These issues are particular to the world of fisheries and seafood, yet they also highlight in more general terms the problem of 'quality'. How is quality determined and evaluated? What relationship does quality have to the biophysical processes, economic demands, and cultural practices that interact throughout the production and consumption of foods? These questions about negotiations over food quality are significant for

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food producers, regulators, and consumers. To address these relationships between quality, nature, and production, this paper analyzes one specific seafood industry, that of *surimi seafood*. *Surimi* is a fish paste made from a number of fish species, including Alaska pollock, the fishery for which is the largest in the world. Surimi paste is then used to make a variety of surimi seafood products, including traditional Japanese fish cakes and newer imitation seafood products (e.g. 'krab'), which is the most common form in the US and Europe. Although surimi is a highly processed, low-cost item, quality of everything from the fish to the final product is paramount in this industry. Because of this, concepts of quality have played an ongoing role in shaping global patterns of surimi supply and demand. However, although regularly raised by individuals, associations, and magazines and journals as an issue, it is not easy to define just what quality means in this industry. Quality seems to be at once defined by the physical characteristics of the product and also by changing socio-spatial relations.

1.1. Approaches to nature

Seen from these perspectives, the problem of quality raises questions about the significance of biophysical processes for production systems, and requires addressing more generally notions about the natural world and its relationship to social processes. Over the past several decades, the nature of Nature has become a major area of research and writing in many academic fields: for example, History (e.g. Cronon, 1995; Merchant, 1980, 1995), Geography (e.g. Castree, 1995; Demeritt, 2001; FitzSimmons, 1989; Smith, 1984), Sociology (e.g. Benton, 1996; Foster, 2000), and Science Studies (e.g. Haraway, 1991, 1997; Latour, 1993). There seems to be general agreement across many of these 'nature studies' that the dualistic categories of 'nature' and 'society' are problematic, and that there need to be new ways of theorizing, analyzing, and talking about the world (see Castree and Braun, 1998 for a review). These new ways must take biophysical entities and processes seriously as existing beyond our imaginations, without falling into a realist stance that accepts that nature exists 'out there', somehow separate from human existence. Demeritt recently termed this overall approach "heterogeneous constructionism", which refers to the "mutual construction of nature, science, and society. Rather than taking these phenomena as given, this approach is concerned with how they are constructed through the specific and negotiated articulation of heterogeneous social actors" (Demeritt, 2001, p. 311). While there is general agreement on the basic outline of this approach, there is also general dissatisfaction with *how* this is actually being done, and the field seems to be at a standstill. There is a sense that each approach, in the end, still resorts to the dualistic categories by treating nature either as an external realm that acts as resource for, limit to, determinant of, or backdrop to human society, or as a pure social construction with no independent reality (see FitzSimmons and Goodman, 1998; Goodman, 1999; Goodman, 2001 for reviews that relate in particular to agro-food studies). How can we treat nature, biophysical processes, and the 'organic' as analytically significant without treating them as a mechanistic function or a materiality that is outside of social existence? The continuing unease about this issue is particularly evident in agro-food studies, in which the 'natural' and the 'social' both seem so present—so real—and yet so elusive. The tension between nature as material reality or as socially produced runs throughout debates about biological determinism, the ability of capital to "outflank" nature, and the ways that nature continues to "rebound" through ecological crises and food scares. Marsden et al. (1996, pp. 367–369) have summarized several of these perspectives on nature in agro-food studies, in which nature is treated as real but residual (to be overcome by industrial development) or as a social construction (a field of meaning produced within social systems). Recent scholarship on nature-based industries addresses these issues by highlighting that biophysical processes can provide both barriers and opportunities for production systems, and as such, they can play a key role in structuring some industries, especially those that are biologically based (Boyd et al., 2001).

This paper attempts to address these issues by analyzing the relationships between biophysical processes and economic production in constructions of product quality within the surimi industry. Analysis of different definitions of quality is particularly useful for examining the role of nature in economic activity and agro-food production because quality itself is alternatively conceptualized as either real and objective, or discursive and subjective. In one view, quality is a physical reality based on measurable characteristics of a product that are quantifiable and given. In another, quality is purely a social construction of what people like, determined within cultural systems of signification and economic systems of capital accumulation. In this analysis, I explore the tensions between these perspectives by addressing how definitions of quality emerge through different types of production practices. Rather than focusing on relationships between 'nature' and 'society', I examine individual production networks to understand how specific aspects of what we call 'the natural world' participate in particular interactions. As such, the emphasis is less on 'nature' as a whole, and more on particular biophysical elements and processes. This shift opens up room for treating natural processes as analytically significant without reducing them to either external reality or social imaginary.

The paper is divided into two main sections. In the first, I discuss the concept of product quality. After outlining how quality has been conceptualized in the agro-food literature, I offer a somewhat different definition, focusing on quality as assemblages of elements and practices within commodity chains. Drawing upon theoretical approaches to relationality, I argue that quality is not simply a *set* of elements within commodity chains, but rather quality assemblages are the outcome of *relations* among these elements. In the second section, I use this definition of quality as a framework for analyzing empirical research on the socio-spatial structure of the global surimi seafood industry. Based on interviews with industry members, site visits to industry settings, and analysis of industry publications, I examine three commodity chains within the global industry. I show that different quality assemblages arise from unique sets of relationships within each of these chains. These quality assemblages are about how physical characteristics of different fish translate into characteristics of surimi, based on variations in production techniques combined with culturally specific food practices. These fluid notions of quality affect material practices in terms of the types of fish used, methods of processing, locations of production, patterns of trade, and the range of products available in different markets. The natural world is thus central to quality and agro-food production more generally, but what is of importance is not nature in the abstract, but particular biophysical processes and their interactions with other dimensions of food systems.

2. Quality and nature

> The quality of surimi plays a very important role in making the surimi business a success. Kamaboko producers must trust the suppliers to give them a consistent quality and supply of material to produce the analog products for consumers. 'Quality' includes the market acceptance of the surimi that a particular company or vessel produces. There is no perfect surimi; the processors prefer a variety of different characteristics of surimi within the same quality parameters.... When we first began producing surimi in the United States, the Japanese markets didn't trust the quality of surimi that the Americans produced. In the past five years, we have developed loyal customers who prefer the products off our vessels. The general taste of Japanese consumers also changes (Jensen, Arctic Alaska, 1992, p. 66).

The above quote about quality in the surimi industry focuses less on physical characteristics of the product, and more on issues of historical patterns, trust, economic practices, and social relationships within the industry. Over the past decade, a number of researchers similarly have found that ideas about quality are not necessarily narrowly focused on measurable characteristics of a commodity. Within the literature, quality is now recognized as a complex concept that goes beyond simple notions such as food safety. One way in which the idea of quality has been introduced is as a way of connecting relations of production and consumption, particularly with the development of transnational food commodity chains (e.g. Arce and Marsden, 1993; Goodman and Watts, 1994; Marsden and Arce, 1995). In this set of literature, quality is about consumers' changing perceptions and how their demands for foods of 'high quality' affect material relations around the world. The quality demands of relatively affluent, first world consumers have had a cascading and uneven effect on producers around the world.

From this has developed a second way of viewing quality. Instead of treating it simply as socially defined by consumers, a variety of scholars have suggested that quality is more broadly about social relations all along these commodity chains. Consumers' quality demands are but one piece of definitions; quality itself is actually constructed through the interrelationship between consumers, producers, traders, retailers, and so on (Busch and Tanaka, 1996; Ilbery and Kneafsey, 1998, 1999, 2000; Marsden and Arce, 1995; Marsden, 1997; Ventura and van der Meulen, 1994). "Quality is a complex notion, the meaning of which may vary for specific products and between individuals, regions and countries. It is socially constructed through the interplay of different actors" (Ilbery and Kneafsey, 2000, p. 217). Definitions of quality might include factors such as the place in which the item was produced, relations of trust among the different actors, or whether the item was made locally. In this social construction view, to focus only on how consumers define quality misses a whole range of social relations through which quality, as a convention, is produced.

Although it is emphasized to different extents, in both of the above definitions, food quality includes a set of physical characteristics that can be measured and standardized, and which then have a material effect within systems of production. However, while acknowledging the importance of physical characteristics, these are basically treated as a blank slate upon which social actors, through social relations, etch their meanings. The question remains as to how material characteristics, biophysical processes, and environmental factors play an analytically significant role in these socially produced definitions of quality.

Drawing on conceptions of nature and society discussed earlier, I propose viewing quality as complex assemblages of political–economic, cultural, and biophysical relations. Quality is neither a subjective judgment (what different people like), nor an objective measure (the characteristics of a commodity), but

instead is produced within relations of commodity production and consumption. By using the term assemblage, I do not mean to imply that to understand concepts such as quality, we need to add up the various elements of individual commodity chains. Rather, to avoid treating quality simply as a set of physical properties or a set of social practices and judgments, I treat constructions of quality as interactions among sets of elements and activities within commodity chains. What emerges in these interactions is not just some new element (i.e. quality), but rather, in interaction, the elements themselves change. There is no pure essence here (natural or social), only identity-in-relation. In other words, the point is not to posit already constituted elements that interact, but to examine how, through interaction, elements themselves are brought into being in specific ways. Deleuze describes this orientation to interaction as "a theory and practice of relations, of the AND" (Deleuze and Parnet, 1987, p. 15). The concept of assemblage is drawn in part from his work, in which he defines assemblages as multiplicities and states that "it is not the elements or the sets which define the multiplicity. What defines it is the AND, as something which has its place between the elements or between the sets" (1987, p. 34). In this formulation, things and ideas cannot be reduced to an essence, but rather exist only in their interaction—in the AND. Yet, while the AND might be a clever rhetorical device, it still leaves open how this theory and practice of relations actually works. I have found the idea of 'translation', as developed separately by Latour and Haraway, to be quite helpful for understanding what it means for elements simultaneously to interact and come into being through that interaction.

In a quote that resonates with Deleuze's definition of assemblages, Latour (1993, p. 113) states that "nothing is, by itself, either reducible or irreducible to anything else. Never by itself, but always through the mediation of another. How can one claim that worlds are untranslatable, when translation is the very soul of the process of relating?" Against essence and permanence, then, Latour argues for "translation, substitution, delegation, passing" (1993, 129). Translation here does not imply a one-to-one correspondence, but rather is about displacements and drift (Latour, 1994). He claims that the world—including beings, entities, representations, and so on—emerges through interactions that are necessarily translations. Through translation, interaction changes the elements that are interacting. This makes the world no less real, but recognizes that it emerges through interactions that are always partial. It is important to note here that although the idea of translation is used widely in Actor-Network Theory, as developed by Latour and others, my use of the term is somewhat different than that generally used. For example, Callon, another major figure in ANT, also writes extensively about translation, but in his definition there is a chain of translation involving a translator, the translated, and an intermediary—for example, inscription devices and technical devices (see Callon, 1991, 1995; Callon and Law, 1995). As is the focus of ANT more generally, translation here is more about the role of intermediaries than it is about multiplicity and interaction. Thus, although I acknowledge the influence of ANT in my use of the idea 'translation', I want to emphasize that translation as used here is more about the act of relating than it is about intermediaries and chains of translation.

Focus on translation and the partial is similarly taken up by Haraway. Although her work on cyborgs and "the promise of monsters" (Haraway 1991, 1992) is also often called upon to address questions about nature and society, it is specifically her work on situated knowledges and partial perspective that I find most useful here.[1] In this work, she claims that knowledge (science) is about "interpretation, translation, stuttering, and the partly understood…Translation is always interpretive, critical, and partial. Here is a ground for conversation, rationality, and objectivity—which is power-sensitive, not pluralist, 'conversation'" (1991, p. 195). In this view of knowledge-as-conversation, there is no dichotomy between 'reality' (materiality, nature) and 'social construction' (discourse, knowledge, representation). Rather, through partial translation, things come into being as objects of knowledge. "Accounts of a 'real' world do not, then, depend on a logic of 'discovery', but on a power-charged social relation of 'conversation'. The world neither speaks itself nor disappears in favor of a master decoder" (1991, p. 198). We do not have access to real-things-as-they-are, but neither are knowledges simply random social constructions. Rather, things arise through 'conversations' that are necessarily partial translations. In other words, what Haraway, like Deleuze and Latour, is arguing is that things are not just what they are, but they become that through interaction with other things—through translation.

From these perspectives, quality, as an assemblage, is about the ways that elements within commodity chains translate each other. Quality is an always partial and power-laden conversation among various aspects of production at different points along commodity chains. This has important implications for how we think about 'the natural'. The natural world is both entirely real and discursive, but is neither resource nor constraint: the key is not whether natural processes put constraints on economic activities or whether economic actors are able to outflank nature through technical innovation, but rather how individual elements and activities within

[1] Haraway's piece "Situated knowledges: the science question in feminism and the privilege of partial perspective" appears as a chapter in her book *Simians, Cyborgs, and Women* (Haraway, 1991).

commodity chains define each other through translation. As material products move through commodity chains, specific pieces of the biophysical world, and specific biophysical processes, are understood in certain ways, and are linked to cultural and economic practices, which are themselves not possible without their linkages to physical processes. The material characteristics of individual products, and the environments from which they come, can play a key role in quality definitions. Yet at the same time, which characteristics count as quality—or not—is defined within the commodity chains and their power-charged relations. Further, this is based on a mix of factors such as for what the product will be used, economic practices within the industry, and available technologies. This perspectives resonates with that of Cronon, who, in his analysis of the creation of a grading system for wheat in Nineteenth Century Chicago, also suggests that quality is the outcome of biophysical, technical, and socio-economic relations (Cronon, 1991). From this perspective, commodity chains are not only about the flow of goods, but commodity chains elicit quality assemblages by creating distinct relationships between material goods and social and economic relations. Because it is through these relationships that objects themselves come to be defined, no one element can be determinant of the others. It is only in their constellation that any particular element (be it 'social' or 'natural') gains its significance.

3. Changing definitions of surimi quality

As the surimi industry has changed over the past quarter century, so have ideas about quality in this industry. Surimi was once exclusively a Japanese industry, but now surimi and surimi products are also produced and consumed in Southeast Asia, Korea, China, Pacific Russia, North America, Chile and Argentina, and Western Europe (particularly France and Spain), among others. Surimi producers—both local and transnational—have developed new commodity chains, often spatially extensive, linking fish to consumers. To examine how these changes affect definitions of quality, and how these new quality assemblages then work within the global industry, I focus primarily on three individual commodity chains: North Pacific pollock to traditional Japanese surimi products; Thai threadfin bream to new Japanese products; and North Pacific pollock and Pacific whiting to US imitation seafoods. Although I do not follow each link of these chains from beginning to end, I use the term 'commodity chain', as opposed to alternatives such as 'systems of provision' (Fine and Leopold, 1993), to emphasize linkages between different stages of production and between different places. Interactions at each stage of a commodity chain contribute to quality assemblages in particular ways. Thus, structuring my discussion around individual commodity chains is useful for focusing on relationships and interactions, rather than on reified differences between people, places, and types of fish. That is, my argument is not that there is one quality assemblage in Japan, another in the US, and another in Thailand, nor that pollock and bream are of different quality, but that quality emerges through the conjunction of specific fish types and specific products within specific cultural economic practices as this seafood flows through individual commodity chains.

As a simplified framework, I focus my analysis on just three types of elements: fish biology and protein biochemistry; processing technologies and strategies for both surimi paste and surimi products; and the range, types, and end-uses of surimi products. Each of these play into quality assemblages in different ways in individual commodity chains. It is not my intention to treat any one of these issues as causal, and the rest subsidiary, but to explore how they shape each other through different interactions. It is only when they are brought into conversation—that is, as they translate each other—that any one of them gains its significance. Further, it is not my intention to suggest that these three types of elements are exhaustive. In particular, the dimensions of fish biology on which I focus here relate primarily to the role of fish protein as input to production systems. Other dimensions of fish biology and ecology, such as oceanographic processes or the environmental effects of fishing, are mostly not taken into account in this paper (but see the discussion of overfishing in the Thai–Japanese commodity chain). How factors such as these affect quality assemblages and economic geographies of seafood industries is an important area for future inquiry.

3.1. From pollock to kamaboko

The first quality assemblage is that connecting surimi made from Alaska pollock (*Theragra chalcogramma*), from the North Pacific Ocean, to traditional surimi products made and consumed in Japan. Although this commodity chain was first developed by Japanese firms in the 1960s, today the majority of pollock surimi is made by US firms operating in Alaskan waters. Exports of pollock surimi from the US to Japan are the largest volume globally, at about 100,000 metric tons per year (NMFS, 2000). Within the surimi industry, discussion of quality for this commodity chain emphasizes the strict quality demands of Japanese producers, and the difficulty of making surimi that meets these high-quality standards. This quality assemblage has been created through the mutual translation of spatial and biochemical characteristics of pollock; refrigeration and freezing technologies and their effects on processing strategies; and the existence of a range of different surimi products.

There are a wide-variety of Japanese surimi products, and they are used as snack foods, main courses, and even desserts (for descriptions see Kammuri and Fujita, 1990; Park, 2000b). Among the most popular are *kamaboko*, a steamed fish cake, and *chikuwa*, a broiled product. One company, known as a high-quality producer, claims to make over 200 varieties of surimi products. The most important characteristic of surimi products in Japan is their elastic texture, known as *ashi* in Japanese; *ashi* affects the "eating quality" of the surimi, and also its appearance (Okada, 1990b, p. 507). As representatives from Nippon Suisan in Japan explained, "People like kamaboko that has as much elasticity as possible and chewable mouthfeel. In addition, the whiter the color, the higher the people's rating" (Kammuri and Fujita, Nippon Suisan, 1990, p. 249). In other words, high-quality kamaboko has a smooth and chewy texture—almost rubbery—and is not doughy.[2]

There is a complex relationship between these traditional products, the desired texture, and the use of pollock as the primary fish source. Pollock has been "the species of choice" for surimi production because it is bland, very white, has a very high gel capacity (or elasticity), and it is an extremely abundant fish, easily caught in large quantities (Holmes et al., 1992, p. 41). However, it is also important to understand that surimi is not simply a paste, but is a gel that is derived from certain types of proteins in the fish. During processing, producers mince and wash the fish not only to remove all bones, scales, viscera and so on, but also to wash away the water-soluble proteins and isolate just the 'myofibrillar' (fibrous) proteins. It is these myofibrillar proteins that set into a gel, giving surimi its elastic texture (see Lanier, 2000). Although surimi (i.e. protein gel) can be made from any animal protein, the best texture comes from whitefish, such as pollock. Dark species such as sardines have lower percentages of myofibrillar proteins, it is more difficult to isolate these proteins, and they have much higher oil content; the resulting surimi has a lower gel capacity, is darker in color, and can go rancid more easily (Hultin and Kelleher, 2000; Park and Morrissey, 2000).

The definition of surimi, then, is based on an iterative relationship between available fish species and end products. Notions of quality are the outcome of the ways that, within this commodity chain, pollock and surimi products each translate certain aspects of the other. Developed as a method for using large quantities of fresh fish, surimi makers originally used a variety of species (including pollock) from the waters around Japan. Because these processors developed surimi as a method for dealing with available fish, it is a translation of biological characteristics of those fish, including the presence of myofibrillar proteins that are easily separated from the other proteins in the fish. These biological characteristics became the basis for making steamed *kamaboko* cakes, and thus species with these characteristics were more in demand than others. Fish biology and *kamaboko* are brought into an ongoing conversation in which they translate each other in specific ways.

At the same time, production technologies are also elements of this assemblage, and translate and are translated by the other elements. That pollock is an abundant, white-fleshed species with high percentages of easily isolated myofibrillar proteins does not in itself explain the use of these fish for making kamaboko. Instead, additional aspects of protein biochemistry meant that Japanese firms involved in producing surimi before the 1960s faced a number of barriers to using pollock in surimi production. Myofibrillar proteins are actually very fragile: they begin to break down, or 'denature', very quickly after the fish dies, and denatured proteins will not set into a gel (MacDonald et al., 2000). Ideally, pollock is processed into surimi within 12 h, and not more than 48 h, after being caught (Park and Morrissey, 2000, p. 29). Further, freezing pollock also destroys these critical proteins, and so processors must use fish that has never been frozen. The requirement for fresh fish, processed shortly after being caught, was a problem for Japanese producers because the large concentrations of pollock, both north of Japan and in the Bering Sea, are located at a distance from shoreside surimi plants in Japan. Throughout most of the history of surimi in Japan, the low availability of fish that could be processed and used within a very short period of time limited the overall quantity of surimi production. This biochemical process of protein denaturation interacted with the fish, the surimi products, and the spatial organization of production in ways that did not facilitate development of a chain linking North Pacific pollock to markets in Japan.

In the 1960s, new technological developments became a part of the quality assemblage, making pollock proteins more usable and therefore making it possible for Japanese producers to rely on pollock for surimi production (for this history, see in particular Okada, 1990a, 1992). Two technologies were particularly critical for preventing the denaturing of proteins. First, the development of onboard processing facilities, in which Japanese firms deployed their processing machinery on fishing vessels, allowed producers to do primary processing in the fishing grounds, as quickly as possible after the fish was caught, thus maintaining the critical temporal–spatial relationship between fishing and processing. Second, at once more simple and, arguably, more important, was the 1959 development of 'cryoprotectants'—or rather, the discovery that certain salts and sugars, when added to the surimi during initial

[2] The term "rubbery" is used primarily by Americans (see Pacific Fishing, 1983 and Sylvia, 1991).

processing, would protect the surimi once frozen. Using these technologies, Japanese firms were able to exploit the large Alaska pollock resource for the first time; they did primary processing onboard their 'factory trawlers', where they also froze the surimi paste, and they then brought it back to Japan for secondary processing into surimi products. Without these technologies, producers using pollock would only have made very low-grade products that did not have the all-important textural characteristics. So, although pollock has many attributes that make it useful for kamaboko production, it is only as part of an assemblage that includes factory trawlers and sugars that pollock became a high-quality fish for use in surimi production.

An additional element of this quality assemblage is the existence of a grading system. Grades (generally SA, FA, A, KA, KB, from highest to lowest quality) are based primarily on measures of gel strength, moisture content, and whiteness, and almost all top-grade surimi goes to Japan (Interview data; FIS, 1999–2000, 3/15/2000). Although the grading system is meant to be a standardized description of characteristics of the surimi paste, it itself works to construct quality. To be able to test individual functional characteristics, particularly gel strength and texture, it is first necessary to process the surimi into a particular product: raw surimi does not have gel strength independent of additional ingredients and processing methods (see Lanier, 1992, p. 126–127). Thus by affecting these factors, the final product and expected use of the surimi paste influences the grade of the surimi paste itself. Grades of the primary product are a function not only of measurable physical characteristics of surimi paste, but of how well it performs as a given product; these aspects are not separable from each other.

In this commodity chain, then, definitions of quality arise out of the interaction between pollock biology, traditional socio-cultural expectations about surimi, and processing techniques and technologies: factory trawlers, sugars, myofibrillar proteins, and *ashi* translate each other into a specific type of product and notion of quality. As one Japanese producer puts it, "the technological goal of kamaboko production is to maximize *ashi* of the final product from a given fish… by applying good processing techniques as well as by using proper ingredients" (Okada, 1990b, p. 507). It is the combination of technologies, fish proteins, and end products that together define quality in this commodity chain. Each of these factors translate the others to create a successful commodity chain linking pollock from the North Pacific to kamaboko products in Japan.

3.2. Thai surimi to Japan

Development of a global industry has involved a wider set of places, fish species, types of firms, and even new surimi products and end uses. As producers have developed these new commodity chains, they bring new sets of elements together; it is out of the interactions among these that new quality assemblages emerge, which then further shape strategies and practices within the global industry. Additionally, some groups of individuals and firms are able to influence commodity chains and quality assemblages more than others. One of the more important new commodity chains, in terms of volume of production and trade, links Thai surimi producers to Japanese surimi products firms. The basic elements of this quality assemblage are similar to the previous one—fish biochemistry, production strategies and geographies, and the range of end products—yet these translate each other in unique ways to create a new commodity chain with particular definitions of quality. As a Thai-based surimi industry has developed around new species of fish, the success of this industry is also premised on new kinds of surimi products, particularly a range of new, inexpensive Japanese products. This set of elements translates each other into a new quality assemblage, for which traditional notions of *ashi* are much less important.

Quality in this commodity chain has been structured in part by uneven relationships between Thai and Japanese firms. The surimi industry in Thailand started in the late 1970s, at the initiative of and with investment from three Japanese surimi firms and the Southeast Asian Fisheries Development Center (Interview data), and today has grown to export over 60,000 metric tons of surimi to Japan each year (Asakawa, 1999). Initially involved in direct investment and joint ventures, Japanese firms such as *Kibun*, *Sugiyo*, and *Suzuhiro Kamaboko* are now mainly involved via marketing agreements and technical assistance (Interview data; also de Franssu, 1992, p. 10; Morrissey and Tan, 2000, p. 14). Although Japanese firms have pulled back from direct investment, they have maintained a key role in quality constructions, a role that has been supported by claims that Thai surimi is of lower quality than that from the North Pacific. In the 1980s, the association of Japanese firms (*Zenkamaren*: 'all kamaboko companies') initiated a quality control program to change quality output to match their own standards (de Franssu, 1992; MFR, 1990). Additionally, the current arrangement of marketing/import agreements provide Japanese firms with significant control over the supply chains, including being able to influence the characteristics of the surimi they import (FIS, 1999–2000, 3/15/2000).

Still based around export to Japan, this Thai industry is premised on a different set of species and production strategies than in the North Pacific. The new fish that Thai firms use include a variety of species, in different genera, from the Bay of Thailand and the Indian Ocean, the highest volumes of which are threadfin bream

(*Nemipterus* spp.). Each species has somewhat different characteristics (e.g. color or oil content); different types of fish (or mixes of fish) yield surimi with different specifications (for discussion of individual species, see Holmes et al., 1992; MFR, 1990; impact on quality from Interview data). Further, surimi processing technologies and techniques are different in the Thai industry than in the North Pacific pollock industry. In particular, almost all of the surimi processing is done in land-based plants, rather than on factory trawlers. A central reason for this is that these surimi plants are supplied with fish that are *bycatch* (i.e. catch of unwanted, low-value species) of other fisheries: surimi production provides one means for utilizing resources that would otherwise be wasted (Interview data).[3] Because the species for surimi production are not the main target, the vessels are not equipped to process surimi on-board. This geography of processing becomes particularly important for quality with overfishing in the waters nearest to Thailand (Interview data). Depletion of local fish stocks mean that producers have to rely on different, less desirable species. Local depletions have also meant that Thai fishers are making longer trips in search of fish. As Thai vessels range toward India and Indonesia, they increase the storage time before primary processing, which also affects the quality of the fish for surimi production. Further, fish biology and processing techniques translate each other in different ways in this industry than in the North Pacific pollock industry. Whereas pollock must be processed fresh, it is possible to freeze threadfin bream before processing it (Park and Morrissey, 2000, p. 32). Even though freezing does change the texture of the surimi, Thai fishers freeze the fish onboard their vessels, especially when they make longer fishing trips (particularly important in a tropical climate) (Interview data).

Although in the late 1990s, Thai and Indonesian firms started a joint venture operating a surimi factory trawler in eastern Indonesian waters, to this point most Thai firms continue to face the challenges associated with both a mix of fish species, and long-distance fishing combined with land-based surimi production. A result of these differences in the species of fish, the fish biology, and processing methods and technologies is that a significant proportion of the surimi made in Thailand is not suitable for traditional Japanese surimi products such as kamaboko: it may have lower gel strength, be somewhat darker, or have more flavor. The particular translations between fish biochemistry and surimi processing have thus altered the product itself: it is still surimi, but a different kind of surimi. That this industry has been successful is based on interactions over time between the producers and the buyers of this surimi. Thai firms sell some of their surimi in Singapore, for use in fish balls, but their main markets are in Japan, where the surimi is used in new types of products.

Since the 1970s, overall consumption of surimi products in Japan has been declining (Interview data; Asakawa, 1999). Industry observers attribute this decline to a number of factors, including increasing costs and shifts in eating habits away from seafood and toward meat and dairy products (Interview data; Asakawa, 1999; Okada, 1990a; Sproul, 1992). Industry members also report a "cheapening" of the Japanese surimi market, so that only less-expensive items sell well (Interview data; FIS, 1999–2000, 7/9/1999). Surimi producers have responded to these shifts by continually developing new products designed to boost surimi sales. These new product forms include snack foods rather than main courses and emphasize fried and flavored surimi products (*agekama*) (FIS, 1999–2000, 7/9/1999, 8/10/1999). Describing the original shift to snack products in the 1970s, one Japanese producer said, "Traditionally, most kamaboko has been eaten as a main course. With the changes in eating habits toward snack foods and fast foods, the industry began to look for new product forms that could meet this market" (Sekine, Taiyo, quoted in Pacific Fishing, 1983, p. 42). Recent developments include a range of products such as surimi burgers or surimi stuffed with cheese (*chiizu-en kamaboko*) (fieldwork; FIS, 1999–2000, 5/26/2000). Recent years have also seen an emphasis on products with a texture that is much softer and less chewy than kamaboko, such as *hanpen*, in which the surimi is kneaded and boiled to yield a product with a texture similar to marshmallows (Interview data; for description, see Kammuri and Fujita, 1990; Park, 2000a). Because these new products are often flavored and fried or boiled, the texture, color, and flavor of the surimi are much less evident than in traditional products. Ingredient mixes become a part of the quality assemblage as well, as texture, color, and flavor can be augmented with inexpensive additives, such as egg whites, gums, and starches, that would not be acceptable in high-quality kamaboko (FIS, 1999–2000, 8/10/1999; Okada, 1990b; Park, 2000a). The result is that whereas *kamaboko* is made with over 70% high-grade surimi, products such as *agekama* are made with as little as 10% high-grade, and demand has increased for mid–low-grade surimi from places such as Thailand (Ishikawa, Nippon Suisan, 1996, p. 20).

As with the relationship between pollock and kamaboko, there is an iterative relationship between the availability of bream surimi and the development of these products. For Japanese firms, bream surimi has, from the start, been a less expensive alternative to

[3] The Southeast Asian Fisheries Development Center originally supported a Thai surimi industry precisely as a way of utilizing bycatch, and continues to provide technical assistance to surimi producers throughout the Southeast Asian region as a way of providing development opportunities using bycatch species.

pollock surimi (for example, FIS, 1999–2000, 6/30/1999; Interview data). Yet, to take advantage of this inexpensive alternative, firms also needed to adapt their products to the available surimi, and in doing so, created new opportunities. As one surimi firm representative explained, when prices diverge enough, processors become more flexible: "Once they develop the know-how for dealing with [substitutable] grades, they always have that as an option" (Interview). Thus, the availability of inexpensive surimi concurred with cultural economic changes in surimi production and consumption within Japan that were, in part, adaptations to this inexpensive surimi. There is no simple chain of causality here between inexpensive products, low-grade surimi, and bream species (nor the reverse, from fish to product), but instead these different elements called each other into being in certain ways as the commodity chain developed over time.

While the inexpensive surimi and surimi products are generally considered to be 'low quality', the success of this new chain is based on a new quality assemblage that incorporates new types of fish, new production methods, and new product forms and uses. The fact that both inexpensive surimi paste and products are in demand in the Japanese industry indicates that there are new definitions of what counts as quality. Were *kamaboko* the only use of surimi, this commodity chain would not be successful: these elements would not translate each other into a quality assemblage. But this does not mean that end products determine what counts as quality. Instead, quality is about whether or not the different elements successfully interact. Just as the end products are critically important in this commodity chain, so is the availability of new fish species and less expensive production techniques. The translations among these different elements change notions of quality: what was quality in one commodity chain is no longer quality in another.

3.3. US imitation crab

Whereas Japanese firms had earlier developed the North Pacific pollock fishery, using factory trawlers for surimi production, after 1976 the US nationalized the most productive fishing grounds by declaring a 200-nautical mile Exclusive Economic Zone, thus displacing Japanese fishing and replacing it with US domestic fishing (Mansfield, 2001). Although this US-based surimi industry is oriented in large part to export markets, these firms have also developed the US domestic surimi commodity chain, in which US firms make and supply surimi products to US consumers. This US surimi market is dominated by "imitation" products, particularly imitation crab (or "krab"). These products were originally introduced to the US by Japanese producers, but as US firms took over surimi production in the North Pacific, they also worked to build a domestic surimi products industry through attempts to grow the product category and expand demand. In this US domestic surimi commodity chain, the discourse of quality centers more on imitation products than it does on the surimi paste itself. Key translations in this quality assemblage are those among fish protein biochemistry, ingredient-mixes of imitation products, the end-uses of these products, and package labeling. In the previous two commodity chains, translations among elements have led to successful industries, even when they are also marked by various challenges and power dynamics. In this commodity chain, however, the quality assemblage seems not to be as successful, and the industry continues to search for new ways to bring the elements together more profitably. In particular, discussion of price and competitive pressure disguises the social and biophysical relations that comprise this quality assemblage.

In this US-based industry, quality and price have not come together so neatly as in the Thailand–Japan chain: price and quality are locked into a competitive "downward spiral" (Joe Bundrant, Trident Seafoods, quoted in SeaFood Business, 2000, p. 44). Emblematic is an article that appeared in the industry magazine *Seafood Leader*: "Ask a surimi-seafood manufacturer and he'll [sic] tell you there are two fundamental truths in the business these days. One, there's always a way to make a cheaper product… Two, they'd really rather not make them. The reason is simple: Consumers may be attracted to a low-priced surimi-seafood product once, but if they buy it and don't like it, the may swear off the category altogether" (Seafood Leader, 1998, p. 66). To make "cheaper" surimi products, US producers manipulate their product formula. They reduce the percentage of surimi in the final product, sometimes to under 30% (Interview data), while increasing the water content and adding starches, other proteins, and oils to replace the functional attributes of surimi, such as texture (Park, 2000a). As they continue to make and market products based primarily on price, producers then accuse each other of playing a "slushbag game" by producing products they describe as "cheap", "cheap crap", "Las Vegas loss leaders", "water-first", or even "substandard" (from Interviews and SeaFood Business, 1997, 1999). Companies are now "racing to make the cheapest product with the lowest margin possible", at once minimizing profits and ultimately driving customers away with bad-tasting products (Interview). Quite strikingly, this discourse of loose quality standards, and the cost/quality minimization approach, dates back to the early stages of the US imitation products industry, in the early 1980s, when marketers (using problematic metaphors) complained of the "'whoring' of the market" as producers started selling more low-quality products, basically at cost (producer quoted in

Pacific Fishing, 1983, p. 43; see also Sylvia, 1991, pp. 146–147; Zalke, Nichirei Corporation of America, 1992).

This quality discourse focuses almost exclusively on the ways that competitive pressures drive decisions about production techniques and ingredient mixes. Yet this emphasis on prices and competitive constraints obscures ways that translations among end products, uses, and labeling, along with biochemical processes, also influence this quality assemblage. End-products that producers offer to consumers are all imitation shellfish—mainly crab—designed to substitute for the 'real thing'. As one producer acknowledged, when marketers think of surimi only "as imitation, then price becomes the primary tool for selling these products" (Chambers, Kibun Products International, 1990, p. 356). Imitation crab legs only work as a substitute for real crab legs when they are inexpensive enough, thus leading to the downward spiral. Further, as an imitation product, US Food and Drug Administration (FDA) regulations require that all packages of surimi must include the term 'imitation'. Those active in the industry argue that this labeling requirement creates problems because consumers then perceive surimi as artificial and inherently low quality (Interview data; Park, 2000b, pp. 205–206; SeaFood Business, 1997, 2000). But at the same time that producers argue that surimi "is not 'imitation' anything. It's a good, quality protein" (Bundrant, Trident Seafoods, in SeaFood Business, 2000, p. 47), they still only make imitation products, not stand alone products that would not require the imitation label.

Further, the end use of these products is often as a 'seafood salad', in which flakes of imitation crab are mixed with mayonnaise and celery. In this form, the texture and taste of inexpensive products are masked (and the characteristics of more expensive products are drowned out) and price again becomes the most important issue (Interview data; Sylvia, 1991, pp. 146–147; Zalke, Nichirei Corporation of America, 1992). There are parallels here to inexpensive products on the Japanese market, which successfully mask any taste, color, and texture problems by creating products for which these are less important. What is different, however, is that in the Japanese market there are a whole range of products that can use surimi with varying characteristics and of varying grades, while in the US, surimi is tied into a single product category and single product use. Whereas producers in Japan have diversified surimi products, US producers have tried to cheapen an existing product. One industry member argues that surimi has "suffered from a lack of creativity. [Producers are] not thinking outside the box" (Interview). So, at the same time that producers complain that consumers are not willing to pay more for a better product, producers offer only products that substitute for more expensive seafood and are used in ways that mask the fact that they are not that more expensive product. Thus, not only do competitive pressures influence quality, but the quality assemblage also includes the limited range of products and uses, and how these translate production strategies such as ingredient mixes.

This quality assemblage also incorporates additional FDA labeling requirements and their relationship to fish biology and biochemistry. US-based producers use surimi made not only from Alaska pollock, but also Pacific whiting (*Merluccius productus*). Until recently, the FDA required producers to list pollock and whiting separately in their ingredient list, so that even if total fish content were over 50%, it might be listed as the second and third ingredients behind water. The result of industry lobbying, in 1999 the FDA changed its regulations to allow 'disjunctive labeling' in which producers can list "pollock and/or whiting" in their ingredient lists (Interview data; also mentioned in SeaFood Business, 1999, p. 68). Supposedly designed to boost quality perceptions by making fish the first ingredient, this measure has created new quality problems. Overall, Pacific whiting surimi is lower grade than pollock surimi (FIS, 1999–2000, 5/30/2000; McReynolds, 1999), particularly as a result of a parasite in the whiting that triggers an enzyme that turns the fish to mush. The gel strength of whiting surimi is generally lower than pollock surimi, and the parasite can also leave black spots and streaks in the surimi. To stop this biochemical breakdown, producers process whiting immediately, and they use enzyme inhibitors such as beef plasma protein (Park and Morrissey, 2000). The new disjunctive labeling makes it more difficult to tell which products have more pollock and which more whiting. And even though some companies are proud to use only pollock and no whiting (Interview data), disjunctive labeling gives producers less incentive to use all pollock. "The flip side [of relaxed regulation] is that it can open a Pandora's Box of abuse ('People will just use the cheapest thing available,' says one supplier) and even more confusion in the marketplace. 'As it is,' says another supplier, 'buyers [retailers and food service] have a hard enough time differentiating between products'" (SeaFood Business, 1999, p. 68).

As this case shows, in practice quality can be quite problematic; the different elements of commodity chains do not necessarily add up to economic success. Translation means that elements interact in complex ways, so that what seems to work in one setting works quite differently in another. This should not simply be interpreted as either the presence or lack of a quality orientation in a given industry or commodity chain. Despite the problems, quality is an important aspect of the US-based industry, as evidenced by concern about competitive pressures and controversy over labeling

regulations. Despite the highly processed, low-cost character of these imitation products, discussions about quality are ubiquitous. But quality is not simply defined: it is about the conjunction of fish characteristics, parasites, and biochemistry; ingredient mixes and additives; a limited range of products and their uses; and package labels as quality markers. As each element gives significance to distinct aspects of the other, what emerges is a quality assemblage fraught with difficulty.

4. Conclusions

Industry members explicitly raise issues of quality when talking about both local and transnational aspects of this industry. Quality differences influence the geography of supply and demand, which not only affects the prospects for the existing industry, but also gives rise to industries in new places and to new trade patterns. Quality thus plays an important role in creating economic development opportunities and pressures, affecting what foods are available in different places, and shaping impacts on the marine environment. Yet quality is about more than just what industry members say. Definitions of quality in each commodity chain are about interactions between the physical characteristics of the fish, food practices, and production strategies; different aspects of each of these become important in individual commodity chains. 'Translation' is a way of thinking about how elements such as fish populations, individual products, protein biochemistry, technologies, sites of production, and so on all bring each other into existence in specific ways. The point is not that each of these emerges out of nothing within these commodity chains, but that they become what they are, with particular definitions and effects, only in relation to the other elements: what counts only counts in relation to the other elements of the assemblage.

This approach to quality—as assemblages that emerge as elements within commodity chains translate each other—allows us to address the role of nature in food production without falling into a functionalist or determinist stance. This approach makes determination elusive: because interactions are complex, neither quality nor the structure of the global surimi industry are biologically or socially (economically, technologically, culturally) determined. Instead, we need to shift our attention from the abstract categories of 'the natural' and 'the social', to look at interactions within commodity chains and how these shape the elements of those chains. Translations mean that nature cannot simply be a resource for human activity, a constraint to be overcome, or a pure figment of social interaction. Rather, distinct aspects of what we call 'the natural world' participate in individual interactions. Thus, although the quality of surimi is not determined by the characteristics and environment of a given fish species, fish are a critical element of the quality assemblage. Further, while we can say that protein biochemistry, for example, is important in each of the commodity chains outlined here, it is important in very different ways. There is no single category 'protein biochemistry' that is 'nature', which we then say has an effect in this industry. Rather, particular chains draw out different aspects of fish, their proteins, and chemical reactions: for example, myofibrillar proteins, denaturation, and parasite-induced enzymes. From this view, different aspects of the biophysical world—of nature—become important at different historical and geographical junctures, and thus reflect and shape the structure of industries and agro-food relations. Giving attention to more specific biophysical elements and processes also helps counter abstract notions of 'nature' that prevail in many approaches to analysis of agro-food systems in particular and nature–society relations more generally.

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