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Stephen LeMay

Dave McMahon

Jeffrey Periatt

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# **Tracing, Security, and Safety: The Problem with Wild-Caught Seafood Supply Chains**

**Stephen LeMay**  
*University of West Florida*

**Dave McMahon**  
*Pepperdine University*

**Jeffrey Periatt**  
*Auburn University, Montgomery*

## **ABSTRACT**

This article explores the difficulties associated with long, complex, supply chains in seafood markets. It does a brief literature review, discusses some of the issues raised by the long supply chain, and then compares one long seafood supply chain to a short, problematic supply chain.

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## **INTRODUCTION**

Seafood supply chains vary greatly in length. On one hand, you might argue for the shortest version of such a supply chain: from the fisher's hook on the bank of the river to the frying pan at his or her campsite on the same bank. This version of a supply chain has some major advantages: the consumer knows the exact provenance of the fish and can readily trace it to its source. The disadvantage of this 'supply chain'—and you can argue that it is not a supply chain—is that it offers little variety, no direct control over choice of fish, no guarantee of a supply, no guarantee of a quantity, and no guarantee of quality. On this last point, other than eyeballing the fish, the fisher probably does not test the fish for contaminants like mercury.

On the other hand, you might argue in favor of much longer supply chains for seafood. One of the longest would be shrimp or catfish coming from Vietnam to the U.S. market. The buyer still does not know the exact nature of the fish or what it was fed, but usually knows the breed and can rely on a steady supply of the right quantity at the right price. Of course, the buyer is often not the consumer, so the consumer may still be left with questions about the seafood. The disadvantage of this supply chain is that the seafood will never be fresh, the aquaculture practices of the farmers may remain questionable, and the quality of the food not entirely known. In fact, at some point, seafood may be untraceable, especially the wild caught seafood.

This paper examines the issues associated with long supply chains for seafood. It focuses on tracing and traceability, security, and safety. It identifies the key issues, the potential solutions, and areas for future research. It also discusses the value of shorter, more direct supply chains, primarily those that qualify as complex adaptive systems (CAS). It begins with a brief overview of the literature on seafood supply chains, delineates some propositions based on that literature review, and ends with suggestions for future research.

## **Literature: Seafood Supply Chains**

The academic literature on seafood supply chains covers issues ranging from productivity growth to poverty reduction, but three key issues surface repeatedly: security, safety, and adaptation. This review covers these three topics in some detail.

### *Security in Seafood Supply Chains*

Supply chain security should be distinguished from supply chain safety. Supply chain security means keeping the goods in the supply chain that you want in it, and keeping out the goods and potentially harmful items that you want kept out. The emphasis in security shifted dramatically on September 11, 2001, from keeping goods in the supply chain— theft prevention—to keeping damaging goods and people out—securing the public from deliberate contamination or sabotage in the supply chain. (Williams, Lueg, and LeMay, 2008). This concern is certainly a factor in managing seafood supply chains.

In its analysis of seafood supply chains, the Nature Conservancy developed a symbol specifically for the lack of monitoring and enforcement. Figure 1 shows that symbol in their case on the Vietnamese Blue Swimming Crab. This example shows where this supply chain is most vulnerable to intrusion or where the seafood product can no longer be associated with its specific source (The Nature Conservancy, 2015).

The length of the supply chain matters to security, whether you mean time or distance, in a seafood supply chain. The longer the supply chain, the more vulnerable the product is to deliberate tampering, intrusion of harmful materials, and theft. The complexity of the supply chain matters for similar reasons. The more points at which the seafood stops for processing or handling, the more opportunity there is for mischief. These problems seldom arise during transit, but they do arise when the freight sits still or when it is handled.

### *Safety in Seafood Supply Chains*

Safety in seafood supply chains differs from security in seafood supply chains in part because security breaches involved deliberate, human intervention. Safety, by contrast, involves keeping biological and chemical contamination out of the seafood, but the kind that might occur by accident or from the ravages of time or lack of temperature control. A substantial portion of the wild catch is lost because of safety concerns.

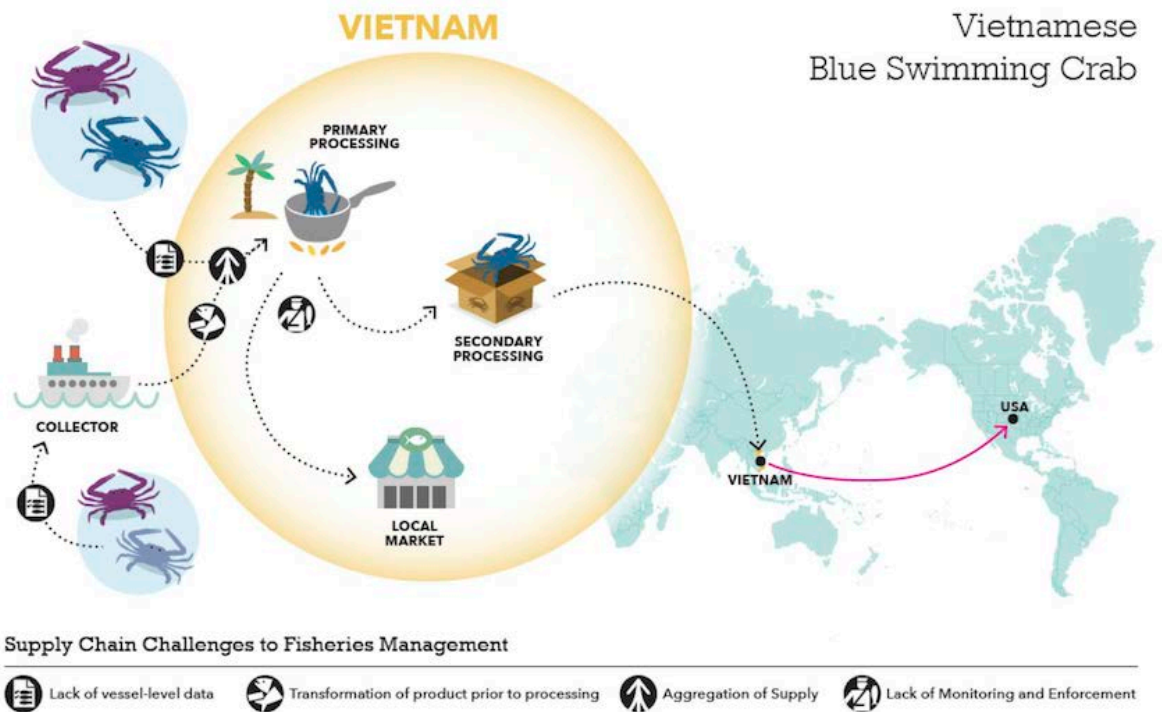


Figure 1: Supply Chain Diagram for the Vietnamese Blue Swimming Crab

Source: <http://www.futureoffish.org/resources/research-reports/making-sense-wild-seafood-supply-chains>

In particular, consumers have shown willingness to pay more for wild-caught seafood that comes from a transparent supply chain, but not necessarily at the expense of flavor. Morgan, Whitehead, Huth, Martin, and Sjolander (2013) studied and stated preferences in consumers of Gulf of Mexico wild-caught oysters. They found that consumers preferred traditional oysters over oysters harvested under new rules from the Food and Drug Administration. Bruner, Huth, McEvoy, and Morgan (2014) even found that consumers would pay a premium for traditional raw oysters over postharvest-processed (PHP, safe) oysters, and that the premium persists even after the consumers have been informed about the comparative risks of the two approaches. Flavor and tradition trumped safety in this instance.

Raw oysters may be a special case, given that small changes in the environment may have significant effects on the flavor. Other wild-caught seafood may not be subject to the same issues. Red snapper that may also come from the Gulf of Mexico is prepared in ways that may cover the changes in flavor caused by differences in handling a processing. Cooking and seasoning matter in such instances.

Nonetheless, domestic food supply chains fall generally under the Sanitary Food Transportation Act of 2005. Regulations regarding this act were just finalized in 2017. They require food producers to secure loads in a way that makes them both safe and secure in the way that we have used these terms. But wild-caught seafood moves through chains that may be much longer, and, as shown in Figure 1, much more likely to have gaps in the traceability and transparency of the handling of the goods. Most research

assumes that more information a consumer has, the more likely the consumer is to make a rational decision (Morgan, et al. 2013; Bruner et al., 2014).

The next section examines a short, problematic wild-caught seafood supply chain. It discusses the advantages and disadvantages of this supply chain versus the longer supply chain depicted in Figure 1.

## **LIONFISH VERSUS BLUE CRABS**

Lionfish have proven to be a serious problem in the Gulf of Mexico, the Caribbean, and eastern coastal waters (Albins and Hixon, 2013). They crowd out other species, consume the young of other species, and proliferate at a high rate. The negative economic impact of this invasion has so far overwhelmed the positive economic impact (Morris and Whitfield, 2009).

One solution to the problem seems to have potential: create a predator for the lionfish in this environment. The obvious predator is the human being (Frazer, Jacoby, & Edwards, 2009). Lionfish provide a tasty, firm white flesh and sell well when they are available. The problem with this is the lack of a reliable supply of the fish. Restaurants are reluctant to list them on the menu when they have no consistent source for the fish. The same is true of retail and wholesale sellers of the fish.

Lionfish ignore fishhooks and live close to reefs, so they are difficult to harvest. This is where the supply chain problem manifests itself. They can easily be harvested by divers with spears or nets, but that very fact makes them difficult to harvest on a commercial scale. If you decide to hire a diver, then a wide variety of regulations come into play. OSHA safety standards and training requirements increase the cost of doing business to the degree that the fish become too expensive to compete effectively against fish that are easier to catch in volume. This, of course, defeats one of the purposes of harvesting the fish: creating enough demand volume to reduce the threat to the Gulf and other ecosystems.

The advantage of this short supply chain, however, is obvious in the context of this research. The fish can easily be traced to a source. That stands in stark contrast to the Vietnamese blue swimming crab.

The blue swimming crab fishery supports more than 20,000 fishers and supplies a major export for Vietnam. In 2017, prices have reached record heights as the crabs are overfished and suffer from poor harvest practices, such as catching too many young crabs, too many gravid females, and weakness in the stock (Osmond, 2016). The blue crab also competes with the red swimming crab, a variety found more commonly off the coast of China (Rubio, 2017).

This fishery is well-established in Vietnam and to a lesser degree in Indonesia (Rubio, 2017). The supply chain is well-defined from strategic standpoint, but, as shown in



Figure 1, the supply chain also has problems when it comes to transparency. If you look closely at the diagram, you see the symbol for “Lack of Monitoring and Enforcement.” Given its position, it might appear to apply to the part of the supply chain moving away from primary processing. And it does apply to that part of the supply chain, but it also applies more broadly.

First, it applies to that part of the supply chain because the product can no longer be traced back into the supply chain once it has been through primary processing, so it loses traceability. Second, it applies to collection or harvest because that process gathers too much of the future of the supply chain, and does so without consequence. If the fishers collect too many gravid females and too many young, then they threaten the future of the supply of blue swimming crabs. If the supply falls too far, then the blue swimming crabs face the same problem as the lionfish: without a reliable supply, buyers will find substitutes.

In the case of lionfish, the substitutes have owned the consumer market since well before the lionfish showed up. In the case of the blue swimming crabs, if supply becomes unreliable, then the demand will be filled by substitute products such as the Chinese red swimming crabs. Both will serve as ingredients for crab cakes in the U.S., and most consumers cannot discriminate between the two.

The evidence currently suggests that consumers would like to know the provenance of wild caught seafood, but not necessarily because they want to make rational, considered decisions. As in the example of wild caught oysters, consumers do not necessarily want the safest food, but they do want to know where it came from.

## **IMPLICATIONS**

These few, simple findings from this comparison suggest three things from the standpoint of marketers at each stage in the supply chain. First, consumers may not care where the food comes from, but they care how it tastes. They assume they can tell the difference between wild caught seafood from one source and wild caught seafood from another. Other research suggests that they probably will be biased to perceive it as coming from the source identified on the label. Second, wild caught seafood supply chains may have legal implications in developed countries. In the U.S., for example, suppliers can be held liable for food borne diseases or contamination; the liability is clearly stated by the Food and Drug Administration. It also transfers to carriers and third parties, so while consumers may not care where the seafood came from—at least not until they experience a problem—the supply chain participants should care, since they may be subject to lawsuits. Third, there is an ethical dimension to supply chain transparency. Sellers should know what they are selling and should want to be sure that their products are safe and ethically sourced.

## **FUTURE RESEARCH**

This area is open for a great deal of new research. First, we need to discover the points in wild caught supply chains where identification and traceability vanishes. We see it in the map shown in Figure 1 and in other such maps developed by the Nature Conservancy, but there are many more supply chains without such maps. Second, we need to identify what is being done to assure that the food is safe, especially when the problems might not be detectable through taste. Consumers cannot easily taste high levels of mercury in fish, for example. Third, we need to determine the extent to which vicarious liability is creeping through the supply chain, bringing more participants in the supply chain to the bar. This could easily provide incentive to improve transparency. Sellers in the developed world will be more likely to hold their suppliers responsible and demand transparency from them if they might themselves be held responsible in domestic courts.

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## ABOUT THE AUTHORS

**Stephen LeMay** is Associate Professor of Marketing and Logistics at the University of West Florida and Professor, Emeritus at Mississippi State University. He has co-authored three books and numerous articles in academic journals. His research interests are eclectic, but focus on human factors in supply chains and the development of human resources in logistics.

**Dave McMahon** is an Associate Professor of Marketing in The Graziadio School at Pepperdine University. He has coauthored one book and numerous articles. His primary interests are in HR logistics, customer services, and the use of websites by nonprofits.

**Jeffrey Periatt** is an Associate Professor of Marketing at Auburn University, Montgomery. His research interests include supply chain human resources, event marketing, and the measurement of participant experiences. He is the coauthor of one book and numerous academic articles.

