

Making Sense of Wild Seafood Supply Chains





About Future Of Fish

Future of Fish is a nonprofit that provides research, design, and business services to organizations and entrepreneurs accelerating sustainability and traceability in seafood supply chains. www.futureoffish.org



About The Nature Conservancy

The Nature Conservancy's mission is to conserve the lands and waters on which all life depends; it works to achieve this mission in more than 35 countries and all 50 states of the U. S. www.tnc.org

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Purpose

The Nature Conservancy commissioned this report to provide conservation practitioners and artisanal fisheries managers with an overview of seafood supply chain structures and how practitioners can harness the power of supply chains to ignite sustainable fisheries management. The Conservancy uses this guide to inform and strengthen fisheries reform efforts and to capture lessons learned from its use with our partners and stakeholders.

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Making Sense of Wild Seafood Supply Chains

**A Primer for Resource Managers, Scientists, Fishers,
and Other Industry Players Seeking to Harness
the Power of Supply Chains to Ignite Sustainable
Management in Artisanal Fisheries**

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Cover Photography:
A fisherman from the
village of Malem gillnet
fishing on the reef edge,
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Frozen skipjack tuna from Indonesian pole and line fishery.

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An Introduction to Seafood Supply Chains

A supply chain represents the process of getting a product from the producer to the consumer.

Though we call it a supply “chain,” there are few products in today’s global economy that move along a simple, linear track, from production to consumption. From clothing to cars to cod, modern supply chains resemble increasingly complex networks of people and companies worldwide that produce, transform, aggregate, separate, package, transport, store, ship, trade, sell, and serve goods. Global supply chains have become sufficiently complicated, such that there are advanced degrees in supply chain management. And few supply chains are more complex, convoluted, and cryptic than those involving seafood. This primer provides an overview of seafood supply chains with a focus on those that intersect with artisanal fisheries in emerging economies.

On a global scale, the seafood industry handles approximately 158 million metric tons of product (over 91 million tons wild caught) every year.¹ Tens of millions of people worldwide who fish for a living collectively harvest thousands of different species; they fish in every ocean on the planet, and range from independent artisanal fishers in emerging economies to months-at-sea workers on factory trawlers. In addition to that diversity, certain product characteristics, as well as practices of supply chain actors, make seafood a wholly unique industry (see Table 1, page 7).

First, fish are the world's last major source of wild protein. Nearly every other protein is farmed. Even within seafood, 50 percent of the global market is farm-raised. Because of ever-changing environmental and biological conditions, wild seafood supply chains face uncertainty and risk that other farm-raised-food supply chains are able to avoid or mitigate.

Second, fresh seafood is highly perishable. Without proper icing on boats and after landing, wild fish has a very short shelf life. Globally, 20 percent of seafood spoils before it reaches the consumer.² Thus, at any given point in the supply chain the player holding the fresh inventory is in a particularly vulnerable position, racing against the clock to sell product before it expires. Knowing sellers are in that predicament can put a potential buyer in a position of power. This dynamic begins with fishers, who are often forced to accept whatever price is offered by their buyers—even if it's a low bid—because refusing to sell and holding out for a higher price could result in losing the sale altogether. Further along the supply chain, this imbalance can result in ultra-squeezed margins, and can sometimes drive suppliers to resort to extreme measures—such as mislabeling product or purchasing illegal product—in order to stay solvent.

While fresh and live fish remain the dominant forms (46 percent) of seafood destined for the global edible seafood market, even seafood supply chains that handle processed products—frozen, canned, dried—must first ensure fresh product makes it from water to the processing facility before it spoils. Frozen product is the most common form of processed seafood on a global scale, accounting for just over half of all processed fish for human consumption, and is driven by demand in developed countries. Recent years have seen an increase in the consumption of frozen fish in emerging economies, but that growth rate has been hindered by a combination of traditional preferences for other forms of preserved seafood (e.g., cured, smoked, dried) and insufficient infrastructure. Lack of electricity, potable water, roads, ice plants, and refrigerated transport threaten larger-scale production and distribution of fresh or iced product.³ To build a robust cold chain capable of preserving and protecting seafood product requires significant investment where adequate facilities and infrastructure are not already in place. As noted, this lack of storage can contribute to skewed power dynamics, especially disenfranchising the fisher. Yet, new cold-chain capabilities are not



Fresh catch at Lima's premier seafood market, Peru.

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1. Food and Agriculture Organization (FAO), *The State of World Fisheries and Aquaculture, 2014*, <http://www.fao.org/fishery/sofia/en>.

2. FAO, "Global Food Losses and Food Waste," 2011, <http://www.fao.org/docrep/014/mb060e/mb060e.pdf>.

3. FAO, *World Fisheries and Aquaculture*.

always the best solution for the health of a fishery. Cold chains that help expand market access may also have the negative impact of putting too much pressure on ecosystems, as fishers can find buyers for more and more catch at ever-distant markets.

Third—and related to the point above—increasingly, the decision-making



Blue Swimming Crab,
Indonesia.

© Keith Flett/Future of Fish

regarding use of fisheries takes place at distances far removed from the environment itself. This is especially the case in emerging economies that sell access rights to foreign countries and in regions where foreign firms buy up local processing and distribution outlets—an increasing trend as seafood companies consolidate and vertically integrate worldwide. Both of these conditions increase the disconnect between those making decisions about extraction from the fishery and the health of the fishery itself.

Fourth, unlike other complex supply chains (such as automo-

bile manufacturing, in which lot-numbers can be permanently etched onto the parts themselves), individual seafood products—or even individual lots—can be difficult to track from the point of harvest through processing, distribution, and on to the end market. In most fisheries, there are transshipments at sea or aggregations on land, which combine multiple species caught by multiple fishers across multiple days or weeks, and from multiple locations. Aggregation and comingling can occur further up the chain as well. With the exception of large, high-value species, it can be impractical and cost-prohibitive to tag individual fish at the point of harvest. Thus, tracking the origins of seafood products and ensuring that information about the journey of the fish is maintained through each step in the chain requires seafood companies to have sophisticated systems for traceability. Currently, this is sorely lacking on an industry-wide scale.

The combination of these factors—a wild resource, highly perishable products, paper-thin margins, and lack of end-to-end traceability—creates conditions whereby fraud, mislabeling, and sourcing illegal, unreported, and unregulated (IUU) product can occur rather regularly, and often with impunity. In some cases, those unlawful practices will be strategies for unscrupulous mid-chain companies to increase profits or to price their competitors out of the market. As recent exposés have highlighted, lack of supply chain transparency also enables egregious human rights violations (including human trafficking and slavery) within the seafood supply chains of some of the world's leading retailers, including Costco, Walmart, and Tesco.⁴

4. Felicity Lawrence, "Walmart, Tesco and Costco among Retailers Responding to Revelations of Slavery in Prawn Supply Chains," *Guardian*, June 10, 2014, <http://www.theguardian.com/global-development/2014/jun/10/walmart-tesco-costco-retailers-respond-prawn-supply-slaves>. This article is part of an ongoing series that can be accessed here or at <http://www.theguardian.com/world/slavery>.

Table 1. Key characteristics of wild seafood supply chains

Characteristic	Consequences
Unpredictable	<i>"We never know what's going to be at the end of our hooks."</i> This fisher's quote encapsulates the highly variable nature of fisheries, which in turn creates risk for the entire supply chain. Unlike farming or aquaculture, where productivity can be managed and maximized, wild fisheries are at the mercy of constantly changing environmental and biological conditions. This unpredictability results in a fierce "daily catch" mentality that leaves little room for planning or business strategy. Given that fishers don't necessarily know what they are going to catch and distributors do not always hold regular schedules—sometimes skipping over certain beaches or landing sites in favor of others—there can often be a mismatch at landing sites, especially in artisanal fisheries.
Highly perishable product	Fishers often have few options when it comes to finding buyers for their catch, and rarely do any have the luxury of holding out for better prices, shopping around for a better offer, or storing their catch until market prices increase (as, for example, coffee farmers do). In seafood, such storage demands refrigeration capacity or transformation of the product into a preserved form—which requires getting the product to a processor before it spoils. Once sold into the chain, mid-chain players must work to rapidly move fresh inventory, which limits their bargaining power, or they must have capacity to preserve (freeze, cure, or can) acquired fresh product before it spoils. Post-harvest, over 20 percent of seafood worldwide goes to waste within the supply chain before it reaches the consumer. In emerging markets, post-catch waste is due largely to lack of infrastructure for refrigeration, storage, and transportation.
Low margins	With the exception of a few high-end products, most seafood companies are working on paper-thin margins. This is a result of the race to sell, as well as the disconnect between the cost of fishing and the price of fish, with prices provided to fishers often not enough to cover their costs. Government subsidies that compensate fishers further contribute to overcapacity and masking the true cost of fishing from the consumer. These conditions force mid-chain players to focus on quantity, not quality, in order to survive.
Disassembly and aggregation	Most seafood is processed in a manner that makes it particularly challenging to tie product-origin data to a finished product. For example, some forms of processing, such as canning, involve the mixing of multiple fish that may have been caught in different regions by different vessels on different days. Other processing methods involve partitioning a single fish into loins that are each sold to a different buyer and even processed in different ways, depending on the quality of the fish.
Minimal product tracking	Putting a serial number on a filet is difficult, expensive, and time-consuming. While advancements have been made in tagging individual high-value fish, ⁵ product tracking is usually done at a much larger scale (if at all), which creates opportunity for substitution, mislabeling, and lost information.
Global market, global demand	Seafood (from wild and farmed sources) is the largest globally traded commodity by value in the world (\$130 billion in 2013). Advances in freezer and transportation technology have enabled access to seafood from any region in the world, at any time of year. This availability (along with subsidies) has fueled growing demand for seafood on a global scale. In particular, growth of the middle and upper classes in China will continue to increase demand for seafood. ⁶

5. Examples of direct tagging on fish include *ThisFish* and *Gulf Wild*, which use small numbered gill tags that are eventually (postprocessing) associated with codes on packaging.

6. According to the World Bank's *Fish to 2030* report, China's per capita seafood consumption has grown at an average of 6 percent per year since 1990. Growth in aquaculture has helped meet this demand, but the influence of China's market on the global seafood market will continue to be significant in the next few decades. World Bank, *Fish to 2030: Prospects for Fisheries and Aquaculture*, December 1, 2013, <http://documents.worldbank.org/curated/en/2013/12/18882045/fish-2030-prospects-fisheries-aquaculture>.

Why Supply Chains Matter to Sustainable Fisheries Management

With few exceptions, the current structure and accepted practices within seafood supply chains make it impossible to distinguish responsible, sustainably harvested products in the marketplace. As a result, consumers and other supply chain players are unable to reward those actors taking the steps (which often result in additional costs) to produce sustainable seafood.

But our global seafood supply chain doesn't have to work this way.

Engaging key actors and supporting shifts in business practices can be a powerful way to incentivize change—all the way down to the water.

Supply chains can serve as a source of data capture to support better fisheries management models, and can be a means for rewarding fishers that fish more sustainably—via increased market access, higher prices,⁷ or stable partnerships, for instance. As much as they currently contribute to the problem of overfishing and IUU, so too can the network of seafood supply chains around the globe become part of the solution.



Measuring snapper in the processing plant, Indonesia.

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The following sections outline the basics regarding how seafood supply chains are structured and how they function. We explore key challenges that prevent supply chain actors from engaging in practices that promote more sustainable fisheries, and provide real-world examples of how some of those challenges can be overcome. We conclude with key insights derived from experienced practitioners in the field, all of which can help guide resource managers looking to engage with supply chains as a mechanism for improving local resource management.

7. It is important to note that higher price is often the most difficult benefit to achieve, as consumers are reluctant to pay more for fish, even if it is sustainably caught. Buyers and consumers, however, will often pay more for higher-quality fish, or for other desired attributes, such as local or fresh. So efforts to teach fishers how to improve handling techniques, plus better logistical management (refrigerated trucks, for example), can help improve margins for fishers by increasing quality. This is the theory of change behind efforts such as SmartFish, working with fishers in the Gulf of California.

Yellowfin tuna is loaded at dockside and transported to a local plant for processing and export, Indonesia.
© Jeremy Rude/TNC



The Structure of Seafood Supply Chains

This primer focuses on commercial seafood supply chains that receive and move product from artisanal fisheries through domestic and international markets. While significant quantities of seafood are also harvested recreationally or for the aquarium trade, those channels of production and distribution are outside the scope of this work.

The Variable Middle

Every wild seafood supply chain begins with a producer (the fisher) and terminates with an end buyer, who sells to a consumer. End buyers include retail outlets (from locally owned fish markets to national supermarket chains), restaurants, and foodservice establishments, such as hotels, hospitals, and schools. (See the Glossary, page 40, for more details on the various roles of supply chain actors.) In artisanal fisheries, it is not uncommon for fishers to bypass the supply chain completely and sell their catch directly to consumers on the beach or door-to-door within the community. However, for seafood sold into more formal markets, supply chains can consist of any number or combination of mid-chain players (e.g., aggregators, primary processors, traders, wholesalers, dealers, secondary processors, distributors, transporters), who transform, package, and move product from the point of production to the final sale.

Generally speaking, the more mid-chain players present, the greater the complexity of the supply chain, the greater the risk of losing data and story, and the greater the possibility of fraud. However, shorter supply chains don't necessarily equate with more trustworthy data. For instance, in a very short supply chain where one processor aggregates catch from dozens of fishers and then sells to two retailers, the process of tracing each product back to the source is impossible without a system for segregating and labeling product from every producer.

The following section identifies common supply chain attributes that are typically present within artisanal fisheries, and which relate to the ways product and product-level information flow, how mid-chain players function within certain seafood supply chains, and the motivations that drive certain practices. Identifying which attributes may be present in a supply chain can help hone strategies for how to effectively promote and incentivize more responsible fishing practices, better data capture and tracking, and better storytelling around product origin (see Table 2, pages 38-39).

ATTRIBUTE 1

Type of Product (commodity Vs Differentiated)

The degree to which a product is differentiated within a supply chain is perhaps the most informative attribute for determining the potential to influence that chain with respect to sustainability.

Commodity chains are not structured to track information about product origin, nor do they recognize source fisheries that adopt sustainable management.

At one end of the spectrum are commodities, which lack differentiation. These are high-volume products aggregated from many sources, and for which all the individual units—be they whole fish, filets, or value-added products—are considered identical, regardless of how, where, when, or by whom they were produced or harvested. Purchasing decisions are driven first by price, and then by decisions regarding quality, with little consideration about sustainability (though see noted exceptions below). Supply chains that handle commodity products typically move processed product that can be frozen and thawed and refrozen multiple times as it travels through multiple players operating in multiple countries. Increasingly, one step within these supply chains involves a routing through China, where processing (e.g., filleting, breading) often occurs before product is then re-exported.

Commodity chains are not structured to track information about product origin, nor do they recognize source fisheries that adopt sustainable management regimes or practices. Instead, sustainable product sold into a commodity chain is comingled with unsustainable product. Many high-volume fisheries feed into commodity supply chains, but some of the most common include salmon, cod (and other types of whitefish), tuna, anchovies, and crab.

With the growth of sustainable-seafood certification programs, however, some commodity-type products now have an element of differentiation. Such is the case with McDonald's MSC-certified whitefish products. High volume and interchangeable, these supply chains segregate the product so that it can be traced back to specific certified fisheries.

At the other end of the product spectrum are differentiated products, which are distinguishable from one another based on specific information, including harvest location, fishing method, fisher or fishing community, certification status, and brand. In general, purchasing decisions by supply chain actors are driven either by quality first and then price, or at least equally by these two features, as opposed to the clearly price-driven decision-making that occurs with commodity products.

Across supply chains, there are several degrees of differentiation. These can

be based on (1) geography: aggregation of all product from multiple vessels in a single fishery; (2) product qualities: specifically graded products (size, quality, sustainability) from vessels in a fishery with or without origin data; (3) vessel: batches of product, such as from a single landing, net haul, or trap set; (4) individual fish: typically high-value species that may be individually tagged with unique codes, and include tuna, lobster, salmon, and snapper. The supply chains that handle differentiated products need more sophisticated data management and traceability systems to track and verify the information associated with the unit of differentiation. Differentiated-product supply chains can serve local, regional, or export markets. In general, the fewer the steps between harvest and when the product is in its final form and labeled, the easier it is to keep the story paired with the fish.

There are no set rules regarding whether a product qualifies as differentiated or commodity. For example, a vessel may unload a single catch that contains individual fish with different features. As opposed to sending the entire lot into a commodity channel, a middleman or processor may grade the product according to size, quality, or some other attribute for which the market is willing to pay a premium. Thus, the catch itself is coarsely differentiated, and then individual products may end up as commodities or differentiated products, depending on the market's demand for distinguishing information. The process can become even more complicated when product from one fishery travels through multiple supply chains based on buyer demand. In a lobster fishery, for example, MSC-certified product might wind up as a premium good in a specialized grocery store, or can be sold as a commodity through a supply chain that delivers product to a chain restaurant. In the latter case, what was once a differentiated product becomes mixed into a commodity chain, where distinguishing features are then lost.

ATTRIBUTE 2

Brand Presence

Some supply chains are driven by brands that dictate product specifications and other protocols that producers, processors, distributors, and end buyers must follow. This influential brand can affect local, regional, national, or international supply chains. In most cases, the influence is top-down, coming from an end buyer (e.g., Whole Foods), a value-added processor (e.g., Wild Planet), a broker (e.g., CleanFish), or a certification standards setter (e.g., the MSC). In other instances a brand created by or in collaboration with fishers will create bottom-up influence over the supply chain, as is seen with some traceability companies (e.g., ThisFish), NGOs (e.g., Gulf Wild), or even fishing cooperatives (e.g., Alaska Gold). The specifications required by the brand may be based on location, quality, sustainability criteria, or other attributes that distinguish the brand in the marketplace. As such, it is of utmost importance to establish systems that ensure the branded product is differentiated from unbranded product. Some mid-chain players may be involved with processing and distributing multiple types of branded and unbranded products, and it is not uncommon for brands to look to such players to serve multiple supply chain roles (e.g., processor/distributor). In some cases, brands will purchase fish directly from producers and perform the processing and packaging themselves in order to maintain close control

It is possible to influence an entire supply chain by working with a brand to incorporate sustainability criteria.

and further protect brand integrity. Each player within the supply chain has a direct or indirect relationship with the brand and in some cases the brand is the exclusive market channel through which product from specific producers flows. Depending on the mission of the brand and ability to access key decision makers, it is possible to influence an entire supply chain by working with a brand to incorporate sustainability criteria into their product specifications.

ATTRIBUTE 3

Relationship Dynamics

Relationships within the seafood industry typically are long lasting and built on trust, especially relationships between fishers and their buyers (e.g., middlemen, first receivers). Within some artisanal fisheries, those relationships tend to be both business and personal in nature. For example, a middleman that buys from a fisher may also provide loans for fuel and ice, and may even have financed the boat. Often, the middleman is a member of the fisher's family. While some fishers may feel comfortable with this type of dependent relationship or may be fortunate to have a charitable buyer, others can become trapped by this arrangement. Even further up the supply chain, the power dynamics of the seller-buyer relationship can skew quite easily, especially if the buyer begins to exploit the seller's vulnerable position (holding spoiling inventory) or limited market access (see Attribute 5: Market access). However, to the extent that trading-partner relationships are healthy and the product can be differentiated to some degree, supply chains containing such close ties might be among the most flexible and potentially open to implementing changes that could benefit the long-term sustainability of a fishery—both in terms of the resource and the people and businesses involved. In situations where trading-partner relationships are weak or acrimonious, the supply chain will be very difficult to influence directly.

Supply chains containing such close ties might be among the most flexible and potentially open to implementing changes that could benefit the long-term sustainability of a fishery.

ATTRIBUTE 4

Supply Chain Consolidation (Vertically Integrated Vs. Dispersed)

Many seafood supply chains are vertically integrated. All supply chain functions fall under single company ownership, with one actor controlling most major steps in the supply chain, from fishing activities until the product is sold to the end buyer, or even to the consumer. When necessary, additional product may also be sourced from independent fishers. Such vertical integration provides a company with guaranteed access to product landed by its vessels, protects the company from ex-vessel price volatility, and allows for close quality and inventory control. Large corporations tend to exhibit this feature most, moving fresh and frozen products around the globe, although consolidation can be found in fisheries serving smaller local markets as well. For sustainably minded companies, vertical integration greatly expedites the implementation of better management and fishing practices—all that is needed is a top-down directive. For companies motivated solely by profit or that do not recognize the importance of sustainable management, vertical integration can create a barrier to change.

On the other end of the spectrum are supply chains in which every function is performed by an independent entity, each working to make a profit. Short supply chains (two to three players) or those focused on differentiated or local product can work quite efficiently and may be effectively motivated around a common and mutually beneficial goal related to sustainability. However, for chains focused on commodity products or for those that are significantly longer (5-10 nodes, for example), that level of collaboration may prove more challenging. In general, as a supply chain lengthens, the margins shrink and players become incentivized to do whatever is necessary to cut costs (including, at times, committing fraud), as each player along the chain is always looking to pay the lowest price possible.

ATTRIBUTE 5

Market Access (Bottleneck Vs. Open Access)

Many remote, artisanal fisheries involve a large number of fishers selling to a few middlemen who hold the supply-chain relationships. These middlemen create a bottleneck for fishers, restricting direct access to the market. Depending on the type of product and location of the fishery, there may be a series of middleman-aggregators that comingle product for a single processor or distributor serving a domestic or international market; or there may be a single middleman-processor-exporter that buys from all local fishers and is the gateway for foreign companies to gain access to artisanal product. (Often the processors hold the export licenses.) The existence of such bottlenecks limits the power fishers have to negotiate price. The ability to influence fisher behavior with respect to sustainable management hinges on being able to leverage the power held by the middleman, which requires convincing him or her that sustainable practices are aligned with business needs. In the case of fishery improvement projects (FIPs), that is often done in partnership with a major domestic or foreign buyer that can promise better market share or premium prices in return for better management or fishing practices.

Some fishers have more choice when it comes to where and to whom they sell their fish. They may be nearer to the end market, with options of bypassing the middleman and selling direct. Or they may have a highly demanded product, with multiple potential buyers bidding up the price. When it comes to influencing fishing practices toward sustainability, these fishers may be easily motivated, especially with the possibility of a new market channel.

The ability to influence fisher behavior with respect to sustainable management hinges on being able to leverage the power held by the middleman.

Summary of Major Attributes of Seafood Supply Chains

Beyond simply describing the common characteristics that exist within seafood supply chains, these attributes also begin to highlight how engagements with supply chain actors may be struck in order to incentivize fisheries management-relevant changes. Understanding who holds the power, where sustainability has already taken root, and how relatively easy it might be to introduce new concepts or practices into the supply chain are all important considerations when looking for inroads to influence supply chains.

Supply Chain Challenges to Fisheries Management

The primary ways in which seafood supply chains perpetuate poor fisheries management relate to lack of transparency, absence of traceability, and perverse incentives that encourage unsustainable fishing practices. However, it must be noted that existing supply chain structures were not necessarily intentionally designed; rather, they may be legacy systems that evolved over time with the intent to move highly perishable (and presumed inexhaustible) product from one region to another. While intentional fraud and nefarious practices certainly exist, seafood supply chain actors behave as

they do largely in response to the system in which they operate.

Since 2008, the Future of Fish team has used a combination of ethnographic research (embedding researchers in a situation for field observation) and extensive interviews with supply chain players to better understand practices and behaviors within seafood supply chains. That deep anthropological and design approach, supplemented with an additional seven interviews with fisheries and conservation practitioners within the network of The Nature Conservancy (TNC), reveals a set of core challenges within seafood supply chains that present major barriers to efforts promoting greater sustainability. As is typical of complex problems, it is important to note that resolving any of these issues on its own, while helpful, will not create sustainable fisheries on a global scale. Instead, all these core challenges must be addressed—preferably through coordinated and simultaneous efforts—in order to shift the entire system.





Lack of Vessel-level Data Capture

What it is: Lack of paper or electronic records of where, when, how, by whom, and what was caught by each vessel for each trip. Ideally, this information would be recorded at the most granular level of fishing activity, such as by a series of traps in one location or individual net hauls. For small-scale fishers, and depending on the method of harvest, data capture may make the most sense at the end of a fishing set, or at the landing site.

Where it occurs: In many fisheries around the world, fishers are not required to report their catch to the government or to any supply chain entity. When they are required to do so, data are spotty, are incomplete, and can easily be lost, as records are kept on paper. Fish are also commonly mislabeled, or labeled under a generic name (e.g., snapper or reef fish). Records of transactions with first receivers, if they exist, often do not include relevant catch data, but rather provide only a logbook of total weight, price, and a generic name, which in the tropics is often incorrect or is a common name applicable to many species. Even when information is recorded by the first receiver, it is usually lost at some point

further up the supply chain. The default for data sharing is that suppliers will pass along only the information required or requested by their customers, or by government rules and regulations. Without clients demanding additional data on catch origin, mid-chain players will not spend their resources to capture or share those details—even when they have them. In the event where they have the data, confidentiality of fishing spots is also at play, although this tends to be more the case in developed countries.

Why it matters: Vessel-level data is the most relevant information for resource management and for determining the sustainability and legality of a product. Fishery-dependent data is often the only available data for determining stock health, especially in countries where government resources are too strapped to run fishery-independent data collection. In addition, all company branding and consumer-facing marketing initiatives that claim to deliver sustainable seafood must have access to vessel-level data (and verification of it) to ensure the business is, in fact, supporting more responsible practices on the water.



Product Transformation Prior to Data Recording

What it is: When a product or group of products is processed prior to the first instance of data collection. This can include:

- Grading of product to selectively deliver certain species or sizes to a processor. Recorded catch at this stage does not account for the original catch composition;
- Removal of flesh from the shell before sizing or sex is determined;
- Skinning and filleting a fish before species identification has occurred.

Where it occurs: In some fisheries, early product transformation tends to occur on deck aboard vessels as a way to consolidate catch and reduce weight (when quotas are in place) or to hide illegal product (e.g., juveniles). Grading or shelling may also take place dockside upon receipt by the first receiver before the product is moved to a more formal processing facility where data are recorded more regularly.

Why it matters: Transforming product, when driven by the purest of intentions,

is a logistics decision. For example, conch fishers do not want to take up space in their small boats or in their coolers with conch shells, so they remove the meat while still at sea and discard the shells overboard. Without the shells, it is impossible to know the age of the conch—which

is determined by shell length and shell lip thickness. Regardless of motive, early product transformation can thwart sustainability efforts related to the harvest of particular species, juveniles, or certain sexes.



Aggregation of Supply

What it is: The mixing of product from different fishing events into a single volume. This makes it difficult, if not impossible, to accurately determine catch origin, catch method, date of harvest, size composition, or any other data related to the fishing activity.

Where it occurs: Aggregation tends to occur at the beginning of the supply chain—on the deck of the vessel, or at the level of the first receiver. With limited hold space, fishers often combine product from different fishing events, even if sets are separated by long distances

and occur over several days. Likewise, most processing plants grade product according to quality or size, regardless of when, where, or how it was caught. As this sorting occurs, product from different batches is mixed and moved along the processing line en masse.

Why it matters: Aggregation makes it impossible to differentiate responsibly harvested product in the marketplace, as the critical information regarding the catch is lost. Aggregation perpetuates “mystery fish”—as opposed to promoting “storied fish”—as the norm.



Relationship Dynamics

What it is: Complex, personal, and imbalanced relationships are common in the seafood supply chain.

Where it occurs: Relationship dynamics occur throughout the supply chain, but ones of particular interest are those between the producer and first receiver (a middleman who often also serves as the processor or wholesaler).

Why it matters: Determining an appropriate intervention strategy for shifting supply chains depends on understanding the human side of the supply chain equation. Knowing which actors hold power and the nature of those relationships is critical for determining whether and how to broach an idea around sustainable management with a community or company. In many cases, the tight-knit and familial relationships between fishers and

middlemen mean that some strategies may be more appropriate than others. For example, one popular suggestion for incentivizing fishers to adopt more sustainable practices involves securing direct market access to end buyers willing to give fishers a price premium for responsibly harvested product. In some circumstances, this approach may mean skipping over an exploitative supplier that had been undercutting fishers; in other cases, it may mean leapfrogging a fisher's close relative, trusted friend, or community member—possibly even someone who finances fishing activities or covers a family's medical costs. Thus, understanding the potential personal and interpersonal ramifications of a particular intervention or engagement is of utmost importance, as leveraging supply chain relationships can be the determining factor for success.



Fishers Typically Are Not Businesspeople

What it is: Fishers are experts at fishing, but might not have the know-how or experience necessary to engage more productively (and sustainably) in the seafood industry.

Where it occurs: At the producer level of the supply chain.

Why it matters: Many fishers are frustrated by the fact that in order to succeed as successful, sustainable fishers, their time is spent doing everything but fishing. Often, strategies to help fishers get more value for their products require skills in processing, marketing, price

negotiations, logistics (e.g., transport, product handling), management and administration (e.g., inventory management, purchase orders, invoices), and even community organizing (via co-ops, sectors, associations, or other structures). A realistic strategy for sustainable management must provide fishers with the necessary business-related support services so that they can focus instead on changing their fishing practices (including new gear types, if necessary). Fishers that *are* natural entrepreneurs and are interested in doing more than just fishing should be offered appropriate training.



Cultural Preferences

What it is: These are the ingrained expectations, assumptions, and perceptions that shape everything from which species are considered “favored” to the way fishers view their roles in the community.

Where it occurs: Most frequently at the two ends of the supply chain: producers and consumers.

Why it matters: Cultural norms can explain a lot about the root motivations or causes for certain behaviors. They are also often the most difficult to shift, especially if they are tied to deeply held values. Understanding the beliefs and expectations that directly influence fisher behavior is critical to crafting strategies that align—and perhaps even leverage—those values, rather than fighting against them.

These final three challenges are not directly linked to the supply chain, but hold great influence over how effectively supply chain players can respond to sustainability initiatives.



Lack of Monitoring and Enforcement

What it is: A glaring hole in government responsiveness to actors in the supply chain that are breaking the rules.

Why it matters: Some interventions require regulatory changes (such as permits for exclusive access rights) that depend on proper enforcement for effectiveness. A significant lack of enforcement—both on the water and inside supply chain facilities—quickly erodes the confidence

of players making sacrifices to “do the right thing.” While it is impossible to root out all “bad” behavior from a fishery even with the most sophisticated technology and well-funded government agency, fishers and supply chain players need at least some level of assurance that the government will support their efforts to make changes to comply with more responsible fisheries management.



Lack of Database and Data Management Capacity

What it is: Many emerging markets lack the institutional resources to support the collection, management, and analysis of fisheries data. Even if it were collected, there is literally nowhere for this information to go.

Why it matters: Whether industry-based, collected from fishers, or via independent methods, efforts to improve data capture will fail to improve fisheries if there is no mechanism for storing, accessing, and analyzing. Currently, many initiatives on

how to improve information for data-poor regions focus on the capture of data while ignoring the need for back-end structures to support this effort. Database management is a heavy lift, requiring maintenance, storage capacity, and strategic development of access rights and security. The latter especially requires careful planning and dialogue with all stakeholders to ensure legality and effective use of the database for both industry and fisheries benefits.



Interrelatedness of Challenges

What it is: Although the challenges just outlined were presented as distinct obstacles, they are actually interrelated. They create feedback loops that serve to perpetuate the status quo, failing to reward fishers for responsible practices and preventing the flow of information required for storied fish to reach the market.

Why it matters: Attempting to remove just one barrier will likely not result in

significant change. The challenges must be addressed simultaneously, through multipronged approaches and with buy-in and participation from various supply chain actors and other stakeholders. However, just as the challenges are caused by supply chain characteristics and dynamics, the removal of the barriers may create an opening for supply chains to act as drivers that incentivize sustainable management.

Case Studies

The following case studies provide examples of the diversity of supply chains around the globe, as well as the myriad challenges embedded within them. Some of these fisheries also provide examples of emergent strategies for progress, which will be discussed in the following section. These real-world examples are from different regions dealing with different species and experiencing different market and regulatory conditions. They aim to provide both the breadth and depth of knowledge managers need when thinking through their own challenges and the potential solutions and opportunities that may be available to them.

Each case study provides:

- Dominant supply chain attributes
- An overview of the fishery
- Product and data flows
- Common challenges and where they occur in the supply chain
- Examples of potential interventions based on the characteristics of the fishery and supply chain, and current stories of progress

**MEXICAN
LOBSTER FISHERY**
PAGE 20

**BAHAMIAN
CONCH FISHERY**
PAGE 27

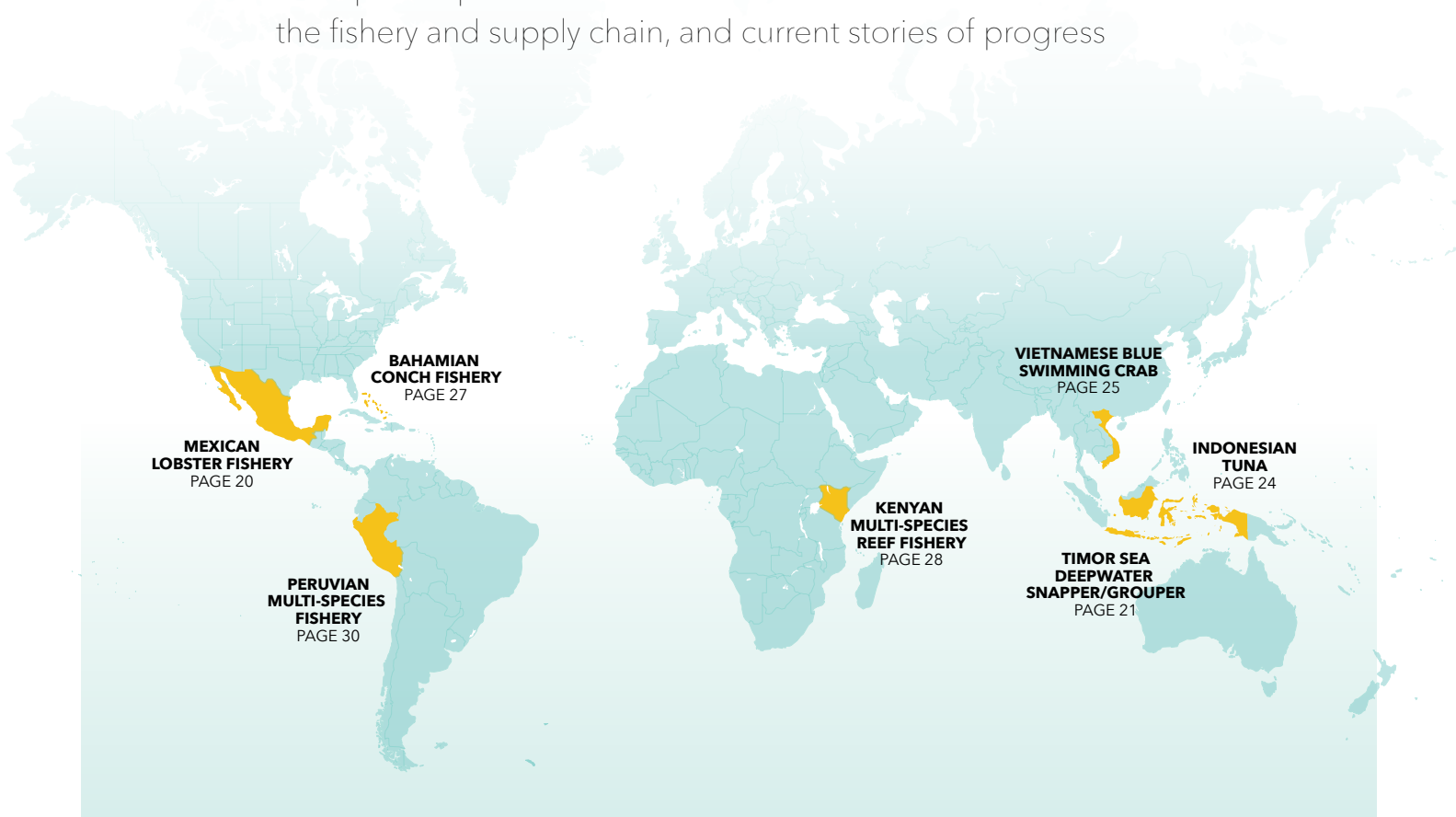
**PERUVIAN
MULTI-SPECIES
FISHERY**
PAGE 30

**KENYAN
MULTI-SPECIES
REEF FISHERY**
PAGE 28

**VIETNAMESE BLUE
SWIMMING CRAB**
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**INDONESIAN
TUNA**
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**TIMOR SEA
DEEPWATER
SNAPPER/GROUPER**
PAGE 21





CASE STUDY

Mexican Lobster Fishery

Dominant supply chain attributes

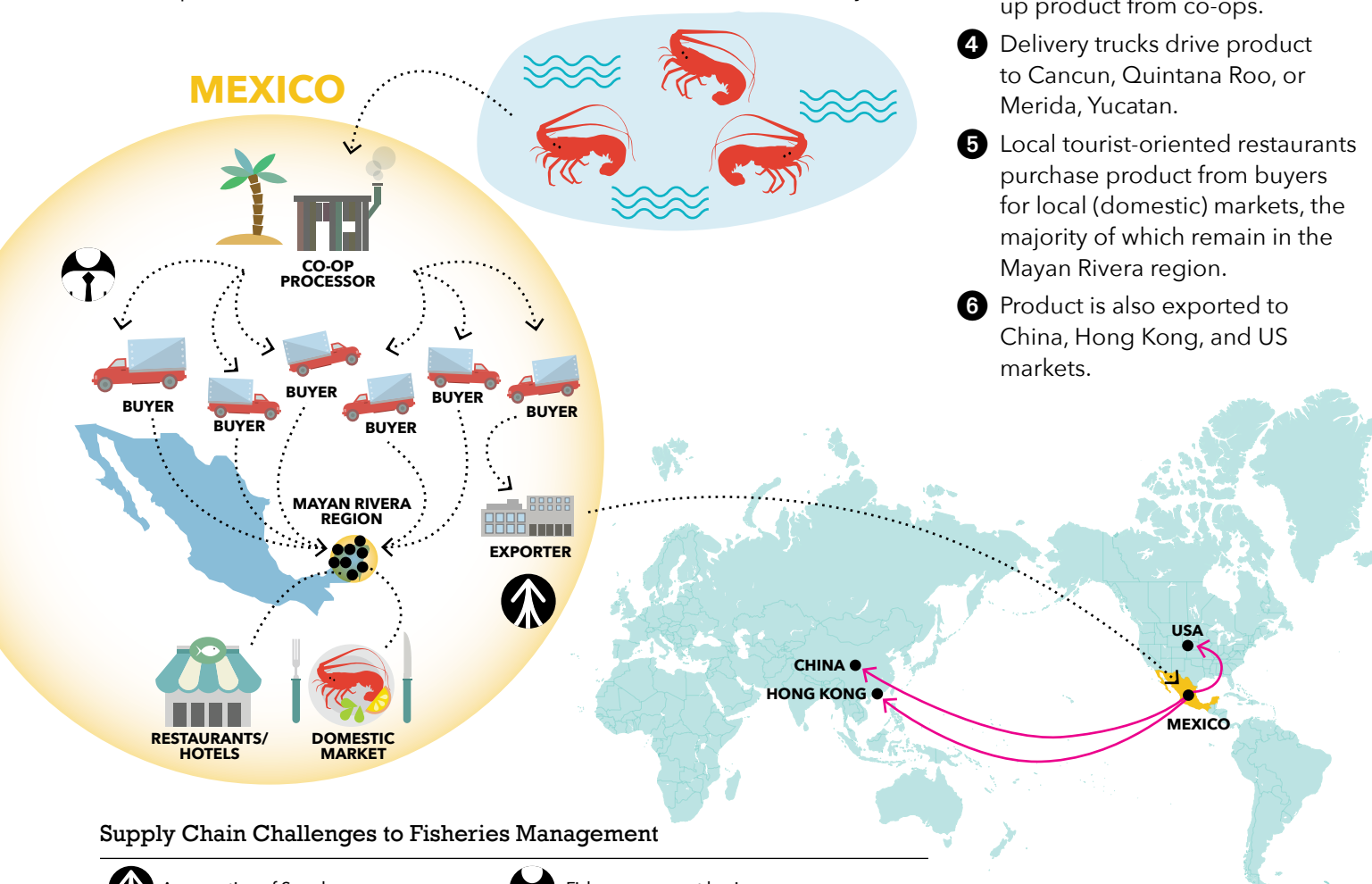
- Differentiated product flowing into a commodity market
- Brand presence (MSC)
- Bottleneck preventing direct access to market
- Dispersed supply chain

This 350 tons/yr spiny lobster fishery in Quintana Roo is fished by 19 fishing co-ops, six of which produce approximately 60 percent of the catch. The six co-ops fish within two natural protected areas: Sian Ka'an

and Banco Chinchorro. In Sian Ka'an, each fisher has their own designated area within the co-op's larger Territorial Use Rights in Fisheries (TURF), and only members of co-ops are permitted to fish in those areas. The co-ops in Banco Chinchorro are in the process of replicating this management system. They fish by putting out lobster shelters and capture live lobster via small hand nets or lassos (snooks). The six co-ops using these sustainable harvesting methods are part of an MSC-certified fishery, but have yet to receive certification for their chain of custody.

Points of information or product exchange

- 1 Fishers, using simple "casitas" or "lobster houses," capture lobsters via lasso or net within their own designated region within the co-op's TURF.
- 2 Co-op receives product at the dock from the fisher and conducts initial grading and processing (low-grade lobsters are tailed).
- 3 Co-op sells the product to one of (estimated) five or six buyers who send freezer trucks to pick up product from co-ops.
- 4 Delivery trucks drive product to Cancun, Quintana Roo, or Merida, Yucatan.
- 5 Local tourist-oriented restaurants purchase product from buyers for local (domestic) markets, the majority of which remain in the Mayan Riviera region.
- 6 Product is also exported to China, Hong Kong, and US markets.



Supply Chain Challenges to Fisheries Management



Aggregation of Supply



Fishermen are not businessmen

Learn more about the challenges on page 14

Data flow

- ❶ Co-ops record weight of catch (kg) per day in a paper-based registry.
- ❷ Monthly paper-based reports are sent from co-op to National Commission of Aquaculture and Fishing (CONAPESCA), including number of boats, fishing days, and total catch. From this information effort/boat can be determined.
- ❸ Electronic records with relevant income for tax purposes are submitted to the government.
- ❹ Electronic invoices are exchanged with buyers along with electronic money transfers (no cash), except for a few very small buyers (local restaurants).

Challenges

Fishers have restricted access to the market, with the regional buyers—likely in collusion—controlling price points. With low-priced product from competing Caribbean

countries, fishers have found that their efforts to protect the resource and manage it responsibly are not being rewarded via higher prices or increased market share. The lack of chain-of-custody certification makes it difficult for the fishers to realize any benefits from their investment in achieving MSC certification of the fishery.

Potential strategies for progress

In collaboration with WWF, Mariana Velez Laris and her colleagues at TNC are actively exploring development of a network of no-take fishing zones and new fisheries management systems to help conserve the marine resources of the Mesoamerican Barrier Reef. Fishers in the sustainable-fishing lobster co-ops have a strong story to tell, if they can get that story to the marketplace. This requires business support services that can help the co-ops explore marketing and price negotiation with buyers, using the power of



Lobster fisher with days catch, Mexico
© Erika Nortemann/TNC

their cooperatives. Carefully structuring deals with new buyers—potentially by leapfrogging exploitative middlemen and going straight to the domestic end buyers—may be one avenue to pursue. SmartFish, a non-profit operating out of Baja, Mexico, has trialed a similar tactic to increase market access for fishers in this region. Through improved handling of product and direct sales, they have managed to increase the price per pound of the landed catch, helping fishers to improve their livelihoods without having to catch more fish.

CASE STUDY

Timor Sea Deepwater Snapper/Grouper



Dominant supply chain attributes

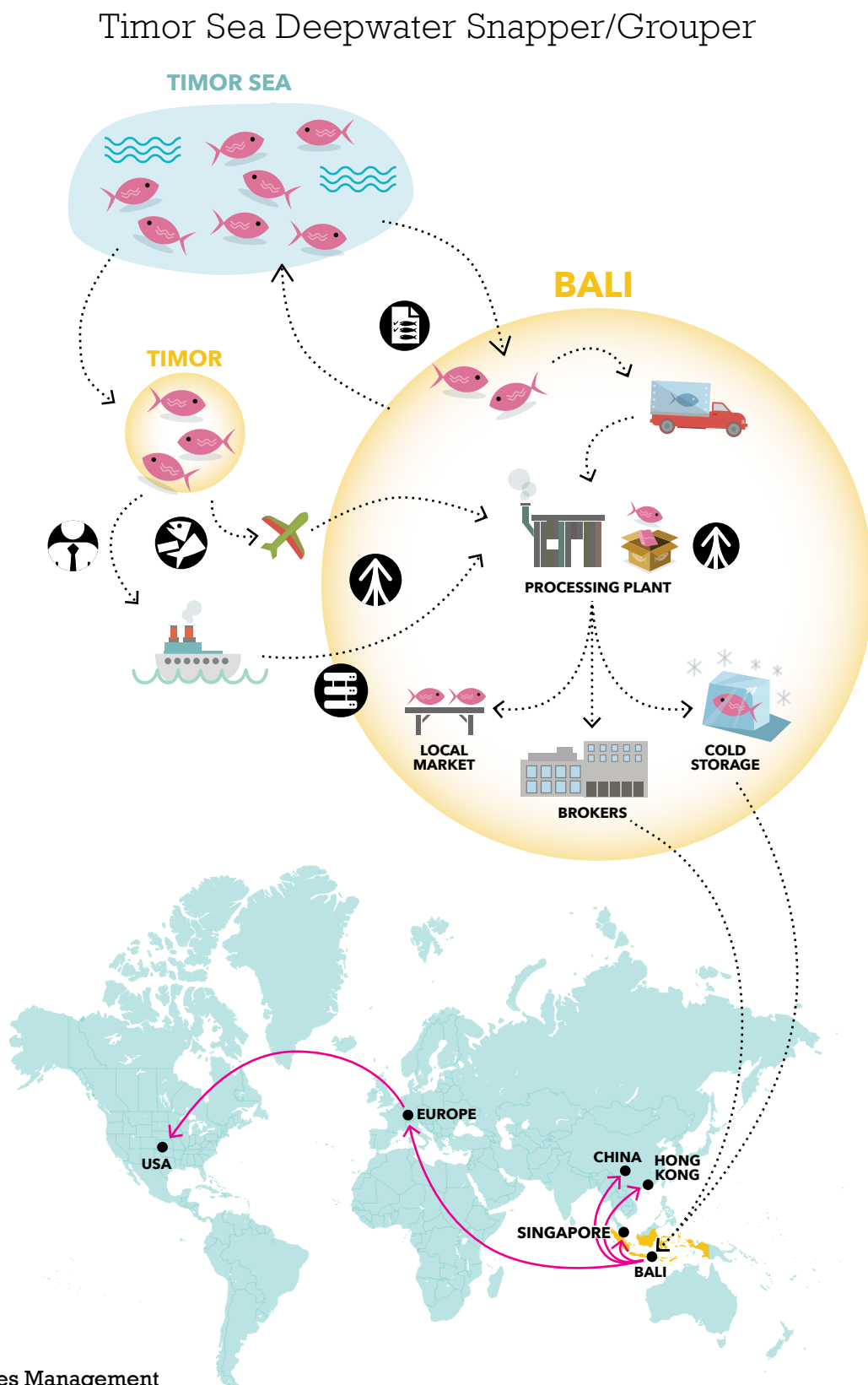
- Differentiated market for high-value products, commodity market for low-value products
 - Close-ties relationships
 - Consolidated supply chain functions with relatively few players
 - Moderately open access to market
- Deepwater snapper and grouper are

not highly migratory fish, and support a fairly conscripted fishery in the area of the Timor Sea south from the coast of Timor, where the slope of the continental shelf is very productive. Producers in this fishery come from Bali as well as surrounding islands. From Bali, midscale-size boats take five to six days to reach the fishing grounds and fish for a minimum of four to five days before returning to Bali with the catch. Smaller boats






from other islands also fish in these waters when weather conditions are good. Often, due to inclement weather or poor fishing conditions, the boats will harbor in Timor (on the Indonesian side) until they either (a) decide it's worth returning to the fishing grounds to do more fishing, (b) find another vessel going to Bali on which they can transport some or all of their catch, or (c) air-freight the catch back to Bali.

Points of information or product exchange

- 1 Producers: Fishers operating out of Bali fish in Timor Sea and return to Bali with the catch.
- 2 Landing: Small trucks transport fish to processing plant on Bali.
- 3 Timor traders: If the fishers don't land in Bali, the catch may be transferred to a transport vessel or air cargo from Timor to the plant in Bali; catch may be pregraded before shipping.
- 4 Processor: Sorting, grading, processing, and filleting high-value fish for export.
- 5 Brokers: Companies that do not have facilities or export licenses make deals between fishers and exporters.
- 6 Cold storage: Boxes of fish are kept in cold storage.
- 7 Exporter: Sends high-quality, high-value fish to premium markets (roughly 30 percent of catch), including Hong Kong, China, and Singapore. Lower-quality fish goes to the EU and then US market, which is least willing to pay a high price premium for quality.
- 8 Local market: Low quality, or fish for which there is no market outside Indonesia (roughly 70 percent of catch)



Supply Chain Challenges to Fisheries Management

- | | | |
|---|---|---|
|  Lack of vessel-level data |  Aggregation of Supply |  Lack of Database Management resources |
|  Transformation of product prior to processing |  Fishermen are not businessmen | |

Data flow

- ❶ Graders sort and grade fish by species and size, box them up, and move them to a weighing station that is linked to a database. Weight is recorded automatically, and fish is typed into the system.
- ❷ Box gets a barcode that is linked to information about what is in the box. The seamless transfer of this information is based on a new system piloted by TNC using technology by Insite Solutions and in close collaboration with a Bali-based processor.
- ❸ Information is potentially uploaded to the ERP system of the end buyer, but not necessarily.

Challenges

There are well over one hundred different species that comprise the catch of this fishery, making for difficult fisheries management. Proper identification of species at the point of processing is a major hurdle, as many plant workers are not experts in snapper biology (at least three to four species are referred to as “red snapper”). There is also a high turnover rate of processing plant workers, so knowledge gained on the floor is often lost. In addition, the multiple streams of fish coming in from transshipments or air are often presorted by the fishers or at an earlier port (e.g., Timor), a process that selects out the favored species, sizes, and best-quality fish. This makes it impossible for scientists to evaluate the health of the stock, which depends on accurate estimates of how many individuals of different sizes and sex are taken from the population at a given time



Workers in processing plant sort, weight, and measure deepwater snapper and grouper, Indonesia.

© Jeremy Rude/TNC

Potential strategies for progress

Peter Mous and his team at TNC Indonesia are working with one seafood company and various small traders to improve traceability of fish in the supply chain, for both business and fisheries advancement. The team created identification guides for the more than 120 species, and routinely trains personnel at the processing plant in species identification. Fish IDs are then assigned specific barcodes that can be scanned, enabling the quality-control personnel and graders to attach the correct name to each fish. That information is transferred to a system that allows for the identification of each batch of graded species and the total weight of each batch to be captured automatically, and then attached to the product as it is moved through the plant. The system is based on a smart weighing scale connected to a database, and it uses barcodes to track fish through the plant. By increasing accuracy, efficiency, and traceability of the processing line, the system brings business wins. By building trust and working closely with this one company, Mous is now building a database with information collected by this system that will inform stock assessments and, eventually, could inform harvest-control

rules. As of August 2015, the TNC Indonesia Fisheries Conservation Program is reaching out to various other companies in Kupang, Java, and Bali that are also sourcing from the same fishery.

In addition, to help capture better estimates of direct take from the fishery, Mous is working closely with several of the Timor traders and boat owners to share their data with government agencies and universities that are involved in management. TNC facilitates this process, and TNC provides cash payment to those traders who agree to record observations in addition to the records they were already taking for business purposes. Furthermore, the TNC Indonesia Fisheries Conservation Program identified a strong incentive among the vessel owners: Their financial investments in operational costs for the fishers' trips increased their desire to stay informed about where the fishers go. Using a low-cost tracking device (Spot Trace) and smartphones, Mous has provided boat owners with the technology they need to monitor their investments (and plan for when fishers are nearing the landing site) in exchange for them sharing valuable data on fishing practices, harvest, and spatial information of fishing grounds.

CASE STUDY

Indonesian Tuna



Dominant supply chain attributes

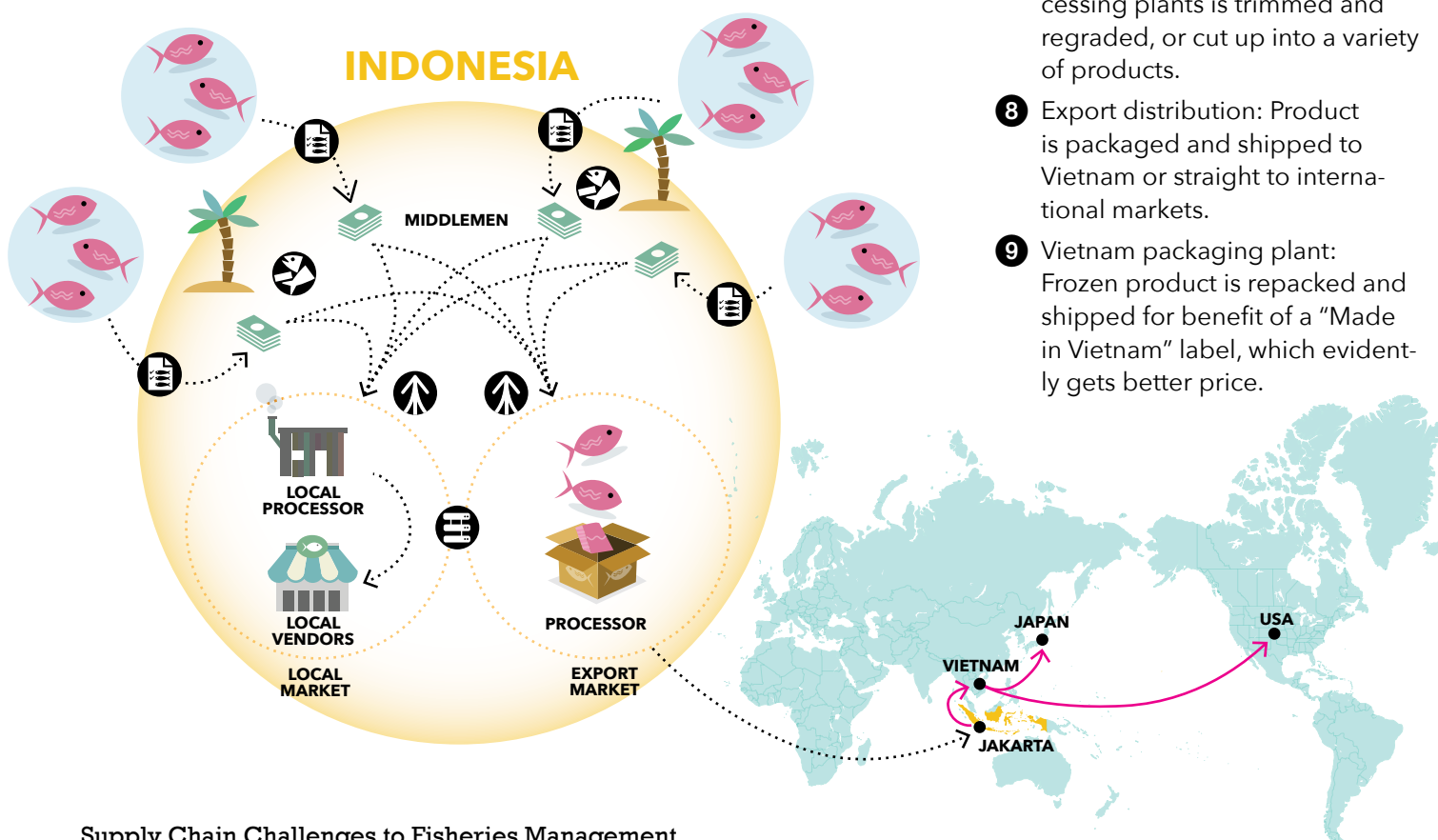
- Differentiated product
- Brand presence (Fair Trade, ThisFish)
- Close-ties relationships
- Dispersed supply chain functions

Tuna is a valuable export for Indonesia, but high demand for quality tuna from international markets is putting pressure on stocks. An opportunity exists to grow the market for more artisanal fishers who are

fishing relatively sustainably compared to giant purse seiners that may be engaged in illegal fishing. Two artisanal vessel types fish via handline around fish aggregating devices (FADs): *Mandar* vessels are 20-35 feet with three to five crew and fish relatively nearshore on two-week-long trips; *penongkol* vessels will travel further to sea and target the smaller-size tuna, staying out for shorter trips, with longer turnaround times between trips.

Points of information or product exchange

- 1 Producers: Remote fishers bring in tuna to a single landing location (each fishery to their own).
- 2 First receivers (middlemen): Purchase the catch dockside and divide product for local and export markets.
- 3 Enumeration: Happens dockside for some locations.
- 4 Local processor: Product is clear-smoked, flash-frozen, and vacuum-packed.
- 5 Local distribution: Product moves to local Indonesian vendors
- 6 Export: Product is shipped to Jakarta.
- 7 Jakarta processor: Frozen loins from the different local processing plants is trimmed and regraded, or cut up into a variety of products.
- 8 Export distribution: Product is packaged and shipped to Vietnam or straight to international markets.
- 9 Vietnam packaging plant: Frozen product is repacked and shipped for benefit of a "Made in Vietnam" label, which evidently gets better price.



Supply Chain Challenges to Fisheries Management

- Lack of vessel-level data
- Transformation of product prior to processing
- Aggregation of Supply
- Lack of Database Management resources

Data flow

- 1 Producer: Paper receipt from the middleman.
- 2 Middleman: Keeps a written ledger of purchased product (vessel, day, number of loins, weight) from fisher and sends the paper form to processor noting the transaction.
- 3 Enumeration: Paper-based dockside data collection is entered into an Excel sheet and uploaded to iFish and government database.
- 4 Local processor: Paper trail follows product.

Challenges

Both boat types—but especially *Mandar*—may fish multiple FADs in a single trip and currently have no mechanism for separating catch from different fishing sessions (or even days) apart. In addition to this aggregation, suppliers aggregate product from multiple fishers in multiple villages in order to maintain consistent supply; processors aggregate their product to make transportation cost effective, as refrigerated



Processing of yellowfin tuna for export markets, Indonesia.

© Jeremy Rude/TNC

trucks and container ships need to be filled. In addition, processing plants lack Wi-Fi and all data is hand-written and paper-based (no scanning).

Potential strategies for progress

Fair Trade certification is already in place in one locale to differentiate this artisan-caught product for high-end markets willing to pay a premium. In a similar approach to expand reach to markets willing to pay for verified sustainable product, the company ThisFish is working with MDPI, a local Indonesian NGO,

to enable traceability and storytelling for premium markets. ThisFish requires processors to upload catch data—including details on the location, catch method, and even the captain of the vessel—into a database. That information is then attached to the product package by QR code, which consumers can scan with their smartphones to learn about the fish. Both Fair Trade and ThisFish efforts are examples of supply chains with a brand-driven attribute, and represent an example by which supply chains can be shifted (or an alternative pathway built) to effect change in the system.

CASE STUDY

Vietnamese Blue Swimming Crab



Dominant supply chain attributes

- Commodity product
- Brand presence (FIP)
- Dispersed supply chain functions

Vietnamese blue swimming crab is a highly overfished fishery with huge

demand from the US foodservice industry, mainly for crab cakes. Fishing activities tend to occur in remote regions of Vietnam on a combination of large boats, small trap boats, small-scale gillnetters, and foreign trap boats and trawlers. The fishery provides critical livelihood for local

residents. A fishery improvement project (FIP) established a number of years ago to eliminate the harvest of egg-bearing females and juveniles has been largely unsuccessful; currently, several US-based buyers and supply chain participants are looking for a new FIP model to restore the fishery.

Points of information or product exchange

- ① Producers: Fishers bring product to the landing site. In some regions, fishers may deliver product to a “collector” boat.
- ② Primary processing: Cooking and grading often happen on the beach. Picking may be an extra step or lumped into cooking/grading.
- ③ Secondary processing: Pasteurization, packaging.
- ④ Distribution: Cooked crab is sent in large vats to local and export markets.
- ⑤ End buyer: Usually foodservice industry in the US.

Data flow

- ① No data is generated at the vessel level (but efforts to create paper-based system are under way).

- ② Paper records from picking and grading stage are passed to FIP.
- ③ Information is captured via purchase orders, invoices, or internal enterprise resource planning (ERP).
- ④ Some suppliers have a cloud-based traceability technology system that communicates information to the end buyer.

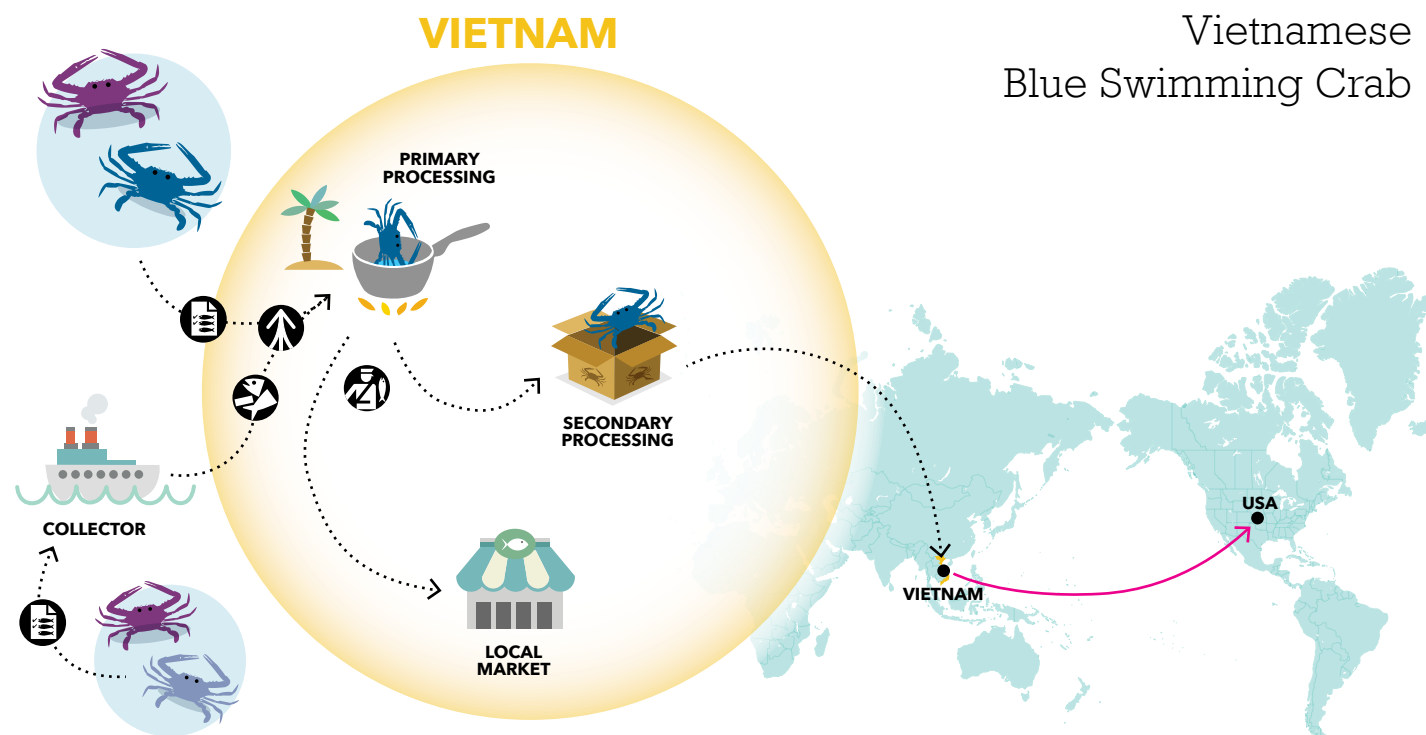
Challenges

Currently, the biggest challenge to sustainable fishing in this fishery is that compensation is on a per-unit basis, so there is no incentive to discriminate between harvesting juveniles and adults—both garner the same price. In addition, once the crabmeat is picked, it is very difficult (though not impossible) to discern what size the original crab was, making enforcement of the size regulations difficult. Finally, transactions

within the supply chain are commonly informal, with no records produced.

Potential strategies for progress

Efforts are under way to introduce both paper-based and smart technology (e.g., smartphones, tablets) at the point of landing in order to increase data capture. Smart technology could aid in providing a way to measure and weigh landed crab quickly and accurately while generating real-time data on the size of the individual crab. This solution is similar to the pilot implemented by TNC in the Indonesian deepwater snapper fishery. The challenge here, however, is that much of the primary processing is done right on the beach, as opposed to within a facility.



Supply Chain Challenges to Fisheries Management

- Lack of vessel-level data
- Transformation of product prior to processing
- Aggregation of Supply
- Lack of Monitoring and Enforcement

CASE STUDY

Bahamian Conch Fishery

**Dominant supply chain attributes**

- Commodity product
- Close-ties relationships
- Consolidated supply chain functions (few nodes)
- Open access to market through multiple buyers

Queen conch (*Lobatus gigas*) is the second leading seafood export product (behind spiny lobster) of the

Bahamas and is strictly governed by CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) under Appendix II (regulated trade based on permits certifying legal catch). The CITES status imposes a cap for the export market at approximately 500,000 lbs of conch meat per year (about 31 percent of the total fishery), but places no limit on harvest for the domestic market. This domestic market

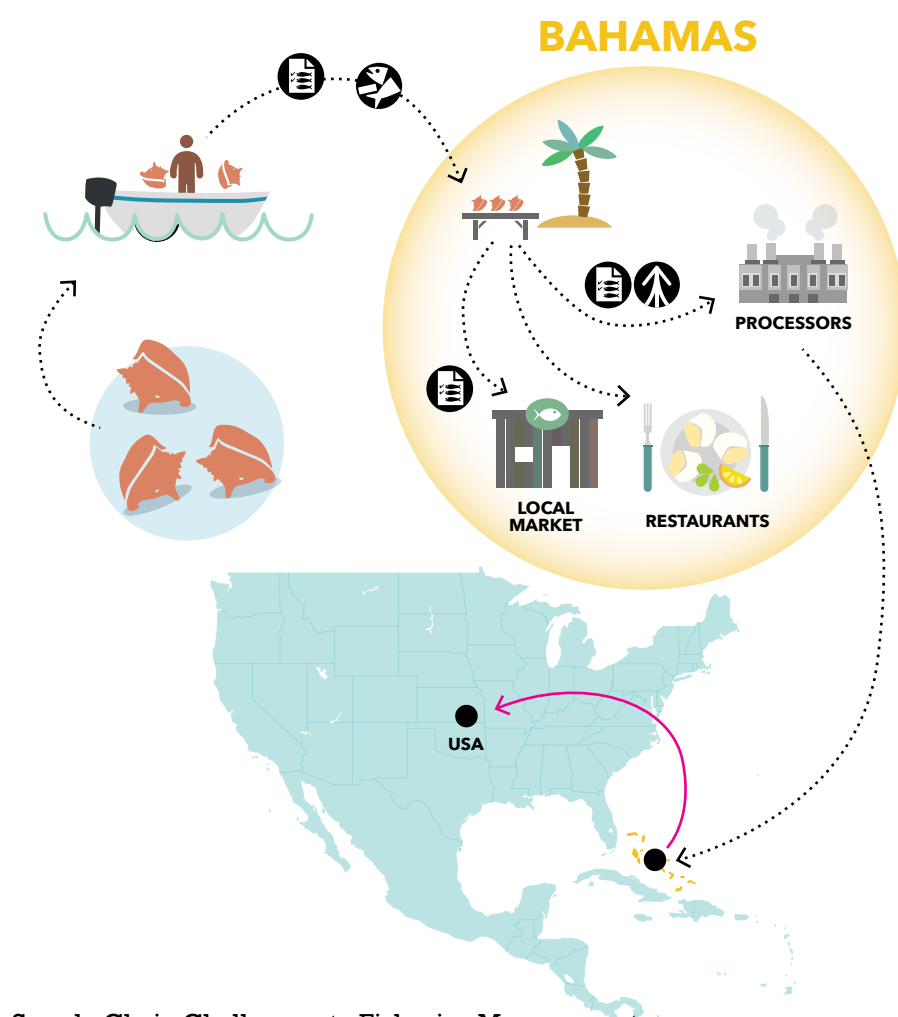
is significant, with an estimated 40 to 50 percent of Bahamians consuming conch every day. Over 60 percent of the total harvest is landed when the lobster season is closed, and fishers turn to conch as an alternative income source.

Current conch fishery regulations limit fishers to only harvesting adult conch, which are distinguished by shells with flared lips. However, most fishers process the conch onboard the vessel, removing the meat and discarding the shell in order to save room in their coolers and reduce weight on the boat. Thus, what is landed is the meat, from which it is nearly impossible to gauge information about conch age.

Points of information or product exchange

- 1 Fisher catches conch and removes shell on boat.
- 2 Fisher sells conch direct to local market (restaurants, retail, fish market traders, dockside to locals).
- 3 Fisher sells conch to processor/exporter (about nine major exporters that split CITES quota).
- 4 Processor cleans, grades, and packages product.
- 5 Product is shipped to US market (approximately 500,000 lbs/yr worth \$3.3 million).⁸

8. L. G. Gittens and M. T. Braynen, "Bahamas National Report: CFMC/OPESCA/WECAFC/CRFM Working Group on Queen Conch," Department of Marine Resources, 2012, [http://www.strom-busgigas.com/Meeting%20Panama/Queen%20Conch%20Meeting%20\(23%20October\)/Bahamas/Bahamas%20national%20report.pdf](http://www.strom-busgigas.com/Meeting%20Panama/Queen%20Conch%20Meeting%20(23%20October)/Bahamas/Bahamas%20national%20report.pdf).

**Supply Chain Challenges to Fisheries Management**

Lack of vessel-level data



Transformation of product prior to processing



Aggregation of Supply

Data flow

- ① Spot checks by landings collection officers who conduct interviews and inspect catches (coverage is very limited).
- ② Processors submit purchase reports to government and include data on aggregate landings such as weight, region, and fishing effort.

Challenges

The lack of any data reporting system for direct sales into the vast domestic market presents a huge problem for fisheries managers. Though processors provide purchase records, the majority of conch sold in the Bahamas goes through the undocumented local supply chain, with fishers selling directly to consumers or to retail and restaurant outlets. Spot checks by local government officials are scarce and cannot determine detailed harvest location information (estimates on the potential range of fishing grounds

based on landing locations limit this resolution). In addition, conch landed without the shell cannot easily be checked for compliance with the flare-lip requirement.

Potential strategies for progress

Felicity Burrows and TNC's Northern Caribbean Program actively works to develop solutions that can improve sustainable management of commercially valuable fisheries, including lobster and conch. With recent progress gained in the lobster industry, there may be opportunity to leverage the efforts already spent in developing a FIP and education campaigns for curtailing the take of undersize lobster to help the conch industry. The "size matters" education campaign implemented by Friends of the Environment calls attention to the illegal take of juvenile lobster, requesting retailers and restaurants (as well as fishers) to stop buying and selling undersize lobster.



Queen conch in its natural seagrass habitat, Bahamas.
© Jeff Yonover/TNC

A similar effort could be initiated for conch. In addition, to help develop more accurate data for the domestic conch market, there may be opportunities for smart technology. Similar to the challenge in the Vietnamese crab industry, smart weighing or sizing scales could aid in developing alternative models for estimating conch maturity based only on the meat; this would allow for enforcement officers to better determine legality of catch and for scientists to adjust fisheries models.

CASE STUDY

Kenyan Multispecies Reef Fishery

Dominant supply chain attributes

- Some differentiated product, mostly commodity
- Close-ties relationships
- Dispersed supply chain functions
- Bottleneck hindering market access

The reef fishery of Pate Island, off the northern coast of Kenya, is a tropical multispecies artisanal fishery that brings in dozens of pelagic and

demersal finfish, squid, octopus, crab, and lobster. These products are sold through multiple seafood supply chains into local, regional, and international markets, with fishers selling to different buyers depending on their catch each day—and on whether buyers are present at the remote landing sites.

Fishers use traditional artisanal gear (traps, handlines) out of nonmotorized canoes, leaving in the morning and coming back in the evening.



In 2007, the Kenyan government recognized the need for local communities to help co-manage marine resources. Local Beach Management Units (BMUs) were formed to manage approximately 20-km stretches of coast and the resources offshore. The BMUs consist of stakeholders (fishers, processors, dealers, and other beach workers dependent on fisheries) from each community, and part of their mandate is to capture and record fisheries data.

Points of information or product exchange

This fishery has several distinct supply chains, depending on the species.

High-value catch: Sea cucumbers, lobsters, crabs, and select high-end finfish

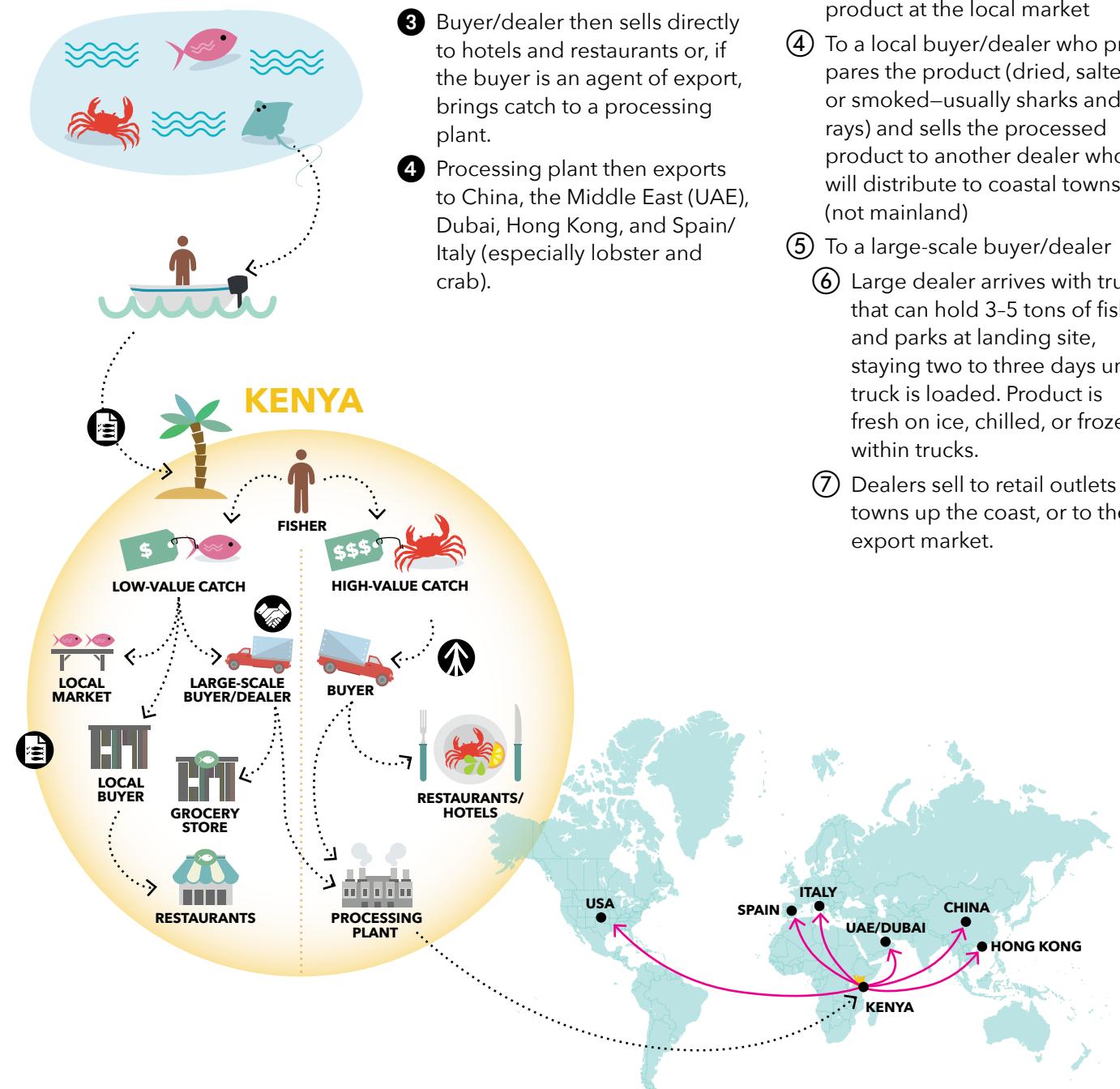
- ① Fisher lands catch at the beach.
- ② Fisher sells to a buyer (dealer) who transports catch (by sea and public bus) to locations farther up the coast (300 km).
- ③ Buyer/dealer then sells directly to hotels and restaurants or, if the buyer is an agent of export, brings catch to a processing plant.
- ④ Processing plant then exports to China, the Middle East (UAE), Dubai, Hong Kong, and Spain/ Italy (especially lobster and crab).

Low-value catch

- ① Fisher lands catch at the beach

Fisher sells catch:

- ② Door-to-door in the neighborhood using a bicycle or on foot
- ③ To a local market woman, who then sells fresh or cooked/dried product at the local market
- ④ To a local buyer/dealer who prepares the product (dried, salted, or smoked—usually sharks and rays) and sells the processed product to another dealer who will distribute to coastal towns (not mainland)
- ⑤ To a large-scale buyer/dealer
- ⑥ Large dealer arrives with truck that can hold 3–5 tons of fish and parks at landing site, staying two to three days until truck is loaded. Product is fresh on ice, chilled, or frozen within trucks.
- ⑦ Dealers sell to retail outlets in towns up the coast, or to the export market.



Supply Chain Challenges to Fisheries Management



Lack of vessel-level data



Relationship Dynamics



Aggregation of Supply

Data flow

- ① Upon landing, fishers record catch with the local BMU.
- ② Fisheries officers check the records of local BMUs to ensure data collection and government reporting are taking place.
- ③ No data accompanies product when fishers sell to small or local dealers.
- ④ For large buyers in the export market, records are kept as mandated by the government for trade purposes.
- ⑤ The Revenue Department also keeps records of export products, but the records are not easily accessed or analyzed.

Challenges

For high-value species (mostly lobster, sea cucumber, crab, and a few select finfish), there is competition among dealers, which results in better prices for fishers. However, for the vast majority of species caught, the buyers hold the power, offering very low prices that fishers have no

choice but to accept. Farther inland, in the capital city of Nairobi, consumers are willing to pay a premium for local reef fish, but there are currently no direct channels through which fishers might access that market; most are unaware that such demand exists.

The variability of the fishery and the remoteness of landing sites make it difficult for fishers and dealers to align supply and demand. Some days when there are no dealers nearby, fishers simply will not go fishing. Other days, fishers might land huge volumes and only one or two dealers will be present, offering low prices, while other dealers up the coast might be struggling to fulfill orders and would be willing to pay much more. Unfortunately, there is no way for dealers and fishers to communicate about excess supply or unfilled demand. There are also challenges with foreign vessels bringing in catch and flooding local markets, driving down prices.

Potential strategies for progress

The TNC Kenya team, led by George Maina, has launched a fish-to-market project that aims to tackle the economic issues of the fishery in order to address the ecological ones. Right now, fishers cannot afford to reduce their landings or absorb reductions in catch that marine protected areas (MPAs) would force. By starting with a value chain analysis, Maina and his team have identified the Nairobi market as a key opportunity that, if it can be tapped, would provide increased economic stability for fishers via higher prices and greater market access. To make that happen, TNC is drafting a business plan for multiple BMUs in the region to address the business needs—logistics of processing, storage, branding, and marketing—that all must be in place for fishers to be able to access and take advantage of this new market. TNC is also exploring how private investment might fund some of this development work.

CASE STUDY

Peruvian Multispecies Fishery



Dominant supply chain attributes

- Commodity (high-value and low-value)
- Brand presence (co-op)
- Close-ties relationships
- Dispersed supply chain functions
- Open access to markets

Ancón, a district of northern Lima

Province, Peru is an iconic fishing community and popular tourist destination. The multispecies fishery in the area is the target of artisanal fishers and divers who operate near shore for benthic resources, such as black rock snails, octopus, crab, loco (a type of abalone), razor clam, and pelagic fish species such as silver-side and demersal species related to hardrock substrate, such as Peruvian

morwong. These activities are mainly oriented to local markets and, depending on the species, may be considered midvalue (crab and snail) or high-value (octopus, loco, silverside) products. Rock snail, however, is what sustains the dive fishery, as it is harvested year-round. The main fishing grounds is in a multiuse marine protected area (MPA) that still lacks a management plan. TNC has set

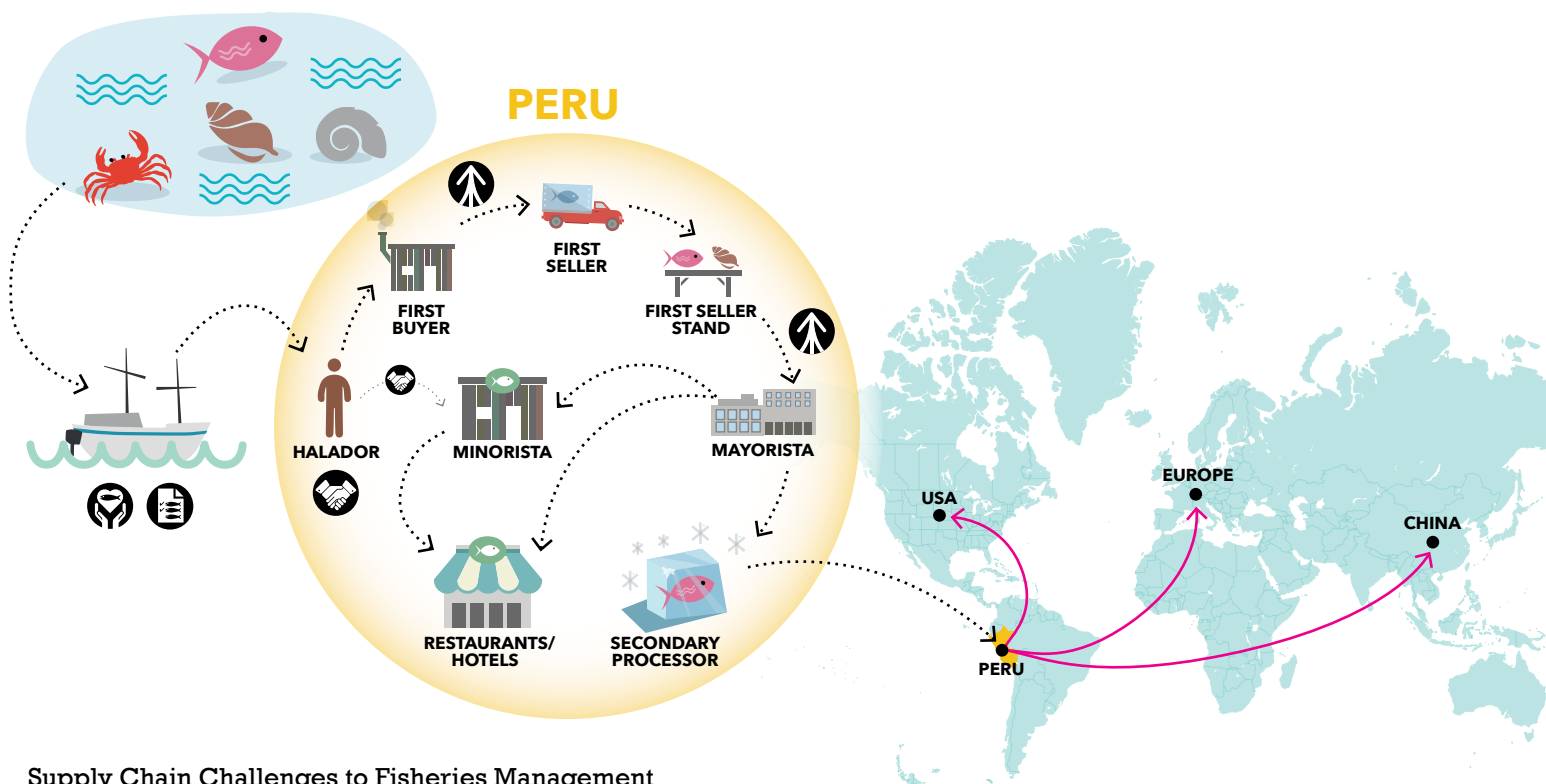
up a pilot with divers and fishers to manage the fishery in a responsible way, using science to support their internal agreements about when to fish, where to fish, how much to fish, and size restrictions.

Points of information or product exchange

- 1 Divers (two per boat) harvest fish and shellfish. Tripulantes (crew) are other fishers on board who help the divers with air hoses and with navigating the boat. Other fishers use hook and line or gill-nets to fish for pelagic species.
- 2 Once in port, a halador (puller) is paid a small sum of money to help the producer (fisher or diver) move the catch from the boat to the selling area at the port.
- 3 The halador connects with the first buyer and facilitates the sale
- 4 In rare cases, a minorista (minor commercial seller who sells to restaurants and hotels) will buy directly from the halador at the port.
- 5 The first buyer purchases the catch from the halador and usually does some primary processing in the landing facility at the port.
- 6 A first seller then buys processed product from the first buyer as well as from other primary processors, aggregating catch from multiple boats and, possibly, multiple ports.
- 7 The first seller then transports the product to the main fishing terminal—the big local market for fish in Peru.
- 8 The first seller will either sell the product directly at the market

(e.g., setting up a stand, or selling out of a truck), or will sell to a mayorista (major seller).

- 9 For local markets, the mayorista will sell to minoristas, or sometimes directly to major hotels, restaurant chains, or supermarkets.
- 10 Minoristas then sell to hotels and restaurants. The highest-value product goes to Lima.
- 11 For export markets, the mayoristas will aggregate catch from several first sellers until they reach a critical volume—usually more than 5 tons—at which point they can sell to a secondary processor.
- 12 The secondary processor will package, freeze, and then sell through a broker or directly to a buyer in another country. The main export markets are the US, the EU, and China.



Supply Chain Challenges to Fisheries Management

- Lack of vessel-level data
- Relationship Dynamics
- Aggregation of Supply
- Cultural preferences

Data flow

- ① TNC has helped set up landings records for some species.
- ② Biological data—including maturity, size and CPUE (catch-per-unit effort)—are due to be recorded by late 2015.

Challenges

There is a lot of informality in the artisanal sector, and there are no government regulations. Thus, little is known about the volume or characteristics of the species targeted, as there are no enumerators or surveillance at all the landing facilities to determine who is offloading and what they have caught. In addition, the Peruvian government tends to be leery of any types of exclusions (e.g., use rights, territorial rights, catch shares) that may increase the risk of social conflict.

In long supply chains, it may be tempting to suggest that producers could get paid higher prices by cutting out some of the middlemen. However, it is important to understand who those middlemen are, and what other roles they might play in producers' lives. For example, in Ancón the *haladors* and first buyers are usually related to divers and fishers, or may be *compadres*—non-biological family. Oftentimes the first buyer is a godmother (women hold very strong positions in the value chain). If someone in the producer's family is sick, they go to the first buyer to get medicine. For some in the fishery (mainly gillnet fishers), the first buyer is also the one financing the fishing activities.

Potential strategies for progress

Although the MPA was approved five years ago, the Ministry of Production (PRODUCE) and the Park Service (SERNANP) responsible for



A fisher's catch of the day on sale dockside, Peru.
© Jeremy Rude/TNC

regulating fishing activities in the area have yet to design a management plan; nor has the Port Authority (Capitanía de Puerto)—in charge of enforcing marine activities, including illegal fishing—designed one. Eventually, regulations will need to be established. A pilot with artisanal fishers operating in the MPA is currently underway within TNC's Humboldt Current Project and could serve as a model for how community-led management can be successful in Peru, providing a starting point for the types of data that can be gathered from fishers both to verify the effectiveness of the management plan and to tell the story of seafood origins in local and export markets.

As noted by TNC Fisheries Specialist Matias Caillaux, the fishers in Ancón want to create some local branding,

as the community is well known in Peru as a historical fishing port and recreational beach. They are also proud of what they are doing in terms of managing the fishery more responsibly, which could add extra value to the name. There are restaurants in Lima interested in highlighting seafood from Ancón, and some are doing so already (even if the product isn't from Ancón).

The fact that women have very strong roles in the Peruvian seafood value chain should be considered further, specifically with respect to their receptivity to ideas around sustainability, resource stewardship, and preservation for future generations. Depending on the dynamics of the relationships, women may have latent influence on fishers' practices that has yet to be explored.

Anchored artisanal fishing boats in the Bay of Ancon, Peru.
© Jeremy Rude/TNC



Emerging Strategies for Progress

Just as there are some common supply chain challenges that impede sustainable fisheries, so too are there some common ideas and innovations that may help to address those challenges. This list of emerging strategies is not comprehensive, but rather is intended to inspire further thought, discussion, and engagement among practitioners in the field. It is an invitation for the resource-management community to help refine and add to these concepts as new pilots are launched, lessons are learned, and new innovations are developed and tested.

Identify Who Holds the Power

As is the case with any group of people, in many supply chains, specific players hold disproportionate influence over others. Identifying who those individuals are—and how they could benefit from a conservation-aligned initiative—might be a powerful approach for initiating a shift toward responsible practices. For example, in some fisheries, suppliers are far more than just fish dealers—they provide financing for boats, fuel, and ice; they support fishers by paying for healthcare costs and other unexpected expenses when they arise. Getting buy-in from suppliers around sustainable-fisheries initiatives has helped convince fishers to participate, and has built support for several such efforts around the world.

Prove the Concept

Industry players are understandably hesitant when it comes to collecting and sharing data. One way to gain trust is to start small, and to prove the value of participation by focusing on one player who can serve as a model for others. Peter Mous with TNC Indonesia did this when he teamed up with a single processor in Bali. Working closely with this forward-thinking business leader, his teams have installed technology and new processes on the

plant floor, which has increased efficiency and traceability and helped the company improve its branding. At the same time, through careful planning, they have built a data-sharing system that provides TNC with near-real-time catch information based on what is moving through the plant—a huge step toward building appropriate fisheries management for this valuable fishery.

Align with Existing Cultural Values

To say that every supply chain is different appears obvious, but it is critical to explicitly acknowledge the differences that may exist between a fishing community in one region and another just up the coast. In comparing Chilean and Peruvian fisheries, major differences in the way fishers view themselves and their work means that some of the strategies that have worked in Chile are not practical for Peru. Instead, TNC's Matias Caillaux, in working closely with fishers in the Ancón region, has identified deep local pride as an important value that could serve to unite fishers around a branding campaign.

Provide Evidence of Progress

Fishers want to see the results of conservation efforts and often cannot afford to wait for long-term ecosystem responses. Providing support for transitions and proof that efforts are, in fact, working, is an important element for participant retention and program success. Focusing on changes in fast-response components of the ecosystem is one way to do this. The nonprofit Blue Ventures used this approach in encouraging a fishing community off Madagascar to leave a small no-take zone just for octopus. Fast-growing and rapidly reproducing, the octopus population required only five months to show significant returns. Seeing the evidence-based benefits, other communities quickly followed suit.

Enable Well-designed Alternative Livelihoods

In a different approach, Wayan Patut has used coral farming and ecotourism as a way to grow the economy and income for fishers and to reduce destructive fishing practices. Small coral pieces can be sold to the aquarium trade after short time periods, helping generate income for the cooperative as well as provide starters to restore the local reef. Ecotourism brings divers and snorkelers to view the farms and reefs, further diversifying income. These revenue streams and more consistent supply for aquarium dealers have made it possible for fishers to make a better living, which frees them from the pressure to catch aquarium fish with destructive techniques, and allows them to focus on fishing sustainably.

A word of caution here, though: the strategy for developing alternative livelihoods must be thought through thoroughly and designed in close partnership with communities to avoid unexpected shifts in effort or practice that can lead to more harm. For example, to reduce fishing effort, the government of the Pacific Island nation of Kiribati subsidized the coconut-oil industry to lure more fishers off the water. The plan worked, and then backfired. Former fishers made more money picking coconuts, and because of this, they didn't have to work as much. In their newfound leisure time, they went fishing. Fishing actually increased 33 percent, while reef fish populations plummeted.⁹ Approaching innovation with a human-centered design

One way to gain trust is to start small, and to prove the value of participation by focusing on one player who can serve as a model for others.

9. Richard Harris, "Reef Conservation Strategy Backfires," *National Public Radio*, November 18, 2009, <http://www.npr.org/templates/story/story.php?storyId=120536304>.

approach or an anthropological lens helps to identify individuals' motivations and values from the start. These can then be leveraged to construct appropriate, long-lasting initiatives with outcomes in alignment with improved livelihoods and ecosystem health.

Team Up

There are many types of partnership structures that can help fishers and supply chain players organize to create positive outcomes for their businesses and the resource. In Chile and Mexico, cooperatives have worked to organize fishers and provide exclusive access to specific fishing areas (TURFs) that they can then manage for maximum returns and long-term sustainability. In Kenya, the BMU model brings in upstream supply chain players to be part of the resource management unit. In the Bahamas, the Bahamas Marine Exporters Association realized that as major beneficiaries of improved lobster harvests, they needed to invest in supporting the FIP efforts. By joining together, they helped create the database management system now used by the government and industry to monitor catch and export of lobster, as well as supporting several other projects within the FIP, including education and outreach campaigns.

Brand the Local Product

There is a growing trend—from huge commercial fisheries in Alaska to small bays in Peru—to harness the power of a good reputation to create regional brands. For many fisheries, eco-certification is cost prohibitive; however, regional markets may be willing to pay for product that comes from areas that are considered “pure,” “natural,” “well managed,” or historic hearts of fisheries. Capitalizing on a region's positive reputation may be one way to open more lucrative market channels for fishers. New technology and forward-thinking seafood companies have opened the door for streamlining the process by which the story of the region and fish can make it to market. A few traceability companies, such as ThisFish, are working with fishers and supply chains to track legal, sustainable product and provide the consumer with access to that story through QR codes on packages. Technology, organization, and creativity are making local branding feasible and affordable for seafood supply chains around the globe.

Capitalizing on a region's positive reputation may be one way to open more lucrative market channels for fishers.

Let Fishers and Industry Lead

Successful engagement with seafood supply chains must prioritize listening and facilitating over dictating and controlling. Understanding deeply the structure, function, culture, and needs of the players involved is the first step toward developing a range of potential interventions and solutions—all of which must be brainstormed and codeveloped with the players themselves. Resource managers must strike the delicate balance of serving as advisor—providing options and evidence that can be used to assess or refine an initiative—while also helping stakeholders take ownership of their ideas. Creating this kind of supportive structure will go a long way in empowering the critical players to take responsibility for their behavior change and to promote the program to their peers, building long-lasting engagement.

Conclusion

The general overview and case studies presented here provide a glimpse into how supply chain structures and functions can create challenges (and offer opportunities) for resource management and sustainability efforts within fisheries—particularly for artisanal fisheries in emerging economies. As with any complex system, driving positive change within a seafood supply chain requires a deep understanding of the human and logistical factors that are creating barriers, and designing solutions that can work in concert with one another over time to shift behavioral habits. There are no silver bullets, no domino effects. Instead, multiple challenges must be simultaneously tackled in order to loosen and free up the entire tangled web. That is easier said than done, but not impossible. The emerging strategies for progress, based on preliminary successes within actual fisheries, offer some starting points for exploration. In addition, we list below several key insights from field experts, along with some guiding questions, that may help practitioners design and execute effective engagements that harness the power of supply chains to build more sustainable fisheries.

Key Insights

Data collection: Start with the resource, then follow it up the supply chain

Given the fractured and convoluted nature of seafood supply chains, it is nearly impossible to gauge what is happening in a data-deficient fishery by attempting to trace product back from the end buyer to the resource. Instead, by starting with fishers, understanding who participates in the fishery, and learning the locations of fishing grounds and landings sites, it is possible to begin building knowledge of where opportunities lie for capturing, storing, and sharing data—perhaps with fishers, perhaps with first receivers, perhaps even further up the chain.

Behavioral change: Think beyond monetary incentives

There is a tendency to default to financial rewards when thinking about how to incentivize behavior change within seafood supply chains. But through careful observation, interviews, and embedding with participants of a fishery, it is possible to unearth motivations at each step in the supply chain that go beyond money. Such an effort demands insight and creativity, but with the right approach, those motivations may then be leveraged to bring added value to the business or fisher while simultaneously benefiting the environment.

Expectations management: Under-promise, over-deliver

Trust and respect are hard-won with fishers and other actors within the seafood supply chain. Many NGOs recognize that truth, and have spent years building relationships in order to work with communities, government officials, and the industry in a productive way. As new innovations—such as technologies, designed interventions, or partnerships—are introduced, it is critical to set realistic expectations from the start. In recovering fisheries, there is a strong desire for immediate results. As noted previously, however, solving for sustainable fisheries management requires addressing multiple challenges at once. Making clear that each innovation, each project, is not in itself the answer, but rather is a part of a multipronged strategy, provides the type of transparency that builds trust. Being deliberate in what is conveyed and constant in managing expectations is critical. That said, any initiative that can show some short-term benefits and gains is always helpful (see Emerging Strategies for Progress, page 33).

Appeal to reputational risks and competitive advantage

Some companies, such as McDonald's, have engaged in more sustainable sourcing in order to stabilize supply, while others such as Walmart have corporate social responsibility (CSR) commitments. In general, however, mid-chain players may not necessarily see how their corporate values align with better data capture, sounder management regimes, or more sustainable practices. If that is the case, it may be effective to engage on the level of competitive advantage and reputational risk. New seafood import policies in the EU and forthcoming in the United States, for example, require far more rigorous documentation that product is from a legal and managed fishery. Thus, the extent to which seafood companies need to prove that they are operating legally and are not supporting IUU could serve as an effective on-ramp for eventually convincing those companies to support better fisheries management and data collection. At the same time, proof of compliance with environmental and social regulations (including supply chains free of human labor violations) can serve as competitive advantages for mid-chain players vying for preferred purchasing agreements with major buyers whose reputations are at risk from public scrutiny.

Making clear that each innovation, each project, is not in itself the answer, but rather is a part of a multipronged strategy, provides the type of transparency that builds trust.

Guide for Understanding Where to Intervene

The following table (Table 2: Evaluating supply chains for effective engagement, page 38-39) can serve as a guide for practitioners interested in exploring supply chain engagement as part of a fisheries improvement initiative. While there is no recipe for absolute success, understanding which strategies are working to overcome particular barriers can help to steer practitioners toward more informed and more effective interventions. A healthy dose of creativity is always advised, but having a framework within which to innovate is essential. The following table can provide the context to get you started.

Table 2: Evaluating supply chains for effective engagement

Considerations	Case Studies			
	Mexican lobster	Timor deepwater snapper	Indonesian tuna	Vietnamese BSC
Fishery stakeholders' desire to address resource or data management problem	Strong among fishers	Strong among vessel owners and processors	Strong among processors	Strong among end buyers
Values or incentives used to motivate stakeholders	Potential for better prices (has not materialized)	Gaining insight into behaviors of fishers; improved efficiency and accuracy within processing facility	Potential for better prices and access to premium markets through Fair Trade certification and traceability	Desire for stable long-term supply; pressure from NGOs to source from sustainable fisheries
Regulations and enforcement	MSC standard; self-enforced	Limited	Regulations exist, but are minimally enforced	Regulations exist, but are not enforced
Attribute 1: Type of product (commodity vs. differentiated)	Differentiated product flows into a commodity market	Mixed	Differentiated	Commodity
Attribute 2: Brand presence	MSC	None	Fair Trade; ThisFish	FIP
Attribute 3: Relationship dynamics	Tense	Close ties	Close ties	N/A
Attribute 4: Supply chain consolidation (vertically integrated vs. dispersed)	Dispersed	Vertically integrated (few players)	Dispersed	Dispersed
Attribute 5: Market access (bottleneck vs. open access)	Bottleneck	Moderately open access	N/A	Moderately open access
End market	Local and export	Local and export	Export with limited local	Export
Are there known but untapped market channels?	Yes: MSC chain of custody	No	Yes: US/EU premium market	No
Obstacles to accessing new market channels	Buyers block access to MSC chain of custody; lack of product differentiation	No	Lack of end-to-end supply chain traceability to distinguish product	
Where innovation is happening	Producer: Organized co-ops to locally manage marine environment	Processor: Introducing traceability and sharing catch data to inform better fisheries management; smartphone technology in exchange for fisheries data	Dockside: Enumerator program to capture catch data; traceability systems into first processors; Fair Trade tuna certification happening in some regions	Producer: Current FIP under way but facing challenges
Strategy for progress	Team up; potential: brand local product	Prove concept; ID who holds power	Align with values; ID who holds power	Let fishers and industry lead

Case Studies (Cntd.)

Considerations	Bahamian conch	Kenyan multi-spp	Peruvian multi-spp
Fishery stakeholders' desire to address resource or data management problem	Weak	Moderate among BMUs	Strong among fishers
Values or incentives used to motivate stakeholders	None currently identified	Potential for access to higher-end market and better prices	Desire for long-term stability of fishery; potential to sell into higher-end market channels
Regulations and enforcement	Regulations exist, but limited enforcement of rules regarding size	Moderate enforcement by BMU	Self-regulated, self-enforced
Attribute 1: Type of product (commodity vs. differentiated)	Commodity	Mixed	Mixed
Attribute 2: Brand presence	None	None	Co-op
Attribute 3: Relationship dynamics	Close ties	Close ties	Close ties
Attribute 4: Supply chain consolidation (vertically integrated vs. dispersed)	Vertically integrated (few players)	Dispersed	Dispersed
Attribute 5: Market access (bottleneck vs. open access)	Open access	Bottleneck	Moderately open access
End market	Mostly local	Mixed	Regional and local, with some export
Are there known but untapped market channels?	No	Yes: Nairobi	Yes: Lima premium market
Obstacles to accessing new market channels		Lack of awareness; geographic and communication isolation	Uncertainty in new market's ability to bear cost of differentiation and to absorb the volumes landed; little capacity of fishers to commercialize fish
Where innovation is happening	Exporter: Exporters Association traceability system for lobster, as well as education campaign, could be leveraged for conch	Producer: TNC's fish-to-market program for branding and marketing, including improved logistics for improved value	Producer: TNC's facilitation of sustainable management program initiated by fishing co-op Restaurants: Want to work with local seafood programs and are interested in sustainable/responsible product
Strategy for progress	Team up; prove concept	Brand local product; align with existing values; team up	Align with existing values; brand local product

Glossary

Below is a list of terms and abbreviations commonly used in the seafood industry and in particular, supply chain management. The list here reflects terms used in this primer as well as some additional terms that are likely to be encountered when working with seafood supply chains.

AGGREGATOR

Supply chain player, usually a middleman, who aggregates fish from multiple producers or middlemen in order to obtain a volume large enough to sell to a large buyer or exporter.

AUCTION

Central location where seafood buyers purchase recently landed fresh fish through a bidding process. Typically, buyers pay auction houses for fish, and fishers or middlemen are paid by auction houses, minus a fee kept by the auction house for facilitating the sale. In addition to providing the auction services, auction houses can supply ice, pallets, and hoists for vessel unloading.

BATCH TRACEABILITY

Ability to track information about a seafood product, such as catch location, species name, catch date, processing location, and so on, from the point of origin through to the end user. "Batch" generically refers to a unit of measurement, such as a single fish, a tote of fish, or a container of fish.

BROADLINE DISTRIBUTOR

Very large distributor of food products and other supplies that serves restaurant and foodservice establishments. Broadline distributors typically purchase products from hundreds, if not thousands, of suppliers and food processing companies.

BROKER

Person who buys, sells, arranges, and negotiates the sale of seafood between and among producers, buyers, and sellers. Brokers sometimes have access to markets that others cannot access. Brokers often do not physically handle the seafood, but make arrangements for the sale and transportation of the seafood. See also Trader.

BUYER

Person working for a wholesaler, retailer, or restaurant who is responsible for purchasing seafood products that meet requirements for price, quality, and consumer preference. Buyers maintain inventory and identify and establish new, direct supplier relationships. Depending on the type of business and location, buyers may buy direct from fishers, processors, or wholesalers.

Some Common Abbreviations

BMU

beach management unit

CITES

Convention on International Trade in Endangered Species of Wild Fauna and Flora

CPUE

catch-per-unit effort

CSR

corporate social responsibility

EEZ

exclusive economic zone (see below)

ERP

Enterprise Resource Planning (see glossary)

FAD

fish aggregating device

FIP

fishery improvement project

IUU

illegal, unreported, and unregulated (see glossary)

MPA

marine protected area

MSC

Marine Stewardship Council (see glossary)

STPP

sodium tripolyphosphate

TURF

Territorial Use Rights in Fisheries

CATCH CERTIFICATE

Certificate required by the European Union (and some other countries) for all seafood imports. Information required includes fishing vessel name, vessel registration number, species, catch area, landing date, total weight, and importer/exporter information. Certificates must be validated by the country in which the fishing vessel is registered. Catch certificates are one way the EU is attempting to combat illegal, unregulated, and unreported (IUU) fishing, and to ensure traceability of fishery products.

CATCH ORIGIN

Location where fish or shellfish are captured or harvested. This can be precisely recorded by vessels equipped with global positioning systems (GPS), or may broadly refer to a fishing region within the jurisdiction of a state or country.

CHAIN OF CUSTODY

Documentation showing transfer of ownership of seafood product every time the product changes ownership and/or is altered or repacked. The Marine Stewardship Council (MSC) requires that MSC-certified product pass through a certified chain of custody in order for the product to maintain its certification and bear the MSC label.

COLD CHAIN

Supply chain that also serves to maintain products at or below a particular temperature through refrigerated storage and transport.

COLD STORAGE

Refrigerator or freezer warehouse that stores seafood product for later use by seafood processors or wholesalers. Commercial cold-storage operators charge a daily, weekly, or monthly fee for storage space and to ensure that proper temperatures are maintained.

COMMODITY

High-volume product aggregated from many sources and for which all the individual units—be they whole fish, filets, or value-add products—are considered identical, regardless of how, where, when, or by whom they were produced or harvested.

CONSUMER

Person who ultimately buys (and presumably eats) a seafood product, and where the supply chain ends. The consumer typically purchases the product from a restaurant or retail location.

DEALER

Person or business that participates in the sale and processing of seafood. In some countries, accurate dealer records of fish landings and sales data are required by the government or fishery managers. However, such accounting is not required by the dealers' customers; thus, most catch-level information is lost after this point in the supply chain.

DISINTERMEDIATION

Removing one or more of the intermediaries (middlemen) in a supply chain involved in moving product from producer to consumer. Although disintermediation can be an effective way for some producers to access the market and increase margins, doing so can be risky if they rely on the middleman for more than just moving product to market, or if the middleman is a close friend or family member.

DISTRIBUTOR

Person or business selling seafood to restaurants or retailers. Distributors typically buy from processors, middlemen, or wholesalers.

DOCKWORKER

Person employed to load or unload fishing vessels at the dock.

DOWNSTREAM

Any successive stage of the seafood production process that involves processing, packaging, and sale of a finished product, which reaches the consumer. Downstream is the direction of the supply chain away from the producer and toward the consumer. For example, packaging is a downstream stage from fish cutting and processing.

END BUYER

Retail or restaurant business that sells seafood to the final consumer.

ENTERPRISE RESOURCE PLANNING (ERP)

Business management software used internally to collect and monitor information related to seafood business processes, such as purchasing, processing, marketing, sales, accounting, and inventory management.

ENUMERATOR

Person usually employed by the government or local NGO who meets boats at the dock to count, weigh, grade, and record landings for fishery management or tax purposes.

EXCLUSIVE ECONOMIC ZONE (EEZ)

An area that extends no further than 200 nautical miles from a country's coast within which the country has exclusive rights to use and harvest ocean resources, including fisheries.

EXPORTER

Person or business shipping seafood out of the country in which it was landed or processed. Export usually occurs to wholesalers. Seafood information can be lost at this point, especially in cases where importing countries do not require catch certificates. Language barriers can also result in lost information.

EX-VESSEL PRICE

The price paid, usually per pound, by the first receiver after fish is landed.

FIRST RECEIVER

Buyer (usually a processor or wholesaler) who purchases seafood directly from the producer. .

FISHERY-DEPENDENT DATA

Data collected from fishing vessels and seafood dealers, which includes fishing locations, gear types, volume of landings, volume of bycatch, ex-vessel price, and fishing costs.

FISHERY-INDEPENDENT DATA

Data collected by government or university scientists for stock-assessment purposes, typically using survey methods. As opposed to sampling where fish are most abundant (which is where fishers usually fish), these surveys take samples throughout a fish's geographic range.

FOODSERVICE

Business or organization that prepares meals in large volumes. Foodservice includes independent restaurants, chain restaurants, universities, hotels, government and hospital cafeterias, and caterers.

FORWARD CONTRACT

Agreement between a fisher and a buyer that commits the buyer to purchase the boat's catch prior to the fisher returning to port. Sometimes the forward contract is made prior to the fisher leaving on a fishing trip, or as early as the start of the season. In cases where the contract is between a fisher and an end buyer (retail or restaurant), the processors and distributors work on a fee-for-service basis and do not take ownership of the product.

FRAGMENTATION

Having different components of seafood processing located in different locations or being performed by different companies. Fragmentation makes maintaining accurate information flow between and among companies difficult.

FUNGIBLE

Good or product that is mutually interchangeable and able to replace or be replaced by an identical item. Commodity products are by definition fungible.

GRADING

Process of separating product based on a particular feature, such as size or quality, in order to send higher-value products into more premium markets.

HORIZONTAL CONCENTRATION

Occurs when a few firms dominate a particular node in the supply chain and can control the flow and pricing of product. In artisanal fisheries, this often is seen as a single middleman aggregating catch from multiple fishers.

ILLEGAL, UNREPORTED, AND UNREGULATED (IUU)

Illegal fishing activities are those being conducted without permission or in violation of formal laws and regulations. Unreported fishing occurs when landings are not reported to the government or fishery management authority. Unregulated fishing is the harvesting of fish and shellfish stocks for which there are no conservation or management measures in place.

IMPORTER

Person or business bringing in seafood from another country for the purpose of resale, usually to a wholesaler.

INTERMEDIARY

(see Middleman)

INVENTORY

Physical amount of seafood product on hand and available for sale.

LANDING LOCATION

Location where fish or shellfish are off-loaded from a vessel. Seafood labels often incorrectly list the landing location as the catch origin, which misleads consumers, masks IUU, and enables seafood fraud.

LOGISTICS

Management process that coordinates the movement of seafood within processing or storage facilities, and among sellers and buyers in a supply chain.

MARINE STEWARDSHIP COUNCIL (MSC)

An independent nonprofit organization that sets standards for sustainable fishing. Fisheries that meet those standards can become MSC-certified. Product originating in a certified fishery is eligible to carry the MSC label as long as it moves through a supply chain that has been chain-of-custody certified by the MSC. If even one supply chain actor is not MSC chain-of-custody certified, the chain of custody is considered “broken,” and the product loses its certification documentation and cannot carry the MSC label.

MASS BALANCE

Accounting method typically used by auditors within certification bodies that ensures the total weight sold for a product does not exceed the total weight purchased. Mass balance does not require the physical separation of certified products, and thus is not sufficient for policing product mislabeling.

MIDDLEMAN

Person or business that purchases seafood at one node in the supply chain and sells to the next node. A chain of middlemen may serve to aggregate product from producers operating in remote areas, and in some cases, the middleman is a family friend or relative. It is not uncommon for the middleman to provide financial assistance for fishing operations or personal needs. Also called Intermediary.

ONE-UP, ONE-DOWN

Record keeping to track purchases (one up) and sales (one down) of all seafood products that move through a particular node in the supply chain. This process is required by some countries for product recall purposes, and is a form of traceability.

PRIMARY PROCESSOR

Person or business that performs the first steps in seafood processing, including heading, gutting, scaling, and deboning finfish, shucking shellfish, and holding crustaceans in live tanks.

PRODUCER

Fisher or aquaculture facility that harvests fish or shellfish.

QR CODE

Printed code that is readable by a smartphone camera and displays a specific webpage. QR codes on seafood labels are usually associated with information and photos about the seafood brand, fishery, fishers, or other information that tells the story of the fish.

RETAILER

Person or business that sells seafood to the consumer, as opposed to another business or wholesaler. Retailers are not required to label seafood with information about dates or origins, especially if it has been processed.

SECONDARY PROCESSOR

Person or business that receives seafood from a primary processor (or other secondary processor) in order to further process the seafood before sale. Secondary processing could involve filleting, portioning, cooking, canning, smoking, adding other ingredients, or merely thawing and refreezing and then repackaging.

SHRINK

1. Loss in weight of seafood due to dehydration; 2. Revenue loss from seafood that has not sold or has spoiled and must be discarded.

SOAKING

Process of submerging seafood in a water bath or a mixture of water and preservative to increase or retain moisture, or extend shelf life. The preservative often used is sodium tripolyphosphate (STPP). Soaking can increase the weight of a product, and is one form of seafood fraud. This process is common for scallops.

SPECIALTY DISTRIBUTOR

Person or business specializing in the sale of seafood items that command a premium price based on quality.

STORIED FISH

Seafood sold with accurate information about its journey from water to plate, including where, when, and how it was caught, who caught it, and any compelling facts about the people or communities involved in the fishery.

SUPPLIER

Person or business buying seafood from producers or wholesaler with intent to sell to restaurants or retailers who serve consumers.

SUPPLY CHAIN

People and businesses involved with the production, processing, brokering, and distribution of seafood from fisher to consumer. Seafood maybe transformed multiple times along the supply chain as it changes hands from one member of the supply chain to another.

THIRD-PARTY CERTIFIER

Independent party or organization specializing in the certification of fisheries, production process, or businesses using an established standard, such as the Marine Stewardship Council.

TRACEABILITY

Ability to track information about the origin and journey of seafood products as they are transformed through successive steps in a supply chain. Traceability requires that the people and businesses in the supply chain have (a) internal systems to capture, manage, and share traceability data; (b) mechanisms for physically linking products and data (such as with tags or barcodes); (c) supply chain transparency, and (d) the ability to verify that data are accurate and remain intact from origin to consumer.

TRADER

Person or business specializing in connecting seafood buyers and sellers by offering competitive pricing. Traders make profits from a percentage of sales, and sometimes promote sellers. See also Broker.

TRANSPARENCY

Degree to which information about products, product sourcing, and companies within a supply chain is knowable by other members of the supply chain and by consumers.

TRANSPORTER

Person or business responsible for moving seafood from one point in the supply chain to another. Often a third party for hire that specializes in seafood and other cold transport.

UPSTREAM

Any stage of the seafood production process that occurs prior to another supply chain process. Primary processors are upstream from wholesalers.

VALUE-ADDED

Amount by which the value of a seafood product is increased at a certain node in the supply chain by way of certain production methods (e.g., fishing, handling, processing), added ingredients, packaging, or branding. Also Added Value.

VERIFIABILITY

Ability to validate and confirm information about seafood origins and other characteristics that may be on a label or otherwise associated with a product.

VERTICAL INTEGRATION

Consolidation of multiple steps of the supply chain into a single company. In seafood, a vertically integrated company may own seafood vessels as well as processing facilities. While vertical integration allows for more seamless and accurate information transfer among processes and to downstream supply chain members, it can also enable seafood fraud and price fixing if a single business controls the majority of a supply chain.

WHOLESALE

Person or business that purchases seafood for the purpose of resale to another business in the supply chain. Risk of seafood fraud is high at this level, as spoilage, waste, and shrink can drive dishonest practices.



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