



# FISHERY DEVELOPMENT BLUEPRINT

## Traceability in the Peruvian Mahi Mahi Fishery





#### **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](http://www.futureoffish.org)

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#### **Disclaimer**

The following report is an output of nearly two years of research and long-form interviews and meetings with key stakeholders involved in various aspects of the supply chain, from extractors to final consumers to regulators. These interviews were qualitative in nature, and findings were synthesized and substantiated where possible with previous work and the best available statistics preferencing official data. Fishery systems are dynamic in nature, and subject to rapid and sudden change. We present this as our best effort to capture an interdisciplinary snapshot and suggest possible steps to unlock trapped value and improve supply chain efficiencies. Together these solutions aim at reinforcing sustainable management by way of incentives and innovations that are market-driven and seek to advance the overall socioeconomic resilience of fisheries-dependent communities. We understand and take responsibility for any inaccurate data which is represented and are willing to take feedback and make alterations as necessary.

Funding to conduct this work was generously donated by the Walton Family Foundation (WFF). The report below is the outcome of FoF research, and does not necessarily represent the views of WFF or any other individuals referenced or acknowledged within the document.

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# A System Blueprint for Fishery Development

As is the case with any complex system, there is no one silver bullet solution that will solve overexploitation of fishery resources. A coordinated effort is needed across multiple domains from governance to trade. We believe that traceability is an important approach that has been identified which, within the seafood industry, allows fishers, processors, distributors, and retailers to seamlessly share key information about a product as it winds its way from dock to plate. Properly applied, traceability can improve inventory management, reduce operational inefficiencies and waste, improve yields, increase the pace of decision making, and fuel innovation across the entire business ecosystem.

This document outlines recommendations and strategies for implementing full-chain digital traceability technology in Peruvian mahi mahi supply chains, in accordance with U.S. import requirements. The blueprint presented here will:

- Define what traceability is and why is it important within both fishery and supply chains;
- Describe the Peruvian mahi mahi fishery and some of its specific attributes that drive the need for traceability;
- Assess and quantify the value and impact potential in the mahi mahi fishery, across various value generating categories;
- Recognize broad solution areas that could be pursued to catalyze and achieve a future state vision which incorporates traceability;
- Outline key players and stakeholders, and their alignment with these solution areas as well as roles they might play in executing strategies; and
- Provide a financial landscape analysis that will help us to assess where traction may be gained for future funding of these solutions and others.

The blueprint is designed to inform multiple organizations as follows:

- For **philanthropic funders**, solution/intervention areas are presented. Consider how this aligns with current funding priorities, particularly for interventions which cannot be easily funded by return seeking investors.
- For **non-governmental organizations** (NGOs), consider the parallel efforts of other organizations and how best to synchronize and leverage each other's progress.

## Abbreviations

### EU

European Union

### FDA

Food and Drug Administration

### FDM

Fishery Development Model

### FIP

Fishery Improvement Project

### FOB

Freight on Board

### FOF

Future of Fish

### HACCP

Hazard Analysis and Critical Control Points

### IATTC

Inter-American-Tropical-Tuna-Commission

### IT

Information Technology

### ITP

Technological Institute of Production

### IUU

Illegal Unreported and Unregulated

### MEY

Maximum Economic Yield

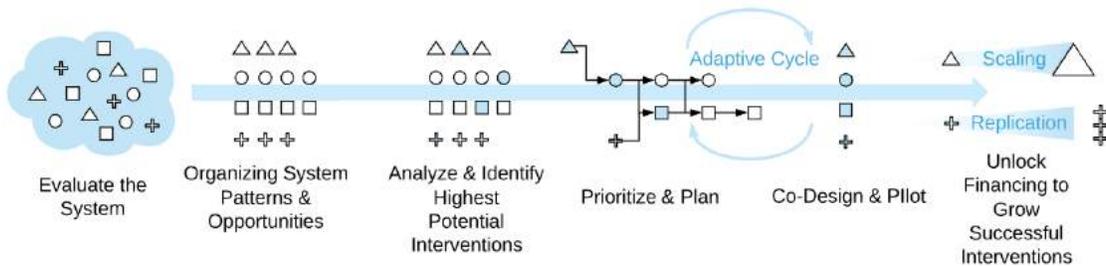
### MSY

Maximum Sustainable Yield

- For **seafood businesses**, we present strategies for generating more value without putting more pressure on stocks. This document acknowledges that business decisions need to be justified by bottom line performance, and provides practical means of meeting this goal.
- For **fishers and boat owners**, this document built with an orientation toward preserving livelihoods, and spurring economic development to support the creation of robust data to feed into management.
- For **investors**, this document highlights where value is locked up in the system, highlights the most promising areas for deal flow, and quantifies the magnitude of returns that can be targeted.
- For **government organizations**, this document recommends strategies to improve data modernisation and traceability, ideally leading to improved management.

Extensive research into the barriers preventing adoption and implementation of traceability in seafood supply chains has shown that funding barriers and capacity issues at the system level (infrastructure, culture, and behavioral factors, etc.) limit the ability of system actors to receive and apply electronic traceability solutions right from the start. Instead, a set of interventions must be designed to both prime the system to receive traceability interventions and support traceability adoption and implementation directly. As financial hurdles and human behavior have been shown to be major stuck points<sup>1</sup> preventing traceability progress in seafood supply chains, this blueprint provides an approach that focuses on unlocking value as a central driver of change, alongside effective market initiatives. By generating and fairly distributing value in the system, fishers and supply chain businesses can be directly incentivized to conduct responsible harvesting and trade, incorporating traceability as a key tool to support these initiatives. The value-oriented solutions proposed in this document aim to align with the self-interest of fishers and businesses, ensuring wins for all stakeholders that pursue responsible practices.

Our approach to scaling successful strategies is shown below (Figure 1). Future of Fish recommends the blueprint be implemented with an adaptive, collaborative process that refines strategies until they are scale-ready.



**Figure 1.** Fisheries Development Model process leading to scaleable models for fisheries transformation. An important aspect of the process is adaptive planning centered on deep interaction with communities and the ability to integrate changing environmental

1. Bhatt et al. 2016. Traceability technology architecture: issues brief. *Comp Rev Food Sci Food Saf* 15:392–429. <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12187>

**MSC**

Marine Stewardship Council

**MT**

Metric Tons

**NCI**

Naturaleza y Cultura Internacional

**NGO**

Non-governmental Organization

**NOAA**

National Oceanic and Atmospheric Administration

**PNACP**

Programa Nacional A Comer Pescado (To Eat Fish)

**PSMA**

Port States Measures Agreement

**SFP**

Sustainable Fisheries Partnership

**SIMP**

Seafood import Monitoring Program

**USA**

United States of America

**USD**

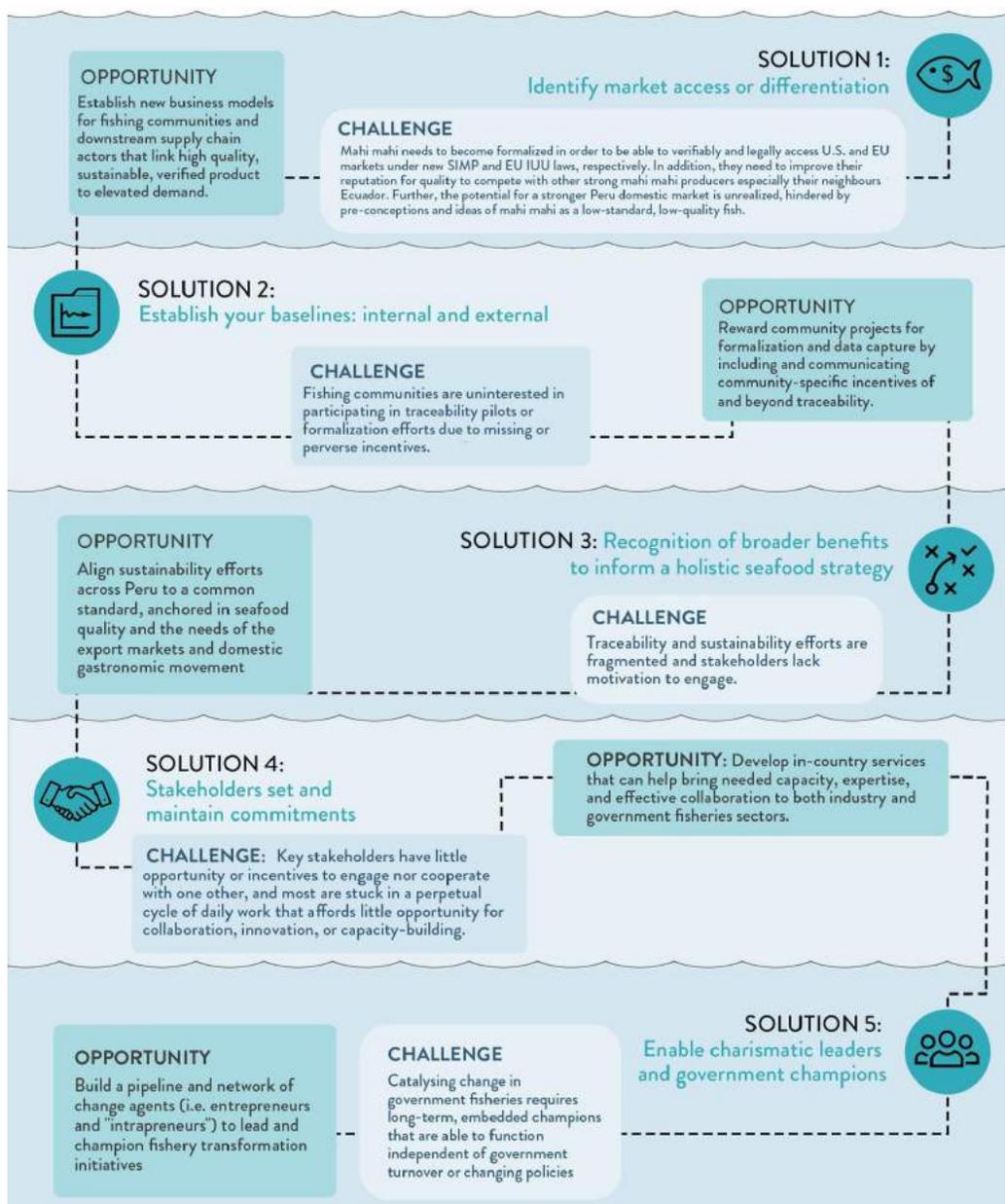
United States Dollars

**WWF**

World Wide Fund for Nature

and cultural landscapes into future implementation and thus, create relevant outcomes. See **Appendix A** for more information on the Fishery Development Model.

This report builds on twelve months of in-depth multidisciplinary research incorporating extensive systems analysis and iterative feedback from partners on the ground and stakeholders in the system that identified the major stuck points preventing progress towards the outlined goal, and the assets (e.g. relationships, cultural norms, available funding, etc.) in the system that can be leveraged to overcome them. Based on these assets and stuck points, five solution areas have been identified. Executed successfully, investment in each solution area can drive robust data creation, traceability implementation, and facilitate national level data modernisation, which in turn can support sustainable resource management. These solution areas are described in more detail in the report and are highlighted below (**Figure 2**). These solutions are ideally executed in parallel and in coordination with each other.



**Figure 2.** Solution model identifying the challenges we aim to overcome and the opportunities to capitalize on for creating change and innovation in the mahi mahi fishery, with regard to traceability and data modernisation efforts.

# Why Traceability?

## TRACEABILITY IN SEAFOOD

Consumer demand for tracking the origin of food products is fueling growth of the traceability technology industry. Allied Market Research predicts that the global market for food traceability technology (including but not exclusive to fish) will grow by 9.3 percent annually from 2018-2025, reaching values of 22.27 billion USD by 2025<sup>2</sup>.

Traceability involves tracing the journey of a product back to its point of origin, as well as tracking the movement of a product forward through the transformations and transactions it undergoes before reaching the final consumer. For seafood, traceability includes data related to species, catch location and date, gear type, vessel name, certification, and any other relevant information that is linked to the fish at the time of harvest. Once the fish is landed, this information accompanies the product as it is transported, processed, distributed, bought, and sold, with additional data added along each step in the supply chain. To ensure the data are valid, the system must be designed to prevent tampering or deliberate falsification of information and accessible to the technologically illiterate. Full-chain traceability requires internal processes and the supporting technology for capturing, receiving, and transmitting information both within a company and among the various nodes of a supply chain. Such data creation and transmission creates an end-to-end information highway from dock to plate that can return valuable business intelligence for supply chain actors, in addition to providing the data necessary for robust fisheries management.

For industry, the ability of fishers, processors, distributors, and retailers to seamlessly share key product information as it winds its way from dock to plate can improve inventory management, reduce operational inefficiencies and waste, improve yields, increase the pace of decision making, and fuel innovation across the entire business ecosystem. For an industry where the difference between making a profit and being in the red can be a matter of pennies per pound, traceability technology can provide clear competitive advantage, especially for midchain players<sup>3</sup>. In addition, detailed data generated by traceable supply chains can help open up market channels. For example, more stringent import requirements, such as those recently passed by the EU and the U.S., aim to eliminate product from illegal, unreported, and unregulated (IUU) fisheries. These new requirements demand detailed and verifiable catch data that can be generated from supply chains that have robust traceability systems in place. Similar data can also help fisheries and supply chains meet certification standards for sustainability and social aspects, which may bring new market opportunities and increase triple bottom line objectives.

2. "Food Traceability Market (Tracking Technologies) by Equipment (PDA with GPS, Thermal Printers, 2D & 1D Scanners, Tags & Labels, Sensors), Technology (RFID/RTLS, GPS, Barcode, Infrared, and Biometrics), End-User (Food Manufacturers, Warehouse/Pack Farms, Food Retailers, Defense & Security Departments, Other Government Departments, and Others) and Application (Meat & Livestock, Fresh Produce & Seeds, Dairy, Beverages, Fisheries, and Others): Global Opportunity Analysis and Industry Forecast, 2018 - 2025

3. Future of Fish. 2014. Getting There from Here: A Guide for Companies Implementing Seafood Supply-Chain Traceability Technology. [http://futureoffish.org/sites/default/files/docs/resources/fof-traceability\\_reportfinal\\_0.pdf](http://futureoffish.org/sites/default/files/docs/resources/fof-traceability_reportfinal_0.pdf)

## US INITIATIVES TO COMBAT IUU & FRAUD

In recent years, the United States has taken a leadership role globally in driving forward the need for programs which identify and combat IUU and fraud in seafood, notably:

In June 2014, the President of the United States released a memorandum titled “Comprehensive Framework to Combat Illegal, Unreported, and Unregulated Fishing and Seafood Fraud”<sup>4</sup>. High level recommendations are outlined, including reference to the following, each with notable links to traceability and transparency:

1. To enhance the tools available to combat IUU including Implementing the Port State Measures Agreement;
2. Optimize traceability mechanisms and programs to collect, share and analyze information and resources that make possible the prevention of IUU and fraud;
3. To promote legally and sustainably caught and accurately labeled seafood;
4. Develop a list of the types of information and operational standards needed for an effective traceability program; and
5. To establish a task-force to set up the first phase of a traceability program that includes point of catch as well as the trading process within the United States.

In addition to these generalized fishery agnostic recommendations, a report issued by the United States regarding mahi mahi ( “dolphinfish” in English and “perico” in Peru) stated that the management of this resource “lacks the capacity to ensure law enforcement.” Throughout the geographic range of mahi mahi an additional gap has been identified, namely that of a lacking catch documentation system. These conditions make this fishery vulnerable to IUU fishing. Furthermore, it is known that some mahi mahi catch is transferred between countries before entering the United States, raising concerns about mislabeling related to product origin<sup>5</sup>.

In response to the 2014 memorandum described above, in January of 2018, the United States’ Seafood Import Monitoring Program (SIMP) went into effect. SIMP is the first stage of a seafood traceability program implemented by the U.S. National Oceanic and Atmospheric Administration (NOAA), initially requiring additional recordkeeping and reporting for thirteen select species with the goal of preventing IUU product from entering the United States<sup>6</sup>. Mahi mahi is one of these thirteen species, meaning compliance requires additional data to be collected at the point of harvest. This includes evidence of authorization to fish, product forms at landing (quantity, weight, date), and the names of entities by whom the fish was landed or delivered. SIMP compliance reports are not yet available per country or per fishery, in order to better understand Peru’s capacity to meet these requirements. Initial reports are expected to be available for the public within two years.

4. Office of the Press Secretary. 2014. Presidential Memorandum -- Comprehensive Framework to Combat Illegal, Unreported, and Unregulated Fishing and Seafood Fraud. <https://obamawhitehouse.archives.gov/the-press-office/2014/06/17/presidential-memorandum-comprehensive-framework-combat-illegal-unreported>

5. Del Solar et al. 2017. Traceability of the Peruvian mahi mahi fishery: Assessment and proposal. [https://www.researchgate.net/profile/Alonso\\_Del\\_Solar/publication/318885976\\_Traceability\\_of\\_the\\_Peruvian\\_mahi\\_mahi\\_fishery\\_Assessment\\_and\\_proposal\\_edited\\_by\\_WWF-Peru/links/59839038458515b420c9655c/Traceability-of-the-Peruvian-mahi-mahi-fishery-Assessment-and-proposal-edited-by-WWF-Peru.pdf](https://www.researchgate.net/profile/Alonso_Del_Solar/publication/318885976_Traceability_of_the_Peruvian_mahi_mahi_fishery_Assessment_and_proposal_edited_by_WWF-Peru/links/59839038458515b420c9655c/Traceability-of-the-Peruvian-mahi-mahi-fishery-Assessment-and-proposal-edited-by-WWF-Peru.pdf)

6. NOAA. US Seafood Import Monitoring Program. [Seafood Import Monitoring Program](#).

# Fishery Context

## FISHERY PROFILE

Mahi mahi (*Coryphaena hippurus*) are a highly migratory, widely distributed, fast growing, and rapidly reproducing species. Their biology indicates great potential for sustainable harvest, but also poses significant challenges to management across large geographic areas.

The mahi mahi fishery is the second largest artisanal fishery in Peru. Harvested using longlines and surface gill nets, the fishery employs over 4906 fishermen utilizing 1140 boats along the Peruvian coastline, from Ilo in the south to Mancora in the far north<sup>7</sup> (**Table 1**). Trips range from ten to twenty-two days in the north and between five to seven days in the south, with trip lengths, especially in the North, steadily growing over the last five years as mahi mahi have continued to migrate farther offshore. The trip lengths in the North have begun to be associated with a bad quality stigma. The vessels conducting these longer trips are typically not using improved ice storage facilities to facilitate the longer journeys and so the product may be stored over extended periods in the vessel holds, having a substantial effect on the mahi mahi quality. There is a lot of overlap between the mahi mahi fishery and the Jumbo Squid (*Dosidicus gigas*) fishery. The jumbo squid fishery is the largest artisanal fishery in the country and the largest fishery supplying seafood for human consumption. The fleet used in the squid fishery has a lot of overlap with the mahi mahi fleet and many fishers are involved in both fisheries, especially significant is the practice of mahi mahi fishers switching to squid fishing during the closed mahi mahi period.

The Inter-American Tropical Tuna Commission (IATTC) conducted an exploratory stock assessment of mahi mahi in the Eastern Pacific Ocean in 2016, and found the associated status of mahi mahi in this region to be uncertain due to lack of reference points required to assess current biomass and fishing mortality rates against sustainable levels. There is no Regional Plan of Action for common dolphinfish in Peru<sup>8</sup>. However, there are two important regulations that contribute to its sustainable exploitation: first, there is an annual fishing season from October 1st to April 30th, with captures (but not sales) prohibited from May 1st to September 30th<sup>9</sup>. Second, mahi mahi has a minimum catch size of 70 centimeters fork length (considered juveniles) with a tolerance of 10% juvenile captured per vessel<sup>10</sup>.

There are currently two active FIPs in the mahi mahi fishery of Peru: an industry-led (Confremar) basic FIP launched in 2016 with a FisheryProgress.

7. Guevara-Carrasco R., Bertrand A. (Eds.). 2017. *Atlas de la pesca artesanal del mar del Perú*. Edición IMARPE-IRD, Lima, Perú, 183 pp.

8. Aires-da-Silva, A., J. Valero, M. Maunder, C. Minte-Vera, C. Lennert-Cody, M. Roman, J. Martinez-Ortiz, E. Torrejon-Magallanes, and M. Carranza. 2016, May 9. *Exploratory stock assessment of dorado (Coryphaena hippurus) in the southeastern Pacific Ocean*. SAC-07-06a(i).

9. PRODUCE. 2014. *Establecen temporada de pesca del recurso perico o dorado a nivel nacional, en el periodo comprendido entre el 1 de octubre y el 30 de abril de cada año*. RM 245-2014-PRODUCE.

10. PRODUCE 2011: *Establecen talla mínima de captura (TMC) del recurso perico o dorado*. NM 249-2011-PRODUCE.

org rating E and at Stage 4, and WWF Peru's NGO-led comprehensive FIP. The WWF FIP began in 2013, and has a current progress rating A and is at Stage 4 according to FisheryProgress.org. Both FIPs are working to address the lack of stock assessment and need for stronger harvest control rules, with WWF Peru's FIP more deeply involved in developing stock models and harvest control rules, and Confremar's FIP focused on gathering industry support and compliance with the new rules as they are rolled out by the RFMO and others.

**Table 1.** Summary of key statistics of the Peruvian mahi mahi fishery. All currency figures are in USD.

<b>GEOGRAPHY</b> The fishery spans the coast of Peru, with fishing grounds varying latitudinally including beyond the EEZ, and a longitudinal division into 'North' and 'South'. Annual landings ~48,840 tons (av. 2012-2017) <sup>11</sup>		<b>EXPORT VALUE</b> Seafood in Peru yields a total value of \$3.2 billion to the economy <sup>12</sup> . Our analysis estimates the approximate current value of the export proportion of mahi mahi is ~\$82 million.	
<b>SOUTH</b> <sup>13</sup> 68% of landings	<b>NORTH</b> 32% of landings	<b>\$3.2B</b> Total Seafood Economy Peru (2009)	<b>~\$82M</b> <sup>14</sup> Mahi mahi export contribution
<b>FISHERS AND GEAR</b> The fishery has 4269 fishermen using longline lengths between 12-19m and no mechanized gear <sup>15</sup> .		<b>MARKET</b> <sup>16</sup> It is estimated that 50% of Peruvian mahi mahi is retained in the domestic market, and 50% is exported. Peru produces 50% of the world's mahi mahi by volume.	
<b>SOUTH</b> Shorter line length than in the north with est. 500 hooks less	<b>NORTH</b> 1300-2400 hooks	<b>GLOBAL VOLUMES</b> Peru ~50% Taiwan ~10% Ecuador ~10% Indonesia ~10% Others ~10%	<b>SOUTH</b> Domestic market- 50% Export market- 50% Export market - almost exclusively US

11. FAO, 2019: <http://www.fao.org/fishery/statistics/software/fishstatj/en>

12. Christensen et al., 2014 *Valuing Seafood: The Peruvian Fisheries Sector*.

13. PRODUCE 2015 landings sourced INFOPEs

14. Amorós, S., Gozzer, R., Melgar, V and Rovegno, N. 2017. *Peruvian mahi mahi fishery (Coryphaena hippurus): characterization and analysis of the supply chain*. WWF Marine Program of WWF-Peru

15. <https://www.produce.gob.pe/index.php/pesca-artesanal/siforpa/listado-de-embarcaciones-para-el-decreto-legislativo-n-1392>

16. *Overview of Global Mahi Mahi Market*

## SUPPLY CHAIN & STAKEHOLDER INTERACTIONS

Mahi mahi is an important, globally-traded species with its primary market in the United States. Peru is the largest source of mahi mahi, providing 50% of the global supply by volume. Based on landings data from 2014-2016, less than 0.1% of global mahi mahi landings (10% of total U.S. landings) meet Seafood Watch's "Best Choice" (green) rating, all of which were U.S. mahi mahi fisheries. Approximately 10% of global mahi mahi landings meet Seafood Watch's "Good Alternative" (yellow), and 70% of global mahi mahi landings meet Seafood Watch's "Avoid" (red) rating. The rest is unrated. The Ecuadorian mahi mahi fishery is currently in a full assessment phase for MSC, and 60% of the global mahi mahi supply is in five fishery improvement projects. However, as of the time of this blueprint publication, there are no certified fisheries<sup>17, 18</sup>.

The United States export market for frozen product is crucial for Peru's mahi mahi fisheries. The frozen market consists primarily of fillets and six to eight oz. portions for foodservice and retail markets. In 2016, mahi mahi represented 12% of total Peruvian frozen seafood exports, totaling 82.9 million USD Freight on Board (FOB) and 11,000 metric tons<sup>19</sup>. Of this total, the United States imported 79% (67.1 million USD FOB). Average export price for 2016 was 7.94 USD/kg, up 19% over the previous two years (6.66 USD/kg and 6.45 USD/kg). While relatively minimal in volume, fresh exports of mahi mahi still make up 12% of Peru's total fresh exports, valued at 14.4 million USD in 2016<sup>20</sup>.

Mahi mahi is the most commonly rejected seafood product by the US FDA. Of the 1,500 shipments of mahi mahi rejected by the U.S. between 2002 and July 2016, 364 were from Peru, 329 from Vietnam, 313 from Taiwan, 243 from Ecuador, and 251 from others<sup>21</sup>. This should be taken in context of volumes of mahi mahi sent by each of these countries.

**Figure 3** depicts a simplified version of a typical Peruvian artisanal mahi mahi supply chain. Stakeholders and their various roles and interactions are as follows:

- Mahi mahi **fishing boats** are primarily the property of boat owners, who lease out vessels and equipment to fishermen. Relationships between fishermen and boat owners are informal, and there is no written record of financial transactions or lending terms. Equally, boat registration and cooperative management falls under the purview of the owners, who are also the individuals interacting directly with market middlemen as well as government representatives. There is a strong national move towards formalisation of fishermen and their vessels (registration).

17. *Fishchoice buying guide mahi mahi*, 2019.

18. *Fishsource Common Dolphinfish Eastern Pacific Ocean*, 2019

19. A morós, S., Gozzer, R., Melgar, V. and Rovegno, N. 2017. *Peruvian mahi mahi fishery (Coryphaena hippurus): characterization and analysis of the supply chain*. WWF Marine Program of WWF-Peru

20. Del Solar, A.; Grillo, J.; Gozzer, R. y Correa, M. 2017. *Traceability of the Peruvian mahi mahi fishery: Assessment and proposal*

21. Del Solar, A.; Grillo, J.; Gozzer, R. y Correa, M. 2017. *Traceability of the Peruvian mahi mahi fishery: Assessment and proposal*

- Once product is landed, it passes into the hands of the **enablers and middlemen**, who follow the fishing boats up and down the coast, picking up mahi mahi from the closest landing site and transporting it on ice by truck to the processing plant. **Transporters** play a logistical role, and may be independent contractors or work for processing plants. Middlemen orchestrate the deals, negotiating price with boat owners, and arranging and coordinating logistics between landing sites, processing plants for export, and the **domestic market**. There may be dependence by boat owners on the middlemen, due to their frequent role in financing of fishing operations, which can influence pricing.
- After initial sorting for size and quality at sea and upon landing, mahi mahi >5 kg (gutted) are transported to **processing plants** to be prepared for export. Upon reception at the plant, there is a second quality inspection in which mahi mahi is tested for histamines—a high value can lead to batch rejections. Mahi mahi is typically processed into skin-off fillets or skin-off portions. It is then exported, with the larger processing facilities having export capabilities. Nearly 70% of the frozen fillet and portions are sent directly to the U.S. The majority of the product goes into food service and retail where uniformed portion size and cost control is very important.

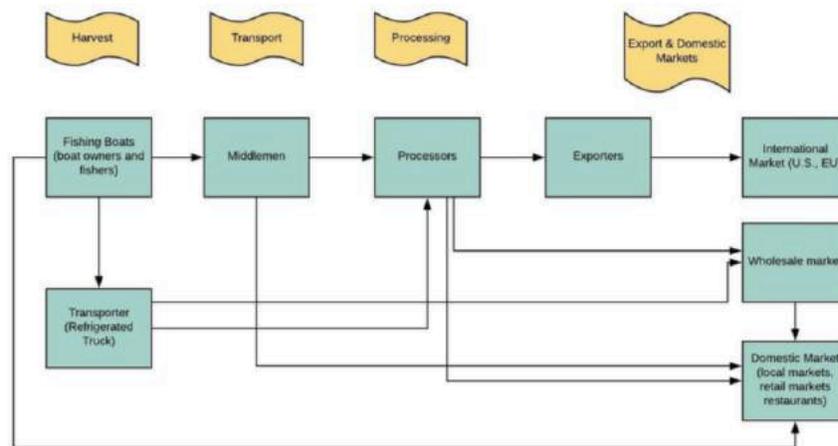


Figure 3. Generalized Piuran mahi mahi (and jumbo squid) supply chain, adapted from WWF report *Peruvian mahi mahi fishery (Coryphaena hippurus) characterization and analysis of the supply chain*<sup>22</sup>.

## CURRENT STATE AND DESIRED FUTURE STATE

The current state of play as it relates to activities that influence or drive traceability in the mahi mahi fishery (as of December 2018) was diagnosed through extensive background research and deep ethnographic study using a system-wide lens that examined regulations, movement of fish through supply chains, and socioeconomic context to understand current challenges and opportunities. Based on an analysis of (i) what and how progress is

22. Amorós, S., Gozzer, R., Melgar, V. and Rovegno, N. 2017. *Peruvian mahi mahi fishery (Coryphaena hippurus): characterization and analysis of the supply chain*

being made, (ii) why and how initiatives and stakeholders are stuck, (iii) what drives the behaviors we see in the system, and (iv) where there is opportunity for improvement, we identified strategic intervention areas to progress traceability in the mahi mahi fishery toward an improved future state. A summary of system stuck points, assets, and tensions identified, specifically related to traceability in the export mahi mahi fishery, can be found in Appendix B. The contrasting future state vision imagines how an improved system might function ten to fifteen years into the future, after the blueprint has been executed, and provides a reference point to which the interventions outlined in this document can be targeted. Our guiding question, which informs the future state, is: How might we prime the Peruvian mahi mahi fishery for implementing full-chain traceability technology solutions that are in accordance with U.S. import requirements? Table 2 compares the current and future states per supply chain node.

**Table 2:** Contrasting current and future state visions specifically related to traceability in the Peruvian mahi mahi export fishery.

	Current State	Future State
<p><b>Fishers</b></p> 	<ul style="list-style-type: none"> <li>*Fishers are engaging in increasingly longer trips on artisanally classified vessels, with limited infrastructure for quality maintenance. ~10% of product is rejected prior to landing and another 10% on transfer to middleman.</li> <li>*Burdensome and sometimes conflicting (national and regional government) paperwork is required for formalization and reporting. Additionally, perverse tax incentives deter from formalization and the general reporting process. Fishers rarely fill out paperwork.</li> <li>*There are a large number of unregistered vessels, and those registered may not have size/capacity verified by government.</li> <li>*Technology focused on data recording is already in use within the supply chain, mainly in processing and export plants but also a VMS and traceability pilot conducted by WWF.</li> <li>*The import regulations such as those required by SIMP, FDA, EU and others have triggered processes aimed at data creation, quality improvement, and fisher-focused training, mainly driven upstream from the exporters.</li> <li>*Fishing takes place aboard vessels 5-10 m in length, which qualifies as artisanal under the SIMP. This means the SIMP traceability data can be managed in aggregated format.</li> </ul>	<ul style="list-style-type: none"> <li>*Fishers are formalized both via registration of their vessels and as active fishermen, and also in the context of being registered in the official tax system. This makes them eligible for government support and benefits. *Fishers are reporting their data seamlessly using technology where appropriate, and are capable of meeting all required national, regional, and international reporting standards, which gives them more presence and stability in the marketplace. Transparency and traceability in the supply chain means IUU is occurring very rarely.</li> <li>*A strong improvement on mahi mahi quality has been achieved through training and improved infrastructure, which means fishers are earning more money per kg of fish and the reputation between Northern and Southern based fishers is comparable.</li> </ul>
<p><b>Middlemen</b></p> 	<ul style="list-style-type: none"> <li>*~75% of landed product is handled by middlemen, of which ~50% goes fresh to domestic markets and ~50% goes to plants to be further processed for export.</li> <li>*Middlemen and ‘invoicers’ take on a large component of the burdensome paperwork required by government, but are to a large part unmonitored and unofficial. Fraudulent paperwork is reputedly processed at this stage of the supply chain.</li> <li>*Middlemen have an important role in logistics and transport.</li> <li>*Some middlemen offer credit to both fishermen/boat owners and processors, creating a powerful role with a lot of influence potential.</li> <li>*May sell products from the North labelled as coming from the South to overcome quality stigma of the northern landings.</li> </ul>	<ul style="list-style-type: none"> <li>*Middlemen have an important and official role in the supply chain, both for domestic and international avenues, and earn a % proportional to their risk and contribution to those chains. This role includes transport and logistics of legal, reported, and regulated seafood.</li> <li>*Middlemen contribute to traceability and transparency in the supply chain, ensuring robust and trustable data is entered into the system.</li> </ul>

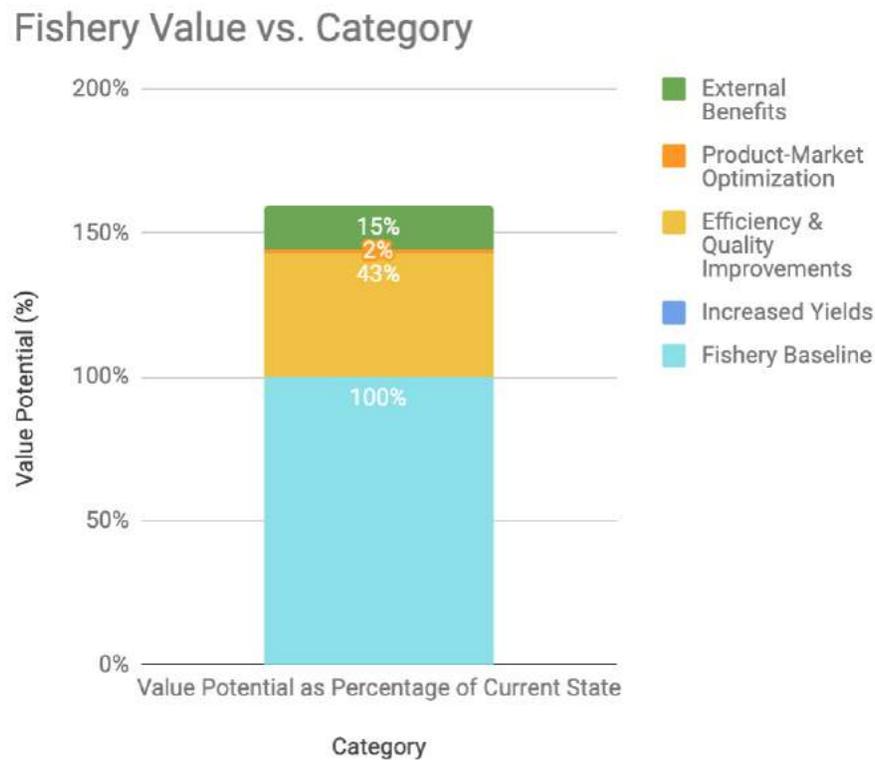
	Current State	Future State
<p><b>Processors/ Exporters</b></p> 	<ul style="list-style-type: none"> <li>*FDA rejections and associated cost of rejections are factored into doing business.</li> <li>*Importers get accused of re-sending rejected shipments to new ports of entry or alternative countries.</li> <li>*Processors regularly gather internal fisheries data in order to better understand stock health, location, and market potential.</li> <li>*Large processors are well-equipped to process varied raw materials allowing for flexibility.</li> </ul>	<ul style="list-style-type: none"> <li>*Exporters are receiving high quality, verifiably traceable mahi mahi from upstream nodes of the supply chain, and are paying a fair price that reflects the product and its attributes.</li> <li>*Peruvian mahi mahi has a strong reputation in the international market due to its high quality and attractiveness.</li> <li>*Cost of doing business has decreased due to more demand and less rejections.</li> <li>*Innovation in product form means Peru is a leader in the international market.</li> </ul>
<p><b>Importers, US specific</b></p> 	<ul style="list-style-type: none"> <li>*U.S. sources fresh product (which typically earns higher prices) from its own domestic fisheries as well as Ecuador, due to apparent superior quality over Peruvian mahi mahi</li> <li>*Many believe they are sourcing mahi mahi from southern Peru (quality perceived to be better), yet verification is often unavailable or falsified.</li> <li>*Importers receive the data required to report for SIMP submissions from exporters, and they generally trust the data they receive.</li> </ul>	<ul style="list-style-type: none"> <li>*U.S. importers have a preference for Peruvian mahi mahi due to its high quality, innovation in product development, sustainability standing, and robust traceability.</li> </ul>
<p><b>Government/ Regulatory framework</b></p> 	<ul style="list-style-type: none"> <li>*Reporting requirements as outlined by PRODUCE, DIREPRO, DICAPI, and SANIPES are robust. On paper, data collected is already sufficient in terms of meeting basic requirements for export under both U.S. SIMP and EU IUU regulations.</li> <li>*Enforcement of laws are not always prioritized nor adequately funded.</li> <li>*Mahi mahi is the most commonly rejected seafood product by the US FDA, and Peru leads in amount of rejected shipments. Of the 1,500 shipments of mahi mahi rejected by the U.S. between 2002 and 2016, 364 were from Peru, 329 from Vietnam, 313 from Taiwan, 243 from Ecuador, and 251 from others (this should be taken in context of volumes of fish sent by each of these countries).</li> <li>*International pressure via SIMP and IUU regulations are driving traceability implementation in these fisheries, forcing the rapid development of new data collection and technological systems.</li> </ul>	<ul style="list-style-type: none"> <li>*National and regional governments are aligned and proactive in supporting the development of the artisanal mahi mahi sector. Support includes proactively marketing Peruvian seafood products on the international scene, where attributes such as sustainable, traceable and high quality make Peruvian mahi mahi a sought after and recognizable international product.</li> <li>*Peru is satisfying international reporting requirements and is noted for its high compliance. Both regional and national fisheries bodies have the resources needed to effectively enforce compliance and apply better data to regional and national management of the stock.</li> </ul>

The following section highlights the types of value that could be unlocked or maximized in order to overcome current state barriers and progress the Peruvian mahi mahi fishery toward an improved future state.

# Value & Investment Potential

## FISHERY VALUATION

Creating and sharing value in the fishery is essential for gaining buy-in from fishers and supply chain stakeholders, and for gaining access to private capital that can scale interventions beyond what grants can support. Future of Fish assesses the value potential of a fishery across four categories (**Figure 4**): 1) increased stock biomass and catch yields; 2) improved efficiency and quality; 3) optimized products and markets and 4) externalized benefits for fishers and communities. The valuation method is empirical and qualitative. Improvement potential is estimated based on performance benchmarks (e.g. percent efficiency improvement that is deemed possible per node based on our past experience in diverse supply chains). Observations were made in select northern mahi mahi fishing communities and are assumed to be representative of the mahi mahi industry in Peru as a whole.



**Figure 4.** Value Potential of Peruvian Mahi Mahi Fishery as Percentage of Current Fishery Value.

*Based on our analysis, from a value perspective, the Peruvian artisanal mahi mahi fishery is best characterized by the lack of quality control in its supply chain, which creates substantial room for improvements. High-level analysis of the efficiency and quality opportunity present in this fishery suggests up to a 43% improvements could be realized over the base-line fishery value (export value estimated at ~ \$82 million today based on total landings and average pricing), with a total value-add across all categories of approximately 60%. See **Appendix C** for a breakdown of value by category<sup>23</sup>.*

*As the Peruvian mahi mahi fishery demonstrate the highest value potential in efficiency and quality improvements, the solutions proposed in the following section focus heavily on improvements in this key area.*

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*23. Future of Fish has developed a fishery valuation scorecard to estimate the value potential of a fishery at a high level, based on common, known sources of value. The scorecard provides a default benchmark, based on our experience in both best practice and developing fisheries. Ideally, these default benchmarks are replaced with primary fishery data collected by government non-profit agencies to derive a more accurate estimate of value, as we have tried to do in the context of Peru. However, where data is unavailable, the default benchmarks—intended to be conservative estimates—are used. These calculations represent this high level analysis for this fishery and should not be seen as an absolute certainty, but rather as a potential space within which we can work to create additional untapped value. As an example, we see value potential not only in price increases but also in quality improvements and in creating efficiency within the supply chain at various nodes. The realization and distribution of these gains depends on the interventions implemented and the dynamics of the fishery system. More detailed calculation methods are available upon request.*

# Proposed Solutions/ Recommendations

## THEORY OF CHANGE

Future of Fish's Theory of Change asserts that in any system, the desired future state will require multiple interventions across three levels: community, enabling, and system (**Figure 5**). Just as no single solution can act as a silver bullet to drive change within complex systems, so too do solutions need to push on different levels of the system in order to effect change. Working in concert, this approach builds the large-scale capacity needed across the system, while also targeting acute challenges within specific components of the system.



**Figure 5.** Future of Fish's approach in implementing its Theory of Change includes a balanced focus of interventions and solutions in all levels of the system: community, enabling and system.

**Community solutions** are oriented towards directly meeting the needs within fishing communities, to reward responsible fishing practices. Solutions are centered around pilot projects created through co-design to improve and maintain livelihoods, and which are grounded in each community's unique strengths and interests. **Enabling solutions** are designed to address gaps consistently seen across fishing communities, and include tactical initiatives that work within the existing system to catalyze progress. Enabling solutions build capacity and collaboration across the supply chain actors while finding ways to make resources accessible to replicate successful models. **System solutions** focus on creating big-picture solutions that cross communities and geographies, and may include innovative business and operating models, unlikely alliances across industries and organizations, efforts to attract new resources to fisheries transformation, and applying disruptive technologies that allow effective innovations to scale.

## TRACEABILITY-ORIENTED SOLUTIONS

Future of Fish has developed a set of *National Level Traceability Recommendations* that are intended as a guide for how to effectively structure potential interventions that can drive traceability and modernized data systems in support of sustainable, responsible, trustworthy fisheries in Peru. We intentionally aimed to identify **system** or **enabling** level solutions—by definition these are not specific to a particular community or supply chain, but are opportunities that could either directly drive traceability or data modernization across multiple fisheries or stakeholders, or prime the system to be able to receive programs and initiatives that can move one or both elements forward at scale. These country level recommendations should be taken into account and used as additional guidance when aiming to develop traceability for the mahi mahi fishery. The following set of solutions have been developed with the mahi mahi fishery specifically in mind.

## PERUVIAN MAHI MAHI FISHERY TRACEABILITY SOLUTIONS

An overarching theme we identified in the Peru mahi mahi fishery is that quality is a strong driver for incorporating traceability into current practices and is often the basis for existing traceability systems. Sustainability as a driver for traceability is not yet the norm, though the presence of various FIPs could increase the power of this driver in the near future. Another theme that emerged in understanding potential ways to drive traceability in the mahi mahi fishery was to include interventions that positively impact the squid fishery. As some of the crew and vessels engaged in both fisheries are the same and overlap in fishing location, and many of the processors/exporters are involved in both fisheries, interventions in one fishery inherently impact the other, especially with regards to data and traceability efforts. Finally, the squid fishery is approximately 10X larger than the mahi mahi fishery in volume, and may offer additional or other leverage points that could benefit mahi mahi traceability efforts/

We identified five overarching solution areas, within which interventions can be designed to help unlock value in the mahi mahi system and use that value to promote full-chain traceability for both domestic and export markets. For each solution, we note the underlying reasons for proposing (“The Rationale”), the key problem and barriers (“The Challenge”), and supporting forces and potential impact (“The Opportunity”). Additionally, each recommendation includes a set of suggested interventions that range from system-wide initiatives to specific pilots. According to our Theory of Change, overall success will be most likely when several (if not all) of these interventions are implemented in coordination with others across each of the five solution areas.



## SOLUTION 1: Create New Market Opportunities Leveraging Peruvian Mahi Mahi's Unique Position

**Rationale:** Mahi mahi is an important, high value species with its primary market in the United States. Annual output from Peru has a significant impact on global market prices and conditions. Global market prices reached an all-time high in 2017 due to reductions in catch and increase in FDA rejections of Peruvian product. As a result, some buyers pulled mahi mahi from their offerings and there has been a rise in substitutions on restaurant menus and supermarkets in the US. Currently, Peruvian mahi mahi suppliers are not taking advantage of their influential role in the global mahi mahi market—nor are they deriving any value from an estimated large but undervalued domestic market. Meanwhile, few strategies currently leverage squid as a means to drive change in mahi mahi despite the catches coming from the same fleet and crews.

**Challenge:** Mahi mahi needs to become formalized in order to be able to verifiably and legally access U.S. and EU markets under new SIMP and EU IUU laws, respectively. In addition, Peru and its exporters need to improve their reputation for quality to compete with other strong mahi mahi producers, especially their neighbors Ecuador. Further, the potential for a stronger Peru domestic market is unrealized, hindered by pre-conceptions and ideas of mahi mahi as a low-standard, low-quality fish.

**Opportunity:** Establish new business models for fishing communities and downstream supply chain actors that link high quality, sustainable, verified product to elevated demand.

### **Intervention Ideas:**

- Identify opportunities to pilot cold storage/flash-freezing of mahi mahi on the water to resolve quality issues associated with logistics. This effort could be packaged with a rebranding effort, if relevant, to differentiate the product in the international market. Improvements in quality would be insured by traceability systems that could verify certain processes and procedures were implemented, such as temperature recordings throughout the supply chain.
- Build the domestic market based on the needs and product form requests, for both mahi mahi and squid. For squid, a market for dried, fried, and other product forms may be ripe for the popular Asian-fusion market. For mahi mahi, this may require a campaign that re-brands mahi mahi as a safe, legal, traceable seafood of choice for the domestic market. Building both markets would involve investment in developing new product forms and marketing efforts, as well as distribution through transparent, traceable supply chains.
- Brand or certify Peru-only caught and processed squid: conduct market assessment, then launch a campaign to highlight safety, legality, and reduced risk for buyers sourcing squid from Peru (as opposed to varied Asian source countries) with traceability as a core element to prove origin.

- Work with the EU market directly (CALAMASUR and Global Squid SR) to drive improvements in the supply chain based on the value of squid.
- Build value-add processing capacity for squid that ties access to improvements to traceability. This could be for either the export market (related to Peru-only caught and processed brand) or domestic market (e.g. new product forms for Asian-fusion market).



## **SOLUTION 2: Create & Activate Community Incentives for Formalization and Data Capture**

**Rationale:** Fishers especially, but also other supply chain actors, have very few incentives for participating in a transparent system. Tax disincentives exist, and there is

little price differentiation for different categories of product quality. These barriers are exacerbated in the artisanal sector due to lack of formalization, within both the fishery (registration of vessels and fishing activities) and the tax system. The recent drive towards formalization, by both regional and national government, means that though many fishers have formalized, the process is now closed and many fishers remain outside the system, in other words undocumented.

**Challenge:** Fishing communities are uninterested in participating in traceability pilots or formalization efforts due to missing or perverse incentives.

**Opportunity:** Reward community projects for formalization and data capture by including and communicating community-specific incentives of and beyond traceability.

### **Intervention Ideas:**

- Identify community incentives of value (Fair Trade, healthcare, education, etc. ) and tie traceability to these as a way to access and reinforce those benefits.
- In coordination with government and funding agencies, develop structures that explicitly connect data reporting and formalization with access to capital. For example, formally registered individuals (both fishery management linked and tax system linked) contributing to data generation could be put on a fast-track to access PNIPA funds or other loans. This could also be done at a cooperative or association level based on member participation. In addition, fishers engaged in these formal structures could immediately receive access to reporting and tax services to offset disincentives associated with formalization.
- Generate and share analyses right away based on information from formalization and data capture programs: Traceability systems and digital data allow for improved models/prediction of the fishery and the market. Such data can be fed to NGOs or university scientists who can help conduct analyses; Tableau (or other applications) could be used to allow

fishers to visualize data and make better decisions regarding trip planning or price negotiations. In this case, data and information for decision-making is the incentive.

- Design systems so that access to meta-data, that can help with business planning, is only available to those who share data.
- Do not lead with traceability for sustainability, instead, sell the business benefits of traceability: Re-frame data collection and sharing as a tool for improved business–inventory management, trip planning, insurance against rejections from buyers due to false claims on quality or handling. Hold workshops and share testimonials from other fisheries and sectors to establish proof of concept.



### **SOLUTION 3: Advance Alignment and Coordination to Inform a Holistic Seafood Strategy**

**Rationale:** Traceability implementation to date is predominantly focused on food safety standards to meet international requirements such as HACCP and to

decrease financial losses due to rejections. Efforts to push traceability are largely decoupled from initiatives working at the policy level to advance government best practices in data and fisheries management, and are largely independent from initiatives targeting food security and the gastronomic movement as a whole. Traceability as a tool for creating high-quality data, mapping trade flows, generating story about differentiated product, and general transparency is, as of now, undervalued and not integrated into a larger sustainable seafood strategy.

**Challenge:** Traceability and sustainability efforts are fragmented and stakeholders lack motivation to engage.

**Opportunity:** Align and unite seafood sustainability efforts across Peru underpinned by robust traceability and anchored in the needs of the export markets and domestic gastronomic movement.

#### **Intervention Ideas:**

- Build community capacity to coordinate action and leverage resources across stakeholders, focusing on traceability, quality improvements, and sustainable seafood. Continue to convene stakeholders groups separately but also create opportunities for bringing actors together to build trust through co-designing solutions, identifying shared goals, and sharing testimonials about what is and is not working from the field. Partner with NGOs involved in policy and negotiation to continue to apply pressure to the government to provide sufficient and ongoing support. Work especially with stakeholders involved in seafood sustainability dialogue to build traceability requirements into agreed-to definitions and standards.
- Unite actors along the mahi mahi supply chain around improving quality, highlighting the benefits and need for traceability to maximize returns

on improvements—this is an issue they all face and all of their livelihoods depend on it. It may be strategic to have processors drive this and apply pressure downstream.

- Present and implement a more holistic data modernization vision in the mahi mahi fishery and in Peru. Such a vision can help demonstrate benefits of modernization, interoperability, and information sharing among data collection agencies across fisheries management, science, and enforcement sectors. For example, increased coordination among departments to identify redundancies and data gaps can result in cost savings and improved functionality, benefiting government agencies and industry. Initiatives to push electronic monitoring and reporting systems could help improve management by providing more accurate data on bycatch and catch volumes, and serve as a driver for governments to upgrade their own systems to be able to capture, store, and analyze data from such systems. Gaining buy-in to a vision for data modernization can help pave the way for traceability within supply chains by ensuring governments can utilize and return value on the better data captured by industry systems.



#### **SOLUTION 4: Provide Tangible, Customized Support to Build Capacity and Trust**

**Rationale:** High turnover and a history of corruption permeates both government and industry sectors in Peru, and has eroded trust between these stakeholder

groups. Meanwhile, regional fisheries agencies remain overwhelmed and under-capacity while still-informal fishers lack organizational and operational support to manage their own data. Daily demands make innovation—or even consideration of innovation—difficult to achieve.

**Challenge:** Key stakeholders have little opportunity or incentives to engage nor cooperate with one other, and most are stuck in a perpetual cycle of daily work that affords little opportunity for collaboration, innovation, or capacity-building.

**Opportunity:** Develop in-country services that can help bring needed capacity, expertise, and effective collaboration to both industry and government fisheries sectors.

#### **Intervention Ideas:**

- Explore potential for an independent, neutral entity with a singular focus on data collection and quality control of this data to serve as a third party data hub to collect, store, and analyze artisanal (+ industrial) fisheries data and supply both industry and government agencies with reliable, trusted information. Such an entity would help to ease tensions and promote efficiencies across initiatives involving data capture and sharing, including data generated by supply chain traceability systems.
- Pair traceability technology with on-the-ground training to support adoption and implementation over the long-term.

- Engage FONDEPES, who focus on developing community infrastructure associated with artisanal fishery landing sites (DPAs), to include data monitoring and registration infrastructure to support improved data capture and continued formalization of fishers (note: formalization process is currently closed).
- Prioritize activities to help design future formalization processes and support systems that incentivize participation. The formalization process is very important as a basis for traceability, and thus, funding and capital needs to be allocated to both the socialization process and design and implementation of incentives to push formalization.
- Create the role of a data modernisation intermediary who can align the efforts and needs among NGOs, technology vendors and experts, government officials, and industry.
- Provide hands on/high touch support for a renewed and extended formalization processes. Customized, in-person support over extended time periods (beyond a year-long pilot phase) is necessary to achieve complex formalization, which will create the most important upstream data for traceability.



### **SOLUTION 5: Build “in-house” expertise and capacity to support data rich fisheries**

**Rationale:** The spatially expansive artisanal mahi mahi fishery places high demand on Peru’s regional and national fisheries authorities, as well as supply chain actors, to provide robust data quickly in order to inform adaptive management and enforcement. Traceability and data systems are evolving at a rapid pace, with new techniques and technologies emerging all the time that could meet Peru’s fisheries demands. However, smart application of these systems to meet specific fisheries demands requires dedicated expertise. We recommend efforts to cultivate a community of practice in Peru of IT and data experts who also understand the unique needs of fisheries management and the seafood trade. These experts would be able to provide the high-touch, on-going support necessary to help both government and industry actors successfully adopt and implement more sophisticated traceability and data systems to meet the needs of Peru’s extensive fishing industry, with a focus on mahi mahi.

**Challenge:** Catalyzing change in government fisheries requires long-term, embedded champions that are able to function independent of government turnover or changing policies.

**Opportunity:** Build a pipeline and network of change agents (i.e. entrepreneurs and “intrapreneurs”) to lead and champion fishery transformation initiatives.

**Intervention Ideas:**

- Create a group or a center organized around cultivating change agents with core data creation, data sharing and transparency components. It is important that this set of change agents are also fluent in fisheries and the complexities of seafood supply chains.
- Engage IT advisors/experts that can support training and on-going needs of the system and its stakeholders.
- Promote conversations around transparency and data openness.
- Identify fledgling leaders within government and design mechanisms to bolster/reinforce their efforts to support traceability and data modernization.

## ROADMAP

Taken together, the solution areas proposed set a vision for fishery transformation towards a traceable Peruvian mahi mahi fishery that spans a 5-10 year timeframe (short-term = 0-2 years, medium-term = 2-5 years, long-term = >5 years). Noting that there is a lot of work to do, especially on formalization before the possibility of full-chain electronic traceability is a scalable and replicable possibility across the entire mahi mahi fishery in Peru, so, successful execution requires close partnerships, extensive collaboration, innovative approaches, and potential policy changes over time. A roadmap highlighting how these interdependent strategies can support and build on one another is shown in **Figure 6** below.

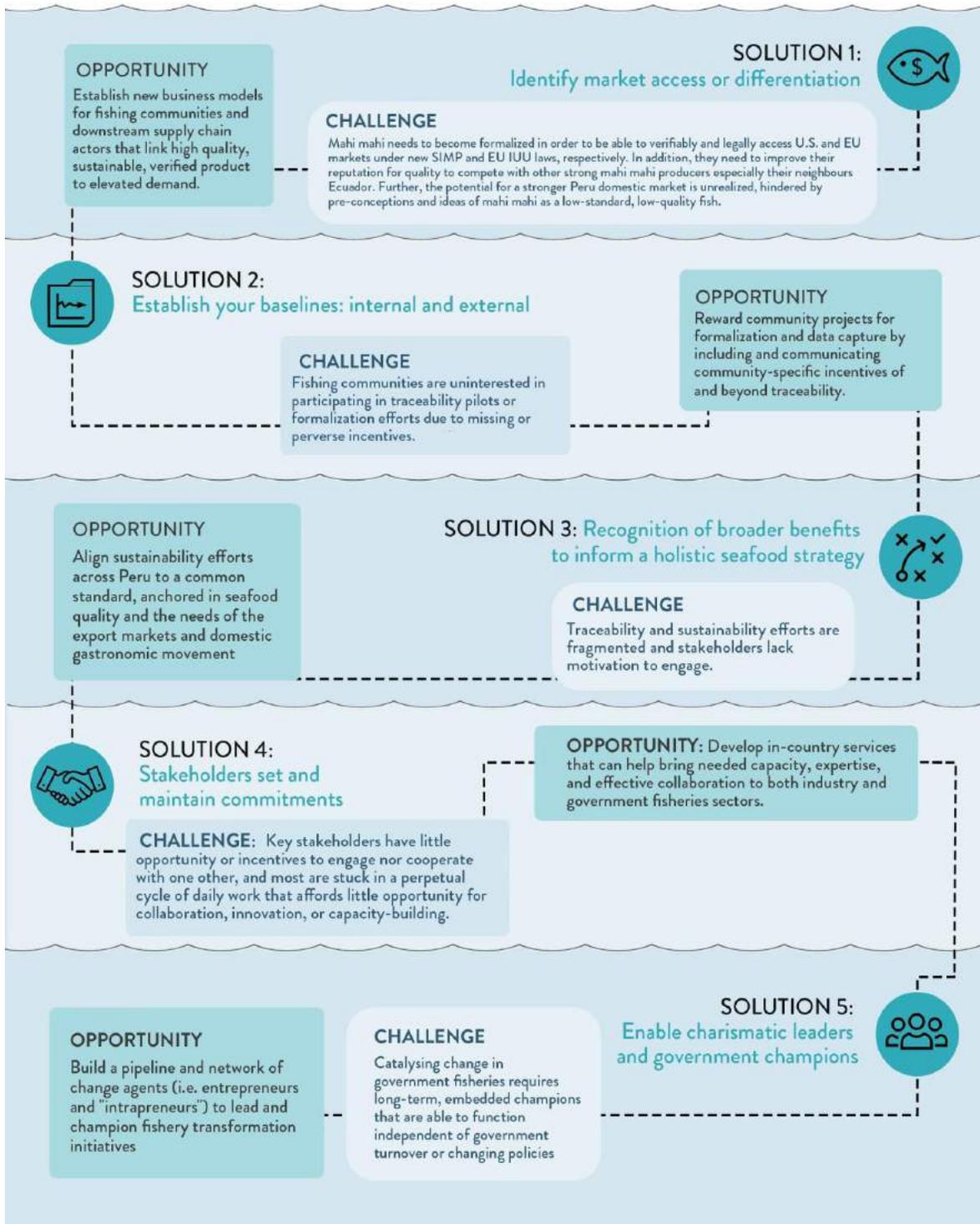


Figure 6. Solution model identifying the challenges we aim to overcome and the opportunities to capitalize on for creating change and innovation in the mahi mahi fishery, with regard to traceability and data modernisation efforts.

These solution areas are pushing on different parts of the system, yet all relate to and build on one another. Solution 1 is critical from a fishery standpoint. Both mahi mahi and the closely associated squid fishery are very important fisheries for Peru in terms of economic and social impacts nationally and the pivotal role Peru plays on a global stage in these fisheries means there is a large potential for taking a leadership role in traceability, sustainability and data modernisation within them. This is deeply linked to solution 4 and solution 5, which aim to build the capacity and ability of Peru's government, industry and civil society to look at the mahi data systems holistically, invest in a long-term vision and infrastructure which supports these and develop a strong network of thought leaders and technical people to build and guide this process.

Noting that a holistic data system and capacity building of the stakeholders within this system is needed (solution 4 and solution 5), it is also important to take into account that the correct incentives for engagement are put in place. This is outlined and prioritized in solution 2, basically ensuring that the incentives for stakeholder engagement (especially from the upstream, but also across the supply chain) and transparency are built into the development of a holistic system and that from the onset that the importance of system wide engagement in a modernized data and traceability system is a must when aiming for long term success. Solution 5 notes the requirement for innovation, the space for innovation to grow and for this to be linked to a strong and supported growing network of leaders. We note that these emerging leaders should identify the important lessons learned and experience which already exist within the system, taking lessons learned from the well established anchovy fishery and the knowledge and advancements which have already been made within traceability and data modernisation linked to quality and food safety. Food safety as a driver for traceability is described in solution 3. Solution 3 additionally points to the advantage of integrating data from various streams and various stakeholders across the system from food safety standards, fisheries management, business operations and management as well as international and domestic policy compliance (solution 1) into one cohesive system, again requiring the need for infrastructure (solution 4), capacity (solution 5) and engagement (solution 2).

We believe the five solution areas proposed above are ripe for development and have a large potential for success if carried out in the current system. In the following section, we discuss key stakeholders and partners that we perceive to be important in moving these initiatives forward in the Peruvian mahi mahi fishery.

# Stakeholder Mapping

We have identified a broad universe of stakeholders that influence and engage in the mahi mahi fishery and associated value chain. Table 3 outlines key stakeholders and potential partners relevant to implementing traceability in mahi mahi supply chains, specifically related to the five solution areas we have proposed. Each stakeholder is described as follows:

1. Key grouping into which the organization falls
2. Where they fall in the community, enabling, and system level categorization
3. How each organization fits into the bigger picture of achieving full chain traceability for the mahi mahi fishery, either directly or indirectly.

**Table 3.** Key stakeholders and potential partners relevant to implementing traceability in Peru mahi mahi supply chains and their perceived alignment with our five proposed solution areas.

Category	Organization	Level of Engagement	Link to full chain traceability
Local actors	<b>Fisher associations:</b> As the initial stakeholders to engage with the fish in the supply chain, they have the potential of creating high quality data which feeds into any traceability system and are key to any future large scale roll out of traceability.	Community	    
International NGOs	<b>WWF (World Wide Fund For Nature):</b> As the leader in the implementation of the mahi mahi FIP, WWF Peru coordinates with fishery system actors in both private and public sectors to implement projects to move the FIP forward to completion. Also have experience in traceability and technology implementation.	Community/ Enabling/ systemic	    
	<b>Oceana:</b> Building off past work, Oceana continues to map and analyze value chains for the entire Peruvian fisheries sector. Working with Villy Christensen of UBC, Oceana are updating a 2013 study characterizing national artisanal fisheries, with the goal of providing more recent information based on data from 2015 on income and employment in-country.	Enabling/ systemic	  
International NGOs	<b>SFP (Sustainable Fisheries Partnership):</b> SFP is focused on engaging and catalyzing global seafood supply chains, rebuilding depleted fish stocks, and reducing the environmental impacts of fishing and fish farming. They are supporting the creation of jumbo squid FIPs in Peru, and are working directly with CALAMASUR and PRODUCE to improve jumbo squid traceability in the country.	Enabling/ systemic	  

Category	Organization	Level of Engagement	Link to full chain traceability
Peruvian NGOs / consultancies	<b>NCI (Naturaleza y Cultura Internacional, Nature and Culture International):</b> Works to protect biologically diverse ecosystems in concert with local people in Latin America, recently partnering with DIREPRO in order to assist in registering boats directly with fishers and communities. Their goal is to support local efforts in the field, protecting Peru’s biological wealth while helping local communities find and sustain livelihoods based on thriving ecosystems.	Community	
	<b>Intelfin:</b> A consultancy that provides economic analyses for NGOs and government actors to inform fishery policy decisions.	Systemic	
Industry	<b>CALAMASUR:</b> Industry group that includes representatives from Peruvian, Chilean, Mexico, and Ecuadorian industrial and artisanal fishing, processing, and academic sectors. CALAMASUR works closely not only with the PRODUCE, but with Global Squid SR, both governed by SFPs Target 75 (T-75) global squid guidelines.	Enabling/ Systemic	
	<b>Global Squid SR:</b> Made up of major global buyers from the European Union as well as the United States. Their goals are to monitor sustainability status and issues related to squid fisheries, engage supply chains and local producers in fishery improvement efforts, and monitor the progress of current squid FIP efforts toward long-term sustainability of squid in domestic and international markets.	Enabling/ Systemic	
	<b>Confremar:</b> A vertically integrated seafood importer that sources primarily from Peru and Spain. They launched a basic mahi mahi FIP in 2013 in partnership with Sustainability Incubator and Pier Fish.	Enabling/ Systemic	
	<b>Peruvian exporters:</b> are already actively engaged in diverse markets and understand increasing international and market demands with regards to traceability. Additionally this stakeholder group has linkages to the communities and therefore holds an important space in the roll-out of technologies and new systems.	Community/ Enabling	
	<b>International importers/buyers:</b> this stakeholder group sets the market demand, influenced by their customers, and have the ability to push and support in country initiatives which meet their import requirements. Often they have experience from varied export countries and can bring lessons learned and insights from other fisheries and projects.	Community/ Enabling/ Systemic	

Category	Organization	Level of Engagement	Link to full chain traceability
Government	<b>GOREs (Regional Government):</b> These offices have political, economic, and administrative autonomy in matters that fall under their jurisdiction, and are responsible for coordinating with municipalities (i.e. local governments). They can create rules and regulations so long as they do not conflict with or negate those of the national government.	Enabling/ systemic	
	<b>IMARPE (Instituto del Mar del Perú):</b> Leads scientific and technical research within PRODUCE. Provides scientific information to set catch limits, closures, and other control measures based on the fishery. IMARPE observers are present at landing sites, recording species name, volume, trip duration, gear, and fishing grounds.	Systemic	
	<b>SUNAT:</b> The National Superintendency of Tax Administration is the main tax-collecting agency in Peru. This office is largely responsible for collecting processing and export data in mahi mahi and squid supply chains.	Systemic	
	<b>CITES Pesquero:</b> Part of the ITP research and training network, this office has projects directed towards developing technology solutions to resolve quality and harvest issues within the mahi mahi fishery.	Systemic	

Table 8 in Appendix D outlines the extended list of stakeholders relevant to traceability deployment in the mahi mahi fishery, beyond the core stakeholders identified above.

The section that follows highlights where financial resources in Peru fisheries transformation work are currently focused, and will help us to assess where we might gain traction for future funding and determine where and how funds need to be focused in order to move these solution areas forward with the proposed partners and stakeholders.

# Financial Landscape Analysis

A blended finance approach is recommended to fund interventions in complex fisheries systems, in alignment with the *Principles for Investment in Sustainable Wild-Caught Fisheries*. Blended finance is defined as “a strategy to leverage philanthropic and development capital to crowd-in private investment in the pursuit of sustainable development goals.” Where typical grant funding supports efforts that lack a strong financial return but are necessary for progress, blended finance seeks to remove systemic barriers that prevent the flow of private capital. To apply this approach, we engage diverse funders, including national, regional, and municipal grantors, in the co-design of interventions and in business planning with stakeholders.

We conducted an initial funding landscape to map funders that are active or interested in Peru against the economic, social, and environmental impacts that proposed interventions seek to create (see **Table 4** and **Figure 7**). This landscape can be referenced for the creation of tailored funding strategies to fuel traceability efforts in the mahi mahi fishery. Generally, grants should be strategically targeted to remove risk that allow development capital and subsequently private investment to be unlocked, given the substantially larger availability of development and private capital potentially needed for large scale roll-out of traceability across an entire fishery and beyond.

## THEMES/FUNDER MANDATE

**Innovation:** Several Peruvian grant programs target scientific, technological and business model innovation. These range from grants to develop new business models, to supporting entrepreneurs in launching new enterprises, to adopting or developing technologies that provide new capabilities or efficiencies. Interventions should consider and explicitly communicate their use of innovation and technology.

**Economic Development & Livelihoods:** Peru is currently classified as a low-income country. As such, development capital is being actively deployed to drive economic growth. This includes development of new infrastructure (physical or institutional), creation of new markets and linkage into existing markets, and initiatives that bolster private sector engagement. Interventions should consider the extent to which they are helping to generate private sector revenues, and improving the livelihoods of communities that live below the poverty line or struggle with financial instability.

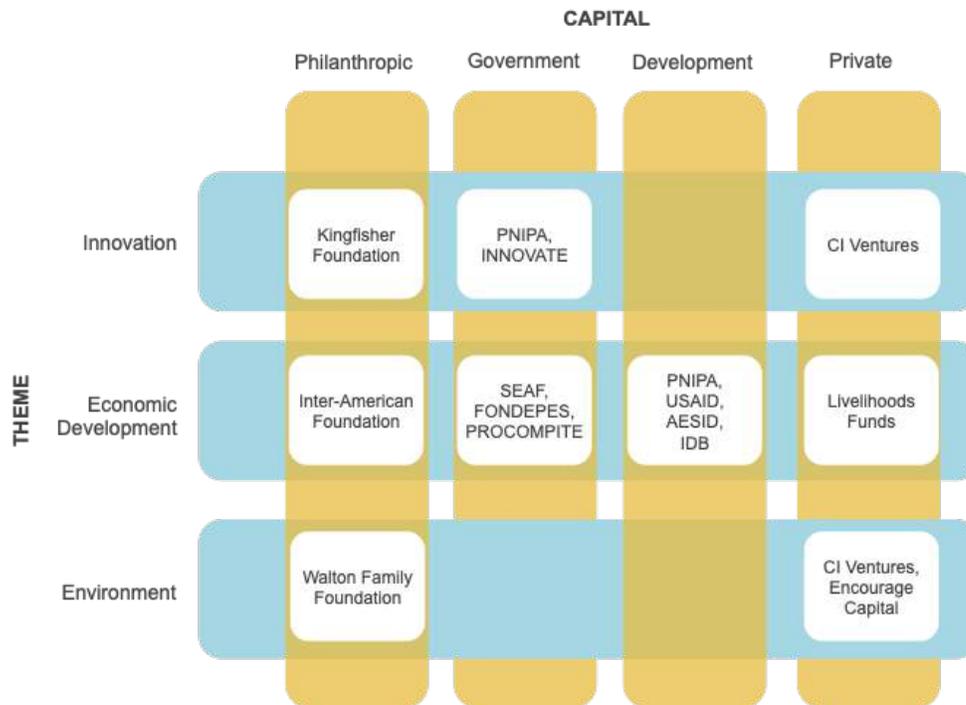
**Environmental Stewardship:** Peru is rich in biodiversity and critical habitats for marine life. As such, Peru is a focus country for many environmental funders seeking to preserve life under water. Interventions should consider the extent to which they are protecting habitats, and helping to preserve or rebound stocks (e.g. management).

**Table 4.** Preliminary selection of potential funders that are active or have prospective alignment to Peruvian fisheries transformation work.

Category	Type	Funder Name	Mechanism	Mandate
Active	Philanthropic	Walton Family Foundation	Grants	Environment
Active	Government	Programa Nacional de Innovación en Pesca y Acuicultura (PNIPA)	Grants	Technology Development Training & Capacity Building Technology Adaptation Pilots
Active	Government	Fondo Nacional de Desarrollo Pesquero (FONDEPES)	Grants & Loans	Tools & Materials Construction
Active	Government	Programa Nacional de Innovación para la Competitividad y Productividad (INNOVATE)	Grants	Business Development
Prospective	Philanthropic	Inter-American Foundation	Grants	Livelihoods, Economic Development
Prospective	Philanthropic	Livelihoods Funds	Grants & Loans	Livelihoods, Economic Development
Prospective	Government	PROCOMPITE	Grants	Economic development
Prospective	Government	Cosejo Nacional de Ciencia, Tecnología, e Innovación Tecnología (CONCYTEC)	Grants	Innovation
Prospective	Development	International Development Bank (IDB) Lab	Loans	Economic development / Social Impact
Prospective	Philanthropic	Kingfisher Foundation	Grants	Innovation (traceability and data modernization)
Prospective	Development	United States Agency for International Development (USAID)	Grants	Economic development
Prospective	Development	Spanish Agency for International Development Cooperation (AECID)	Grants	Economic development
Prospective	Development	Global Affairs Canada (Canada)	Grants	Economic development
Prospective	Development	Food and Agricultural Organization (FAO)	Grants	Science
Prospective	Private Investment	Conservation International (CI) Ventures	Loans, Equity, Convertible	Social/Environmental Impact

## STRATEGY

Building on the three themes above, interventions in the mahi mahi fishery should orient around the use of technology and business model innovation, economic development, and environmental stewardship. Given that value predominantly lies in quality improvement and efficiency, there should be clear alignment to both innovation (technology and updated business models are needed to achieve better quality) and economic development funders (improving quality generates greater economic activity and improves access to global markets). Environmental funders can be incorporated by clearly demonstrating how improved quality generates incentives for fishers to control their effort (e.g. by ensuring greater profitability or other community benefits), and incorporating better traceability.



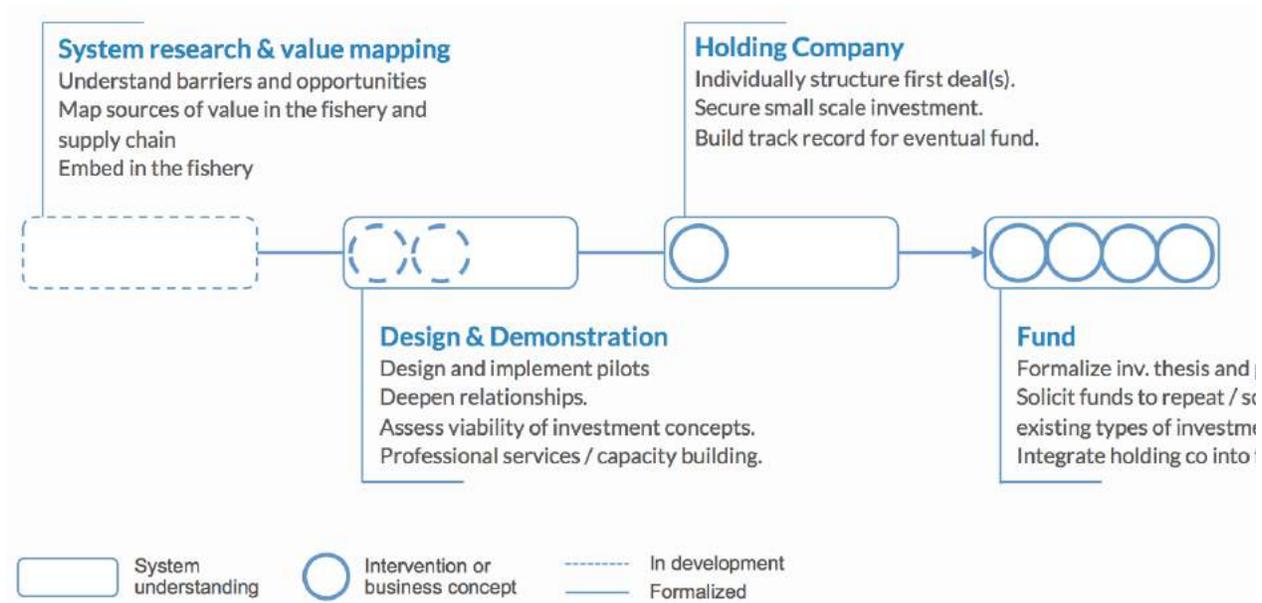
**Figure 7:** Landscape of potential Peruvian investors according to the predominant themes identified in the funder mandates.

This strategy will be referenced in the development and launch of new fishery transformation programs and ventures, to match them with the best fit portfolio of funders. Crucially, a deal structuring and development service will be required to adequately package initiatives together to meet the requirements of such a diverse funder base. Future of Fish advocates developing a finance platform with three core functions:

1. Connect funders to interventions aligned with fund size, mandate, and risk profiles;
2. Add development capacity (e.g. professional services, management coaching, impact measurement) to get projects and organizations investment-ready; and
3. Structure deals to mobilize capital (e.g. aggregation of projects and/or funders, de-risking partnerships such as insurers and guarantors, etc.).

Such a platform would act as the go-to entity to fund interventions, regardless of their profit orientation and impact targets, thus simplifying the process of resourcing and scaling effective strategies. By holding relationships with diverse funders, and being able to map projects to the mandates and investment requirements of these funders, time to funding can be greatly reduced and structural barriers to the flow of capital can be minimized.

While the platform is initially envisioned as a holding company making one-off investments into deals that align to this blueprint and strategic themes outlined in this document, the proposed platform could eventually include its own fund (with participation from other aligned funders in the region), as a pipeline of investable deals is built up, and consistent, scalable investment strategies are demonstrated. The phased progression of this strategy is shown in **Figure 8** below.



**Figure 8:** Evolution of a finance platform over time.

# Next Steps

Given increasing international and national focus on improved data systems and some key initial leadership steps taken by the Peruvian government in driving for traceability and transparency, now is the time to find supply chain-driven solutions to traceability in Peru's mahi mahi fishery, including ways to reward more and better data. The blueprint presented here offers interventions that can prime the system and forge pathways that lead to traceability adoption and eventual implementation, in order to promote long-term health and sustainability of these vulnerable and potentially threatened stocks while improving livelihoods for artisanal fishing communities.

Proposed solutions and associated intervention ideas identified in this document will continue to be refined through an adaptive cycle that responds to stakeholder input, system response to these interventions, and changing conditions in the fishery. In this way, we aspire to catalyze progress of the Peru mahi mahi fishery toward a data-rich, value-generating future that rewards responsible fishing and sourcing practices. Fishery development is a multi-stakeholder process that will require collaboration across multiple stakeholders. Future of Fish is actively seeking partnerships to support the implementation of this blueprint. Interested organizations can contact us at [info@futureoffish.org](mailto:info@futureoffish.org).

# Appendix

## APPENDIX A: FISHERY DEVELOPMENT MODEL

The Future of Fish Fishery Development Model (FDM) is a development approach that is designed to progress a seafood system from its current state to an envisioned future state. A short description of the FDM is available [here](#).

## APPENDIX B: SYSTEM ASSETS, STUCK POINTS & TENSIONS

Future of Fish develops an emerging framing of systems based on the patterns we observe throughout the research process. Analyzing assets, stuck points, and tensions within the system help to reveal insights about the system, which in turn inform the opportunities for system transformation.

**Stuck points** are defined as obstacles hindering progress toward the roll out of a fishery wide traceability system and the ability for fishers and other stakeholders to gain benefits from such an improved system. Stuck points include major challenges that are symptoms of larger failings or inefficiencies in the way a process or system works, so as to prevent optimal functioning. Understanding stuck points allows us to gain insight into how we might design solutions that can overcome deeper, underlying system-wide barriers. Stuck points are often challenges one or more individual actors in the system are trying to resolve, but the integrated solution required is beyond the capacity of any single actor to implement. By definition, stuck points are moveable—and thus changeable—elements of the system.

Just as there are stuck points that impede adoption of integrated solutions, so too are there **assets** – positive elements within a system that can be leveraged to address stuck points, and that can be used to unlock challenges. Assets include factors such as relationships, ongoing initiatives, and tools that currently exist within the system.

Another critical component of the fishery analyses is the identification of **tensions**, defined as social, political, economic, and behavioral trends and biases that perpetuate a problem. These are the conflicting realities of the system that tend to lock in the status quo. Finding tensions is often the first step towards generating insights and opportunities in a space, and tend to show where big change is needed.

### STUCK POINTS

Current challenges that hinder the mahi mahi fishery and its stakeholders from engaging in and adopting full-chain traceability within the Peruvian can be found in **Table 5** below.

**Table 5.** Stuck points in the Peruvian mahi mahi fishery that prevent or impede full-chain traceability adoption.

Stuck Point	Traceability Link	Description
Northern geography limits opportunity in international market	Quality issues linked to northern component of fishery means fraud to disguise actual origin exists.	<ul style="list-style-type: none"> <li>• 20 days fishing, limited refrigerated storage capacity, and regulation hinders 'mechanized' facilities onboard. Quality issues mean Peru has a notably high rate of mahi mahi rejections rates US FDA.</li> <li>• Seafood fraud mislabelling is thought to be occurring, where claims exist that sellers and processors are selling northern fish as originating from south, where fishing trips are typically 7 days or less and hence quality is higher.</li> </ul>
Government regulations and policies currently prioritize socioeconomics over sustainability	A push for regulatory transparency and traceability are lacking, linked to perverse tax laws and burdensome paperwork which incentivize data fraud.	<ul style="list-style-type: none"> <li>• The governments formalisation process is now closed and has not progressed quickly or inclusively enough. The process was deemed too complicated and burdensome for small scale fishers, meaning it is not possible to currently ensure fleet size and capacity is reasonably linked to the resource.</li> <li>• Friction, overlap, and sometimes conflicting rules are pushed by national and regional governments.</li> </ul>
Effective workarounds minimize importance of long-term solutions	Loopholes in rules and ingrained workarounds may exacerbate IUU and the need to fraudulently report.	<ul style="list-style-type: none"> <li>• "Ghost boats" circumvent the costly and time-intensive process of legal registration.</li> <li>• There are claims that some processors simply resend US FDA rejected shipments that have been rejected from one port to new ports of entry.</li> <li>• Vessel registration program launched, but does not require measurement and verification of vessel size, so total capacity remains unknown.</li> </ul>
Moving targets thwart strategic planning and process	A dynamic system with changing management officials and domestic and international regulation creates confusion for stakeholders.	<ul style="list-style-type: none"> <li>• National and regional governments on separate paths towards formalization, now closed, created confusion with regards to processes and paths towards legal harvest.</li> <li>• Increasing and changing international standards and expectations are confusing, time-consuming, and costly to invest in. Many have little or no perceived incentives.</li> </ul>
Lack of predictability combined with rapid change creates opportunities to hide	The mahi mahi fleet in Peru has grown rapidly in recent years with little regulatory oversight.	<ul style="list-style-type: none"> <li>• High rates of government turnover creates conditions where it may be easy to skirt the rules and where poor or illegal practices remain undetected.</li> <li>• High turnover rates in government mean new administrations create new approaches and rules, adding confusion and uncertainty on how to move forward.</li> </ul>

## ASSETS

Existing elements that can be leveraged to address stuck points or risks can be found in **Table 6** below.

**Table 6.** Assets in the Peruvian mahi mahi fishery that can be leveraged to promote the adoption of full-chain traceability.

Stuck Point	Traceability Link	Description
Technology integrated into businesses across the supply chain	The basic infrastructure for implementing a traceability system exists.	<ul style="list-style-type: none"> <li>Fishermen informally communicate where and when they are seeing mahi mahi or jumbo squid to fellow boat captains by radio in real-time.</li> <li>Electronic scales located at both landing points and processing plants have the capacity to digitally record and report data directly to the national and regional government.</li> </ul>
Market pressure from international players	There are a number of international initiatives directly impacting transparency and traceability work in the Peruvian mahi mahi and jumbo squid supply chains.	<ul style="list-style-type: none"> <li>The Sustainable Fisheries Partnership (SFP) helped to fund the recent stock assessment conducted for jumbo squid, and are actively involved in supporting both the mahi mahi and jumbo squid FIPs in Peru, especially through the Global Squid SR initiative.</li> <li>Recent U.S. SIMP laws, combined with concerns regarding organoleptic “sniff tests” at the U.S. border are driving the need for traceability for mahi mahi.</li> <li>An increasing perception in Peru, that their neighbors Ecuador have a higher quality more sustainable product, which will potentially soon be MSC certified, is adding pressure on Peruvian industry to follow suit.</li> </ul>
Small wins for more value	Improved handling and basic adherence to HACCP and international food safety-oriented practices and regulations can support increased value and hence incentivize traceability.	<ul style="list-style-type: none"> <li>SANIPES has had success in the past with basic training sessions on how to appropriately manage gut removal so as not to damage the fish, which positively impacts product quality, international rejection rates, and market price.</li> <li>Ecuador, Peru’s neighbor to the north, serves as a model for how to improve quality as well as build an international reputation.</li> </ul>
Fishers have downstream exposure	There have been a number of efforts to educate fishers about what is happening to product downstream.	<ul style="list-style-type: none"> <li>Private processors, industry groups such as Global Squid SR and CALAMASUR, and a number of government entities including PRODUCE and SANIPES have invited fishers to view processing plants at home and abroad, participate in courses on how to correctly clean fish, and communicate directly with chefs in Lima. This provides an opportunity to learn more about downstream prices, processes, and requirements.</li> </ul>
Processor flexibility	Processors have some flexibility, with the capacity to process mahi mahi, jumbo squid, and other seafood products in their plants, necessary to maintain the processing plants at functional capacity year-round.	<ul style="list-style-type: none"> <li>This flexibility allows for the natural diversification of products, ensuring stable income regardless of annual fluctuations in stock size and availability.</li> <li>Processing plants have significant storage capacity, permitting them to store and sell mahi mahi nationally as well as for export, even when it is no longer in season.</li> </ul>

## TENSIONS

Conflicting realities of the system that tend to lock in the status quo, and that need reframing for the Peru mahi mahi fishery to adopt full-chain traceability can be found in **Table 7** below.

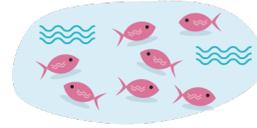
**Table 7.** Tensions in the Peruvian mahi mahi fishery that need reframing to facilitate full-chain traceability adoption.

TENSION	Description
EU/SIMP makes exports more burdensome for paperwork and data needs <--> The national level tax system incentivizes exports over domestic sales	The complexity of the process required to formally register a vessel and obtain all documentation necessary to fish in accordance with national law has created a scenario in which the paperwork required by the government is frequently falsified by stakeholders in the supply chain. While there is a range of fraudulent activity (from creating boats that don't exist to verbally collecting information rather than recording it), the system as it currently functions not only encourages but requires falsification of paperwork so that the product will be accepted by processing plants. While this service is currently invaluable to product flow, ideally this particular practice will become increasingly obsolete as more formal systems come into play.
Fisheries policy on paper is relatively robust and forward-thinking <--> Policy in practice is weak due to lack of prioritization and enforcement	Reporting requirements as outlined by PRODUCE, DIREPRO, DICAPI, and SANIPES are robust. On paper, data collected is already sufficient in terms of meeting basic requirements for export under both U.S. SIMP and EU IUU regulations. However, enforcement of the laws and policies governing these fisheries is low, with laws on the books rarely enforced, a critical gap when it comes to effective policy implementation.
Data that could support traceability is collected by both the government and other supply chain actors <--> Data is privatized, inaccessible, or falsified and thus, traceability is hindered	PRODUCE, DIREPRO, SUNAT, DICAPI and other key governmental organization have the capacity to collect robust data at various points along the supply chain. Additionally, information ranging from catch date and location to weight and volume of product entering the processing plant is recorded privately and comprehensively by industry members. However, this data can be rendered inaccessible due to private interests, lack of resources to make it available to the public, or through conscious action to hide data.
Formalization includes rigid requirements <--> Dynamic ecosystems require flexibility in fishing	Artisanal fishers in Peru are regulated through boat size, equipment, and fishing seasons—requirements which help to define and distinguish the artisanal fleets from the industrial and, in theory, assist with better management. At the same time, artisanal fishers are required to contend with the effects of shifting mahi mahi and jumbo squid migratory patterns, annual weather events such as El Nino and La Nina, and a rapidly shifting political environment—all of which requires them to have greater flexibility in their trade. Resolving this tension could allow for more novel management schemes that could support fishers while securing greater oversight.
International regulations drive national traceability efforts <--> System resists traceability	There is little internal impetus for improved transparency or traceability. Instead, there are a number of factors that actively discourage implementing such systems. Fishermen are concerned that boat owners will use VMS units to track their movements and work at sea, and there is no existing cultural or historical practice of recording data to encourage reporting. Additionally, there is an element of due diligence avoidance at play—buyers don't want to purchase old fish, and if there is no documentation indicating how old the product is, there is a significantly higher chance of sale. At the same time, international pressures in the form of SIMP and IUU regulations are driving traceability for these fisheries forward, forcing the rapid development of new data collection and technological systems. National level resistance is in direct conflict with new external pressures, which could both benefit, as well as negatively impact, effective traceability.
Push for decentralization <--> Political structures are centralized	The ongoing push for decentralization has been plagued by unclear guidelines and roles, lack of resources, corruption, infighting, and resistance to the diversification of power. Although certain functions and responsibilities are supposedly decentralized, in reality all significant events, meetings, and decisions still occur in the city center of Lima. Maintaining a centralized power structure is preventing the successful implementation of a decentralized government, increasing conflict between national and regional authorities and effectively preventing any stakeholders located outside of Lima from creating or affecting national level policy.

## APPENDIX C: VALUE POTENTIAL BY CATEGORY

### Stock biomass & catch yields

**Where value is lost or unrealized:** Stocks are not adequately monitored in order to optimize yields against Maximum Sustainable Yield or Maximum Economic Yield. Absent a reliable, regular stock assessment, there is a high likelihood that the stock is overfished, which diminishes catch year-over-year and decreases long-term value of the fishery.

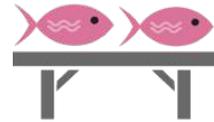


**How value can be reclaimed or generated:** Stocks should be regularly monitored to inform appropriate management policy and enforcement to keep stocks at MSY or MEY.

**Economic benefit:** Economic benefit cannot be calculated due to lack of baseline stock information.

### Efficiency & quality

**Where value is lost or unrealized:** High occurrence of rejection at Port of Entry means product is returned and re-shipped multiple times, incurring additional distribution costs, as well as spoilage and loss of product. Product lacks appropriate refrigeration at sea, thus quality degrades and product receives a lower price than would otherwise be possible.



**How value can be reclaimed or generated:** Incorporate refrigeration at sea, and unbroken cold chain to ensure product integrity throughout distribution. Implement stricter quality control and quality assurance processes to minimize rejections at Port of Entry. Adopt traceability to verify cold chain and quality assurance measures. More direct supply chains could avoid spoilage and other inefficiencies.

**Economic benefit:** Shortening the supply chain could avoid 10% loss of value between current price mark-ups and any spoilage loss from the extra product hand-off. Implementing best practices within current nodes, thereby reducing waste (e.g. from processing), and improving efficiency (e.g. streamlined operations) could yield up to 33%.

### Product & market optimization

**Where value is lost or unrealized:** MSC certified products could generate a modest price premium. Optimization of product form against buyer preferences could yield better price / lb. In select circumstances, product story could be sold, including the heritage of the fishery, and novel characteristics of mahi mahi.



**How value can be reclaimed or generated:** Secure MSC certification. Conduct market survey and optimize forms against buyer demand. In select premium channels, implement concerted storied fish campaigns.

**Economic benefit:** Certification and optimization efforts could yield an additional 1.5% of value to the fishery as a whole.

## Externalized benefits

**Where value is lost or unrealized:** Many fishers and community members are not formalized, so tax income is not generated to fund services. Tourist and other local markets under engaged in fishing communities.



**How value can be reclaimed or generated:** Localization is the preferred strategy that has been assessed, though formalized promises greater long-term potential.

**Economic benefit:** Bolstering local consumption would recirculate wealth in the local economy - assuming 10% of products could be consumed locally, and that local consumption has a standard local economic multiplier of 1.45, an additional 15% in value could be created.

## APPENDIX D: EXTENDED STAKEHOLDER MAPPING

Extended list of stakeholders relevant to the roll-out of full chain electronic traceability in the Peruvian mahi mahi fishery can be found in **Table 8**, this is to compliment the list of core stakeholders already outlined in **Table 3** in the main text above.

**Table 8.** Extensive list of stakeholders and potential partners relevant to implementing traceability in Peru mahi mahi supply chains, and their alignment with our five proposed solution areas.

Category	Organization	Level of Engagement
Regional actors	<b>OSPAs:</b> Fisher organizations, generally social in nature, that can be organized around a fleet, fishery, or community. They are the main mechanism that fishermen have for representation in political processes	Community
	<b>FIUPAP:</b> This is the largest artisanal fishing organization in Peru. It is the most politically active organization and includes 212 smaller syndicates/fisher associations, which combined, represent approximately 45,000-60,000 artisanal fishermen. It predominantly links southern communities to the national government	Enabling/ systemic
Peruvian NGOs/ Org.	<b>SPDA:</b> is working to formalize the artisanal fleet via rights-based management (RBM) framework by providing support to PRODUCE reforming Peru's fisheries legal framework to establish RBM for artisanals and improve formalization of the artisanal fleet.	Systemic
	<b>REDES:</b> A consultancy that works closely with WWF and Oceana on the market analysis of Peruvian fishery supply chain. Have work proposed to investigate the domestic market and consumer choices.	Community

Category	Organization	Level of Engagement
News and Media	Mongabay: An international nonprofit news organization working to education, inspire, and inform the public on environmental conservation.	Systemic
	Other media outlets	Systemic
Universities	<b>Agraria-La Molina:</b> the primer university in Peru for the marine sciences. It has active projects, including INFOPES, that are pushing for data transparency and traceability within the seafood sector.	Systemic
Industry	<b>SNI:</b> Promotes the direct human consumption seafood. SNI represents the largest number of DHC producers in Peru and is actively promoting new regulations to reduce the informality in the local fisheries.	Systemic
	<b>ADEX:</b> is a large Peruvian industry association, founded in 1973 with the purpose of representing and providing services to associated organizations such as exporters, importers and service providers. It is made up on a combination of large, medium and small companies, with the overarching goal of enhancing the development of Peruvian foreign trade.	Systemic
	<b>CERPER:</b> A Peruvian business that aids in branding and ensuring the health and safety certification of products, mainly fish meal, in line with both national and international standards.	Systemic
	<b>NovaPeru:</b> a main squid and mahi mahi exporter looking to improve internal traceability.	Systemic
Government	<b>SANIPES:</b> National Organization for Fish Health. Oversees compliance with sanitary conditions, and is the national authority for seafood production and export. SANIPES is in charge of drafting.	Enabling/ Systemic
	<b>DG. CHD:</b> The direction of human consumption within PRODUCE. Its main role is to sanction and process the formalization of industrial fishing boats, and was instrumental in the creation of mahi mahi fleet fishing cooperatives in the communities of La Isilla and La Tortuga.	Systemic
	<b>DG. Pesca Artesanal:</b> The direction of artisanal fishing within PRODUCE which coordinates the national government's oversight of the artisanal fishing fleets, including mahi mahi.	Systemic
	<b>DG SFSPA:</b> The direction housing responsible fishing. It oversees vessel monitoring and sanctioning of fishing activity in restricted areas or out of season. It uses VMS and GPS data to track industrial and a portion of the mahi mahi fleet within peruvian waters. Actively working to develop port to plate traceability.	Enabling/ Systemic



[www.FutureofFish.org](http://www.FutureofFish.org)