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Fisheries Catch Documentation and Traceability in Southeast Asia

Technical Concept and Specifications

THE USAID OCEANS AND FISHERIES PARTNERSHIP

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Fisheries Catch Documentation and Traceability in Southeast Asia:
Technical Concept and Specifications

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CONTENTS

TECHNICAL ANNEXES

Annex 1

Annex 2

Annex 3

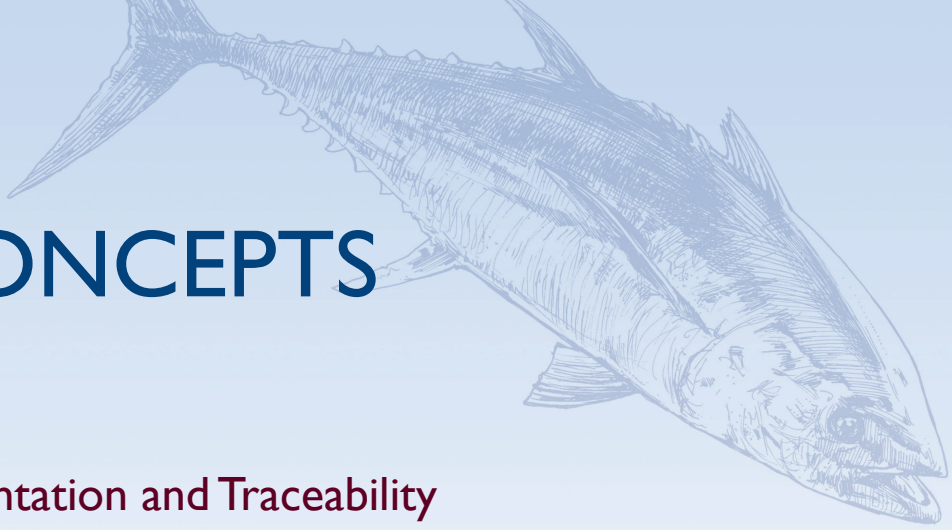
Annex 4

Acronyms

ACDS	ASEAN Catch Documentation Scheme
ACE	Automated Commercial Environment
AP2HI	Asosiasi Perikanan Pole & Line dan Handline Indonesia
ASEAN	Association of Southeast Asian Nations
ASSP	ASEAN-SEAFDEC Strategic Partnership
BFAR	[Philippines] Bureau of Fisheries and Aquatic Resources
CBP	Customs and Border Protection
CCRF	Code of Conduct for Responsible Fisheries
CDS	Catch documentation scheme
CDT	Catch documentation and traceability
CDTS	Catch Documentation and Traceability System
CSV	Comma separated values
CTI-CFF	Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security
DEX	Data exchange
DTD	Digital Traceability Document
EAFM	Ecosystem Approach to Fisheries Management
EDI	Electronic Data Interchange
EEZ	Exclusive Economic Zone
ERP	Enterprise Resource Planning
ESI	Electronic Signatures and Infrastructures
EU	European Union
FAO	Food and Agricultural Organization
FIS	Fisheries Information System
FLUX	Fisheries Language for Universal Exchange
GFTC	Global Food Traceability Center
GOC	Global Oceans Commission
GTIN	Global Trade Item Number
GTS	Global Traceability Standard
HTTPS	Hypertext Transfer Protocols
HCI	Human-to-computer interface
ILO	International Labour Organization
IMO	International Maritime Organization
IoT	Internet of Things
IOTC	Indian Ocean Tuna Commission
ITDS	International Trade Data System
IPNLF	International Pole and Line Foundation

IUU	Illegal, unreported, and unregulated [fishing]
JSON	JavaScript Object Notation
KDE	Key data element
KM	Knowledge management
M2M	Machine-to-machine communications
MCS	Monitoring, control, and surveillance
MMAF	[Indonesia] Ministry of Marine Affairs and Fisheries
MVA	Minimum viable approach
NGO	Non-government organization
MSC	Marine Stewardship Council
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
OCC	Oceans Consultative Committee
ODK	Open Data Kit
PPP	Public-private partnership
PSMA	Port State Measures Agreement
RDMA	Regional Development Mission for Asia
RFID	Radio-Frequency Identification
RFMO	Regional fisheries management organization
RPOA	Regional Plan of Action
SEAFDEC	Southeast Asian Fisheries Development Center
SIMP	[United States] Seafood Import Monitoring Program
SWIFT	Society of Worldwide Interbank Financial Telecommunication
TAG	Technical Advisory Group
TWG	Technical Working Group
UN	United Nations
UN/EDIFACT	United Nations/Electronic Data Interchange for Administration, Commerce and Transport
US	United States
USAID	United States Agency for International Development
USAID Oceans	USAID Oceans and Fisheries Partnership
VAS	Value added services
VAN	Value Added Network
VMS	Vessel Monitoring System
WCPFC	Western and Central Pacific Fisheries Commission
XML	Extensible Markup Language

KEY CONCEPTS



Catch Documentation and Traceability

USAID Oceans supports the development of transparent and financially sustainable electronic Catch Documentation and Traceability Systems (CDTS) to help ensure that fisheries resources from Southeast Asia are legally caught and properly labeled. Electronic CDTS' encourage the collection and analysis of ecological and economic data related to seafood products throughout the supply chain, such that they are traceable from the point of catch to import and retail. CDTS' provide an important opportunity to support effective national fisheries monitoring, control, and surveillance (MCS), as catch documentation and traceability (CDT) remains one of the most valuable and comprehensive methods for collecting fisheries statistics at a reasonable cost. Catch documentation at the point of catch can also be valuable for fisheries management, particularly stock assessment and marine spatial planning efforts.

Electronic catch reporting has already been tested successfully in several domestic wild-caught fish markets, including in the United States and the European Union.[1] In these jurisdictions, electronic catch reporting systems, and the associated analytics performed on the data collected through them, are well-recognized aspects of a broader approach to marine ecosystem management.

Illegal, Unreported, and Unregulated Fishing

The International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated (IPOAA/UU) Fishing of the Food and Agriculture Organization (FAO) of the United Nations will be used by USAID Oceans as the reference for what constitutes illegal, unreported, and unregulated (IUU) fishing (see FAO 2001). In brief, IUU fishing refers to those vessels operating in violation of the laws of a fishery or fisheries that are under the jurisdiction of a coastal state or to high seas fisheries regulated by regional organizations.

Unreported fishing refers to catch that has not been reported, or has been misreported to the relevant national authority, in contravention of national laws and regulations or of the reporting procedures of regional organizations.

Unregulated fishing refers to fishing conducted by vessels without nationality, or by those flying the flag of a State not party to an organization, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organization; or in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

IUU fishing on the high seas and within a Coastal State exclusive economic zone (EEZ) has significant negative ecological, economic, and social impacts, disproportionately affecting developing countries. To effectively combat IUU fishing, the illegality of the practice needs to be uniformly established, the likelihood of being caught increased, and market access restricted for IUU fish products.

[1] See DG-MARE Electronic Reporting and Recording System online at: http://ec.europa.eu/fisheries/cfp/control/technologies/ers/

Oceans Governance

In 2013, the Global Oceans Commission (GOC) was initiated as an independent, international body of globally-recognized experts to raise awareness and promote solutions relating to the governance of the high seas (i.e., areas beyond national jurisdiction/EEZs). Between 2013 and 2016, the GOC released a series of reports designed to address key issues relating to oceans governance, including addressing IUU fishing. The GOC issued several recommendations, relevant to USAID Oceans, calling upon:

- Members of the International Maritime Organization (IMO) to require that the mandatory requirements for IMO numbers and tracking already in place for merchant vessels be extended to all fishing vessels fishing within the high seas;
- Coastal nations and Regional Fisheries Management Organizations (RFMOs) to ban at-sea transshipment of fish;
- Coastal nations to commit to and fast-track the entry into force of the Port State Measures Agreement (PSMA; see FAO 2009[2]), by urging all States who are not yet party to this agreement to expedite their policy instruments of adherence or ratification;
- All stakeholders to work together to build a global information-sharing platform for real-time sharing of data on high seas fishing vessels and their activities so as to deter IUU fishing and promote traceability; and
- Commercial seafood processors and retailers to commit to sourcing sustainable products, including the adoption of effective catch documentation and traceability systems.

In support of these goals, the GOC encourages civil society organizations and private sector partners to more aggressively embrace their role as independent watchdogs and market influencers regarding the performance and transparency of RFMOs, Flag States, and Port States. The GOC calls upon local, national, and international authorities to cooperate with such independent, non-government organizations (NGOs) and private sector partners.

Seafood Supply Chains

For the purpose of this document, seafood supply chains refer to the collection or network of all actors associated with a wild-caught seafood product, reflecting its movement from the point of catch through to the end-sale of the product to a consumer. Although seafood supply chains also apply to aquaculture-produced seafood, this technical document does not explore those supply chains as USAID Oceans is a wild-caught seafood-focused program.

Typical actors within a wild-caught seafood supply chain include: the fishing operation for the harvest event (point of catch); catch transshippers (either at sea or once directly off-loaded in port); first receivers (including at landing points, carrier vessels, and mini-plants); second receivers (including aggregators, pack houses, and suppliers); first and second processors; cold chain facilities; actors involved in seafood storage, supply, and export logistics; seafood buyers, including foreign importers; international customs and trade entry within a regulated market state jurisdiction; and wholesale and retail distributors.

[2] 2009 FAO Agreement on Port State Measures to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated Fishing; accessed online at: http://www.fao.org/fishery/psm/agreement/en

Existing CDT Initiatives

Existing and relevant catch documentation and traceability initiatives must be acknowledged and should be integrated and supported under USAID Oceans' CDTS approach. Current, significant initiatives are spear headed by the five following major groups:

1. Supply Chain Initiatives: Based on food traceability, generally, with a focus on products that have been processed, packaged, and utilize a bar code, Radio-Frequency Identification (RFID) tag, or other electronic tracking tool to achieve electronic, end to end, interoperable traceability. There are a number of standard and de facto industry standard data formats already in widespread use.

2. Customs Agencies: "Single Window" electronic clearance initiatives that deal with all goods, not specifically seafood. They tend to align, to some extent, with supply chain data standards and adopt similar approaches.

3. Government Agencies: National governments that import a large volume of seafood from Southeast Asia each year have launched major initiatives to combat IUU fishing, such as the U.S. Presidential Taskforce on Combating IUU Fishing and Seafood Fraud and the European Union's IUU Catch Regulation (see Section 2.4).

4. Fisheries Authorities: Various electronic reporting systems, involving web-based data entry, data logging with later upload and, in some cases, real-time reporting via satellite communications. The data standards used tend to parallel existing paper logbook formats, and can be highly specific to an individual regulator. Some pan-regional standards exist, primarily at the level of the European Union, and some data exchanges between RFMOs. There is wide variation in approach to data entry, with some regulators specifying an application (for example, using tablets and smartphones rather than laptops), while others define only the data standard and some form of approval process for software vendors.

5. Fishing Industry: Many commercial harvesters use software to manage their production process. This includes, along with other data, detailed catch logs. In many cases the data collected for internal purposes is more granular than what is required by regulators; which raises the question of whether such systems might automatically generate regulatory and traceability reports — thus reducing the compliance burden for industry.

6. Independent Certifiers: Most systems of this nature address points early and late in the supply chain (i.e., point of catch and retail) and rely on a database of record maintained by the certifier, with some form of website access provided for the harvester or processor, and separately for retailers and/or consumers.

7. NGOs and For-Profit Vendors: A number of NGOs, profit, and not for profit organizations have launched initiatives to combat IUU fishing, conducting significant research in the region and bringing awareness to IUU impacts. Increased awareness has brought additional funding and resources to intervention efforts.

1 INTRODUCTION

1.1 Purpose of this Document

The purpose of the USAID Oceans and Fisheries Partnerships' (USAID Oceans) Fisheries Catch Documentation and Traceability in Southeast Asia: Technical Overview and Specifications (CDT201) is to outline USAID Oceans' technical approach and specifications to designing, testing, and implementing a CDTS with public and private partners in Southeast Asia. This document follows USAID Oceans' *Fisheries Catch Documentation and Traceability in Southeast Asia: Conceptual Overview*, also referred to as the CDT101, released in 2016. This technical overview serves as a longer, more in-depth technical addendum to the non-technical conceptual overview, geared towards technical experts and service providers, academia, and other interested stakeholders including (but not limited to): U.S. government counterparts, including the U.S. National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of the Interior; commercial stakeholders operating within the seafood supply chain; national regulators; private sector technology partners; international fishing and shipping industry partners; seafood certification organizations; technical and scientific organizations; and academia. By releasing this document, USAID Oceans hopes to clearly and transparently share its proposed technical approach and specifications relating to the CDTS.

1.2 Situation Analysis and Theory of Change

Seafood is the most widely traded animal protein on Earth.[3] It plays a critical role in global food security, accounting for nearly one-fifth of humanity's protein intake. With the waters of the Asia-Pacific region being home to the most biologically diverse and productive marine ecosystems on Earth, it is no surprise that Southeast Asia's commercial fisheries supply one of the largest and most active seafood markets in the world, exporting products daily to international markets, including the United States (US), the European Union (EU), and China, Japan, Korea, and Russia. Importers rely heavily on Southeast Asia's seafood products, with the US importing approximately 90 percent of the seafood it consumes — and nearly half being sources from Southeast Asia.[4]

The marine ecosystems of Southeast Asia are a vital source of daily food and income for people living in the region. Similar to global trends, capture fisheries' production in Southeast Asia has risen steadily during the past several decades.[5] A continued demand for seafood from the region's fisheries has impacted the productivity and health of the region's marine ecosystems, and is degrading or destroying native marine species and the habitats that they depend upon. Chief among the threats to the region's marine resources and habitats are IUU and unsustainable fishing practices, along with unsustainable rates of extraction; that is, taking more of a fishery population than will allow the population to optimally replenish itself. Cumulatively, these threats negatively impact marine biodiversity, food security, and livelihoods in the region.

[3] Rabobank "Seafood is world's most widely traded animal protein" accessed online at: https://www.seafoodsource.com/news/supply-trade/rabobank-seafood-is-world-s-most-widely-traded-animal-protein

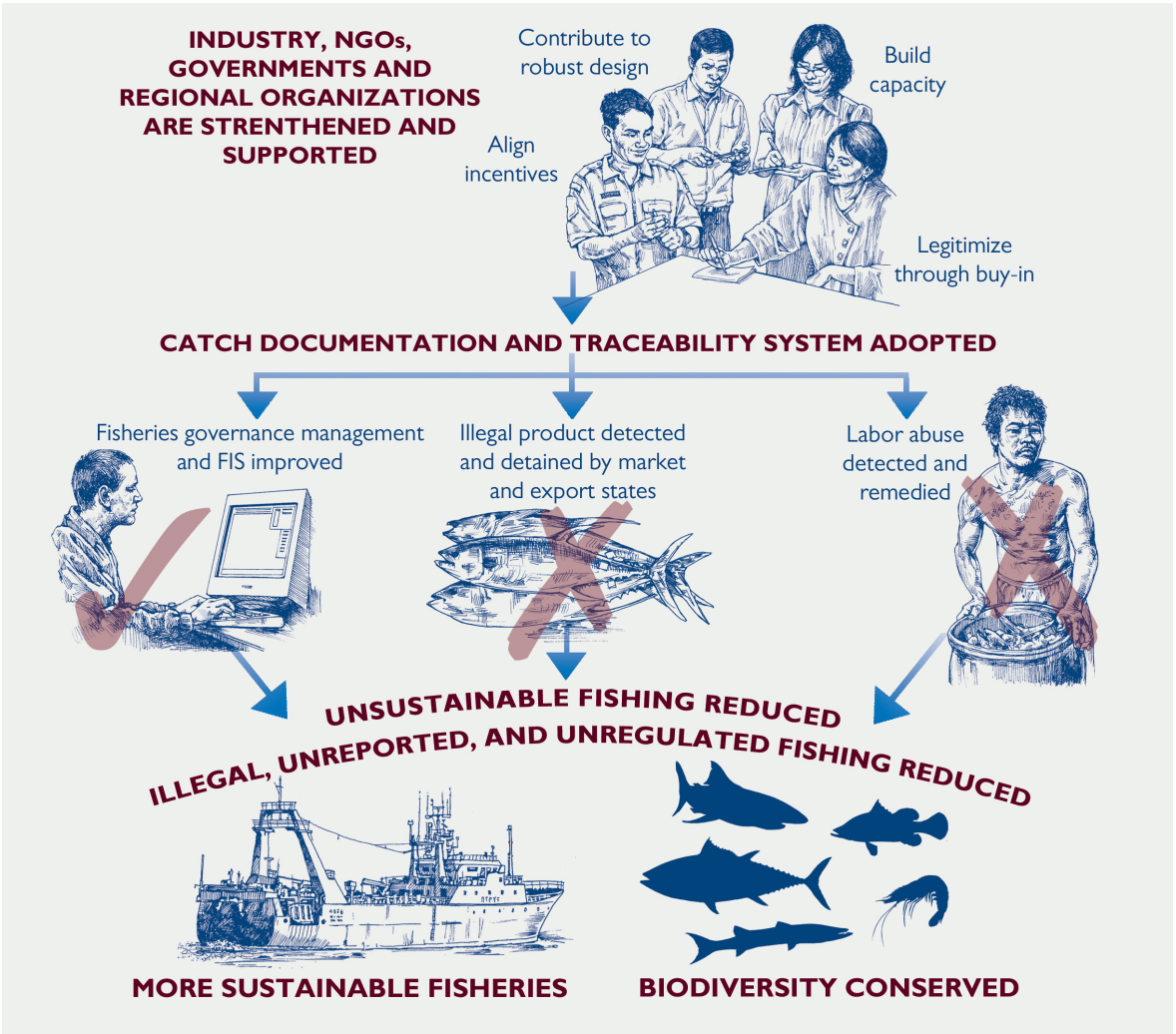
[4] Ganapathiraju Pramod, Katrina Nakamura, Tony J. Pitcher, and Leslie Delagran 2014. "Estimates of illegal and unreported fish in seafood imports to the USA" Marine Policy 48: 102-113. http://www.sciencedirect.com/science/article/pii/S0308597X14000918?via%3Dihub

[5] FAO (2014) The State of World Fisheries and Aquaculture accessed online at: http://www.fao.org/3/a-i3720e.pdf

Additional challenges include unethical and illegal labor practices, engaged in by some fishery operators in the region, which may include unfit working conditions, labor rights violations, and the use of indentured servitude and slave labor. These issues have gained traction in the media, garnering attention from international news outlets and prompting human welfare initiatives and demand for increased traceability. Concerns calling for enhanced traceability include recent studies that suggest that a significant proportion of seafood products being imported by the U.S. are illegally caught and/or mislabeled.[6] Insufficient fisheries management and a lack of transparency in terms of how, where, and by whom seafood products are being caught threaten to perpetuate such challenges. Enhanced CDT is growing in demand, as are the impacts from IUU and unsustainable fishing practices.

USAID Oceans' Theory of Change model (Figure 1) is built upon these realities. Through engagement of the multitude of players that have the potential to positively impact the region's fisheries challenges — industry, governments, NGOs, and regional organizations — USAID Oceans strives to build capacity within the sector and support regional efforts to combat IUU fishing. With collaboration, adoption of the CDTS system will be possible, resulting in improved fisheries management and governance, enhanced ability to detect illegal products, and increased awareness and support of labor abuse detection and interventions.

Figure 1. The USAID Oceans' Theory of Change Model



[6] Oceana 2013. Oceana Study Reveals Seafood Fraud Nationwide. Accessed online at: http://usa.oceana.org/sites/default/files/reports/National_Seafood_Fraud_Testing_Results_FINAL.pdf.

1.3 The USAID Oceans and Fisheries Partnership

Seafood accounts for approximately 17 percent of global protein intake — with Southeast Asia housing some of the most productive and biologically diverse marine ecosystems that supply the global seafood market. These ecosystems provide food and income to over 200 million people in the region;[7] however, unsustainable and illegal fishing practices threaten biodiversity, food security, and livelihoods.

USAID Oceans is a five-year program and a partnership between USAID and the Southeast Asian Fisheries Development Center (SEAFDEC). The activity aims to strengthen regional cooperation to combat illegal, unreported, and unregulated (IUU) fishing and conserve marine biodiversity in the Asia-Pacific region. USAID Oceans seeks to improve integrated and sustainable fisheries management, focusing on priority species that are vital for food security and economic growth and are under threat from IUU fishing and seafood fraud. The activity supports U.S. and regional efforts in Asia and the Pacific to promote sustainable fishing practices, collaborating with organizations and agencies such as the Coral Triangle Initiative for Coral Reefs, Fisheries and Food Security (CTI-CFF) and NOAA.

Core to the Activity's objectives is combating IUU fishing, enhancing fisheries management, and improving human welfare through enhanced CDT. To this end, USAID Oceans will design, develop, implement, and test an electronic Catch Documentation and Traceability System (CDTS), harnessing cutting edge technology and leveraging global expertise.

USAID Oceans works with partners across the Asia-Pacific region to synergize with and build upon ongoing and emerging initiatives to develop CDT systems. This includes the ASEAN Catch Documentation Scheme (ACDS) which will serve as a foundation for program efforts as well as the various national level CDT initiatives being undertaken. The CDTS will seek to leverage ongoing compliance efforts including those to meet European Union and national regulations in order to limit data collection burdens and improve data compatibility across user needs.

1.4 Overview of the USAID Oceans Approach and Strategy

USAID Ocean will work with information technology (IT) partners to leverage, bridge existing, and create new technologies to cultivate an environment of innovation and solution-building for a financially- and technically-sustainable CDTS.

USAID Oceans aims to improve marine biodiversity conservation and increase the sustainability of Southeast Asia's international seafood trade through five strategies. These strategies align with regional partner, SEAFDEC's, objectives to build regional capacity and enhance fisheries sustainability, and supports their work on the ACDS. The ACDS was developed to provide a common regional catch documentation scheme to combat IUU fishing and enhance international and intra-regional trade of fish and fisheries products from the ASEAN Member States. The draft ACDS was developed in 2014, and was circulated to ASEAN member countries in early 2015, with regional work ongoing to finalize and implement the scheme. USAID Oceans' CDTS seeks to align with and complement the ACDS and other regional efforts.

Catch Documentation and Traceability. USAID Oceans proposes the development of a transparent and financially sustainable electronic CDTS to help ensure that fisheries resources from Southeast Asia are legally caught and properly labeled. The CDTS will be integrated with fisheries information systems (FIS) to encourage the collection and analysis of ecological and economic data related to seafood products throughout the seafood supply chain, so that they are traceable from their point of catch to the importer and end-retailer. The integrated CDTS will provide an important opportunity to support effective national fisheries monitoring, control, and surveillance (MCS), as CDT remains one of the most valuable and comprehensive methods for collecting fisheries statistics at a reasonable cost. Catch documentation is also valuable for fisheries management, particularly for stock assessment and marine spatial planning efforts.

Ecosystem Approach to Fisheries Management. The global shift away from the single-species fisheries management approach of the past and towards the EAFM approach seeks to balance environmental and

[7] Harvey, Nick. Global Change and Integrated Coastal Management: The Asia-Pacific Region. Springer, 2006.

socioeconomic concerns through improved fisheries governance. USAID Oceans' CDTS will support EAFM fishery information needs. CDTS data, collected over time and across multiple fisheries and ecosystem types, will help decision-makers and stakeholders more effectively and adaptively manage fisheries at increasingly large scales, both ecologically and economically. The implementation of an EAFM approach at a site-level will also encourage the integration of single, site-specific fisheries within a wider ecosystem context.

In partnership with national institutions, the USAID Oceans team will increase the capacity of local partners and stakeholders in site-based EAFM and local fisheries governance. USAID Oceans will leverage previous regional and national EAFM capacity building investments made in the region, such as USAID-funded CTI-CFF training modules.

Public-Private Partnership Engagement. To ensure that the CDTS meets the needs of a diverse set of stakeholders, USAID Oceans has engaged with and continues to develop public-private partnerships (PPPs) to encourage the full and inclusive testing and adoption of a CDTS that supports sustainable fisheries management. USAID Oceans will develop strategic market-driven partnerships that leverage the seafood industry's technical expertise, market position, and capacity to engage national and local government counterparts. Fishing companies, brokers, and NGOs will be consulted on the CDTS' design in order to ground-truth and motivate seafood suppliers to adopt and scale the system across multiple countries and fisheries in Southeast Asia, and to provide a voice in the development of traceability standards and requirements. USAID Oceans is engaging multiple stakeholders — including government agencies, private fishing companies, fishing groups and associations, intergovernmental organizations, and NGOs — from across the international seafood and information technology industries to support the design, testing, and implementation of the CDTS. USAID Oceans has engaged technology partners to assist in the testing and integration of CDTS-sourced data to enhance existing and new FIS for adaptive fisheries management purposes.

Human Welfare. USAID Oceans aims to encourage the adoption of and adherence to safe, legal, and equitable labor standards and support of gender equity within the region's seafood industry. To this end, the design of the CDTS will include a collection mechanism for relevant labor data to monitor labor practices and enhance both worker protection and voluntary compliance with labor standards. In turn, the actual costs of labor associated with fisheries operations will be more transparently reflected while workers will be empowered to make informed employment decisions and will benefit from increased access to enforcement and grievance communication mechanisms.

Regional Coordination and Capacity Building. USAID Oceans will coordinate its strategies and activities across Southeast Asia in close coordination and consultation with relevant regional organizations and partners, as well as support efforts to build capacity for regional fisheries coordination and governance. USAID Oceans aims to strengthen regional coordination and governance of transboundary fisheries, and build capacity to support the implementation of the CDTS. A strengthened network of regional partners will benefit both national and local fisheries management efforts. To achieve these objectives, USAID Oceans has partnered with regional organizations, SEAFDEC and CTI-CFF. These organizations are critical to regional coordination and collaboration with national government counterparts. Through these relationships, USAID Oceans has established the USAID Oceans National Technical Working Group — a working group comprised of country-appointed representatives that will work in partnership with Oceans' technical leads on work stream-specific objectives.

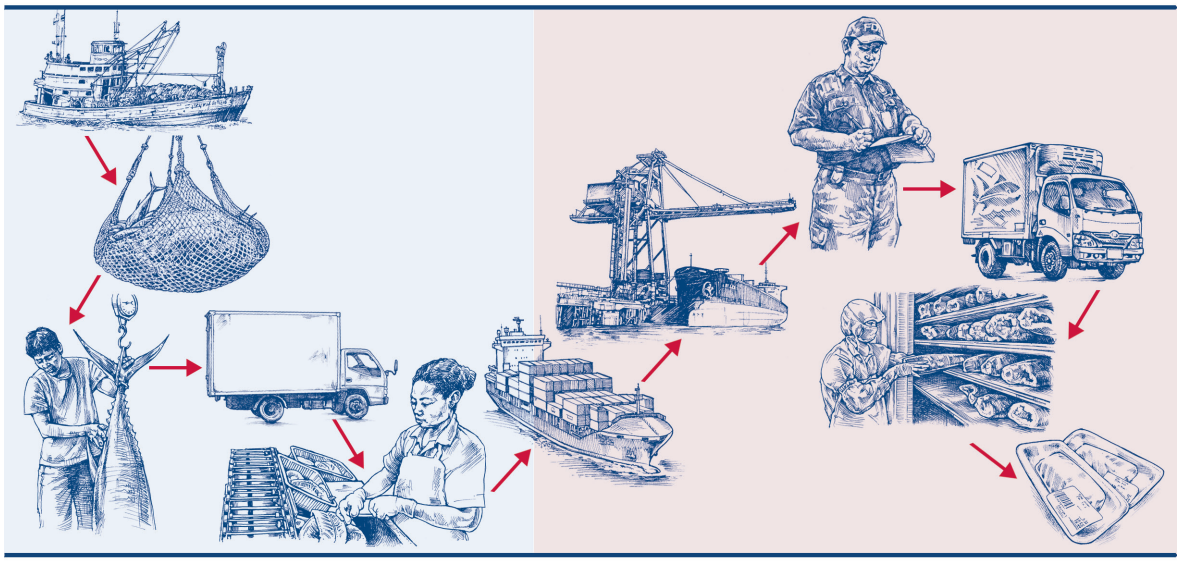
1.5 Introduction to Catch Documentation and Traceability

A foundational concept of the USAID Oceans Activity is the documentation and traceability of seafood products after being caught. For project purposes, CDT is defined as: recording and sharing verifiable information relating to a specific seafood product throughout the product's movement within the full seafood supply chain. For example, information relating to a specific seafood product would be captured incrementally as it moves through all points within the supply chain: from the point of catch, to landing, through the various buyers, processors, shippers, importers, distributors, and retailers that handle the product, all the way to the end consumer.

At its simplest, CDT means that once captured, the full "path" of a traceable seafood product can be followed, from the fishing boat to the consumer's plate. The assumption is that CDT will not only allow consumers to select and purchase seafood products that can be traced and verified as legal, equitable, and sustainable, but also discourage untraceable or questionably sourced seafood products being imported by foreign markets or entering foreign markets. Recent technological advances have supported increased capacity for reporting and connectivity, enabling at-sea data capture for traceability purposes in a manner that was once limited only to shore-side landing sites or storage and processing facilities. Thus, such provides the opportunity to expand and enhance traceability reporting, which has often been limited by connectivity and technology restrictions.

Within the supply chain, USAID Oceans proposes to facilitate traceability from the cold storage and shipping part of the chain (where standards exist) back to the processor and harvester (where standards are less developed). The objective is to promote seafood traceability and transparency to be embedded within existing fisheries information systems (operated by fisheries regulators), "Single Window" customs and importing systems (operated by customs agencies), and catch reporting, logistics, and Enterprise Resource Planning (ERP) systems (operated by harvesters and processors within the supply chain).

Figure 2. The Seafood Supply Chain



*A simple example of a **seafood supply chain** involving foreign consumers would include actors in two countries: the country where the seafood product was harvested (for example: Thailand), and the country where the seafood product was being imported for consumption (for example: the United States). Actors involved in such a supply chain often include: the fishing operator who harvested the seafood product; the handlers and processers of the seafood product; the cold storage shippers; fisheries regulators from both the exporting and importing nations; customs representatives and food safety regulators from the importing nation; retailers; and the end consumer. In some cases, regional and transnational regulators — such as Regional Fisheries Management Organizations (RFMOs) — are also involved in the supply chain.*

To capture and exchange 'traceable' data reliably within such a diverse environment of supply chain actors presents a variety of technical, political, and logistical challenges. Additionally, various stakeholders (i.e., harvesters, processors, ports/authorities, fisheries regulators, cold chain/operators, customs agencies, wholesalers, retailers, NGOs, and technology suppliers) each bring their own unique perspectives and interests regarding supply chain traceability. In order to be successful, USAID Oceans needs to account for and incorporate the diverse needs and perspectives of the full range of relevant stakeholders within the supply chain.

USAID Oceans will be responsive to both commercial and small-scale fisheries in developing a CDT system. To account for the differences in scale and capacity, USAID Oceans will work with actors in the small-scale supply chain as well as governments to build capacity and facilitate solutions. Additionally, USAID Oceans will help medium- to large-scale fisheries to make their systems more efficient, improving data flow and interoperability with others in the supply chain. USAID Oceans recognizes the challenge of building a CDTS that addresses the complexity of large-scale operations, while remaining accessible and practical for small-scale fishers. USAID Oceans aims to develop a system that is accessible to all players, provides equal opportunity for market access, and offers value to the end-user through operational benefit.

In the context of the Southeast Asian seafood market, CDT will help industry partners and national governments address a number of critical issues, not only including IUU fishing, the mislabeling of seafood products and seafood safety issues — but also legal, safe, and equitable labor practices, gender equity, and enhanced capacity and data for improved fisheries assessments and management. USAID Oceans will work with national government counterparts to leverage data collected through the CDTS to benefit fish stock assessments and other fisheries practices promoting sustainability. Through additional data in electronic form, catch data is more easily collected, analyzed, and tracked to help national fisheries agencies establish, monitor and calibrate management practices and regulations that encourage the sustainability of fish stocks in priority areas.

Further detail is provided on how traceability is expected to address each of these key issues in USAID Oceans' overview document, *Fisheries Catch Documentation and Traceability in Southeast Asia: A Conceptual Overview* (USAID Oceans, 2016).

One of the major concerns within the seafood industry when it comes to a CDT system and especially, digital traceability, is cost. However, recent investigations on the potential return on investment (ROI) of traceability have identified at least three major types of value that can be generated from full-chain traceability (meaning traceability across multiple nodes in the supply chain from water to end user). This value, in many cases, can help offset or even recoup the initial costs of traceability investments. They include:

- Efficiency-based ROI opportunities: These can generate value that is locked in supply chains that have not optimized distribution and logistics, internal handling, processing, etc. Traceability helps supply chains to better coordinate their efforts, and helps individual actors to identify where value is being lost.
- Market-based ROI: Returns that result from accessing new markets that have strict traceability requirements (e.g. access to the EU and US markets), and optimizing the product's form and destination with more dynamic, more accurate supply and demand data.
- Premium-based ROI: Though more theoretical than realized, anecdotal information points to a strong potential for price premium based on trusted story and provenance of the product. Further studies are underway to document exactly how this value may manifest.

1.6 Overview of the U.S. Policy Context

On June 17, 2014, the White House released a U.S. Presidential Memorandum titled, *Establishing a Comprehensive Framework to Combat Illegal, Unreported and Unregulated Fishing and Seafood Fraud.* Key excerpts from the Memorandum that are relevant to USAID Oceans include:

- Section 1 (Policy): "(a) It shall be the policy of the United States for all executive departments and agencies to combat IUU fishing and seafood fraud by strengthening coordination and implementation of relevant existing authorities and, where appropriate, by improving the transparency and traceability of the seafood supply chain…"
- Section 4 (Functions): "(a) …The Task Force should consider a broad range of strategies, including implementation of existing programs, and, if appropriate, development of new, voluntary or other, programs for seafood tracking and traceability [including] (vi) industry approaches that contribute to efforts to combat IUU fishing and seafood fraud, including with respect to seafood traceability and ways to minimize any costs and reporting burdens on small businesses."

The Presidential Memorandum established a Task Force of federal agencies, co-chaired by the U.S. Department of State and NOAA, which was directed to provide recommendations on combating IUU fishing and seafood fraud, within six months' time.

After the recommendations were developed and released for a six-month public review and comment period, on December 18, 2014, the IUU Task Force released its recommendations for combating IUU fishing and seafood fraud. Key excerpts from the IUU Task Force Recommendations that are relevant to USAID Oceans include:

Recommendations 14 and 15 – Create a Risk-Based Traceability Program to Track Seafood from Harvest to Entry into U.S. Commerce:

- "The process to develop types of information and operational standards … should allow for input from interested stakeholders including industry, non-governmental organizations, supply-chain experts, and state, local and foreign governments. It should also draw upon and utilize applicable experience, best practices, and existing standards where possible."

Following off Recommendation 14:

- "A program will be developed and implemented to establish these types of information and operational standards as pre-requisites for entry into commerce. The program will initially be applied to certain fish or seafood that are of particular concern because they are subject to significant seafood fraud or because they are at significant risk of being caught by IUU fishing."

The IUU Task Force requested comments from key stakeholders and interest groups to advise on effective implementation of the proposed recommendations. The public comment period began December 18, 2014, and closed on January 20, 2015. Subsequently, on March 15, 2015, the IUU Task Force released its *Action Plan for Implementing the Task Force Recommendations* on combating IUU fishing and seafood fraud. Key components of the Action Plan that are relevant to USAID Oceans include:

- It is in the interest of the U.S. to promote a comprehensive framework that supports sustainable fishing practices while combating seafood fraud and the sale of IUU seafood products, including by implementing technologies that improve the transparency and traceability of products through the seafood supply chain;
- The IUU Task Force includes agency members such as the Department of Homeland Security and Department of Defense, which have authorities at the US border and within US waters to inspect and seize commodities such as fraudulent or illegally imported seafood; and
- USAID should play a lead role on implementing capacity building efforts that support sustainable fisheries management and the harvest of legal and traceable seafood products within major seafood exporting countries, including in developing nations.

In September 2016, NOAA's National Marine Fisheries Service (NMFS) released regulations on "Trade Monitoring Procedures for Fishery Products; International Trade in Seafood; Permit Requirements for Importers and Exporters" (81 FR 51126). These regulations call for capacity development, specifically relating to USAID and the U.S. Department of State to work "…with countries to help develop electronic reporting systems that can produce the information needed at the point of catch and feed into traceability systems that will follow the product throughout the supply chain." Enhancement of "… seafood traceability infrastructure among the developing countries" of Southeast Asia is cited by NOAA NMFS in the regulation as being undertaken through the USAID Oceans Activity.

On December 8, 2016, NOAA NMFS released the regulations establishing the "Seafood Import Monitoring Program" (81 FR 88975), implementing the IUU Task Force's Action Plan Recommendations 14 and 15. The Seafood Import Monitoring Program (SIMP), which has an implementation date of January 1, 2018, establishes, for imports of certain seafood products, reporting and recordkeeping requirements for the importer of record in order to prevent IUU-caught and/or misrepresented seafood from entering U.S. commerce. This is the first-phase of a risk-based traceability program, focusing on an initial list of imported fish and fish products identified as at-risk and particularly vulnerable to IUU fishing and/or seafood fraud.

The data collected under the SIMP will allow priority species of seafood to be traced from the point of entry into U.S. commerce back to the point of harvest or production to verify that the seafood was lawfully harvested and produced. Catch and landing documentation will be through the International Trade Data System (ITDS), the U.S. government's single data portal for all import and export reporting and the importer of record will be required to keep records regarding the chain of custody of the fish or fish product from harvest to point of entry into the U.S.

1.7 Overview of the Regional Coordination and Development of Public and Private Partnerships

USAID Oceans is engaging a wide range of stakeholders—governments, intergovernmental organizations, associations, seafood and technology companies, fisher groups, NGOs and others—as partners in the design, testing, and implementation activities of the CDTS (see Figure 3).

Government Partners. Close collaboration with and support from governments is critical to USAID Oceans' success. Government involvement in the design, implementation, and management of the CDTS (or components thereof) is imperative, as they are main providers of some of the key data elements (KDEs) and have a role in ensuring the quality and authenticity of CDTS-contained data. (See Section 4.2 and Annex IV for more details on KDEs). Adequate regulations can be key drivers for CDTS adoption.

Partnerships with regional organizations, SEAFDEC and CTI-CFF, aid in grounding the Activity in the region and facilitate close collaboration with the ASEAN and CTI-CFF member countries. Through SEAFDEC and CTI-CFF, USAID Oceans is able to tap into each country's environmental resources and fisheries agencies. A USAID Technical Working Group has been formed, with agency representatives from each country that mirror the Activity's individual work streams. CDT counterparts work closely with the USAID Oceans team to ensure country realities and unique requirements are reflected in the CDTS design and implementation plan.

Private Sector Partnerships. USAID Oceans will develop strategic market-driven partnerships that take advantage of the industry's technical expertise, market position and capacity to engage their national and local government counterparts. Developing partnerships in the seafood industry grounds the CDTS within the seafood industry's regional and international realities, and will provide increased scale and sustainability of the system in the long-term. Engaging buyers, seafood companies, and NGOs early in the design of the CDTS will be essential to motivate suppliers to adopt and scale the CDTS across multiple countries and fisheries in Asia Pacific, and provide a more common industry voice on traceability standards and requirements.

Given the scale of the challenge, USAID Oceans will also engage development partners, foundations and other funding partners to support the deployment and expansion of the CDTS. Banks, impact investors, and other financial institutions can provide sustainable investment and financing mechanisms to address cost barriers and support wider adoption of the CDTS.

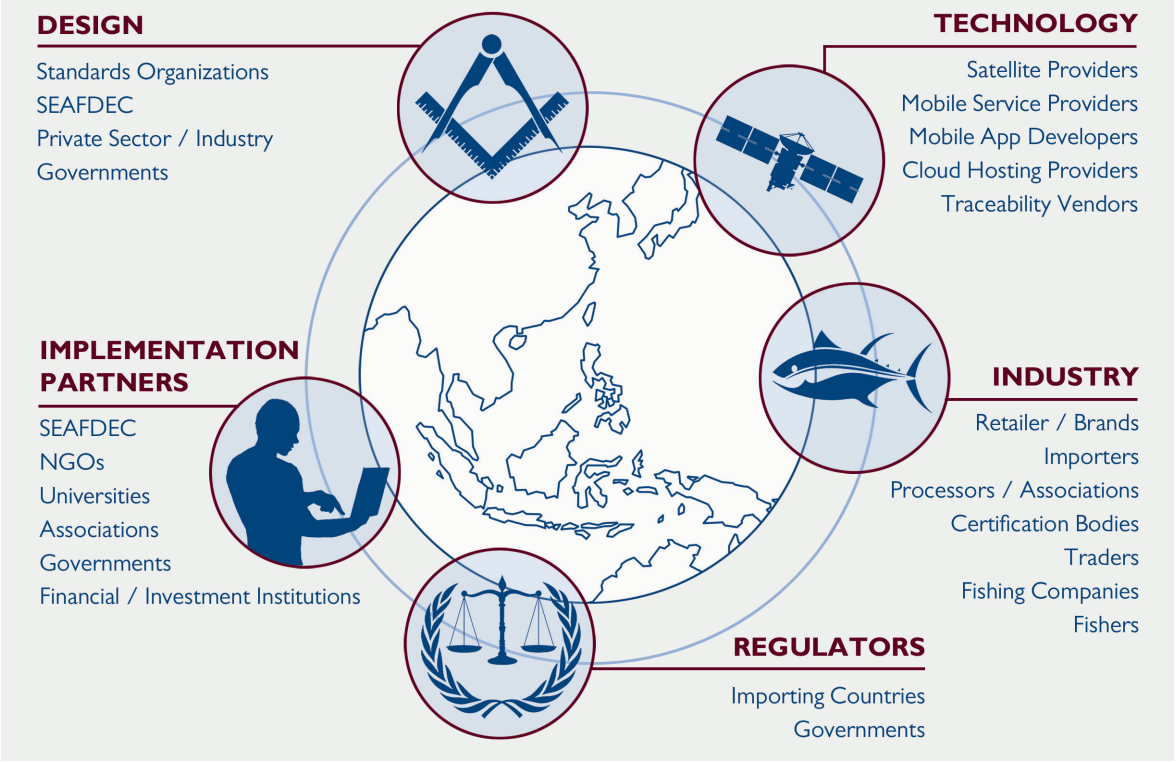
USAID Oceans is looking to develop a number of strategic partnerships with technology providers to harness the latest communication technologies and traceability innovations to ensure the successful development, implementation, and adoption of the system. For industry and governments, partnerships will play a key role in lowering the risk involved in adopting technologies. Partnerships with technology companies can also demonstrate an interoperable and flexible CDTS that works for multiple value chains, different industry scales, and markets. Initially, USAID Oceans will focus on identifying partners that can support the design and development of the technical architecture for the minimum viable approach (MVA) of the CDTS (see Section A1.1 for further information on the MVA). USAID Oceans will also engage technology partners to:

- Address connectivity issues at sea, in remote landing areas, and in communities to enable data collection for both traceability and fisheries management;
- Optimize catch reporting mobile applications for electronic data capture and verification anywhere at sea, and remote areas not currently serviced by reliable communication services using existing low cost technologies;
- Demonstrate interoperability between multiple technology providers in the CDTS demonstration, and identification of sustainable business modeling to effectively scale the system;
- Develop and deploy mobile application and wireless mobile-to-mobile sensor developments for collecting environmental and traceability data; and
- Develop and deploy cost-effective data collection and communications technologies for small-scale artisanal and small-scale commercial fishing vessels.

Key components of USAID Oceans' PPP approach include:

- A focus on partnerships within the fisheries industry;
- Close coordination with regional partners such as SEAFDEC and CTI-CFF;
- Partner capacity building and technical assistance at national and site levels; and
- Engagement and consultation with partner standards organizations.

Figure 3. The wide network of USAID Oceans' partners



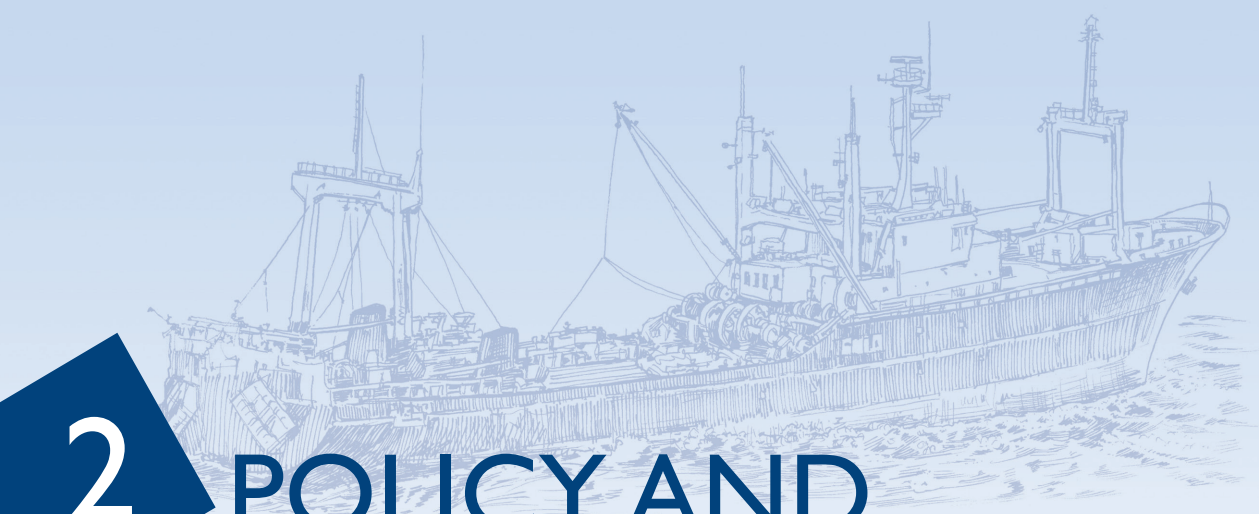
1.8 Engagement with Stakeholders

In order to engage directly with relevant stakeholders and expert bodies, USAID Oceans has entered into several partnership agreements with a number of organizations and partners, including prominent standards organizations (e.g., the Global Food Traceability Center (GFTC)); certification organizations (e.g., Control Union); non-governmental organizations (e.g., Future of Fish); industry associations (e.g., the International Pole and Line Foundation (IPNLF), Asosiasi Perikanan Pole & Line dan Handline Indonesia (AP2HI); and technology and industry partners (e.g., Thai Union). USAID Oceans is committed to regularly engaging with and inviting the ideas and perspectives of these stakeholders into the design, testing, and implementation of the proposed CDTS.

To this end, USAID Oceans has created a Technical Advisory Group (TAG) comprised of a number of technical stakeholders and experts to guide and support the design, development, and implementation of the CDTS. Current membership includes representatives from several relevant non-governmental organizations, industry standards-setting bodies, private companies, and independent technical experts and advisors. USAID Oceans' TAG will bring a wide diversity of technical expertise and experience into design, testing, and implementation while building confidence in the CDTS with industry, non-government, and project implementation partners. The TAG will review and monitor CDTS testing and implementation activities during the second and third years (2016-2018) of the project at the Bitung and General Santos City project learning sites.

1.9 Capacity Building and Technical Assistance

Working with its partners, USAID Oceans aims to build the technical capacity of both commercial fisheries operators and national regulators to test and adopt the CDTS within selected fishery supply chains at sites throughout Southeast Asia. For example, the Governments of Indonesia and the Philippines have partnered with USAID Oceans to establish two project "learning sites." USAID Oceans will test and implement the CDTS in the learning sites — the major fisheries centers of Bitung, Indonesia (Northern Sulawesi) and General Santos City, Philippines (Mindanao). USAID Oceans will work with national and local partners at the implementation sites to build the capacity for testing and implementation of the CDTS, and provide ongoing technical assistance, including training and site-level IT support, relating to site-based CDTS testing and adoption. Such local assistance will be matched with national-level capacity building and technical assistance with national and provincial fisheries management and regulatory agencies. To further regional expansion and capacity building, USAID Oceans has partnered with the remaining ASEAN and CTI-CFF member countries to establish "expansion sites," in which learning site lessons and best practices will be applied.



2 POLICY AND REGULATORY CONTEXT

There is a significant amount of international media attention and consumer interest to ensure that imported seafood products were captured using sustainable, legal, and safe capture and processing methods. With increasing international scrutiny and concern regarding seafood products exported from Southeast Asia, the policy and regulatory context within which USAID Oceans operates remains a dynamic and regularly-changing environment. This section outlines some of the key fisheries management policies that are shaping the evolving legislative context, and that are further necessitating an electronic CDT system in Southeast Asia.

2.1 Relevant Fisheries Management and Catch Documentation Policies

GLOBAL POLICIES

There are a number of relevant global policies that relate to fisheries management, catch documentation, and traceability. Two of the most notable international policies are the "Code of Conduct for Responsible Fisheries" (1995) and the "Port State Measures to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated Fishing" Agreement (2009) of the United Nations Food and Agriculture Organization (FAO). ASEAN nations are signatories of both the FAO Code of Conduct for Responsible Fisheries (CCRF) and the Port State Measures Agreement (PSMA).

Since 1995, the FAO CCRF has served as an international framework to guide the development of national and regional fisheries management efforts in Southeast Asia, including supporting the formulation of policies and legal and institutional frameworks to encourage sustainable fisheries management and economic well-being. As of June 2016, the PSMA became the first binding international treaty focusing specifically on curbing illegal fishing.

REGIONAL POLICIES

Within Southeast Asia, there are two key regional policies that underlie the regional move toward catch documentation and traceability: the **ASEAN Catch Documentation Scheme** (ACDS), and the **Regional Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated Fishing** (RPOA IUU).

The RPOA IUU was endorsed in 2007 by 11 signatory nations, including the ASEAN countries. The Asia-Pacific Fisheries Commission, SEAFDEC, and WorldFish also signed the agreement. The agreement aims to enhance and strengthen fisheries management in the region, through the management of fisheries capacity and combating IUU fishing in the South China Sea, Sulu-Sulawesi Sea, Gulf of Thailand, and Arafura-Timor Sea.

At the ASEAN-SEAFDEC Regional Technical Consultation on International Fisheries-related Issues in 2010, SEAFDEC was charged with documenting the lessons and recommendations regarding ASEAN member country experience in complying with European Union (EU) fishery import requirements (EC Regulation 1005/2008) to prevent, deter, and eliminate IUU fishing. Subsequently, at the 2010 Fisheries Consultative Group meeting of the ASEAN-SEAFDEC Strategic Partnership (ASSP), a call to develop a common catch documentation system was issued. As a result, the ACDS was developed as a non-regulatory set of guidelines regarding regional catch documentation efforts by ASEAN member countries. As of March 2016, an updated set of ACDS recommendations and catch documentation guidance was released by SEAFDEC, including sample catch declaration and logbook forms, processing statements, and export catch certificates.

2.2 Regional Fisheries Management Organizations

Regional fisheries management organizations (RFMOs) play an important role in the management of capture fisheries within Southeast Asia and the Western Pacific Ocean. USAID Oceans' approach is in alignment with key RFMO recommendations, including measures established by the Western and Central Pacific Fisheries Commission (WCPFC). In 2013, the WCPFC released the Conservation and Management Measure on Daily Catch and Effort Reporting (WCPFC Measure 2013-05) requiring that fishing vessels under operation complete "an accurate written or electronic log of every day that it spends at sea," pursuant with Article 10 of the WCPFC Convention. In 2014, the WCPFC released a discussion paper outlining the rationale and components of a standard catch documentation scheme (CDS) for the Western and Central Pacific Tuna Fisheries, which includes a recommendation that catch documentation should be designed as an electronic system. Further, WCPFC outlines catch documentation measures for transboundary seafood supply chains.

Other supporting RFMO requirements include the 2010 Resolution of the Indian Ocean Tuna Commission (IOTC) Compliance Committee's requirement for fishing vessels to maintain relevant information within an official fishing logbook to encourage catch documentation compliance and support MCS measures as required by the Commission; and the WCPFC's similar management measure provisions.

2.3 Relevant National Initiatives in Southeast Asia

Currently, both Indonesia and the Philippines are implementing national catch documentation schemes that are largely comprised of catch logbooks, paper-based documentation, and certificates for seafood products at the landing, shipping, and export points within the supply chain. These schemes are supported by national guidance, such as the Philippines Bureau of Fisheries and Aquatic Resources' issuance of Administrative Circular Order No. 251 (2014) on traceability for fish and fishery products, providing requirements on documentation for traceability for wild caught fish.

At USAID Oceans' project learning sites, Bitung and General Santos City, relevant paper-based systems will be migrated to and integrated within the learning site CDTS. USAID Oceans' approach to build upon and improve existing national CDT efforts, leveraging existing catch documentation systems, will encourage uptake of the CDTS by national and provincial government authorities.

Other relevant national initiatives include Thailand's investment in CDT. In 2016, the Government of Thailand began to test an electronic CDT software system developed for licensed commercial fishing operations in Thailand on mobile and handheld devices (e.g., smartphones and tablets). USAID Oceans is working with the Thailand Department of Fisheries to provide technical expertise and leverage results for regional learning and application.

2.4 Relevant Importing Policies and Regulations

THE UNITED STATES

On December 8, 2016, NOAA's National Marine Fisheries Service (NMFS) finalized the "Seafood Import Monitoring Program" or SIMP (81 FR 88975), establishing the first phase of traceability requirements for seafood imports into the United States, to be implemented beginning on January 1, 2018 (see Section 1.6).

The SIMP establishes, for imports of certain seafood products, reporting and recordkeeping requirements for the importer of record in order to prevent IUU-caught and/or misrepresented seafood from entering U.S. commerce. The regulations require that certain at-risk species, identified as vulnerable to IUU fishing and seafood fraud and imported into US markets, be traced from the point of entry into U.S. commerce back to the point of harvest or production to verify that the seafood was lawfully harvested or produced.

Seafood Import Monitoring Program: List of Priority Seafood Species

- Abalone*
- Atlantic Cod
- Blue Crab (Atlantic)
- Dolphinfish (Mahi Mahi)
- King Crab (red)
- Pacific Cod
- Red Snapper
- Sea Cucumber
- Sharks
- Shrimp*
- Swordfish
- Grouper
- Tunas: Albacore, Bigeye, Skipjack, Yellowfin, and Bluefin

* January 1, 2018, is the mandatory compliance date for most priority species listed in the rule, with shrimp and abalone compliance phased in at a later date.

As outlined by NMFS :

- "[The SIMP] establishes permitting, data reporting and recordkeeping requirements for the importation of certain priority fish and fish products that have been identified as being particularly vulnerable to IUU fishing and/or seafood fraud.
- The data collected will allow these priority species of seafood to be traced from the point of entry into U.S. commerce back to the point of harvest or production to verify whether it was lawfully harvested or produced.
- The collection of catch and landing documentation for these priority seafood species will be accomplished through the International Trade Data System (ITDS), the U.S. government's single data portal for all import and export reporting.
- [The SIMP] is not a labeling program, nor is it consumer facing. In keeping with the Magnuson-Stevens Act authority (under which the regulatory program has been promulgated) and the strict information security of the ITDS — the information collected under this program is confidential.
- The importer of record will be required to keep records regarding the chain of custody of the fish or fish product from harvest to point of entry into the U.S."

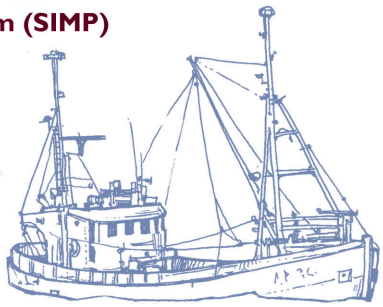
Important potential ramifications of the regulations include the establishment of seafood catch documentation and traceability as the new standard for seafood imports; and that private sector import, retail companies, and conservation NGO organizations in the U.S. will become active partners in seafood traceability and curbing IUU fishing.

To facilitate the importation process, the United States Customs and Border Protection (CBP) operates an automated commercial environment (ACE). In 2016, this became a 'single window' system through which all data and documentation relating to imported seafood is submitted for inspection and review to determine admissibility. The CBP's automated system includes an electronic data interchange through which all import and export data are filed electronically, as well as a secure data portal from which

users can generate reports and manage user (importer/exporter) accounts. The CBP requires that the manifests of all imported goods, including seafood products, be electronically transmitted through the ACE system. Therefore, USAID Oceans' CDTS must be compliant and compatible with CBP's data interchange needs.

On September 20, 2016, the U.S. Government finalized the rule titled, Trade Monitoring Procedures for Fishery Products; International Trade in Seafood; Permit Requirements for Importers and Exporters. The rule sets forth regulations to revise procedures and requirements for filing import, export, and re-export documentation for designated fishery products. NOAA NMFS sets forth regulations to integrate the collection of trade documentation within the government-wide International Trade Data System and requires electronic information collection through the automated portal maintained by CBP.

Information to be collected under the
Seafood Import Monitoring Program (SIMP)



Harvesting or Producing Entity

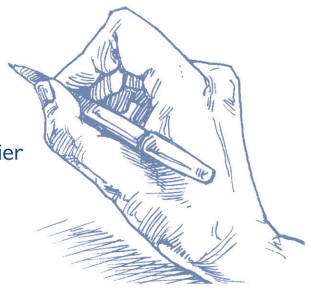
- Name and flag state of harvesting vessel(s).
- Evidence of authorization to fish (permit or license number).
- Unique vessel identifier (when available).
- Type(s) of fishing gear.

Seafood Product – what, when and where

- Species of fish — Scientific/Acceptable market name (ASFIS three-alpha code).
- Harvest date(s).
- Product form(s) at time of landing - including quantity and weight of product.
- Area(s) of wild-capture or aquaculture harvest.
- Point(s) of first landing.
- Name of entity(ies) to which the fish was landed or delivered.

Importer of Record

- Name, affiliation and contact information.
- NOAA Fisheries issued international fisheries trade permit (IFTP) number.
- Importer of record is responsible for keeping records regarding the chain of custody detailed above.
- Information on any transshipment of product (declarations by harvesting/carrier vessels, bills of landing).
- Records on processing, re-processing, and commingling of product.



THE EUROPEAN UNION

The EU's regulation to prevent, deter, and eliminate IUU fishing entered into force on January 1, 2010 (European Commission Notice 1005/2008). This regulation established a community system to combat IUU fishing and to permit importation to only legally-caught fish.

The regulation:

- Requires that all imports of marine fishery products are accompanied by a catch certificate validated by the vessel's 'flag State';
- Enables seafood imports to be banned from 'non-cooperating' countries and IUU fishing vessels; and
- Includes provisions on punishments for those involved in the fishing of, or the trade in, IUU fishery products.

The regulation was implemented into law in England and Wales by the Sea Fishing (Illegal, Unreported and Unregulated Fishing) Order of 2009.

Catch certification is an essential part of the EU Regulation, intended to help facilitate legal trade and prevent unfair competition from IUU products in the EU market. It provides data on all points in the fishery product supply chain that will help to improve product traceability (from catch to importation, including processing and transport) and the effectiveness of controls used to support compliance with conservation measures.

Marine fishery products, including processed products, can only be imported into the EU when accompanied by a validated catch certificate. Validation is conducted by the competent authorities of the flag State of the catching vessel in order to certify that the fish was caught in accordance with applicable laws, regulations, and international conservation and management measures (i.e., the domestic, regional and international rules that the coastal State and flag State have adopted). As part of this process, it is the duty of the flag State to ensure that the catch certificate is complete and that the information provided is correct. Consignments with validated catch certificates can then be exported to the EU. While this approach is achievable for larger scale vessels, it can be challenging for small-scale fishers. Therefore, USAID Oceans must ensure the developed system is accessible to and appropriate for both small and large-scale users.

2.5 International Safe Labor Policy

Currently, there are no globally-accepted international rules specifically regulating safe and fair labor practices aboard fishing vessels in Southeast Asia. There are currently efforts underway within the international community to produce regulations, including the development of relevant guidelines by the International Labour Organization (ILO).

Underlying the development of such fisheries-specific labor rules is the ILO Forced Labour Convention (i.e., the Convention Concerning Forced or Compulsory Labour, 1930; No. 29) and the subsequent Protocol of 2014 to the Forced Labour Convention (2014).

The ILO Work in Fishing Convention (2007; No. 188) encourages fishers to be provided decent conditions of work on board commercial fishing vessels with regard to work requirements, conditions of service, accommodation and food, occupational safety, health and medical services, and ethical and welfare policies applicable to the crew — including safe labor practices and suitable living conditions. The Convention has not been ratified by any of the ASEAN nations.

Other initiatives for developing standards include the UK-released guidelines related to its Anti-Slavery Laws; USAID's fair labor guidelines, Counter-Trafficking in Persons Policy (2012), and recent "Supply Unchained" initiative — currently working to prevent human trafficking within supply chains and business operations, including within commercial fisheries.

3 TRACEABILITY IN THE SEAFOOD SUPPLY CHAIN

USAID Oceans builds on inputs from a wide cross section of stakeholders — including the seafood industry, supply chain, industry standards bodies, fisheries regulators, customs agencies, and non-government organizations — in order to:

- Identify a suitable technical approach for implementation of electronic catch documentation and traceability within Southeast Asian and Pacific fisheries.
- Ensure the system architecture incorporates sufficient flexibility to accommodate multiple languages, time-zones, local customs/conventions and the wide range of regulatory practices used for fisheries management, both regionally and globally.

3.1 Introduction to the Seafood Supply Chain and its Actors

Seafood supply chains refer to the collection or network of all actors associated with a seafood product, reflecting the product's movement from the point-of-catch through to the end-sale of the product to a consumer. Typical actors within a wild-caught seafood supply chain include: the fishing operation for the harvest event (point-of-catch); catch transshippers (either at sea or once directly off-loaded in port); first receivers (including at landing points, carrier vessels, and mini-plants); second receivers (including aggregators, pack houses, and suppliers); first and second processors; cold chain facilities; actors involved in seafood storage, supply, and export logistics; seafood buyers (including foreign importers); international customs and trade entry process within regulated market state jurisdiction; and wholesale and retail distributors (see Figure 4).

A core objective of USAID Oceans' CDTS is full seafood product traceability upon reaching the customs/import stage in the supply chain. Although traceability considerations on the importing side of the seafood supply chain fall outside the scope of USAID Oceans, they include: customs inspection and protections such as clearance systems and "single window" automated customs processing systems (e.g., US CBP ACE); import logistics (such as product distribution and time); wholesale logistics; and date of arrival into retailers.

Although they are not part of a supply chain, independent certifiers including the Marine Stewardship Council, ISEAL Alliance, Fair Trade USA, and cold chain processing certifiers (e.g., Control Union) may all contribute in providing traceability information relating to the seafood supply chain.

A fundamental element of USAID Oceans' analysis is the mapping of seafood supply chains and their CTEs to ensure that the CDTS, and the required KDEs, provide a timely collection of data and support data audit requirements.

Current catch documentation schemes have been shown to not be entirely effective and do not have the capacity to trace all products along the complex supply chains of international, regional, and trans-boundary seafood trade back to the harvest event. This is due, in large part, to the inability of existing catch documentation systems and document flows to effectively connect with the complexities of international seafood supply chains. In addition, exemptions for specific operations (such as artisanal and small-scale fisheries) and specific seafood product derivatives, present further gaps in current schemes. In some cases, domestic landings are exempt from catch documentation, traceability, or certification, further weakening systems and diminishing their scope to cover non-IUU related management functions.

Effective CDT systems will have to be as comprehensive and inclusive as possible in terms of coverage and reach. Potential and interesting objectives of future CDT systems include enabling the timely electronic capture of data associated with integrated trip reporting, trip declarations, data driven monitoring of fishing harvest activity and fishing effort, quota usage via electronic trip declarations, electronic catch logbook reporting, and receiver and dealer electronic reporting of transshipments or landings. To achieve this effectively, national centralized electronic infrastructure and the adoption of a data standardization scheme for seafood supply chain interoperability is a basic requirement.

Figure 4. A graphical representation of the current versus future data capture (under the USAID Oceans CDTS) across a generic seafood supply chain in Southeast Asia.

Seafood Supply Chain	At sea capture (small scale; >4 to <30 MT)	At sea capture (medium scale; >30 MT)	Port	Buyer/Broker	Shipper (land or boat; domestic)	Processor (1st, 2nd etc.)	Shipper (air or ship; export)
Current: Typical data capture method (not integrated across supply chain)	None, or paper	None, or paper	Paper or electronic	Paper or electronic	Paper	Paper and electronic	Paper and electronic
Who	Captain	Captain	Company and Port Authority (government)	Buyer/Broker (company or agent)	Shipper (company)	Processor (company)	Shipper and Export Authority (government)
Data/Document Type	Logbook and Captain's certificate	Logbook and Captain's certificate	Catch certificate / document	Purchase order	Manifest or delivery order	Raw material, batch ID; finished good ID	Certificate of Origin; Packing list; Health certificate; Bill of lading
Future: Data capture method via USAID Oceans' CDT System (integrated across chain)	Mobile data collection device; pushed to DEX*	Mobile data collection device; pushed to DEX	Mobile data collection device; pushed to DEX	Data submission into DEX; cloud storage	Data submission into DEX; cloud storage	Data submission into DEX; cloud storage	Data submission into DEX; cloud storage
CDT data submission method	Cell or satellite	Cell or satellite	Cell or WiFi	Internet	Internet	Internet	Internet

*Data Exchange (DEX)

Annex IV details the USAID Oceans-recommended KDEs to be captured at each point in the supply chain. These recommendations have been established through the analysis of various catch documentation schemes and regulations. Required data across systems has been aggregated, prioritized, and recommended by the USAID Oceans team to be included in the CDTS, in support of compatibility with multiple regulation schemes.

3.2 Seafood Traceability

3.2.1 Approach

The distributed nature of the seafood supply chain, and existing IT infrastructure, leads USAID Oceans to recommend an Electronic Document (file) based approach.

Any supply chain participant may need to create traceability content, including:

- Individuals (e.g., catch data being entered into an electronic logbook);
- Technology Suppliers (e.g., tracking data, extracts from fishing company/aquaculture IT systems);
- Facilities (e.g., a vessel, aquaculture facility, or processor providing storage temperature of product);
- Competent Fisheries and Customs Authorities (e.g., when issuing an Export Approval or approving Imports); and
- Independent Certification Providers (e.g., auditors of Quality, Labor, and Sustainability practices).

A strong chain-of-custody for data is essential. USAID Oceans proposes to address Integrity and Non-Repudiation through the use of Digital Signatures.[9] Where appropriate, data encryption may be used to provide confidentiality.[10]

This approach can support both on-line and off-line data transfers, and provides a vendor-neutral technology approach for integrating with existing IT systems.

3.2.2 System Interoperability and Compatibility

The seafood industry has expressed qualified support for initiatives to improve traceability, but with the proviso that, should major importing nations adopt incompatible systems, producers may struggle to satisfy a plethora of different reporting requirements and technical approaches.

As technology providers, our challenge is to develop solutions that can meet the joint requirements of the industry, service providers, national regulators, seafood buyers, and their regulators.

It is important to note that data flows may be accomplished via any suitable technical means; examples include, but are not limited to: web services (HTTPS), email, file transfer, satellite communications, and wireless terrestrial communications (Wi-Fi, Cellular).

The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT), in its 27th forum in Geneva, April 2016, introduced The Fisheries Language for Universal Exchange (FLUX) that offers a harmonized message standard to access electronic data from fishing vessels, such as vessel and trip identification, fishing activities or fishing data (catch area, species and quantity, date and time, and gear used)[11].

3.2.3 Transition to Digital Documentation

The transition from traditional paper-based to electronic catch records affects all participants in the supply chain — with each participant having different levels of access to software, hardware, and communications technology.

The IT systems on-board a small fishing vessel (typically with no remote connectivity) are very different from those deployed by multi-national seafood distributors; yet, both are essential participants within the seafood supply chain.

[9] XMLDSig Standard

[10] USAID Oceans does not recommend any specific encryption standards; however, noting: HTTPS and S/MIME are two common methods already in widespread use, http://www.w3.org/TR/xmldsig-core/

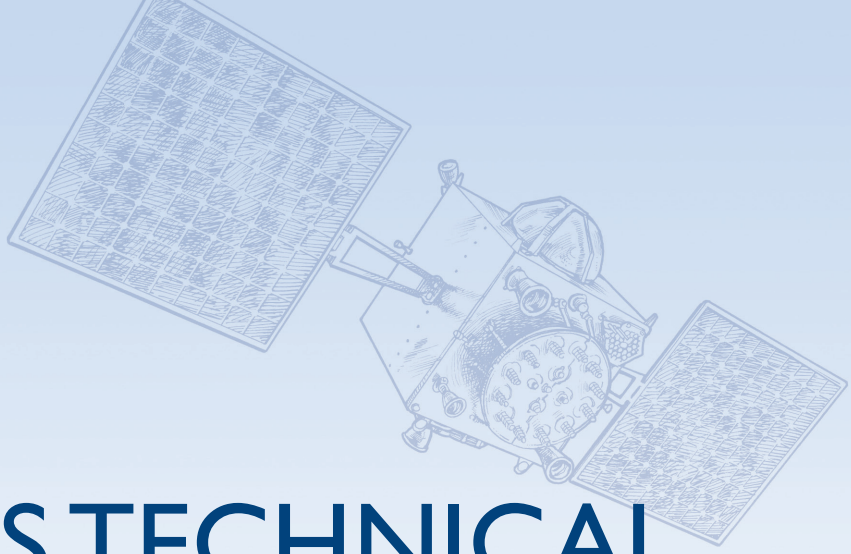
[11] http://www.unece.org/info/media/presscurrent-press-h/trade/2016/uncefact-adopts-the-flux-standard-for-sustainable-fisheries-management/doc.html

"Data capture" in our context spans:

- Pen-and-paper logbooks;
- Data-logging devices;
- Remote sensing, satellite communications equipment (i.e., VMS/AIS[12]); and
- Factory control and automation systems (i.e., bar coding, RFID tags, telemetry gathered at Hazard Analysis Critical Control Points).

To encourage and ensure full traceability, USAID Oceans recommends data be captured at multiple points in the supply chain, wherever possible — as this provides the best visibility into potential IUU activities (i.e., more catch being exported than was reported caught).

[12] The Automatic Identification System (AIS) is an automatic tracking system for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites.



4 CDTS TECHNICAL CONSIDERATIONS

As noted in section 1.4, the goal of USAID Oceans is the development of a transparent and financially sustainable electronic CDTS to help ensure that fisheries resources from Southeast Asia are legally caught and properly labeled. Today, food traceability remains a nascent concept, moving from the conceptual to the functional in parallel across numerous food supply chains. In the seafood industry, internal traceability systems that allow a company to keep track of products under its own control are quite common; however, external traceability systems are rare and require complex information sharing to pair data and product through all of the supply chain, including product and data generated beyond the immediate control of a business entity. External traceability is hampered by the prevalence of paper documents in the supply chain and very low implementation of standards for data exchange. With the development of the CDTS and establishing full chain traceability, emphasis must be placed on encouraging businesses and government agencies to adopt electronic data entry and to embrace a culture of information sharing to achieve a broader purpose — i.e., elimination of illegal product and mislabeling — than their own self-interest. In order to achieve a robust CDTS that can meet these goals, the following four overarching technical conditions must be met.

First, electronic documentation and verification of catch data and landings data is necessary. Paper documentation of seafood in supply chains, as exists in most countries around the world, has proven insufficient to meet the requirements of traceability robust enough to eliminate illegal catch and mislabeling.

Second, government import and export certification systems must also be electronic. The data generated by these systems must allow for tracking product forward in the chain, tracing product back through the chain, and must enable verification of customs status.

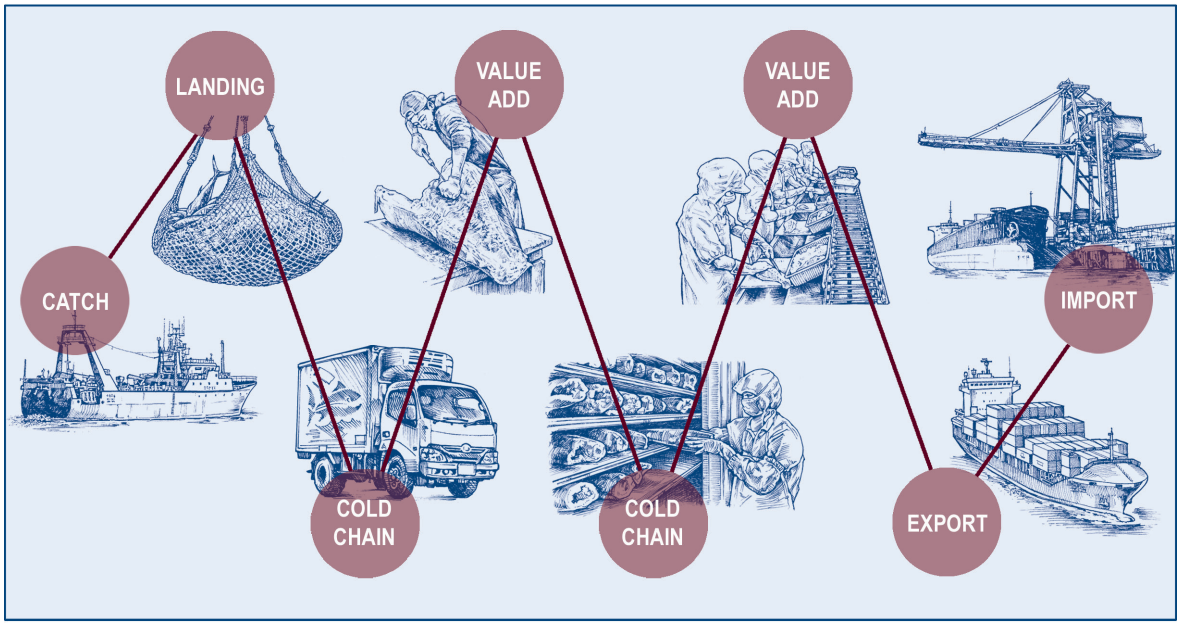
Third, traceable product requires serialization in order to uniquely identify gross quantities entering or moving through the supply chain. Serialization can be as basic as country of origin labeling or a serial customs stamp or mark, or as complex as uniquely identifying retail packaging to protect consumer safety or allow consumers to make sustainable food choices.

Fourth, transactions within the cold chain also must be electronic, not just for business-to-business exchange, but also for traceability.

Without these four significant conditions in place, robust catch documentation and traceability will be very difficult to achieve.

This chapter provides an overview of the different types of technology that can effectively support electronic CDTS and serialization in seafood supply chains. The chapter is broadly organized to follow product and data from point of capture on the water through the supply chain. The examples provided are presented for explanatory purposes; further insight into more specific recommendations and details on how these concepts can be applied in practice are provided in Annex I.

Figure 5. Seafood product movement and data flow



Seafood product and accompanying data flow through a generic seafood supply chain. Each circle notes a point in the chain where product is handled, modified, or transferred and thus, technology is required to electronically document the event and pass along that data.

The technology reviewed in this section focus on the systems and technical considerations most relevant to the USAID Oceans CDTS objective. USAID Oceans seeks to support regional CDT adoption through individual support to national governments to implement supply chain-specific and scalable systems. USAID Oceans does not seek to establish a system for universal application across all seafood product traceability efforts around the world, but to test and advance a practical, electronic-based catch documentation approach that allows for traceability of seafood products throughout the supply chain and supports countries' compliance with U.S. (and other export market) seafood import regulations.

4.1 Capturing Supply Chain Data

While capture of wild fish and movement of that product through the supply chain presents unique challenges to traceability, there are some basic fundamentals to traceability for *food systems* that provide applicable frameworks for seafood, especially with regard to data capture and data security.

In 2009, the Institute of Food Technologists (IFT) defined a framework for food traceability based on Critical Tracking Events (CTEs) and Key Data Elements (KDEs). CTEs are defined as supply chain events that are recorded in order to allow for effective tracing and track-back of products throughout the chain. The framework was developed to improve the investigation of foodborne illness outbreaks and was catalyzed by a number of large, nationwide outbreaks between 2005 and 2010 that were associated with commercially (and often internationally) distributed food products (e.g., *E. coli* infections; *Salmonella* outbreaks).

KDEs are the aspects or characteristics that are associated with a CTE and support product traceability. The core recommendations from the IFT document state that each supply chain partner must:

- Identify CTEs in order to trace the product;
- Record standardized KDEs for each CTE that link incoming with outgoing product, whether the product is transformed (internal tracing) or changes location (external tracing); and
- Provide the U.S. Food and Drug Administration with KDEs in an electronic form for each CTE within twenty-four hours of a request.

The document also recommends that:

- Standardized ways of expressing KDEs should be agreed upon; and
- Education on CTEs and KDEs should be developed, and evidence of appropriate implementation should be part of standard audits.

4.1.1 Critical Tracking Events (CTEs)

CTEs will serve as critical data points within the USAID Oceans CDTS, including both when a seafood product moves from one position to another within the seafood supply chain, as well as when the product is processed and repackaged. CTEs will play a central role in the design of how and when data are collected within the system. Some examples of CTEs within a seafood supply chain include points where seafood is:

- caught
- chilled
- transferred
- transported
- filleted
- inspected
- packaged
- shipped
- docked
- delivered
- unpacked
- mixed
- commingled
- processed

Critical tracking events (CTEs) are defined by the Institute of Food Technologists (2009) as events that are recorded in order to allow for effective traceability of products throughout the supply chain.

Most notably, CTEs are instances when a product is originated, moves between locations (shipping and receiving events), is processed (transformation event), or is depleted (consumed or disposed of) and where data (specifically, Key Data Elements) need to be captured to enable and/or maintain linkages to traceability.

4.1.2 Key Data Elements (KDEs)

As noted in Section 4.1.1, a robust traceability system must record every CTE. The details that describe or define that event are defined as Key Data Elements (KDEs). At each CTE, several KDEs need to be captured to inform the "who, what, when, where, why and how" of the seafood under consideration. Common characteristics that are captured by KDEs along the supply chain include:

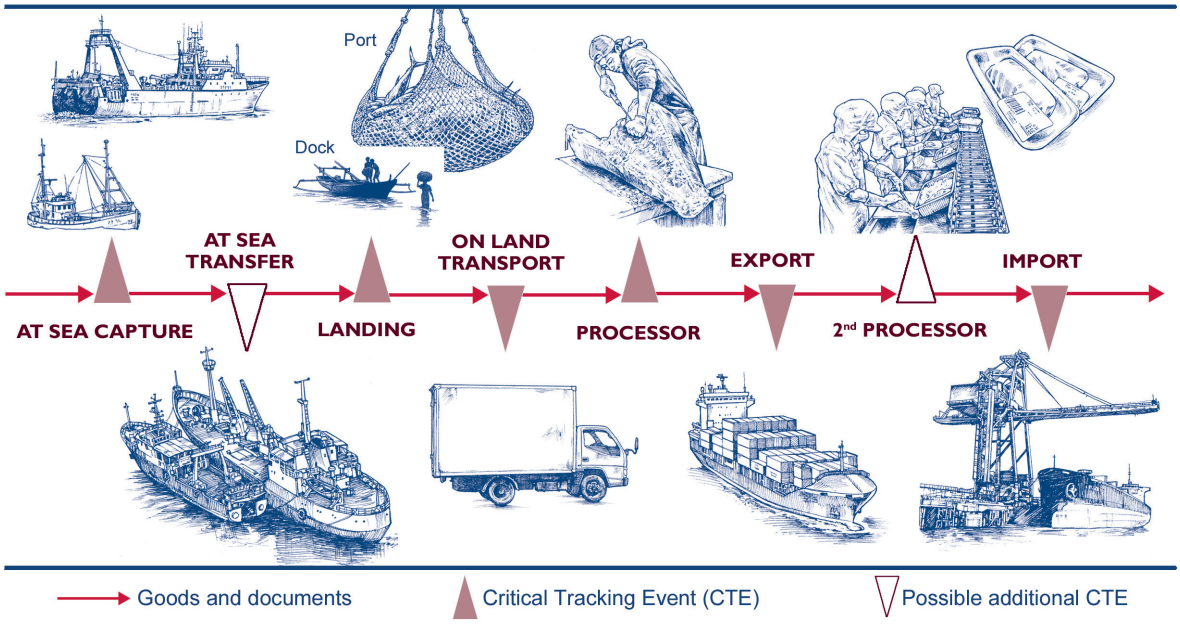
- The physical location where the product resides;
- The amount or quantity (e.g., the volume and/or weight) of the product;
- The movement of the product in or out of a CTE (including the batch or lot number); and
- The date and time of when the product was received into or shipped out of the CTE.

Both CTEs and KDEs must be captured adequately (accurately, verifiably, securely, and in a timely manner) within the CDTS to enable traceability. Traceability data at all points along the seafood product chain will be captured in real time through the CDTS.

Key Data Elements (KDEs) are critical aspects or characteristics of the CTEs that they are associated with. Because KDEs are linked to CTEs, they are often used to support the tracking of products through the supply chain.

KDEs can be generated by the supply chain (such as at point of catch) or by regulatory agencies (such as fishing or export licenses). The CDTS will play a central role in stitching together these various data sources to enable the ability to follow the seafood as it moves through its supply chain. Accurate, reliable and timely capture and access of KDEs within the CDTS is a key requirement to enable effective seafood traceability.

Figure 6. Movement of KDEs throughout the CTEs in the supply chain.



Some examples of KDEs within a seafood supply chain include data such as:

- Date/Time
- Location
- Method of harvest
- Vessel identification
- Species
- Weight
- Lot number
- Batch code
- Supplier identification
- Customer identification
- Temperature
- Certification

Currently, a number of global organizations are working to create minimum information standards for wild-caught seafood. Efficient functioning of the CTDS depends on agreement and establishment of these standards to align the minimum requirements for seafood traceability. USAID Oceans is engaging with standards development organizations to align the CDTS' standards with current best practices.

Annex IV details the "minimum" recommended KDEs to be captured within each link of the seafood supply chain under the scope of the USAID Oceans CDTS. USAID Oceans has also developed a "KDE Manual," the Data Requirements for Catch Documentation and Traceability in Southeast Asia: Critical Tracking Event and Key Data Element Framework and Glossary, to be released in 2017. This document provides detailed definitions and information for each KDE.

4.1.3 Proprietary Data and Data Security

One of the greatest obstacles to achieving even minimal product traceability in the seafood supply chain is that many actors in the chain consider their data and their tracking events to be proprietary to themselves and their trading partner. While many are aware of the increasing business value of traceability and data sharing, there is hesitancy to share select data that may be sensitive or unwillingly shared with competitors or government agencies.

With increasing mandates to comply with national and international food safety initiatives, seafood businesses and government agencies are rethinking the value of their data to traceability and, ultimately, how their data may add value to their products. As clearly demonstrated by the finance industry, there are numerous methods of electronic information management that effectively protect proprietary data while making some portion of it available to other actors in the system. Some of the most common methods are detailed below.

4.1.3.1 Data Verification

For many, the initial perception is that greater traceability will require government and industry to dramatically open up their data, risking exposure to those outside their traditional business partnerships.

However, while traceability seeks to provide greater transparency and rapid trace-back in the supply chain, it is possible to "verify" when and where a product moved through a node in the supply chain without disclosing all of the data associated with that CTE.

For example, with an import certification number from a government agency, a retailer further down the supply chain could electronically verify that a certain batch of product was imported into this country from another country on a certain date; but, that same retailer would not be able to see details about who brokered the product or who harvested the product — unless specific permission were granted. The verification alone would provide a great deal of certainty about the quality and claims made about the product and often would be enough to satisfy traceability needs.

4.1.3.2 Digital Signatures

A digital or electronic signature is an effective means of ensuring that a human being has verified a CTE or KDE and can occur with or without having to provide the complete dataset associated with the event. An electronic signature is essentially the equivalent of a hand-written signature: data in electronic form is attached to another electronic data form (e.g., invoice, payment slip, and contract) as a means of authentication and to prevent forgery.

Electronic signatures and electronic seals have legal effect, supported by the first European Commission e-sign Directive (1999/93/EC) and Regulation (EU) No 910/2014. Similar effect is provided by the June 2000, U.S. government e-sign bill. In November 2008, the European Commission adopted an 'Action Plan on e-signatures and e-identification to facilitate the provision of cross-border public services in the Single Market' (COM (2008) 798). In December 2009, the European Commission issued a standardization mandate on electronic signatures (M/460) for the definition of a rationalized standardization framework. And in 2014, the Regulation No 910/2104 (called eIDAS Regulation) on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC was adopted. Both electronic signatures and electronic seals can be supported technically by digital signatures which are data appended to, or a cryptographic transformation of a data unit that allows a recipient of the data unit to prove the source and integrity of the data unit and protect against forgery by the recipient.

4.2 Data Capture Methods for Catches and Landings

The CDTS will capture CTEs and KDEs along the supply chain using a number of data capture methodologies that can support the various technical capacities of current commercial fisheries and supply chains. The most common methods will likely include:

- Encourage migration of currently used paper-based record keeping methods, particularly by small-scale commercial fishing operators for nationally-mandated trip and catch documentation reporting, into an electronic format and subsequent submission and import into the CDTS;
- Export of currently used electronic record keeping methods, typically used by medium- to large-scale commercial fishing operators to capture trip and catch reporting, as well as dealer reporting, into a compatible data format that is submitted and imported into the CDTS; and
- Manual entry and wireless transmission of data submitted into the CDTS via a handheld digital device (e.g., a weather/waterproofed computer tablet) provided to actors within the various points along the seafood supply chain by USAID Oceans, including at sea.

For point-of-harvest data capture, several existing technologies exist. These technologies provide data that can support data collection and verification for both fisheries management and supply chain needs:

1. Several technologies currently allow for tremendous amount of fisheries data to be collected and delivered to shore in near real time via satellite and cellular networks. These include: Vessel-based technologies including Vessel Monitoring Systems (VMS); Automatic Identification Systems (AIS); Electronic Monitoring (EM) and Electronic Logbooks (e-Logs). While historically (and primarily) used for safety, law enforcement, and fisheries management, data collected via these technologies can provide valuable information about seafood products prior to their entry into commerce.

2. Technologies that physically pair information to product allow for the immediate capture or verification of a products' location and critical tracking events. These include: Bar codes, QR codes, Radio Frequency IDentification (RFID) and other digital marks affixed to products.

3. Data logging devices can monitor the physical conditions that seafood products are subjected to during shipment including time, temperature and humidity. This information can provide verification of product quality and viability and is most applicable for use further up the chain.

4.2.1 Communications Technology

The success of seafood traceability through the USAID Oceans CDTS is highly dependent on real-time communications technology. In addition to facilitating seafood traceability, enhanced communications technology will also support USAID Oceans' human welfare objectives. The following sub-sections detail how real-time communications technology can address many of the human welfare concerns that currently stem from limited connectivity, including increased reporting on fishing vessel and crew safety, maintenance of on-board fair labor standards, and access to grievance mechanisms. While most vessel monitoring systems (VMS) are being implemented by government agencies to facilitate monitoring of fishing effort and enforce closed fishing areas, VMS also can provide near real time communication of data to fishing companies and fisheries managers, and some systems provide tamper-proof messaging services that allow crew members to independently send safety messages back to family members.

4.2.1.1 Cellular/Mobile/Wireless Telecommunications

USAID Oceans' CDTS requires widely accessible and reliable wireless communications networks to support mobile digital hardware (rugged, water/weather-proofed tablets) and software (the CDTS). Mobile telecommunications will include contracted service agreements with reliable carriers of both cellular and Wi-Fi system networks at each of the learning sites.

Cellular coverage and wireless connectivity varies greatly across the region and within the learning site territories, requiring a multi-prong approach that considers differing levels of connectivity within fishing zones. Influencing factors include the topography, line-of-site limitations, and carrier infrastructure, among others. For small-scale fishers that typically fish closer to shore, cellular connections can likely be used — provided there is a tower located near the coast. For many fishers that travel further out to sea and typically out of range of communications networks, alternative connectivity solutions will need to be considered. To address this complex environment, USAID Oceans will conduct a thorough analysis of connectivity solutions within the learning sites and will work with communications service providers to develop a multi-prong approach. In this space, there is potential for great private sector interest, as building connectivity in this sector may present opportunity for new markets. A number of mobile network operators have already begun to develop hybrid communication models to extend their service offerings. Hybrid systems contain multiple radio frequency transmitters and choose the least-cost option for transmitting a message based on the urgency of the message and the availability of service whether satellite, cellular or even dockside Wi-Fi.

4.2.1.2 Satellite Communications

In addition to cellular and Wi-Fi telecommunications, the CDTS will use satellite communications to enable real-time transmission of captured KDEs at the point-of-catch. In addition to enabling remote (at-sea) data collection and transmission, satellite communications will also enhance fishing vessel and crew safety measures. Basic safety services offered through satellite communications service providers include emergency calling capabilities, storm alerts, international border zone warnings, and panic buttons/relays. Satellite connectivity also enables basic ship-to-shore or ship-to-ship communications and email and SMS text services via smartphone or tablet while at sea. Many satellite providers also offer a hybrid satellite-cellular solution where communication will automatically switch between satellite-to-cellular connectivity, dependent on availability. USAID Oceans has conferred with numerous satellite service providers, including Inmarsat, Thuraya, and Iridium, amongst others. Their offerings and potential benefits include:

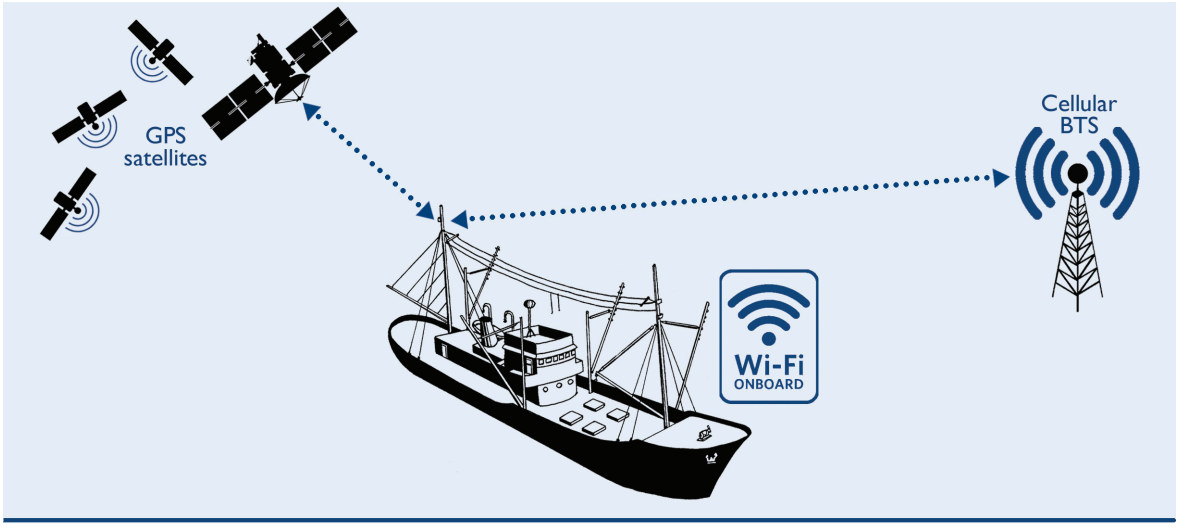
Provider	Offerings and Benefits
Inmarsat	Inmarsat owns and operates a global satellite network, offering mobile and fixed communications services for maritime, enterprise, government, and aviation. The Inmarsat C communications protocol has served as the de facto standard for VMS solutions since the early 1990s. The IsatData Pro was also recently deployed in 2015 in Indonesia and Thailand for VMS testing. IsatData Pro is also being tested in Indonesia (Sisfo POINTREK system) using M2M/IOT technology to provide real-time VMS and electronic catch data (e-logbook) via handheld device (tablet). The system offers person-to-person (P2P) communication from ship to shore through onboard Wi-Fi connected mobile devices via text message, email, and conventional SMS technology. Inmarsat is also currently rolling out the FleetOne Coastal product that has voice and enhanced data capability (up to 100 kbps targeted to <24 meter fishing vessels).
Thuraya	Satellite provider Thuraya also provides similar capabilities with its MarineComms product family. This product line supports voice and broadband data communications at speeds up to 444kbps. Thuraya Atlas IP, one of the top-line products in this family also has a Wi-Fi feature to connect with other nearby devices such as mobile phones. In the Philippines, Thuraya has developed a joint partnership with communications provider, SMART, to offer a hybrid connection.
Iridium	Iridium's constellation of 66 Low-Earth Orbiting (LEO) cross-linked satellites operate as a fully meshed network with voice and data communications coverage for maritime, aviation and terrestrial customers anywhere in the world. In Indonesia, the local service provider PT Amalgam Indocorpora has successfully introduced the Iridium-based BlueTraker® VMS transponder on a substantial number of fishing vessels. Other offerings include the 134 kbps Iridium Pilot® terminals and Iridium GO!, a portable satellite-enabled Wi-Fi hotspot device that offers up to five mobile devices access to voice, SMS and data communications via satellite through optimized apps. Partners are developing CDT apps for Iridium GO! for launch in Southeast Asia in 2017, to be closely followed by apps to address safe and fair labor concerns. With the full deployment of the Iridium NEXT satellite constellation in 2018, these apps will also be available for the new Iridium CertusSM service platform supporting speeds ranging from 88 kbps to 1408 kbps.
Others	• UK-based SuccorFish offers a mini solar powered VMS based on Iridium technology for small-scale fishers. • Pelagic Data Systems, based in California, provides solar powered, and high temporal resolution vessel tracking solutions that function autonomously. The system records a vessel location every few seconds, which can be used to verify fishing activities on the water and the precise location of the catch. Pelagic also makes auxiliary sensors that track gear use and/or cold chain integrity on board the vessel. • Louisiana-based Spot offers a low power, low cost satellite based tracking device with simple messaging capabilities and emergency signaling that can be used for vessel tracking and/or crew welfare monitoring. • CLS-Argos, a French VMS satellite provider offers a series of at-sea data capture and trip reporting solutions. CLS-Argos is currently the sole VMS solution in the Philippines. CLS-Argos' e-Logbook was piloted in the Philippines in October and November 2013 using CLS's MARLIN application. In Indonesia, CLS-Argos has a large volume of installed users.

4.2.1.3 Radio-based Communications Technologies

In addition to cellular and satellite technology, radio-based communication technologies may be employed to support CDTS connectivity. To support the transmission of data at-sea, USAID is exploring radio-based TV White Space (TVWS). TV White Space utilizes unused TV broadcasting frequencies in the wireless spectrum that result from gaps between television channels left by television networks for buffering purposes. This space in the wireless spectrum is similar to what is used for 4G technology and can be used to deliver widespread broadband internet. Furthermore, the switchover to digital television frees up large areas between about 50 MHz and 700 MHz, because unlike analog, digital transmissions can be packed into adjacent channels. TV White Space has numerous benefits, including up to 100 times the coverage that Wi-Fi and Non-Line-of-Sight (NLOS) Performance can provide. The technology is receiving increased interest, with the Maritime and Port Authority of Singapore exploring TV White

Space technology for future maritime wireless communication technology. USAID Oceans is exploring this technology to be used in the remote coastal areas of the Philippines.

FIGURE 6. Diagram illustrating vessel connectivity



4.3 Data Capture Methods for the Cold Chain

Once data has entered the cold chain, seafood businesses typically share information via paper-based or electronic data systems designed for node-to-node business transactions. The weaknesses of a paper-based system for rooting out fraudulent and illegal product have already been discussed. Below, the two primary methods of data capture and sharing currently employed across seafood cold chains are discussed, with reflection on how these methods hold up in a full-chain traceability context.

4.3.1 Electronic Data Interchange (EDI)

While global standards for sharing supply chain data and, to a lesser extent, fisheries management data exist, adoption has been low. Most fisheries management and customs data are proprietary to the business that creates them. A large number of seafood businesses use Electronic Data Interchange (EDI)[13] to engage in commercial trade. EDI is an electronic communication framework that provides positional text based messaging for routine business document formats including invoices, purchase orders and shipping notices. The EDI standard (UN/EDIFACT, 1997) is over thirty years old and was never designed to accommodate external traceability; the business document formats contain proprietary information not suitable for use outside of trading partners.

To extract traceability-relevant data from business transactions without compromising proprietary information, ERP software providers will have to take additional measures to parse out relevant traceability data elements from the EDI document. This parsed information can then be made available through channels other than the EDI network.

In addition to private-sector use, EDI also has a suite of customs messages that are in use as the mandatory communication format for most electronic communications with the U.S. Customs & Border Patrol's (CBP) International Trade Data System (ITDS). The CDTS should encourage electronic filing of customs declarations using EDI to national single window systems including the U.S. ITDS and the EU Customs Single Window.

While very common for data exchange in the cold chain, EDI is a positional text based protocol developed for passing business documents. It is not adaptable and requires a third-party translation service called a Value Added Network (VAN) to facilitate every transfer of documents. EDI was not designed to share data between more than two parties in the supply chain and to facilitate traceability, and thus is not suitable for application under the CDTS.

[13] United Nations/Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) is the international EDI standard developed under the United Nations. The UN/EDIFACT Syntax Rules were approved as the ISO standard ISO 9735 by the International Organization for Standardization.

4.3.2 Extensible Markup Language (XML)

Supply chain standards organization, GS1, has more recently certified EDI coupled with the more modern Extensible Markup Language (XML)[14] format to exchange commerce data, and handle product serialization and traceability. XML is a meta-language, a language for describing other languages, which for the design of other markup languages that are specific to a particular topic allowing for limitless different types of documents that share a common vocabulary and syntax. XML is sometimes referred to as 'self-describing' because the names of the markup elements can represent the type of content they hold. For example, the XML element <SPECIES_NAME> Cod, Atlantic <\SPECIES_NAME> very clearly shows that the element is going to contain the species name. XML is hierarchical; the species name element might be a sub-element of a section that describes the product:

<PRODUCT>

<SPECIES_NAME> Cod, Atlantic <\SPECIES_NAME>

<LATIN_NAME> Gadus morhua <\LATIN_NAME>

<FAO_TAXONOMY_CODE> 1480400202 <\ FAO_TAXONOMY_CODE>

<\PRODUCT>

This snippet of XML can be used to describe the product with as many attributes as deemed necessary. XML is designed to be flexible; human readable; machine readable; and extensible for use in any subject matter area.

GS1 EDI is a suite of semantic tools covering a host of standards offered by GS1. GS1 EANCOM® is a basic subset of the UN/EDIFACT EDI standard for commerce documents and can be augmented with GS1 XML that includes elements of traceability and product data sharing not supported by EDI. These include the "Despatch Advice - Fish Traceability Extension" designed specifically for the seafood industry. Event data semantics are supported through the Electronic Product Code Information Services (EPCIS) which is a GS1 interface standard used to capture and inquire event data. The GS1 Global Data Synchronisation Network® (GDSN®) is a network of interoperable data pools that allows trading partners to share EPCIS product data and other uniform master data based on GS1 standards. The GDSN supports accurate, real-time data sharing and trade item updates among subscribed trading partners. Adopting XML-based standards for e-commerce has the potential to greatly improve data sharing and transparency. Documents become much more robust; more easily programmed into modern ERP systems; and do not require the support of a third-party translation service to share documents. GS1 EDI is being adopted most rapidly in Europe by food companies and technology providers. Encouraging its adoption in the CDTS project will allow for significant cost savings and more informative trade documents.

4.4 Data Capture Opportunities in Import and Export Systems

Government agencies around the globe play a significant role in the validity and veracity of the seafood supply chain by regulating and documenting the import and export of products in and out of their national and economic borders. The FAO estimates that approximately 130 billion U.S. dollars' worth of seafood products are exported or re-exported annually around the globe. With the expansion of free trade agreements and development of single window systems, there is an immense amount of electronic trade data sitting in government repositories that could potentially contribute to traceability.

4.4.1 Single Window Systems

The Single Window System concept is a technology architecture that consolidates regulatory document submission requirements under a single entity or information service to facilitate trade and simplify the movement of products across national or economic borders. The single window system allows traders to submit requests for permits, clearances, declarations and other trade documents to a single authority that is then authorized to share those documents with other government agencies that have some

[14] Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable so it can be used in the exchange of a wide variety of data on the Web and elsewhere. Source: https://www.w3.org/XML/

regulatory oversight of international trade. The trader only has to submit the data once and only has to check one information service to receive relevant customs documents.

The International Trade Data System (ITDS) in the Automated Commercial Environment (ACE) is the single window system in the United States that allow traders to comply with import/export requirements from Customs & Border Patrol, Homeland Security, Agriculture, NOAA and the Food & Drug Administration through a single reporting and permitting environment. The European Community has two major Single Window initiatives: the Single Window Initiative of the Directorate-General Taxation and Customs Union (DG TAXUD) and, the "Maritime Single Window" of Directorate-General for Mobility and Transport (DG MOVE). The Association of Southeast Asian Nations (ASEAN) Single Window is an effort to consolidate the national single window systems of its ten partner nations under a single trade agreement and information system. A nation's single window system is an ideal partner for the USAID CDTS project as it is a centralized and electronic source of critical supply chain data.

Single window systems are designed to effectively collect data from an exporter and share it with multiple government agencies in both the exporting and the importing nation. Single window systems do not, however, maintain continuity of data in the commercial supply chain. Most single window systems rely on paper-based and web-based data entry or the EDI Export Declaration business document to collect data on the export transaction. None of these modes are designed to accommodate Critical Tracking Event and Key Data Element information for the passage, landing, or processing of catch across the digital divide between the importer and the exporter. Adoption of modern EDI messaging using EDI-XML would allow a client group or even broad swaths of the industry to augment standard business documents with specific data on traceability and sustainability and pass these data between the exporter and the importer and down through the supply chain.

Multiple government data compliance can be done first through harmonizing KDE, standardizing data format and messaging protocol. Oceans will look, propose and promote existing data messaging standard and protocol such as FLUX in the DEX architecture. If certain country government's single window system allow data exchange through API, the data passing can be done through The Data Exchange Server (DEX).

4.4.2 Container Traceability Technology

Most seafood product that is traded globally whether by ship or by air is transported in a specialized shipping container. To protect the cargo, many shipping containers utilize container tracking and environmental monitoring technologies to know where the container is located at all times and if the product is being held to temperature and humidity specifications. These data are generated for the purpose of protecting the cargo, however, they potentially have value in the supply chain for verifying the dates of export and import; the quality of the product; and the presence of an electronic tracking device immediately lends a serial identification to that lot of product if someone were able to access that data further down the supply chain.

4.5 Standards Required for Full-Chain Traceability

The previous sections detailed where and how data is currently generated across different nodes of the supply chain and across government systems. At every node of the supply chain, data are collected for business purposes. The intent of wholesalers, transportation and retailers is to buy and sell products to meet demand in the market and to generate revenue. Similarly, government agencies collect catch and landing information for the purpose of fisheries management and law enforcement which may have no direct relevance for businesses transactions. Import and export authorities seek to keep the supply chain safe, enforce trade laws and collect tariffs.

While not for the purpose of traceability, each of these business and government activities overlap with the CTE's that have been identified as making up traceability. These events along the supply chain generate data and a subset of these data comprise the KDE's necessary to build traceability. However, current access to this information and the capacity to efficiently and effectively share data in meaningful ways, remains limited. Use of data for traceability purposes demands disparate systems share data so that it can be interpreted and analyzed — and this requires standards and interoperability.

In the CDTS, traceability data will be identified at CTE points along the supply chain in government, customs applications, or commercial ERP systems and will be submitted electronically when it is mutually agreed that the data support traceability. The following technologies and technical specifications will assist development of the standards that will make possible the collection of traceability-relevant data.

4.5.1 CTE Framework and Fisheries Semantics

Both CTEs and KDEs require agreed upon standards. The international non-profit data standards organization, GS1, promotes a system of global standards to efficiently identify, trace, and track CTEs and KDEs. These standards can also be used to capture sustainability-related KDEs, including: country of catch (national waters); management zone where at-sea capture occurred; fishing techniques and gears used to land the product; and any associated "responsibly-caught" rankings or certifications prepared by third-party, non-government investigators, and "watch" groups.

USAID Oceans' CDTS will be designed to work with GS1 standards, particularly relating to CTE and KDE management and capture.

GS11 has fully adopted six independent and curated reference data sets specific to marine fisheries and included in their Fish Despatch XML schema.

Standards for size, product, grade, species, area, and gear exist among different international organizations. Three European Union Common Fisheries Policy standards include databases fishSizeCode, fishPresentationCode and qualityGradeCode; and, three FAO standards for aquaticSpeciesCode, catchArea and fishingGearTypeCode. In addition, FAO and ISO have standardized reference lists for catch location, including the FAO major fishing areas and ISO 3166 country codes (if the product is caught within an EEZ). See "Additional References" for links to these databases.

The FAO standards adhere to the guidance and standards outlined in the Revised International Standard Classification of Fishing Gear (2010) and the Aquatic Sciences and Fisheries Information System (ASFIS) List of Species for Fishery Statistics Purposes. Recognizing the complexity of product forms in seafood compared to other proteins, it would be helpful if GS1 and the CDT project also adopted the FAO's International Standard Statistical Classification of Fishery Commodities (ISSCFC).

4.5.2 KDE Consensus for Fisheries

USAID Oceans has reviewed existing recommendations for seafood product KDEs, including those from the ACDS guidelines, EU regulations, and newly proposed U.S. seafood import regulations. Annex IV outlines USAID Oceans' recommended KDEs, based on an aggregation and prioritization of common requirements among existing traceability scheme requirements. USAID Oceans is focused on partnering and working with supply-side actors located in Southeast Asia. Therefore the CDTS focuses on CTEs and KDEs only from the point of catch to the point of export. The team has also considered potential KDEs within the import-side of the seafood chain (also included in Annex IV). In support of the Activity's human welfare objectives and in acknowledgement of the severity of the sector's human welfare concerns, USAID Oceans has also conducted research to identify human welfare-related KDEs within the supply chain, particularly at the point-of-catch (at sea), landing, and first processing.

Through the CDTS, KDEs currently being collected by national governments or fishing companies will be merged or integrated within a set of KDEs that will be tracked and traced throughout the full, linked seafood supply chain (see Figure 5). Doing so will allow KDEs collected by a specific actor to transition from being non-traceable (at present) to being linked to a traceable supply chain (under the USAID Oceans CDTS).

For example, consider the "current" versus the proposed "under USAID Oceans" scenarios for specified KDEs captured in Indonesia and the Philippines along the below points of the typical seafood supply chain:

Critical Tracking Event	Current	Under USAID Oceans
Point of Catch (At Sea)	(1) Limited to Large Vessels (30+ gross ton vessels): (a Current) paper-based logbooks (manual entry); (b) paper-based captain's certificate/ document (manual entry); (2) Partial application of VMS	(1) Digital logbook (software) to easily enter/collect and transmit at sea KDEs; and (2) Hardware: handheld device (encased) with wireless transmit enabled.
At Port (Receiver)	At Landing Site: (1) Paper catch certificates; sometimes entered electronically within desktop computer; and (2) Catch origin landing statements: captain's statement; catch certificate.	Digital form with key KDEs transmitted in real-time via handheld device.
Transport (Road-Based) *Including between Processing Facilities*	Paper-based shipping manifests	Digital form with key KDEs transmitted in real-time via handheld device.

While beyond the scope of the USAID Oceans Activity and its CDTS architecture, KDEs captured by the CDTS can also support increased consumer data accessibility. With the interest and investment of interested organizations, and independent of USAID Oceans' focus activities, select KDEs can be made available to end consumers. For example, once a seafood product has been traced through the CDTS and imported, a QR code associated with the seafood product could be accessed by the retailer's scanning system or a customer's smartphone to quickly access and display selected KDEs associated with the purchased seafood product; such information might include: (a) origin country and date of catch; (b) country of catch/landing; (c) verified fish species (preventing seafood fraud); (d) date exported; and (e) date imported.

4.5.3 Global Traceability Standard

The Global Traceability Standard (GTS) is promulgated by GS1 as an international not-for-profit association with member organizations in more than 100 nations. The use of the GTS process allows traceability systems to be possible along the supply chain at the international scale, regardless of which or how many actors are involved or the technologies used. In this regard, from a requirements perspective, USAID Oceans views the GS1 standards as a foundation for the CDTS' design and functions. At the core of the GTS are unique serial identifications for the physical location of each node in the supply chain and a unique identifier for all products (items) traded in the supply chain. The GTS standard further facilitates traceability with the application of item serialization and pedigree documents standards.

USAID Oceans recognizes that in terms of serialization, GS1 defines a workable standard for serializing products and producers across the entire supply chain, but it can be cost prohibitive for many producers and processors. An over-arching governance would ensure that serialized data are passed across nodes in the supply chain or are translated through CTEs that break down lots of product into smaller batches or portions.

Accommodating this need will be critical to the design of the pilot implementation. In particular, USAID Oceans' learning site pilots will look to identify where traceability can provide value—such as by facilitating new market access, or gaining efficiencies — and how that captured value can be used to offset costs of implementation.

4.5.4 Globally Unique Identifiers

A Global Trade Item Number (GTIN) is the standardized and globally unique way to identify items traded in a supply chain, and their use provides a common language to support traceable product identification. GS1's Global Location Numbers (GLN) are assigned for company and location identification, using

specified prefixes that are globally unique identifiers. Using the GS1 Global Traceability Standards (see below) and GTINs, any specific seafood supply chain — including all associated facilities and actors within it — can be uniquely identified. Globally unique identifiers will be assigned for each of the seafood supply chains within the USAID Oceans CDTS, and will be tested and implemented at the learning sites. These unique identifiers support serialization of products in the supply chain, another necessary factor for robust traceability and functional CDTS.

4.5.5 Serialization Standards

Serialization is widely used in the pharmaceutical sector and has only been recently piloted in the food sector. Serialize transactions (or products) make possible authentication, validation, and tracking of transactions in relation to one another. This is because serialization creates the ability to number and identify a series of events in a sequence — allowing a unique identifier for a product that can accumulate data as the product moves along a supply chain.

In some industries, such as pharmaceuticals, serialization has become mandatory. For example, in its guidance to the pharmaceutical industry , the U.S. Food and Drug Administration describes the use of standard numerical identifiers to track packages and refers to the use of serialized GTINs to provide this functionality.

Success of the CDTS depends on a reliable way to identify small and very large quantities of product back to the point of harvest and entry of such product into commerce. Serialization can provide such an identifier, but it requires specific standards for effective execution. Some of the current ways in which serialization can be implemented include RFID, and barcoding at the lot, batch, pallet, and container level, as well as uniquely identifying actors in the supply chain including physical plant locations, fishing vessels, and at-sea transshipment vessels.

4.5.6 Reference Standards

Traceability and serialization are inherently transactional as they are representations of units of product moving through the supply chain. To share data about the transactions and to promote interoperability between trade systems, a standard semantic for metadata about the products is necessary to harmonize references to attributes like product form, weights and measures, species and fishery. As a part of the CTDS, there are two types of references standards that are required. The first type of reference standard validates static content that is allowed for a specific type of KDE. For example, a list of gear types that can be entered into an attribute that is capturing gear type for a specific CTE. This type of reference standard is typically maintained by a global or international organization or a standards setting body such as FAO or ISO.

Another type of reference standard validates dynamic content for the purpose of verification of KDEs as they flow through the supply chain. For example, the ministry of fisheries of a specific country could maintain a list of valid fishing licenses or catch certificates that could be used to verify legality of the seafood being traded. This type of reference standard is typically maintained by a stakeholder in the supply chain of the seafood itself — either private sector, non-governmental, or regulatory.

4.5.7 FLUX

The Fisheries Language for Universal Exchange (FLUX) was developed by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) as an open and global standard that allows for the electronic exchange of fishery data. FLUX is a harmonized message standard that allows Fishery Management Organizations (FMOs) to access and share electronic data from fishing vessels, such as vessel and trip identification, fishing operations (daily catch or haul-by-haul) or fishing data (catch area, species and quantity, date and time, and gear used). This emergent standard will allow FMOs around the world to automate the collection and dissemination of the fishery catch data to promote sustainable fisheries management and detect and combat illegal, unreported and unregulated (IUU) fishing.

4.5.8 Data Interoperability

Robust traceability depends on standards for interoperability and interoperability inherently depends on agreed-upon standards. Defined here, interoperability is the ability of different information systems and software applications to communicate, exchange data, and to be able to use the information that has

been exchanged. Syntactic interoperability is the ability of two machines to physically communicate with each other using specified communications protocols, data standards, and even the same character set (ASCII, Unicode, etc.). Semantic interoperability is when data exchanges share a common vocabulary so that software applications on both ends can actually interpret and act upon the shared data.

True interoperability is when different machines or software applications can send, receive, and correctly interpret the data based on the use of the same semantic and syntactic standards. Therefore, no third-party translation or user intervention to facilitate data exchange is necessary under true interoperability. Encouraging and facilitating the adoption of semantic and syntactic standards for traceability are essential to building out the CDTS and connecting public and private nodes in the seafood supply chain.

In order to support robust national fisheries management, the USAID Oceans CDTS must be interoperable with and connected into existing FIS infrastructures and with databases that capture supply chain data. Currently, both Indonesia and the Philippines are in the process of developing national FIS efforts to acquire, collate, store, and access relevant fisheries information, including for foreign export. 'Fisheries Information Systems' (FIS) are a collection of integrated computer applications, hardware, and processes used by a national fisheries authority to support its management of national fisheries activities and resources. The USAID Oceans CDTS will link with an integrated FIS that is designed to acquire, collate, store, and provide real-time access to CDTS and other national data. In concert with the CDTS, the FIS will support seafood traceability and analysis in real time. The FIS will also serve as a repository, or 'data warehouse', of all information collected regarding the seafood supply chain through time, allowing it to be stored for future access, analysis, and reporting by authorized users, such as national government agencies and authorized private sector actors.

The FIS will allow for monitoring of KDEs at specific points within the supply chain, analyze fishery product movements over time, and allow access to catch documentation data through time. The FIS will play a central role in monitoring and evaluating changes in the supply chain and market over time, and allow for time series analysis within supply chains across all actors.

The FIS concept aims to connect a wealth of national databases that are currently siloed and inaccessible from one, common entry point. As data systems and inventories vary from country to country across the region, national data sets will require screening and selection for inclusion in the FIS. USAID Oceans has developed the following list of potential data sets for inclusion in the FIS to enable a comprehensive database that contains the data necessary for robust fisheries management and planning.

USAID Oceans does not intend to build a complete FIS program. However, for the purpose of supporting the CDTS, USAID Oceans will work with the national fisheries agencies to ensure existing datasets leading into an FIS contain high-integrity data. To provide for this high-integrity data and to ensure CDTS can be used to combat IUU fishing practices, a number of mandatory applications need to be put in place. These applications include registration, licensing, permitting for vessels and fishers, and trip and catch reporting and will generate datasets that can support the CDTS. Some of the data sets and sources for consideration and inclusion in an FIS for wild-caught fisheries include:

- Vessels Registration, Licensing, and Permitting
- Monitoring Control and Surveillance (MCS)
- Vessel Monitoring Systems (VMS)
- Electronic Trip and Catch Reporting Systems (ECR) e-Logbook
- Landing Certificates and Inspections
- Port in/Port Out
- Cold chain and logistics
- Catch Certificates (Catch Documentation Scheme)
- Health Certificate (HACCP)
- Fishery Observer Programs
- Quota Management System

While several of these data sets include registered businesses, the proposed model for the CDT system (see Section 4.6) would provide dealer/processor licensing information as a service. This service will uniquely identify all businesses that are properly licensed to conduct business. Another possibility is to

use the GS1 Global Location Number, which is an even more standardized way of identifying unique locations in the supply chain where products are handled and transformed.

Evaluation of these systems will be included in design of CDTS in order to ensure the systems can be efficiently bridged in the future. In terms of supply chain-generated data, the CDTS proposes a decentralized model, called the Data Exchange Model (DEX), summarized in Section 4.6.

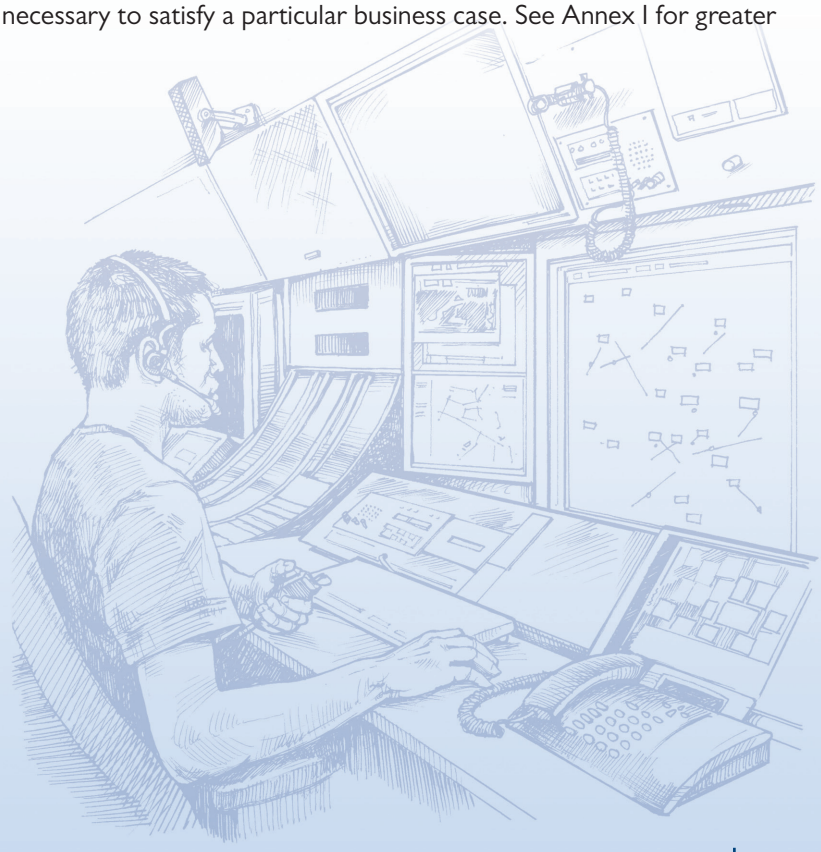
4.6 Summary of the Data Exchange Server (DEX) Model

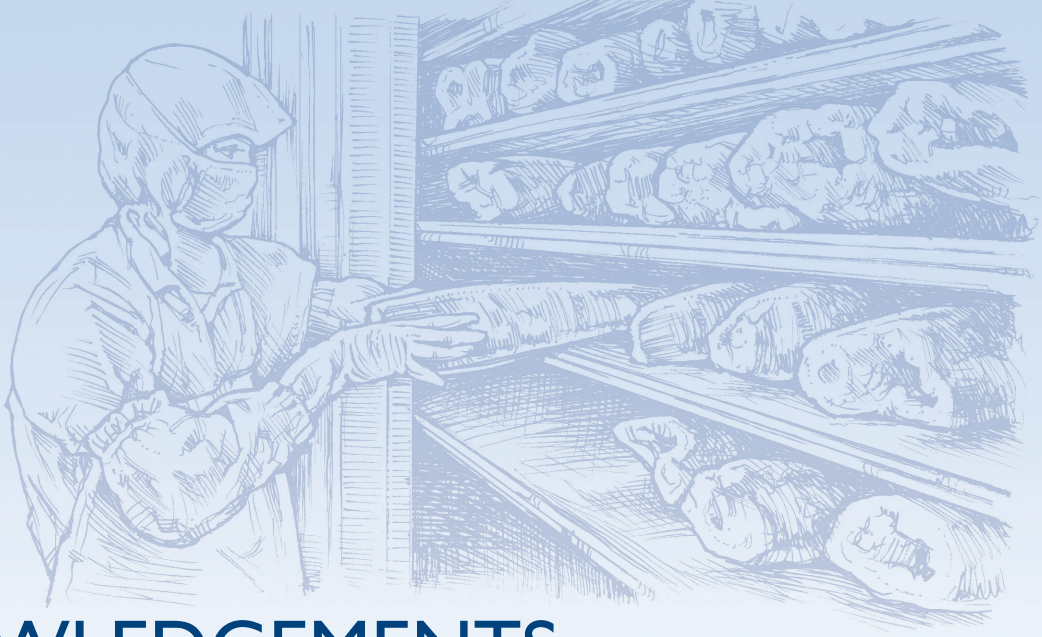
When asked to design an intermediate solution that facilitates data movement across disparate nodes in the seafood supply chain, USAID Oceans realized that a Data Exchange Server (DEX) could be a potential solution. DEX is a decentralized approach to traceability data sharing and can be a physical or virtual (cloud-based) server that publishes web services that facilitate the movement of data across the supply chain. A web service is any piece of software that makes itself available over the internet and uses a standardized XML messaging format to communicate from machine-to-machine as opposed to a web site which communicates from machine-to-human.

The current vision is for each node in the supply chain to easily communicate electronically as the physical product moves from location to location. DEX is a physical or virtual server that is owned by whatever entity generates and chooses to host the CTE, including supply chain companies, governments, or third parties. As long as the data are all encoded in the same way, these DEX will facilitate data movement across disparate nodes in the chain. Multiple DEX allows the seafood supply chain to make choices in how they track and interact with data. The DEX model also provides a means for singular data entry events to populate databases that others can access, given specific permissions, thereby reducing duplication of data entry for supply chain actors. This includes integration with single window systems, as detailed in the Annex.

In the absence of a full standard, an agreement must be reached between DEX service owners that will define how they communicate with each other. This agreement ensures interoperability while eliminating fraud and promoting better practices up and down the chain.

In addition, DEX service owners and any data provider will also need to determine usage agreements. This is the power of the decentralized DEX model: it allows case-by-case partitioning of traceability data from proprietary data. As many in industry would argue that traceability data itself is proprietary, usage is always determined by the data owner and DEX service provider. A user may expose as little of their supply chain data as they deem necessary to satisfy a particular business case. See Annex I for greater details on the DEX model.





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FURTHER READING

Electronic Catch Documentation Systems *(selected examples)*

United States: NOAA Fish Information System Program (also, as implemented by the Atlantic States fisheries)

European Union: FLUX, Electronic Vessel Reporting (domestic) and Catch Certification Scheme (for imports: currently paper based, but converted to electronic format upon inspection of documents)

Asia: ASEAN Catch Documentation Scheme (ACDS)

Commission for the Conservation of Antarctic Marine Living Resources: e-Catch Documentation Scheme

Commission for the Conservation of Southern Bluefin Tuna: Catch Documentation Scheme

Supply Chain Perspective and Existing Data Standards

Assessing the Value and Role of Seafood Traceability from an Entire Value-Chain Perspective (IFT)

EDI XML Electronic Document Interchange Standards (general, for seafood and meat products) (GSI)

Customs "Single Window" Initiatives *(selected examples)*

United States Customs & Border Protection Automated Commercial Environment (ACE)

ASEAN Single Window (ASW)

European Maritime Safety Agency (EMSA) National Single Window Prototype (NSW)

The Global Seafood Market

The State of World Fisheries & Aquaculture (United Nations Food & Agriculture Organization)

Fisheries of the United States (National Oceanic and Atmospheric Administration)

The EU Fish Market (European Commission)

ASEAN Combating IUU Fishing and Seafood Fraud

Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain (ASEAN)

The Presidential Task Force on Combating IUU Fishing and Seafood Fraud

Establishing a Comprehensive Framework to Combat IUU Fishing and Seafood Fraud

Recommendations of the Presidential Taskforce on Combatting IUU Fishing and Seafood Fraud (Federal Register)

Action Plan for Implementing the Task Force Recommendations (Departments of Commerce and State)

Draft principles for determining seafood species at risk of IUU fishing and seafood fraud (NOAA)

Determining Types of Information and Operational Standards Related to Data Collection (NOAA) Seafood Import Monitoring Program Final Rule

Implementation Guide for Seafood Import Monitoring Program

Human Welfare and Social Responsibility

Social Responsibility in the Global Seafood Industry: Background and Resources (FishWise)

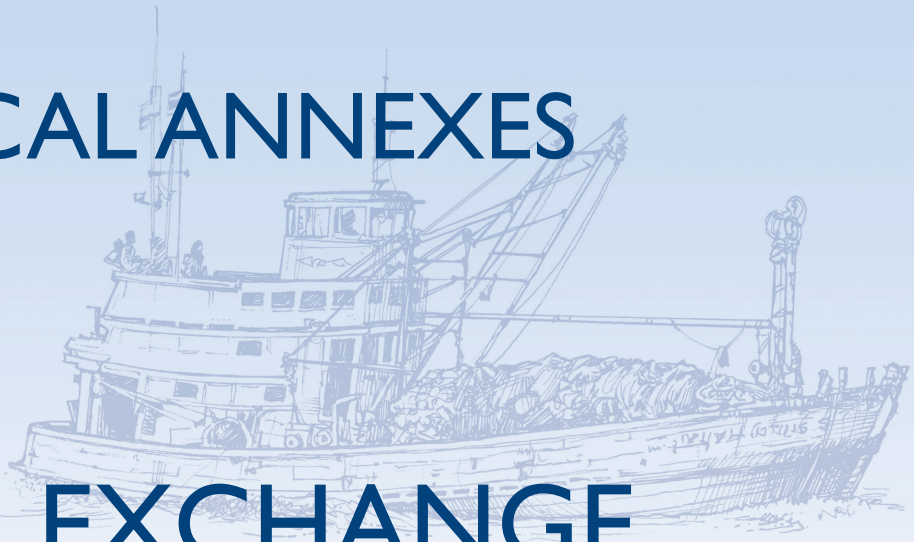
Seafood Traceability

Advancing Traceability in the Seafood Industry: Assessing Challenges and Opportunities (FishWise)

Interoperable Seafood Traceability Technology Architecture: Issues Brief (GFTC)

Project to Develop An Interoperable Seafood Traceability Technology Architecture: Issues Brief (GFTC)

TECHNICAL ANNEXES



Annex I

DATA EXCHANGE SERVER: DESIGN AND APPROACH

There is a growing trend toward greater adoption and implementation of traceability technology within seafood supply chain companies; however, on a global scale, few fully traceable seafood supply chains exist. Internal traceability — the ability of a company to capture and store information about a product or group of products as those products are moved or processed within a company's facility — allows companies to meet most food safety and recall requirements. However, internal traceability alone is not sufficient for product-level information to be captured, stored, and shared with other supply chain partners in manner that can effectively root out IUU, mislabeling, and other fraudulent activities. Full-chain traceability — the ability to track key data elements (KDEs) and other information about seafood products as they move between trading partners throughout a supply chain — must be in place to achieve more complete and robust information capture (Hardt MJ, *et al* 2017).

Currently, full-chain traceability is difficult to achieve. Full-chain traceability (also end-to-end traceability) hinges on two key requirements: (1) multiple supply chain partners agreeing to share specific product-level data, and (2) technology vendors interoperating on a standardized level so that their systems can effectively and seamlessly communicate these data. Some emergent standards exist (e.g., GS1) to help facilitate full-chain traceability for semantic interoperability (data meaning and interpretation) and syntactic interoperability (data formatting and transfer); however, because of multiple technical, financial, and business-culture challenges, uptake of those standards in seafood has been slow. Thus, instances of full chain traceability across commercial seafood supply chains are rare.

To overcome the challenges mentioned above, USAID Oceans was asked to design an intermediate solution to facilitate data movement across disparate nodes in the seafood supply chain. Here we offer the Data Exchange Server (DEX) model as an option for meeting that need. This Annex provides an overview of the DEX model, its points of integration within the seafood supply chain, and requirements.

A1.1 Introducing the Data Exchange Server (DEX) Model

When asked to design an intermediate solution that facilitates data movement across disparate nodes in the seafood supply chain, USAID Oceans conceptualized the DEX model as a potential solution that aggregates data from all supply chain players, enabling full chain traceability while protecting the security and integrity of contributed data. The DEX can be a physical or cloud-based server that publishes services that facilitate the movement of data across the supply chain. Behind the DEX, are a series of independent databases that host and maintain their individual data, and feed into the DEX

model for a comprehensive system that enables full chain traceability. It is important to note that this flexibility in DEX structure (i.e. physical or cloud-based servers) does not affect security of the data. There are numerous security schemes available to accomplish data sharing across disparate systems. Parties to the information must cooperate on implementation of security.

While previous models and theories about traceability relied on a centralized document to hold all data about a certain process, USAID Oceans believes this process comes with many challenges that may prevent a fully effective system. The desire for privacy and concern about publishing sensitive or proprietary data discourages supply chain members' participation in this form of traceability. To address the issue of privacy while still maintaining the necessary sharing of data, USAID Oceans proposes a more decentralized model that allows for access to be verified information on an as-needed basis. Under this model, multiple servers may contribute to the DEX system, allowing supply chain members to independently maintain and manage their data, while still connecting to the DEX for information transfer.

USAID Oceans' vision is for each node in the supply chain to easily communicate electronically as the physical product moves from location to location. The DEX model will facilitate data movement across disparate nodes in the chain, each with their own database that feeds data into the DEX model. This approach requires that all data are encoded in the same way, thus Oceans' emphasis on standards and serialization, as discussed in Section 4. The DEX allows the seafood supply chain to make choices in how they track and interact with data, which will ensure interoperability while eliminating fraud and promoting better practices up and down the chain. In the absence of a full standard, an agreement must be reached between DEX service owners that will define how they communicate with each other.

A1.2 DEX Server Architecture

The DEX acts as a both a technical and institutional bridge between nodes in a supply chain. It facilitates the movement of traceability data along the chain and builds links between different databases. The DEX allows the owner of certain supply chain data to publish the data to the DEX, making data available to other actors in a supply chain.

FIGURE A1. The DEX Model as seen through the supply chain.

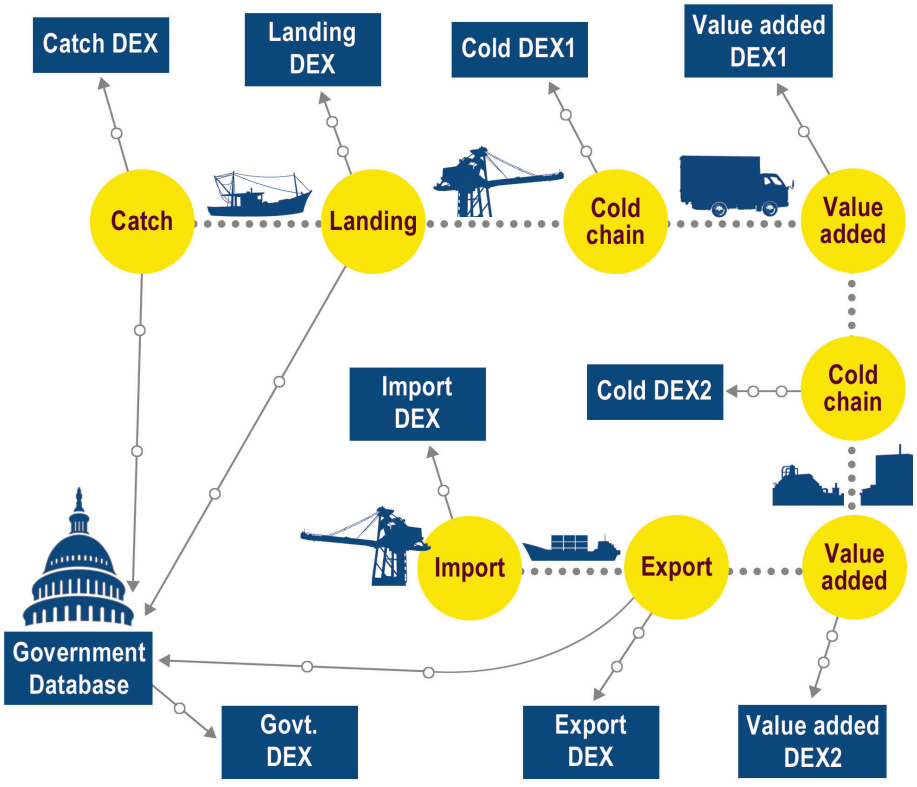
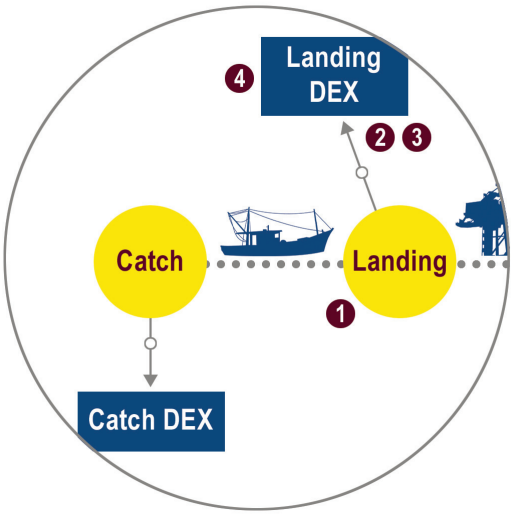


Figure A1 illustrates the proposed DEX model. Supply chain nodes are represented in graphic icons (e.g., fishing vessel, landing docks, transport, buyer, exporter, importer, etc.), the flow of physical product is shown in yellow circles, with DEXs services called out in blue boxes, and the flow of data to DEXs is shown in grey lines. The multiple DEXs shown in this illustration are an example of how the system can be scaled as additional participants become involved. For USAID Oceans' learning site implementation, a simplified approach will be adopted, using a single DEX to first test system capability and effectiveness (see Annex II).

A1.3 Application of the DEX Model



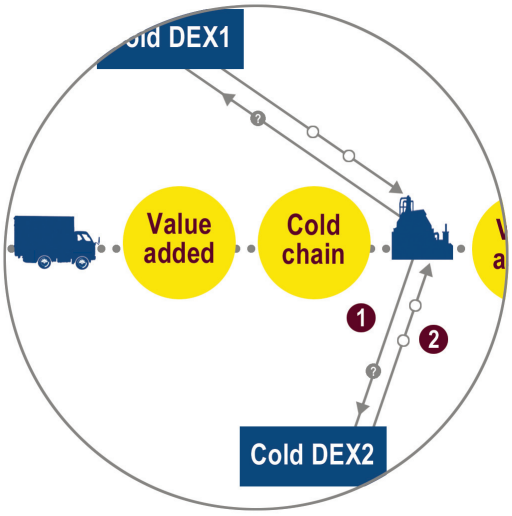
1: Fish lands at the dock.

1) Critical Tracking Event (CTE) - An event that produces potential new data. In this case a certain species of fish lands at the dock in a certain location, on a certain date, weighs a certain amount, and is received by an individual or company.

2) Key Data Elements (KDEs) - Data points created during a CTE, are captured individually and encoded in the same fashion. An individual product will have numerous KDEs, all of which will be uploaded to the DEX for permission-based access at a later time.

3) Serialization - The process of labeling each individual product with a unique code. For DEXs to be effective, players up and down the chain must make available the unique numbers they use for the products they handle. The primary benefits of serialization are flexibility of data and the ability to establish lineage or pedigree throughout the chain. As long as each node encodes its data in the same way, data can be used in a myriad of ways. Ultimately, electronic access to serialized data is required, and if links between nodes can be maintained, it will be possible to trace products back to catch documents.

4) Data Exchange Server (DEX) - When all KDEs are uploaded, the data are accessible to anyone with permission to query the DEX. As part of USAID Oceans' long term vision for the system, any company could host a DEX and anyone with the right privileges or licensing could access another node's DEX. Multiple companies could agree to use the same DEX, or each node could use its own DEX as long as info is encoded using the agreed upon standards and is made accessible as per requirements.

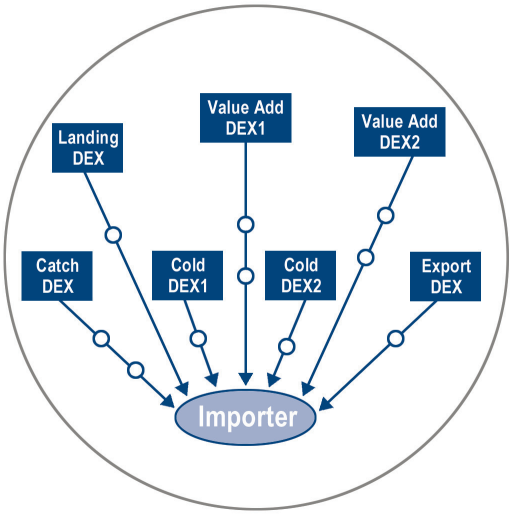


2: Value Add DEX and Information accessible to all.

1) Request sent - When the product changes hands and lands with a processor whose role is to perform a "value add" service like portioning off products for sale, they will need information about landing species, location, weight, etc. To obtain this data, their ERP system queries the DEX.

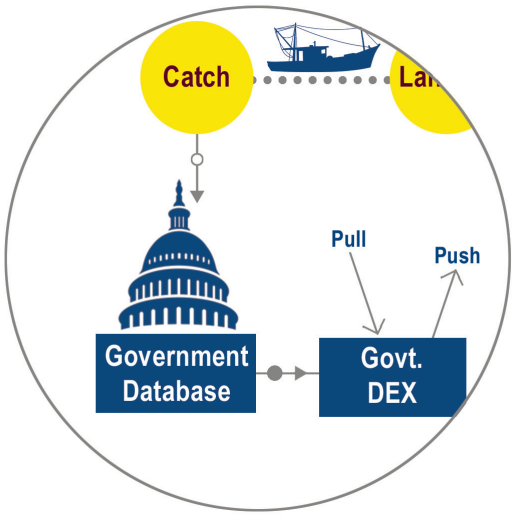
2) Data received - Supply chain members' credentials will determine their ability to obtain certain data from the DEX. The creation of KDEs and the uniformity of encoded serialization facilitate access to verified information about every fish.

3: Data landscape across an entire supply chain can be viewed in one place and easily reported to the government or other regulatory agencies.



The uniformity of encoded data housed in the DEX allows importers far up the chain access to verified, high level information about all of the data exchanges that occurred through a product's journey. Currently this type of access is rare and often only exists in short supply chains. Ease of information gathering and guarantee of accuracy will reduce the burden of reporting product information to higher agencies. DEX services become a 'single source of truth.' The owner of the product at the time of a critical tracking event takes the responsibility to: assign a unique identifier to the event; publish a subset of the KDE as a web service; and provide downstream nodes with the unique identifier. As identifiers travel the data chain and accumulate in business documents, paths to the single source of truth accompany the product in the supply chain. In this manner, the DEX helps reduce duplication and redundancies of data entry: the relevant KDEs are published one-time by the owner where the CTE occurs and the KDEs are generated and downstream nodes can access this information based on need and permissions.

A1.4 Government Roles



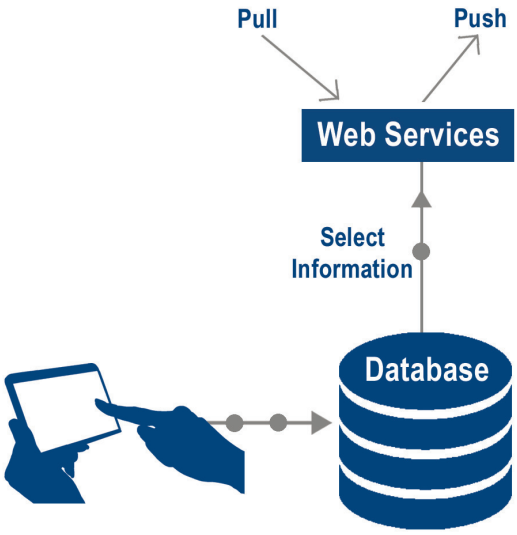
Government agencies have a significant role to play in supply chain traceability. Government is almost always the impetus behind efforts to capture data elements in the 'first mile', being responsible for instituting VMS tracking, catch reporting, and landing receipts. These data are critical for establishing the identity of product entering the supply chain and for verification of product as it makes its way through the supply chain. Government agencies also play a significant role in the export and import of seafood products. In the context of combating IUU fishing, government plays an important role as a competent authority providing verified data to validate and issue license, permits, and catch and health certificates.

It is important to clarify that the entire supply chain could benefit from small bits of government data and that traceability is by no means a mandate to open proprietary data to the rest of the supply chain or to the general public. Significant value could be realized if government agencies offered verification services (via DEXs) that allowed any participant in the supply chain to query a lot number or an import/export certificate number and receive a digital reply confirming that the lot was exported to or imported from a particular country on a particular date. These simple facts alone would help improve the veracity of traceability data in the supply chain.

A1.5 Data Exchange Server (DEX) Services

Mobile apps and software applications are the most common frontends to information management systems. For seafood dealers, those information management systems are typically Enterprise Resource Planning (ERP) systems. For governments, they are large import/export and catch/landing systems. Software applications are most often built on top of databases, which store information and enforce referential integrity between data elements and collections of records. Web services are another layer on top of the application. Web services allow disparate systems or components of a system to communicate using a standard format known as Extensible Markup Language (XML) via the Internet.

FIGURE A1. DEX Services



In our DEX architecture, web services publish only select data from one software application in the supply chain (e.g., an ERP system) and make them available to certain other applications in the supply chain (e.g., the ERP system of a trading partner, a government system, etc.). Web services can be viewed simply as the push or pull of data based on an electronic request or event. Certain Critical Tracking Events (CTEs) can trigger a push of data out to specific recipients via email or via an electronic message to another application. Supply chain nodes looking to capture data or verify data already received can pull information from a web service by sending a request to a Uniform Resource Identifier (URI), which is an address where a web service is published. For example, imagine an importer receives a shipping manifest via a third party Electronic Data Interchange (EDI) service that lists a vessel registration number. That importer's ERP application can send that registration number and a date range to a URI published by a government agency and pull a verification message confirming whether or not that vessel was properly registered for that fishery on that date. To support data functionality and access, USAID Oceans' will build web services as a layer of the DEX. DEX services will enable data verification from authorized data recipients, i.e., the U.S. CBP to comply with seafood import regulations.

Figure A1 offers an overview of where DEX services would occur across an entire supply chain. Below, DEX services are detailed further by first listing and defining the various DEX services. Following are tables for each DEX service, with detail on what CTEs occur in the supply chain and the category of KDEs that are created by each event.

Below is a listing and description of each DEX service:

1) Catch: Any relevant supply chain data generated in the "first mile" prior to landing, including fishing time, VMS tracks/area fished, labor conditions, fishery, bycatch, species, and estimated weights. Data exchange services might be provided by captains, fishing companies/cooperatives, fishery management authorities, and eLogbook programs.

2) Landing: The moment when product arrives onshore and is formally declared to a fishery management authority. KDEs might include port of landing, species, product form, and actual weights. Other parameters might include whether transshipment has occurred or if the product was consolidated and trucked from the actual landing location.

3) Cold Chain: Any events or data normally associated with transactions and handling in the seafood supply chain including purchase orders, invoices, shipping notices, and bills of lading. The digital standard for data exchange is primarily EDI and EDI-XML.

4) Value Add Events: Because seafood exists in many product forms, capturing the one-to-many and many-to-many relationships among product forms is the hallmark of batch-level, lot-level and item-level traceability. This is a critical point of distinction in the seafood industry. These events and data are closely tied to the ability to serialize products in the chain and to maintain relationships between, for example, a whole fish and its portions, or the thousands of cans of processed fish produced from a single fishing trip. These certificates would not need to expose any confidential data but simply provide verification via a web service.

5) Import and Export Certification: Required by law in nearly every country, import and export certification is critical to verifying the country of origin, species, age, and product form of seafood products. This electronic data is often considered proprietary to the government authorities and the importer and the exporter of the product. The rest of the supply chain could benefit by having electronic access to verified certificate numbers that confirm the validity of products in the global supply chain.

6) Serialization: Represents a hierarchy of identity from a country of origin or fishing stock down through unique fishing trips or ports of entry and into the supply chain as containers, batches, lots and items. Serial master data is also essential for uniquely identifying physical supply chain locations and product data across the supply chain.

In the DEX model, traceability does not have an owner, but rather is a collection of information or links between datasets owned by supply chain partnerships that describes how seafood products move through a supply chain. In a larger model, when the system is used by a large number of participants, governance, management, and dissemination of the DEX data may be shared by numerous parties, not just the national fisheries agency. In this case, organizations would form a contract to facilitate traceability, or agree to hold the combined data in perpetuity for a well-defined purpose. In most cases, the DEX should either be managed by a data owner publishing its own data, or serve as a collection of data that exists only long enough to track product through the full supply chain. Any database, anywhere in the supply chain, must be managed according to the best practices of data governance so that the data are secure, well defined, and collected and managed for a specified purpose. In USAID Oceans' implementation, the DEX will be owned by the home country's national fisheries agency (see Annex II for further detail).

The table below notes individual nodes in the supply chain, the relevant sample CTE and KDEs that occur in the supply chain, the entities creating these KDEs, and the likely DEX publisher.

	Critical Tracking Events (CTE) and Key Data Elements (KDE)	Data Creators	Likely DEX Publishers
CATCH	CTE - Vessel begins trip	• Captain • Fishing Company • VMS Authority • At-Sea Observers	• Fishery Management Authority • Fishing Company • eLogbook Provider
	KDEs captured by VMS		
	Port of Origin		
	Unique Vessel ID		
	Date of Product Established		
	Fishing Effort		
	Landing Declaration		
	KDEs captured by eLogbook		
	Species		
	Estimated Weight		
	Product Form		
	Transshipment		
	Vessel trip ends		
LANDING	CTE - Vessel Lands Product	• Captain • Fishing Company • Fishery Management Authority • Seafood Dealer	• Fishing Company • Fishery Management Authority • eLogbook Provider • Dealer ERP System
	KDEs captured by landing declaration or eLogbook		
	Port of Landing		
	Unique Vessel ID		
	Date of Landing		
	Species		
	Actual Weight		
	Product Enters Commercial Supply Chain		

	Critical Tracking Events (CTE) and Key Data Elements (KDE)	Data Creators	Likely DEX Publishers
COLD CHAIN	CTE – Product Enters Commerce at First Point of Sale	• Suppliers • Buyers	• Proprietary, but shared from node to node in the supply chain
	KDEs to capture		
	Purchase Orders		
	Invoices		
	Shipping Notices		
	Bills of Lading		
	Actual Weight		
	Product Reaches Consumer		

VALUE ADD	CTE – Product Form is Changed	• Suppliers • Buyers	• Proprietary, but shared from node to node in the supply chain
	KDEs to capture		
	Value added processing		
	Value added product forms		
	Wholesale, restaurant and consumer packaging		
	Product Reaches Consumer		

IMPORT / EXPORT	CTE – Product Declared for Export from Country A	• Government Import/ Export Authorities	• Not readily available electronically in many countries
	KDEs to capture		
	Export declaration		
	Bills of lading		
	Customs documentation		
	Import declaration		
	Product Received for Import into Country B		

	Serialization Services	Data Creators	Likely DEX Publishers
SERIALIZATION	Location, Product, Product Forms or Items Needs to Be Uniquely Identified	• GS1 • Private Serialization Services • Fishery Management Authorities	• GS1 • Private Serialization Services • Fishery Management Authorities
	Serial identification of vessels and vessel trips		
	Unique identification of ports, countries, and water bodies		
	Unique identification of species		
	Serial identification by product and product form		
	Serial Identification 'Injected' into COLD CHAIN and VALUE ADD services		

A1.6 Establishing a Standard Semantic

Lastly, it is important to highlight that supply chain participants and data contributors do not have an established semantic standard for sharing fisheries data. However, establishing a standard will be key to enable comparison and compilation of data across fisheries and supply chains. USAID Oceans will draw upon ongoing efforts in the field to establish data standards at each node of the supply chain. These efforts include:

- Well-curated reference data is available through the FAO, and there is an ongoing effort to build a fisheries/seafood ontology into the GS1 supply chain standard.
- Although there is no established global standard for import and export data exchange, many government authorities do publish rudimentary data formats, usually positional text, to allow batch import of supplier/broker data into their systems.
- In the cold chain, there is a very long established semantic in the edifact standard which has evolved into the more modern EDI-XML standard.
- Many ERP systems in the seafood supply chain are fully capable of exchanging documents through a type of data exchange service called a Value Added Network (VAN). The Value Added Network is moderately well supported by FAO and other reference datasets for food products and product forms.

Annex 2

TECHNICAL APPLICATION

A2.1 Solution Architecture

USAID Oceans intends to support national governments to implement a Catch Documentation and Traceability System (CDTS) that fully traces seafood products from their point of catch to country of import. USAID Oceans will not build an end-to-end application, but will seek to incorporate existing traceability solutions into a more comprehensive system that leverages existing capabilities and strengthens them with an enhanced infrastructure. Where traceability technology and capabilities are missing, USAID Oceans will support the building or modification of existing technologies to achieve full connectivity.

CDTS solutions will be inclusive of small-scale fishers as well as medium and large industrial fishing players. Oceans will support small-scale fishers' participation in the market's traceability requirement with the provision of technology and solutions that enable data collection. Until now, the inability for small-scale fishers to provide traceability records and paperwork has excluded these fishers from a larger export market. Use of communication technologies that are accessible to the public (i.e., Android-based mobile phones and applications), especially members of small-scale coastal communities, is critical to USAID Oceans' approach.

For medium and large-scale fishers, USAID Oceans will work to bridge available technology and communication solutions including VMS, e-logbook, and technologies from logistic service providers to meet the market requirements, and establish consistent Key Data Elements (KDEs) and data standards.

Further down the supply chain, USAID Oceans will engage with processors to support their integration into the CDTS and traceability chain. Improving computer systems and communications technologies of fisheries processing companies will not only improve the business process, but also provide the company with better ways of keeping records, should traceability audits be needed in the future. Many small and medium processing companies in the region are still using manual and semi-electronic systems due to cost barriers, with only larger companies being able to afford the implementation of an Enterprise Resource Planning (ERP) system. USAID Oceans will work with a number of regional and national institutions that are currently working in providing simple supply chain applications to find a robust, least-cost solution that improves inclusion of all supply chain participants.

USAID Oceans has developed the Data Exchange (DEX) model as interoperability engine that will connect various traceability systems. This system will include a set of web services to provide serialization that links traceability data from and to other nodes in the supply chains. The DEX will also serve to validate KDEs, as queried by other relevant systems, including government, licensing, permitting, etc.

Lastly, to improve the ability of government agencies to support traceability, USAID Oceans will work with local and regional government agencies to improve permit and licensing systems and build interoperability features that allow government systems to communicate data with commercial systems. As needed, USAID Oceans will provide hardware infrastructure support for government agencies in project learning sites, Bitung, Indonesia and General Santos City, Philippines.

A2.2 Hosting

USAID Oceans supports the use of cloud hosting to enable decentralized use. Applications can be installed in site-based servers as required, i.e., where there is a lack of quality internet, where the application is being used in closed environment, or where such is required by government regulation or policy.

USAID Oceans strongly suggests the use of secure public hosting services such as Amazon Web Services, Google Cloud, and Microsoft Azure, however, additional security measures must be employed to improve their cybersecurity. National or private clouds may be used, as long as they meet the necessary performance quality, including Service Level Agreement (SLA) and Security.

A2.3 Application Structure and Function

USAID Oceans recommends that the following requirements and specifications be considered in the development of CDTS solutions, web services and supporting applications.

Point of Catch and Landing

a. Small and medium scale: A trader and buyer application (mobile Android and web-based application that enables data collection at small-scale buying stations, ports, or docks). The application will enable first point traders to record their purchase from small-scale fishers and produce any traceability documents. Data input by traders will comply with USAID Oceans' KDEs. The mobile CDTS application to be used on handheld devices, such as tablets and smart phones, will be built using native Android application or web.

b. Large-scale: USAID Oceans will work with commercial VMS and e-logbook systems that have the ability to send data (e.g., location, catch) through hybrid satellite and cellular communication. Systems must comply with the standard KDEs and communicate with the government logbook, certification system, and any other licensing and permit systems.

Transport, Logistic and Processing

a. Medium and small scale-processing: A web based processing and inventory control system is required to support full-chain traceability. USAID Oceans will assist in providing processing companies that currently have no system with infrastructure support. The proposed system will have the capacity to perform machine to machine communication, such as electronic scale, that is able to feed the data directly to the server.

b. Large-scale processing: USAID Oceans will not develop any large-scale application but only assist in the modification of existing commercial Enterprise Resource Planning (ERP) systems to enable participation in the industry traceability system (e.g., provide a link from and to other nodes in the supply chain through the DEX).

DEX

In the learning sites, the DEX can be defined as:

a. A web services application that sends and receives data from and to other authorized systems, managed through web pages viewable in standard compatible web browsers, and various operating systems such as Windows, Macintosh, and Linux on desktop computers;

b. Runs in a high availability 24 x 7 environment; and

c. Employs high security HTTPS and data encryption.

Operations Center

Learning sites will be equipped with Operations Centers that support the DEX, and connect DEX services with other national systems to bolster security and enhance port operations to combat IUU fishing. The national fisheries operations centers are to be hosted in secure Port Authority government offices. The Operations Centers will be maintained beyond the life of the project by National and Provincial Fisheries agencies. Features include:

a) Main hardware components including workstations, video wall, CCTV camera, printer, scanner, router and servers; and

b) Dashboards and Business Intelligence widgets with the ability to drill down to the underlying data.

A2.4 Anticipation of Future Application Changes and Additional Future Deployments

a) The CDTS apps should be built in a modular way to support staged implementation and deployment. The development of the MVP (Minimally Viable Product) version of these applications will use Agile methodology to enable immediate realization of usability and learning.

b) Following the successful launch of the CDTS application, USAID Oceans expects that there will be requests for new functions or features in the CDT application that were not anticipated in the first definition. It is likely that, to handle those additional feature requests, USAID Oceans may issue one or more Purchase Orders for additional development.

c) USAID Oceans expects that over time changes will be made to the completed CDTS app to accommodate new needs or adjustments. The CDTS application should be designed to be highly flexible so that small adjustments to the workings of the completed app do not cause the CDT App to "break."

A2.5 Training, Documentation, and Technical Support after launch

To provide the training and documentation necessary to support CDTS implementations, USAID Oceans will work with existing local organizations that have strong records in implementing traceability, including social enterprises, NGOs, and associations.

a) USAID Oceans will assist such organizations with capacity building and enhancing technical knowledge.

b) USAID Oceans will hire an ICT service company to support the technical deployment of both the DEX and supporting applications. The contracted ICT provider will be responsible for first line customer support and help desk services.

c) Long-term support, beyond the life of USAID Oceans, will be gradually transferred to the organization that will take the ownership of the CDTS (i.e., the national fisheries agency).

A2.6 Communications during application development

Development implementation will be carried out in the order and timeline based on the "Phases" specified for the main set of functions.

a) Applications will be developed using Agile Scrum methodology where each work and milestone will be divided into a regular, repeatable work cycle, known as a sprint or iteration. The length of Scrum can be one-week or two-week sprints or more.

b) During each sprint, a team creates a potentially shippable product increment.

c) During the sprint, team members check in with each other at the daily Scrum meeting, also called the "standup."

d) Most developer-client communications will be held during a weekly development meeting, where progress, needed inputs for each sprint, and other issues are discussed. This will be either a telephone meeting or in person in the client's office. (The developer and the client will also be in ongoing communication throughout the week as needed).

e) Online software collaborative development tools should be used; tools like JiraSoftware and Confluence is strongly suggested.

f) Code repository like Github is strongly suggested where "in-progress" version of the application will be available and visible to the client online.

A2.7 Required Application Compliance

The following requirements must be considered in the development of the CDTS application:

a) The application is funded by the US Agency for International Development, and therefore must observe certain requirements for branding, primarily the position of the USAID logo on certain pages of the application.

b) Any application developed using USAID funds should be available to the public domain and open source.

c) The following three categories of open source software usage must be considered; to ensure license compliance, every tool or program must be put through an approval process prior to the start of the project:

   i. As a tool: Open source software is used as-is in binary form without modification during the development process and as an external component not part of project deliverables.

   ii. As part of project deliverables, without modifications such as Javascript libraries, PHP frameworks and others.

   iii. As part of project deliverables, with modifications.

d) The application must respect local laws, data privacy and sovereignty.

e) Developers are obligated to adhere to local data protection laws. Developers and vendors must comply with various legal regulations that govern the collection, processing and sharing or transmitting of data. Also, information which have been converted and stored in binary digital form is subjected to the law of the country in which it is located.

f) Application software developed for this project is available for use at no monetary cost. Anyone is freely licensed to use, copy, study, or change the software in any way. The source code is available to openly be shared so that people are encouraged to voluntarily improve the design of the software. Selling or distributing a more capable version of this software does not require permission, however, proper credit should be given to USAID as the original creator of this project.

g) Notwithstanding, to ensure the sustainability of the solution beyond the project, other organizations are allowed to build business around the product by providing value added services (VAS). This VAS could include, but is not limited to: modifications, adding new features, installation and maintenance, technical support (on site and help desk).

h) Any commercial applications that will be connected to the DEX are able to retain their IP.

Annex 3 IMPLEMENTATION STRATEGY

A3.1 CDT System Roadmap

In furthering regional catch documentation and traceability, USAID Oceans seeks to not only support the development and implementation of regionally adaptable learning site Catch Documentation and Traceability Systems, but a process for enhanced traceability that can easily be adopted and utilized by countries across the region and beyond. As a five year program, USAID Oceans has established a phased approach to system development and implementation. The program seeks to establish tested protocols, best practices, and a "road map" to CDT implementation that can benefit ASEAN, Coral Triangle member countries, and others.

A3.1.1 Phase One: Research and Engagement

At the outset of the USAID Oceans project, focus was placed on developing regional relationships, buy-in, and conducting foundational research. A landscape analysis was conducted to establish key players and involved stakeholders at regional, national, and local levels. A situational analysis was also undertaken to survey the current situation, available solutions, current regulations, protocols, policies, and resources available.

Following initial analysis, engagement activities began. The USAID Oceans team worked to engage with stakeholders at all levels — regional, national, and site-level — as well as those from multiple sectors, including industry, academia, government officials and fisheries agencies, nongovernmental and intergovernmental organizations (i.e., WWF and FAO, United Nations, respectively), private sector, USG partners, and like-minded organizations. USAID Oceans viewed these consultations as critical for obtaining buy-in, feedback on strategy and approach, and forming an established base of engaged stakeholders. In addition to country consultations where the program introduced its mission and vision, gauged interest, and secured country participation, the team also met with private sector and industry members, NGOs, standards organizations, etc. to obtain buy-in on the program's long-term vision to bolster the system's success and ultimate sustainability.

In 2015 and 2016, USAID Oceans held a series of consultations and conducted in-depth analyses to select two learning sites to host and support on-site CDTS development, implementation, and testing; conduct complementary fisheries management and human welfare activities; and to serve as models for regional learning and future system expansion. Sites were assessed against biodiversity (including the presence of vulnerable habitats and species), regional impact, and sustainability criteria. USAID Oceans also considered other key dimensions including the degree to which transboundary elements are involved such as trade; national government site and fisheries priorities are being met; industry preparedness to engage is present; overall political will is evident; sustainability is likely to be achieved; and the operating environment is sufficiently viable for long term engagement.

Using this defined set of selection criteria in combination with extensive discussion and dialogue with SEAFDEC and partner countries, USAID Oceans selected the Philippines and Indonesia as target locations for the establishment of learning sites in which to develop, design, and test the CDTS and perform supporting EAFM and Human Welfare activities. Working closely with Philippine and Indonesia government agencies and local stakeholders, General Santos City, Philippines, and Bitung, Indonesia (Fisheries Management Area–WPP 716) were formally determined to be USAID Oceans' primary learning sites.

In addition, USAID Oceans worked closely with ASEAN and CTI-CFF member countries to define locations for potential expansion sites where knowledge from capacity building activities and learning site exchanges will be applied. Applying a tiered approach, USAID Oceans and member country counterparts established levels of support for each location based on contextual needs, marine biodiversity conditions, and other factors.

With the foundation set following research, engagement, and target sites for implementation, operationalization followed. USAID Oceans established operational mechanisms to support program activities both internally and at the regional, national, and local levels. These included the USAID Oceans Technical Working Group, a Technical Advisory Group, and defined operational structures to inform working relationships and responsibilities between implementing partners, including USAID, SEAFDEC, and CTI-CFF.

Lastly, before moving to the next phase — Design and Build — USAID conducted additional research to expand on the initial desk studies and preliminary research carried out at the start of the program. With learning sites targeted and established, USAID Oceans commissioned national and site-specific research to ensure that the CDTS' design, and complementary program activities, are rooted in current and comprehensive research. Research conducted included Value Chain Analyses, Rapid Assessments for Fisheries Management, and Labor and Gender Analyses. These studies allowed the program to ground truth and adjust strategy, and enter Phase II with an informed approach for design.

A3.1.2 Phase Two: Design and Build

In Phase 2, CDTS design is informed by Phase I's research and consultations, and is supported by the relationships and operational mechanisms established. As the USAID Oceans CDTS does not strive to be a "one size fits all" system, but rather one that is customizable and tailored to individual country needs and priorities, the Activity has worked to design an overarching CDTS architecture that can be modified for individual country application. This version, referred to as a generic, "reference" version, will establish the CDTS' structure and functionalities (Annex I).

To inform the design process, Phase 2 includes significant engagement with established working groups, supporting partners, and influential stakeholders. USAID Oceans will actively engage with its Technical Advisory Group, as well as a broader network of stakeholders, industry and traceability experts, and supporting partners (such as USG initiatives, regional organizations, and implementing partners), to ensure the system's design leverages the latest technology, reflects regional priorities and needs, and has a core network of engaged partners that have an interest in and will support implementation, expansion, and long term sustainability.

Capacity building is critical to the implementation of the CDTS and long term sustainability. Without a core group of users that are equipped to use and test the system, CDTS testing in the learning sites will not be effective and long-term sustainability will be compromised. Throughout the design and build process, USAID Oceans will engage participating countries and regional partners in capacity building activities that crosscut program work streams (traceability, fisheries management, and human welfare) to ensure that stakeholders are equipped with the necessary skills to implement, utilize, and contribute to the CDTS and to support a participatory approach to implementation.

Finally, with design complete, USAID Oceans will engage a subcontracted third-party for the build out of the CDTS, building off of the established "reference" version of the system that will be customized for the learning sites in the Philippines and Indonesia. System dashboards and mobile applications will also be developed to facilitate data input and utilization, supporting a user-friendly design that reflects the realities of connectivity and available resources in each site. As all supply chain actors at the learning sites may not have technologically advanced and comprehensive systems for data collection, USAID will provide interim tools and applications for those partner companies (i.e., interim solutions such as spreadsheets will be provided to data gatherers that are currently using strictly paper-based record keeping).

In order to easily integrate the DEX into national fisheries information systems (FIS), USAID Oceans will help to strengthen those existing systems to improve information validation and verification, seafood product transparency, and fisheries analysis. The IT subcontractor will work with USAID Oceans' staff to ensure that the CDTS will link to and be compatible with existing national FIS.

A3.1.3 Phase Three: Implementation, Testing, and Optimization

With the design of the CDTS established in Phase 2 and system build out complete, Phase 3 will be characterized by the implementation of the system in the learning sites, followed by testing, and optimization. The CDTS will be tested incrementally by "first-mile users" and supply chain actors (e.g., small and large-scale fishers, buyers, processors, shippers, exporters) partnering with USAID Oceans and operating within existing commercial tuna fisheries supply chains from the ports of General Santos City and Bitung. Site-based IT service providers contracted during Phase 2 will support deployment and training on the mobile app and dashboard locally.

Testing and troubleshooting of the mobile application software will be completed by various actors within the supply chain using a beta version of the mobile application developed during Phase 2. Redesigns and updates to the mobile app and DEX model will be completed during this phase, as required.

As part of CDTS implementation, additional sub-systems and functionalities will be build out, including the proposed government-sanctioned and port-based National Fisheries Operations Centers at the General Santos City and Bitung Ports. Installation will include deployment and testing of the national fisheries monitoring dashboards conducted by National and/or Provincial Government Fisheries Officers assigned to the established Operations Centers.

A3.1.4 Phase Four: End-of-Project Handoff

In addition to continued CDTS expansion and maintenance, during the final ten months of this activity, the USAID Oceans team will work with regional partners, including SEAFDEC, national governments, and private sector partners to ensure the successful handoff and adoption of the deployed system(s) after the close of the USAID Oceans project, in a coordinated effort between USAID Oceans and the National Technical Working Groups. Partnership activities completed through the lifetime of the Partnership seek to secure the support of private sector partners that will support CDTS sustainability.

A3.2 Learning Site Implementation Strategies

After assessing regional fisheries data and opportunities, USAID Oceans selected two learning sites to host and support on-site CDTS development, testing, and implementation, and to serve as a model for regional learning and future expansion. Indonesia and the Philippines will host national-level and learning site activities, located in Bitung and General Santos City, respectively. The following section presents high-level site information, analysis gathered through in-depth site research, and USAID Oceans' implementation strategy.

A3.2.1 Indonesia

Site Selection Considerations. In coordination with SEAFDEC and the Indonesian Ministry of Maritime Affairs and Fisheries (MMAF), USAID Oceans identified Fishery Management Area (WPP) 716 as the optimal Indonesia learning site. The site presented the best opportunity in Indonesia to implement traceability for high value tuna fisheries because of the high volume of fishing activity in transboundary areas, the large number of small-scale fishers, and its high marine biodiversity. Bitung port in Northern Sulawesi is the largest landing site for tuna in WPP 716. In 2014, MMAF issued 4,692 catch certificates, covering over 25,000 metric tons of fish — 79 percent of which was tuna landed in Bitung port.

Engagement Strategy. Engagement at the national and site level includes close coordination with MMAF, particularly with nominated MMAF counterparts on the USAID Oceans National Technical Working Group, supporting each of USAID Oceans' programmatic objectives: catch documentation and traceability, implementing EAFM, and improving human welfare in the fisheries sector. USAID Oceans will ensure strategic alignment with MMAF leadership, facilitated by on-the-ground USAID Oceans support — led by national and site-level coordinator. USAID Oceans' Indonesia-based staff will assist MMAF in managing the USAID Oceans implementation plan for Indonesia.

To support national and learning site activities and implementation, USAID Oceans has built partnerships with a number of locally-based organizations, including MDPI, AP2HI, IPNLF, and Marine Change. USAID Oceans has also engaged with non-traditional partners to bolster system capabilities and sustainability, including technology providers such as Cisco, Qualcomm, Intel, Inmarsat, and Iridium.

Site Assessment. To inform the learning site implementation strategy, assess opportunities for engagement, and identify potential challenges, USAID Oceans conducted extensive research in Bitung, Indonesia. Research studies included a Value Chain Analysis, Rapid Appraisal for Fisheries Management, and Gender and Labor Studies. Findings from these studies have been used to develop the learning site strategy across the CDT, EAFM, Human Welfare and PPP work streams. Summary findings are presented below. Throughout CDTS development and implementation at the Bitung learning site, USAID Oceans will consider and address the following barriers and opportunities:

Opportunities. The USAID Oceans team and its partners have assessed and analyzed the current situation at the Bitung learning site, including the current state of catch documentation, coordination and relationships between supply chain actors, regulations, market factors and technology use and needs. USAID Oceans has identified the following opportunities upon which it can build as the CDTS is developed and implemented.

Implementation Timeline. In Years Two and Three (2017-2018) of the USAID Oceans program, the team will pursue the following steps at the Bitung learning site:

Design

- Design, build and promote the use of the DEX as an interoperability hub for stakeholders;
- Study, formulate and facilitate incentives for small-scale fishers to implement the CDTS through cross-agency partnerships;
- Identify the CDT requirements of different stakeholders to develop a CDTS design that builds upon and aligns with existing systems;
- Conduct a Value Chain Assessment to identify the main export markets and articulate the cost, benefits, and return on equity; and
- Perform in-depth analyses to support EAFM plan development and human welfare interventions, including a Rapid Appraisal for Fisheries Management and Gender Analysis of the fisheries sector.

Development

- Engage a wide variety of private sector actors, including fishing companies, buyers, retailers, financiers and technology companies, secure their support for implementing a CDTS that is financially sustainable in the long term.

Implementation

- Provide assistance to supply chain actors in implementing CDTS by:
  - Building capacity to operate the CDTS;
  - Promoting a business-enabling environment for the CDTS;
  - Supporting IT and infrastructure;
  - Engaging in knowledge-building (information, education, and communications); and
  - Developing relationships among wider seafood supply chain stakeholders;
- Support government agencies at the central and local levels to adopt the CDTS and leverage data captured for export activities, as well as fisheries management; and
- Work with traceability service providers to implement interoperability.

Expansion

- Conduct a gap analysis and create a roadmap for CDTS expansion across Indonesia.

A3.2.2 Philippines

Based on the same criteria and the high volume of fish landed from the same transboundary area as Bitung, USAID Oceans has selected the port of General Santos City in Mindanao, Philippines to host the Philippines-based learning site.

General Santos City, situated in the Sarangani Bay and facing the Celebes Sea, was identified as the optimal Philippines-based learning site for implementing traceability for high value tuna fisheries because of the site's proximity to a major tuna migration corridor in the Celebes Sea, its high volume of tuna landed at port, and rich biodiversity. General Santos is recognized as the tuna capital of the Philippines, responsible for over 65 percent of the country's tuna production. In 2014, over 190,000 metric tons of fish were landed in General Santos City, more than twice the volume of fish landed just ten years ago (Philippine Fisheries Development Authority).

Engagement at the national and site level includes close coordination with the Philippine Bureau of Fisheries and Aquatic Resources (BFAR), particularly BFAR Region 12, with nominated BFAR counterparts supporting each of USAID Oceans' programmatic objectives. USAID Oceans will ensure strategic alignment with BFAR leadership, with Philippines-based USAID Oceans' national and site-level coordinators assisting BFAR to manage the USAID Oceans implementation plan for the Philippines.

USAID Oceans has developed local partnerships to support activity development and implementation. Partnering with the SOCKSARGEN Federation of Fishing and Allied Industries, Inc. (SFFAII), a non-government and non-profit organization that serves as an umbrella organization of seven associations with a total of over 100 companies involved in fishing, canning, fish processing, aquaculture production and processing, and other allied industries, will help the CDTS reach a wider audience and ensure the long-term sustainability of the CDTS. USAID Oceans is also building partnerships with major Philippines-based telecommunication companies, including Globe and SMART.

Opportunities. The USAID Oceans team and its partners have assessed and analyzed the current situation at the General Santos learning site, including the current state of catch documentation, coordination and relationships between supply chain actors, regulations, market factors and technology use and needs. USAID Oceans has identified the following opportunities upon which it can build as the CDTS is developed and implemented.

Implementation Timeline. In Years Two and Three (2017-2018) of the USAID Oceans program, the team will pursue the following steps at the General Santos learning site:

Design

- Conduct a Value Chain Assessment to identify the main export markets and articulate the cost, benefits, and return on equity;
- Identify the CDT requirements of different stakeholders to develop a design that builds upon existing systems;
- Perform in-depth analyses to support EAFM plan development and human welfare interventions, including a Rapid Appraisal for Fisheries Management and Gender Analysis of the Fisheries Sector; and
- Incorporate solutions and lessons learned into the CDTS approach from the Indonesia learning site such as iFISH and stock assessment applications.

Development

- Engage a wide variety of private sector actors, including fishing companies, buyers, retailers, financiers and technology companies, secure their support for implementing a CDTS that is financially sustainable in the long term.

Implementation

- Provide assistance to supply chain actors in implementing CDT by:
  - Building capacity to operate the CDTS;
  - Promoting a business enabling environment for the CDTS;

- Supporting IT and infrastructure;
- Engaging in knowledge-building (information, education, and communications); and
- Developing relationships among seafood supply chain stakeholders.

- Support government agencies at the central and local levels to adopt the CDTS and leverage data captured for export activities, as well as fisheries management.
- Partner with government agencies such as the Department of ICT and local government units to consolidate national ICT investment and efforts and pave the way for wider implementation.

Expansion

- Conduct a gap analysis and create a roadmap for CDT expansion across the Philippines.

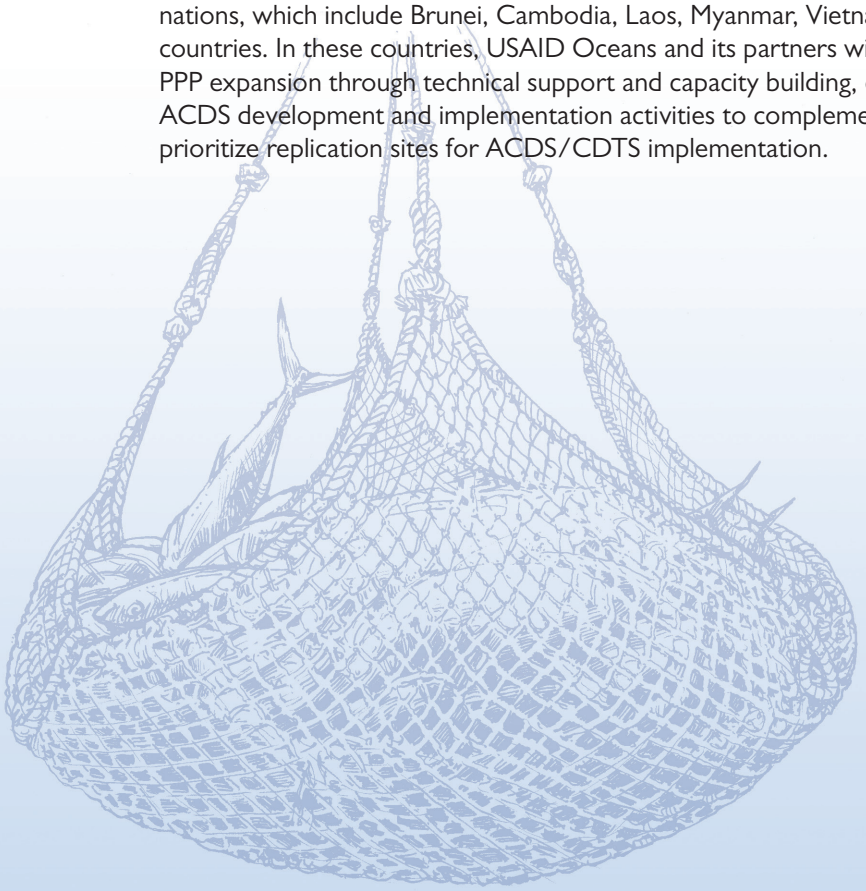
A3.2.3 Expansion Sites

The learning sites will serve as models for regional expansion, with ASEAN and Coral Triangle Initiative member countries leveraging site-based learnings for their own planning and implementation. Member countries will select learning sites in each of their respective countries that will leverage Philippine and Indonesian activities.

Following discussions between USAID Oceans and the Governments of Malaysia and Thailand, expansion sites have been identified for CDTS testing and implementation during Year 3 (2018) within specified seafood supply chains. The identified sites, Kelantan and Songkhla, will employ lessons learned from the design, implementation, and testing of the CDTS in the Philippines and Indonesia.

In Kelantan and Songkhla, USAID Oceans will initiate the development of the ACDS/CDTS guidelines, helping Malaysia and Thailand develop national roadmaps for implementation. USAID Oceans will provide a targeted package of technical, operational and material support to expansion countries to facilitate the adaptation and application of the CDTS while also providing support on EAFM planning and software and training on the data exchange server.

Through the USAID Oceans Technical Working Group, national government partners, and regional project implementing partners will identify prospective expansion sites within the other ASEAN nations, which include Brunei, Cambodia, Laos, Myanmar, Vietnam and Coral Triangle member countries. In these countries, USAID Oceans and its partners will support regional EAFM, CDTS, and PPP expansion through technical support and capacity building, closely coordinate with SEAFDEC ACDS development and implementation activities to complement the CDTS testing, and identify and prioritize replication sites for ACDS/CDTS implementation.



Annex 4

RECOMMENDED KEY DATA ELEMENTS

This annex details the "minimum" recommended key data elements (KDEs) to be captured within each link of the seafood supply chain under the scope of USAID Oceans. Relevant KDEs for each link of the supply chain are itemized in summary tables in this annex. Summary tables contain several fields (columns) of data, including (from left to right): (1) the relevant category, including human welfare (HW; far left-hand column); (2) the specific KDE; (3) the equivalent Data Label; (4) whether or not (if yes, "X") the KDE has been recommended for capture by WWF International; (5) whether or not the KDE has been required for capture under the updated U.S. seafood import regulations; (6) whether or not the KDE has been required for capture under EU importing regulations; (7) whether or not the KDE has been recommended for captured under the ASEAN Catch Documentation Scheme (ACDS); and (8) whether or not the KDE is being recommended as a "minimum" KDE for captured under USAID Oceans.

Full KDE definitions and guidance on data collection methods, timing, and location can be found in the USAID Oceans *Data Requirements for Catch Documentation and Traceability in Southeast Asia: CTE-KDE Framework and Glossary*, or "KDE Manual" for short (USAID Oceans 2017[16]). The KDE Manual also includes a full listing of required and ideal Human Welfare data elements.

A4.1 Producer KDEs (Point-of-Catch)

Table A4.1: Summary table of the key data elements (KDEs) that are to be captured by the **fishery product shipper/transporter (including domestic and export)** under the USAID Oceans CDTS.

Category	Key Data Element (KDE)	Data Label (equivalent)	The Expert Panel on Legal and Traceable Wild Fish Products	KDE capture required for US SIMP	KDE capture required for EU Imports (EC 1005/2008)	KDE capture recommended under ACDS	Minimum KDE proposed under USAID Oceans
Who	Event owner	Company or organization name				X	X
Who	Owner name	Company/fishing vessel owner name	X			X	X
HW	Owner sex	Sex					X
Who	Owner ID	Fishing license #; personal ID card	X	X	X	X	X
Who	Owner ID expiry date	License expiration date					
Who	Owner address	Company address		X*		X	X
Who	Owner phone	Company phone			X		X
Who	Trading partner	Consignee					X
HW	Trading partner sex	Sex					X
Who	Vessel name	Name of fishing vessel	X	X	X	X	X
Who	Vessel size	Vessel type/tonnage (MT)	X*			X	
Who	Vessel flag	Flag state of fishing vessel	X	X	X	X	X
Who	Vessel ID	Unique vessel id/registry #; VMS Unit #; IMO/Lloyd's #; Inmarsat #	X	X	X	X	X

[16] USAID Oceans (2017). *Data Requirements for Catch Documentation and Traceability in Southeast Asia: CTE-KDE Framework and Glossary.* Tetra Tech ARD, Bangkok, Thailand.

Category	Key Data Element (KDE)	Data Label (equivalent)	The Expert Panel on Legal and Traceable Wild Fish Products	KDE capture required for US SIMP	KDE capture required for EU Imports (EC 1005/2008)	KDE capture recommended under ACDS	Minimum KDE proposed under USAID Oceans
What	Event type	Catch or farmed		X			
What	Event number	Trip #; catch ID		X			
What	Item type	Species caught (common market name; catch description)		X*	X	X	
What	Item code	Scientific name (species)	X	X*	X	X	X
What	Item number	ASFIS # or product code		X		X	
What	Bycatch	Bycatch (Y/N)			X		X
What	Batch or lot number	Batch or lot number					X
What	Quantity	Volume of catch (quantity)	X	X	X	X	X
What	Weight: item	Verified weight of catch/ species (kg)				X	X
What	Weight: batch/lot	Total weight (kg) of batch/ lot					X
What	Total weight (kg) of batch/lot	Product Form at landing		X			
When	Event date	Catch date; batch/lot creation date	X		X	X	X
When	Event time	Time of catch	X				X
When	First freeze date	Vessel first freeze date					X
When	Date of departure	Date of departure				X	X
When	Time of departure	Time of departure					X
When	Date of return	Date of return/landing (at port)	X	X		X	X
When	Time of return	Time of return/landing (at port)	X				X
Where	Origin	Vessel's port of departure					X
Where	Event location	Location of catch	X	X	X	X	X
Where	Product destination	Port name (where landed)	X	X		X	X
Where	Vessel home port	Vessel home port	X				X
How	Event method	Gear type (method used)	X	X		X	X
How	FAD use	FAD use			X		X
How	FAD location	FAD location			X		X
Link	Activity type	Lead document type					X
Link	Activity ID	Lead document ID					X
HW	Captain name	Name of captain	X		X	X	X
HW	Captain sex	Sex					X
HW	Captain ID	Personal identification	X		X	X	X
HW	Captain nationality	Nationality	X			X	X
HW	Contract ID	Document ID					X
HW	Crew name	Name of crew/fisher(s)				X	X
HW	Crew sex	Sex					X
HW	Crew ID	Personal identification				X	X
HW	Crew nationality	Nationality of crew/fisher(s)				X	X
HW	Crew DOB	Date of birth of crew/ fisher(s)				X	X
HW	Crew job/title	Job/position				X	X

A4.2 Buyer/Receiver KDEs: At-Sea (Transshipment)

Table A4.2: Summary table of the key data elements (KDEs) that are to be captured by **fish buyers and fishery product receivers at-sea** (transshipment) under the USAID Oceans CDTS.

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Who	Event owner	Company or organization name				X	X
Who	Owner name	Company/transshipment vessel owner name	X			X	X
HW	Owner sex	Sex					X
Who	Owner ID	Fishing license #; personal ID card		X		X	X
Who	Owner ID expiry date	License expiration date					X
Who	Owner address	Company address				X	X
Who	Owner phone	Company phone					X
Who	Trading partner	Consignee					X
HW	Trading partner sex	Sex					X
Who	Vessel name	Name of transshipment vessel	X	X	X	X	X
Who	Vessel size	Vessel type/tonnage (MT)	X			X	
Who	Vessel flag	Flag state of transshipment vessel	X			X	X
Who	Vessel ID	Unique transshipment vessel id #; IMO/Lloyd's #; Inmarsat #	X	X	X	X	X
What	Event type	Transshipment					X
What	Event number	Transshipment ID/#					
What	Item type	Species transshipped (com-mon market name or catch description)		X		X	X
What	Item code	Scientific name (species)	X	X		X	X
What	Item number	ASFIS # or product code		X		X	
What	Bycatch	Bycatch (Y/N)			X		X
What	Batch or lot number	Batch or lot number	X	X			X
What	Quantity	Volume of catch (quantity)	X		X	X	X
What	Weight: item	Verified weight of catch/ species (kg)				X	X
What	Weight: batch/lot	Total weight (kg) of batch/ lot		X			X
What	Fork length	Length of transshipped fish					X
What	Unit of measure (length)	Unit of length					X
When	Event date	Catch date; batch/lot creation date		X		X	X
When	Event time	Time of catch					X
When	First freeze date	First freeze date					X
When	Date of departure	Date of departure				X	X

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
When	Time of departure	Time of departure					X
When	Date of return	Date of return/landing (at port)				X	X
When	Time of return	Time of return/landing (at port)					X
Where	Origin	Vessel's port of departure					X
Where	Event location	Transshipment location	X	X	X	X	X
Where	Product source	Feeder vessel name				X	X
Where	Product destination	Port destination		X		X	X
Where	Vessel home port	Vessel home port	X				X
How	Event method	Transshipment method	X	X	X	X	X
How	FAD use	FAD use			X		X
How	FAD location	FAD location			X		X
Link	Activity type	Lead document type					X
Link	Activity ID	Lead document ID					X
Link	Invoice	Transshipment note					X
Link	Certificate ID	Transshipment certificate ID					
HW	Captain name	Name of captain	X		X		X
HW	Captain sex	Sex					X
HW	Captain ID	Personal identification	X		X	X	X
HW	Captain nationality	Nationality	X			X	X
HW	Contract ID	Document ID					X
HW	Crew name	Name of crew/fisher(s)				X	X
HW	Crew sex	Sex					X
HW	Crew ID	Personal identification				X	X
HW	Crew nationality	Nationality of crew/ fisher(s)				X	X
HW	Crew DOB	Date of birth of crew/ fisher(s)				X	X
HW	Crew job/title	Job/position				X	X

A4.3 Buyer/Receiver KDEs: At-Port

Table A4.3: Summary table of the key data elements (KDEs) that are to be captured by **fish buyers and fishery product receivers/suppliers at-port** under the USAID Oceans CDTS.

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Who	Event owner	Company or organization			X	X	X
Who	Owner name	Company owner/buyer name	X		X		X
HW	Owner sex	Sex					X
Who	Owner ID	Buyer business license/regis-tration #; personal ID card				X	X
Who	Owner ID expiry date	License/registration expiration date					X
Who	Owner address	Company address			X		X
Who	Owner phone	Company phone					X
Who	Trading partner	Consignee					X
HW	Trading partner sex	Sex					X
Who	Vessel name	Name of vessel providing catch	X		X	X	X
Who	Vessel flag	Flag state of vessel providing catch	X		X	X	X
Who	Vessel ID	Unique vessel id #; IMO/ Inmarsat #	X		X	X	X
What	Event type	Purchase	X				X
What	Event number	Purchase ID/#					
What	Item type	Description of purchased catch; including common market name	X				X
What	Item code	Scientific name (species)			X	X	X
What	Bycatch	Bycatch (Y/N)			X		X
What	Batch or lot number	Batch or lot number	X				X
What	Quantity	Volume of catch (quantity)	X		X	X	X
What	Weight: item	Verified weight of catch (kg)	X		X	X	X
What	Weight: batch/lot	Total weight (kg) of batch/ lot					X
When	Event date	Purchase date; batch/lot creation	X			X	X
When	Event time	Time of purchase	X				X
When	First freeze date	First freeze date					X
Where	Origin	Point of catch source					X
Where	Event location	Point of sales location	X			X	X
Where	Product destination	Consignee				X	X
Where	Vessel home port	Home port of vessel providing catch	X				X
How	Event method	Receiving/offloading equipment used			X	X	X
How	FAD use	FAD use			X		X
Link	Activity type	Lead document type					X

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Link	Activity ID	Lead document ID					X
Link	Invoice	Sales invoice					X
Link	Packing slip	Packing slip and #					X
Link	Certificate ID	Catch certificate and/ or landing declaration number(s)					X
HW	Captain name	Captain name receiving catch from				X	X
HW	Captain sex	Sex					X
HW	Captain ID	Personal identification of captain				X	X
HW	Captain nationality	Nationality of captain				X	X
HW	Contract ID	Document ID					X
HW	Crew name	Name of crew/fisher(s) receiving catch from					X
HW	Crew sex	Sex					X
HW	Crew sex	Personal identification of crew					X
HW	Crew nationality	Nationality of crew/ fisher(s)					X
HW	Crew DOB	Date of birth of crew/ fisher(s)					X
HW	Crew job/title	Job/position of crew					X

A4.4 Processor KDEs

Table A4.4: Summary table of the key data elements (KDEs) that are to be captured by **fishery product processors** under the USAID Oceans CDTS.

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Who	Event owner	Company or organization	X	X		X	X
Who	Owner name	Company owner/processor name				X	X
HW	Owner sex	Sex					X
Who	Owner ID	Processor business license or registration #; personal ID card		X		X	X
Who	Owner ID expiry date	License/registration expiration date					X
Who	Owner address	Company/processing plant address		X		X	X
Who	Owner phone	Company phone		X			X
Who	Trading partner	Consignee					X
HW	Trading partner sex	Sex					X
What	Event type	Processing					X
What	Event number	Processing ID/#					
What	Item type	Description of seafood processed	X	X		X	X
What	Item code	Scientific name (species)		X		X	X
What	Packaging type	Packaging type/code		X			X
What	Packaging materials	Packaging materials description					X
What	Batch or lot number	Batch or lot number	X	X		X	X
What	Quantity	Quantity of processed product	X	X		X	X
What	Weight: item	Total weight of processed item (kg)	X	X		X	X
What	Weight: batch/lot	Total weight of processed batch/lot	X	X		X	X
When	Event date	Validation date of processing; processed batch/lot creation date	X	X		X	X
When	Event time	Time of processing				X	X
When	First freeze date	First freeze date					X
Where	Origin	Product origin		X			X
Where	Event location	Processing location/facility				X	X
Where	Product source	Company				X	X
Where	Product destination	Consignee				X	X
How	Event method	Description of processing method				X	X
Link	Activity type	Source document (PO/WO/BOL)					X
Link	Activity ID	Source document ID				X	

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Link	Invoice	Sales invoice					X
Link	Packing slip	Packing slip and #					X
Link	Certificate ID	Health and/or catch certificate					X
HW	Crew name	Name of processing laborers					X
HW	Crew sex	Sex					X
HW	Crew ID	Personal identification of laborers					X
HW	Crew nationality	Nationality of laborers					X
HW	Crew DOB	Date of birth of laborers					X
HW	Crew job/title	Job/position of laborers					X

A4. 5 Broker/Wholesale KDEs (Sellers)

Table A4.5: Summary table of the key data elements (KDEs) that are to be captured by **fishery product brokers/wholesalers (sellers)** under the USAID Oceans CDTS.

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Who	Event owner	Company or organization				X	X
Who	Owner name	Company owner/broker name					X
HW	Owner sex	Sex					X
Who	Owner ID	Seller business license or registration #; personal ID card					X
Who	Owner ID expiry date	License/registration expiration date					X
Who	Owner address	Company/broker address					X
Who	Owner phone	Company phone					X
Who	Trading partner	Consignee					X
HW	Trading partner sex	Sex					X
What	Event type	Broker/Wholesale					X
What	Event number	Processing ID/#					
What	Item type	Description of seafood sold				X	X
What	Item code	Product code					X
What	Packaging type	Packaging type/code					X
What	Packaging materials	Packaging materials description					X
What	Batch or lot number	Batch or lot number					X
What	Quantity	Quantity of product sold				X	X
What	Weight: item	Total weight of item sold (kg)				X	X
What	Weight: batch/lot	Total weight of batch/lot sold (kg)				X	X
When	Event date	Date of sale; batch/lot sales date				X	X
When	Event time	Time of sale					X
When	First freeze date	First freeze date					X
Where	Origin	Product origin					X
Where	Event location	Packaging location					X
Where	Product source	Product source					X
Where	Product destination	Consignee					X
How	Event method	Description of packing method					X
Link	Activity type	Source document (PO/WO/BOL)					X
Link	Activity ID	Source document ID					X
Link	Invoice	Sales invoice					X
Link	Packing slip	Packing slip and #					X
Link	Certificate ID	Health and/or catch certificate					X

A4.6 Transporter KDEs (including Domestic and Export)

Table A4.6: Summary table of the key data elements (KDEs) that are to be captured by **fishery product shipper/transporter (including domestic and export)** under the USAID Oceans CDTS.

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Who	Event owner	Company or organization			X	X	X
Who	Owner name	Company owner/manager name			X		X
HW	Owner sex	Sex					X
Who	Owner ID	Transporter business license or registration #; personal ID card				X	X
Who	Owner ID expiry date	License/registration expiration date				X	X
Who	Owner address	Company/transporter address			X		X
Who	Owner phone	Company phone					X
Who	Trading partner	Consignee			X		X
HW	Trading partner sex	Sex					X
What	Event type	Transport (domestic, international; road, rail, air, ocean)			X		X
What	Event number	Transport ID/#					
What	Item type	Name/description of product being transported				X	X
What	Item code	Product code					X
What	Batch or lot number	Batch or lot ID					X
What	Quantity	Quantity of items shipped				X	X
What	Weight: item	Total weight of items shipped (kg)				X	X
What	Weight: batch/lot	Total weight of batch/lot shipped				X	X
When	Event date	Transport start/end date				X	X
When	Event time	Transport start/end time					X
When	First freeze date	First freeze date					X
Where	Origin	Product origin					X
Where	Event location	Transport location, description of route/trip taken			X	X	X
Where	Product source	Product source					X
Where	Product destination	Consignee; signature of receiver upon delivery of product shipped				X	X
How	Event method	Description of transport (vehicle/air /rail/ship)			X		X
Link	Activity type	Source document (PO/WO/BOL)					X
Link	Activity ID	Source document ID (transport manifest/BOL)					X
Link	Invoice	Invoice/delivery order/BOL/export declaration form					X

Category	Key Data Element (KDE)	Data Label (equivalent)	KDE capture recommended by WWF	KDE capture required for US Imports	KDE capture required for EU Imports	KDE capture recommend-ed under ACDS	Minimum KDE required under USAID Oceans
Link	Packing slip	Packing slip and #					X
Link	Carrier ID	Transporter ID No.					X
Link	Container/trailer no.	ID number of container vessel or trailer/ compartment used for transport of product			X	X	X
Link	Certificate ID	Health and/or catch certificate; transport/export certificate; eco-friendly product certificate			X		X

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