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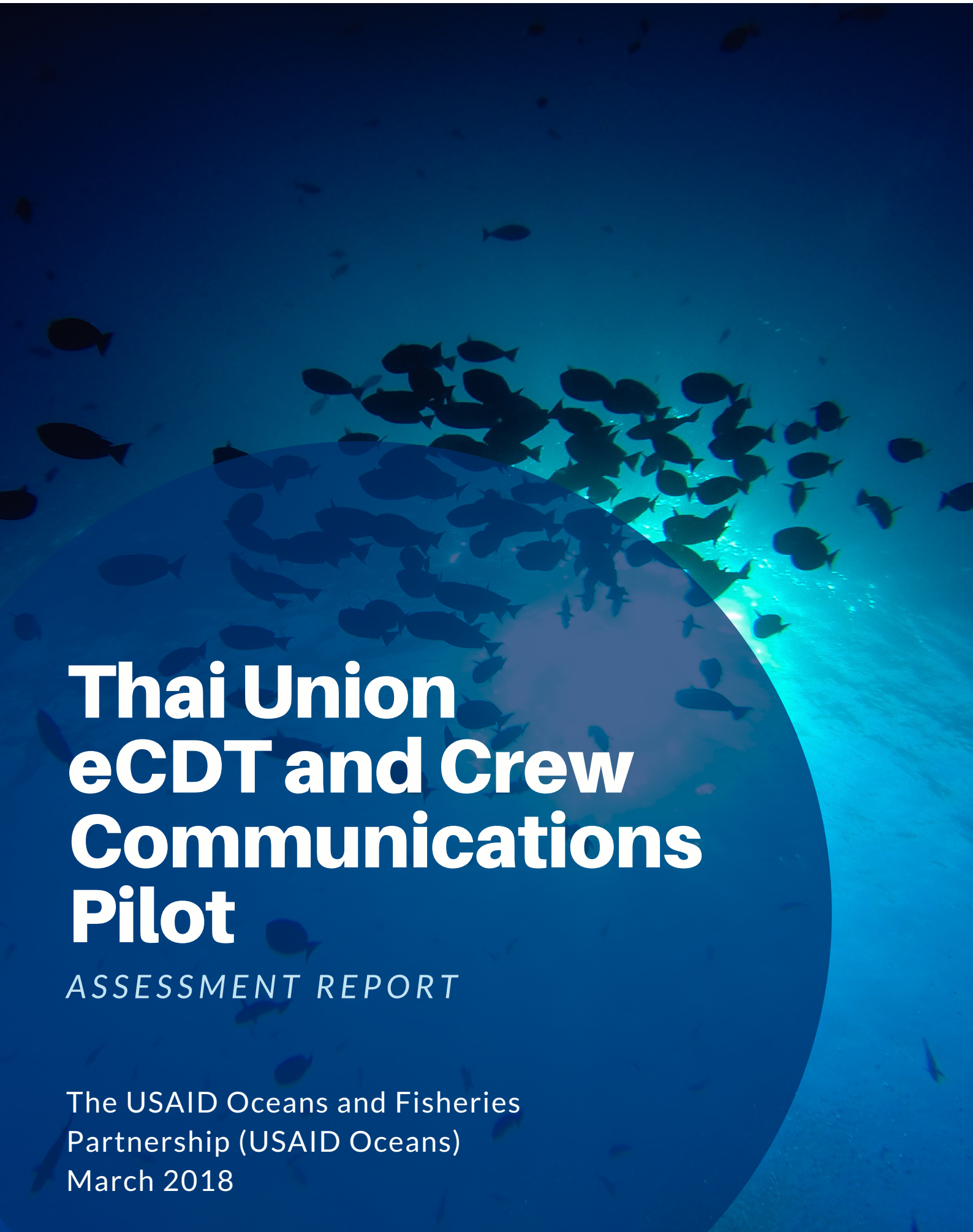

Thai Union eCDT and Crew Communications Pilot

ASSESSMENT REPORT

The USAID Oceans and Fisheries Partnership (USAID Oceans)
March 2018

Submission to USAID Oceans: February 2018

Submitted by: MARINE CHANGE
USAID Contract Number: AID-486-C-15-00001
Contract Period: May 14, 2015 to May 13, 2020
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This document was produced by Marine Change for the USAID Oceans and Fisheries Partnership, a United States Agency for International Development/Regional Development Mission for Asia (USAID/RDMA) funded Activity.

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ACRONYMS AND ABBREVIATIONS

ACDS	ASEAN Catch Documentation Scheme
ASEAN	Association of Southeast Asian Nations
BHT	Thai Baht
CDTS	Catch Documentation and Traceability System
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
DoF	Thailand Department of Fisheries
EAFM	Ecosystem Approach to Fisheries Management
EEZ	Exclusive Economic Zone
GT	Gross Ton
IUCN	International Union for the Conservation of Nature
IUU	Illegal, Unreported and Unregulated (fishing)
KDEs	Key data elements
NFC	National Farmer Council
NGO	Non-governmental Organization
NPCI	National Plan of Control and Inspection
NPOA – IUU	National Plan of Action to prevent, deter and eliminate IUU fishing
MT	Metric Ton
MSY	Maximum Sustainable Yield
PIPO	Port in and Port out
PPP	Public-Private Partnership
SEAFDEC	Southeast Asian Fisheries Development Center
SFMP	Sustainable Fisheries Management Plan
SEAFDEC	Southeast Asian Fisheries Development Center
SIMP	Seafood Import Monitoring protocol
SWOT	Strengths, Weaknesses, Opportunities, Threats
USAID	United States Agency for International Development
USAID Oceans	USAID Oceans and Fisheries Partnership Activity
USD	United States Dollar
USG	United States Government
VMS	Vessel Monitoring System

EXECUTIVE SUMMARY

In March 2017, the USAID Oceans and Fisheries Partnership (USAID Oceans) and Thai Union signed a partnership agreement to collaborate in the design and implementation of a regional catch documentation and traceability (CDT) system to combat Illegal, unreported and unregulated (IUU) fishing, promote sustainable fisheries, counter labor exploitation, and conserve marine biodiversity In the Asia Pacific Region.

Immediately after the MOU signing, Thai Union launched a pilot program to test the usability and scalability of CDT technology that supported the at-sea collection of data as well as improved crew communications. Thai Union led the pilot, in cooperation with the Department of Fisheries Thailand (DoF), Inmarsat, Xsense, and Mars Pet Care. The pilot took place on four vessels over a 36-week period between May and December and tested Inmarsat Fleet One Vessel Monitoring System (VMS) technology with two-way communications, an e-logbook and a mobile phone application, Hi-Chat, which was used for crew communications. As well as testing and understanding the potential for electronic CDT within the Thai fleets, the pilot was particularly interested in human welfare aspects and the ability of the crew to communicate securely to a trusted person on land.

As part of its partnership with Thai Union, USAID Oceans conducted an assessment of the CDT pilot (via subcontractor Marine Change) to assess its successes, opportunities for improvements, and identify how results from this pilot can inform regional traceability projects. As part of the assessment, Marine Change conducted interviews with the vessel owners, captains and crew in both pilot locations, Ranong and Pattani, Thailand. In addition, researchers also conducted interviews with technology providers, DoF personnel, and Thai Union staff to obtain their opinions and impressions of the technology. Lastly, researchers observed the operations of the Port-In-Port-Out (PIPO) center in Ranong and interviewed additional personnel.

To assess the pilot, Marine Change conducted a SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats), which demonstrated that whilst the technology did bring additional benefits to the users and the companies at hand, there we also severe operational constraints that resulted in less enthusiastic reception of the technology by its users. The connectivity was down between 50-70% of the time, depending on the vessel, which resulted in much frustration as the tools were not working then. In addition to preventing users from being able to test the applications, it also that the crew could not get accustomed to use with real time connectivity. In addition, the e-logbook was not connected to the DoF system during the pilot since it was not in the scope of the trial, which resulted in additional paper based reporting for vessels. For this reason, it was not possible to quantify any efficiencies and time savings that may have resulted from the use of the e-logbooks.

Marine Change also conducted an evaluation on the key data elements (KDEs) collected under the pilot, which showed that additional data points are needed for the system to be compatible with the CDT system in use by the Thailand Department of Fisheries, and with other international standards—including USAID Oceans' recommended point of production KDEs. These additions to meet Thailand's CDT standards are easy to make and are recommended as part of the next phase of the pilot as updates to the e-logbook.

Despite the problems that occurred during the pilot, the technology did clearly assist in CDT tasks, resulted in some business benefits and greatly improved crew morale and retention on board the vessels. It is clear, that with further adjustments and improvements there is potential for this technology to the mutual objectives of USAID Oceans, Thai Union, and DoF for enhanced traceability and at-sea connectivity. In 2018, DoF plans to test CDT technology onboard Thai distant water fleets in the Indian Ocean with a view of introducing it to the domestic vessels in 2019. Therefore, there is a very good opportunity to align the lessons from this pilot, and its next phase, with the policy development and implementation of CDT both in Thailand and in the region.

Additional recommendations for next steps include involving a number of PIPO centers in future implementations, both in terms of receiving the e-logbook information directly as well as included in the Hi-Chat application. This would enable time/cost benefits to be evaluated, as well as help further improve crew access to confidential sources. Other smaller, practical, and technical recommendations resulted from the analysis and are enclosed within, as well as a very preliminary analysis of potential costing and sharing of airtime costs.

1. BACKGROUND

1.1 The USAID Oceans and Thai Union Partnership

USAID Oceans was launched in May 2015 to strengthen regional cooperation to combat illegal, unreported and unregulated (IUU) fishing and promote sustainable fisheries, to conserve marine biodiversity in the Asia-Pacific region. USAID Oceans works in close collaboration with the Southeast Asia Fisheries Development Center (SEAFDEC), the Coral Triangle Initiative on Coral Reefs Fisheries and Food Security (CTI-CFF, national fisheries agencies, and other program partners—including Thai Union. USAID Oceans supports the development of electronic CDT (CDT) systems to help ensure that fish from Southeast Asia are legally caught and properly labeled. USAID Oceans encourages the collection and analysis of ecological, economic, and human welfare-related Key Data Elements (KDEs) for seafood products throughout the supply chain.

In 2016, USAID Oceans and Thai Union launched a partnership to collaborate in the design and implementation of a regional CDT system to combat IUU fishing, promote sustainable fisheries, counter labor exploitation, and conserve marine biodiversity In the Asia Pacific Region. Technical areas of collaboration between USAID Oceans and Thai Union include design of the CDT system, demonstration of the CDT system in Thailand, expansion of the CDT system, and participation in industry dialogue on CDT.

1.1.1 Pilot Introduction

In May 2017, Thai Union launched a pilot in Ranong and Pattani, Thailand, to test the use of electronic catch documentation and traceability (CDT) tools on board four Thai fishing vessels. Thai Union led the pilot, in cooperation with the Department of Fisheries Thailand (DoF), Inmarsat, Xsense, and Mars Pet Care. The pilot took place over a 36-week period between May and December and tested Inmarsat Fleet One Vessel Monitoring System (VMS) technology with two-way communications; an e-logbook; and a mobile phone application, Hi-Chat, which was used for crew communications. As well as testing and understanding the potential for electronic CDT technology within the Thai fleets, the pilot was particularly interested in human welfare aspects and the ability of the crew to communicate securely to a trusted person on land. The collaborative pilot project was designed to demonstrate best practices in implementing electronic traceability as a model for the industry and Thai government to address IUU fishing, sustainable fisheries management and fair labor monitoring.

The pilot project sought to test a combination of technology to establish fishing efforts as legal, regulated and reported; demonstrate fair labor practices; as well as develop efficient oversight on fishing trips for fleet owners, develop efficient processes for trip monitoring at sea for fishery management, and help enable continued access to international markets. To accomplish these goals, the pilot tested Inmarsat's "Fleet One" satellite IP terminals with mobile applications provided by XSense to document fishing efforts, as well as the "Fish Talk" (Hi Chat) chat application for testing of crew communications outside of the vessel. Thai Union seeks to continually integrate with DoF digital vessel traceability systems, and will integrate data with its internal enterprise resource planning (ERP) and traceability systems.

There are significant differences across Thailand's tuna industry key stakeholders—including fishers, brokers, processors, associations, exporters and government—in understanding the effectiveness of Electronic Report System (ERS) systems that include e-Logbooks and vessel monitoring systems; and their deployment to capture Key Data Elements (KDEs) from the point of catch to the processing facility and beyond. Thus, Thai Union, Inmarsat and USAID Oceans agreed to conduct an assessment of the availability, accessibility and accuracy of ERS systems, including the way they are incorporated across the supply chain by different stakeholders, their potential linkages with government systems, and the extent to which effective verification and validation processes can reduce risks and meet key market requirements. This report presents the findings of this assessment.

1.1.2 Evaluation Objectives

As a contribution to the USAID Oceans and Thai Union partnership, USAID Oceans funded the assessment of Thai Union's CDT Pilot, which was facilitated by third-party contractor Marine Change. The assessment sought to provide recommendations on CDT implementation strategies, revisions and next steps forward for stakeholders involved in the CDT Pilot in Thailand and elsewhere. As such, the assessment was guided by the following objectives:

- Analyze KDEs collected during the pilot and whether they meet US and EU market requirements– including labor criteria;
- Analyze the KDE collection and validation process, identify challenges and provide suggestions for improvement;
- Explore potential linkages between the CDT pilot system and the DoF traceability system; and
- Assess benefits and gaps of the CDT pilot vessel platforms for fleet owners and industry through conducting a value proposition and SWOT analysis.

Marine Change worked closely with the USAID Oceans technical staff, Inmarsat, Thai Union, Mars PetCare, Inmarsat, Xsense, as well the DoF, to:

- Conduct comparative desk research to assess how KDEs collected during the pilot meet current US and EU market requirements and Thai regulations, based on USAID Oceans' KDE Manual and Human Welfare KDEs;
- Visit two ports (Pattani and Ranong) to interview boat owners and crews who participated in the pilot about their training, data submission, and data verification process;
- Conduct interviews with Inmarsat and Xsense on their software/applications to review KDE processing and system functionalities;
- In both ports, conduct interviews with Thailand DoF to assess their existing vessel traceability system, verify results from USAID Oceans' earlier-conducted assessment of Thailand's CDT protocols, and analyze whether the DoF and Thai Union CDT systems can be linked;
- In both ports, conduct interviews with other boat owners and fisheries stakeholders to gain insights on the level of interest to participate in the CDT system;
- Develop a SWOT Analysis and assessment on the ability to scale the CDT and crew communications platform across the industry.

1.2 Overview of the Thai Fisheries Sector

The fisheries sector, including aquaculture, is important to Thailand economically, socially and for food security. In 2015, there were 42,512 active fishing vessels (including 25,002 powered vessels), and marine fisheries employed about 172,430 fishers—82% of whom were migrants. Additionally, seafood processing and other fishery-supporting industries employed about 515,000 people, most of whom were women[1].

Thai fisheries and aquaculture are currently undergoing a comprehensive reform initiated by the Thai Government in 2015. This was driven largely by concerns over deep-rooted problems of IUU fishing, which had led the European Union to issue Thailand a 'Yellow Card' in April 2015.[2] Thailand also was designated by the US as a 'Tier 3' country in their 2014 Trafficking in Persons Report[3]. These issues were widely exposed following investigations and reporting by the Associated Press[4].

The reform process has included the enactment of the Royal Ordinance on Fisheries B.E. 2558 (2015)[5] which entered into force in November 2015 and empowers government agencies to combat and significantly penalize IUU fishing and labor abuse in the sector. The government also adopted a Marine Fisheries Management Plan for 2015- 2019; developed a National Plan of Action to Prevent, Deter and Eliminate IUU Fishing (NPOA-IUU);

[1] Thailand Department of Fisheries (2015) Marine Fisheries Management Plan of Thailand 2015-2019
[2] http://europa.eu/rapid/press-release_IP-15-4806_en.htm
[3] https://www.state.gov/j/tip/rls/tiprpt/2014/226649.htm
[4] Associated Press (2015 – 2016) Seafood from Slaves. https://www.ap.org/explore/seafood-from-slaves/
[5] Royal Ordinance on Fisheries, B.E. 2558 (2015). http://www.fao.org/faolex/results/details/en/c/LEX-FAOC159730/

established a National Plan of Control and Inspection (NPCI) in 2015; and became a signatory to the FAO Agreement on Port State Measures to Prevent, Deter and Eliminate IUU Fishing in 2016[6] and the UN Fish Stocks Agreement in 2017.[7]

Thailand's Marine Fisheries Management Plan has set out specific targets for reforming its fisheries, including reducing fishing capacity and effort, particularly in the commercial sector. The plan sets reduction targets for demersal fisheries (40% in the Gulf of Thailand and 10% in the Andaman Sea) and for pelagic fisheries (30% in the Gulf of Thailand and 20% in the Andaman Sea). There are a number of approaches being taken, including freezing vessel registrations and licenses, cancelling the registrations of IUU vessels (including cases where multiple vessels were operating under a single vessel license) and revoking licenses from some inactive vessels.

With a high proportion of fishing crew and seafood processing workers being migrants, Thailand will continue to have a high risk of labor issues. The Thai Government and National Farmer Council (NFC) launched a basic fisherman training school in November 2017, with the aim of reducing the need for immigrant workers in the fishing and seafood industries.

Although the current round of fisheries reforms have been primarily driven by concerns from export markets, local consumption and access to affordable seafood are also significant factors in the reform process. At times there have been suggestions that local access to seafood is threatened by the fisheries reforms,[8] although these short term adjustments need to be viewed against the long term impacts of overfishing and consequent stock and catch declines.

1.3 Indo-Pacific Mackerel Fisheries

The Thai Union CDT Pilot took place in the context of the Indo-Pacific mackerel (*Rastrelliger brachysoma,* or *pla thu* in Thai) fishery, which is the third largest fishery in Thailand by value and the fourth largest by volume (Table 1). Other species such as tongol and sardines were also caught by the vessels that participated in the pilot, but in lesser quantities.

Table 1. Thailand's top five marine capture fisheries, ranked by volume and value (2015)

Vol	Val	Species	Volume (MT)	Value (USD)
		Total marine capture fisheries	1,317,200	1,486,362,112
1		Anchovies	102,108	43,368,471
2		Sardines	81,051	47,827,632
3		Jellyfish	76,300	7,722,344
4	3	Indo-Pacific mackerel	70,303	98,254,462
5	1	Squid	68,117	208,711,687
	4	Indian mackerel	46,610	62,859,059
	2	Blue swimmer crab	22,379	110,762,469
	5	Banana shrimp	31,459	57,113,805

Source: Thai Fisheries Yearbook 2015[9]

Indo-Pacific mackerel recorded the highest volume in 2014 (145,300 MT worth, 174.2 million USD) but dropped substantially in volume in 2015. In 2015 only 70,303 MT was caught, a 52% decline in catch, with the value falling to 98.3 million USD. In 2015, 76% of the catch came from the Gulf of Thailand and 24% from the Indian Ocean, representing in particular a drop in the Gulf of Thailand (which in 2014 accounted for 89% of the catch)[10].

[6] http://www.fao.org/fishery/psm/agreement/en
[7] UNCLOS ratifications
[8] http://www.nationmultimedia.com/national/Seafood-shortage-looms-30263650.html
[9] Note: Thai Fisheries Yearbook data includes catches outside Thai waters Department of Fisheries (2017) Fisheries Statistics of Thailand Yearbook 2015 http://www.fisheries.go.th/strategy-stat/themeWeb/books/2558/1/yearbook2558_Rev060960.pdf
[10] FAO (2017) Yearbook: Fishery and Aquaculture Statistics 2015. http://www.fao.org/3/a-i7989t.pdf

The species occurs in coastal waters up to 50m depth, and Thailand shares stocks with Cambodia in the Gulf of Thailand and Myanmar and Malaysia in the Andaman Sea.[11] In 1994, Maximum Sustainable Yield (MSY) was calculated as 104,000 MT, and the species was considered fully or over-exploited with mean size declining over time.[12] Indo-Pacific mackerel is listed as data deficient by the International Union for Conservation of Nature.[13]

Under Thailand's Marine Fisheries Management Plan (2015 – 2019),[14] Indo-Pacific mackerel is considered together with "other pelagic fish" (only anchovy is considered separately) for which MSY and optimal fishing effort were calculated in 2014. For the Gulf of Thailand MSY is 248,176 MT with an optimal fishing effort of 130,493 days. This is currently exceeded by 27% in terms of fishing days. For the Andaman Sea MSY level is 118,477 MT with an optimal fishing effort of 54,238 days, which is being exceeded by 16.5%.

As of October 2017, the Thailand DoF registered 908 Indo-Pacific mackerel vessels. The fishery is seasonal and involves shorter trips, with vessels returning to port regularly. These factors mean that although the crews are mainly migrant workers from Myanmar and Cambodia, the sector does not have the same risk of labor abuse as the trawl and distant water fleets which can operate away from port for much longer periods. There is also a gillnet fishery for Indo-Pacific mackerel, with 772 gillnet vessels registered with DoF in 2017.

Currently, three seasonal closures are in place to protect Thailand's Indo-Pacific mackerel stocks. In the Andaman Sea, an area around Phuket, Phang Nga, Krabi, and Trang is closed from 1 April to 30 June. In the Gulf of Thailand, two areas which are spawning and feeding grounds are closed; the area in the outer Gulf of Thailand is closed from 15 February to 15 May every year, and the area in the Inner Gulf is closed from 15 June to 30 September. Indo-Pacific mackerel stocks are also affected by juvenile bycatch in other fisheries, including trawl fisheries and anchovy fisheries using a smaller mesh size. In 2009, the United Nations Food and Agriculture Organization (FAO) reported that the mean total length of Indo-Pacific mackerel had declined over the previous 30 years, from 18 cm to 15 cm, evidence that the species was over-exploited. Indo-Pacific mackerel is found in trash fish catches, both as juveniles and adults, with sizes ranging from five to 16 cm total length.[15]

Indo-Pacific Mackerel imports to Thailand exceed its exports. The processed seafood industry mainly exports mackerel in the form *prepared or preserved mackerel, whole or in pieces* (product code 160415) of which Thailand exported 29,725 MT with a value of 73.8 million USD in 2016. Of that, 87% was "in airtight containers" and 13% "other." Mackerel is commonly consumed locally, salted and steamed in baskets then fried or else canned in sauce.

1.4 Key Data Elements

As defined in USAID Oceans' *Data Requirements for Catch Documentation and Traceability in Southeast Asia: Critical Tracking Event and Key Data Element Framework and Glossary*—or *KDE Guide*, for short—key data elements (KDEs) are defined as critical data that are required to successfully 'trace' a seafood product and/or its ingredients through all relevant Critical Tracking Events (CTEs) within the supply chain. Because KDEs are linked to CTEs, they are often used to support the tracking of products through the supply chain. In this respect, KDEs usually focus on information relating to the 'who,' 'what,' 'when,' 'where' and 'links' of a seafood product as it moves through different CTEs within the supply chain. Figure 1 illustrates the movement of KDEs throughout CTEs within a generic seafood supply chain.

Common characteristics captured by KDEs along each position within the supply chain include:

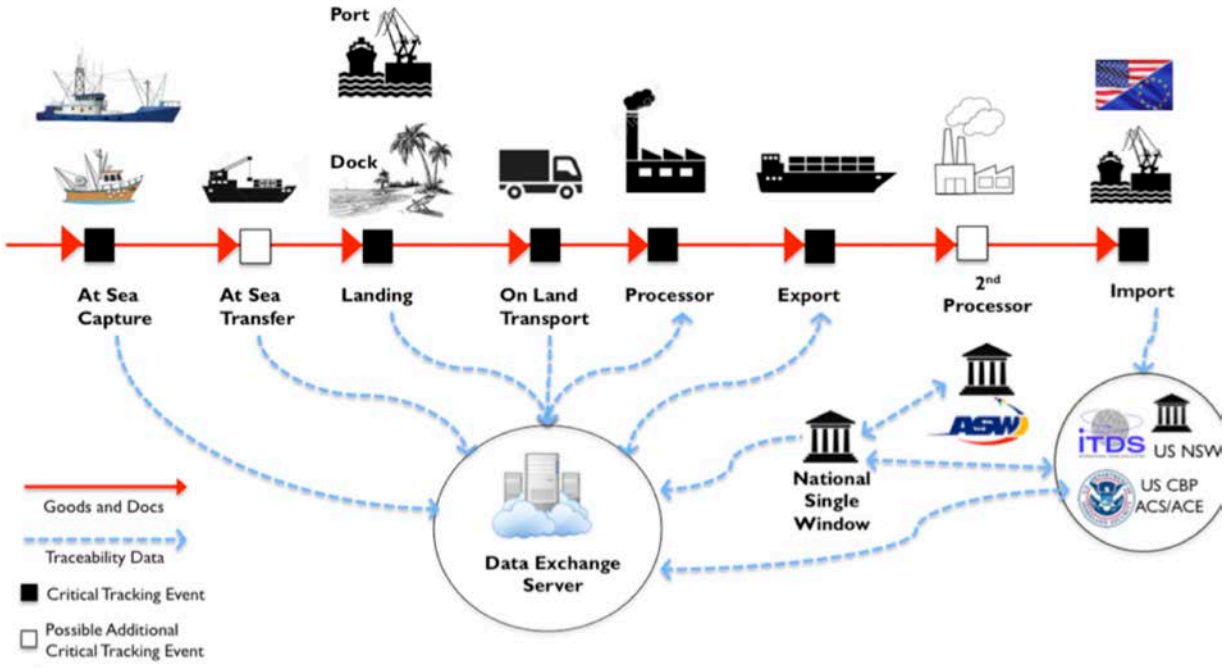
- The physical location of where the product resides at any point of time;
- The movement of the product in or out of a CTE (including an associated batch or lot number);
- The amount or quantity (e.g., the volume and/or weight) of the product;
- The individual who handles, processes or provides a service to the product; and
- The date and time of when the product was received into or shipped out of a CTE.

[11] Yingyuad, W. and Chanrachkij, I. (2010) Purse Seine Fisheries of Thailand
[12] FAO (2009) Fishery and Aquaculture Country Profile: Thailand
[13] IUCN (2011) Red List of Threatened Species: *Rastrelliger brachysoma*
[14] Department of Fisheries (2015) Marine Fisheries Management Plan of Thailand http://extwprlegs1.fao.org/docs/pdf/tha165156.pdf
[15] FAO (2009) Fishery and Aquaculture Country Profile: Thailand

Similar to CTEs, KDEs serve as critical data collection points within a CDTS. Because of this, KDEs play a central role in the design of how and when data are collected within the system. This section presents a list of common KDEs terms and definitions relating to the USAID Oceans CDTS, listed by corresponding CTE type (see Table 2).

As illustrated in this diagram, the capture of information relating to CTEs (red arrows) and KDEs (black boxes) occurs at each stage in the seafood production chain. Traceability data collected along the product chain are transmitted (dotted blue lines) to data exchange services that handle data processing, storage, and retrieval. Traceability data captured along the supply chain may also be transmitted to a third party who provides publishing data services. The adequate transmission (i.e., accurately, verifiably, securely, and in a timely manner) of data collected within the CDTS enables a seafood product's traceability.

Figure 1. The flow of traceability data throughout the seafood production chain



Accurate, reliable and timely capture of KDEs within the CDTS is a key requirement for seafood traceability to occur. Industry-wide and region-wide government agreement has not yet been reached on which KDEs should be required for capture under traceable fisheries in Southeast Asia.

Table 2. Glossary of key data elements (KDEs)

Category	Term (KDE)	Definition
Who	Event owner	The name of the business/company that has possession (the "owner") of the seafood product at the time of that the CTE "event" is measured (via KDE data capture), and therefore is responsible for the complete and timely submission of KDE data collected. In the case of a small-scale fishery where there is no business/company, the captain or master/lead fisher's first and last name is the event owner. Note that the event owner (business/company submitting the KDEs) might be different than the enumerator (the person or entity that collected the KDE data for the event owner).
Who	Name of owner representative	The first and last name of the individual who owns, is chief executive officer, or is otherwise the designated authority of the business/company named that is listed as the "event owner." For example: the name of the owner of the fishing vessel, the processing company, the transport company or export company.

Who	Owner representative sex	The sex of the individual who owns, is chief executive officer, or is otherwise the designated authority of the business/company named that is listed as the "event owner." For example: the sex of the owner of the fishing vessel, the processing company, the transport company or export company.
Who	Owner ID	The unique number or alphanumeric designation that is identified within the legally-recognized identification (ID) associated with the owner (individual). For example: the owner's personal identification card; the owner's fishing license; the owner's business license.
Who	Owner ID expiration date	The date on which the owner ID listed expires or becomes no longer valid.
Who	Owner address	The full street address of the business/company named as event owner. This should include street number, street name, district, town or city, province, postal code and nation.
Who	Owner phone	The country code, area code and daytime phone number of the business/company named as event owner.
Who	Trading partner	The immediate party within the seafood supply chain to the current event owner that was involved either before or after the occurrence of the CTE event. For example: (a) the trading partner (TP) for a shipping CTE is the intended recipient of the shipment; (b) the TP for a receiving CTE is the immediate previous shipper; (c) the TP for an input transformation CTE is the supplier of the product inputted into the transformation process; and (d) the TP for an import CTE is the prior exporter. Potential trading parties include any supply-chain partner that has a direct impact on the flow of goods through the supply chain; for example: a processor, wholesaler, distributor or fisher.
Who	Trading partner sex	The sex of the immediate party within the seafood supply chain to the current event owner that was involved either before or after the occurrence of the CTE event.
Who	Vessel name	The name of the fishing vessel associated with the production CTE event (i.e., the fishing boat that did the wild capture of the seafood product). The vessel name must be legally associated with the "vessel ID."
Who	Vessel size	The gross weight (in metric tons) of the vessel. The estimated size for small-scale boats is acceptable.
Who	Vessel flag	The registered flag state of the fishing vessel associated with the production CTE event. The vessel flag must be legally associated with the "vessel ID."
Who	Vessel ID	The unique, flag state-issued registration number of the fishing vessel associated with the production CTE event. The vessel ID must be legally associated with the "vessel name."
What	Event type	The type of CTE event occurring at the time of KDE capture. The event type includes both a major (i.e., creation; transformation; transportation or depletion) and an associated minor (i.e., creation; landing; input; output; shipping; receiving; consumption or disposal) event designation.
What	Event number	The unique number or alphanumeric designation associated with the specified CTE event. In most cases, event numbers are sequential as they move through each event within the seafood supply chain.
What	Item	The traceable seafood product that requires the need to retrieve pre-defined information (KDEs) at any point within the supply chain, either through digital or paper (e.g., invoice; purchase order) format.

What	Item type	The specific type or descriptive category used to define the traceable seafood product ("item") at any point within the supply chain. The minimum data requirements associated with "item type" include: (1) the scientific name (Latin designation; both genus and species); (2) the FAO 3-Alpha Code (3-letter code used to identify species, and verify scientific name; and (3) the common market name associated with the "item," in the language of the event owner. In later stages within the supply chain, the item type may also include the descriptive category of the seafood product (e.g., "smoked fillets").
What	Item code	The associated Aquatic Sciences and Fisheries Information System (ASFIS) number, FAO code or product code for the species identified under the "item type."
What	Item number	The unique identification number or other alphanumeric designation associated with the individual "item." For example: input or output ID number; transport order number; or tag number (of a landed finfish). Note that this differs from the "batch or lot number" that the item might be associated with.
What	Batch or lot number	The unique identification number or other alphanumeric designation associated the batch or lot that the "item" is associated with. Note that this differs from the "item number" that the item might be associated with.
What	Quantity	The number or amount of items within an associated batch or lot. For example: the precise number of items or volume of a batch or lot. This KDE is measured and referenced in conjunction with "unit of measure."
What	Weight: item	The individual weight (in kilograms) of the "item" (seafood product).
What	Weight: batch/lot	The total weight (in kilograms) of all items within a specified batch/lot.
What	Fork length	For finfish seafood products: the measurement of the individual "item" (fish) length from the tip of the snout to the end of the middle caudal fin rays.
What	Unit of measure	The unit of measure relating to the specific quantity.
What	Packaging type	The specific type or descriptive category used to define the cast package type used to enclose the traceable seafood product ("item"). Common cast package types include: (a) fixed-weight units (case or shelf ready); (b) variable-weight units (case of shelf ready), pre-priced; (c) variable-weight units, un-priced; (d) tray-ready and (e) store processed (labeling and packaging done at retailer).
What	Packaging materials	A description of the materials associated with the "packaging type" for a specified "item;" for example: plastic bag, wax box, plastic bin or expanded polystyrene. Packing materials may change throughout the seafood supply chain due to unpacking and re-packaging of the traceable seafood product ("item") along specific transformation and transportation CTEs of the supply chain.
What	Sell-by date	The specified date before which the traceable seafood product ("item") is to be safely purchased for consumption. Also known as the "expiry date" or "date of expiration." Related to the "best before" or "use by" date.
When	Event date	The date (day, month, and year) on which the CTE event occurs for the specified "item." For example, the: (1) production date (date of wild harvest); (2) packaging date; (3) ship date; (4) receipt date; and (5) date of purchase.
When	Event time	The time (hours, minutes) on which the CTE event occurs for the "item."

When	First freeze date	The date (day, month, and year) on which the specified item was first frozen.
When	Date of departure	The date (day, month, and year) of the departure of the fishing vessel of item origin (i.e., from which the "item" was harvested) from the port (or other anchorage/mooring site) at the start of the fishing trip during which the "item" was harvested.
When	Time of departure	The time (hours, minutes) of the departure of the fishing vessel of item origin (i.e., from which the "item" was harvested) from the port (or other anchorage/mooring site) at the start of the fishing trip during which the "item" was harvested.
When	Date of return	The date (day, month and year) of the return of the fishing vessel of item origin (i.e., from which the "item" was harvested) to a port (or other anchorage/mooring site) at the completion of the fishing trip during which the "item" was harvested.
When	Time of return	The time (hours, minutes) of the return of the fishing vessel of item origin (i.e., from which the "item" was harvested) to a port (or other anchorage/mooring site) at the end of the fishing trip during which the "item" was harvested.
Where	Origin	The name of the geographic location from which the fishing vessel originated (departed from) during a specified fishing trip; for example, the name of a city, town or port complex.
Where	Event location	The place where a traceable seafood product ("item") is located during any given CTE within the seafood supply chain. This includes, but is not limited to: the fishing grounds from where the item was harvested; the landing site of the item; the place where the item under goes transformation (e.g., a processing site); a cold storage location and a retail location.
		The "event location" place is recorded as the physical address of the location where the CTE occurs, except for a production event. The "event location" for a production event (i.e., wild harvest) is recorded using the FAO Fishing Area coding system, inclusive of: major area (2-digit code) + sub-area (roman numeral designation) + division area (lower case letter) + sub-division (single digit). In addition (but not required), the production event can include the GPS coordinates where the "item" was harvested.
Where	Product source	The immediately prior (source) "event location" during the CTE.
Where	Product destination	The immediately intended (destination) "event location" during the CTE.
Where	Vessel home port	The recorded homeport (including country; may differ from flag state) of the fishing vessel that is associated with the production of the "item."
How	Event method	A description of the methods used during the CTE. For example, the fishing gear type used during a production CTE, or the mechanical process used during a transformation CTE.
Link	Link	Recorded information that is necessary to establish the relationships between other relevant information (KDEs) for the "item" within the supply chain.
Link	Activity type	The specific type of activity(ies) used during the CTE process that influences the traceability of a seafood product, as specified within the work order (WO), purchase order (PO), bill of lading (BOL) or other invoice/document.
Link	Activity ID	The unique identification number assigned to the "activity type" completed within any point in the supply chain for a given "item." For example, the ID number of a WO, PO, BOL or other invoice/document.

Link	Invoice	A document detailing the type, quantity, and destination of a shipped traceable seafood "item." The invoice serves as a contract between the shipping party and the transporter. It also serves as a receipt of shipment when the shipment is delivered to the receiving party.
Link	Packing slip	A document detailing the type, quantity, and destination of a shipped traceable seafood "item" that is bundled with or within the shipped item.
Link	Batch/lot date	The date (day, month and year) associated with a batch or lot during a specified CTE, including "landing on," "shipped on," "received on," "best by" or "purchase by" dates.
Link	Carrier ID	The unique identification number or other designation assigned to specified supply chain actors associated with transportation CTEs. These include: carrier name; trailer number; ship form number; destination location name or number.
Link	Container/Trailer ID	The unique identification number or other designation assigned to a specific container, trailer (truck) or other transport container that is associated with transportation CTEs in the supply chain. For example, a truck's license plate number or a shipping container's alphanumeric designation.
Link	Certificate ID	The unique identification number or other designation of a certificate associated with an item's CTE within the supply chain. For example, the: (a) catch certificate number; (b) landing declaration number; (c) transshipment certificate authorization number or (d) green-certified product number.
HW	Captain name	The given name of the captain of the fishing vessel associated with the production CTEs of a traceable "item."
HW	Captain sex	The sex of the captain of the fishing vessel associated with the production CTEs of a traceable "item."
HW	Captain ID	The unique number or alphanumeric designation that is identified within the legally-recognized identification associated with the captain of the fishing vessel associated with the production of a traceable "item." For example: the captain's personal identification card, birth certificate or passport.
HW	Captain nationality	The verifiable nationality (country of origin) of captain of the fishing vessel associated with the production CTEs of a traceable "item." Verified by the document/ID associated with "Captain ID."
HW	Contract ID	The unique identification number or other designation assigned to a specific employment contract for any fisher or other crewmember on board the fishing vessel associated with the production CTE for a traceable "item." To be traceable, the "contract ID" must be linked to a verifiable contractual employment agreement or hiring and recruiting arrangement, with all associated identity papers/documents.
HW	Crew name	The given names of any individual associated with the production and/or transformation CTEs of a traceable "item." This includes seafood processors, fishers, or other fishing vessel crewmembers associated with the production or transformation of the traceable "item."
HW	Crew sex	The sex of any individual associated with the production and/or transformation CTEs of a traceable "item." This includes seafood processors, fishers or other fishing vessel crewmembers associated with the production or transformation of the traceable "item."
HW	Crew ID	The unique number or alphanumeric designation that is identified within the legally-recognized identification associated with the seafood processors, fishers, or other vessel crewmembers associated with the production or transformation of a traceable "item." For example: the crew's personal identification card, birth certificate or passport.

HW	Crew DOB	The date (day, month and year) of birth of any worker, processor, fisher, or other vessel crewmember associated with the production or transformation of a traceable "item." Verified by the document/ID associated with "crew ID."
HW	Crew job/title	The term or specific employment title used to describe the position and/or duties and responsibilities of the seafood processors, fishers or other vessel crewmembers associated with the production or transformation of a traceable "item." For example: "first mate," "inspector" or "safety officer."
HW	Crew nationality	The verifiable nationality (country of origin) of any worker, processor, fisher or other vessel crewmember associated with the production or transformation of a traceable "item." Verified by the document/ID associated with "crew ID."

Source: USAID Oceans' Data Requirements for Catch Documentation and Traceability in Southeast Asia: Critical Tracking Event and Key Data Element Framework and Glossary (KDE Guide)

More technical details about the KDE requirements, their practical application and data needed is available in the full KDE Guide, www.seafdec-oceanspartnership.org/KDEManual. For this assessment, Marine Change used the 'Production Stage' KDE recommendations provided by the USAID Oceans KDE Guide to evaluate the comprehensiveness of the data collected in the pilot.

2. METHODOLOGY

To conduct this assessment, marine Change performed desk-based research, engaged in field work to interview and survey key stakeholders, and conducted strategic analyses of the pilot to assess and provide recommendations.

As a background for this study, Marine Change reviewed relevant Thai regulations and existing studies from USAID Oceans, including USAID Oceans' *KDE Guide*, findings from USAID Oceans' Thailand CDT Gaps Analysis, and government policies and regulations including the Royal Ordinance on Fisheries 2015, Marine Fisheries Management Plan of Thailand, and National Policy for Marine Fisheries Management 2015-2019. Secondly, in order to understand the context of the pilot and the KDEs collected, Marine Change performed a comparative analysis of KDE requirements under EU, US, and Thai regulations, as well as the ideal required KDEs recommended by USAID Oceans. Using this analysis, Marine Change compared pilot-captured KDEs to formulate a comparison table and recommendations. Finally, Marine Change reviewed existing scientific literature on the ports and fisheries of interest, port based information and data, and Thailand's annual fisheries statistics.

Field work was planned in two parted to accommodate the timing of fishing vessels in port. Field work in Ranong was conducted October 31 to November 3, 2017; and Pattani from December 3 to 5, 2017. Marine Change developed and used questionnaires for each of the interview targets (DoF officials, captains, crew, owners and other vessel captains/crew), with approval on survey methods and questions received from Thai Union and USAID Oceans prior to field work. Thai Union personnel accompanied the consultant to the field and assisted with meeting arrangements and Thai-English translations. The vessel owners assisted with Burmese, Laos and Cambodian translations as needed. In addition, telephone interviews were conducted with Inmarsat and Xsense staff involved in the planning and execution of the pilot.

Following the background research and follow up field work, Marine Change initiated analysis and writing, clearly highlighting the outcomes of each part of the work and an overall SWOT (strength, weaknesses, opportunities and threats) analysis on the pilot technology. The SWOT analysis follows a standard format described by MindTools.[16]

[16] Mind Tools (available online) SWOT Analysis www.mindtools.com/pages/article/newTMC_05.htm

Recommendations have been formulated to improve the operations of the next stage of the pilot as well as provide advice on how to best approach the project for greater industry scalability.

Figure 2. SWOT analysis diagram

3. THE PILOT

For the purpose of testing on board e-logbook technology as well as at-sea crew communications, several different vendors were initially approached by Thai Union. Inmarsat and the Fleet One technology were chosen for the pilot on the basis of their readiness to roll out the pilot in suitable time frame. XSense was chosen as the local developer and contact due to their existing good relationships with the DoF and involvement in the area, as well as readiness to implement.

3.1 Pilot duration and scope

Thai Union and pilot partners deployed on the vessels in Pattani on March 10, 2017, and in Ranong on July 7, 2017. The equipment was still on board at the time of writing and submitting data with a view to continue the pilot until end of 2017 (extended from September 2017). Interviews were conducted on November 2, 2017, with the vessel owner of the two vessels operating in the Andaman Sea, after 17 weeks of testing the pilot technology. Following, interviews were conducted on December 21 in Pattani with two additional fleet owners, which each had one vessel testing the pilot technology. These interviews were conducted after 36 weeks of testing. Both of the captains and a number of crew from the vessels were also interviewed for their views on the software tested.

3.2 Pilot locations and fisheries

The pilot companies, locations and vessels were chosen based on availability of progressive companies within the Thai Union network of suppliers in Thailand. All companies were approached and three companies were eventually included in the pilot. No other criteria in terms of the type of vessels, number or nationality of crew, fishing gear, distance and time of fishing trips or company structure was used.

3.2.1 Andaman Sea - Ranong

Ranong is a coastal town on the coast of the Andaman Sea. It is located in an estuary bordering Myanmar and is the closest official seaport to Myanmar. To the south of Ranong is Phuket, a major fishing port and import location. The Ranong province is the least populated of all Thai provinces with just under 200,000 inhabitants and still has intact forest coverage. Together with fishing and agriculture, tin mining has been an important economic activity to the province.

Ranong Port is one of the Indian Ocean Sea Ports with the fishing port distributed along the sheltered estuary. The fishing port is a government port with one of 36 official Port in and Port out Control Centers (PIPO) located there. The fishing fleet operating out of Ranong consists of both small scale and commercial size pelagic and demersal vessels, according to one official the vessels are approximately 30% purse seine and 70% trawlers. According to the port official report,[17] the catch in 2015 consisted mainly of Indo-Pacific Mackerel, squid and cuttlefish, trash fish and other fish.

[17] http://www.fishmarket.co.th/images/uploads/stat/stat58/ranong.pdf

Table 3. A summary of Ranong port reported landings by species and total volume and value between 2006 and 2015[18]

Year	Indo Pacific Mackerel	Other fish	Shrimps	Squid and cuttle fish	Trash fish	Total volume (MT)	Total value (Baht)
2015	2,876	11,502	148	771	7,382	22,679	1,197,887,335
2006	7,206	28,822	986	4,888	8,289	50,192	3,263,161,893

The port data shows that the catch of Indo-Pacific Mackerel, the main target species of the fleet and the vessels that participated in the pilot, has reduced by 60% in just nine years.

Overall, catches have dramatically collapsed in Ranong Port over the last nine years, a 55% drop in landed volume and a 63% reduction in value. Although it is not clear if this decline is due to fewer vessels landing in this port, or if the fishing effort and capacity have remained the same, this is in line with the general declining trend of Thailand's fisheries that has reportedly lead to an increased level of IUU fishing as well as human rights abuses on board fishing vessels.[19] Both issues have been widely documented and the new Thailand Fisheries Management Plan 2015-2020 now aims to reverse this fishery decline as well as curb illegal and unethical practices within the industry.

Given the close proximity of Ranong to Myanmar, literally across the estuary, the fishing crews in Ranong are mainly Burmese. Ranong has been at the center of some of the recent human rights abuse scandals exposed in the Thai Fishing industry. The Environmental Justice Foundation interviewed 15 Burmese fishers held by the police in Ranong for a report in 2013, part of their exposure of widespread misconduct within the industry.[20]

The company participating in the pilot in Ranong was a second generation owned-family company with eight 120GT vessels targeting pelagic species; mainly mackerel and sardines. The vessels each have 20 to 30 crew and operate in the 40 to 50 nm mile zone of Thailand's Exclusive Economic Zone (EEZ) in the Andaman Sea. The vessels conduct mainly two to three day trips to the fishing grounds and return after approximately 60 to 70 MT catch is complete.

The company also has 16 smaller (approximately 50GT) squid light boats that use purse seine nets and conduct short overnight trips in the near-shore area. All the catch is landed in Ranong from where the owner organizes the sale of the products within a network of buyers in Ranong and neighboring provinces.

The company has approximately 300 staff at any one time. Whilst captains are permanently employed with salaried contracts, fishing crew are recruited for one-month contracts. They have a base salary (the amount was not shared with us) and a one to one and a half percent extra share of an exceptional catch. The company reviews each contract's monthly salary to ensure it is competitive with the industry in the area in order to retain crew. Crew members are also paid for non-fishing days as part of their monthly base salary. The turnover of crew is high currently, due to the general shortage of foreign crew available for work in fishing boats in Thailand and the resulting competition. The crew easily switch between vessels and companies. Some of the PIPO staff mentioned that although not confirmed by the owner, some crew demand an advance payment in order to join a vessel. As part of their policy on crew welfare, the company offers accommodation for crew on land, where some of their families also stay. It is typical for the family to stay there until the child is of school age, at which point the family returns to their native village. All the crew employed by the company were Burmese with Thai captains.

Due to the seasonal closing in the Andaman Sea, one of the vessels was in dry dock during our visit and the crew had gone to Burma to visit their families. They, including the captain, were not available for interview. The

[18] http://www.fishmarket.co.th/images/uploads/stat/stat58/ranong.pdf
[19] Marine Fisheries Management Plan of Thailand. A National Policy for Marine Fisheries Management 2015-2019 http://extwprlegs1.fao.org/docs/pdf/tha165156.pdf
[20] https://www.theguardian.com/global-development/2013/may/29/thailand-slaves-sea-burmese-migrants

other vessel was in port and the captain and Marine Change was able to interview two of the Burmese crew. The impressions of these interviews are included in detail in the SWOT analysis (Section 4.4).

3.2.2 Gulf of Thailand - Pattani

Pattani is a coastal town in the Gulf of Thailand close to the Malaysian border. It is located south of the much larger Songkhla fishing port in the river mouth of the Pattani River. Pattani was an independent Muslim city-state, ruling a large portion of the surrounding region until the 16th century, when it became a vassal state of Siam (now Thailand). As a result, it is one of the four provinces in Thailand where the population majority is Muslim. In 2005, the population was 43,631.[21]

The Pattani port had 800 registered fishing vessels in 2010 and PIPO officials confirmed the number of active vessels to be the same in 2017.[22] The number of vessels inspected at the PIPO center in Pattani is higher than in Ranong, with 60 vessels inspected for both in and out procedures per day on average.

Pattani port data shows that scads are the highest volume fish landed in the port with 28,482 MT landed in 2015. The target species of the vessels participating in the pilot, Indo-Pacific mackerel, is the second highest landed species with 8,176 tons landed. All of the landed volumes, apart from shrimps, crabs and trash fish, have increased in Pattani from 2006-2015. The mackerel catch has increased 3.6% during this time and the total catches increased 25.6%. The value of the catch increased 225% in the same time (Table 4).

It is unusual that the catches in Pattani have increased so dramatically as the general trend in Thailand has been catch declines across the fishing sectors. When questioned, the PIPO center officials were not able to explain this. Foreign fishing vessels are not allowed to land catches in Pattani so this could not have contributed to the trend.

Table 4. A summary of Pattani port reported landings by species and total volume and value between 2006 and 2015[23]

Year	Indo Pacific Mackerel	Scads	Other fish	Shrimps	Squid and Cuttle fish	Trash fish	Total volume (MT)	Total value (Baht)
2015	8,176	28,482	64,257	39	2,367	15,004	117,317	10,036,507,946
2006	7,888	23,331	42,205	201	1,284	17,336	93,433	3,079,818,509

Unlike Ranong, Pattani has a much more diverse fishing crew with a mix of Burmese, Cambodian and Lao crews as well as Thai. Whist human rights and labor issues to do with especially Burmese (Rohinga) migrant workers have been documented in nearby Songkhla[24] and associated jungle migrant camps that have been located in the southern forests, Pattani Port itself has not had much publicity on these issues. This may be a result of the political unrest and lack of investigations in this region rather than a reflection of better industry standards.

Thai Union has contracts with 70 boats in Pattani, making it the biggest fishery center in the country for them. Two companies participated in the pilot in Pattani with one pilot vessel each. Both companies were small family-run companies that operate in fishing grounds in the Gulf of Thailand. Whilst captains are

[21] https://en.wikipedia.org/wiki/Pattani,_Thailand
[22] http://www.ilo.org/dyn/migpractice/docs/184/Fishing.pdf
[23] http://www.fishmarket.co.th/images/uploads/stat/stat58/pattani.pdf
[24] https://www.theguardian.com/global-development/2015/jul/20/thai-fishing-industry-implicated-enslavement-deaths-rohingya

Captain and crew interview in Pattani. Photo: Marine Change/Sari Tolvanen

permanently employed on salaried contracts, fishing crew are recruited for one-month contracts. The have a base salary of 308 baht per day (approximately ten US dollars) and a one to one and a half percent extra share of an exceptional catch. The monthly salary is reviewed for each contract to ensure it is competitive with the industries in the area in order to retain crew. They are also paid for non-fishing days as part of their monthly base salary. Neither of the companies interviewed offered accommodation for crew on land. The younger, single crew slept on board the vessel while in port and crew with families stayed with their families in rented accommodation close to the port.

One of the companies only own two vessels (70GT) themselves, but have a supply contracts with 58 more vessels. The vessels fish on average eight days at a time with maximum 15-day trips. The fishing grounds are 100-120 miles out to sea. The target catch is mackerel, with some sardines and other pelagic fish caught as well. Thai Union buys the majority of their catch. The company's vessel captain and 22 crew members were all available for the interview as the fishing vessel was tied up due to having reached their maximum number of annual fishing days. The crew was comprised of both Burmese and Cambodian nationalities. The captain was a 54 year old Thai man, and whilst positive about the pilot he had not used the e-logbook himself. Initially, his son who also worked on board the vessel was filling in the e-logbook until the son was recruited for the army leaving nobody to fill in the logbook anymore.

The second company, owns four vessels (70-100GT) that target mackerel, tongol and sardines. The company is now on its second generation of owners, with the owner and his wife running the business and available for the interview. Their fishing grounds are approximately 70 nm from shore and the fishing trips are 10 days long on average. Sometimes their vessels may stay at sea for as long as two weeks if catches are low. Marine Change interviewed the captain of the pilot vessel, a Thai crew member who operated the e-logbook, as well as three Cambodian crew members. The owner reported crew turn over to be high normally, for up to six months of new crew arriving. After that, those who stay settle into the vessel culture and job and often stay long term.

The findings from these interviews are included in detail in the SWOT Analysis (Section 4.4).

3.3 Solutions tested

Two types of technology were deployed during the pilot on all of the four vessels that participated in the project. The fishing vessels were all of commercial size (above 30GT), and thus required under Thai law to carry Vessel Monitoring System (VMS) as well as one-way communication systems. The technology tested in this pilot was in addition to current legal requirements and was operated in parallel and in addition to vessels' usual communications and VMS operations. Inmarsat Fleet One satellite terminals were installed to the vessels to service the additional two applications provided for the crew in the form of a smartphone application as well as for the captain in the form an e-logbook tablet. The terminal also enables two-way communications with land, instead of the usual one-way radio system used onboard. This communications aspect, between the vessel and the shore, was also evaluated in this pilot.

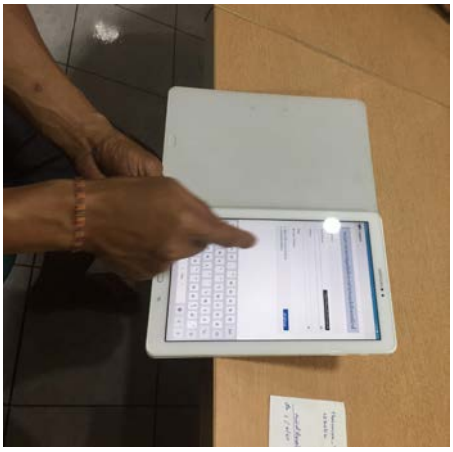
3.3.1 Inmarsat Fleet One Technology and e-Logbook

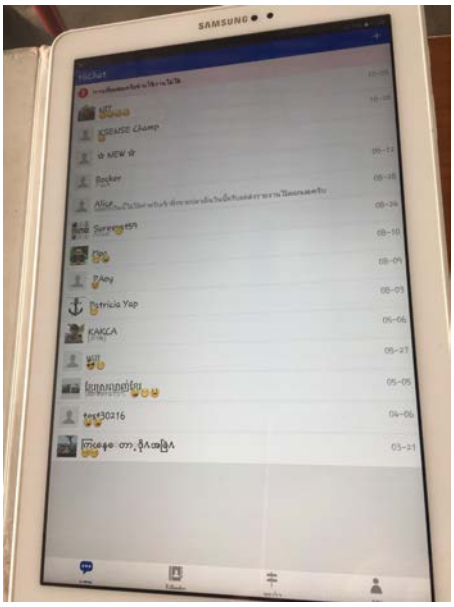
The Inmarsat application offers broadband connectivity at sea to enable connectivity not previously possible beyond phone (GSM) coverage at sea. The terminal provides the necessary connectivity needed while at sea, including email and business-critical applications like VMS, weather reports and navigation charts, simultaneous voice and SMS texting, plus Inmarsat's free '505' safety service, which in an emergency directs a call straight through to a Maritime Rescue Coordination Centre. This is delivered over the world's most reliable commercial L-band satellite network using the Inmarsat-4s satellites, with over 99.9% average network availability.[25]

Key features of the Inmarsat Fleet One technology include:

- Simultaneous voice and IP data, up to 100kbps
- Compact, low-cost antenna (2.5kg and 27.5 x 22.1cm)
- Flexible airtime pricing
- 505 Emergency calling
- Wi-Fi capability to connect smart phones and tablets
- Easy installation

The Fleet One two-way communication system compliments the traditional VMS system used onboard fishing vessels, providing new models for captains and fleet managers to plan, monitor and implement their fishing operations. As part of this pilot, an electronic logbook (e-logbook) application was also used onboard the fishing vessel to allow for real time reporting of the catch data of the vessel. The e-logbook was provided to the captain in the form of a tablet with easy to select options for the different categories of entry.





(Top) A crew member demonstrating the e-logbook use in Pattani. (Below) A demonstration of Hi-Chat application on a captain's tablet. Photo: Marine Change/Sari Tolvanen

3.3.2 Xsense Hi-Chat Application

With the broadband coverage onboard the fishing vessel provided by the Fleet One antennae, Xsense developed a smart phone application for the use of the fishing vessel crew, captain and the owner whilst at sea. The application is a simple chat platform, which provides access to registered users to have a group discussion. In addition to the vessel/company-specific chat platform, the registered users can have a two-way private account with a contact on land for personal communications. The two-way conversations are private to the other users, whilst the group chat platform data is something that can be viewed by the vessel owner as well as by Thai Union or anyone else who has registered as a user for the particular vessel/company. This application operates in Thai, Burmese, Cambodian and Lao to enable the crew of different nationalities to use it.

[25] https://www.inmarsat.com/news/inmarsat-launches-new-targeted-fleet-one-plan/

4. RESULTS

4.1 Analysis of Collected KDEs

Marine Change assessed the KDEs collected during the pilot using the e-logbook system against the regulatory requirements EU and US import regulation requirements, the current CDT requirements of the Thai Government, as well as the ideal KDEs recommended by the USAID Oceans program (Table 5).

Table 5. Comparison table of KDEs collected in the pilot vs. those currently recommended/required by import markets, standards recommendations

Point of Catch KDE	USAID Oceans Ideal KDEs	Thai e-CDT KDEs	US Import Requirements	EU Import Requirements	Thai Union Pilot KDEs
Who					
Event Owner	•			Validating authority	
Owner name	•	•		•	•
Owner gender	•	•			•
Owner ID	•	•			•
Owner ID expiration date	•				
Owners contacts	•	•		•	•
Trading partner	•		• Entity to which the product was landed/delivered	•	
Trading partner gender	•				
Vessel name	•	•	•	•	•
Vessel flag	•	•	•	•	n/a
Vessel UVI / IMO ID #	•		•	•	
Company / vessel license ID	•	•	•	•	
Company / vessel license expiry	•			•	
VMS or Inmarsat unit #	•	•		•	•

Point of Catch KDE	USAID Oceans Ideal KDEs	Thai e-CDT KDEs	US Import Requirements	EU Import Requirements	Thai Union Pilot KDEs
What					
Event type/description	•			•	•
Weight item estimate	•			•	•
Weight item confirmed	•	•	•	•	
Product type(s) at landing			•		
Batch/ lot number	•				
Weight lot/batch	•				
Species Latin name	•		•	•	
Species common name	•	•	• ASFIS 3-alpha code		•
Length of fish	•				
Date, time & location of transshipment	•	•	•	•	n/a
Product co-mingling record			•		
Where					
Port of Origin	•				
Catch location	•	•	•	•	•
Port of destination	•		• (point of first landing)		
Vessel home port	•			•	
Product destination	•				
When					
Date and time of departure	•	•			?
Date and time of catch	•	•	•	•	•

Point of Catch KDE	USAID Oceans Ideal KDEs	Thai e-CDT KDEs	US Import Requirements	EU Import Requirements	Thai Union Pilot KDEs
Date and time of first freeze	•				
Date of landing	•	•			?
Date and time of return	•				•
How					
Catching method	•	•	• (Including other gear of vessel)	•	•
Link					
Activity/product type	•				
Activity / product ID	•			•	
Human Welfare					
Captain/master name	•	•		•	•
Captain gender	•	•			
Captain ID	•	•			
Captain nationality	•	•			
Crew name	•	•			
Crew gender	•	•			
Crew job/title	•	?			
Crew ID	•	•			
Crew nationality	•	•			

USAID Oceans' recommended KDE list requires 45 items of data, and the Thai e-CDT legal requirements contain 26 KDEs and meet 58% of the USAID Oceans ideal KDE requirements. When interviewed, PIPO staff confirmed that these data points are being collected and also entered into the Fishing Information 2 electronic network. However, Marine Change was not able to access the Fishing Information 2 platform to confirm this.

The pilot project currently only collected 14 KDEs (plus two additional nationality and transshipment details that were not relevant to others recommendations/requirements). In order to compare the pilot fairly to the other standards, the two non-relevant KDEs were included in the count making the total KDEs in the pilot 16. Both the e-logbook records, as well as the information sheet required for registration of the e-logbook, were provided by XSense as the documentation collected and used as the basis for understanding the pilot KDEs.

In summary, the 16 pilot KDEs collected meet 62% of the Thai legal requirements, 57% of the EU requirements, 44% of the US requirements and 36% of USAID Oceans' ideal KDE requirements. The pilot KDEs differ particularly in their collection of human welfare information with only one such KDE collected. If the pilot collected all the required information in this category, it would meet 80.8% of the Thai e-CDT KDE requirements and 53% of USAID Oceans' ideal KDEs. This information could be easily added to the e-logbook

so that the information is entered and verified by the owner and captain before the vessel sails and then double-checked by the PIPO staff when they do their own inspections.

Other important KDEs missing in the pilot were 1) the date and time of departure and 2) date and time of landing (already included return date), 3) species Latin name, 4) confirmed weights, 5) vessel fishing license ID and expiry and 6) IMO number or UVI. It was not clear if the date of return was the same as date of landing and if the date and time of departure were also somehow visible in the system. The information regarding the date of departure and landing can easily be added to e-logbook, as can the Latin name and confirmed weights. The other information such as fishing license details and IMO/UVI numbers can be added to the vessel/owner information sheet that is required in order to be a registered user of the e-logbook.

If these improvements were made, the pilot would fully meet the Thai legal requirements. This is an important factor to consider in order to align with the PIPO centers' operations in collecting the correct information. If these KDEs are not added, the fishing vessels will need to keep providing paper based logbooks and information to the DoF, making the e-logbook more of a burden than a tool.

In regards to meeting the US regulatory requirements, this is not currently a priority as the target species are not among the species monitored by the new import rules. For the EU market requirements this is only relevant if the products are sold to the EU market, which currently does not seem to be the case.

To fully meet USAID Oceans' ideal point of catch KDEs, 29 additional KDEs would need to be introduced. Some of these may require differential product storage and marking that may be harder for the operators to adopt. In addition, some of the information required, such as product destination may not be information the captain knows, making recording more complicated as the e-logbook would need to be completed by a number of people. Further research is recommended to see how easily these additional point of catch KDEs could be added without creating resistance from the industry, while ensuring the e-logbook collects necessary information to combat IUU and seafood fraud, as well as achieves operational efficiencies over a paper-based system.

4.2 Observations of Department of Fisheries Operations

4.2.1 PIPO center operations

In both ports, Marine Change observed the operations of the Port in and Port out Control Center (PIPO), which were recently established under the new Royal Ordinance on Fisheries in 2015 in order to improve the overall monitoring of fisheries. The center consists of the following departments:

- The Department of Fisheries (DoF)
- The Marine Department
- The Department of Employment
- The Department of Provincial Administration
- The Labor Department
- The Navy Police

The Thai Navy manages these agencies under the operations of the PIPO. The PIPO center monitors all vessels above 10GT. Small-scale vessels are not required to use official ports and do not fall under the monitoring of the PIPO. The center is open 24 hours and requires two to 24 hour notice for vessels arriving in order to proceed with the inspection on arrival of the vessel.

As well as the port in and port out procedures, the PIPO center is one of the units that monitors the VMS of the vessels registered to the port (which is a legal requirement for vessels above 30GT). If the VMS is off for more than four hours (Ranong) and six hours (Pattani),[26] the vessels are called back to port for inspection and explanation for the VMS failure. If no credible reason is given, the vessel will receive a warning followed by other measures as per law. According to the officials interviewed, VMS blackouts usually happen because of problems with the satellite connections or electrical issues on the vessels. The government is currently

[26] As both ports gave a different number of hours, it was not clear which is the official government requirement.

prioritizing the development of a fail proof system where a backup connection is made if the first VMS signal fails.

Marine Change's visit to Ranong was one week before the official review date of the EU yellow card. The PIPO center managers were very concerned about the researchers' visit at this time. This made it somewhat difficult to ask more controversial questions about the functionality of the PIPO center and the CDT system as clearly there was pressure to show a high level of completeness in data required and good functioning and implementation of the system itself. The atmosphere in Pattani was much more open and the Thai Union staff there had a good relationship with the PIPO staff, which made the interviews more relaxed.

The Ranong PIPO center appeared to be well staffed, as the vessel traffic to the port is not very high. According to one official, only 10 vessels on average are received per day so there is plenty of staff at hand to conduct the necessary inspections, paper checks and reporting. In Pattani, the vessel traffic is much higher with 60 vessels on average per day for both in and out inspections.

When questioned, key staff were able to explain the operational procedures and the data input and verification methods. Researchers were also able to observe an inspection of a vessel (port in check) in Ranong. In Pattani, there were no vessels being inspected at the time of the site visit as the vessels had already filled their annual allowance of fishing days and were mainly tied up in port.

Whilst researchers observed all the necessary steps of an arriving ship to be completed, paper work checked and verified on the spot, some of the procedures were completed by staff quite quickly. The total inspection took about 20-30 minutes, which was mentioned as the normal time. The human welfare officers did speak to crew without the presence of the captain, but not with a translator, and observed their physical condition, as well as checked the conditions on board, safety and communications equipment (life jackets, fire extinguisher, working VMS and radio), and food and water supplies on arrival.

Crew photo shoot, ID and work permit check at the Ranong PIPO centre. Photo: Marine Change/Sari Tolvanen

Researchers were not able to verify if all KDEs captured were entered into the electronic system, but all were confirmed to be recorded in paper-form. In an interview with a vessel owner about the CDT system verification, the owner mentioned that the vessel's catch details and other logbook-related information are emailed to him from the PIPO center for verification. If there are any mistakes he has to correct them as soon as possible and present the necessary paper work to make corrections, if need be. It appeared the mistakes normally were small and related to typos and human error. As mentioned elsewhere, the e-logbook tested in this pilot was not being used by the PIPO center and it was not possible to further evaluate the compatibility of the e-logbook system with the DoF CDT system beyond the analysis of the KDEs presented elsewhere. However, when we described the e-logbook system to PIPO staff, their view was that it would help the speed and accuracy of the system, as long as it functioned in real time.

4.2.2 The Thailand Department of Fisheries

On board vessel inspection by PIPO officers in Ranong. Photo: Marine Change / Sari Tolvanen

The Director of IT from the Thailand Department of Fisheries was interviewed by phone on January 5, 2018, regarding their opinions and ambitions on fishing related technology.

The Thai government is currently rolling out an e-logbook based technology on its overseas fleets active in the RFMO area (Southern Indian Ocean Fisheries Agreement) of the Indian Ocean. This is in addition to VMS already in place on these vessels. The e-logbook will be used from March 2018, when the vessels get re-licensed for fishing activities in the Indian Ocean. The government does not decide which vendors are used and each vessel is free to decide the most suitable e-logbook design and technology for connectivity. The plan is then to evaluate the technology and applications used, in terms of their performance as well as associated costs, and roll out the e-logbooks for domestic fleets in 2019.

Although the government is interested in crew welfare and any technology that could assist with this, they do not currently have active pilots or plans to test any such technology as the cost of using it is seen as prohibitive. The government does see it as an important factor to consider, welcomes the development of the Hi-Chat application, and are willing to discuss in more detail and any such structures and incentives that could be put into support scalability.

After the Thai distant water fleets, the domestic vessels fishing for export are the second highest priority for rolling out the CDT technology. When questioned about future collaboration with private sector, PIPO centers, and Fishing Information 2 for this project, they confirmed their interest in any private sector initiatives towards this end and their willingness to start testing e-logbooks with select PIPO centers in 2018.

4.3 Interviews with technology providers

4.3.1 Inmarsat

An Inmarsat representative was interviewed to provide insights on Inmarsat technology design, implementation and performance during the pilot. The Inmarsat Fleet One system was already in use by Thai flagged high seas vessels operating in the IOTC area, both reefers as well as fishing vessels. This is the first time the technology has been deployed on domestic Thai vessels. In designing the pilot, Thai Union aligned its technology with existing XSense operations in Thailand which determined the unit price and airtime price of the pilot's products. Inmarsat was not involved in the detailed development of the e-logbook and the Hi-Chat applications. Inmarsat was closely involved in the selection and set up of the pilot, together with XSense staff.

In testing the technology in the pilot, several challenges were encountered related to connectivity. These appeared to be mainly related to the airtime credited for accounts used by the vessels to enable use of all applications in the pilot, rather than technological issues to do with Inmarsat. Further analysis of the Inmarsat technology is included in the SWOT Analysis (Section 4).

4.3.2 XSense

An XSense representative was interviewed by phone to provide insights on the operational aspects, design and implementation of the pilot. Marine Change also sent questionnaires about the operational aspects to Xsense field staff, however the surveys were not returned to the consultant in time for their inclusion in this study.

XSense designed the applications and e-logbook in collaboration with the DoF in order to ensure that all the key data was collected during the pilot (see also the KDE analysis above). The costing of the pilot is based on standard pricing of data packages that XSense operates for off-shore fleets. The hardware and airtime costs of the pilot technology are presented in Table 6, below. XSense staff confirmed that the vessels' specific accounts

with airtime were frequently out of credit as the crew of the vessels used their monthly credit allowance faster than they normally would use their phones. Hence, the rest of the month/time the pilot technology was not operational.

Additional insights gathered from XSense team i are included in the SWOT Analysis (Section 4.4).

Table 6. Pilot Costs

Item	Unit cost (Baht)	XSense and CAT Telecom package	Features	User costs
Fleet One hardware	145,000 BHT (4,409 USD)	150,000 BHT (4711 USD) *Includes SIM Activation, Registration Fees, Installation, Accessory Set*	WiFi router, cables, terminals	One-time payment with expected 10 year life time. Fleet One has two year warranty.
WiFi license for crew communica-tions		Optional		Monthly
Software package (coastal)	10,000 BHT (305 USD)	Optional	Vessel tracking only per month	Monthly
Software additional	15,000 BHT (358 USD)	700 BHT (22USD) *Marine Touch, eLogbook, Hi-Chat*	One-way voice system, 10 minutes per month	Monthly
Hi-Chat/e-logbook data package	24,000 BHT (733 USD)	2,899 BHT (91 USD) *Tracking, Voice (10 mins), Chat (5MB)*	5MB/month *(e-logbook takes about 700 Bytes for each message)*	Monthly
Data package additional above 5MB	150 BHT (4.50 USD)/MB	150 BHT (USD 4.50)/1 MB (data) 30 BHT (USD 0.94)/1min (voice)	Price per additional MB	Recurring

4.4 SWOT Analysis

The performance and user experience of the three applications tested in this pilot were so connected they are evaluated as a single "unit" of services. Where a particular attribute is specific to the technology this is mentioned in the analysis. All other comments are generic to the pilot itself. Strengths and weaknesses are related to the technology and its operations and usability itself. Threats and opportunities are related to the external environment such as the market and regulatory landscape.

Strengths	Weaknesses
General -The applications themselves are easy to use once installed. -Given there are efficiency-based business benefits and vessel owners do see value in the technology (in the absence of satellite phone), if the price point was set correctly they could be persuaded to use it by the supply chain. -The technology tested already covers the needs of the e-CDT and crew welfare. There is no need to look at additional vendors or technology, but rather improve the existing platforms. **Hi-Chat** -The Hi-Chat application contributes to crew welfare as it is used frequently and enables incidents to be reported to a partner or relative. -Hi-Chat appeals to crew. They prefer vessels with it over other vessels and the internal chat aspect of the vessel contributes to improved onboard culture, which in return is the key aspect of crew retention (when all others aspects such as pay and safety are equal). -Especially for vessels with longer sailing times, the opportunity to speak with wife/relative is very attractive. -If applications that are more commonly used in Myanmar and Cambodia were used it would work better for crew communications back to home (Facebook is easiest). **e-Logbook** -The e-logbook, once the user is accustomed to it, is easy to use and faster than a paper-based logbook. Good for correcting mistakes and survives better than paper on board a vessel. **Fleet One** -The Fleet One two-way communication system makes communications between captain and land easier and results in more sharing of trip and catch details. This speeds up logistics and improves the quality of fish as it can be sold faster, helping achieve premium product. -The Fleet One two-way communication system also improves efficiency of operations and saves time for owner/captain. -The Fleet One two-way communication was better quality than similar communications using satellite phone.	**General** -The short time the technology was operational meant the users did not become reliant on it; therefore, it is likely users evaluated the necessity of the technology as low. -Willingness to pay for the system is low among the owners interviewed, and most likely requires policy incentives to drive broader adaptation across the industry. **Hi-Chat** -The Hi-Chat application and its installation procedure is limiting as not all relatives have smartphones nor know how to download/use the app without technical help aback in the village. This limited the use of Hi-Chat to those friends/relatives present in Thailand. -Some owners were nervous of false accusations of crew abuse through Hi-Chat. -Vessel owners view Hi-Chat as nice to have, but not essential for short trips. **e-Logbook** -The use of e-logbook technology was difficult for some of the older captains who were resistant to changing habits and had designated the e-logbook filling to another crewmember. The captains did use Hi-Chat, thus it seems the problem is with user interest rather than technical capability. **Fleet One** -The Pattani fishing vessels both had a satellite phone; hence the Inmarsat two-way communications did not provide an additional advantage for them. -Poor performance (running out of credit and only operational 30-50% of the time) during the pilots has lessened the enthusiasm to purchase/participate in the technology in future.
Opportunities	**Threats**
General -Systems that allow for the use of other internet-based programs may provide a greater incentive for crew and captains to pay a share of the airtime costs. -PIPO center officials were very interested in further	**General** -Ability and willingness to adopt technology that is not compulsory is very dependent on the personalities and progressiveness of captains and owners.

technology that could help with efficiency and speed of operations, especially e-logbooks. -Some of the vessel owners seemed to recognize the market and business related advantages of being an early adopter of technology and being a leader in transparency and ethical treatment of crew. This may contribute to willingness to invest in the system. -Attractive costing will need to be developed for any system to be adopted outside of the regulatory requirements. Some vessels do pay extra for a satellite phone in order to communicate with vessels while they spend long periods at sea. The price point needs to be close to this. -Thai government is moving towards implementing e-logbooks in 2019 in domestic fishing vessels. Given this, there is a likely to be a regulatory or other incentive scheme (to be determined) introduced to drive this. It is a good time to develop the applications of this pilot into an attractive and cost effective offering that meets the objectives of USAID Oceans and Thai Union. -USAID Oceans' regional scope and ability to develop technology tools allows this pilot to benefit from experiences elsewhere as well as feed into a regional system that can assist in addressing IUU, overfishing and labor issues. **Hi-Chat** -All interviewed crewmembers liked having Hi-Chat. There is a shortage of fishing crews in Thailand; any tool that can help retain and recruit crew is attractive to the owners currently. -Crew currently pay for calls and data on their smart phones (up to 300-400 baht per month). If the pricing was reasonable, crew may pay for at-sea time also, or at least a share of it. -Hi-Chat is interesting to PIPO centers. Perhaps crew can also have a channel to local PIPO officers to report any incidents in real time and prepare them for any follow up in port, as group interview situations in the presence of the captains was reported to be a possibly limiting environment. -More advanced markets will continue to demand traceable and verifiable crew and workers conditions for seafood supply chains from the region, and especially Thailand, as they are seen as high risk. This will continue to drive approaches such as Hi-Chat, regardless of domestic policy forces. -Thai Union has extensive plans regarding crew welfare and improving industry standards in terms of transparency of crew conditions including possibly, crew based auditing of their conditions on board etc. This work is taking place in the context of the Indian Ocean long-line fisheries currently. The Hi-Chat application links into this whole development and its successful further development will likely pay dividends in many areas of work in improving the lives if fishing crews.	-Even the progressive companies in this pilot were very wary of authorities getting the data in this pilot, this will need bridging over with incentives, demonstrating benefits, etc. -Thai fishery regulations including VMS requirements have been changing frequently in recent years. This has caused bad will in the industry and mistrust in the government. It is unlikely people will invest in additional technology unless they can be assured by the government they will not be required to change it and pay for something else in few years' time. **Fleet One** -Satellite phones are currently cheaper (both hardware and air time at 60,000 baht/year) and can be used instead of Fleet One for two way communications. **Hi-Chat** -The advancement of mobile phone networks further in coastal areas may provide lower cost competition. -As part of government plans for e-CDT, human welfare applications as Hi-Chat may be seen as too expensive or only a "nice to have" as they are not part of the EU yellow card requirements on IUU.

5. CONCLUSIONS AND RECOMMENDATIONS

It is clear from the interviews conducted that the pilot technology works well (provided there is sufficient credit for air time) and has met its initial objectives, set by Thai Union and Mars Petcare, of enabling both CDT data collection as well as crew communications onboard the fishing vessels. It is easy to use and benefitted the operations of vessels and companies. It also illustrated its potential to significantly improve crew well-being and culture on board, allowing for better monitoring of the crew conditions by vessel owners and enabling better accountability in terms of the human welfare and operations at-sea on a real time basis.

While the pilot demonstrated the usability of the technology, it was also observed that the information collected, its operational aspects, as well as its compatibility with government systems currently falls short of what is required for the technology to spread. These shortfalls meant it was not possible to estimate in detail the system efficiencies and related cost-savings. Therefore, the pilot did not demonstrate its ability to save time, improve business transactions and operations and more easily meet regulatory requirements.

Despite the short falls and problems identified, these are not insurmountable and the pilot did meet the objectives set for the project by USAID Oceans and Thai Union in addressing IUU fishing, sustainable fisheries management and fair labor monitoring. There are clear opportunities to improve the system and pilot test it further so that the technology can scale across the Thai fishing industry, and further into the region, as per the vision of Thai Union and USAID Oceans.

In addition, the Thai Government is interested in the technology under development and the pilot objectives align with its own plans of testing e-logbook technology on Thai overseas vessels in the Indian Ocean in 2018. The experiences there, as well as the experiences from this pilot, and its possible next steps, can help shape future policy on e-logbooks as well as crew welfare. Given these alignments, Marine Change recommends a "Phase Two" of this pilot with the following adjustments and improvements in place.

5.1 Hi-Chat application

The Hi-Chat application was universally loved by all the users and everyone reported to be using it. There were a few exceptions were crew members did not have anyone in Thailand to sign up for the private channel and only used the group chat. This was due to the difficulty of installing the application, which could not be done without the help of Xsense staff and hence relatives and friends back at home could not be reached. Crews who had no contact on shore had nobody personal to talk to during the pilot.

The crew preference was to talk to someone on shore in Thailand, as well as back at home. Generally more channels than just one was requested, as well as additional features such as Facebook, internet browsing etc.

It also appeared that the high volume of traffic on Hi-Chat resulted in the accounts running out of credit fast which had a knock on effect on the e-logbook and two way communications functionality as well. It should be considered that business operations and e-CDT related information and their timely and accurate transmission remains a priority for the vessel throughout the trip. Hence it should be considered that the Hi-Chat and the other functions are split between two accounts, if possible. Also, it would be ideal if each crew were given a limited quota for the trip (for example 10 messages each or 1MB) that they can use as they wish over the trip rather than it being a race to use it and once it is finished it is done. This way the quota would be fairly distributed and it would be up to each crew how they wished to spend it during the trip. This would also possibly help the crew to consider paying a share of it, currently this is not possible as the quota is pooled between everyone.

Limiting the bandwidth use per individual as well ensuring sufficient usage for the essential e-CDT function and two way communications on each fishing trip is essential in the next step of the pilot in order to assure the users of the value of the system for payment and to assess the amount users will pay for the system.

5.2 KDEs and e-logbook

In regard to the collection of KDEs, there are clear improvements needed in terms of the number of KDEs collected by the e-logbook system. They do currently not meet the Thai legal requirements and especially fall short in human welfare aspects. The following additions are recommended for the next version of the e-logbook in order to meet the Thai legal requirements as well as more closely match other KDE standards. If it is required by the market, it would make sense to update the system with additional market related requirements as outlined previously (Table 5).

Most users mentioned that the e-logbook was easy to use and makes things quicker; hence the design is already convenient and clear. One user mentioned that sometimes the data view is split between two screens, and this could be further improved. In addition, the daily logs were not saving on the main page in chronological order, making it harder to check back on a particular date's catch. These two points, as well as the KDE information cite above, could be further improved.

Table 7. Summary of recommended minimum additional KDEs

Human welfare KDEs	Other KDEs
Captain gender	Date of landing
Captain ID	Date and time of departure
Captain nationality	Vessel UVI / IMO ID #
Crew name	Company / vessel license ID
Crew gender	Company / vessel license expiry
Crew job/title	Wright item confirmed
Crew ID	Species Latin name
Crew nationality	Vessel flag (default to Thai)
	Transshipment information (default to N/A)

5.3 Fleet One two-way communications

In regard to the Fleet One two-way communications, researchers received only positive feedback. When there was sufficient credit, crew could make calls with good quality. Both vessels using parallel satellite phones also reported that Fleet One provided better quality calls using smart phones than using the satellite phone handheld devices.

At the next stage of the pilot it will be important to look at the price point of the data package and call times and ensure that the costs, both initial hardware and airtime are as closely aligned as possible with the satellite phones. It appeared that given the better quality calls, owners might be more willing to pay for this system. Also, vessels that do longer trips, up to two weeks, seem to be more willing to invest in two-way communications over the shorter trips (two to three days) where it appeared frequent communications with the vessel were not as important.

5.4 Connectivity with DoF

Due to the limited scope of the pilot, the trial did not connect the e-logbook data to the operations of the DoF and the PIPO center. This is clearly the next step in ensuring the e-logbook is compatible with the Thai CDT development and that it fully meets the objectives of USAID Oceans and Thai Union. Discussions with DoF and PIPO officials indicated their willingness to pilot fully electronic reporting from vessels to a PIPO center and the electronic Fishing Information Base 2. This is essential to do next in order to understand and demonstrate the benefits of this systems over a paper based system to both the captain and the owner in more detail, as well as in see how this benefits the operations of the PIPO center and the Thai CDT system.

This next step, in addition to helping understand benefits, will help evaluate the willingness of stakeholders to pay for or cost share the system. This should include the government's role in providing incentives such as policy support, tax benefits, licensing discounts or insurance benefits, as well as a possible subsidy or loan scheme towards hardware and airtime costs.

In addition, from the crew welfare point of view it would make sense to connect Hi-Chat to the local PIPO center so that each crew could, if necessary, directly and privately inform a PIPO officer of any incidents or circumstances on board they find distressing (in their own language). This could speed up and direct the PIPO officers' work in port and provide additional assurance that the crew has an official channel to report any issues, as well as their personal chat channels. It is understood that this may be a difficult aspect for vessel owners to accept and may need to be approached in a step-by-step fashion with a supporting incentives scheme.

5.5 Airtime costs

The pilot's hardware and airtime costs were all subsidized and none of the users paid for any of the services. It is assumed that hardware costs, if assurance exists they will be usable from the regulatory point of view for their life time, will not be a problem for most vessel owners to purchase, especially if there are schemes in place that can help with loan and payment schedules to spread the costs over a longer time frame. The airtime costs of the system are, however, significant and require ongoing investment on top of the already expensive hardware.

Fishing crews and captains all reported that they personally spend money on either daily or monthly data and call time packages for their mobile phones. The most popular approach seemed to be to purchase a daily unlimited call/data package of 60 baht for the days the crew is on land and within a signal range (mobile phone signal was available for up to 10-20nm at sea). For periods where they spent more time in port, they purchased more expensive monthly packages of up to 300-400 baht; the upper limit a crewmember would spend. Crewmembers reported that they preferred to be in the range of all internet-based services whilst at sea, not just Hi-Chat. This indicated there could be willingness to pay for this service, especially if full connectivity was allowed.

In addition, the companies with satellite phones reported spending on average 5,000 baht per month on phone costs. The 5MB monthly data package by Xsense currently costs 24,000 baht. If this cost was shared between the "vessel" and "crew," the owner would pay the same 5,000 baht for the two-way communications and e-logbook functionality, but with the rest of the crew of approximately 30 workers would have to double their current monthly spending to pay the balance in lieu of the individual plans they currently purchase. The pilot also indicated that the 5MB was not a sufficient amount of bandwidth, for so many users meaning they would need to pay even more for equal data usage as on land.

This indicates that some "value" will need to be realized in more concrete terms from especially the use of the e-logbook, or from aspects of crew retention, to incentivize the vessel owner (and possibly the captain) to contribute more towards the "vessel" share of the cost. Based on this, it would seem that the possible crew share of this could not be more than 200 baht per month, which would mean approximately 6,000 baht or 25% of the monthly data cost (24,000 baht). This means the owner would need to take the remaining 75% if no subsidy from elsewhere is available. It should be noted that if the technology was to scale, this would in the longer term erode the crew retention benefit as it is now related to the unique circumstances on board the pilot vessels.

5.6 Other considerations

For the next stage of the pilot, there are a few additional practicalities that should be considered. First, it would make sense to carry on with the current vessels in order to be able to judge how well the improvements may work and allow comparisons to the original product. In addition, now that some trust has been built with these companies it should be easier to negotiate with them the next step of joining the pilot with government data collection.

It would also make sense to add one or two additional vessels that fish on average 8-10 days and currently do not have a satellite phone. This would help better evaluate the added benefit of the two-way communications, particularly for the captain and owner. These vessels could be from the companies already in the pilot.

In addition, the current pilot was hampered by vessel maintenance periods as well as vessel inactivity due to seasonal and fishing day restrictions. It should be made sure that no pilot vessel is due to go through major dry dock maintenance during the pilot time period and that they intend to be actively fishing at sea. It seems that

the vessels become increasingly inactive towards the end of the third quarter of the year, this this period should be avoided.

The Department of Labor, beyond the officers of PIPO center, were not included in the evaluation of this pilot. It would make sense to also include them in the next phase of the pilot in order to understand the Hi-Chat applications' benefits more directly to their work in monitoring crew welfare and to gain policy-level support for increased transparency on board vessels.

Table 8. Summary of recommendations for the second phase of the pilot and an evaluation of estimated difficulty of implementation

Improvement area	Proposed improvements	Estimated difficulty
i) Hi-Chat	1. Improve use of Hi-Chat by making it easier to connect with relatives at home	High
	2. Include additional online user options to hand phone access (i.e., Facebook)	Medium
	3. Consider limited/split bandwidth per trip/per user in order to manage costs and allow for uninterrupted use of essential CDT tasks	Medium
ii) e-logbook	4. Include all necessary KDEs required for Thai legal requirements	Low
	5. Improve operational details	Low
iii) Connectivity with DoF	6. Include PIPO centers in real time e-logbook data collection	Medium
	7. Include PIPO center as a private crew channel in Hi-Chat	High
iv) Costing of airtime	8. Conduct a detailed value proposition analysis based on improved pilot and evaluation of efficiencies and business benefits	Medium
	9. Consider vessel/owner price points close to satellite phone usage for two -way communications and e-logbook	High
	10. Consider model for crew cost sharing of communications, based on improved and extended operability of Hi-Chat and added value	Medium
v) Other considerations	11. Include additional vessels with no current satellite connection	Low
	12. Ensure pilot considers fishing seasons and vessel maintenance periods	Low
	13. Include department of labor in discussions around crew welfare and development of Hi-Chat	Low