Traceability Improvement with the Yellowfin Tuna Handline Fisheries Improvement Project in the Philippines

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ACRONYMS AND ABBREVIATIONS

BFAR	Bureau of Fisheries and Aquatic Resources
BLE	Bluetooth Low Energy
CDTS	Catch Documentation and Traceability System
CSO	Civil Society Organization
DA	Department of Agriculture
DILG	Department of Interior and Local Government
eCDT	Electronic Catch Documentation and Traceability
FAME	Futuristic Aviation and Maritime Enterprise
FAO	Food and Agriculture Organization of the United Nations
FAO	Fisheries Administrative Order
FARMC	Fisheries and Aquatic Resources Management Council
FIP	Fisheries Improvement Project
IUU	Illegal, Unreported and Unregulated (fishing)
LGU	Local Government Unit
MCDTS	Municipal Catch Documentation and Traceability System
MCS	Monitoring, Control and Surveillance
MSC	Marine Stewardship Council
NFARMC	National Fisheries and Aquatic Resources Management Council
NFC	Near-field Communication
NGO	Non-governmental Organization
NSAP	National Stocks Assessment Program
NTMP	National Tuna Management Plan
OMTFA	Occidental Mindoro Federation of Tuna Fishers Association Inc.
OTG	On-the-Go
PaNaGaT	Pangingisda Natin Gawin Tama Network
PPTST	Partnership Program Towards Sustainable Tuna
R.A.	Republic Act
RDMA	Regional Development Mission for Asia
USAID	United States Agency for International Development
USAID Oceans	USAID Oceans and Fisheries Partnership
WWF	World Wind Fund for Nature

1. Introduction

Municipal fish catch contributes significantly to the overall production in the country, contributing to almost 26% of the total production in 2018. But on the Department of Agriculture - Bureau of Fisheries and Aquatic Resources report from 2014 – 2018 shows a decline in terms of volume of fish production of the municipal fisheries sector from about a million Metric tons in 2014 to 941 thousand Metric Tons in 2018. That said, Philippine fisheries are under immense stress as a result of overfishing, and the exploitation of fish stocks has led to an alarming decline in total catches. The tuna fishery is divided into small-scale or municipal fisheries, which are artisanal fishers using small boats, and commercial fisheries which use boats larger than three gross tons. The commercial vessels use various fishing gears such as trawls or ringnets that catch large amounts of juvenile yellowfin tuna and other nontarget species. Up to 87% of total yellowfin tuna landings are small juveniles (0.5-3 kg), with pressure exceeding sustainable levels. This has led to a decrease of yellowfin tuna biomass in Philippine waters and a dramatic decline of the adult yellowfin tuna catches to only 25 per cent of their 1990 level within 20 years (WWF-EU Factsheet April 2013). The dwindling tuna stock in the Philippine waters are putting the fishers and their families at risk of losing their livelihood. One major issue that contributes to exploitation is illegal, unregulated and undocumented fishing (IUUF). Despite many efforts to control IUUF, it remains prevalent throughout the municipal and commercial fishing sector. IUUF is problematic for various reasons. Not only does it further unsustainable fishing practices, skews data collected to estimate fish stocks, compromises food safety, and also puts municipal fishermen at high risk of losing income and livelihoods.

The Bureau of Fisheries and Aquatic Resources (BFAR) fish catch data from 2010 to 2015 shows a decreasing trend in terms of fish catch volume in the municipal fishing sector and such an alarming trend would mean lower income for the artisanal fishers. The municipal fisher sector remains to be the poorest of the poor among all sectors while providing a significant contribution in the total fishing production of the country. Approximately 34% of the total fish production of the country amounting to almost Php 80 million (USD 1.6 million) per year comes from this humble sector (Fisheries Statistics of the Philippines Vol. 25 2014 – 2016). There is a pressing need to properly manage the fisheries in our municipal waters and to do that, sufficient data are needed to come up with an effective management strategy. It is more challenging to facilitate effective management strategies in the municipal fishing sector because most of the local government units, who are mandated to manage their respective municipal waters, lack sufficient capacity to conduct fish catch reports. These reports would generate data to serve as basis in crafting effective policies for the protection and conservation of the resources within the municipal waters.

Tuna fisheries face threats due to several reasons: (1) tuna fisheries in the Philippines are open access, with few measures in place to restrict catch levels., (2) there has been increasing fishing capacity and growing pressure on the stocks, as well as declining yellowfin tuna resources, (3) there are conflicts among resource users, e.g. commercial fisheries vs artisanal, (4) there is a lack of financial mechanisms for funding improvements in fisheries governance. Ultimately, the overexploitation of the tuna resources is threatening the income security of small-scale fisheries.

2. Significance

The project aims to improve governance in the tuna fishery by facilitating the capacity building and technical developments necessary to facilitate the development of a Catch Documentation Scheme and Traceability System for Handline Tuna Fisheries in Mindoro Strait. This project contributes to addressing the problem in illegal, unregulated, and undocumented fishing (IUUF), with its aim to improve the traceability and fish catch documentation scheme in Mindoro Strait. ln the long term this will also help to

manage the tuna resources of the Philippines using science-based data, while also contributing valuable catch data to the Western Central Pacific Fisheries Commission (WCPFC), the Regional Fisheries Management Organization (RFMO). The project will also help in promoting sustainable fisheries by pioneering traceability, an essential requirement in the compliance to the international trade of any fishery product.

3. Project Objectives

The project aims to improve governance in the tuna fishery by facilitating the capacity building and technical developments necessary to develop a Catch Documentation Scheme and Traceability System for Handline Tuna Fisheries in Mindoro Strait.

The project will work on the following key elements to achieve the overall objectives:

- Conduct or support pilot testing for the institutionalization and implementation of digitized EU catch certification of the E-CDS in Mindoro.
    a. Establish an electronic database in collaboration with Local Government Unit (LGU) and BFAR and assess how the E-CDS tested by WWF can be used/link to the database of electronic EU catch certificate, if BFAR is to develop such system.
    b. Conduct training workshops on how E-CDS will work to relevant stakeholders (BFAR, LGUs, FARMCs).
- Development of the catch documentation system roadmap/guidelines that will ensure the continuous implementation of catch monitoring.
    a. Assist LGUs on development of Catch Documentation System (CDS) based on their respective dynamics.
    b. Advocate for capacity building in the LGUs in implementing comprehensive CDS and data analysis to inform tuna fisheries management processes.
    c. Conduct training workshop for the Agricultural Technician (AT) on Fisheries and/or LGU encoder for the data banking (database) system for the consolidation of the fish catch report and simple data analysis and identify process through which the local government will effectively use the data for the management.
    d. Establish a monitoring system to ensure effectivity of the implementation of the CDS.
    e. Lobby for the addendum of to the Local Municipal Fishery Ordinances the CDS and all other relevant information thru FARMCs.
- Implementation of IUUF prevention plan to improve the compliance on registration and licensing.
    a. Establish a monitoring system and/or strategy to monitor effective implementation of IUUF prevention plan.
- Develop a boat registration and licensing database for Local Government Units that can be access through World Wide Web (www) for verifying vessel compliance.
    a. Conduct training of the Municipal Agricultural Office of LGUs encoder for the management of database on R&L.
- Develop or identify a vessel monitoring device that is affordable for the artisanal fishers but is also reliable in the fishery enforcement and can be linked to electronic traceability and CDS system.

Results and Discussions

4. Applying ECDT technologies to small-scale handline tuna fisheries

Figure 1. Small-scale handline tuna fisheries full traceability From Hook to Cook.

The project has been working with different organizations, institutions, CSOs, and technology providers to develop and identify schemes to effectively create a digital platform that can demonstrate verifiable traceability that can cater the tuna small-scale handline tuna fisheries in the Philippines. The work does not only help identify the appropriate technology to address the lack of fish catch report for the municipal fisheries but it can also provide a great tool to support compliance with both local and international market regulations. In a way, this work can measure the capacity and determine the capability of artisanal fisheries to keep up on the growing consumer and regulatory demand for better transparency within seafood supply chains. By using interoperable CDTS technologies this project aims to elevate the artisanal fisheries to compliance with the international standard.

The complexity of fisheries in the Philippines makes the work of developing a traceability system challenging, especially for small-scale fisheries. The technology needs to be flexible enough to a specific fishery and must be interoperable with other systems to achieve “Hook to Cook” traceability. The project has tried various traceability devices and technologies to identify the right system for the small-scale handline tuna fisheries in the Philippines.

4.1 Navama Technology for Nature

In February 2016, the project entered in a collaborative work with NAVAMA, a Germany based technology provider of vessel monitoring devices for small scale fisheries. The purpose of this collaborative work is to pilot test a multiple tracking device for use on small scale fishing vessel to improve transparency and for nature conservancy. The test trial of the new devices was participated by 13 tuna fishing vessels from the Municipality of Mamburao, Occ. Mindoro. In total, 4 different models from 3 companies has been tested for their reliability and seaworthiness, Table 1.

Table 1. List of Participating Tuna Fishing Vessels with the corresponding GPS monitoring device.

Fishing Vessel	GPS Monitoring Device
Lhiam Jade	FM1204 Demo 1
Jemuel	FM1204 Demo 2
Uzel 3	FM1204 Demo 3
Princess Camile	FM1204 Demo 4
Onoy	SpotTrace 001
Four and One	SpotTrace 002

Tita Nhor 6	SmartOneC 002
Precious Bien	SmartOneC 003
King Dave	SmartOneC 004
Yu Rianne	SmartOneC 005
Lady Dephany 2	MecSolar 002
Kevin Andrei 2	MecSolar 003
Disciple	MecSolar 004

The table below shows the lists of the tracking devices and summarizes all data gathered by them in the time between 22nd February 2016 and 31th May 2016. This is a total of 97-99 days, depending on the day the device was installed, Table 2. All devices were in working condition immediately after their mounting and were installed sometime between the 22nd and 24th of February 2016.

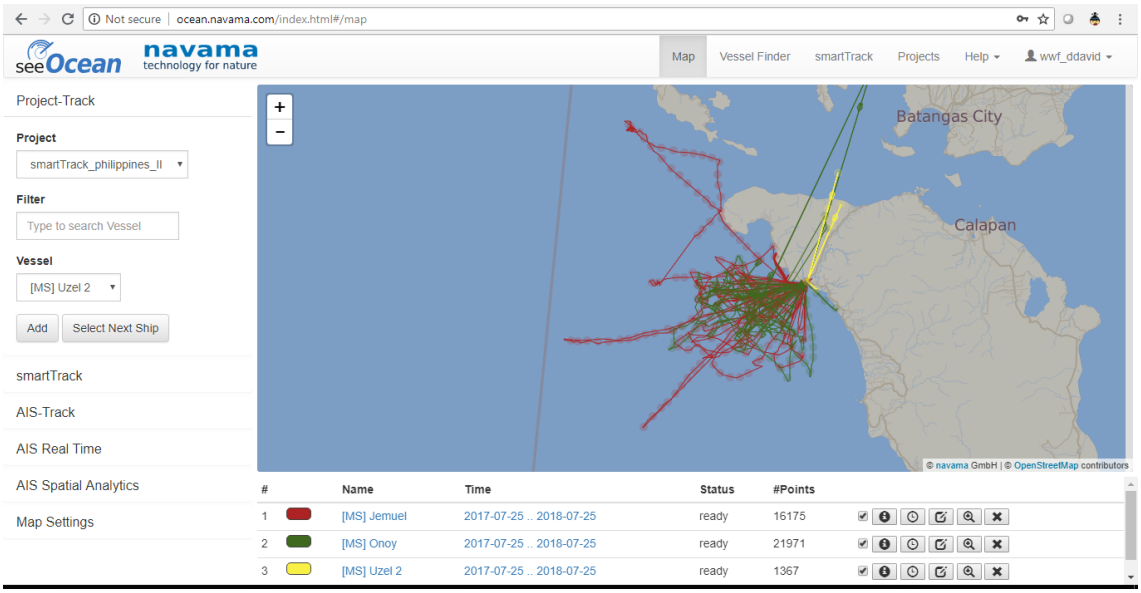
Table 2. Summary of data gathered by the tracking devices.

Device	# Raw Data Points	Configuration Interval	Time	Days	Power Supply
FM1204 Demo 1	170	Config A*	22.02.2016 - 13.03.2016	20	External
FM1204 Demo 2	1279	Config B**	22.02.2016 - 01.05.2016	69	External
FM1204 Demo 3	1305	Config B**	23.02.2016 - 12.05.2016	79	External
FM1204 Demo 4	3220	Config A*	23.02.2016 - 12.03.2016	18	External
SpotTrace 001	1811	30 min	24.02.2016 - 09.04.2016	45	Battery (additional on board power supply)
SpotTrace 002	3275	30 min	23.02.2016 - 14.05.2016	81	Battery (additional on board power supply)
SmartOneC 002	1380	60 min	22.02.2016 - 22.04.2016	60	Battery
SmartOneC 003	1875	60 min	22.02.2016 - 11.05.2016	79	Battery
SmartOneC 004	700	60 min	22.02.2016 - 31.05.2016	99	Battery
SmartOneC 005	634	60 min	24.02.2016 - 05.05. 2016	71	Battery
MecSolar 002	1565	dynamic	22.02.2016 - 31.05.2016	99	Solar
MecSolar 003	1424	dynamic	22.02.2016 - 31.05.2016	99	Solar
MecSolar 004	1887	dynamic	22.02.2016 - 31.05.2016	99	Solar

*Config A:
If moving, all 600s or all 500m or if angle change larger 30 degrees.
If not moving, all 1800 sec.
**Config B:
If moving, all 600s or all 200m or if angle change larger 30 degrees.
If not moving, all 1800 sec.

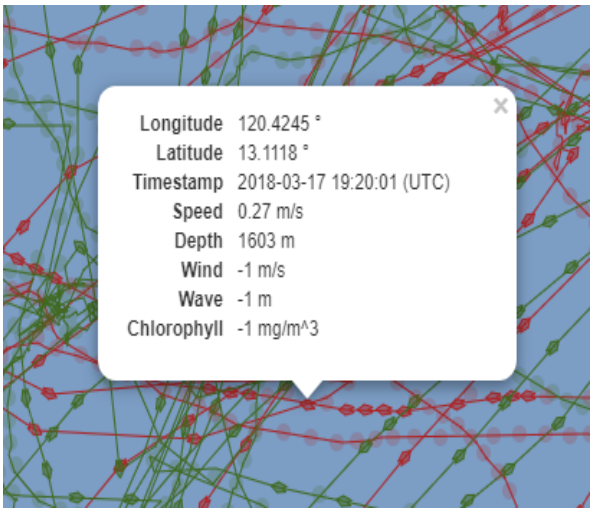
For the monitoring and visualization platform for the Pilot Project, the seaOcean Explorer was used. The seaOcean Explorer is a web-based analysis tool for marine geographic information, AIS, VMS and other systems (such as the ones used for this pilot). It offers global coverage of satellite and terrestrial AIS data from today back to 2009. Vessels activities can be analyzed in the context of oceanographic data, Marine Protected Areas, landing sites, fishing activity and other data.

Figure 2. Tuna fishing vessels tracks during fishing.



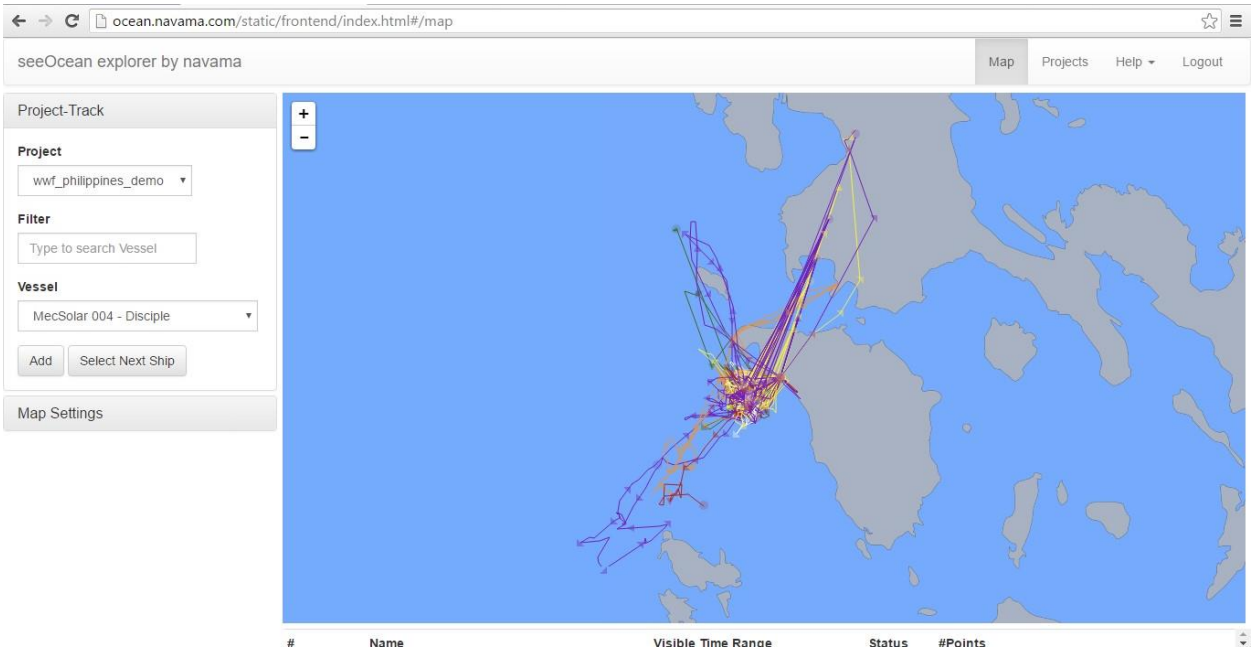
Through various algorithms, fishing activity, signal reliability and harboring activities of vessels can be analyzed. Any single location of vessels can be reviewed in the context of water depth, wind speed, wave index and chlorophyll.

Figure 3. GPS data gathered in a single location.



For the purpose of the Pilot, Navama created a link to monitor the selection of test devices in near real time. An account access to seeOcean was given to WWF Philippines to monitor the vessels through for 3 Months and learn about their movements. It was observed that there are instances boats were going to Batangas area. Though there was no clear explanation why these boats were going to Batangas, it is possible that they were landing their catch direct in Batangas, purchasing supplies, or repairing their boats. This valuable information is essential in establishing the traceability system for the handline yellowfin tuna in Mindoro.

Figure 4. Fishing vessel tracks using MecSolar devices reaching areas beyond Mindoro Strait.



All over, the test showed very valuable results. The Mecomo device set passed all requirements and is still operating. A major challenge is not so much the data transfer (both GSM and Satellite work fine) but rather a reliable installation and robust power supply.

Phase 2 of the pilot testing uses 3 MecSOLAR devices to further test the device in a long period of time (2 years). The three (3) device was installed in 3 small-scale tuna handline fishing vessels on March 14 – 16, 2017 at the Municipality of Mamburao, Occidental Mindoro, Figure 4.

4.2 Catch Technologies

Navama's GPS devices provided the project a tool for monitoring vessel movement, but the aim of traceability improvement is to create a system that can monitor the whole supply chain from the point of catch up to the consumer level. The project decided to sign an agreement with The Catch Corporation to develop a traceability software for the Yellowfin tuna handline Fishery Improvement Project in the Philippines. During the first meeting, Catch Corporation and the Traceability team of WWF Philippines reviewed the capabilities of the Catch Software and that of the partners that Catch Corp. is working with, Futuristic Aviation and Maritime Enterprise (FAME), a Philippine-based technology provider of vessel monitoring devices. This collaborative work aimed to incorporate not just full traceability of the boat and the fish but also the conditions that the fish is exposed to in the supply chain.

The flexibility of the Catch software can allow pricing and stock to be incorporated into the platform providing the opportunity in the future for fully empowering the fishermen to be fairly paid and to offer their catch to a wider audience.

During the discussion, major risks that needed to be addressed in the supply chain were: (1) Mixing of catch from the other areas and from non-compliant fishing vessels, (2) Geofencing, to make sure that the fish was not harvested from a protected area or from unmanaged areas, and (3) Time-temperature abuse and histamine build up due to poor handling from catching to transport. The data fields of the Catch

Software were discussed also and identified sets of data need to be included in the eCDS software, Table 3.

Table 3. Notes on the Catch Software data fields.

Data Fields	Remarks
1. Species Settings	• Add column for the fish local names. • Add category for by-catch or Target species.
2. Received Forms	• All Okay.
3. Fishing Gears	• All Okay.
4. Landing Areas	• Add a column for Fishing Grounds.
5. Fishers	• Boat Owner: Yes or No • Add column for Boat Registration Number. • Add column for Fisher Registration Number. • Remove License Quota. • Photo ID to function.
6. Harvest Method	• Add with FAD.
7. Vessels	• All Okay.
8. Ports	• Add column for Municipality.
9. Transport	• Add column for Plate Number.
10. Under the Tab Ports (before transport)	• Add Casa/Consignee. • Add Casa Name, Address, Business Permit Number, Business permit Expiry Date.
11. Harvesting	• Add Casa to Landed Catches & Local Transport. • Casa (in Settings) to include Casa Name, Address, Business Permit Number & Expiry Date.
12. In Harvesting	• Add price from Casa. • Add price from Market. • Delta.
13. Have a drop-down for each area	• i.e. Mindoro and Lagonoy.

Based on the additional data sets identified by the team, at least a couple of years is needed to complete the first Module to have a fully functional eCDS. Integration with other technology providers is important to have all the valuable information needed for supply chain and traceability be visible on the Catch portal. With all the gaps in traceability like in awareness, commitment, implementation, technology and standard, the team identifies some works needed to be integrated on this traceability work that can maybe make this traceability system be verifiable:

- Set up automatic alerts for licensing and registration.
- Make the data publicly available.
- Develop a standard template for compliance on the local and global markets.
- Expand the data sets to include geofencing, temperature, time, licensing, weight and transport monitoring.
- Possibilities of expanding to other species and other locations.

With all the consultations on the additional data sets needed for the small-scale tuna handline fisheries, the Catch system was ready for integration to FAME to complete the full supply chain traceability. The

project inputted the necessary tuna handline fishers and fishing vessels data to the Catch system in preparation for the eCDS pilot testing. However, the planned pilot testing of the system did not push through due to the unexpected turn of events between Catch Technologies Limited, the project, and FAME. Catch Technologies charged FAME one thousand US dollars per month to access the Catch System and wanted them as a consultant to Catch Technologies, which the FAME did not agree with. Similarly, Catch technologies also charged the project to access the system after the needed data was inputted. The project had not allocated any amount to cover the cost of the monthly access to the Catch system for the pilot testing. The project decided to terminate the agreement to pilot test the Catch system on its FIP sites because of this reason. Furthermore, with the costs of the access to the Catch system, the Project concluded that it is not an ideal traceability system for the small-scale handline tuna fisheries or any other small-scale fisheries in the country.

The high cost of the system makes it unattractive to the users like the fishing vessel owners and the buying stations, especially since the tuna fishers are not getting a premium price for their catch. The main consideration of the project is to develop or identify an effective but affordable electronic catch documentation and traceability system that can cater to the needs of the two small-scale handline tuna fisheries FIP sites.

4.3 CAWIL.ai

With continuous fishing pressure on different fishing grounds, countries and fishing industries are now focusing on combatting IUU Fishing by supporting guidelines and legislations that promote sustainable fisheries. There is a growing demand for a robust traceability system that can address seafood fraud and the continuous degradation of our marine resources that paper-based traceability fails to address. To address the lack of a catch documentation and traceability system in the Philippines, another technology developer collaborated with WWF-Philippines to test their application that can be used in Artisanal Fishermen Traceability.

Catch Automation With Identification and Location (CAWIL.ai) is a Philippine-based technology developer using Artificial Intelligence technologies that automatically identify patterns and detect anomalies. CAWIL.ai developed Trace.ai, a mobile phone application intended for seafood traceability. It can automate catch documentation by utilizing artificial intelligence (AI) in identifying seafood species plus estimating their size and records as well the location, Figure 5. The software can be customized to include all the key data elements that

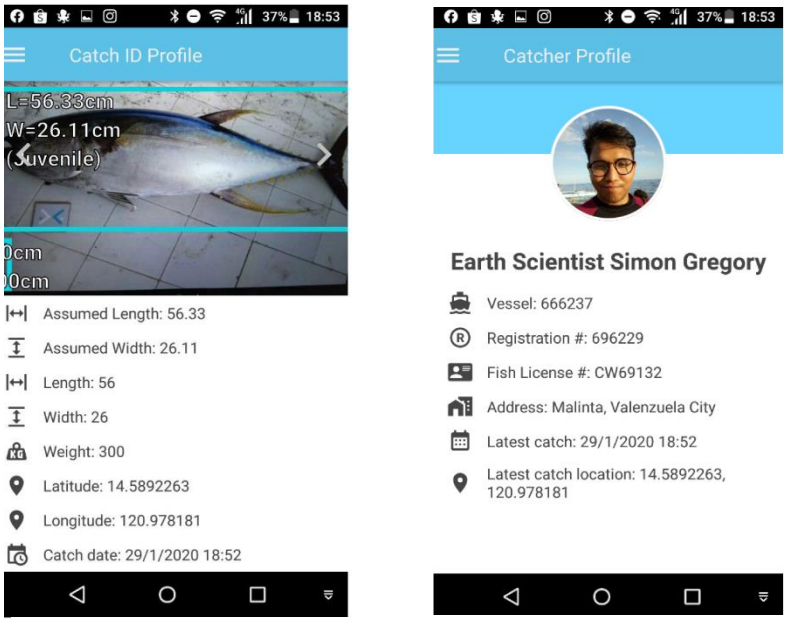


Figure 5. Trace.ai mobile application.

will meet the industry standard such as fisherman identification, fisher folk registration number, fishing license, fishing vessel name, etc.

The newly developed software was conducted in the Municipality of Mamburao and Sablayan in Occidental Mindoro. The pilot testing was intended to collect more data sets on catch reports to increase the accuracy of the software in estimating fish sizes and species identification. The more data is inputted, the faster the detection will be.

During the test, 250 data sets were collected and the software increases the detection from 60 – 70% to 80 – 85%. The software has a lot of potential as it is interoperable with other systems. At the moment, Trace.ai is not so enticing to the fishers since it will cost them an additional USD200.00 monthly for using the application. Furthermore, not a lot of tuna fishermen use smartphones.

4.4 Futuristic Aviation and Maritime Enterprise (FAME)

The FAME technology has undergone so much improvement in terms of electronic catch documentation and traceability system. It started with developing transponders, a cheaper alternative to vessel monitoring devices for the small and medium scale commercial fishing vessels. Later on, FAME decided to improve their system to digitize the catch documentation and traceability system requirements of the municipal yellowfin handline tuna fisheries of Mindoro Strait and Lagonoy Gulf. The project had the opportunity to fully test the FAME system through a collaborative work with the USAID Oceans project by the USAID Regional Development Mission for Asia (RDMA). The USAID Oceans projects goals were aligned with WWF's traceability goals. One of these goals is to support the development and implementation of eCDT technologies, to help ensure that fisheries resources from Southeast Asia are legally caught, properly labeled, and environmentally and socially sustainable. Having heard of WWF's work on traceability improvement for the small-scale handline tuna fisheries in Mindoro Strait, they decided to extend their work from the commercial handline tuna fisheries of General Santos City to the small-scale handline tuna fisheries of Mindoro Strait and Lagonoy Gulf.

Futuristic Aviation and Maritime Enterprise, Inc. (FAME), offers a maritime transponder that can track and monitor maritime vessels in real-time using a PC or a mobile device. The transponder can be installed in different types of maritime vessels including small-scale fishing vessels. The technology features include independent messaging, meaning it does not need a telecommunication service provider. There is an optional messaging capability and it has Bluetooth Low Energy (BLE) or On-The-Go (OTG) connectivity for a smartphone application. Additional features are Global Positioning System (GPS) and sensors that can record speed, location, path, and with optional sensor connections.

For now, the limitation of the FAME technology is that it records the target species only. It is highly recommended to have a fish catch enumerator to assist fishers to record not just the target species but the bycatch/retained species as well because this is very vital in the monitoring of the status of fisheries impact to the ecosystem, and could be a basis for fisheries resource management. Constant improvement of the eCDT technology is ongoing to meet the global traceability minimum key data elements requirements and it will include recording of bycatch or retained species as well and to other possibilities that may be required by any circumstances in termsofseafood traceability.

FAME learned a lot with their USAID Oceans project and made the necessary adjustments during the deployment in Sablayan, Occidental Mindoro and Lagonoy Gulf in Bicol.

The following are the specific lessons learned by FAME during the pilot testing of eCDT technology:

- The processors and/or exporters should be part of the process because of the direct link with both the fishermen and the buyers.
- The Fish Processors Organization who will be a part of the Small-scale handline tuna MSC Chain of Custody is willing to pay for the services of eCDT technology provider rather than charge the fishermen.
- Traceability is a vital part of any certification that is needed for exporting fish (e.g. MSC Certification).
- FAME technology is interoperable with other systems which are key in achieving full traceability to the small-scale handline tuna fisheries of the Philipines.
- Fishermen are very willing to learn and adapt to newly available technologies.
- The technology being offered by FAME plays a vital part in tracing fish from the point of the catch.
- FAME technology is ready to adapt any improvement based on the feedback from the pilot testing sites.

Results from the Periodic Monitoring

The monitoring on the at-sea testing and maintenance was supposed to include the mapping of the Fish Aggregating Devices (FADs) used by the tuna handline fisherman. This would have been used to determine the spatial distribution of the fishing operations in Mindoro Strait and Lagonoy Gulf and also to update and estimate the number of FADs present in each fishing ground. The data gathered would have been a basis for the plan of BFAR to establish a Tuna Conservation and Management Zone (TCMZ) for each fishing ground. Furthermore, the information is critical for the National Tuna Management Plan (NTMP) and juvenile catch conservation measures like the TCMZ. Periodic monitoring was also supposed to monitor the seaworthiness of the FAME transponder during the pilot testing period. At the same time, a dialogue with the fishers was supposedly scheduled to gather information on the experience of the tuna handline fishers on the use of the transponder and give technical assistance whenever they experience technical problems with the device.

These activities were canceled due to the Covid-19 pandemic, to adhere to the ongoing Enhanced Community Quarantine implementation in the entire island of Luzon. Because of this, the gathering of information was done through mobile phones and during the distribution of food packs for the members of the small-scale tuna handline fisher's association whenever possible. The food packs are from the fundraising campaign organized by the Tuna Fishers Federation assisted by the Sustainable Tuna Partnership Project of WWF-Philippines to give rice packs to the family of the tuna handline fishermen in Mindoro and Bicol during the quarantine period.

In the early stage of the pilot testing, the FAME transponders and the FAME eCDT platform seemed to be working fine. There were 33 yellowfin tuna catches recorded and traced from Sablayan, Occidental Mindoro. The system recorded where the fish was caught, when it was caught, the name of the fishing vessel, the name of the boat captain, fisherman's ID, and the fishing vessel's license number. The transponder was successfully integrated with the processing plant application where it generated QR codes from the processing up to the packing stage. In Bicol, there were 4 fish catch detections recorded in the FAME eCDT platform, showing the

location, date, name of fishing vessels, name of the boat captain, fisherman's ID, and the fishing vessel's license number as well. The fishers started using NFC card several days just before the declaration of Enhanced Community Quarantine because of Covid-19 pandemic. At the moment JAM seafoods was not sourcing tuna caught from Lagonoy Gulf. This is why there were no trials on the integration with the processing plant from this site.

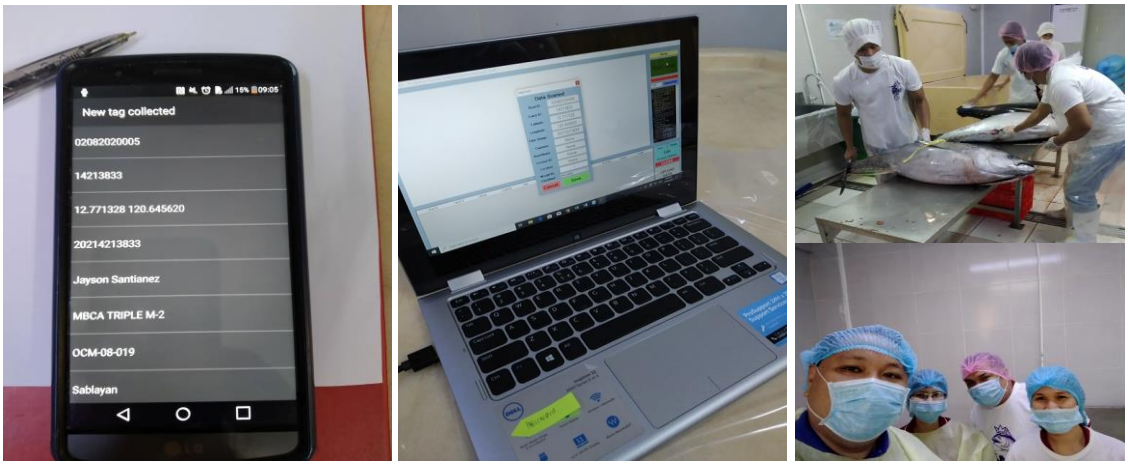


Figure 6. Data flow and interface of eCDT technology using FAME eCDT platform for small-scale handline tuna fisheries from WWF FIP site.

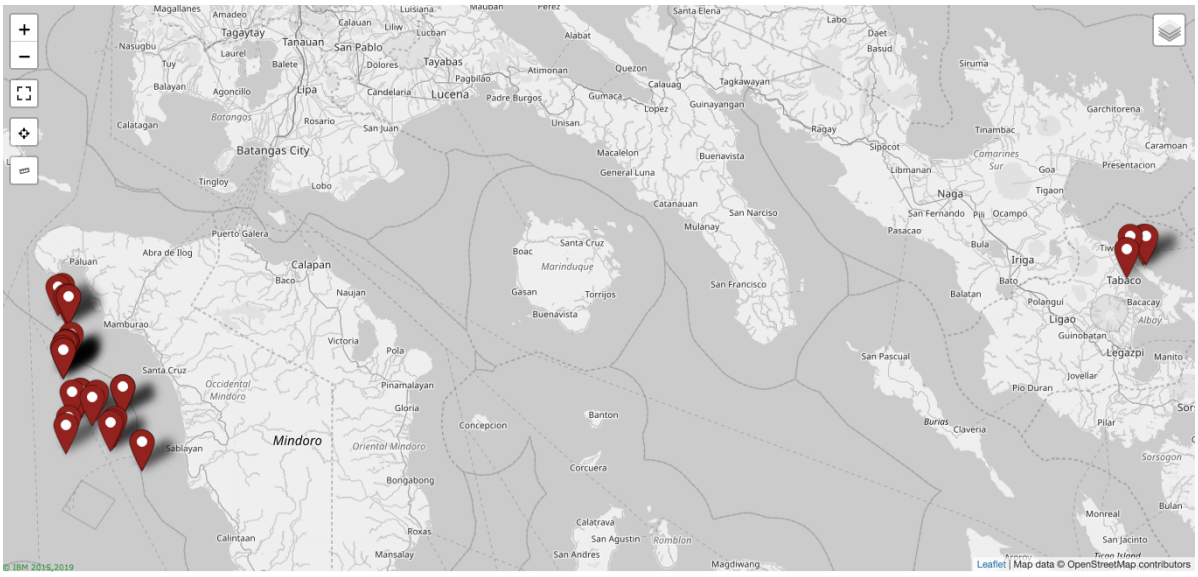


Figure 7. Locations where the YFT was caught by the tuna handline fishermen in Mindoro Strait and Lagonoy Gulf.

Credit: FAME technology

During the eCDT technology system trials, there were a few glitches observed in the use of FAME transponder and NFC cards. There were instances that the returned NFC card didn't have data in it. Several

possibilities have been observed: maybe the card was not properly tapped on the transponder or the fishers were confused, and, instead of tapping the NFC card to the transponder, they tapped it on the tuna. Another challenge was experienced by some fishers that operate at night. Even though they exposed the solar panel to the sun all day to charge the transponder, at night, the charge on the battery did not last long and the light from the transponder turned off, an indicator that the battery has run out of power. In Sablayan, Occidental Mindoro, fishers sometimes observed that the transponder indicator light turned off even the device was connected to their generator during their fishing operation at night time. There were also instances that the fishers returned a broken NFC card. It is possible that the cards were damaged when the fishermen poured cracked ice over the NFC card attached to the tuna when they stored it in their cold storage. Another possibility is that the card got was damaged in the process of storing the caught tuna in the boat's cold storage. These incidents have been discussed with FAME and there is a plan to switch the NFC cards with an NFC keychain tag which is more compact and durable.

Generally, according to the fishermen, the device is easy to use and it does not get in the way of their fishing operations. The solar panel is great because they do not need to worry about charging it before fishing. Also, knowing that it is equipped to send distress signals during emergencies, they somehow feel more at ease when they are out fishing. It was observed during the transponder installation and also during an interview that the giving of incentives to the fishers who participate in the eCDT technology pilot testing makes it more enticing for the other fishers to also participate. Some fishers have expressed their interest to be part of the system in the future, once their buyers and exporters require them to use it for traceability. For a more successful implementation of eCDT technology for small-scale fisheries, the government and supply chain actors need to think of a mechanism for incentivizing the compliant fishermen in addition to market access.

Minimal information has been gathered regarding the experiences of fishermen during the field trial of the FAME transponder because of the Enhance Community Quarantine due to the Covid-19 virus pandemic. Not all fishermen own a mobile phone and some of them are residing in areas with limited to no cellular network services. The movement of the fish catch enumerators based in the project sites is very limited, and gathering of data and information regarding the eCDT technology pilot testing is challenging.

5. Status of fish stock and fishing capacity.

To further support the pilot testing of the electronic catch documentation and the development of a catch documentation guidelines that will ensure the continuous implementation of catch monitoring, the project hired a fish catch enumerator based in the two major tuna landing municipalities of Occidental Mindoro namely Mamburao and Sablayan. The fish catch data collection started in in July 2017 and ended in early of the year 2020 due to the countrywide lock down cause by Covid-19 pandemic. All data collected are from the landed catch and effort from the tuna fishers who are willing to share their catch data to the enumerators. This effort was made by the project to augment the lack of fish catch data in tuna fisheries due to lack of catch documentation implementation in the Local Government Units level.

The method used in the collection is based on the National Stock Assessment Program (NSAP) method and the fish catch enumerators were trained on how to properly measure the fish and in fish identification. The data collection was focused only on hook and line fisheries targeting Yellowfin Tuna. The data collected under this project was used also to determine the fishing capacity of Mindoro Strait. A

fisheries scientist was commissioned under the Sustainable Tuna Partnership Phase 1 project to determine the fishing capacity of Mindoro Strait. The catch and effort profile for Mindoro Strait were computed using basic total and mean averages. For the indicator of stock status, only Catch Per Unit Effort (CPUE) (kg/boat/year and kg/boat/day) for the dominant catches by hook and line were computed.

Based on the analysis done by Dr. Mudjekeewis Santos of the Department of Agriculture – National Fisheries Research and Development Institute (DA-NFRDI), the CPUE of tunas in Mindoro Strait appears to be stable over the 7-year period of study. Using this as an indicator the tuna fishing capacity appear to be sustainable as of this time. This is reflective of the overall status of the tuna stocks in the Western Pacific, where the population of these highly migratory species were assessed as stable and not experiencing overfishing. However, due to the slight decreasing tendency of the CPUE values in recent years, it is recommended that the existing fishing capacity should not be increased. Instead, to ensure the sustainability of the tuna fisheries in the area, management interventions such as the establishment of continuous monitoring and evaluation programs of fisheries indicators needs to be hastened. Moreover, continuous implementation of the provisions of RA 8550 as amended by the RA 10654 particularly in Illegal, Unreported and Unregulated (IUU) Fishing should be strengthened (Santos, M.D. 2021). The data used in this study were form 2014 – 2015 under the Partnership Program Towards Sustainable Tuna Project and from 2017 to 2019 under this project.

6. Yellow Fin Tuna Seasonality

Monsoon variability known to influence the productivity processes in the oceans and have different effects in different fishing grounds. In Mindoro Strait, it has been observed by the tuna fishers that during the onset of the Northeast monsoon that starts in the Month of June up to August experiences low catch of yellowfin tuna. This observation was demonstrated as well by the data collected in the yellowfin tuna handline fisheries of Occidental Mindoro from 2017 to 2019 (Figure 8). This data supports also the observation of tuna fishers that they have better catch during Southwest monsoon (November to May). However, there is a need for continuous implementation of fish catch documentation to gather sufficient data to better conclude this observation. It would be supported by a physico-chemical parameters study in Mindoro Strait to better understand the productivity processes of this fishing ground.

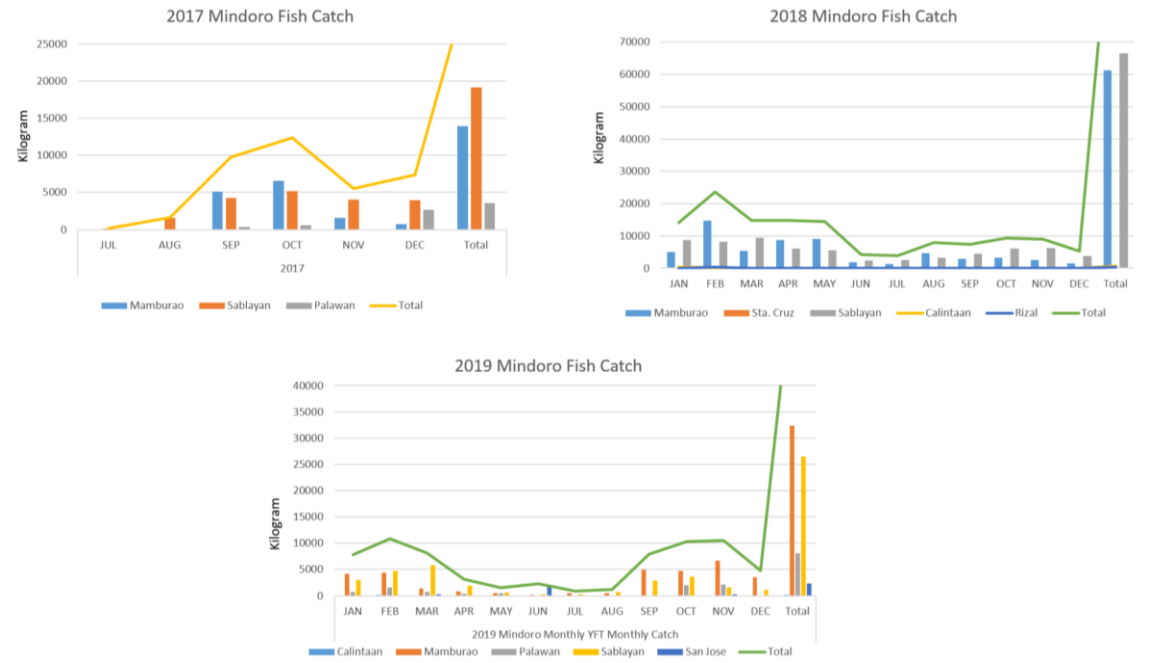


Figure 8. Yellowfin Tuna Seasonality in Mindoro Strait

7. Development of the Municipal Catch Documentation and Traceability Guidelines

In the Philippines, establishing a fish catch documentation and traceability system is challenging due to the complexity of fisheries in different fishing grounds. Coastal LGUs have different levels of understanding regarding existing fisheries regulations and there is no existing effective mechanism to deliver new national fisheries policies to the LGU level for adoption, resulting in different level of implementation of fisheries regulations in the ground. This project has significantly contributed to the development of the Voluntary Guidelines on the Establishment of a Municipal Catch Documentation and Traceability System (MSCDTS) for Local Government Units to manage fishery resources. Among the major activities that the project was involved was during the national consultation on MCDTS guidelines and during the presentation of the guidelines to the National Fisheries and Aquatic Resources Management Council (NFARMC) for approval.

A partnership with other Civil Society Organizations (CSOs) and a close coordination and collaboration with the Bureau of Fisheries and Aquatic Resources (BFAR) led to the finalization of the draft Fisheries Administrative Order (FAO) on Guidelines for the Establishment of a Municipal Catch Documentation and Traceability System for LGUs to Manage Fishery Resources. This was completed in December 2019. The general objective of this Order is to establish a data collection system that is appropriate and viable at the local government level; to provide a management tool to prevent, deter and eliminate illegal, unreported and unregulated fishing (IUUF); to ensure effective and efficient fisheries management; to implement food safety requirements; and to ensure continued market access of fish and fishery products. It is the aim of this Order to enjoin LGUs to establish and implement a municipal catch documentation and traceability system (MCDTS) with the help of relevant government agencies such as the Department of

Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR), the Department of the Interior and Local Government (DILG), civil society organizations and academe.

The final draft of the MCDTS guidelines was lobbied to the National Fisheries and Aquatic Resource Management Council (NFARMC) during the NFARMC 4th Quarter Meeting on the 12th of December 2019 for endorsement to DA – BFAR for approval.

Figure 9. Coordination meeting with BFAR-MIMAROPA on the application of eCDT in the small-scale tuna handline fisheries.

Photo: WWF-Philippines/Jemuel Cueto

In the coordination meeting conducted with the BFAR Regional offices in MIMAROPA and Bicol, they expressed that they appreciate efforts and projects that support and help improve their capacity to better deliver their mandate as fisheries regulatory agency, Figure 9. It is important that the ongoing work on eCDT for small-scale fisheries is in line with the Bureau's effort to develop eCDT to keep up with the global trends of digitizing the MCS platform in order to curb IUU Fishing and promote more sustainable management of the fisheries resources in the coastal communities. There were concerns that arose during the meeting that this might be not acceptable to fishers because of the notion that the government might tax them more if they become transparent and declare all their fish catch through eCDT. Another issue is regarding what the fishers call their "*trade secret*." This pertains to the idea that if the fishers declare their good fishing spots through eCDT, other fishers might discover these also, and the potential competition might result into a lower fish catch for them.

It was explained that the eCDT platform is equipped with security access, and the only person or group of people who can view the information being submitted by the fishers are those who belong to a single supply chain, including LGUs and also BFAR as the national fisheries regulatory agency. The development of eCDT is still ongoing and there are existing collaboration works with other organizations who are finding ways to directly incentivize small-scale fishers using the eCDT technology. The key here is the interoperability of the system. This collaborative effort has led to the approval of the Fisheries Office Order 129 also known as the Voluntary Guidelines for the Establishment of the Muncipal Catch Documentation and Traceability system Figure 10.

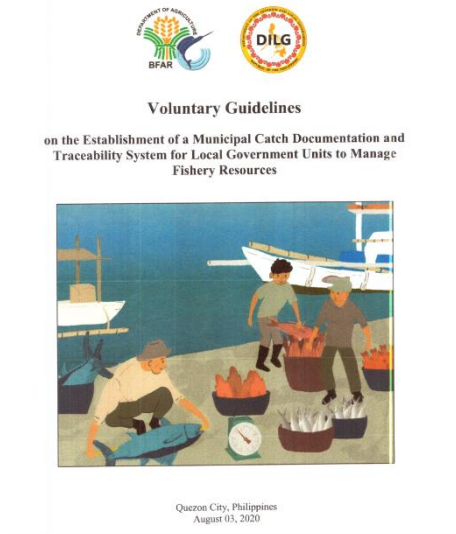


Figure 10. Approved MCDTS Guidelines

8. Lessons Learned:

8.1 Fishers

- Participants should be a member of the TFA in their respective municipalities and should meet government criteria in conducting fishing operations like being legally registered with valid fishing licenses;
- Communicating effectively to the small-scale fishermen the benefits of using the technology to them and to the reputation of their fisheries increases their interest to participate; and
- It is easier to convince the fishers to participate in this kind of project if they know that they will be receiving an incentive by making their fish traceable using the FAME transponder.

8.2 Local Government Units (LGUs)

- One of the factors that contributes to why the majority of the LGUs have a weak capacity to produce reliable fisheries-related data is the absence of policy guidelines on the standard key data elements. This can result in the inconsistency of fish production data between government agencies that gather and manage fisheries-related data;
- It is important that the Department of Agriculture (DA) through the Bureau of Fisheries and Aquatic Resources (BFAR) should be able to formulate a working CDTS that can be easily adopted by LGUs for fisheries management purposes; and
- The eCDT technology can lead to the establishment of a database for the municipal fish catch report that can be used by the LGUs to inform policies and plans for coastal and fisheries resource management.
- The eCDT can help LGUs generate revenues by having robust traceability data of landed and transported fish that will be the basis of issuing auxiliary invoices because the current practice is simply voluntary reporting by traders and most LGUs don't have inspectors.

8.3 Concerned National Government Agency

- It is important that the ongoing work on eCDT for small-scale fisheries is in line with the Bureau's effort to develop eCDT to catch up and keep up with the global trends of digitizing monitoring, control and surveillance platforms to curb IUU Fishing and promote more sustainable management of the fisheries resources in the coastal communities;
- The eCDT platform must come with a security access, wherein the only person or group of people who can view the information being inputted by the fishers are only those who belong in a single supply chain including LGUs and also BFAR as a national fisheries regulatory agency; and
- The development of eCDT is still ongoing and there are existing collaboration works with other organizations who are finding ways to directly incentivize small-scale fishers using the eCDT technology the key here is the interoperability of the system.

8.4 Fish Buyer, Processor/Exporter

- Based on our observation, fishers are not comfortable in filling up the BFAR-prescribed fish catch report. Most of the time, the buying stations are the ones assisting in filling up the BFAR fish catch report. This practice will only record traceability from the point of landing to the processor which

does not meet the full traceability standard that the project wants to meet, which is from the point of catch to the consumer level;

- The support and pressure from the processors/exporters are vital in achieving the full seafood traceability to promote sustainable fisheries to address issues on IUU Fishing and seafood fraud;
- The involvement of JAM Seafoods in the application of eCDT with the small-scale tuna handline fisheries makes the process of establishing traceability from the point of catch using FAME transponder and eCDT platform a lot easier. Giving incentives to the fishers in making their catch traceable by using electronic devices makes it more enticing for the fishermen to comply with the reportorial requirement which is vital in traceability.

8.5 eCDT Technology

- Given all the challenges and situations in the adoption of eCDT technology for small-scale fisheries from a developing country, technology providers need to consider several things: (1) affordability and effectiveness of the technology, (2) should be able to compensate for the inconsistent digital communication structure of the area without additional costs, and (3) should be customizable to adopt the complexity of fisheries in the Philippines.

9. Further Actions and Recommendations

People nowadays are becoming more aware and concerned about what is happening to our environment. Because of this there is a growing demand in the sustainable seafood, where consumers from EU member countries and the US are willing to pay a premium price just to make sure that what they are buying comes from a sustainable fishery. Consumers are beginning to appreciate and shift their attention to a healthier source of food and environment-friendly practices of farming and fishing, like choosing organic produce over non-organic and supporting artisanal fishing as a more traditional and environmentally friendly method of fishing.

However, in countries like the Philippines which is one of the sources of seafood products being exported to EU and US, establishing a traceability system for the small-scale fisheries is a challenge because of the cultural and organizational practices that the coastal communities are accustomed to for a very long time. But, since the small-scale fishery already caters to the international market as a source of responsibly caught fishery product, it needs to step up and establish full transparency along its supply chain by adapting eCDT to showcase a verifiable traceability system.

Fishing companies, consumers, regulators, NGOs, and government agencies demand more transparency around the seafood products, to address the issues on IUUF and seafood fraud in the seafood industry. These are demonstrated in the EU IUUF regulations, US Seafood Import Monitoring Program (SIMP) and the consumers demand for seafood product with eco-label that all requires traceability system. On a global scale, UN Food and Agriculture Organization (FAO) estimated that about 26 million tonnes of seafood losses annually through IUU fishing, which equivalent to a staggering USD 23 billion losses yearly. This tremendously affects the livelihood of fishers, exacerbates poverty, and contributes heavily to food insecurity.

Transparency along the seafood supply chain demands a huge amount of data and information sharing which cannot be met through a manual paper-based system. The technology for the implementation of traceability system in seafood does exist, what is need is the collaboration of seafood industry and

government stakeholders to adopt and implement a traceability system applicable for small-scale fisheries and find a way to disincentivize bad practices or noncompliance to government criteria like vessel registration and licensing and incentivize those who are compliant to the sustainable fisheries regulations. Here are some next step recommendations that need to be considered for the improvement of the application of eCDT for small-scale fisheries to promote full traceability along with the small-scale handline tuna fisheries in the Philippines or the what we called "From Hook to Cook" traceability concept.

The following are specific recommendations for future application in support of eCDT systems and other fisheries related initiatives:

- Integration with BFAR eCDT system and application of data analytics and visualization tools (for example:https://www.seafdec-oceanspartnership.org/resource/innovative-digital-solution-supporting-fisheries-management-and-catch-documentation-data-analysis-msu-naawan-foundation/).
- Test alignment with the GDST v1.0 Interoperability guidelines, covering key data elements and formats to ensure interoperability, full-chain traceability. Test traceability on several supply chains from first mile to retailer, prior to full adoption across all products in both FIP sites and future sites.
- Integration with a seafood traceability mobile application to help customers make more informed decisions in buying fully traceable seafood.
- Establish data verification protocols based on best practice, i.e. FAO, include traceability software interoperability with authorized data sources, i.e. municipal licensing records/database.
- Test and scale traceability and trade data for access to capital – ensure interoperability of other technology solution to FAME, for example.
- Level-up the pilot testing up to the distributor level to establish full chain traceability.
- Application of eCDT to local markets and link to municipal CDT policy.
- Conduct of study to quantify the cost and benefits of eCDT system investment.
- Application to other small-scale fisheries (e.g., blue swimming crab, squid, mahi-mahi, etc.).
- Linking eCDT data with fish catch monitoring (e.g., National Stock Assessment Program) for improved fisheries management decision-making and strengthened fish stock assessments.
- Explore how real time fisheries data from eCDT can provide information to support logistics and transportation of seafood products in the supply chain (i.e., from fish landing to retail markets and urban centers) to ensure fish supply, availability, and food security, in case of emergency situations (i.e., COVID-19 situation).
- Establish crisis contingency plans in the event of supply chain disruption.
- Establish feasibility plans for investment in pre and post-harvest facilities and other services, including alternative livelihood in aquaculture facilities to secure value added services within the community where economies of scale justify these investments.
- Develop a database for LGUs to have a publicly available database on fisheries profiling to help in management and enforcement.

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