Data collection protocol for small-scale pole and line fisheries of Indonesia

(September 2015)

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Chapter 1 – Introduction

1.1 Motivation for a data collection system for Indonesia

In recent years, the concept of 'sustainability' has become an important focus of fisheries management, but is hard to explicitly define, as interpretation of the concept continues to evolve (Rice 2014). It is generally accepted that a fishery must fulfill three sustainability dimensions to be considered sustainable: ecological, economic and social (Garcia & Staples 2000). The three dimensions may be defined as follows:

- ecological dimension: the stock biomass should be greater than a minimum reference level
- economic dimension: the individual vessel profit should be greater than a minimum reference level
- social dimension: there must be a minimum level of employment and activity (Martinet et al. 2007).

Additional requirements relating to bycatch of non-target species and environmental impacts can be included when necessary (Jacquet et al. 2009). Continuous data collection systems are required to evaluate the status of the three dimensions of sustainability. This protocol aims to contribute towards data collection activities for pole and line fisheries of Indonesia, so that progress towards achieving sustainability can be monitored and improved.

The global demand for sustainably-sourced seafood is increasing as certification schemes and consumer recommendation lists influence consumers' preferences (Belson 2012). The European Commission has regulations stipulating a traceability system as a requirement for food producers and a catch certification scheme to combat the import of IUU fish (EC 2009; EC 2008). In the US, the 2011 Food Safety Modernization Act (Anon 2011) allows the Food and Drug Administration to order the establishment of food product tracing systems as well the newly (2014) formed Presidential Task Force on Combatting IUU Fishing and Seafood Fraud. To maintain Indonesia's position as a competitive player in the global seafood market it is advised that Indonesian seafood products begin a conversion process towards sustainability and eventual certification of sustainability. Such a certification process can only be conducted when a high level of knowledge exists regarding annual catch estimates, separated by gear and species, operational catch and effort data, size distribution of the stock and general health of the stock and the ecosystem. This data is usually limited within Indonesian tuna fisheries and it is important that data collection processes are improved.

Despite referencing a 'sustainable approach' to fisheries resource management in its Development Plan, Indonesia has a poor record of implementation and enforcement and has been supporting expansion rather than following the precautionary approach to fisheries, the ecosystem approach to fisheries or improving stock sustainability. Important regulations covering Indonesian fisheries include the decentralisation act of 2010 (MMAF 2010b) and the regulation relating to fishing effort in Indonesia's Fisheries Management Areas (MMAF 2012). National regulations are established and to monitor the success/progress of these regulations, robust data collection is required. Regulations relevant to this protocol include:

- Ministerial Regulation No.56/2014: Temporary suspension of fishing licenses to vessels constructed abroad (MMAF 2014a)
- Ministerial Regulation No.57/2014: Transshipment ban unless offloading to designated Indonesian port (MMAF 2014b)
- Ministerial Regulation No.59/2014: Prohibits export, but not necessarily capture, of oceanic whitetip shark and hammerhead sharks from Indonesia (MMAF 2014c)
- Ministerial Regulation No.2/2015: Prohibition of trawls and seines in all of Indonesia's fishery management areas (MMAF 2015a)
- Ministerial Regulation No.4/ 2015: Fishing banned in breeding and spawning ground of the Banda Sea (MMAF 2015b)

Monitoring the progress and success of these regulations requires robust data collection activities. Fisheries management in Indonesia has developed into a decentralised system, whereby individual regions can introduce region-specific regulations. To coordinate management of the stocks at a national level, the government must have information from the different regions. Each region should have a number of data collection sites, providing sufficient sampling coverage to contribute to national management plans. Efforts should be made to coordinate and consolidate the data from each region. Taken together, the international obligations, the national regulations, the regional decentralisation and the market demand for sustainably-sourced seafood motivate the need for improved data collection systems in Indonesia. This need exists in both the commercial and artisanal fisheries as also in the various gear differentiated fisheries. This protocol focuses on data collection for tuna species from the small-scale pole and line tuna fishery. Two methods for data collection are described in this protocol. The first is a daily port sampling form and the second is a monthly unloading form. The associated staff training protocol (available from the IMACS website) should be consulted for detailed information on the duties of field staff.

1.2 Objectives of this data collection protocol

This protocol has been commissioned by Masyarakat dan Perikanan Indonesia, MDPI, and the IMACS program under USAID. This document is a guide for the data collection process at pole and line tuna landing sites within Indonesian archipelagic waters It includes: a chapter with seven Standard Operating Procedures, covering various aspects of the data collection process, and a chapter describing the Data Collection Process, both for daily port sampling forms and monthly unloading forms.

This protocol has the following objectives:

- Ensure a set of standards are in place for the data collection process for pole and line tuna fisheries in Indonesia; that this data is collected in a uniform way, that transferability of this data is ensured and that it is done in a cost efficient method
- Allow fishery managers, government agencies, regional fishery management councils and private industry to gain access to high quality data on pole and line tuna catches in Indonesia and to use this information improve Indonesian tuna management
- Ensure Indonesia fulfills its data reporting obligations and its compliance to regional and international institutional frameworks for fishery governance, such as those described by FAO, UN, IOTC and WCPFC

In achieving the above objectives it is anticipated that the following sub-objectives may also be achieved. These objectives address scientific, management and market related issues for tuna in Indonesian waters:

- Improve existing knowledge within Indonesia and the wider scientific community on a small but important sector of the Indonesian tuna fishery.
- Use the improved knowledge to better understand stock dynamics, changes occurring due to environmental factors, such as climate change, and to adapt to these changing circumstances with appropriate management measures
- Catalogue the encounters this fishery has with endangered, threatened and protected species and develop strategies to minimize the impact of fishing activity on these species

- Ensure ecosystem and habitat functioning and resilience within the homing range of the tuna by increased knowledge and adaptive decision making
- Acquire additional information on the associated bycatch and make decisions to minimize the indirect effects on these species/stocks
- Ensure that sustainable management practices are implemented to profile the stock correctly, ensuring catch advice adheres to sustainable and precautionary guidelines, progressing towards a sustainable pole and line tuna fishery in Indonesian waters
- Ensure that the management of tuna species, which are highly migratory, is appropriately matched to their stock structure, migratory routes and spawning areas
- Ensure that good relations exist between neighboring countries and states with regards to tuna management
- Increase local government involvement in the data collection process by capacity building and creating data collection networks
- Ensure that the management process takes financial as well as food security matters into consideration when making decisions on catch allowances, especially relevant to small-scale pole and line fishery, as it is categorized as an artisanal fishery
- Transfer knowledge and background of the data collection process to various stakeholders involved in the pole and line tuna supply chain, with the aim of developing ownership and eventual acceptance within the community
- Support Indonesian pole and line tuna achieve management and sustainability levels required for eco-certification, enhancing its competitiveness in the global market
- Maximize/maintain profits from tuna fisheries while considering ecological limits

This protocol is designed to complement existing data collection efforts within Indonesia and provides instructions for data collection staff to help with data recording and entry, species identification, etc. This protocol is subject to change to incorporate recommendations from field staff when necessary. The activities outlined in this protocol are similar to scientific observer schemes, which are implemented globally. Such schemes provide independent baseline information on fisheries, which can be used for stock assessments and for countries to collaboratively manage highly migratory species.

1.3 Background to small-scale pole and line fisheries in Indonesia

After China, Indonesia is the world's second largest producer of marine capture products, with skipjack and yellowfin tuna being the third and eight most caught species globally, respectively (FAO 2014). Indonesian tuna fisheries are of great economic importance and well as food security value to the country. The main species are skipjack (*Katsuwonis pelamis*), yellowfin (*Thunnus albacores*), bigeye (*Thunnus obesus*), albacore (*Thunnus alalunga*) and tongkol (multiple species). The main gears are purse seines, troll line, longline, pole and line and handline. It is estimated that up to 90% of vessels targeting tuna species are <5GT (Sunoko & Huang 2014) but ~60% of the catch volume is caught by purse seines and ~20% of the volume caught by longline fishing, the remainder caught with a mixture of small to medium sized purse seiners (Davies et al. 2014). In recent years, the number of pole and line vessels has declined, with many fishermen switching to handline fishing for mature yellowfin, with the 2013 provisional annual catch estimates the lowest estimate since the 1960s (Williams & Terawasi 2014). The Indonesian Ministry for Maritime Affairs and Fisheries, MMAF, developed a Strategic Plan, 2010-2014, aiming to increase marine capture fisheries production by 0.5% per year (MMAF 2010). This proposed annual increase is despite mounting concern for the status of some stocks: bigeye is classified as overexploited, yellowfin is classified as fully exploited and skipjack classified as exploited at a moderate level (Sunoko & Huang 2014). The situation is exacerbated by sparse data collection, (under) estimated annual catches and poor management (Bailey et al. 2012).

In Indonesia, vessels >5GT are legally required to register to obtain a license. Smaller vessels are termed 'artisanal' and are not required to register. There are two types of vessel for artisanal handline tuna: 1) medium-size vessels between 14-35GT, called '*huhate*', and 2) small vessels between 5-10GT, called '*funae*'. Live bait is used to catch the tuna, with vessels either purchasing the bait from local '*bagans*', or fishing for it themselves in inshore waters with a lift net. The bait fishing occurs at night, using lights to attract the bait fish, which are then kept alive onboard the vessel. Fish Aggregating Devices, FADs, dolphins and sea birds are used to locate tuna. FADs or 'rumpons', are anchored floating platforms, working on the basis that tuna and other species aggregate around such floating objects. FADs are foci for the fishery, with benefits such as less operating costs spent on fuel searching for catch. Various species aggregate at the rumpon at different depths. Skipjack are thought to associate at 0-30 m, juvenile yellowfin and bigeye tuna at 30-80m and large mature yellowfin and bigeye tuna at 150-200m. Pole and line fishing begins by throwing the live bait into the sea, with water sprinklers, creating the illusion of the presence of a large school of small fish near the water surface. The tuna start biting at any shiny object they perceive to be a small fish, including the barbless hooks. The hooks are barbless and catch the tuna one-by-one. One crew member has one rod, with a line of crew fishing from the bow of the vessel. The main target of the pole and line fishery is skipjack, ~70-85% of the catch, with juvenile yellowfin tuna, bigeye tuna and albacore comprising ~15-20% of the catch (Williams & Terawasi 2014).

Tuna are a 'highly migratory species', requiring cooperation between multiple countries for efficient management of stocks. Indonesia is subject to the United Nations Law of the Sea, 1982 (UNCLOS), revised and specified in the UN Fish Stock Agreement, 1995, FAO Code of Conduct on responsible fisheries, and is a member of two Regional Fisheries Management Organisations, RFMOs, the Western and Central Pacific Fisheries Committee, WCPFC and the Indian Ocean Tuna Committee, IOTC. The RFMOs were established to help manage transboundary stocks. Although Indonesia is required to submit catch data to both RMFOs, in reality it has a poor submission record and, along with the Philippines, represents one the 'single largest source of uncertainty in current regional stock assessments' (WCPFC 2009). Improving Indonesian input is essential to progress towards sustainability of tuna fisheries and to maintain the role of tuna in the food security of the state.

The most recent review of the status of yellowfin, bigeye and skipjack in the Western and Central Pacific Ocean, WCPO show that:

- For yellowfin tuna latest catch marginally exceed the Maximum Sustainable Yield, MSY, recent levels of spawning potential are likely above the level that will support the MSY and recent levels of fishing mortality are most likely below the level that will support the MSY (Davies et al. 2014)
- For skipjack, latest catches slightly exceed the MSY, fishing mortality is estimated to have increase continuously but fishing mortality remains below the level that would result in MSY and estimates of spawning potential are above the level that will support the MSY (Rice et al. 2014)
- For bigeye, current catches exceed the MSY level, recent estimates of spawning potential are likely at or below the level that will support MSY and recent estimates of fishing mortality lively exceed the level that will support MSY (Harley et al. 2014). Incomplete data for recent years makes it difficult to determine whether the advised 32% reduction between 2006-2009 has successfully reduced fishing mortality

These stock assessments are according to WCPFC, based on catch data submitted by members, of which Indonesia is one, and cooperating non-members. The coverage of this data is not complete, as reporting obligations may not be entirely fulfilled by members and these figures are sensitive to Indonesian catch estimates. Currently, data is collected by government agencies in the port/landing site, either DKP District, DKP Provincial or Central KKP. Some Indonesian ports have Tuna Monitoring Stations that collect data. Despite these collection efforts, the catch is often (under)estimated, recorded either as total catch of mixed species or total catch per species. This data forms the basis for Indonesian stocks assessments yet contains a large amount of uncertainty: unrecorded catches, low coverage, flawed estimation method, non-differentiation of gear types and non-differentiation of species. Recommendations and analyses based on this information will be unreliable. Appropriate exploitation rates, reference points and harvest strategies need to be developed so that initiatives to reduce fishing pressure can be implemented when the stock is at a low biomass. These initiatives may include closed seasons, limits on vessel numbers or capacity entering the fishery and implementation of total allowable catches, TACs. However these decisions are dependent on complete (as possible) data provision, which comes from data collection initiatives, as is proposed and described by this document. Two methods for data collection are described in this protocol. The first is a daily port sampling form and the second is a monthly unloading form.

1.4 I-Fish database system and Data Management Committees

Given the volume of data that can be collected to inform fisheries management, a database system has been developed to store the collected data and make it easily available to different types of stakeholders. This system, termed I-Fish (Indonesian Fisheries Information System), aims to inform fisheries management planning at district, provincial and national levels, and address the urgent need for an effective and flexible data management platform in Indonesia (Figure 1). I-Fish aims to align with national fisheries data standards, as well as with Marine Stewardship Council (MSC) requirements. In this way, I-Fish provides a transparent tool for data entry, storage and processing, fulfilling an essential need for fisheries under consideration for MSC certification. I-Fish is a comprehensive system for enabling the private sector to collect valid and verifiable data required by the government in order to manage fisheries sustainably. Involvement of the private sector — including fishers, traders, fishing companies, and exporters—provides near real-time data about the fishery, and assists governments to target resources where they are needed most.

To ensure I-Fish data transparency and promote collaboration amongst stakeholders, Data Management Committees, DMCs are established as co-management initiatives. DMCs focus on data from artisanal fisheries, such as handline fisheries for large tuna and skipjack tuna. The committee aims to achieve a complete representation of stakeholders to the fishery in the target area, and if necessary to support a rotational system of membership. The committees are an efficient way to coordinate data management between government officials, representatives of the fishing industry, and researchers. Through the DMCs it is expected that these stakeholders gain an informed and shared understanding about the status of fish stocks in a local region.

The mission of the DMCs is to support and contribute to the collection and analysis of data relating to catch composition, fishing grounds and effort so as to identify specific patterns within the fishery. A summary of this data shall be published and disseminated to DMC members and stakeholders. Fishery targets can be suggested based on the shared use of the data, stakeholders can be informed of the implications of the data analysis and the information can be integrated into local management decisions. The tools and capacity to contribute to management of the fishery are then developed in the DMC members, who can help sustainably develop and manage the fishery.

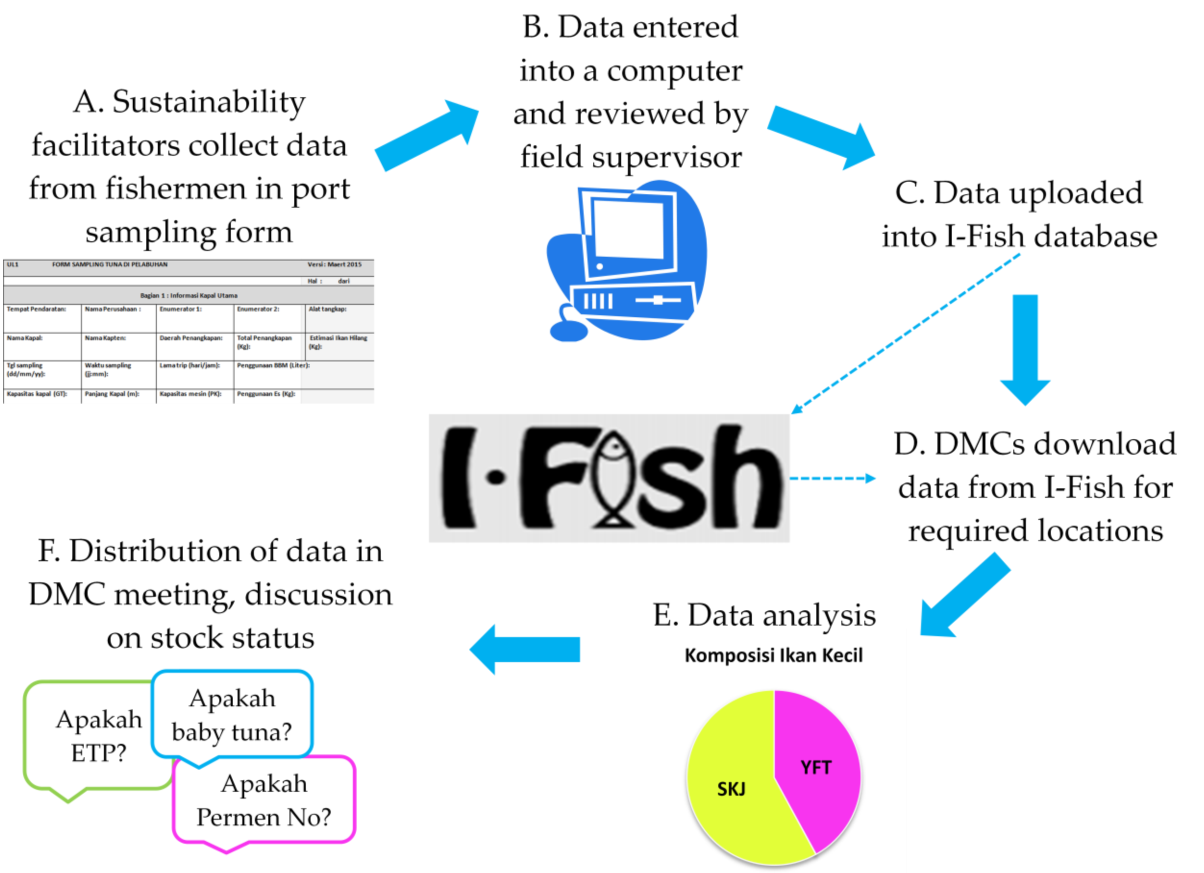


Figure 1. The data flow for the I-Fish approach. A. Sustainability facilitators collect the data from fishermen and suppliers, in both the port sampling form and the monthly unloading form. B. The data is entered in into a computer and verified by the field supervisor. C. Once the data has been verified it is uploaded into the I-Fish database where it can be accessed by stakeholders. D. Representatives of the Data Management Committees, DMCs, can access and download the data from I-Fish. E. Representatives of the DMCs can conduct data analysis and evaluation. F. The analyses data is presented and discussed at the DMC meetings by various stakeholders.

Chapter 2 – Standard Operating Procedures

This chapter covers seven Standard Operating Procedures, SOPs, which can support field staff in their data collection activities. These SOPs should be referred to in the first instance should there be any problem with data collection in the field. If the problem can not be resolved using the relevant SOP, the site supervisor/manager should be contacted. The solution to the problem should then be incorporated into the relevant SOP.

2.1. Standard Operating Procedure, SOP, I – Fishing grounds

Indonesia has 11 Fisheries Management Areas, FMAs, also known as Wilayah Pengelolaan Perikanan, WPPs. These are management areas for fishing, mariculture, conservation, research and fisheries development, covering internal waters, archipelagic waters, territorial seas and the Indonesian Exclusive Economic Zone (Regulation of the Minister of Fisheries and Marine No.01/MEN/2009). Indonesian waters are part of FAO Fishing Area 57 (Eastern Indian Ocean) and FAO Fishing Area 71 (Western Central Pacific), with the 11 FMAs indexed as follows (Figure 2):

1. FMA 571 – Malaka Strait waters and Andaman Sea
2. FMA 572 – West Sumatera and Sunda Strait of Indian Ocean waters
3. FMA 573 – Indian Ocean Waters, Southern Java to Southern Nusa Tenggara, Savu Seas, and Western Timor Seas
4. FMA 711 – Karimata Strait waters, Natuna Sea, and south China Sea
5. FMA 712 – Java Sea waters
6. FMA 713 – Makassar Strait, Bone Bay, Flores Sea, and Bali Sea
7. FMA 714 – Tolo Bay and Banda Sea
8. FMA 715 – Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea and Berau Bay
9. FMA 716 – Sulawesi Sea and northern Halmahera Sea
10. FMA 717 – Cendera Wasih Bay waters and Pacific Ocean
11. FMA 718 – Arafuru Sea and eastern Timor Sea

Three maps are available to help sustainability facilitators collect fishing ground data in the landing site. Figure 2 will help sustainability facilitators identify in which FMA fishing activity occurs. The second and third maps (Figures 3 and 4) will help describe the approximate locations of the fishing grounds. The maps display Indonesian waters, gridded in

1° latitude and longitude squares. Each square is named by a letter on the vertical axis and by a number on the horizontal axis. The fisherman identifies the square where he conducted fishing activity and the sustainability facilitator records the coordinate of the areas in the map, for example, W24 for south Lombok. If fishing was conducted in multiple squares, all of these squares must be recorded. Only squares where fishing activity occurred should be recorded, not squares through which the vessel travelled to get to the fishing ground.

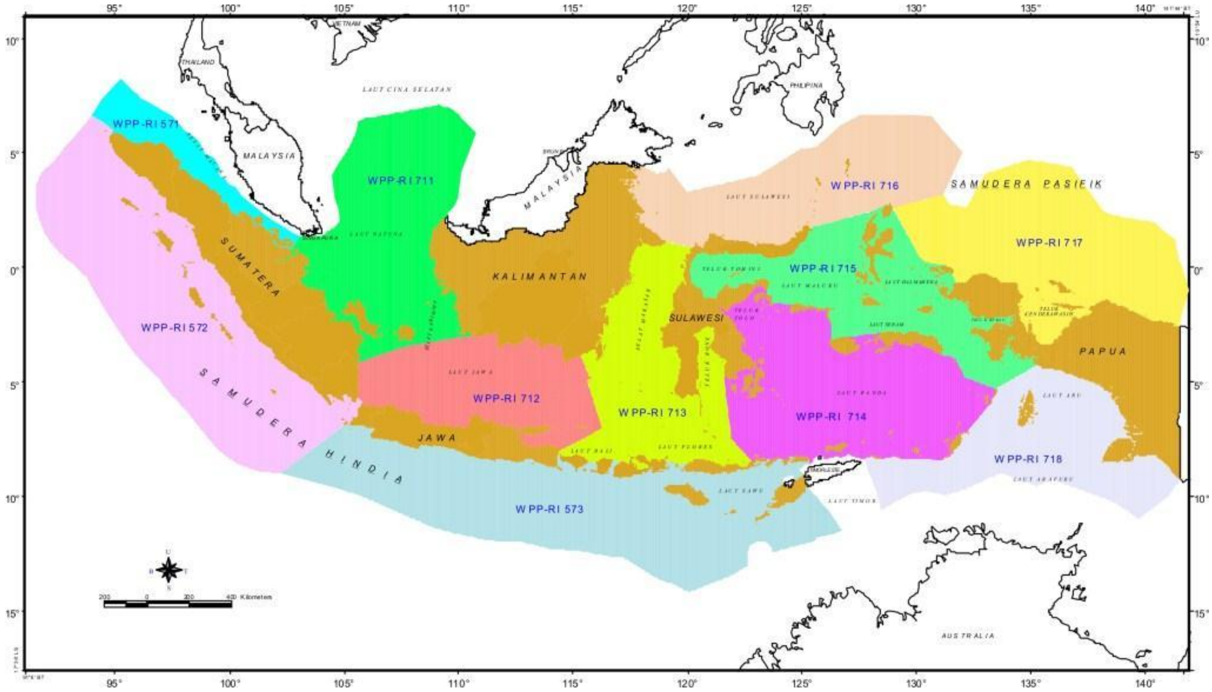


Figure 2. Fisheries Management Areas

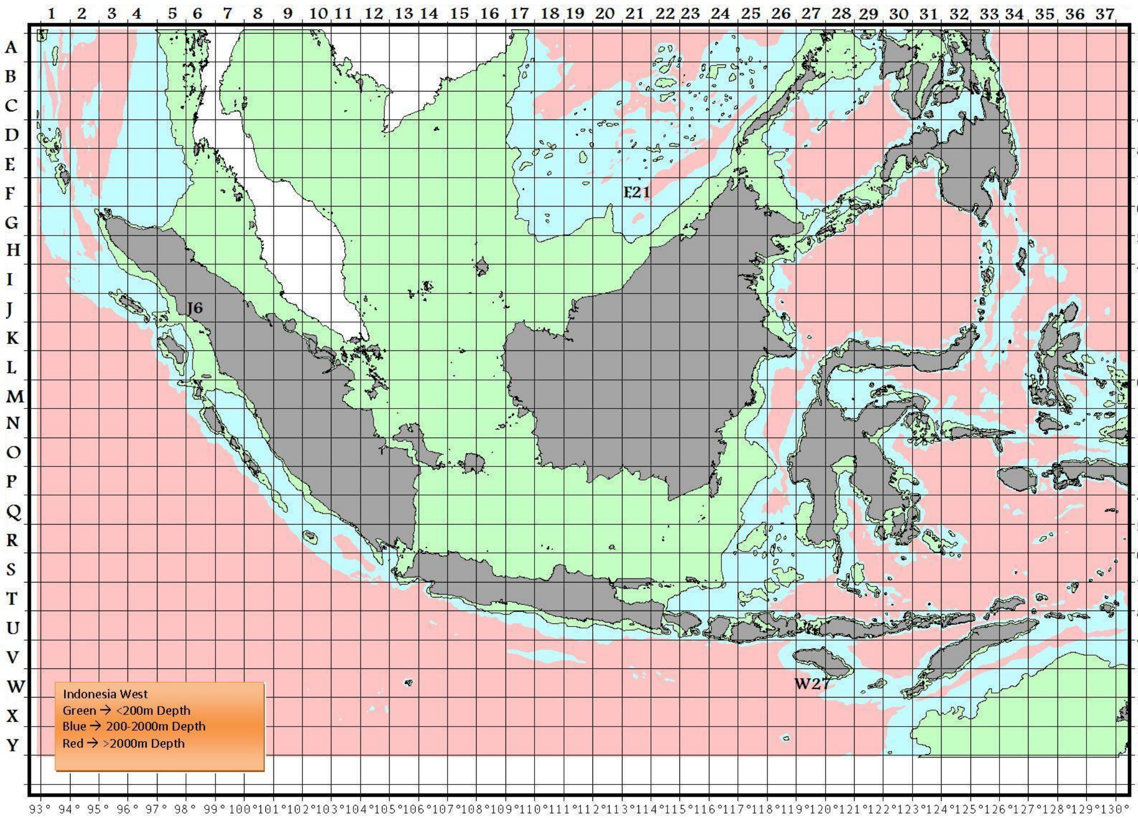


Figure 3. Tuna Fishing Ground Map for Western Indonesia

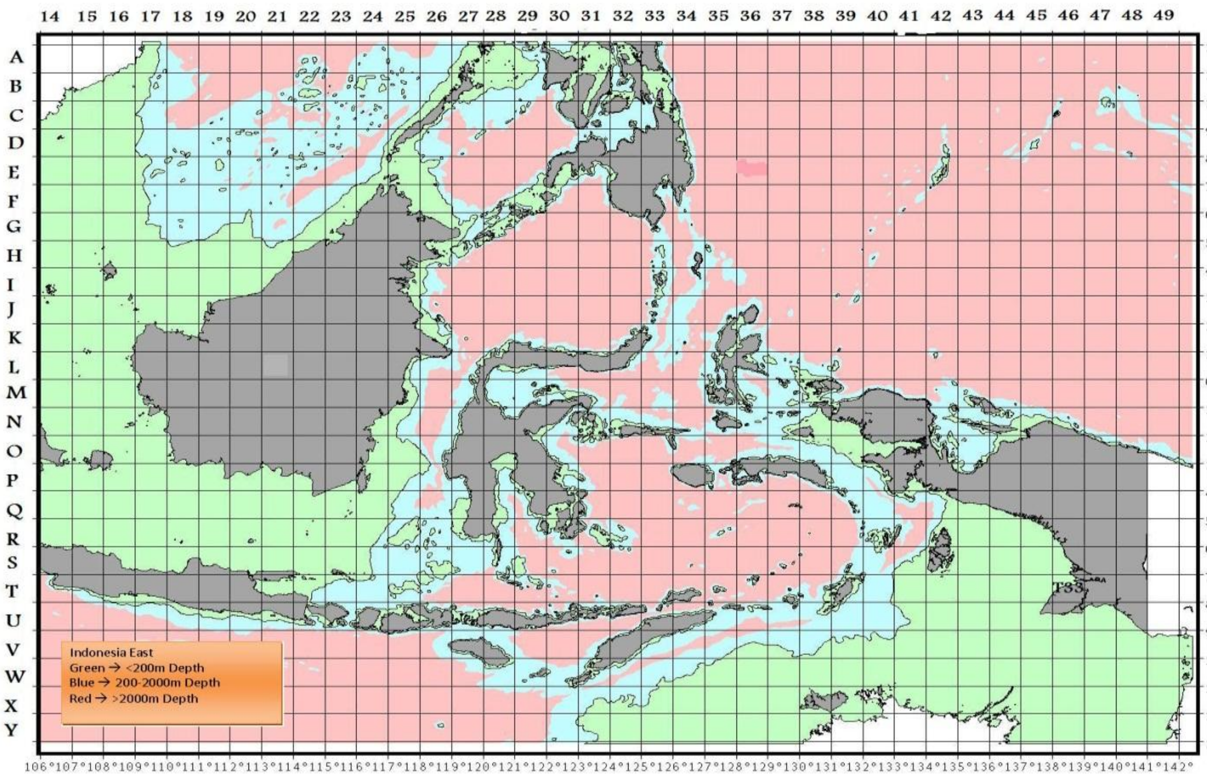


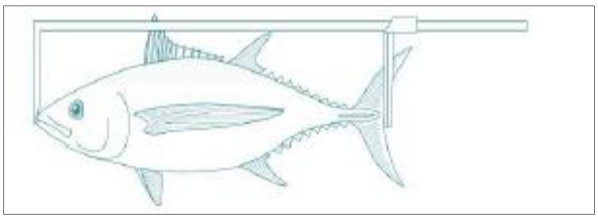
Figure 4. Tuna Fishing Ground Map for Eastern Indonesia

2.2. Standard Operating Procedure, SOP, II – Individual length measurements

The individual fish length is measured as the fork length. Fork length is a useful way of measuring fish as it does not need to accommodate for bias which occurs when measurements are taken to the end of tail rays, which are often damaged. Fork length is measured from the tip of the upper jaw to the centre of the forked tail (Figure 5.a), except for billfish. Billfish (sailfish, marlin and swordfish) have a long upper "beak" and fork length measurements for these species are from the tip of the bottom jaw to the centre of the forked tail (Figure 5.b). Only whole fish are measured. Decapitated fish and fish without tails are not measured. Fork length of large individuals (≥10 kg) is measured using a calipers and fork length of smaller individuals is measured with a measuring board.

The front of the calipers is placed at the tip of the jaw and the movable arm is extended to reach the centre of the fork in the tail. The fork length is read from the small arrow (Figure 6) and rounded down to the nearest whole cm, i.e. 69.9cm is recorded as 69 cm. The calipers are 1m in length and an extension of 1m is available.

(a)



(b)

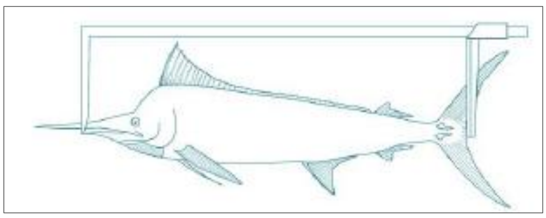


Figure 5: (a) Fork length is measured from the tip of the upper jaw to the centre of the fork in the tail. (b) For all billfish the fork length is measured from the tip of the lower jaw to the centre of the fork in the tail.

(a) (b)

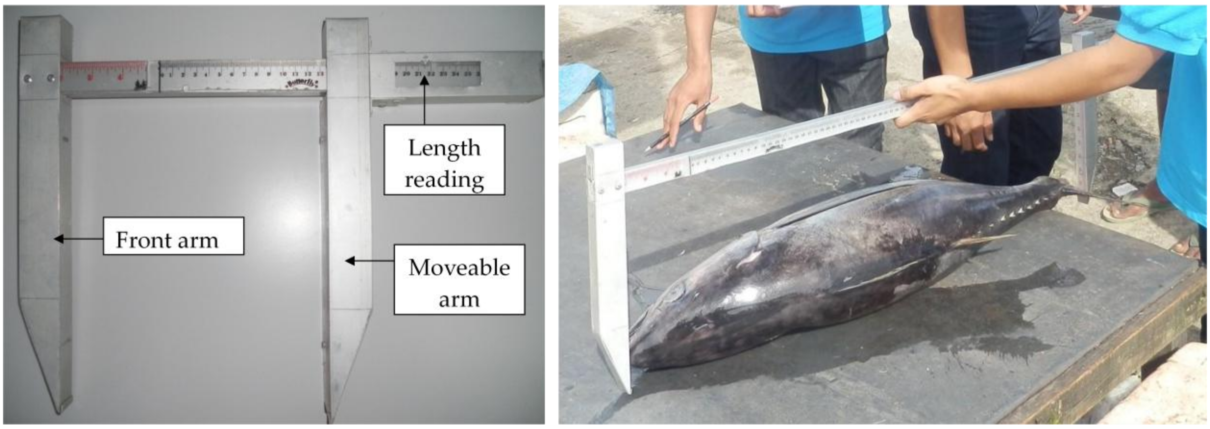


Figure 6: Calipers. (a) The measurement is read from the small arrow highlighted. Front and moveable arm of calipers are marked and (b) demonstration of the use of calipers.

The measuring board is 60cm long. The tip of the jaw is placed against the front of the board and the centre of the tail lies over the steel measuring tape. The fork length is read from the centre of the fork on the tape (Figure 7).

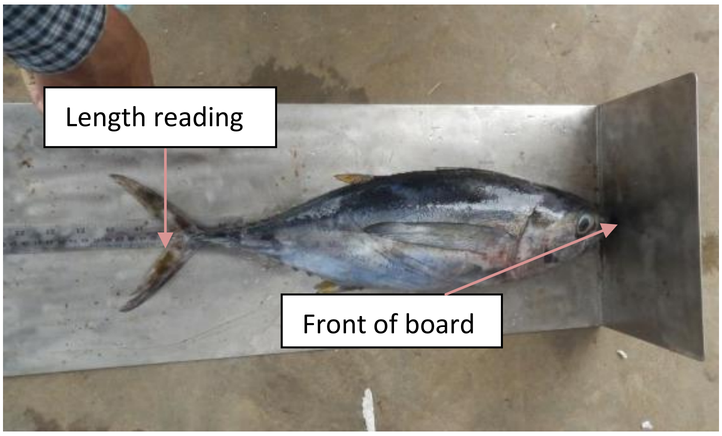


Figure 7: The fork length of a juvenile yellowfin tuna measured with a board.

2.3. Standard Operating Procedure, SOP, III – Species Identification

The main catch contains a variety of species and it is important Sustainability Facilitators recognize each species and that the correct species is recorded. Misidentification of species leads to invalid data. Sustainability Facilitators are responsible for ensuring all sampled fish are identified to species level. If there is doubt as to the identification of a fish the following steps should be taken:

- This protocol should be consulted and the "new" fish compared to the list below. If the fish is not on the list, the fishermen/transit staff/supplier should be consulted as to the identification of the fish. This may result in the fish being identified with a local name, which should be recorded and reported to the supervisor. The supervisor should ensure the new species is included in the list of species.
- If the fish cannot be identified a detailed description of external features of the fish should be recorded and a picture taken for reference. This should be forwarded to relevant supervisors/manager.

2.3.1. FAO Identification Codes

Each species is recorded with an FAO identification code (Table 1). This identifier code is used globally for species identification, making this information transferable to other organizations and interest groups. Using FAO codes will avoid confusion arising from the use of local names or the use of the same name for multiple similar species. English or local names should only be used as a last resort if there are problems with species identification.

Table 1. FAO identification codes, English names and local names of species

FAO code	English name	Local name
YFT	Yellowfin tuna	Madidihang
SKJ	Skipjack tuna	Cakalang
BET	Bigeye tuna	Matabesar
ALB	Albacore tuna	Albakor
RRU	Rainbow runner	Ikan salam
DOL	Dolphin fish	Mahi-mahi
KAW	Mackerel tuna	Tongkol komo
BLT	Bullet tuna	Tongkol lisong
FRI	Frigate tuna	Tongkol banyar

2.3.2. Species Descriptions

A description of the main target species and other retained species is given below. Please note that a list of Endangered, Threatened and Protected species is provided in the MDPI Protocol for Continuous Port Based Surveys and a description of bait species is provided in SOP VI. The anatomy of fish, with all fins labeled, is shown in Figure 8.

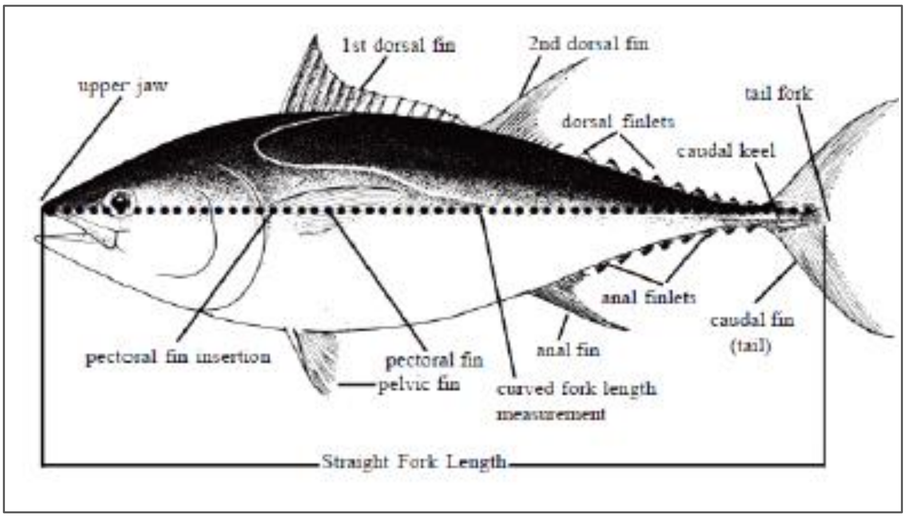


Figure 8. General fish anatomy for identifying specific fins.

Main target species:

1. *Katsumonus pelamis* / Skipjack tuna / Cakalang / SKJ

Skipjack tuna are a fast growing species, possibly measuring 42cm fork length after 150 days, and can reach a maximum length of 120cm (Rice et al. 2014). Skipjack tuna do not have scales, except for the corselet and lateral line (Figure 9). The dorsal side is dark purple/blue and the ventral side and belly are silver. The ventral side has a number of noticeably dark horizontal stripes, usually 4-6. There are between seven and nine finlets after the second dorsal fin.

Figure 9: *Katsuwonus pelamis* / Skipjack Tuna / Cakalang / SKJ

2. *Thunnus albacares /* Yellowfin tuna / Madidihang / YFT

The maximum fork length of yellowfin tuna is ~180cm and the length at first maturity is 103.3cm. The second dorsal fin and the anal fin of yellowfin tuna can be very long, sometimes measuring ~20% of the total fork length (Figure 10). Yellowfin tuna are black/blue on the dorsal side, changing to silver on the ventral side, with a yellow mid-lateral line. The ventral side has ~20 broken vertical lines, which may appear as columns of small white/silver dots. The dorsal and anal finlets are bright yellow and sometimes have a very narrow black outline. Juvenile yellowfin tuna often associates with skipjack at water depths of less than 50m, with adult yellowfin tuna found deeper in the water column, usually between 50-250m.

Figure 10: *Thunnus albacares* / Yellowfin Tuna / Madidihang / YFT

3. *Thunnus obesus* / Bigeye tuna / Tuna Matabesar / BET

Bigeye tuna have a maximum fork length of ~200cm. Bigeye tuna have a distinctively large eye and have a deep rounded body (Figure 11). The ventral side is white and the dorsal side is black, edged with a thin blue line. The ventral and dorsal sides are separated by a golden/yellow mid-lateral line. Broken vertical lines are usually present on the ventral side and sometimes extend above the mid-lateral line. The finlets are bright yellow with a thick black edge.

Figure 11: *Thunnus obesus* / Bigeye Tuna / Tuna Matabesar / BET

4. *Thunnus alalunga* / Albacores / Albakor / ALB

The maximum length for albacore tuna is ~140cm. Albacore tuna has very small scales and a noticeably long pectoral fin compared with other tuna species (Figure 12). The pectoral fin can sometimes extend beyond the anal fin in larger individuals and has a pointed tip. The dorsal side is black, the ventral side is white and the finlets are dark.

Figure 12: *Thunnus alalunga* / Albacore / Albakor / ALB

Other retained species:

5. *Elagatis bipinnulata /* Rainbow runner / Ikan Salam / RRU

Rainbow runners can reach lengths of 180cm but individuals of 80cm are more common. The dorsal side of the Rainbow Runner is green/blue and the ventral side is yellow/white (Figure 13). The ventral and dorsal sides are separated by two light blue horizontal stripes, with a green/blue section between these two lines. The Rainbow Runner has pointy snout, a small eye and a sharply forked tail. The fins are short, with two separate finlets behind both the dorsal and anal fins.

Figure 13. *Elagatis bipinnulata* / Rainbow runner / Ikan Salam / RRU

6. *Coryphaena hippurus* / Dolphin fish / Mahi-mahi / DOL

The Dolphin fish can grow to sizes of 200cm but individuals of 100cm are more common. It is a fast growing species, with the age at first maturity three or four months. The bodies of dolphin fish are compressed vertically, with a single, long dorsal fin, extending from the head to just before the tail (Figure 14). No finlets are present beyond this large dorsal fin. Dolphin fish are brightly coloured, with a bright blue/green dorsal side, bright yellow ventral side and the pectoral fins are blue. Blue spots are present laterally. The tail is deeply forked and bright yellow. These bright colours fade after death, changing to yellow-grey colours. Mature males have a prominent forehead whereas females have a smaller, rounded head.

Figure 14: *Coryphaena hippurus* / Dolphin Fish / Mahi-mahi / DOL
The different head shape of the female and male can be seen.

7. *Euthynnus affinis* / Mackerel tuna / Tongkol Komo / KAW

Mackerel tuna is a small tuna, usually not growing larger than 1m, and has a deeper body shape than bullet tuna (described below). Individuals have an oblique striped pattern on the dorsal side, blue/green in colour, which does not extend past the beginning of the first dorsal fin (Figure 15). There are between two and five dark sports above the pelvic fin. The anterior spines of the dorsal fin are much higher than spines further along the dorsal side.

Figure 15: *Euthynnus affinis* / Mackerel Tuna / Tongkol Komo / KAW (White et al. 2013)

8. *Auxis rochei* / Bullet tuna / Tongkol lisong / BLT

The maximum fork length for bullet tuna is ~50cm and the body is more elongate than mackerel tuna (Figure 16). Bullet tuna have a striped/blotch pattern on the dorsal side, which does not extend past the beginning of the first dorsal fin. The pelvic and pectoral fins have a purple tinge to them. The second dorsal fin and the anal fin are very small (smaller than those of the mackerel tuna).

Figure 16: *Auxis rochei* / Bullet Tuna / Tongkol lisong / BLT (White et al. 2013)

9. *Auxis thazard thazard* / Frigate tuna, Frigate mackerel / Tongkol banyar / FRI

The maximum fork length for the frigate tuna is ~65cm. The dorsal side is dark blue, with a section of 15 or more narrow oblique, near horizontal wavy lines above the lateral line and reaching forward until the first dorsal fin and above the pectoral fin (Figure 17). The ventral side is white. The pectoral and pelvic fins are purple on the exterior side and black on the interior side. It is similar to *Euthynnus affinis* and *Auxis rochei*, but it has a larger distance between the dorsal fins, a lower spinous dorsal fin and a more slender shape.

Figure 17. *Auxis thazard thazard* / Frigate mackerel, Frigate tuna / Tongkol banyar / FRI

2.4. Standard Operating Procedure, SOP, IV – Differentiating between juvenile yellowfin and bigeye tuna

While adult yellowfin and bigeye tuna are easy to differentiate, it is not as easy to differentiate between juveniles of these species. This is especially the case when fish is frozen onboard vessels or when it is not in a completely fresh state, as colorings become less conspicuous and fins and other characteristics become damaged. A number of internal and external features can help differentiate between the species. These are explained in more detail in "Buku Penuntun untuk Identifikasi Madidihang dan Matabesar dalam Keadaan Segar, tetapi Kondisinya Kurang Ideal" and in "FISHING & LIVING: A Guide to the Tunas (and Tuna-like Species) found in Indonesian waters". Sustainability facilitator must be in possession of these booklets and undergo training in the differences of the two species. Training must be refreshed every year to ensure misreporting or under-reporting does not occur. The most useful and common ways to differentiate between juvenile yellowfin and bigeye tuna are as follows ((Itano 2004), was used as a source for the information and photos relating to external and internal differences):

2.4.1. External differences

Feature	Yellowfin Tuna	Big Eye Tuna
Body markings (Figure 18)	• Obvious pattern of closely spaced vertical silver stripes • Solid stripes alternate with stripes of fainter dots • Stripe pattern is present from tail to beneath the pectoral fin and above the mid-lateral line	• Irregular, vertical and widely spaced white stripes • Some dots in line format are present but irregular • Stripe pattern broken and usually present below the mid-lateral line

Figure 18: Two comparisons of yellowfin and bigeye tuna.

Body shape (Figure 18)	• Body elongate, long tail • Body slightly compressed between second dorsal and caudal fin and between anal and caudal fin	• Body deep and rounded • Body outline rounded, creating smooth ventral and dorsal arc between snout and caudal peduncle
Head and eye shape (Figure 19)	• Shorter head length and depth vs. fork length than bigeye • Smaller eye diameter compared to bigeye of same fork length	• Greater head length and depth vs. fork length than yellowfin • Greater eye diameter compared to yellowfin of same fork length

Yellowfin

Bigeye

Figure 19. Close up of the differences between the head and eye shape of yellowfin and bigeye

Pectoral fin characteristics (Figure 20)	• Short pectoral fin, extending to base of second dorsal fin • Thick, stiff and rounded at the tip	• Long pectoral fin, extending beyond the base of the second dorsal fin • Pointed tip, flexible, often curves downward

Figure 20. Differences in pectoral fin characteristics

Caudal fin characteristics (Figure 21)	• Centre of tail fork forms distinct notch, with two raised ridges on either side	• Centre of tail fork forms flat or very faint crescent shape. Two small mounds may be present

Figure 21. Differences between caudal fin characteristics. The differences between the finlets can also be seen.

Coloration: Important to note: after death color fades very quickly and both species will appear similar (Figure 18)	• Fresh Yellowfin have a bright yellow mid-lateral line • Dark/black dorsal side separated from the golden ventral side by a thin blue band (not always present) • Fins are bright yellow, the anal fin sometimes silver • Flanks and ventral aide are silver/ white • Bright yellow finlets with no or very little black edges	• Golden/bronze mid-lateral line • Dark/black dorsal side edged with a bright metallic blue line, separating two distinct colors of dorsal and ventral sides • Fins yellowish, anal fin may have silvery appearance • Caudal fin black/grey • Flanks and ventral side silver/white • Yellow finlets with thick black edge

2.4.2. Internal differences

Feature	Yellowfin	Bigeye
Liver morphology and appearance (Figure 22)	• Right lobe longer and thinner than other lobes • Smooth lobes, no striations	• Three rounded lobes of ~ equal size • Ventral surface striated

Figure 22. Differences between livers

Swim bladder (Figure 23)	• Only in anterior section of body cavity • Not obvious, usually deflated or slightly inflated	• Occupies almost entire body cavity • Large and conspicuous, often inflated

Figure 23. Differences between swim bladders.

2.5. Standard Operating Procedure, SOP, V – ETP Interaction

Endangered, Threatened and Protected species, ETP, cover a variety of species such as turtles, dolphins, whales, sharks, rays and birds. MDPI has an ETP program, to improve information/monitoring on the possible interaction between ETPs and pole and line tuna fisheries. According to the MSC pre-assessment report for Indonesian pole and line skipjack and yellowfin tuna fisheries "All available evidence suggests that there are, at most, extremely limited interaction between this fishery and ETP species, although detailed independent quantification is lacking (and so use of RBF would be recommended)" (Hough 2013). Additional information is needed to confirm these assumptions. The ETP program and an ETP species list are described in more detail in the MDPI Protocol for Continuous Port Based Surveys. Guidelines are presented below on how the implementation should be conducted in the field, as a component of the port sampling activities.

For every fourth vessel unloaded per day, one questionnaire (ETP1) should be filled-in. For this fourth unloading, both a complete Port Sampling form and a complete ETP questionnaire are required, as shown below:

- **Vessel 1: Port Sampling form + ETP questionnaire (ETP1)**
- Vessel 2: Port Sampling form
- Vessel 3: Port Sampling form
- Vessel 4: Port Sampling form
- **Vessel 5: Port Sampling form + ETP questionnaire**
- **Vessel 9: Port Sampling form + ETP questionnaire**
- Etc.

Sustainability Facilitators keep a logbook of all unloading events, to avoid confusion over when ETP data should be collected. If, for any reason, ETP data cannot be collected on every fourth unloading, please collect ETP data of the next vessel and continue to collect ETP data according to the scheme, as shown below:

- **Vessel 5: Port Sampling form + ETP data FAILED**
- **Vessel 6: Port Sampling form + ETP data**
- Vessel 7: Port Sampling form
- Vessel 8: Port Sampling form
- Vessel 9: Port Sampling form
- **Vessel 10: Port Sampling form + ETP data**
- Etc.

One crew member of the unloading vessel, present on the last fishing trip, should be interviewed. Interviews should be arranged after the unloading activities, preferably at the fisherman’s home, or another place where disturbance by other people in the community is less likely (e.g. at the MDPI field office). The ETP species FAO codes can be found in Appendix III.

The Fishing & Living ETP Guide should be used to aid in identification of ETP species. Additional identification aid may be found in the booklet “*Marine Species Identification Manual For Horizontal Long line Fishermen*”, of which a copy should be available to all sustainability facilitators on site.

2.6. Standard Operating Procedure, SOP, VI – Bait Data

Live bait is used in the Pole and Line tuna fisheries, usually caught by the fishermen, on the way to or at the fishing ground. Live bait is caught in hauls using a '*bagan*', beach seine and other gears. The bait fishery should be regarded as a separate fishery from the main target fishery and undergo a separate evaluation. To determine whether the bait species is at risk of overexploitation, a risk-based assessment should be conducted. If a stock is considered at risk, mitigation measures should be determined and implemented. Every port sampling activity should include data collection on bait. Bait data is recorded in UL 1, Section 3 of the port sampling form. The following data is collected on bait:

- ❖ Bait Category
- ❖ Bait species
- ❖ Fishing ground
- ❖ Total catch (actual/estimate)
- ❖ Number of buckets of bait
- ❖ Gear type

There are six possible bait categories: T) anchovies, U) sprats, V) sardines, W) scads, X) chub mackerel, Y) fusiliers, with a seventh bait category of Z) others, included for other miscellaneous, less dominant species. Anchovy is the often the most common bait species used. Species of these categories are described below, with photos where possible. If the species can not be identified, the category of the bait should be recorded. The same gridded maps for identifying tuna fishing grounds can be used to identify bait fishing grounds. For additional information see the bait section described in "*Marine Species Identification Manual For Horizontal Long line Fishermen*", pages 145-152 and also the "*Illustrated guide to common skipjack pole and line batfishes of Eastern Indonesia*" (AP2HI 2015).

Category T – Anchovies / Ikan teri, puri

1. Encrasicholina heteroloba / Shorthead anchovy / ECT

This species can grow to lengths of 12cm but lengths of 8cm are more common. The snout is pointy, with the upper jaw extending noticeably beyond the lower jaw. There is a thin blue edge to the upper edge of the dull lateral line. The ventral side is dull silver/grey and the dorsal side is beige/dark brown (Figure 24). *Encrasicholina* species are distinguished from *Stolephorus* species by the start position of the anal fin: behind the dorsal fin for *Encrasicholina* and under the dorsal fin for *Stolephorus*.

Figure 24. *Encrasicholina heteroloba* / Shorthead anchovy / ECT

2. *Encrasicholina devisi* / Gold Anchovy / END

This is a small fish, generally not exceeding 80mm in length. The dorsal side is blue/grey and the ventral side is silver/white. There is a bright silver band on the flank with a thin blue line directly above (Figure 25). The snout is pointy, with the upper jaw extending noticeably beyond the lower jaw. The head is small with a big eye.

Figure 25. *Encrasicholina devisi* / Gold anchovy / END

3. *Encrasicholina punctifer* / Bucanneer anchovy / STL

This species does not grow longer than 13cm. It has a rounded belly, with short dorsal and anal fins (Figure 26). The dorsal side and flanks are silver, the ventral side is grey/translucent. The mouth is very small with a big eye.

Figure 26. *Encrasicholina punctifer* / Bucanneer anchovy / STL (White et al. 2013)

Category U – Sprats / Maeroa

4. *Spratelloides gracilis* / Silverstriped round herring / SRH

This species grows to lengths of 9cm and has rounded body with a bright silver stripe along the flank (Figure 27). The rest of the body is blue in colour. This fish has a medium length mouth, ending in a pointed snout.

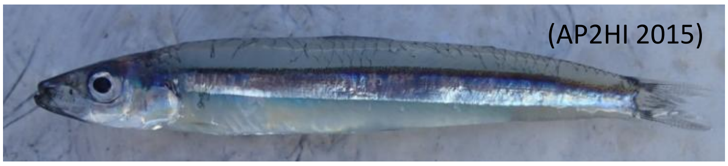


Figure 27. *Spratelloides gracilis* / Silverstriped round herring / SRH

5. *Spratelloides delicatulus* / Delicate round herring / SPD

This fish grows to lengths of 7cm, but sizes of 4-6cm are more common. It has a small, pointed mouth (Figure 28), with a big eye. The dorsal side is blue/green and the ventral side is silver. The belly is slightly rounded.

Figure 28. *Spratelloides delicatulus* / Delicate round herring / SPD

Category V – Sardines / Tembang

6. *Sardinella fimbriata* / Fringescale sardinella / FRS

This fish can grow to lengths of 13cm. The body is compressed vertically with a slightly rounded belly (Figure 29). The dorsal side is light blue/green and the ventral side is silver. There is a dark spot at the origin of the dorsal fin.

Figure 29. Sardinella fimbriata / Fringescale sardinella / FRS

7. *Sardinella gibbosa* / Goldstripe sardinella / SAG

This species can grow to lengths of 17cm but lengths of 15cm are more common. It has a small blunt snout and a small head (Figure 30). The dorsal side is dark blue and the ventral side is silver. There is a golden midlateral line along the flank and the dorsal and caudal fin margins are dusky black. The pelvic and pectoral fins are white/silver.

Figure 30. *Sardinella gibbosa* / Goldstripe sardinella / SAG (White et al. 2013)

8. *Amblygaster sirm* / Spotted sardine / AGS

This species can grow to lengths of 23cm. It has a bright blue dorsal side and a silver ventral side (Figure 31). The dorsal and ventral sides are separated by a row of spots, which are gold in life and dark when preserved.

Figure 31. Amblygaster sirm / Spotted sardine / AGS

9. *Sardinella lemuru* / Bali sardinella / SAM

This fish can grow to lengths of 23cm but lengths of 20cm are more common. The body is elongate and slightly cylindrical, with a rounded belly. It is distinguishable from other *Sardinella* species by the number of rays in the pelvic fin; one unbranched and eight branched, whereas other species have one unbranched and seven branched. There is a faint golden spot near the gill opening and a noticeable black spot near the border of the gill (Figure 32). The dorsal side is dark blue/green, the ventral side is silver golden and there is a faint mid-lateral golden line. The caudal fins may have small black tips.

Figure 32. *Sardinella lemuru* / Bali sardinella / SAM

Category W – Scads / Layang

10. Decapterus macrosoma / Shortfin scad / Layang / DCC

Shortfin scad are small, slender fish, with a maximum total length of 35cm. The dorsal side is metallic blue and the ventral side is silver, separated by a thin dark lateral line (Figure 33). They have a small black mark above the base of the pectoral fin. The top of the head is scaleless. The fins are almost transparent and have a glassy appearance. Separate finlets occur after the dorsal and anal fins.

Figure 33: *Decapterus macrosoma* / Shortfin Scud / Layang / DCC

11. Decapterus kurroides / Redtailed scad / Momor ekor merah / DCK

Redtail scad are a small fish, with a deep body compared with other species of similar length (Figure 34). There is a small dark blotch above the base of the pectoral fin. Redtail scads are a blue-green colour dorsally and silver ventrally. The most distinguishing feature is the bright red caudal fin.

Figure 34: *Decapterus kurroides* / Red Tailed Scad / Momar Ekor Merah / DCK (White et al. 2013)

12. Decapterus macarellus / Mackerel scad / Layang biru, Malalugis / MSD

Mackerel scad can grow to a maximum length of 45cm but smaller individuals are usually recorded. Mackerel scad have an elongated body, which is dark blue/metallic on the dorsal side and silver on the ventral side (Figure 35). Like other *Decapterus* species, they have a small dark blotch above the base of the pectoral fin. There are no spots on the lateral line. They have a small, detached dorsal and anal fin located between the main dorsal fins and the tail. The caudal fin may have a reddish colour.

Figure 35: *Decapterus macarellus* / Mackerel Scad / Layang biru, Malalugis, / MSD (White et al. 2013)

Category X – Chub mackerel / Kembung

13. *Rastrelliger kanagurta* / Indian mackerel / Banyar, Kembung lelaki / RAG

This species can grow to lengths of 35cm, with lengths of 20-25cm more common. The body is elongate and moderately deep, with the head longer than the body depth (Figure 36). The dorsal side is blue/green, with narrow, golden bands. These bands become darker in less fresh specimens. The ventral side is silver/white. There is a dark spot near the base of the pectoral fin. The dorsal fins are yellow in colour, with dark tips, the pectoral and caudal fins are yellow in colour and the other fins are dusky in colour.

Figure 36. *Rastrelliger kanagurta* / Indian mackerel / Banyar, Kembung lelaki / RAG

14. *Rastrelliger brachysoma* / Short mackerel / Kembung perempuan / RAB

The Short mackerel can grow to a maximum size of 35cm. It has a small, pointed snout. The dorsal side is solver/green and the ventral side is white/silver (Figure 37). The dorsal fins are hyaline, with a black mark at the tip. The pelvic and anal fins are clear and the caudal fin is dusky colour with a dark spot at the tip of the upper lobe.

Figure 37. *Rastrelliger brachysoma* / Short mackerel / Kembung perempuan / RAB

Category Y – Fusiliers / Lalosi

15. Gymnocaesio gymnoptera / Slender fusilier / GMY

This species can grow to lengths of 18cm. It has an elongate, narrow body (Figure 38), with a small mouth and pointed snout. The eye is relatively large. The dorsal side is orange/brown and the silver side is silver/white. There may be a thin yellow line along the lateral line. The caudal fin is orange/red, with the remaining fins white or transparent.

Figure 38. *Gymnocaesio gymnoptera* / Slender fusilier / GMY

16. Dipterygonotus balteatus / Mottled fusilier / DTB

This species can grow to lengths of 14cm. The body is elongate and slender, with a slightly rounded belly. The dorsal side is bronze and the ventral side is silver/white (Figure 39). The membrane on the dorsal fin is deeply notched, with the final few spines almost separate. The pectoral fin and caudal fins are orange/red, with all other fins white.

Figure 39. *Dipterygonotus balteatus* / Mottled fusilier / DTB (White et al. 2013)

Category Z – Other species

17. Thryssa baelama / Baelama anchovy / EYB

The maximum length of this fish is 16cm. It has a rounded belly and a short, pointed snout. The mouth is large and extends almost as far as the beginning of the gill cover (Figure 40). The dorsal side is dark blue/black and the ventral side is white/silver. There is often a dark spot at the edge of the gill cover, behind the eye.

Figure 40. *Thryssa baelama* / Baelama anchovy / EYB (White et al. 2013)

18. Herklotsichthys quadrimaculatus / Bluestripe herring / HES

This species can grow to lengths of 25cm. The dorsal side is orange/silver and the ventral side is silver/white. There is a bright blue line along the flank, with two small orange spots located at the edge of the gill cover (Figure 41). The mouth is small with a blunt snout. The caudal fin has a black line through the middle of each fork section.

Figure 41. *Herklotsichthys quadrimaculatus* / Bluestripe herring / HES

19. Selar crumenophthalmus / Bigeye scad / Bentong, selar, kembung / BIS

The Bigeye scad has a large eye, covered with a fatty eyelid (Figure 42). The body is elongate, fusiform and moderately compressed. This fish can grow to lengths of 30cm. The dorsal side is metallic blue/green and the ventral side it white. A yellow stripe sometimes extends along the lateral line. The dorsal fins are close together, with the first dorsal fin marginally higher than the second. The anal fin is small and there are no finlets after it. The caudal fin is a dark colour, with the remaining fins white/silver in colour.

Figure 42. *Selar crumenophthalus* / Bigeye scad / Bentong, selar, kembung / BIS

20. Selaroides leptolepis / Yellowstripe scad / Selar kuning / TRY

This fish grows to lengths of 22cm, with smaller individuals used for bait purposes. The body of this fish is slightly compressed ventrally, with a rounded belly (Figure 43). The dorsal side is metallic blue/green and the ventral side is silver/white. There is a thick yellow stripe along the lateral line, thicker than the yellow stripe in *Selar crumenophthalmus*. The lateral line arches towards the anterior of the body. There is a dark spot behind the eye, above the gills. This fish is similar to *Selar crumenophthalmus*, but the fins do not have a dusky edging, the caudal fin does not have dark tips, the head is higher with a smaller eye and the upper and lower edges of the eye do not have a dark colour.

Figure 43. *Selaroides leptolepis* / Yellowstripe scad / TRY (White et al. 2013)

21. Hypoatherina temmincki / Samoan silverside / FQB

This species can grow to lengths of 12cm. The body is elongate and narrow. It has a big eye, a small head, a small mouth with a pointed snout (Figure 44). The body is blue/grey in colour, with little difference between dorsal and ventral sides. There is a silver mid-lateral stripe and sometimes two rows of pigmented spots are present below the mid-lateral line.

Figure 44. *Hypoatherina temmincki* / Samoan silverside / FQB (White et al. 2013)

Chapter 3 – Data Collection and upload to I-Fish

This section focuses on the collection process of fishery-dependent data from Indonesian ports and landing sites for use in stock assessments. This data will be the basis for designing improved management systems that will move Indonesian tuna fisheries towards sustainability. The process of uploading the data to I-Fish is described.

In collaboration with district DKP and the owner / supplier of the vessels, the following vessel data should be recorded:

- vessel name
- captain name
- origin
- registration number
- vessel size class (GT)
- engine capacity (HP)
- number of fishermen employed
- gear used
- main fishing ground

This process is conducted annually in most ports, through an automatic renewal system for registration, which may result in vessel/gears changes being unrecorded. Therefore this information should be recorded at the start of each year for each vessel participating in data collection activities.

Operational level catch and effort data relates to information gathered in a logbook. Logbooks are compulsory for vessels >30 GT and compulsory logbook implementation for the entire Indonesian fleet (including all registered vessels >5GT) will be implemented over the coming years. Information on length of trip may be collected by DKP in various ports but collected irregularly across the country. A logbook system has recently been deployed for artisanal tuna fisheries. To support logbook integration, sustainability facilitators should conduct a socialization process, covering:

- Logbook explanation, use and benefit
- Overview of logbook requirements
- Continuous support and encouragement to fishermen to ensure gradual adoption and acceptance of logbook by all active vessels.

Fish quality codes are used to differentiate between catch quality. Each supplier will have a way of categorizing his catch according to size / quality / species. Category codes should be no longer than 10 characters and site-specific categories should always be used. When dealing with small delivery vessels, the number of the unloading vessel should be recorded.

3.1. Daily Port Sampling Form

The daily port sampling form is used to collect data from unloading events from individual vessels on a daily basis. One form is used per vessel per day. Two sampling designs are available, the use of each depending on the size of the vessel and the volume of the catch. Effort is made to collect data from 20% of landing events in the port sampling sites, to be compatible with WCPFC data reporting requirements. This coverage is considered a representative sample of all vessel landings as well as a feasible amount to survey by sustainability facilitators.

The first sampling design is for vessels between 3-15GT, which land a large volume of fish. With these catches it is not possible to record data on every individual fish and a subsampling system is developed, specifically for section 6 (described below in more detail). Aside from the target large yellowfin tuna, which are dealt with separately, the small tune from these catches are landed in boxes. A box sampling approach is used until a maximum of 200 fish have been measured. All fish from Box 1, Box 5, Box 10 and every fifth box thereafter will be sampled, until the maximum of 200 fish have been sampled. If 200 fish have been measured after sampling Box 1 and 5, sampling ends. Similarly, if 200 fish have been measured after sampling Box 1, Box 5 and half of Box 10, sampling should end halfway through Box 10.

Only boxes containing species of fish that occur in large amounts (>5%) should be sampled. It is important that subsampling is conducted on unsorted fish. If Sustainability Facilitators notice that the fish is being sorted by size, approach the transit staff/supplier and request reasoning. Discontinue sampling and contact supervisor. Either alternative subsampling must be devised or transit staff/supplier will be asked to return to non-sorting.

The following two methods pertain to the manner in which the 'small tuna', <10kg, is sampled, specific to section 6 of the sampling form. Other sections of the sampling form and details are described below.

<u>Method 1 – Subsampling for larger catches</u>

- Measure the length of all individual fish from Box 1, Box 5, Box 10 and every fifth box after this (i.e. 1, 5, 10, etc.), until a maximum of 200 fish have been sampled.
- If a box of fish containing species that occur in small amounts, e.g. Mahi-mahi appears in the unloading sequence (i.e. box 1, 5, 10, etc.) this box should be discarded and not counted in the sequence.

- Fork Length is measured from the tip of the upper jaw to the center of the fork in the tail. Only whole fish should be measured. The fork length should be rounded down to the nearest whole cm → 69.9cm recorded as 69 cm (see SOP II for more details).
- The delivery vessel number and the weight of the box should be recorded (-/25: describes fish unloading at landing site, no delivery vessel and the box weight is 25 kg).

The second sampling method is for small vessels catching a low number of individual fish per trip. In this case the subsampling system is not implemented and instead data on the entire catch is recorded.

<u>Method 2 – sampling for small vessels, <3GT, which tranship catch or unload on land</u>

- Record the number of the vessel from which the sampling is being conducted (if a delivery vessel)
- The fork length of a maximum of 10 individual fish of each category should be recorded in a random fashion
- If fish are landed in a processed state the fork length of the carcass should be recorded as well as the length and weight of the top right loin

The following is a description of the data that should be recorded in each section of the port sampling form, (the port sampling form can be found in Appendix I):

<u>UL1, bagain 1 – general information</u>

Tempat Pendaratan	- Name of the port/landing site
Nama Perusahaan	- Name of the supplier/company
SF 1, SF 2	- Names of the sustainability facilitators
Alat Tangkap	- Gear type used during the trip. Use of multiple gears should be recorded. If handline gear is used, specify if it is surface water, deep water or troll line.
Nama Kapal	- Vessel name. If no vessel name is available record the name of the captain
Nama Kapten	- Name of Captain
Daerah Penangkapan	- Fishing area using the grid maps (PSIndoMap_West and PsIndoMap_East, Figures 2 and 3, see *SOP I*)

	-	If fishing has been conducted in two or more fishing area grids, please record all squares where fishing was conducted
Total Penangkapan	-	Total catch weight, kg, of the unloaded fish per vessel, or per collection vessel, excluding bait. The total catch weight includes data from catches of other species (*Form UL, Section* 4), catches of small tuna species, <10kg, (*Form UL2, Section 6*) and catches of large tuna species, >10kg, (*Form UL4, Section 8*).
Estimasi ikan Hilang	-	Total estimate of lost fish, kg. This is the estimated weight of fish that is not recorded in the total catch, e.g. fish eaten, given away or discarded (exclude bait).
Tgl sampling	-	Sampling date, format dd/mm/yy
Waktu sampling	-	Time of sampling, format hh:mm
Lama trip	-	Trip length, including day of departure and day of return. Record in hours or days
Penggunaan BBM (liter)	-	Amount of fuel used during the trip, L
Penggunaan Es (kg)	-	Total amount of ice used on the trip, kg
Kapasitas Kapal	-	Vessel capacity, in gross tonnage, GT
Panjang Kapal	-	Vessel length, in metres, m
Kapasitas mesin	-	Engine capacity, in horse power, HP/PK
Jumlah awak kapal	-	Number of crew working during the fishing trip per vessel
Jumlah pengunaan pancing	-	Number of lines and rods used per trip per vessel
Tuna locating technique	-	Tuna locating technique, i.e. birds, dolphins, kites...
Vessel Material	-	Vessel material, wood or fibre
Rumpon	-	Rumpon, whether a Rumpon was used, ‘F’- all fishing conducted around rumpon, ‘X’ some fishing conducted around rumpon, ‘N’ – no fishing around rumpon
Capacity of bait bucket	-	Capacity of the buckets used to load bait onto vessel, recorded in litres, l

UL1, bagian 2 – small delivery vessels (<3GT)

No.	-	Delivery vessel number (in order of daily unloading)
Nama Kapal / Kapten	-	Vessel name or captain name
Total Penangkapan	-	Total catch, kg
Estimasi ikan Hilang	-	Estimate of fish lost, kg
Lama trip	-	Trip length, including day of departure and day of return. Record in hours or days
Penggunaan BBM	-	Amount of fuel used during the trip, L
Kapasitas mesin	-	Vessel capacity, in gross tonnage, GT

<u>UL1, bagian 3 – bait information</u>

Kategori	-	Bait category, recorded as one or more of the seven bait categories: : T) anchovies, U) sprats, V) sardines, W) scads, X) chub mackerel, Y) fusiliers, and Z) other
Spesies	-	Bait species, if known (see *SOP VI*)
Daerah Penangkapan	-	Fishing ground for bait. Use the gridded maps from *SOP I*
Pengadaan Umpan (beli / menangkap sendiri)	-	Was the bait bought or caught by the fishermen?
Berapa ember	-	How many buckets of bait were brought on the trip
Total Umpan	-	Total catch of bait, kg.
Estimasi Umpan	-	Record an estimate if the actual catch is not available
Alat tangkap Umpan	-	Gear type used to catch the bait

<u>UL2, bagian 4 – other types of catches</u>

Nama species	-	Species name of other catches
Jumlah ekor	-	Number of individuals caught per species
Kg	-	Weight of total individuals caught
Perkiraan	-	Is the weight an estimate, Y / N

UL2, bagian 5 – category summary of small tuna species, individuals <10kg

Kode	-	Supplier quality code
Deskripsi	-	A brief description of the meaning of the quality code, i.e. skipjack good quality
Total Berat	-	Total weight of each category

UL 2, bagian 6, UL3, bagian 7 and UL4 bagian 8 – random length sampling of individuals <10kg - continued

Berat basket	-	Record the total weight of the box, kg
Spesies	-	Record the species contained in the box
Panjang	-	Record the length of each individual in the box, cm (see *SOP II* and *III*) , see description above in section 3.1.

UL5, bagian 9 – category summary of large individuals, >10kg

Kode	-	Supplier quality code
Deskripsi	-	A brief description of the meaning of the quality code, i.e. skipjack good quality
Total Berat	-	Total weight of each category

UL5, bagian 10 and UL6, bagian 11 – measurements for individuals >10kg, whole or processed - continued

No. Ikan	-	Record fish number
Spesies	-	Species, either yellowfin tuna, bigeye tuna or albacore
Kode	-	Category code from section 7 above
Berat Utuh	-	Total weight of whole fish, kg.
Panjang Utuh / Karkas	-	Fork length of the whole/processed fish, cm (same as for Section 6 above)
Berat Loin atas	-	If the fish is processed, record the weight, kg, of a top loin. The weight should be recorded to one decimal place
Panjang Loin atas	-	If the fish is processed, record the length, cm, of a top loin. The loin weight and length should be for the same loin, i.e. top right or top left.
Termasuk Insang	-	Gills included in the weight – Y/N

Termasuk Isi Perut	-	Stomach contents included in the weight – Y/N
Termasuk Daging Perut	-	Belly included in the weight – Y/N

3.2. Monthly Unloading Form

The monthly unloading form is used to collect monthly summary data on each vessel in a landing site. Monthly unloading forms are to be completed by suppliers, with the assistance of sustainability facilitators when necessary. The following is a description of the data that should be collected in each column of the monthly unloading forms (the monthly unloading form can be found in Appendix II):

Nama Tempat Pendaratan		-	Name of landing site
Alat Tangkap		-	Gear used
No.		-	No. of the recorded vessel per month
Nama Kapal		-	Name of the vessel
Kapasitas Kapal (GT)		-	Capacity of the vessel
Tgl Mendarat		-	Date of landing
Lama Trip		-	Duration of fishing trip, in hours or days
WPP Lokasi		-	Fishing ground location
Total Tangkapan (kg)	Tuna Kecil, <10kg	-	Record the total weight of all small tunas (total weight of small YFT and total weight of SKJ)
	Tuna Besar, >10kg	-	Where possible, record the total weight of each of the following species: ALB, BET and YFT
	Lain	-	Where possible, record the total weight of each of the following species: BUM, BLM, MLS, SSP, SWO
ETP		-	Whether there was any ETP interaction
Port form		-	Whether a port sampling form was completed for this vessel

3.3. Data storage and analysis

All data collected in these forms will be checked by the site supervisor, who then enters the data into spreadsheets on a computer every day. Data are entered into spreadsheets on the same day that they are collected to ensure discrepancies or data errors can be addressed and corrected while the information is still fresh. The site supervisor will then upload the data to I-Fish every month.

The sampled data can be analysed to create graphs and tables showing different types of information, such as:

a. Total produksi per alat tangkap
b. Total produksi per kategori spesies
c. Cakupan Sampling dari total produksi
d. Komposisi tangkapan spesies target
e. Komposisi tangkapan dari total tangkapan
f. Komposisi spesies tangkapan
g. Frekuensi Panjang target tangkapan (YFT, SKJ, BET)
h. Persentase % dari target tangkapan dewasa vs dewasa (berdasarkan panjang fishbase.org pada saat jatuh tempo pertama)
i. Hubungan Panjang / berat spesies target (YFT)
j. Tangkapan per Upaya Unit (Kg / L bahan bakar)
k. Tangkapan per Upaya Unit (Kg / Jam (hari) di laut)
l. Penggunaan Umpan dan Komposisi Spesies Umpan
m. Tangkapan per Kg Umpan
n. Komposisi Kualitas Tangkapan (Penggunaan es, Lamanya waktu di laut, Bahan bakar yang digunakan)
o. Komposisi Tangkapan per Fishing Ground (1 ° x 1 ° bujur sangkar)
p. Komposisi Tangkapan per WPP
q. Produktivitas per Fishing Ground (FG)
r. Produktivitas per WPP
s. Kapasitas per Site (jumlah kapal aktif per kategori GT)
t. Frekuensi Interaksi dengan Hewan Langka, Terancam dan Dilindungi
u. Nasib Interaksi ETP
v. ETP per FG / WPP

These graphs and tables can be shared with stakeholders using the I-Fish automatic reporting system and used for discussion at the DMC meetings.

Appendix I – Port Sampling Form

UL1	MDPI / IMACS FORM SAMPLING TUNA POLE AND LINE DI PELABUHAN	Versi : September 2015
		Hal : dari

Bagian 1 : Informasi Kapal Utama

Tempat Pendaratan:	Nama Perusahaan:	SF 1:	SF 2:	Alat tangkap:
Nama Kapal:	Nama Kapten:	Daerah Penangkapan:	Total Penangkapan (Kg):	Estimasi Ikan Hilang (Kg):
Tgl sampling (dd/mm/yy):	Waktu sampling (jj:mm):	Lama trip (hari/jam):	Penggunaan BBM (Liter):	Penggunaan Es (Kg):
Kapasitas kapal (GT):	Panjang kapal (m):	Kapasitas mesin (PK):	Jumlah awak kapal:	Jumlah Pengunaan Pancing:

Teknik mengetahui lokasi tuna:	Bahan kapal:	Rumpon:	Kapasitas ember umpan (l):

Bagian 2: Informasi Kapal Kecil: Bongkar ke Kapal Utama

No	Nama Kapal/ Kapten	Total Penang kapan (Kg)	Estimsi Ikan Hilang (Kg)	Lama Trip (Hari/ Jam)	Penggu naan BBM (Lt):	Kapasit as mesin (PK):	No	Nama Kapal/ Kapten	Total Penan gkapa n (Kg)	Estimsi Ikan Hilang (Kg)	Lama Trip (Hari/ Jam)	Pengg unaan BBM (Lt):	Ka pas itas me sin (PK):
1							6						
2							7						
3							8						
4							9						
5							10						

Bagian 3: Informasi Umpan

Kategori	Spesies	Daerah Penangkapan	Pengadaan Umpan (Beli / menangkap sendiri)	Berapa ember	Total Umpan (Kg)	Estimasi Umpan (Kg)	Alat tangkap Umpan
T Ikan Teri				5	50		
U Maeroa				5		45	
V Tembang						30	
W Layang							
X Kembung							

Y Lalosi							
Z Lain-Lain							

UL2	**MDPI / IMACS FORM SAMPLING TUNA POLE AND LINE DI PELABUHAN**	**Versi : September2015**
Hal : dari		

Bagian 4: Jenis hasil tangkapan lain (Perkiraan total tangkapan)

Nama Spesies							
Jumlah ekor							
Kg							
Perkiraan?							

Deskripsi sampling

Bagian 5: Ringkasan Per Kategori Tangkapan Utama (Termasuk semua jenis tuna <10kg)

Kategori		**Total Berat (Kg)**	**Kategori**		**Total Berat (Kg)**
Kode	**Deskripsi**		**Kode**	**Deskripsi**	

Bagian 6: Sampling Acak Panjang Tangkapan Utama (Termasuk semua jenis tuna <10kg)

Berat basket	**Spe-sies**	**Panjang (cm)**	**Berat basket**	**Spe-sies**	**Panjang (cm)**	**Berat basket**	**Spe-sies**	**Panjang (cm)**	**Berat basket**	**Spe-sies**	**Panjang (cm)**

UL3 **MDPI / IMACS FORM SAMPLING TUNA POLE AND LINE DI PELABUHAN** **Versi: September2015**

Hal : dari

Bagian 7: Sampling Acak Panjang Tangkapan Utama (Termasuk semua jenis tuna <10kg) – Sambungan

Berat basket	Spe-sies	Panjang (cm)	Berat basket	Spe-sies	Panjang (cm)	Berat basket	Spe-sies	Panjang (cm)	Berat basket	Spe-sies	Panjang (cm)

UL4 **MDPI / IMACS FORM SAMPLING TUNA POLE AND LINE DI PELABUHAN** **Versi: September2015**

Hal : dari

Bagian 8: Sampling AcakPanjang Tangkapan Utama (Termasuk semua jenis tuna <10kg) – Sambungan

Berat basket	Spe-sies	Panjang (cm)	Berat basket	Spe-sies	Panjang (cm)	Berat basket	Spe-sies	Panjan g (cm)	Berat basket	Spe-sies	Panj ang (cm)

Deskripsi mengenai sampling

UL5	MDPI / IMACS FORM SAMPLING TUNA POLE AND LINE DI PELABUHAN	Versi: September 2015
		Hal : dari

Bagian 10: Ringkasan Per Kategori (Tuna >10kg)					
Kategori		Total Berat (Kg)	Kategori		Total Berat (Kg)
Kode	Deskripsi		Kode	Deskripsi	

Bagian 11: Tuna >10kg: Utuh dan Dalam Keadaan Sebagian Diolah									
No.	Spesies	KODE	Berat Utuh (Kg)	Panjang Utuh / Karkas (cm)	Berat Loin atas	Panjang Loin atas	Termasuk Insang? (Y/T)	Termasuk Isi Perut? (Y/T)	Termasuk Daging Perut? (Y/T)

UL5 MDPI / IMACS FORM SAMPLING TUNA POLE AND LINE DI PELABUHAN Versi: September 2015

Hal : dari

Bagian 11: Tuna >10kg: Utuh dan Dalam Keadaan Sebagian Diolah – Sambungan									
No.	Spesies	KODE	Berat Utuh (Kg)	Panjang Utuh / Karkas (cm)	Berat Loin atas	Panjang Loin atas	Termasuk Insang? (Y/T)	Termasuk Isi Perut? (Y/T)	Termasuk Daging Perut?

									(Y/T)

Appendix II – Monthly Unloading Form

Catatan Pendaratan Kapal Bulanan																				
Semua Kapal harus dicatat dalam log, walaupun Enumerator tidak ada saat unloading																				
Nama Tempat Pendaratan:										Alat Tangkap:										
No	Nama Kapal	Kapasitas Kapal (GT)	Tgl dan jam Mendarat	Lama Trip (hari / jam)	WPP lokasi	Komposisi tangkapan													ETP Y/N	Port form Y/N
						Total tangkapan (kg)	Tuna Kecil (<10kg)		Tuna Besar (>10kg)					Lain						
									YFT			ALB	BET							
							YFT	SKJ	Loin Kotor	Loin Bersih	Total			BUM	BLM	MLS	SSP	SWO		

Appendix III – FAO codes for ETP species

Sharks, Skates and Rays	**FAO code**
1.1 Pelagic Thresher Shark (VU)	PTH
1.2 Bigeye Thresher (VU)	BTH
1.3 Common Thresher Shark (VU)	ALV
1.4 Whitetip Oceanic Shark (VU)	OCS
1.5 Dusky whaler	DUS
1.6 Tiger shark (NT)	TIG
1.7 Blue shark (NT)	BSH
1.8 Sicklefin Weasel Shark (VU)	HEH
1.9 Fossil Shark/ Snaggletooth shark (VU)	HEE
1.10 Shortfin Mako (VU)	SMA
1.11 Longfin Mako (VU)	LMA
1.12 Crocodile shark (NT)	PSK
1.13 Silvertip shark (NT)	ALS
1.14 Bignose shark (DD)	CCA
1.15 Spinner shark (NT)	CCB
1.16 Silky shark (NT)	FAL
1.17 Common Blacktip Shark (NT)	CCL
1.18 Sharptooth Lemon Shark (VU)	NGA
1.19 Pondicherry Shark (CR)	CCK
1.20 Hooktooth Shark (VU)	HCM
1.21 Broadfin Shark (EN)	LMT
1.22 Sandbar shark (VU)	CCP
1.23 Pigeye Shark (DD)	CCF
1.24 Scalloped Hammerhead (EN)	SPL
1.25 Great Hammerhead (EN)	SPK
1.26 Smooth hammerhead (VU)	SPZ
1.27 Deepwater Spiny Dogfish (VU)	DGS
1.28 Megamouth Shark (DD)	LMP
1.29 Whale shark (VU)	RHN
1.30 Giant Manta Ray (VU)	RMB
1.31 Coastal Manta Ray (VU)	RMA
1.32 Londheaded Eagle Ray (EN)	MAF
1.33 Pelagic stingray (LC)	PLS
1.34 Common shovelnose ray (VU)	RBQ
1.35 Narcine prodorsalis (DD)	TNO
1.36 Narcine timlei (DD)	TNQ

Marine Mammals	
2.1 Blue whale (EN)	BLW
2.2 Fin whale (EN)	FIW
2.3 Sei whale (EN)	SIW
2.4 Bryde’s whale (DD)	BRW
2.5 Minke whale (LC)	MIW
2.6 Humpback whale (LC)	HUW
2.7 Sperm whale (VU)	SPW

2.8 Orca (DD)	KIW
2.9 False killer whale (DD)	FAW
2.10 Pilot whales (DD)	GLO
2.11 Melon headed whale (LC)	MEW
2.12 Risso’s dolphin (LC)	DRR
2.13 Oceanic dolphins --> only a grouping, not a type	
2.14 Humpback dolphins - Coastal dolphins (NT)	DHI
2.15 Irrawaddy dolphin – Coastal dolphins (VU)	IRD
2.16 Finless porpoise – Coastal dolphins (VU)	PFI
2.17 Bottlenose dolphins – Coastal dolphins (DD & LC)	
2.18 Cuvier’s beaked whale (LC)	BCW
2.19 Ginkgo-toothed beaked whale (DD)	TGW
2.20 Dugong (VU)	DUG
Sea Turtles	
3.1 Olive Ridley Sea Turtle (V)	LKV
3.2 Loggerhead Sea Turtle (E)	TTL
3.3 Green Sea Turtle (E)	TUG
3.4 Leatherback Turtle (CE)	DKK
3.5 Hawksbill Sea Turtle (CE)	TTH
3.6 Flat Back Sea Turtle (DD)	FBT
Birds	
4.1 Barau's Petrel (EN)	PTZ
4.2 Bulwer’s Petrel (LC)	PTZ
4.3 Matsudaira’s Storm-petrel (DD)	PTZ
4.4 Abbott's Booby (EN)	SZV
4.5 Red-footed Booby (LC)	SZV
4.6 Masked Booby (LC)	DSQ
4.7 Lesser Frigatebird (LC)	
4.8 Christmas Island Frigatebird (CE)	
4. 9 Greater Frigatebird (LC)	
4.10 Chinese Crested Tern (CE)	SVZ
4.11 Bridled Tern (LC)	SVZ
4.12 Aleutian Tern (LC)	SVZ

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