Data collection protocol for small-scale handline tuna fisheries of Indonesia

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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 and progress of the three dimensions of sustainability. This protocol aims to contribute towards data collection activities for handline 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 will the newly (2014) formed Presidential Task Force on Combating 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 (as mentioned above (MMAF 2010b)), 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 hand line tuna fishery.

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 handline tuna landing sites within Indonesian archipelagic and EEZ 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 handline 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 have access to high quality data on tuna catches in Indonesia and to use this information to 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 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 the handline fishery as it is categorized as an artisanal fishery
- Transfer knowledge and background of the data collection process to various stakeholders involved in the handline and pole and line tuna supply chain, with the aim of developing ownership and eventual acceptance within the community
- Support Indonesian handline 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 handline 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 as well as bringing food security value to the country. The main species are yellowfin (*Thunnus albacores*), skipjack (*Katsuwonis pelamis*), 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 larger 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). 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 2010a). 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 encouraged to register but are not required to do so. There are two types of vessel for artisanal handline tuna: 1) small vessels, ~1-16GT, unloading directly and 2) small vessels which transfer fish to a collection vessel. Trips to sea vary between less than one day up to 20 days, with Fish Aggregating Devices (FADs), dolphins and sea birds used to locate tuna. FADs or 'rumpons' in the handline fishery, are predominantly 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, large mature yellowfin at 100-120m and bigeye tuna at 150-200m. This species-dependent depth variation has the advantage that theoretically the fishery can be conducted selectively, with hooks dropped to specific depths depending on the target species. The main target of the handline fishery is mature yellowfin and bigeye tuna, with skipjack becoming increasingly important. Sometimes skipjack and juvenile yellowfin and bigeye are caught to maximize use of space, time and efficiency of the trip, especially during low season of the large adults.

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 three Regional Fisheries Management Organisations, RFMOs, the Commission for the Conservation of Southern Bluefin Tuna, CCSBT, the Western and Central Pacific Fisheries Committee, WCPFC, and

the Indian Ocean Tuna Committee, IOTC, with the latter two being relevant to the important handline relevant species. 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 from village sampling and from companies. Despite these collection efforts, the catch is often estimated, recorded either as total catch of mixed species or total catch per species, with little consistency in species identification. 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 should include input and output controls and may be in form of 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. The associated staff training protocol (available from the I-Fish website) should be consulted for detailed information on the duties of field staff.

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) and aims to do this by including industry in the collection and provision of data. 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 and may make localized management decisions based on this knowledge.

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.

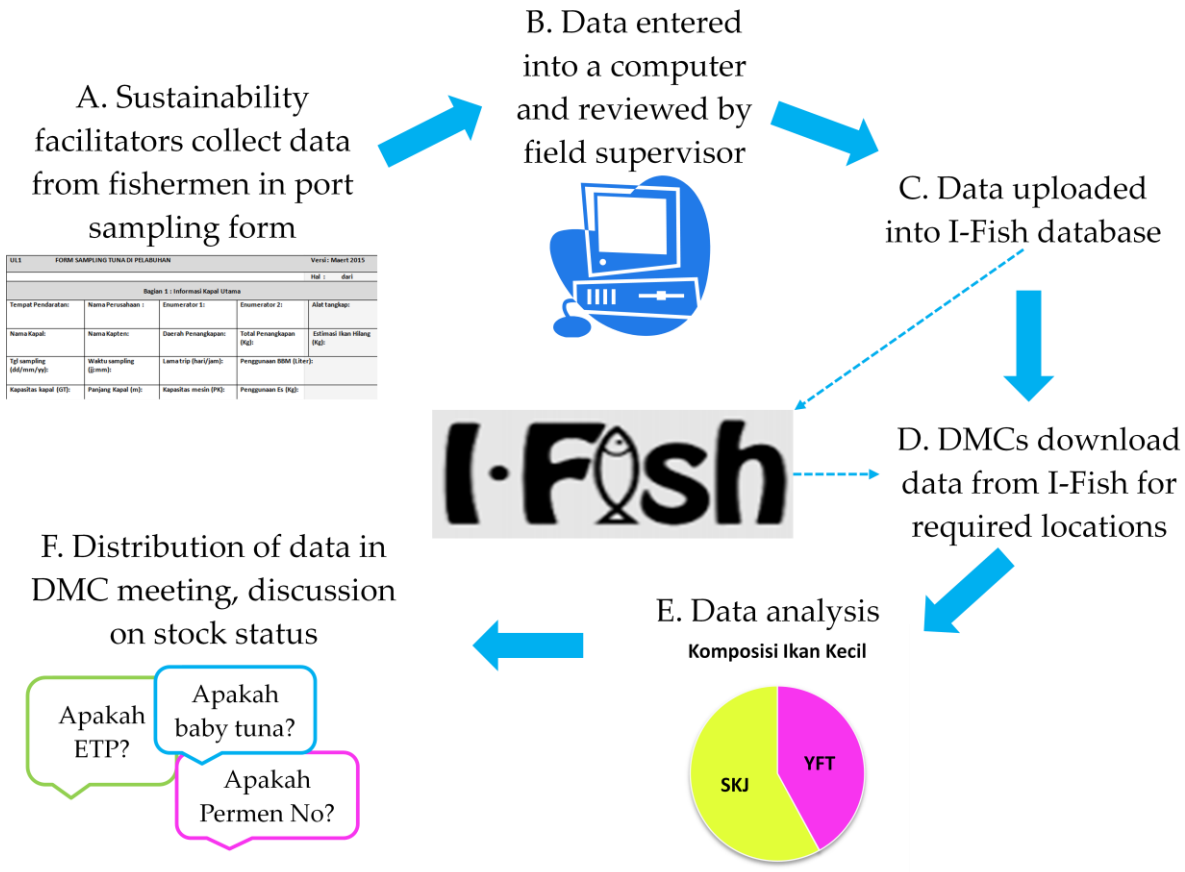

Figure 1. The data flow for the I-Fish approach. A. Sustainability facilitators collect the data from fishermen and suppliers, in both the port sampling form and the monthly unloading form. B. The data is entered in into a computer and verified by the field supervisor. C. Once the data has been verified 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 cannot 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 (MMAF 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 at 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 coordinates of the area 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.

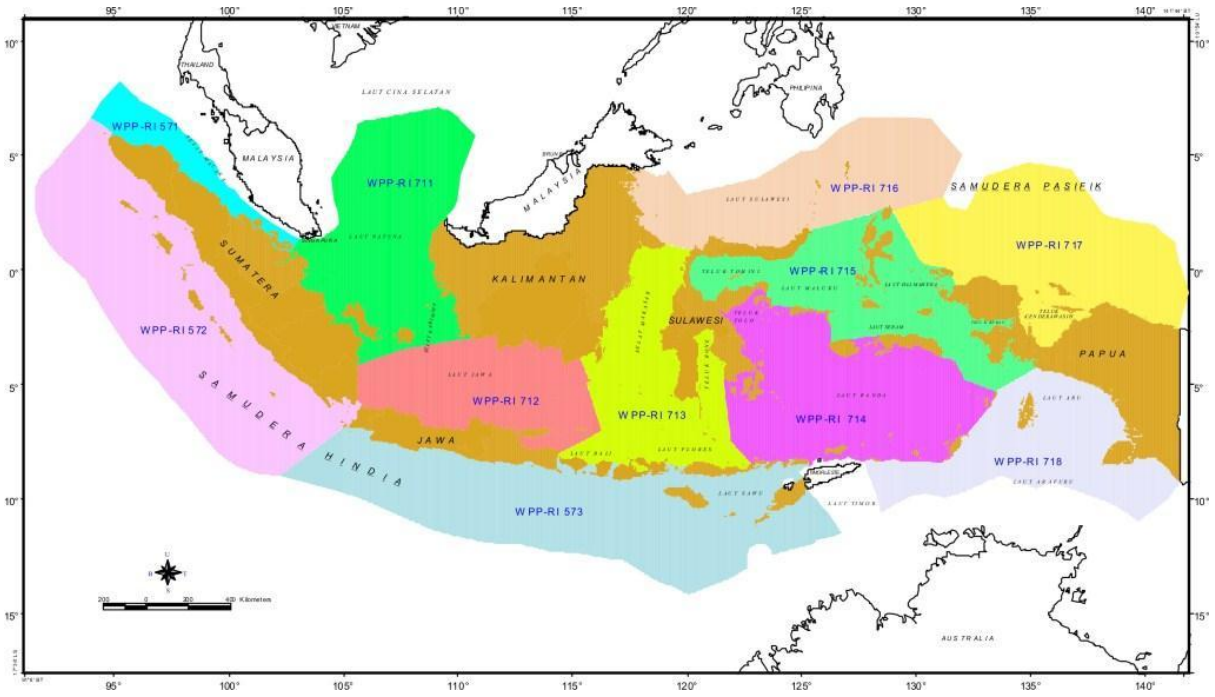

Figure 2. Fisheries Management Areas

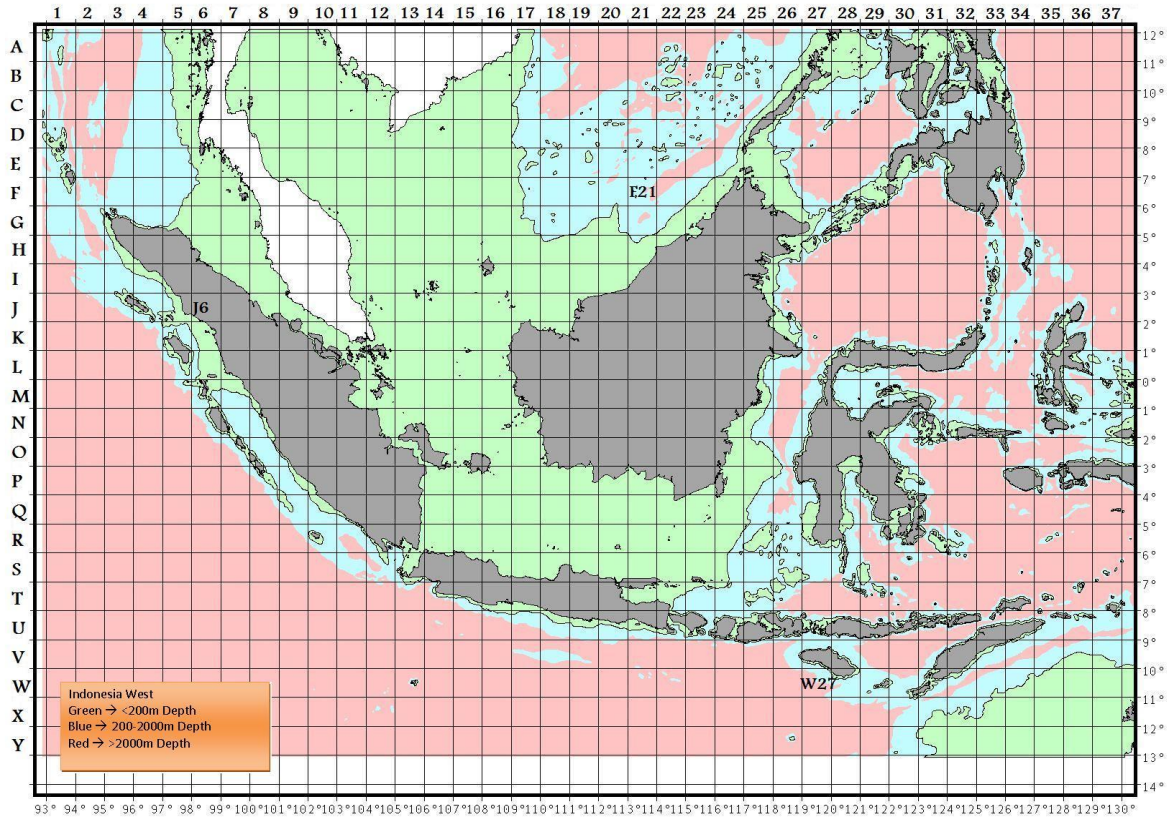

Figure 3. Tuna Fishing Ground Map for Western Indonesia

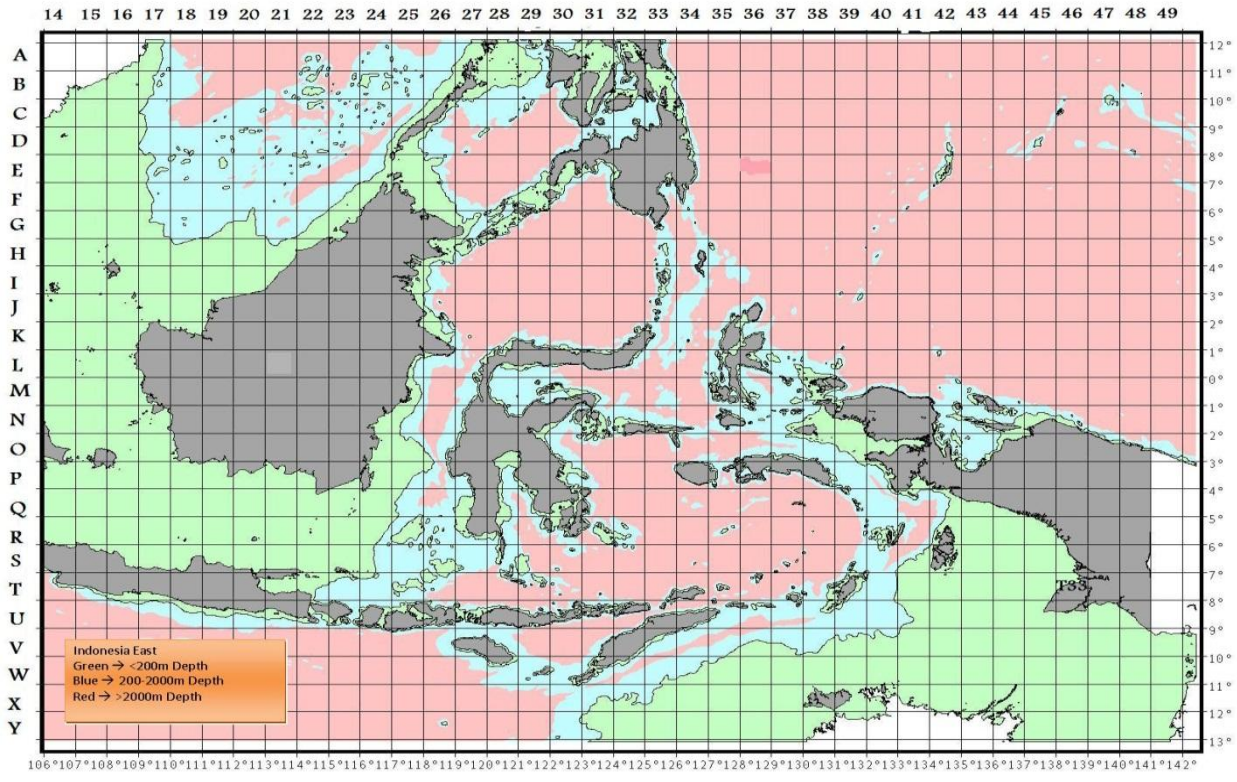

Figure 4. Tuna Fishing Ground Map for Eastern Indonesia

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 errors that occur 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)

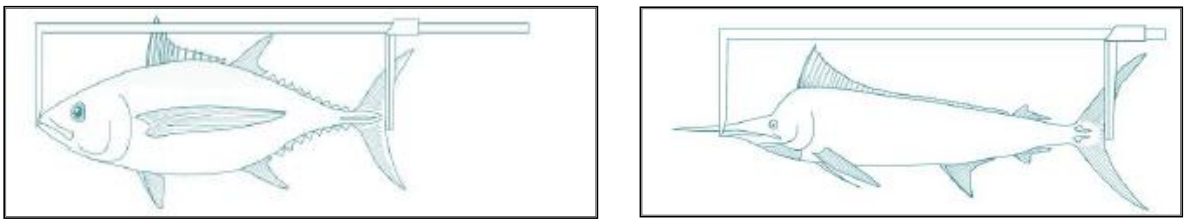

Figure 5: (a) Fork length is measured from the tip of the upper jaw to the centre of the fork in the tail. (b) For all billfish the fork length is measured from the tip of the lower jaw to the centre of the fork in the tail.

(a) (b)

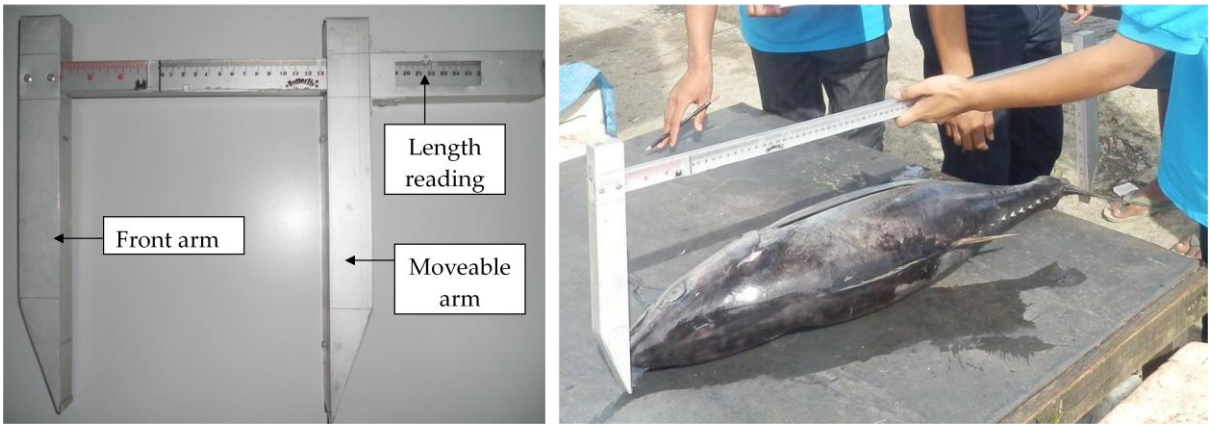

Figure 6: Calipers. (a) The measurement is read from the small arrow highlighted. Front and moveable arm of calipers are marked and (b) demonstration of the use of calipers. (© MPDI)

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).

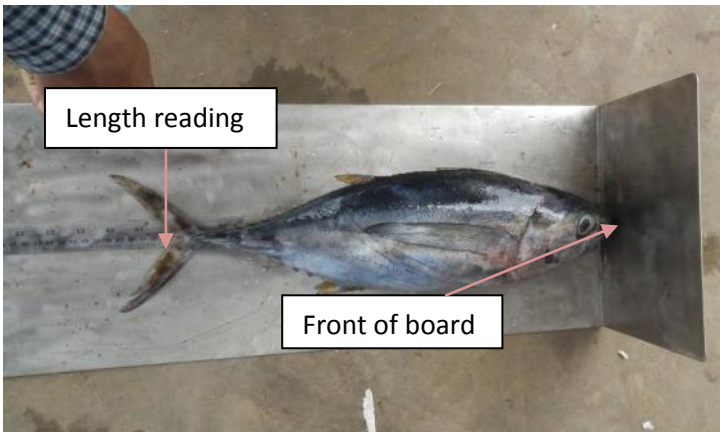

Figure 7: The fork length of a juvenile yellowfin tuna measured with a board. (© MPDI)

In some locations in Indonesia it is common to land large tuna as loins (Figure 8), i.e. the meat is cut from the body in four pieces and stored in a cool box. The carcass is also landed. This usually occurs when the fishing boats are small, typically 1GT, and there is not enough room to store the whole fish on ice. In sites where this occurs, the length and weight of the top right loin is recorded in addition to the length and weight of the whole carcass.

Figure 8: An example of a yellowfin tuna loin in a processing plant (©MDPI).

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 the 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	FAO code	English name	Local name
YFT	Yellowfin tuna	Madidihang	BUM	Blue marlin	Marlin
SKJ	Skipjack tuna	Cakalang	BLM	Black marlin	Setuhuk hitam
BET	Bigeye tuna	Tuna Matabesar	MLS	Striped marlin	Setuhuk loreng
ALB	Albacore tuna	Albakor	KAW	Mackerel tuna, Kawa-kawa	Tongkol komo
COM	Spanish mackerel	Tenggiri	BLT	Bullet tuna	Tongkol, lisong
GUT	Indo-Pacific King Mackerel	Tenggiri papan	FRI	Frigate tuna	Tongkol banyar
WAH	Wahoo	Tenggiri	OIL	Oilfish	Ikan Setan, Jambangan
RRU	Rainbow runner	Ikan salam	LOB	Tripletail	Mujair Laut
YTC	Yellowtail amberjack		ONI	Red-toothed triggerfish	Pogot
DOL	Dolphin fish	Mahi-mahi	CXS	Bigeye Trevally	Kwe, Bubara, Cotex

SFA	Sailfish	Ikan layar	GBA	Great barracuda	Barakuda, Piskada, Kuda
SWO	Swordfish	Ikan pedang	BSH	Blue shark	Hiu
SSP	Shortbill spearfish	Ikan todak			

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 VII for bait data. The anatomy of fish, with all fins labeled, is shown in Figure 9.

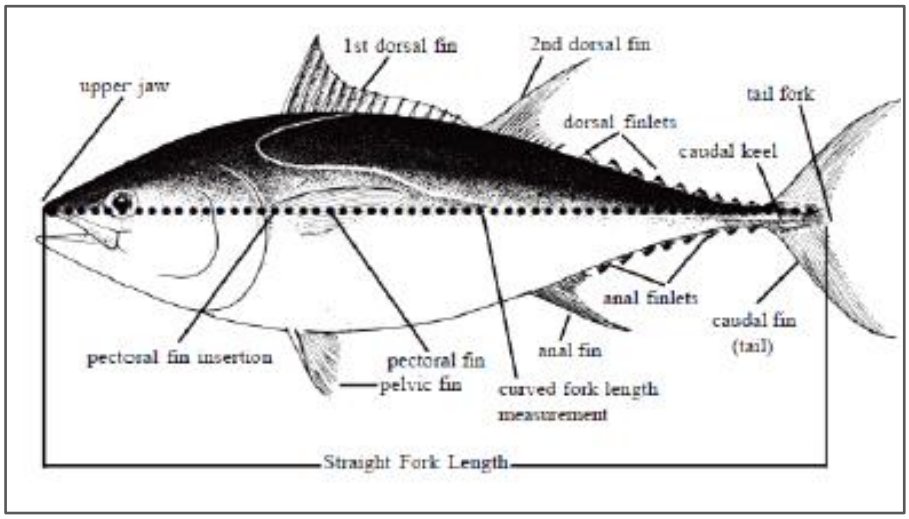

Figure 9. General fish anatomy for identifying specific fins.

Main target species:

1. *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

2. *Katsuwonus 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 11). 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 11: *Katsuwonus pelamis* / Skipjack Tuna / Cakalang / SKJ

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 12). 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 12: *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 13). 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 13: *Thunnus alalunga* / Albacore / Albakor / ALB

Other retained species:

5. *Scomberomorus commerson* / Spanish Mackerel / Tenggiri / COM

Spanish mackerel, also known as the Narrow-barred Spanish mackerel, can grow to >200cm and have a long, narrow, elongated body (Figure 14). The dorsal side is dark grey and the ventral side is silver/grey. The snout is long and pointy. Numerous broken vertical lines extend from the ventral side to the dorsal side but may not always reach the top of the dorsal side. The second dorsal fin may be the same height as or higher than the first dorsal fin. The pelvic fin is small compared with the anal fin. Juveniles have large oval spots along the body.

Figure 14: *Scomberomorus commerson* / Spanish Mackerel / Tenggiri / COM (White et al. 2013)

6. *Scomberomorus guttatus* / Indo-Pacific King Mackerel / Tenggiri papan / GUT

The Indo-Pacific King Mackerel can grow to fork lengths of ~75cm and reaches maturity at lengths of 42-53cm, depending on the geographic location. The flanks are silver/white and above the lateral line there are a number of rows of dark brown spots (Figure 15). The first dorsal fin membrane is black and the pectoral, second dorsal and caudal fins are dark brown. The pelvic and anal fins are silvery/white. The dorsal side is blue/grey metallic and the ventral side is silver/white. There are usually eight finlets between the second dorsal fin and the caudal fin.

The Indo-Pacific King Mackerel can appear similar to the Narrow-banded Spanish mackerel in general appearance. However, the Indo-Pacific King Mackerel has noticeable spots along the flank instead of narrow bands. Additionally the Indo-Pacific King Mackerel has deeper body, with the ventral side more rounded than that of the Narrow-banded Spanish Mackerel.

Figure 15. *Scomberomorus guttatus* / Indo-Pacific King Mackerel / Tenggiri papan / GUT (White et al. 2013)

7. *Acanthocybium solandri* / Wahoo / WAH

The body of the wahoo is long, elongated and narrow, with a silver ventral side, a blue/grey dorsal side and very small scales (Figure 16). The maximum fork length can be 250cm. Wahoo also has vertical blue lines along the body, which may not always reach the fully to the bottom of the ventral side and which fade in colour after death. The second dorsal fin may be the same height as or higher than the first dorsal fin and located towards the

posterior of the body. The snout is long and pointy and the teeth are smaller than that of the Spanish Mackerel. Wahoo is similar to the Spanish Mackerel but can be distinguished by a fold of skin that covers the jaw when the mouth is closed; this is absent in the Spanish Mackerel.

Figure 16. *Acanthocybium solandri* / Wahoo / WAH (White et al. 2013)

8. *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 17). The ventral and dorsal sides are separated by two light blue horizontal stripes, with a green/blue section in 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 17. *Elagatis bipinnulata* / Rainbow runner / Ikan Salam / RRU

9. *Seriola lalandi* / Yellowtail Amberjack / YTC

Yellowtail Amberjack has an elongated, compressed body, with a pointy snout (Figure 18). It can grow to ~190cm but smaller individuals are more common. It is blue on the dorsal side and upper flanks and silver to white on the ventral side. The dorsal and ventral sides are separated by a bronze lateral stripe along the body, which becomes more yellow towards the tail. All fins are yellow, the pectoral fin is short and there are no individual finlets after the dorsal and anal fins (small fins joined together).

Figure 18: *Seriola lalandi* / Yellowtail amberjack / YFC

10. *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 19). 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 19: *Coryphaena hippurus* / Dolphin Fish / Mahi-mahi / DOL
The different head shape of the female and male can be seen.

11. *Istiophorus platypterus* / Sailfish / Ikan Layar / SFA

The sailfish is a species of billfish, meaning that the upper jaw extends further than the lower jaw (Figure 20). The elongated upper jaw (bill) is round in cross-section. Sailfish can grow to more than 340cm but individuals measuring 140-240cm is more common. The sailfish has a very large first dorsal fin, often higher than the body depth. The membrane of

the large first dorsal fin is deep blue in colour, with smaller dark spots scattered across it. The second dorsal fin is much smaller. The pelvic fins are very long and narrow, sometimes reaching as far as the anus. The body is slender and compressed vertically. The dorsal side is metallic blue and the ventral side is silver/white. There are ~20 vertical stripes along the flanks of sailfish, each composed of small blue dots. The flanks sometimes have a brownish tinge.

Figure 20: *Istiophorus platypterus* / Sailfish / Ikan Layar / SFA

12. *Xiphias gladius* / Swordfish / Ikan Pedang / SWO

The bill of swordfish is usually longer than those of other billfish species and is flattened instead of circular (Figure 21). Swordfish can reach lengths of ~440cm but individuals measuring 120-190cm are more common. The swordfish has a cylindrical, elongated body with two widely separated dorsal fins, the first much higher than the second. Adult swordfish have no teeth or scales and have a large eye. Juveniles have a lateral line which fades as the individual matures. Pelvic fins are absent and the pectoral fins are located lower towards the ventral side. A horizontal keel extends from either side of the caudal peduncle. The dorsal side is black/brown which fades to light brown/silver on the ventral side and the fins are black/brown.

Figure 21: *Xiphias gladius* / Swordfish / Ikan Pedang / SWO

13. *Tetrapturus angustirostris* / Shortbill Spearfish / Ikan todak / SSP

Shortbill spearfish are a rare species and can reach maximum lengths of 230cm but individuals of 190cm are more common. The bill is small compared with bills of other billfish species (Figure 22). The first dorsal fin is long with a triangular peak at the beginning. The second dorsal fin is much smaller. The dorsal side and dorsal fin are dark blue whereas the ventral side and anal fins are silver. The pectoral fins are small whereas the pelvic fins are long and narrow, approximately twice the length of the pectoral fins. Brown blotches may be present on the flanks.

Figure 22: *Tetrapturus angustirostris* / Shortbill Spearfish / SSP

14. *Makaira mazara* / Indo-Pacific blue marlin / BUM

Indo-Pacific blue marlin has a slightly compressed body shape with a highly elevated nape (Figure 23). They have a long bill which is round in cross section. The first dorsal fin is long with a triangular peak at the anterior section, the remainder of the dorsal fin is much shorter. The second dorsal fin is smaller. The pectoral fins are long and thin and the pelvic fins are shorter than the pectorals. Two horizontal keels are present on the caudal peduncle. The lateral line is present in juveniles but difficult to distinguish in adults. The dorsal side is dark blue and the ventral side is silver/white. Pale blue stripes, ~15, are present on the flanks, which are composed of smaller dots.

Figure 23: *Makaira mazara* / Indo-Pacific blue marlin / BUM

15. *Istiompax indica* / Black Marlin / Setuhuk hitam / BLM

Black marlins can grow to >450cm, with females reaching larger sizes than males. They have a slightly rounded body with a shorted bill than other billfish. The first dorsal fin is long with a rounded peak at the anterior section (Figure 24). Black marlins have two horizontal keels at the caudal peduncle. The pectoral fins stick out from the sides, are located lower towards the pelvic fins and cannot be flattened, unlike other billfishes. The pelvic fins are long and thin. The dorsal side is dark blue/black and the ventral side is silver/white. Faint blue lines may be present on the flanks.

Figure 24: *Istiompax indica* / Black marlin / Setuhuk hitam / BLM

16. *Kajikia audax* / Striped Marlin / Setuhuk loreng / MLS

The striped marlin can grow to >420cm but smaller individuals are more common. Striped marlins have a compressed body and a very visible lateral line. The bill is long and round in cross-section. Like other marlins, Striped marlins have a high, pointed first dorsal fin, which is shorter as it continues long the body (Figure 25). The pectoral fins are long and narrow with a pointed tip. The pelvic fins are thin and roughly the same length as the pectoral fins, if not shorter. A horizontal keel is present at either side of the caudal peduncle. The dorsal fin is dark blue; all other fins are dark brown. The dorsal side is dark blue/black, the ventral side is silver/white and the lateral line is obvious. There are ~15 horizontal light blue stripes along the flanks, each consisting of smaller blue dots. Unlike other marlins, the horizontal stripes on a striped marlin remain visible after death.

Figure 25: *Kajikia audax* / Striped Marlin / Setuhuk loreng / MLS

17. *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 26). 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 26: *Euthynnus affinis* / Mackerel Tuna / Tongkol Komo / KAW (White et al. 2013)

18. *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 27). 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 27: *Auxis rochei* / Bullet Tuna / Tongkol lisong / BLT (White et al. 2013)

19. *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 28). 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 28. *Auxis thazard thazard* / Frigate mackerel, Frigate tuna / Tongkol banyar / FRI

20. *Ruvettus pretiosus* / Oilfish / Ikan Setan / OIL

Oilfish are brown/black in colour and have a rough, scaly surface. Individuals can grow to a maximum of 2m and ~64kg. The lower jaw protrudes a little bit further than the upper jaw and the teeth are fang-like (Figure 29). The first dorsal fin has noticeable spines, second dorsal fin higher than the first. There are two finlets before the caudal fin and a lateral line present on the flanks. The tips of the fins may be white.

Figure 29. *Ruvettus pretiosus* / Oilfish / Ikan setan / OIL

21. *Lobotes surinamensis* / Tripletail / Mujair laut / LOB

The tripletail gets its name from the rounded caudal fin and the large second dorsal and anal fin, which together give the appearance of a tripletail (Figure 30). The moth slants downwards, with the lower jaw protruding slightly beyond the upper jaw. The body is deep and compressed. There is a lateral line along the flanks and the body is dark brown/green in colour. The fins can be a darker colour than the body.

Figure 30. *Lobotes surinamensis* / Tripletail / Mujair laut / LOB

22. *Odonus niger* / Red-toothed triggerfish / Pogot / ONI

The Red-toothed triggerfish has noticeably red teeth; the two upper teeth are visible when the mouth is closed. This fish is dark blue/purple in colour, with pale blue margins (Figure 31). The first dorsal fin is short, with a peak at the anterior section. The second dorsal fin is longer and higher than the first. The anal fin is approximately the same size as the second dorsal fin. The body is deep and compressed ventrally, with a large head and the mouth orientated upwards. The eye is large, with a deep groove present at the front.

Figure 31. *Odonus niger* / Red-toothed triggerfish / Pogot / ONI

23. *Caranx sexfasciatus* / Bigeye trevally / Kwe, bubara, cotex / CXS

The bigeye trevally has a noticeably large eye, with a well developed eyelid. There is a small black spot behind the eye (Figure 32). The body is elongate and compressed. The bigeye trevally is silver/olive dorsally, with shades of iridescent blue/green. The ventral side is silver/white. The first dorsal fin is short, with the second dorsal fin having a peak followed by a lower section, extending to the base of the caudal fin. The anal fin has a peak for the first spines, and then continues lower, extending as far as the base of the caudal fin. There are not finlets after the second dorsal and anal fins. The caudal and second dorsal fin are dark/black, the other fins are white/clear. There is a strong lateral line along the flank.

Figure 32. *Caranx sexfasciatus* / Bigeye trevally, Kwe, bubara, cotex / CXS

24. *Sphyraena barracuda* / Great barracuda / Barakuda, paskada, kuda / GBA

The Great barracuda may reach lengths of 2m. The body is elongate and slim, torpedo-shaped, with the dorsal side green/grey and the ventral side while/silver (Figure 33). Irregular dark blotches may be present along the lower flanks, and a number of diagonal darks bars present on the upper flanks. The dorsal fins are widely separated, the anal fin is small. The

caudal, anal and dorsal fins are dark with white tips. The snout is long and pointed, with a protruding lower jaw and many long, sharp teeth.

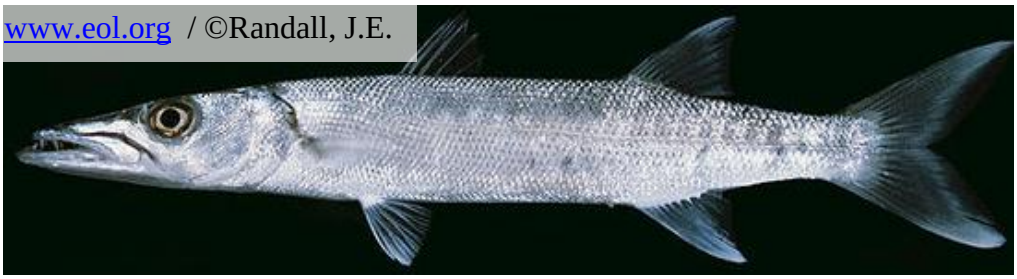

Figure 33. *Sphyraena barracuda* / Great barracuda / Barakuda, paskada, kuda / GBA

25. *Prionace glauca* / Blue shark / Hiu / BSH

The Blue shark has a slender body and a characteristic deep blue/indigo colour on the dorsal side (Figure 34). The colour changes to a bright blue on the sides and turns white on the ventral side. The snout is long and pointed, with large eyes and conical teeth. The pectoral fins are long and slightly curved. The second dorsal fin is much smaller than the first. The upper lobe of the caudal fin is elongated, with a notch below the tip. The lower lobe of the causal fin is short.

Figure 34. *Prionace glauca* / Blue shark / Hiu / BSH

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

2.4.1. Differences between juveniles of species

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 facilitators 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):

External differences

Feature	Yellowfin Tuna	Big Eye Tuna
Body markings (Figure 35)	• 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 35: Two comparisons of yellowfin and bigeye tuna.

Body shape (Figure 35)	• 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 36)	• 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

Figure 36. Close up of the differences between the head and eye shape of yellowfin and bigeye

Pectoral fin characteristics (Figure 37)	• 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 37. Differences in pectoral fin characteristics

Caudal fin characteristics (Figure 38)	• 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 38. 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 35)	• 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

Internal differences

Feature	Yellowfin	Bigeye
Liver morphology and appearance (Figure 39)	• Right lobe longer and thinner than other lobes • Smooth lobes, no striations	• Three rounded lobes of ~ equal size • Ventral surface striated

Figure 39. Differences between livers

Swim bladder (Figure 40)	• 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 40. Differences between swim bladders.

2.4.2. Loin Differences

As mentioned in SOP II, some locations in Indonesia land tuna as loins rather than as the whole entire fish. This is done so that the meat can be stored on ice. Both yellowfin and bigeye tuna are loined in these sites. There are a number of differences between the loins of yellowfin and bigeye tuna (Table 2).

Table 2. The differences between yellowfin and bigeye tuna loins.

Yellowfin loin	Bigeye loin
- Long loin, not very thick - Pink in colour - Meat is durable and not easily damaged - Meat does not have a greasy feel	- A wider loin, thick and not too long - Dark red in colour - Meat is easily damaged - Meat has a slightly greasy feel

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 handline tuna fisheries. According to the MSC pre-assessment report for Indonesian handline yellow fin tuna "Handline-fishing is highly selective due to the method and size of bait used." and "… it would appear highly unlikely that there are any associated ETP by-catch interactions with the handline fishery." For full-assessment, 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, dead and artificial bait are used in the tuna fisheries. Live bait is usually caught by the fishermen, on the way to or at the fishing ground. Artificial bait consists of home-made lures. 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)
- Gear type

There are seven possible bait categories: A) squid; B) flying fish; C) tongkol species; D) scad; E) tuna, as dead bait, F) artificial bait and G) Other included to cover any additional species that may be used as bait. The possible bait species are described below. Jereb & Roper (2006) review of inshore squids was used to supplement the description of some of the squid species below. 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.

Category A – Squids

1. Chiroteuthis imperator

The mantle of this squid can measure up to 30cm and photophores are present on the arms (Figure 41).

Figure 41. *Chiroteuthis imperator*

2. *Chiroteuthis picteti* / KTP

This squid is medium sized and the most noticeable feature is the very long slender clubs when compared with other squids (Figure 42).

Figure 42. *Chiroteuthis picteti* / KTP

3. *Idiotheuthis cordiformis*

This squid can grow to one hundred centimeters but smaller individuals are used for bait purposes. The fin attached to the mantle is semi-circular in shape and wider than other squid species (Figure 43). The cuticle is covered in small, conical tubercules and is usually red in colour, which may be damaged during hauling. The suckers on the clubs are much larger than on other squid species, especially towards the posterior end.

Figure 43. *Idioteuthis cordiformis*

4. *Loligo pickfordi* / SQC

The mantle of this squid is slender, with a small fin at the tip. Arms II and III of males have enlarged suckers compared with the females. No photo available

5. *Loliolus affinis*

This squid has a short mantle, ~ 35mm, which is slightly compressed dorsoventrally. The arms are short, except for the club arms (Figure 44). The club sucker rings have between 15-20 small teeth.

Figure 44. *Loliolus affinis*

6. *Loliolus hardwickei*

This is a small squid, between 30-40mm, with a stout mantle, with rounded fins; the width of the fins is generally equal to or slightly larger than the length of the mantle (Figure 45). In the males the fins extend past the posterior end of the body and fuse together. The tentacles are short, with small clubs. This squid has no photophores

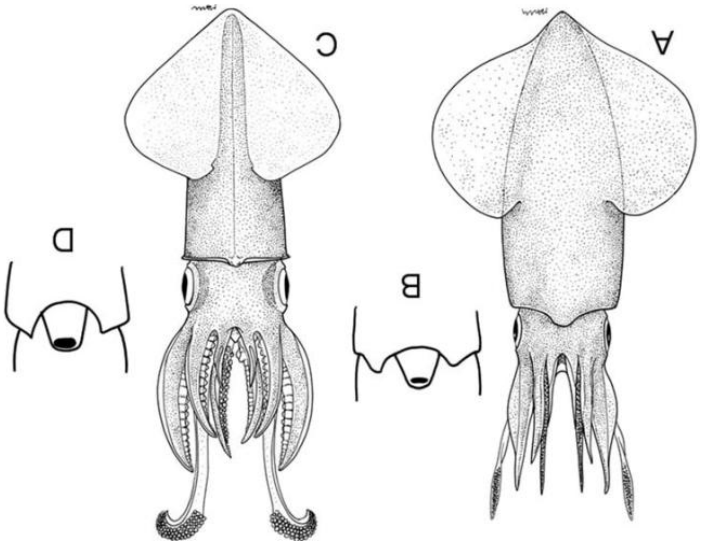

Figure 45. A and B – dorsal view and funnel of female *Loliolus hardwickei*. C and D – dorsal view and funnel of male *Loliolus hardwickei*. (Jereb & Roper 2006)

7. *Loligo chinesnis* / Mitre squid / OJH

This squid can grow to a maximum length of 30cm. The mantle is cylindrical, which tapers to a blunt tip (Figure 46). The fins are found on the posterior half of the mantle and are triangular in shape, with a rounded tip. The arms are long with the tentacles even longer. The clubs are long and slender with large suckers.

Figure 46. *Loligo chinensis* / Mitre squid / OJH

8. *Uroteuthis duvaucelii*

The mantle is long and slender, rounded for the majority of the body and then tapers into a blunt tip. The fins are widest in the middle point of their length (Figure 47). The arms are moderately long and the suckers of Arms II and III of males are larger than on females. The tentacles are long, measuring ~half the mantle length. This squid can have a red/brownish colour if in good condition when caught.

Figure 47. *Uroteuthis duvaucelii*

9. *Pterygioteuthis giardia* / Roundear enope squid / TID

This is a small squid species, usually measuring 25mm, rarely growing to 30mm. The mantle has a very pointy tip and the fins are small, semi-circular and do not extend to the end of the mantle (Figure 48). The arms are short and strong and the tentacles are long and thin with a small club. There are pink patches on the surface of adult individuals.

www.tol.org

Figure 48. *Pterygioteuthis giardi* / Roundear enope squid / TIB

10. *Sepioteuthis lessoniana* / Bigfin reef squid / UHL

Bigfin reef squid can grow to ~33cm in length. The fin extends nearly fully around the mantle and is narrow and oval in outline (Figure 49). Both the arms are tentacles are long, tentacles longer with elongated, thin clubs

www.diverosa.com

Figure 49. *Sepioteuthis lessoniana* / Bigfin reef squid / UHL

11. *Sthenoteuthis oualaniensis* / Purple back flying squid / YMO

The Purple back flying squid can grow to 30cm in length, with individuals >10cm usually having a large yellow organ under the skin (Figure 50). The mantle is long and robust with the fins occurring on the posterior section of the mantle. The width of the fins exceeds the length of the fins, and the fins are longest in the middle part of their length.

www.shell.sinica.edu.tw

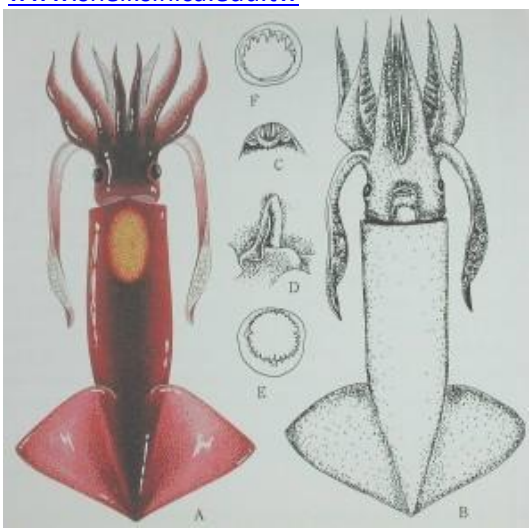

Figure 50. *Sthenoteuthis oualaniensis* / Purple back flying fish / YMO

12. Thysanoteuthis rhombus / Diamondback squid / YUR

This squid can grow to lengths of 100cm. It has very short arms and noticeably large triangular fins, which extend the full length of the mantle (Figure 51). It is usually ref in colour with big eyes, short arms and long tentacles.

Figure 51. *Thysanoteuthis rhombus* / Diamondback squid / YUR

13. Uroteuthis bartschi / Bartsch's squid / URB

This squid has an elongated body shape, with a narrow mantle and growing to lengths of 20cm. The posterior end of the mantle extends noticeably beyond the posterior section of the fins (Figure 52). The fins are located towards the posterior of the mantle and are pointy and triangular.

Figure 52. *Uroteuthis bartschi* / Bartsch' squid / URB

14. Uroteuthis sibogae

This squid has an elongated body and can grow to ~16cm. The mantle extends slightly beyond the posterior end of the fin (Figure 53). The fins are small, triangular and pointy, located at the posterior end of the mantle. The arms are short and the tentacles are long

.

www.quazoo.com

Figure 53. *Uroteuthis sibogae*

15. Uroteuthis singhalensis / Long barrel squid / OJN

The mantle of this squid is long and narrow, tapering into a pointed tip. The fins are just over half the length of the mantle, narrow and extend to the limit of the pointed mantle tip. The arms and tentacles are slender and short, with small clubs (Figure 54).

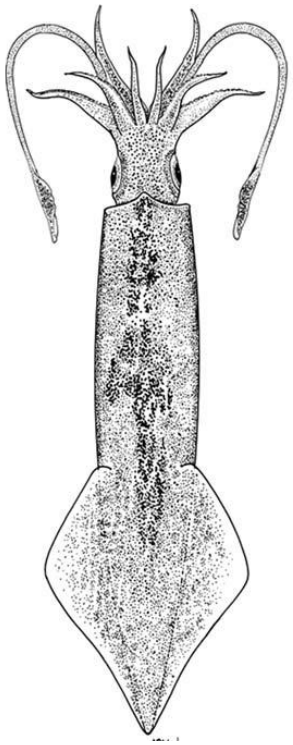

Figure 54. *Uroteuthis singhalensis* (Jereb & Roper 2006)

16. Uroteuthis edulis

This species can grow to measure 40cm. The fins are large and triangular, present along 50-70% of the mantle length, with the mantle and fin, finishing in a blunt tip (Figure 55). The arms are short and the tentacles long with a large club. Accurate identification of this species is difficult due to its polymorphic nature, i.e. a variety of 'forms' exist depending on locality and season.

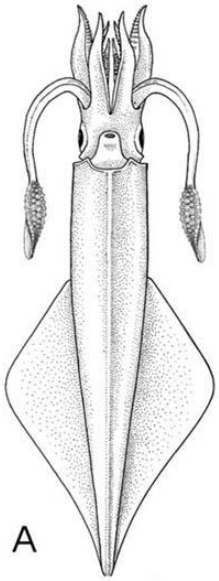

Figure 55. *Uroteuthis edulis* (Jereb & Roper 2006)

17. Abralia andamanica / BLK

This squid is a small species, usually not measuring more than 50mm. The mantle is short and conical, ending in a short pointed tail (Figure 56). The fins are located on the posterior section of the mantle extending along ~40% of the mantle length. The fins are triangular and pointed and do not extend the full length of the mantle.

Figure 56. *Abralia andamanica* / BLK

18. Abralia renschi

This is a small species of squid, usually, not measuring more than 45mm. The mantle is slender, tapering into a blunt end. The fins are triangular and located at the mantle posterior where they extend along ~60% of the mantle length (Figure 57).

Figure 57. *Abralia renschi*

19. Pholodoteuthis boschmai

The mantle of this species can grow to lengths of ~60cm. The mantle is cylindrical, and the fin diamond shaped, extending to the end of the mantle. The tentacles are long and the club is generally not much wider than the tentacle, may be slightly compressed in adults. No figure available for this species.

20. Enoploteuthis reticulata

This species can grow to mantle lengths of 130mm. The mantle is conical, measuring approximately half of the total body length, and with approximately six longitudinal rows of photophores (Figure 58). The fins are triangular and pointed, with the mantle extending beyond the fin end. The arms and head constitute approximately half of the total length. The arms are long and thick whereas the tentacles are thin and weak. The club of the tentacle is narrow and small.

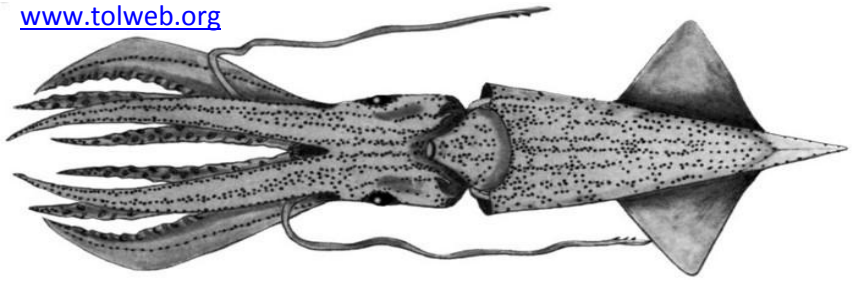

Figure 58. *Enoploteuthis reticulata*

21. Galiteuthis pacifica

There is a lack of information on this species. Mantle lengths could measure as much as 33cm. The arms and tentacles are short. The fins are triangular, slightly rounded and small and are located on the posterior section of the mantle (Figure 59). The mantle is conical, extending slightly beyond the end of the fins.

Figure 59. *Galiteuthis pacifica*

22. Taonius belone

This species can measure ~660mm in mantle length. The fins are long, narrow and tapering, with the mantle extending beyond the end of the fins (Figure 60).

Figure 60. *Taonius belone* (juvenile)

Category B – Flying Fish

23. Cheilopogon abei / Abe's flying fish

Abe's flying fish can grow to a maximum length of ~22cm. The body is elongate and cylindrical, with a small head, large eye, blunt snout and small mouth. The lower jaw may sometimes extend past the upper jaw. Flying fish have noticeable larger and wider pectoral

fins than other fish species, which can reach as far as the base of the caudal fin, and which are used for flying. The pectoral fins of *Cheilopogon abei* have an orange/cream band across the width. The pelvic fins are located closer to the anus than in other fish (Figure 61) and are also larger and wider than usual. This fish is dark blue/green dorsally and silver ventrally. The lower fork of the tail is slightly longer than the upper fork.

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Figure 61. *Cheilopogon abei* / Abe's flying fish

24. Cheilopogon arcticeps / White-finned flying fish

The White-finned flying fish can grow to ~21cm. The body is cylindrical and wide, with a small head and mouth, big eye and a slightly pointed snout (Figure 62). The pectoral fin is large, wide and white in colour. The pelvic fin is located towards the posterior of the body, is larger and wider than usual and white in colour. The dorsal side is dark blue/green and the ventral side is silver. The lower fork of the tail is longer than the upper fork.

Figure 62. *Cheilopogon arcticeps* / White-finned flying fish (White et al. 2013)

25. Cheilpogon antoncichi

Little is known about this species. Like other flying fish species it has large and wide pectoral and pelvic fins. The head is small with a big eye and the lower jaw extends slightly further than the upper jaw. The lower fork of the tail is longer than the upper fork and both have a white tip (Figure 63).

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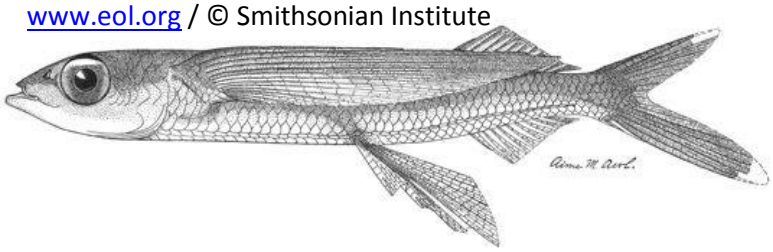

Figure 63. *Cheilopogon antoncichi*

26. Cheilopogon atrisignis

This flying fish can grow to lengths of 33cm. The body is elongate and cylindrical. It has a short head, big eye, small mouth, with the lower jaw sometimes extending further than the upper jaw. The pectoral fins are large and wide, with many small black spots present (Figure 64). The pelvic fins are located towards the anus and are large, wide and white/grey in colour. The lower fork of the tail is longer than the upper fork. The dorsal side is grey/black and the ventral side is white/silver.

Figure 64. *Cheilopogon atrisignis* (White et al. 2013)

27. Cheilopogon intermedius

Little is known about this species. It can grow to lengths of 22cm. The body is elongate and deep close to the head. The head is short, with a big eye, small mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, with large black/brown spots present (Figure 65). The pelvic fin is also large and wide, located towards close to the anus and is grey/white in colour. The lower fork of the tail is longer than the upper fork.

Figure 65. *Cheilopogon intermedius* (White et al. 2013)

28. Cheilopogon katoptron

Little is known about this species. It can grow to lengths of 18cm. The body is elongate and deep close to the head. The head is short, with a big eye, small mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, with a band of paler colour present (Figure 66). The pelvic fin is also large and wide, located towards close to the anus. The lower fork of the tail is longer than the upper fork.

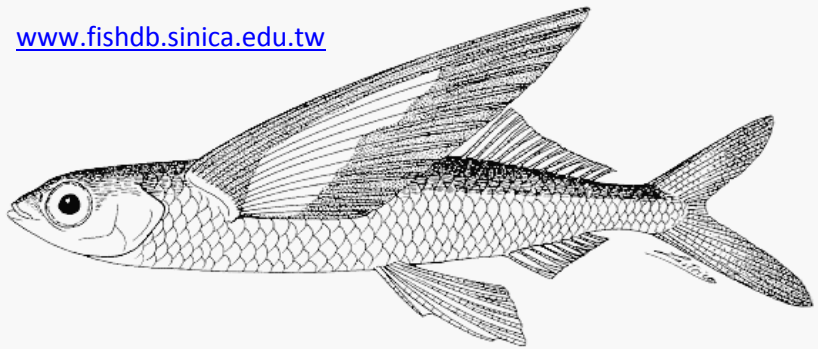

Figure 66. *Cheilopogon katoptron*

29. Cheilopogon unicolor

This species can grow to lengths of 38cm. The body is elongate and cylindrical. The head is short, with a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, and are white or translucent (Figure 67). The pelvic fin is also large and wide, located towards close to the anus and is grey/white in colour. The lower fork of the tail is longer than the upper fork. The dorsal side is dark blue/green and the ventral side is silver/white.

Figure 67. *Cheilopogon unicolor*

30. Cypselurus hexazona

This species can grow to lengths of 18cm. The body is elongate and cylindrical. The head is short, with a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide. They are mainly dark in colour but with a narrow paler band around the edge (Figure 68). The pelvic fin is also large and wide, located towards close to the anus. The lower fork of the tail is longer than the upper fork. The dorsal side is dark blue/green and the ventral side is silver/white.

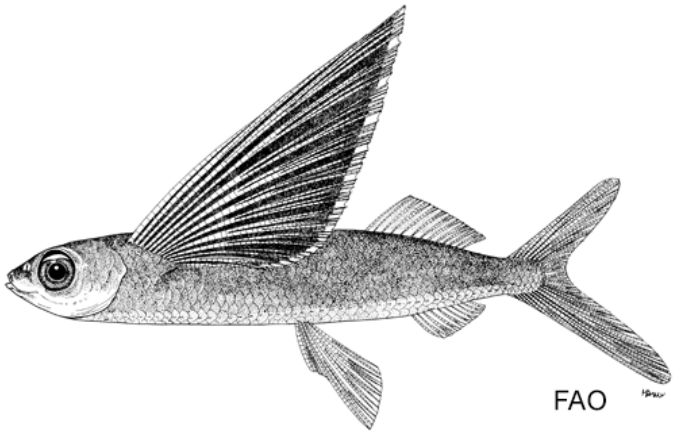

Figure 68. *Cypselurus hexazona*

31. Cypselurus oligolepis

This species can grow to lengths of 18cm. The body is elongate and cylindrical. The head is short, with a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, and are black/grey in colour (Figure 69). The pelvic fin is also large and wide, located towards close to the anus, and is translucent with a

black section near the tip. The lower fork of the tail is longer than the upper fork. The dorsal side is black and the ventral side is silver/white.

Figure 69. *Cypselurus oligolepis*

32. Cypselurus opisthopus / YPX

This species can grow to lengths of 18cm. The body is elongate and cylindrical. The head is short, with a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide. The pelvic fin is also large and wide, located towards close to the anus. The lower fork of the tail is longer than the upper fork. No picture available.

33. Cypselurus poecilopterus / Yellow flying fish / ECP

This species can grow to lengths of 27cm. The body is elongate and cylindrical. The head is short, with a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, and are brown/yellow in colour with multiple brown spots (Figure 70). The pelvic fin is also large and wide, located towards close to the anus and is grey/white in colour. The lower fork of the tail is longer than the upper fork. The dorsal side is dark blue/green and the ventral side is silver/white.

Figure 70. *Cypselurus peocilopterus* / Yellow flying fish / ECP (White et al. 2013)

34. Hirundichthys albimaculatus

The body of this fish is elongate, flattened ventrally and can grow to 23cm. The pectoral fins are very long, reaching almost as far as the base of the caudal fin. The pelvic fins are also long, located close to the anus and extending beyond the origin of the anal fin. No picture available.

35. Hirundichthys oxycephalus / Bony flying fish / FFZ

This species can grow to lengths of 18cm. The body is elongate, with a short head, a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, and are grey in colour, with a thin white edge (Figure 71). The pelvic fin is also large and wide, located towards close to the anus and is grey in colour, with a thin white edge. The lower fork of the tail is longer than the upper fork. The dorsal side is dark grey and the ventral side is silver/grey.

Figure 71. *Hirundichthys oxycephalus* / Bony flying fish / FFZ (White et al. 2013)

36. Parexocoetus brachypterus / Sailfin flying fish / PXB

This species can grow to lengths of 20cm. The body is elongate and cylindrical. The head is short, with a big eye, a small, blunt mouth and the lower jaw sometimes extends past the upper jaw. The pectoral fins are large and wide, and are white or translucent (Figure 72). The dorsal fin is larger than other flying fish and is clear in colour with a black blotch near the edge. The pelvic fin is also large and wide, located towards close to the anus and is grey/white in colour. The lower fork of the tail is longer than the upper fork. The dorsal side is dark blue/green and the ventral side is silver/white. The caudal fin has a red tinge, with the lower fork longer than the upper fork.

Figure 72. *Parexocoetus brachypterus* / Sailfin flying fish / PXB

Category C – Tongkol Species

37. 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 73). 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 73: *Euthynnus affinis* / Mackerel Tuna / Tongkol Komo / KAW (White et al. 2013)

38. Auxis rochei / Bullet Tuna / Tongkol / BLT

The maximum fork length for bullet tuna is ~50cm and the body is more elongate than mackerel tuna (Figure 74). 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 74: *Auxis rochei* / Bullet Tuna / Tongkol / BLT (White et al. 2013)

Category D – Scads

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

The Bigeye scad has a large eye, covered with a fatty eyelid (Figure 75). 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 75. *Selar crumenophthalus* / Bigeye scad / Bentong, selar, kembung / BIS

40. Decapterus russelli / Indian scad / Layang / RUS

The Indian scad can grow to lengths of 45cm. The body is elongate and compressed. The dorsal side is blue/green and the ventral side is white/silver (Figure 76). There is a small black spot at the top of the opercle. The caudal fin is hyaline/yellow. The dorsal fins are hyaline at the base becoming dusky at the edges. The pelvic and pectoral fins are clear/white.

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Figure 76. *Decapterus russelli* / Indian scad / Layang / RUS

41. 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 77). 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 77: *Decapterus macrosoma* / Shortfin Scud / Layang

42. Decapterus kurroides / Red tailed scad / momar ekor merah / DCK

Redtail scad are a small fish, with a deep body compared with other species of similar length (Figure 78). 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 78: *Decapterus kurroides* / Red Tailed Scad / Momar Ekor Merah / DCK (White et al. 2013)

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

Mackerel scad can grow to a maximum length of 46cm 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 79). 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 79: *Decapterus macarellus* / Mackerel Scad / Layang biru, Malalugis / MSD (White et al. 2013)

44. Selaroides letolepis / 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 80). 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 80. *Selaroides leptolepis* / Yellowstripe scad / Selar Kuning / TRY (White et al. 2013)

Category E – Tuna, as dead bait

Tuna species are often used as bait. Juvenile skipjack and yellowfin tuna are commonly used. When known, the species of tuna should be recorded in the port sampling form.

Category F – Artificial bait

Artificial bait can be bought or handmade from materials, such as brightly coloured plastic to attract the tuna (Figure 81).

Figure 81. Artificial bait used for tuna fishing

Category G – other species

45. Sardinella gibbosa / Goldstripe sardinella / Tembang / 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 82). 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 82. *Sardinella gibbosa* / Goldstripe sardinella / Tembang / SAG (White et al. 2013)

46. Sardinella lemuru / Bali sardinella / Lemuru / 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 83 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 83. *Sardinella lemuru* / Bali sardinella / Lemuru / SAM

47. Rastrelliger kanagurta / Indian mackerel / Banyar, Kembung lelaki / RAG

The body depth of the Indian mackerel is shorter than the length of the head and the mouth is large (Figure 84). Indian mackerels can grow to lengths of 35cm. There is a black spot near the lower margin of the pectoral fin. The body is a silver/white colour, with a number of dark stripes on the dorsal side. Some of these dark stripes may break into smaller spots. The second dorsal fin is smaller than the first. The dorsal fins are yellowish with black tips and the pectoral fins are yellowish.

Figure 84. *Rastrelliger kanagurta* / Indian mackerel / Banyar, Kembung lelaki / RAG

48. 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 85). 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 85. *Rastrelliger brachysoma* / Short mackerel / Kembung perempuan / RAB

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 weight of the box should be recorded.

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.

Method 2 – sampling for small vessels, <3GT, which transship catch or unload on land

- Record the number of each fish, i.e. 1, 2, 3, etc,
- 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 a top 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):

UL1, Section 1 – general information

Tempat Pendaratan	-	Name of the port/landing site
Nama Perusahaan	-	Name of the supplier/company
SF 1, SF 2	-	Names of the sustainability facilitators
Number of hooks	-	Record whether single or multiple hooks were used, or if a combination of both was used. S – single, M – multiple and B – both.
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 target 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	-	Amount of fuel used during the trip, L
Kapasitas Kapal	-	Vessel capacity, in gross tonnage, GT
Panjang Kapal	-	Vessel length, in metres, m
Kapasitas mesin	-	Engine capacity, in horse power, HP/PK
Pengguaan Es	-	Total amount of ice used on the trip, kg
Tuna locating technique	-	Tuna locating technique, i.e. birds, dolphins, kites...
Number of crew	-	Number of crew per vessel
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
Alat Tangkap	-	If handline gear was used, mark with an 'x' whether it was troll line. If another gear besides handline was used, write the name of the additional gear here

UL1, Section 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	-	Estimate of fish lost, kg

Hilang		
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

UL1, Section 3 – bait information

Kategori	-	Bait category, recorded as one or more of the seven bait categories: A) squid, B) flying fish, C) tongkol species, D) scad species, E) tuna, dead bait pieces/live bait whole and F) artificial bait and G) other.
Spesies	-	Bait species, if known (see *SOP VI*)
Daerah Penangkapan	-	Fishing ground for bait. Use the gridded maps from *SOP I*
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
Tangkapan domestic / import	-	Is the bait sourced from domestic fisheries, D, or imported, I

UL1, Section 4 – other types of catches

Nama species	-	Species name of other catches
No.	-	Number of individuals caught per species
Kg	-	Weight of total individuals caught
Perkiraan	-	Is the weight an estimate, Y / N

UL2, Section 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, Section 6 and UL3, Section 6 cont. – random length sampling of individuals <10kg

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.

UL4, Section 7 – 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

UL4, Section 8 and UL5, Section 8 cont. – measurements for individuals >10kg, whole or processed

No. Ikan	-	Record the 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 1	-	If the fish is processed, record the weight, kg, of the top right or left loin. The weight should be recorded to one decimal place
Panjang Loin 1	-	If the fish is processed, record the length, cm, of the top right or left loin. The same top loin must be measured for the loin length and weight.
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. If handline gear is used specify whether it is surface, deepwater or troll
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 YFT and total SKJ)
	Tuna Besar, >10kg	- Where possible, record the total weight of each of the following species: ALB, BET and YFT - If YFT is landed in loins, record the weight of dirty loins, clean loins and total weight
	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 DI PELABUHAN	Versi : September 2015		
			Hal :	dari
Bagian 1 : Informasi Kapal Utama				
Tempat Pendaratan:	**Nama Perusahaan :**	**SF 1:**	**SF 2:**	**Jumlah mata pancing**
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):**	**Rumpon:**
Kapasitas kapal (GT):	**Panjang Kapal (m):**	**Kapasitas mesin (PK):**	**Penggunaan Es (Kg):**	
Bahan kapal:	**Jumlah awak kapal:**	**Teknik mengetahui lokasi tuna:**		
Alat Tangkap				
Handline Troll		**Lain**		

Bagian 2 : Informasi Kapal Kecil: Bongkar ke Kapal Utama

No	Nama Kapal/ Kapten	Total Penangkapan (Kg)	Estimsi Ikan Hilang (Kg)	Lama Trip (Hari/ Jam)	Penggunaan BBM (Lt):	Kapasitas mesin (PK):	No	Nama Kapal/ Kapten	Total Penangkapan (Kg)	Estimsi Ikan Hilang (Kg)	Lama Trip (Hari/ Jam)	Penggunaan BBM (Lt):	Kapasitas mesin (PK):
1							6						
2							7						
3							8						
4							9						
5							10						

Bagian 3: Informasi Umpan

Kategori	Spesies	Daerah Penangkapan	Total Umpan (Kg)	Estimasi Umpan (Kg)	Alat tangkap Umpan	Tangkapan domestik / impor
A Cumi-Cumi						
B Ikan Terbang						
C Spesies Tongkol						
D Spesies Layang						
E Spesies Tuna						

F Umpan Tiruan						
G Lain-Lain						

UL2 **MDPI/IMACS FORM SAMPLING TUNA 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 DI PELABUHAN	Versi: September 2015

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 DI PELABUHAN Versi: September2015**

Hal : dari

Bagian 8: 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)

Deskripsi mengenai sampling

Bagian 9 : Ringkasan Per Kategori (Tuna >10kg)

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

Bagian 10 : Tuna >10kg UtuhdanDalamKeadaanSebagianDiproses

No.	Spesies	KODE	Berat Utuh (Kg)	Panjang Utuh/ Karkas (cm)	Berat Loin atas (Kg)	Panjang Loin atas (cm)	TermasukInsang? (Y/T)	Termasuk Isi Perut? (Y/T)	Termasuk DagingPerut? (Y/T)

UL5	MDPI/IMACS FORM SAMPLING TUNA DI PELABUHAN	Versi: September2015

Hal : dari

Bagian 11 : Tuna >10kg: UtuhdanDalamKeadaanSebagianDiproses - Sambungan

No.	Spesies	KODE	Berat Utuh (Kg)	Panjang Utuh/ Karkas (cm)	Berat Loin atas (Kg)	Panjang Loin atas (cm)	TermasukInsang? (Y/T)	Termasuk Isi Perut? (Y/T)	Termasuk DagingPerut? (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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