

Tuna Fishing Gear Used in Indonesian Archipelagic Waters

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1 Introduction

Tuna fisheries are of major importance in Indonesian Archipelagic Waters (IAW), which include fisheries management areas (FMAs or "Wilayah Pengelolaan Perikanan") WPP 713, 714 and 715. This area is reported to produce more than half of all tuna landings in Indonesia [1]. The fisheries here include three major oceanic species, yellowfin tuna or "madidihang" (*Thunnus albacares*), bigeye tuna or "tuna mata besar" (*Thunnus obesus*), and skipjack tuna or cakalang (*Katsuwonus pelamis*), as well as a number of neritic (coastal) tuna species such as kawa-kawa or "tongkol" (*Euthynnus affinis*), frigate tuna or "tongkol krai" (*Auxis thazard*), bullet tuna or "tongkol lisong" (*Auxis rochei*) and longtail tuna or "tongkol abu-abu" (*Thunnus tonggol*).

The information on tuna effort and catch in the IAW is still fragmented and has a low resolution in terms of the gear types used in the highly complex fisheries here. The Government of Indonesia (GoI) has issued a fishing gear classification under Ministerial Decree No. 6 in 2010, but this regulation does not cover the complexity of the multi-gear and multi-scale fisheries in the IAW. Since that complexity is of major importance when assessing selectivity, catchability, and effort components of fishing mortality, there is an urgent need to improve the categorization tuna fishing gears used in the IAW and beyond.

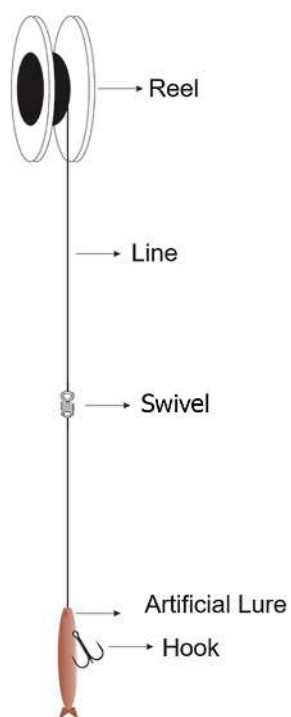
The current report for the first time provides the high resolution needed to accurately describe the fishing gears based on the frame survey that was done from January 2017 to January 2019 covering 46 tuna landing sites in 12 provinces along IAW [2]. It starts from many different types of small scale hook and line gears to larger scale long lines, pole and line, purse seine, gillnet, and even explosives [3]. In the classification of the hook and line gears, we include the method of application, hook size, and type and size of the baits and lures. For each gear type, we also indicate the typical target and non-target catches, whereas actual species and size-structured catches will be recorded for each of these gear types through our SPOT-CODRS approach. For larger tuna species, we categorize target catches by species as well as by size class, with baby tuna (applies for both yellowfin and bigeye tuna) classified as up to 60 cm, medium tuna between 61 and 105 cm and large tuna for specimen larger than 105 cm [4].

2 Trolling line for large tuna with large hook

2.1 Trolling line without kite, one large hook, artificial lure (TrollOneLargeArtificial)

Target Catch : Medium or Large Tuna

Non-Target Catch : Skipjack tuna, Mahi-mahi, Billfish, Wahoo

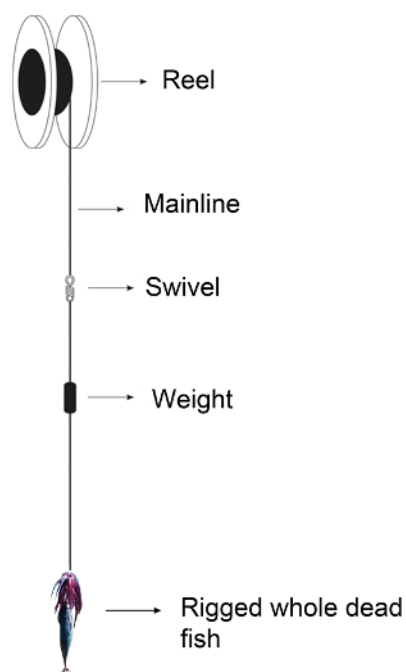


No.	Part of Gear	Information
1.	Mainline	PE, Monofilament, d=1.25 mm, l=200-300 m
2.	Artificial lure	Made from wood or lead wrapped by plastic, weight= 50-400 gr
3.	Sinker	NA
4.	Hooks	l=7 cm, w=3 cm, treble J-hook
5.	Bait	NA
6.	Swivel	Stainless steel
7.	Buoy	NA
8.	Trolling distance	20-50 m
9.	Number of hooks	NA
10.	Branch line	NA
11.	Distance branch lines	NA

2.2 Trolling line without kite, one large hook, dead natural bait (TrollOneLargeNatural)

Target Catch : Medium or Large Tuna, Mahi-mahi, Wahoo

Non-Target Catch : Skipjack tuna, Wahoo

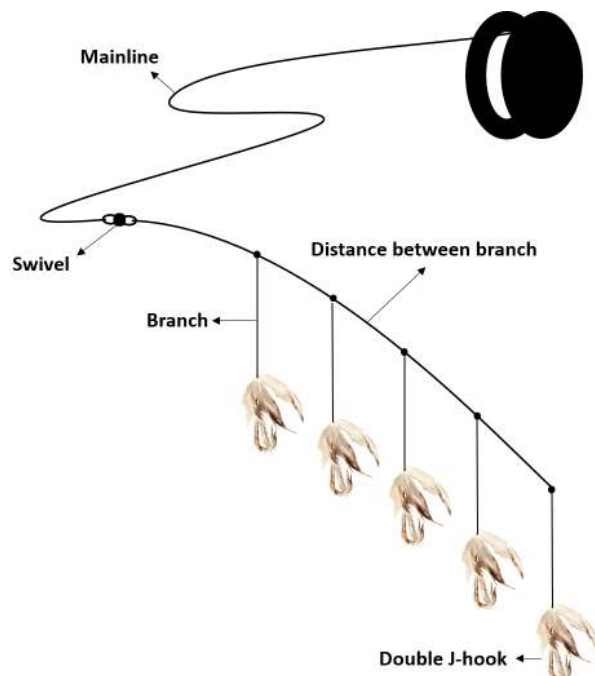


No.	Part of Gear	Information
1.	Mainline	PE, Monofilament, d=1.25 mm , l=200-300 m
2.	Artificial lure	Fabric yarns used as skirt over the bait
3.	Sinker	Lead sinker, weight= 400-500 gr
4.	Hooks	l=7 cm, w=3 cm, single J-hook
5.	Bait	Decapterus spp., Flying fish, small skipjack, bonito
6.	Swivel	Stainless steel
7.	Buoy	NA
8 .	Trolling distance	20-50 m
9 .	Number of hooks	NA
10 .	Branch line	NA
11 .	Distance branch lines	NA

2.3 Trolling line without kite, multiple large hooks, artificial lures (TrollMultipleLargeArtificial)

Target Catch : Medium or Large Tuna

Non-Target Catch : Skipjack, Wahoo, Mahi-mahi

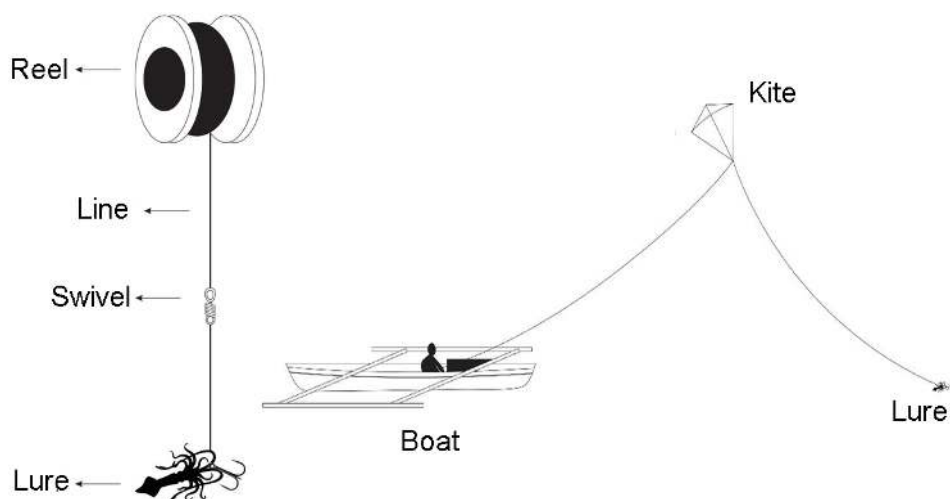


No.	Part of Gear	Information
1.	Mainline	PE, monofilament, d=1.25mm , l=200-300m
2.	Artificial lure	Feathers of bird or chicken
3.	Sinker	NA
4.	Hooks	l=6cm, w=2-3cm, double J-hook closed
5.	Bait	NA
6.	Swivel	Stainless steel
7.	Buoy	NA
8.	Trolling distance	20-50 m
9.	Number of hooks	5-6 hooks
10.	Branch line	PE, monofilament, d=1.2mm, l=20-30 cm
11.	Distance branch lines	5 m

2.4 Trolling line with kite, one large hook, artificial lure (KiteOneLargeArtificial)

Target Catch : Medium or Large Tuna

Non-Target Catch : Mahi-mahi, Billfish

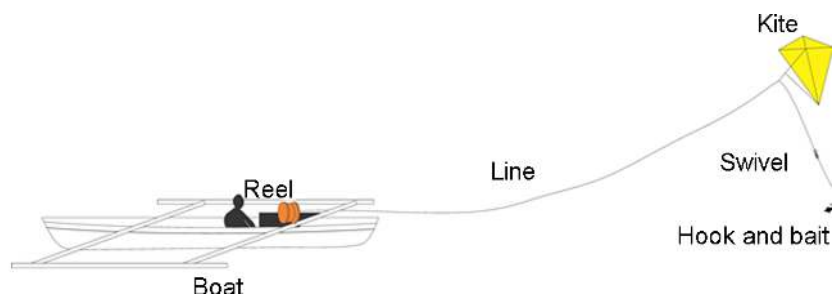
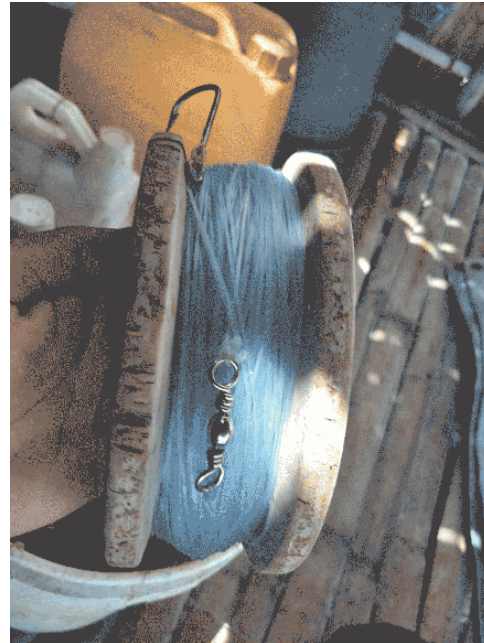
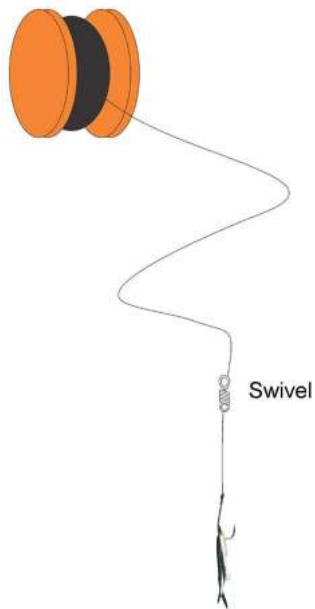


No.	Part of Gear	Information
1.	Mainline	PE monofilament, d=1.25 mm, l=200-300 m
2.	Artificial lure	Made from rubber or plastic
3.	Sinker	NA
4.	Hooks	l=7 cm, w=3 cm, double or quadruple J-hook closed
5.	Bait	NA
6.	Swivel	Stainless steel
7.	Buoy	NA
8.	Trolling distance	20-50 m
9.	Number of hooks	NA
10.	Branch line	NA
11.	Distance branch lines	NA

2.5 Trolling line with kite, one large hook, dead natural bait (KiteOneLargeNatural)

Target Catch : Medium or Large Tuna

Non-Target Catch : Mahi-mahi, Skipjack tuna

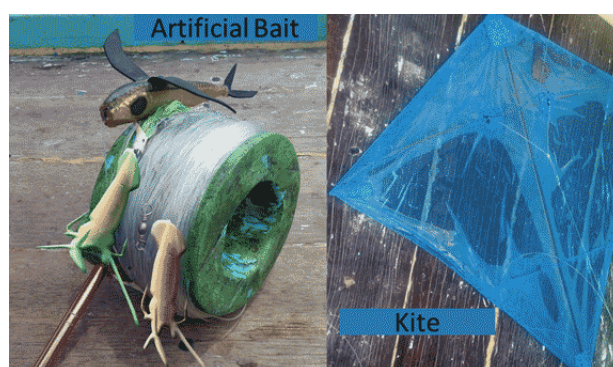
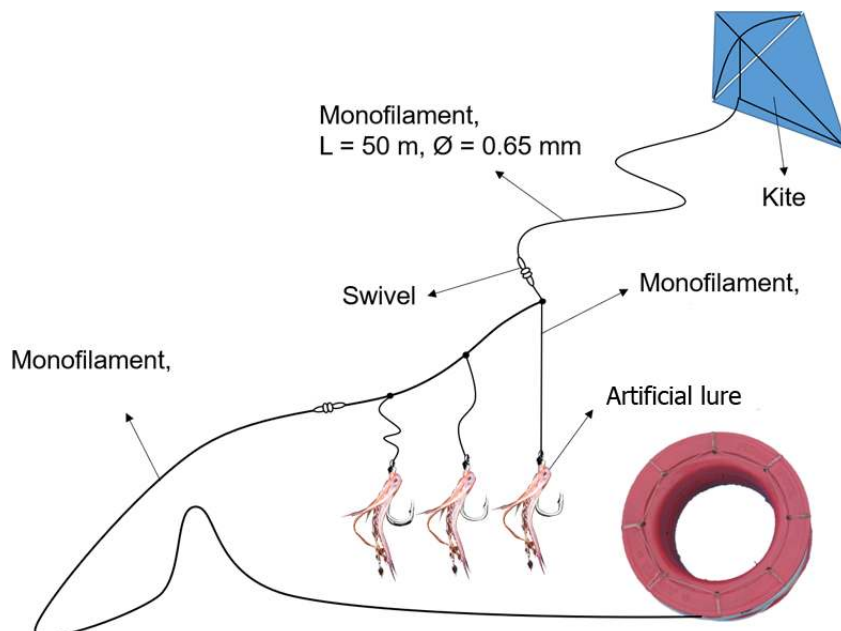


No.	Part of Gear	Information
1.	Mainline	PE monofilament, d=1.25 mm, l=200-300 m
2.	Artificial lure	NA
3.	Sinker	NA
4.	Hooks	l=7 cm, w=3 cm, single J-hook
5.	Bait	Decapterus spp., Flying fish, or Squid
6.	Swivel	Stainless steel
7.	Buoy	NA
8.	Trolling distance	30-90 m
9.	Number of hooks	NA
10.	Branch line	NA
11.	Distance branch lines	NA

2.6 Trolling line with kite, multiple Large hooks, artificial lures (KiteMultipleLargeArtificial)

Target Catch : Small and Medium Tuna

Non-Target Catch : Mahi-mahi

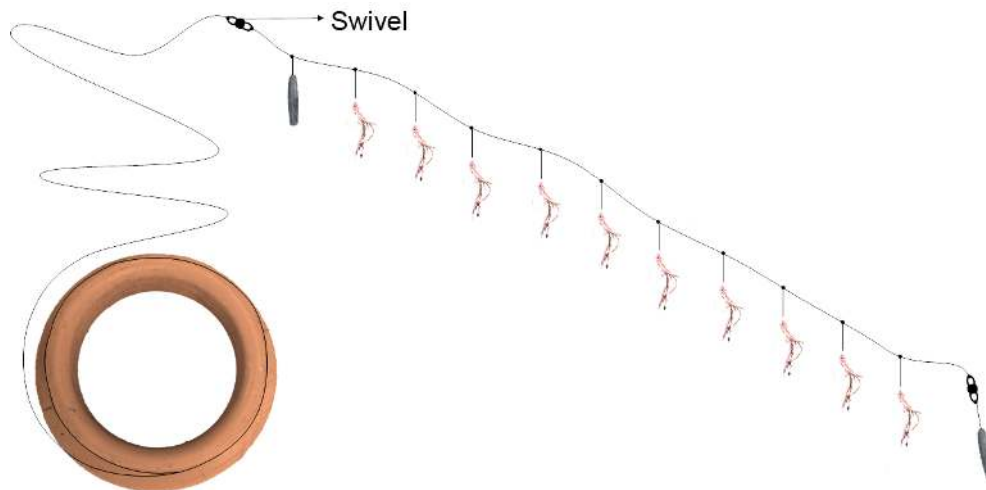


No.	Part of Gear	Information
1.	Mainline	PE Monofilament, d=1.47 mm, l=100-150 m
2.	Artificial lure	Made from rubber or plastic
3.	Sinker	NA
4.	Hooks	l=7 cm, w=3 cm, triple or quadruple J-hook
5.	Bait	NA
6.	Swivel	NA
7.	Buoy	NA
8.	Trolling distance	50-100 m
9.	Number of hooks	2-3 hooks
10.	Branch line	PE, monofilament, d=1.25mm, l=4-6 m
11.	Distance branch lines	8-15 m

3 Trolling line for small tuna with small hook

3.1 Trolling line without kite, multiple small hooks, artificial lures (TrollMultipleSmallArtificial)

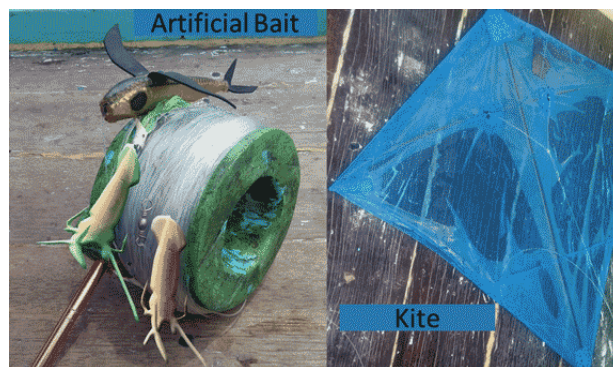
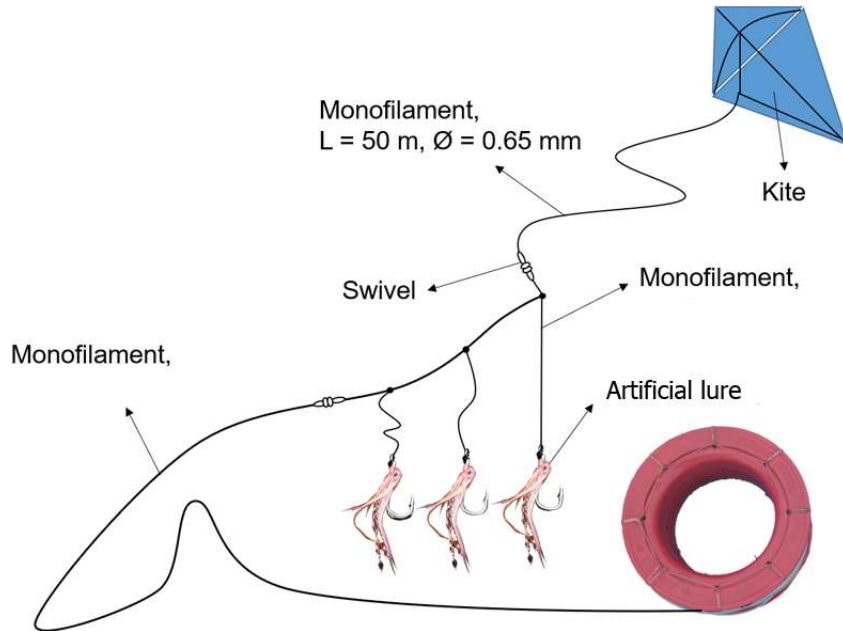
Target Catch : Baby tuna, Skipjack tuna, Bullet tuna, Frigate tuna, Kawa-kawa
Non-Target Catch : Mahi-mahi (small)



No.	Part of Gear	Information
1.	Mainline	PE monofilament, d=1.2 mm, l=200-300 m
2.	Artificial lure	plastic yarns, silk lure
3.	Sinker	Lead sinker weight=100 gr
4.	Hooks	l=4 cm, w=1.5 cm, single J-hook
5.	Bait	NA
6.	Swivel	Stainless steel
7.	Buoy	NA
8 .	Trolling distance	30-90 m
9 .	Number of hooks	50 hooks
10 .	Branch line	PE, monofilament, d=1.2mm, l=20-30 cm
11 .	Distance branch lines	0.5-5 m

3.2 Trolling line with kite, multiple Small hooks, artificial lures (KiteMultipleSmallArtificial)

Target Catch : Baby tuna, Skipjack tuna, Bullet tuna, Frigate tuna, Kawa-kawa
Non-Target Catch : Mahi-mahi (small)



No.	Part of Gear	Information
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3.3 Trolling line without kite, one small hook, artificial lure (TrollOneSmallArtificial)

Target Catch : Baby tuna, Skipjack tuna, Bullet tuna, Frigate tuna, Kawa-kawa
Non-Target Catch : Mahi-mahi (small)



No.	Part of Gear	Information
1.	Mainline	PE monofilament, d=0.94mm l=20-30m
2.	Artificial lure	Artificial made from silk or plastic
3.	Sinker	NA
4.	Hooks	l=2.6cm w=0.8cm, treble J-hook
5.	Bait	NA
6.	Swivel	NA
7.	Buoy	NA
8.	Trolling distance	10-30 m
9.	Number of hooks	3 hooks
10.	Branch line	NA
11.	Distance branch lines	NA

3.4 Trolling line without kite, one small hook, natural bait (TrollOneSmallNatural)

Target Catch : Baby tuna, Medium tuna, Skipjack tuna

Non-Target Catch : Mahi-mahi (small and medium)



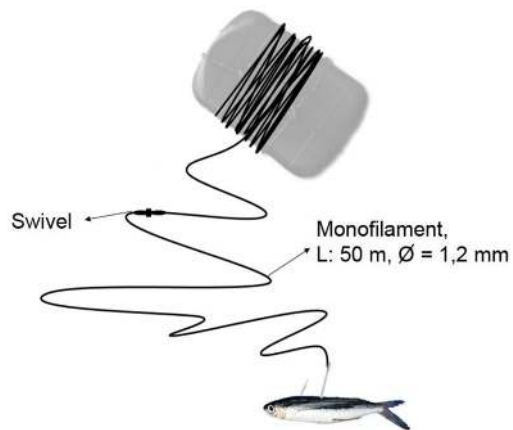
No.	Part of Gear	Information
1.	Mainline	PE monofilament, d=1.58 mm, l=70 m
2.	Artificial lure	NA
3.	Sinker	Lead sinker, weight=300-500 gr
4.	Hooks	l=5 cm, w=1.9 cm, single J-hook
5.	Bait	Decapterus spp., Flying fish, Selar crumenophthalmus
6.	Swivel	Stainless steel
7.	Buoy	Jerry can
8.	Trolling distance	5-30m
9.	Number of hooks	NA
10.	Branch line	PE monofilament, d=1.06mm l=10m
11.	Distance branch lines	NA

4 Handline for large tuna with large hook

4.1 Drift line with buoy, one large hook, natural bait (DriftOneLargeNatural)

Target Catch : Large & Medium Yellowfin Tuna, Bigeye Tuna, Billfish

Non-Target Catch : Mahi-mahi

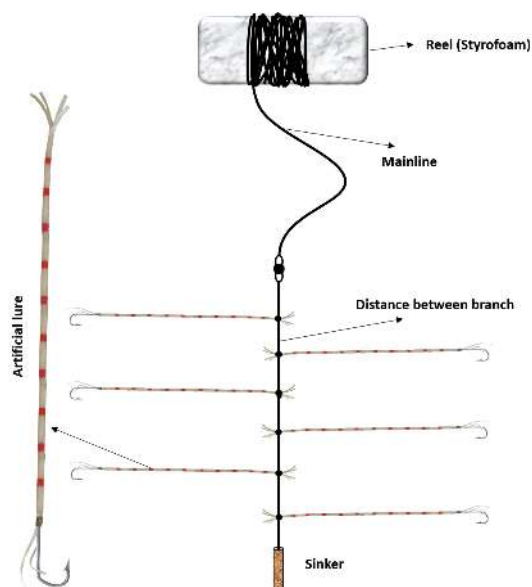


No.	Part of Gear	Information
1.	Mainline	PE, monofilament, d=1.25 mm, l=150-200 m
2.	Artificial lure	NA
3.	Sinker	NA
4.	Hooks	l=7 cm, w=3 cm, single J-hook
5.	Bait	Decapтерus spp, Flying fish, baby tuna, small skipjack
6.	Swivel	Stainless steel
7.	Buoy	Jerry can or styrofoam
8.	Number of hooks	NA
9.	Branch line	NA
10.	Distance branch lines	NA
11.	Fishing depth	30-40 m

4.2 Weighted drift line with buoy, multiple large hooks, artificial lures (DriftMultipleLargeArtificial)

Target Catch : Medium or Large Tuna

Non-Target Catch : Skipjack, Wahoo

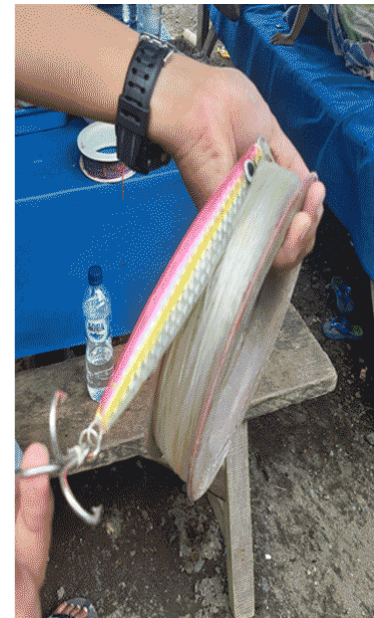
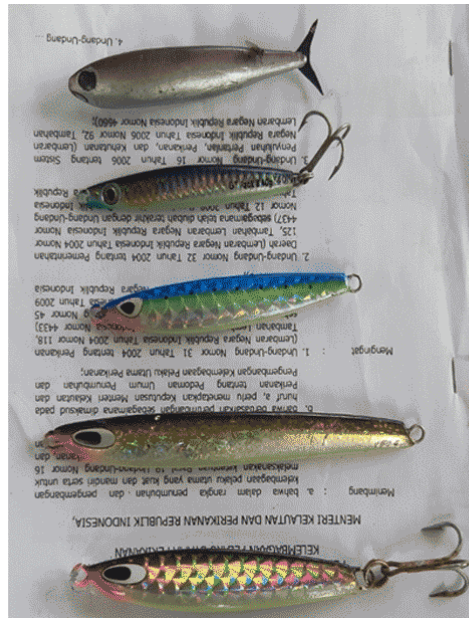
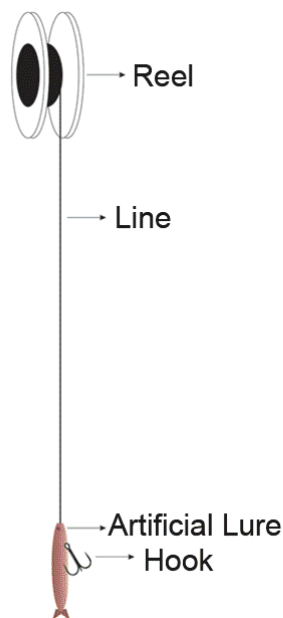


No.	Part of Gear	Information
1.	Mainline	PE monofilament, l=100-150 m
2.	Artificial lure	Rubber
3.	Sinker	Lead sinker or iron
4.	Hooks	l=4-6cm, w=1-3cm, single J-hook
5.	Bait	NA
6.	Swivel	Stainless steel
7.	Buoy	Jerry can, Styrofoam
8.	Number of hooks	6-7 hooks
9.	Branch line	monofilament covered by rubber tube, l=0.5-1 m
10.	Distance branch lines	12-15 m
11.	Fishing depth	? m

4.3 Weighted drop lines with one large hook, artificial lure (DropOneLargeArtificial)

Target Catch : Large Tuna

Non-Target Catch : Mahi-mahi, Billfish

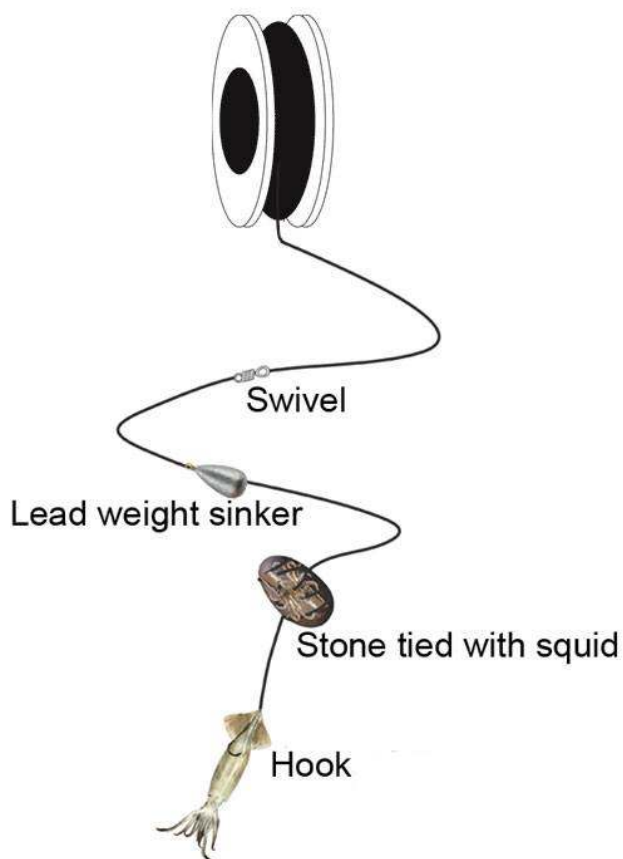


No.	Part of Gear	Information
1.	Mainline	PE, monofilament, l=130-200 m
2.	Artificial lure	Made from lead or iron wrapped by plastic (Jigging bait)
3.	Sinker	The artificial lure, weight = 400-900 gr
4.	Hooks	l=7 cm, w=3 cm, Treble J-Hook
5.	Bait	NA
6.	Swivel	NA
7.	Buoy	NA
8.	Number of hooks	NA
9.	Branch line	NA
10.	Distance branch lines	NA
11.	Fishing depth	80-150 m

4.4 Weighted drop lines with one large hook, natural bait (DropOneLargeNatural)

Target Catch : Large Tuna

Non-Target Catch : Mahi-mahi, Billfish

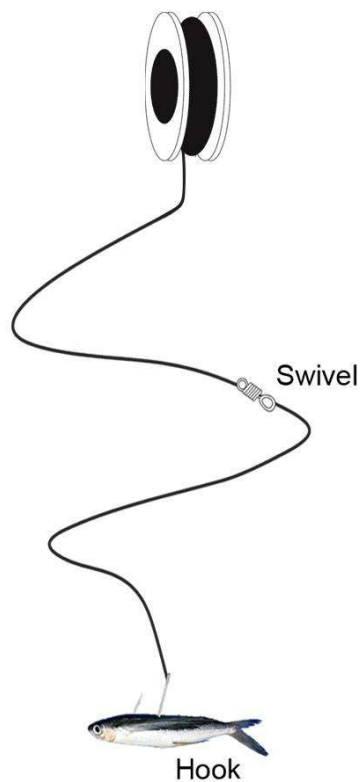


No.	Part of Gear	Information
1.	Mainline	PE, monofilament, l=150-200 m
2.	Artificial lure	NA
3.	Sinker	Lead sinker, Stone 1-2 kg
4.	Hooks	l=6 cm, w=3 cm, single J-hook
5.	Bait	Piece of fish (decapterus, flying fish), piece of squid
6.	Swivel	Stainless steel
7.	Buoy	NA
8.	Number of hooks	NA
9.	Branch line	NA
10.	Distance branch lines	NA
11.	Fishing depth	NA

4.5 Surface line with one large hook, live bait (SurfaceOneLargeLive)

Target Catch : Medium or Large Tuna

Non-Target Catch : Billfish, Wahoo, Mahi-mahi, big Skipjack



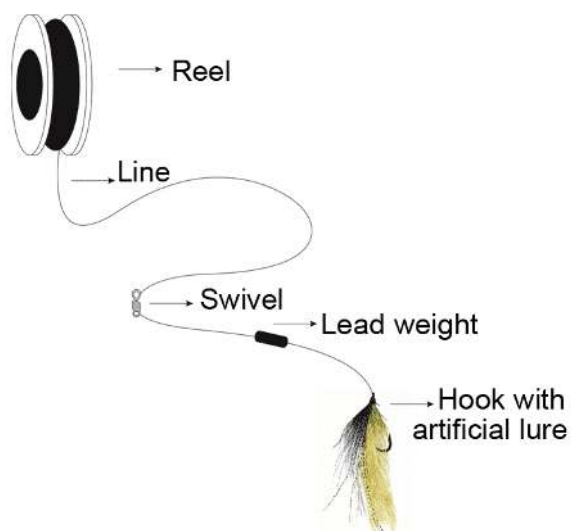
No.	Part of Gear	Information
1.	Mainline	Monofilament, l=150-180 m
2.	Artificial lure	NA
3.	Sinker	NA
4.	Hooks	l=6-7 cm, w=2-3 cm, single-J hook
5.	Bait	Live flying fish, Decapterus spp., Auxis spp, baby tuna, small skj
6.	Swivel	Optional
7.	Buoy	NA
8.	Number of hooks	NA
9.	Branch line	NA
10.	Distance branch lines	NA
11.	Fishing depth	NA
12.	Fishing surface	0-10 m

5 Handline for small tuna with small hook

5.1 Weighted drop lines with one small hook, artificial lure (DropOneSmallArtificial)

Target Catch : Small and Medium Tuna

Non-Target Catch : Mahi-mahi, Skipjack



No.	Part of Gear	Information
1.	Reel	Wood or plastic
2.	Mainline	Monofilament, l=100-150 m
3.	Artificial lure	Artificial made from silk or rubber
4.	Sinker	Lead sinker, weight = 400-600 gr
5.	Hooks	l=4-5.5 cm, w=1-1.5 cm, Single J-hook
6.	Bait	NA
7.	Swivel	Stainless steel material
8.	Buoy	NA
9 .	Number of hooks	NA
10 .	Branch line	NA
11 .	Distance branch lines	NA
12 .	Fishing depth	30-100 m

5.2 Weighted drop lines with one small hook, natural bait (DropOneSmallNatural)

Target Catch : Small and Medium Tuna

Non-Target Catch : Wahoo, Barracuda

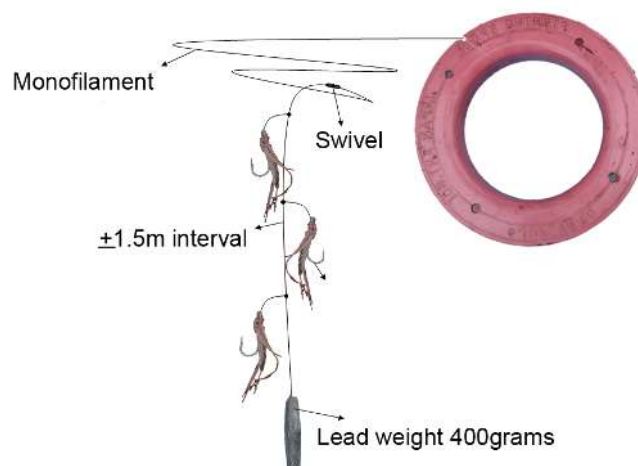


No.	Part of Gear	Information
1.	Mainline	Monofilament, d=1.2 mm, l=100-200 m
2.	Artificial lure	NA
3.	Sinker	Lead sinker, weight=400 gr
4.	Hooks	l=4-5.5 cm, w=1-1.5 cm, Single J-hook
5.	Bait	Bigeye Scad
6.	Swivel	NA
7.	Buoy	NA
8.	Number of hooks	NA
9.	Branch line	NA
10.	Distance branch lines	NA
11.	Fishing depth	NA

5.3 Weighted drop lines with multiple small hooks, artificial lures (DropMultipleSmallArtificial)

Target Catch : Baby Tuna, Skipjack, Tongkol

Non-Target Catch : Rainbow Runner, Trigger Fish, Squid

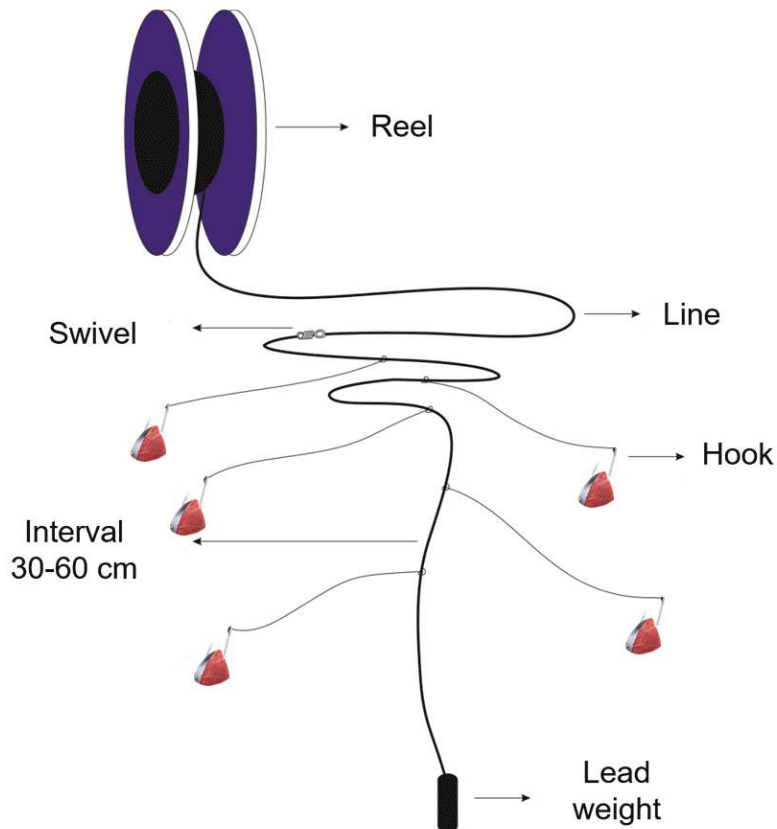


No.	Part of Gear	Information
1.	Mainline	PE monofilament, d=1.2 mm, l= 100-150 m
2.	Artificial lure	Made from rubber, silk or plastic
3.	Sinker	lead sinker, weight = 400 - 500 gr
4.	Hooks	l= 5.5 cm, w= 1.5 cm, single J-hook
5.	Bait	NA
6.	Swivel	Stainless steel
7.	Buoy	NA
8 .	Number of hooks	10-20 hooks
9 .	Branch line	50-100 cm
10 .	Distance branch lines	1.5 m
11 .	Fishing depth	30-40 m

5.4 Weighted drop lines with multiple small hooks, natural baits (DropMultipleSmallNatural)

Target Catch : Baby Tuna, Skipjack, Tongkol

Non-Target Catch : Rainbow Runner, Trigger Fish, Squid



No.	Part of Gear	Information
1.	Mainline	PE monofilament
2.	Artificial lure	NA
3.	Sinker	lead sinker, weight = 400 - 500 gr
4.	Hooks	l=6 cm, w=2.5 cm, single J-hook
5.	Bait	Piece of fish, Decapterus spp, Flying fish, Squid
6.	Swivel	Stainless steel
7.	Buoy	NA
8.	Number of hooks	5 hooks
9.	branch line	20-30 cm
10.	Distance branch lines	30-60 cm
11.	Fishing depth	10-20 m
12.	Fishing surface	NA

5.5 Rod and reel (RodAndReel)

Target Catch : Mahi-mahi, Wahoo, Amberjack, Skipjack

Non-Target Catch : Rainbow runner, Tripletail



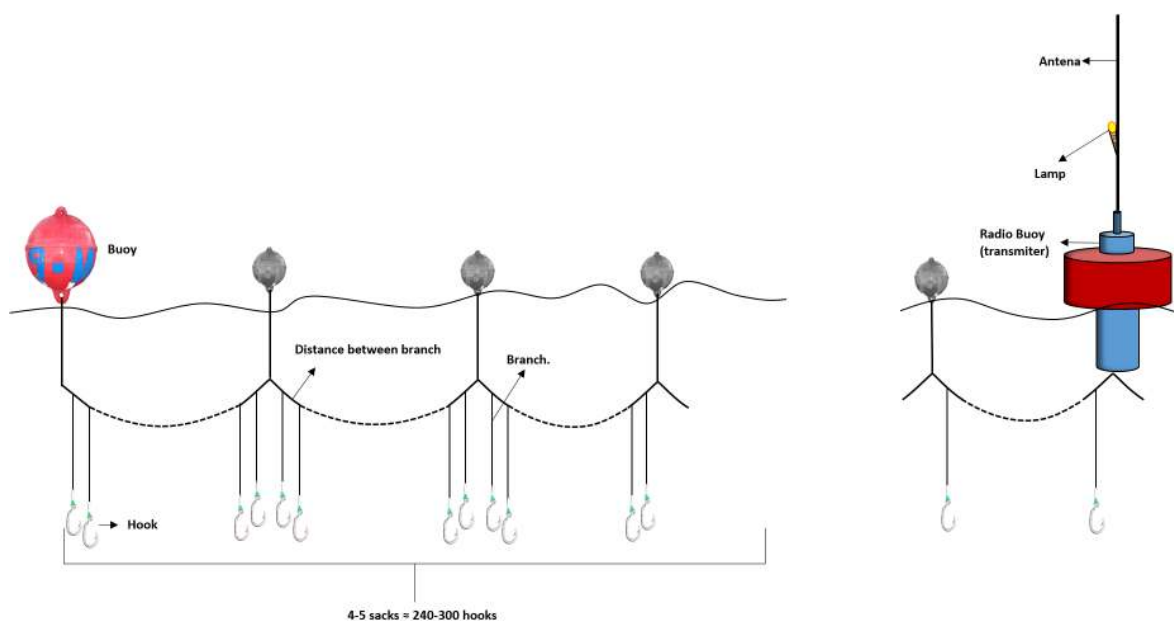
No.	Part of Gear	Information
1.	Mainline	Monofilament, l= 150 m
2.	Artificial lure	Made from metal, Jigging
3.	Sinker	NA
4.	Hooks	l=3 cm, w=1.8 cm, single or treble J-hook
5.	Swivel	NA
6 .	Stick	Fiberglass or carbon fiber

6 Longline

6.1 Longlines with multiple large hooks, natural baits (LongMultipleLargeNatural)

Target Catch : Large Yellowfin, Bigeye, Billfish

Non-Target Catch : Opah



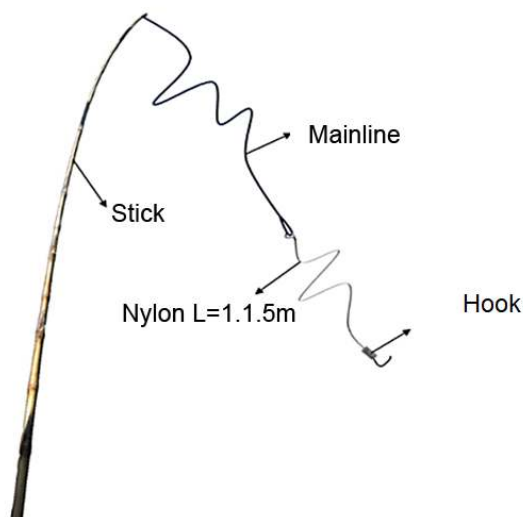
No.	Part of Gear	Information
1.	Mainline	9-10 km
2.	Artificial lure	NA
3.	Sinker	NA
4.	Hooks	l=5-6cm, w= 3 cm, single J-hook or circle hook
5.	Bait	Decapterus spp., flying fish, small milk fish
6.	Swivel	Stainless steel
7.	Buoy	6-7 buoys, made from plastic
8.	Branch line	20-30 m
9.	Distance branch line	35 m
10.	Total hooks	1200-1500 hooks
11.	Total hooks between buoy	240-300 hooks
12.	Number of hooks per sack	60 hooks
13.	Number of sacks between buoy	4-5 sacks
14.	Distance between branch lines	50-80 m

7 Pole and line

7.1 Pole and line with artificial lure, live chum (PoleAndLine)

Target Catch : Skipjacks, Baby tuna, Medium tuna

Non-Target Catch : Tongkol, Rainbow runner, Mahi-mahi



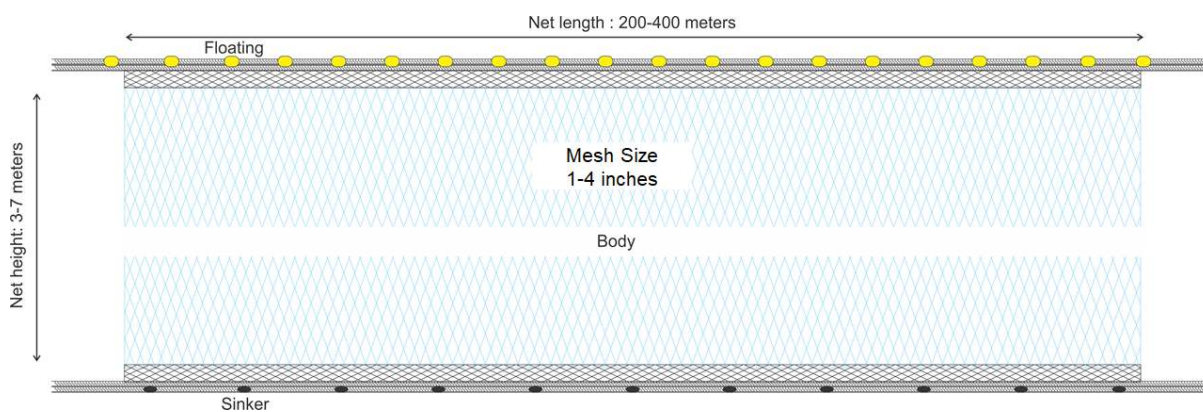
No.	Part of Gear	Information
1.	Mainline	Monofilament, d=3.2 mm, l=1-1.5 m
2.	Sinker	NA
3.	Hooks	jig-hook, home made
4.	Lure	Artificial made from silky yarns or feather of chicken or bird
5.	Swivel	NA
6.	Stick	l=2-3.5m
7.	Chum	Live anchovy or milk fish

8 Gillnet

8.1 Drifting gillnets with buoys at the surface (Gillnet)

Target Catch : Mackerel, Skipjack, Baby tuna

Non-Target Catch : Mahi-mahi, Billfish, Shark



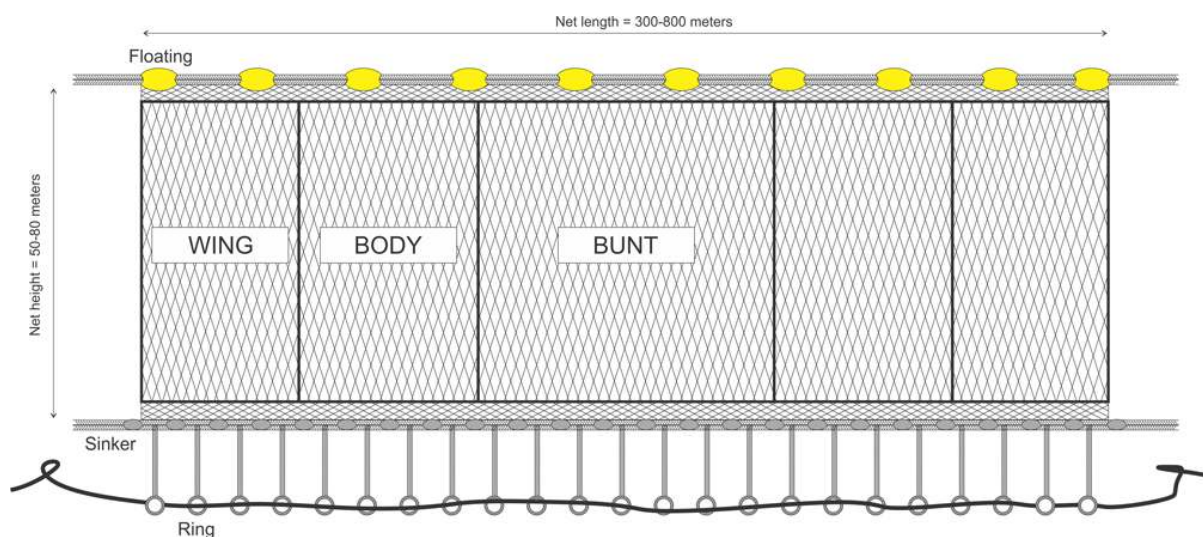
No.	Part of Gear	Information
1.	Float rope	PA, Multifilament, l=200-400 m per piece
2.	Floater	jerry can, plastic
3.	Distance between float	? m
4.	pieces	230 pieces
5.	Total depth/height	16.2 m
6.	Ground rope	PA, multifilament, l = 200-400 m/piece, d= ?
7.	Sinker	heavy rope or made from cement
8.	Anchor	NA

9 Purse seine

9.1 Boat operated surface encircling nets with purse lines (PurseSeine)

Target Catch : Mackerel scad, Yellowstripe scad, Skipjack, Baby tuna, Bullet tuna

Non-Target Catch : Rainbow runner, Medium tuna, Mahi-mahi

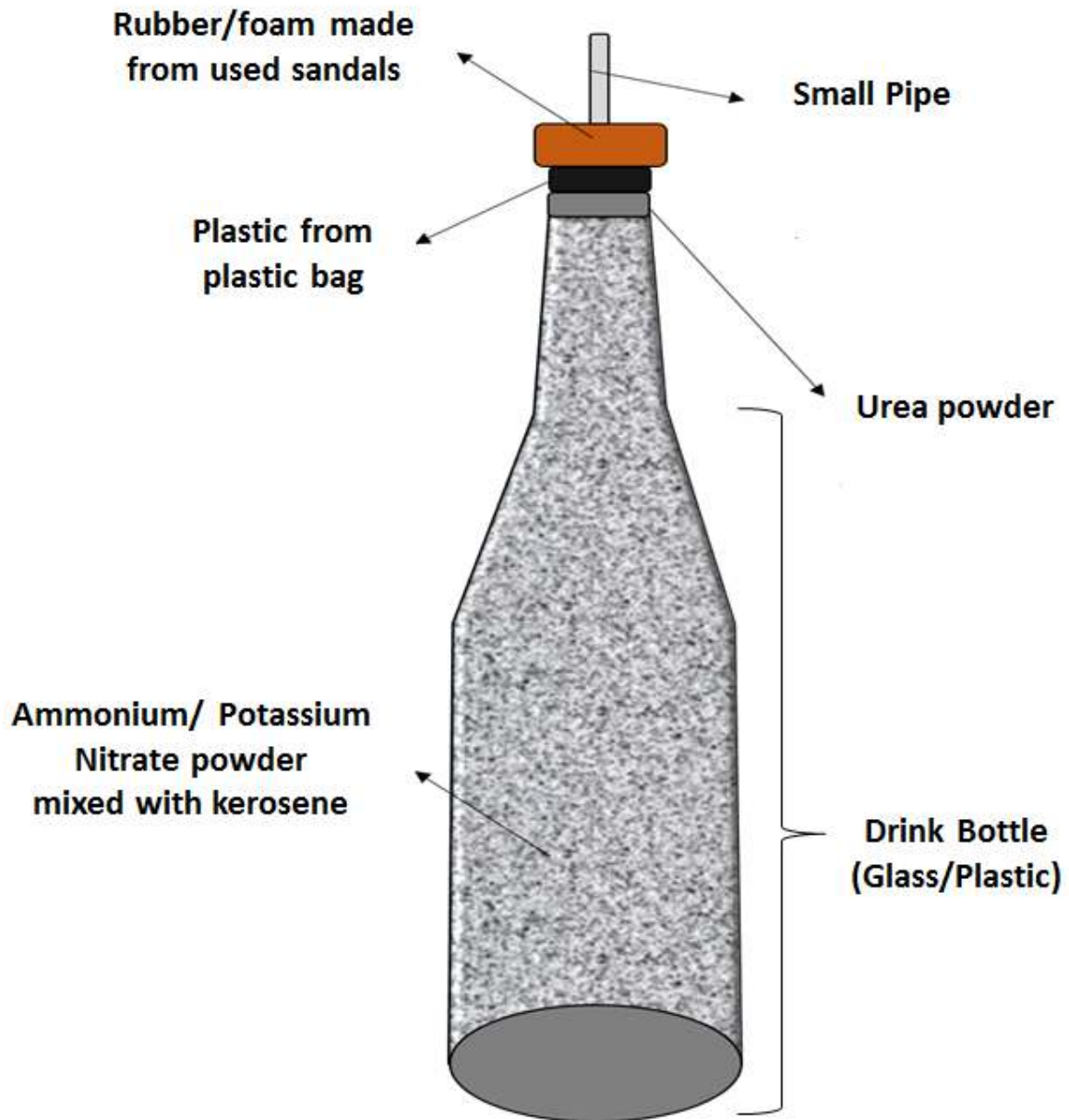


No.	Part of Gear	Information
1 .	Net (bag)	PE monofilament, mesh size = 25 mm
2 .	Total depth/height	m
3 .	Float rope	l = 225 m
4 .	Floater	made from, size, total
5 .	Distance between float	? m
6 .	Sinker line	l = 225 m
7 .	Purse line	350 m

10 Explosives (Explosives)

Target Catch : Baby tuna, Medium tuna, Skipjack tuna

Non-Target Catch : Sharks, Dolphin



No.	Part of Gear	Information
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11 Other (Other)

Any gear type not elsewhere included.

12 Mixed gears (MixedGears)

Any combination of gear types above

13 References

- [1] Ministry of Marine Affairs and Fisheries [MMAF], 2017. Statistics of Marine Capture Fisheries by Fisheries Management Area (FMA) 2015-2016. Jakarta.
- [2] Aidy, A. D. G. Fergiawan, D. Kolibongso and Y. Apridianto. 2019. Frame Survey of Tuna Fisheries in Indonesian Archipelagic Waters (IAW). TNC-IFCP Technical Report. Denpasar.
- [3] WWF-Indonesia, 2013. Bomb fishing in the East Flores Waters. Jakarta. 18pp.
- [4] Haruna, A. Mallawa, Musbir and M. Zainuddin, 2018. Population dynamic indicator of the yellowfin tuna (*Thunnus albacares*) and its stock condition in the Banda Sea, Indonesia. *AAFL Bioflux* 11(4): 1323- 1333.