Southeast Asian Fisheries Development Center

Training Department

CRUISE REPORT ON RESEARCH ACTIVITY
M.V. PLALUNG Cruise No. 5-1/2023

3 – 10 April 2023 (8 days)

Sea Trial for Trawl Monitor System (SCANMAR), Experiment on the Comparative Efficiency and Impact of Vee Type and Rectangular Otter Boards for Trawling

TD/RP/227

This report bases on preliminary data
For readers who may need data in the report, please contact to:

Southeast Asian Fisheries Development Center
Training Department
PO. BOX 97 Phrasamutchedi
Samut Prakan, 10290
THAILAND
Tel: 662-4256100
Fax: 662-4256110
E-mail: td@seafdec.org

Contents

1. Cruise Summary

Vessel name **:** M.V. PLALUNG

Cruise No. **:** M.V. PLALUNG No.5-1/2023

Period **:** 3 – 10 April 2023 (8 days)

Area of Operation **:** Upper part of the Gulf of Thailand (Rayong Province)

Port of Call **:** Ban Phe Municipality Pier, Rayong Province, Thailand

Activities **:** Sea trial for trawl monitor system (SCANMAR)

: Conduct the Experiment on the comparative efficiency and impact of Vee type and Rectangular otter boards for trawling

2. List of ship personnel (M.V. PLALUNG)

No.	Name	Position
1	Mr. Woraphat Soodkangwan	Skipper
2	Mr. Rattanawat Ponsawat	Able seaman
3	Mr. Somyos Pornprasert	Fishing assistance
4	Mr. Wasuphon Laeatoso	Fishing assistance
5	Mr. Chanchai Chid-u-dom	Oiler
6	Mr. Adisak Aiemsuwan	Oiler
7	Mr. Phisanu Chantahnid	Cook

3. Researchers from SEAFDEC/TD

No.	Name	Position	Period on board
1	Dr. Nopporn Manajit	Researcher	4-9 April 2023
2	Mr. Nakaret Yasuk	Researcher	4-9 April 2023
3	Mr. Santiphong Putsa	Researcher	4-9 April 2023
4	Mr. Komson Pofa	Researcher	4-9 April 2023
5	Dr. Supapong Pattarapongpan	Researcher	4-9 April 2023
6	Ms. Nathacha Changphetphol	Researcher	4-9 April 2023
7	Mr. Kultawat Manomayittikan	Researcher	4-9 April 2023
8	Ms. Saruttaya Jaroonpongsawat	Researcher	4-9 April 2023

4. Observers from JTF/SEC

No.	Name	Position	Period on board
1	Dr. Tomoko Nakazato	Observer	6 April 2023
2	Mr. Takatsugu Kudoh	Observer	6 April 2023

5. Research Activities

Date	Time	Activities	Remark
03 April 23	0530	All crews of M.V. PLALUNG embarked on the vessel	
	0630	M.V. PLALUNG Left SEAFDEC/TD for Ao Phe, Rayong Province	
	0800	All researchers Left SEAFDEC/TD by SEAFDEC's van for Ban Phe, Rayong Province	-
	1200	Arrived at Eastern Marine Fisheries Research and Development Center (EMDEC)	13°22.42′N 100°37.67′E-13°20.74′N 100°36.60′E
	1330-1400	All researchers have a meeting with the director of EMDEC	
04 April 23	0130	M.V. PLALUNG arrived at Ao Phe and anchored at a depth of 9.0 m.	12°33.66′N 101°26.01′E
	0530	M.V. PLALUNG heaved up anchor and then proceed to Ban Phe Municipality Pier	
	0630	M.V. PLALUNG arrived at Ban Phe Municipality Pier.	
	0645	All researchers embarked the vessel M.V. PLALUNG	
	0700	Left Ban Phe Municipality Pier for the fishing ground	-
	0850-0855	Oceanographic survey Op.1, sea depth 24.8 m. - CTD	12°28.70′N 101°25.47′E-12°28.20′N 101°24.20′E
	0855-0940	SCANMAR Hydrophone preparation	
	0940-1026	Shooting bottom trawl Op.1 (Vee type otter board), sea 24.2 depth m.	12°28.20′N 101°24.18′E-12°28.29′N 101°23.22′E
	1037-1050	Hauling bottom trawl Op.1 And then proceed for bottom trawl Op.2	12°28.56′N 101°23.14′E-12°28.50′N 101°23.34′N
	1055-1105	Shooting bottom trawl Op.2 (Vee type otter board) at the sea depth of 23.0 m.	12°28.53′N 101°22.59′E-12°28.53′N 101°22.41′E
	1205-1230	Hauling bottom trawl Op.2 And then proceed for trawl Op.3	12°28.99′N 101°20.40′E-12°29.21′N 101°20.10′E
	1300-1315	Shooting bottom trawl Op.3 (Vee type otter board)	12°29.39′N 101°20.00′E - In-active SCANMAR system
	1315-1340	Hauling bottom trawl Op.3 And then proceed for bottom trawl Op.4	12°29.52′N 101°20.28′E
	1340-1350	Shooting bottom trawl Op.4 (Vee type otter board)	12°29.52′N 101°20.38′E-12°29.56′N 101°20.54′E
	1355-1415	Hauling bottom trawl Op.4 And then proceed to Ban Phe Municipality Pier	12°29.62′N 101°20.49′E-12°29.98′N 101°20.37′E
	1505-1510	Removed the otter boards at port side from gallows and stored at deck area	- Gallows at port side is broken

Date	Time	Activities	Remark
	1630	Alongside at Ban Phe Municipality Pier and all researchers disembarked the vessel	-
05 April 23	0900-1200	All researchers and crews repaired the gallows (port side) on the vessel M.V. PLALUNG	-
	1300-1700	Researchers try to transfer/export the data from SCANMAR and download data collected by SENSUS at EMDEC	-
06 April 23	0630	All researchers and observers embarked on the vessel M.V. PLALUNG at Ban Phe Municipality Pier	-
	0645	Left the port for fishing ground	-
	0820-0825	Oceanographic survey Op.5, sea depth 27.5 m. - CTD	12°29.62′N 101°20.49′E- 12°29.98′N 101°20.37′E
	0825	Vee type otter board otter boards preparation	-
	0855	Bottom trawl shooting preparation - Adjust and fix the chain position of gallows on both sides for safety operation - SCANMAR Hydrophone preparation	-
	0930-0955	Shooting bottom trawl Op.5 (Vee type otter board), sea depth 27.5 m.	12˚26.84′N 101˚23.75′E- 12˚26.87′N 101˚23.01′E
	1100-1130	Hauling bottom trawl Op.5 And then proceed for bottom trawl Op.6	12˚26.81′N 101˚20.72′E- 12˚27.81′N 101˚23.49′E
	1140-1145	Oceanographic survey Op.6, sea depth 27.0 m. - CTD	12˚47.20′N 101˚20.46′E
	1220-1250	Shooting bottom trawl Op.6 (Vee type otter board), sea depth 27.0 m. (Adjust the chain length of otter boards)	12˚27.66′N 101˚18.72′E- 12˚28.01′N 101˚17.79′E
	1350-1415	Hauling bottom trawl Op.6 And then proceed for bottom trawl Op.7	12˚28.11′N 101˚15.88′E- 12˚28.41′N 101˚15.53′E
	1435-1440	Oceanographic survey Op.7, sea 25.0 depth m. - CTD	12˚27.53′N 101˚15.72′E
	1440-1500	Shooting bottom trawl Op.7 (Vee type otter board), sea depth 26.0 m.	12˚27.58′N 101˚15.75′E- 12˚27.71′N 101˚16.10′E
	1600-1625	Hauling bottom trawl Op.7 And then proceed to Ban Phe Municipality Pier	12˚29.14′N 101˚15.00′E- 12˚29.55′N 101˚14.66′E
	1905	Alongside at Ban Phe Municipality Pier and all researchers disembark the vessel	-
07 April 23	0615	All researchers embark on the vessel M.V. PLALUNG at Ban Phe Municipality Pier	-
	0630	Left the port for fishing ground	-
	0825-0830	Oceanographic survey Op.8, sea depth 27.5 m. - CTD	12˚26.47′N 101˚24.25′E
	0830-0900	Change otter boards from Vee type otter board to Rectangular otter board otter boards	-
	0900-0915	SCANMAR Hydrophone preparation	-
	0915-0935	Shooting and hauling bottom trawl Op.8 (Rectangular otter board), sea depth 27.0 m. And then proceed for bottom trawl Op.9	12˚27.01′N 101˚24.51′E - Incomplete operation due to the weather condition (strong wind and heavy rain)
	1100-1115	Shooting bottom trawl Op.9 (Rectangular otter board), sea depth 26.0 m.	12˚27.29′N 101˚24.65′E- 12˚27.27′N 101˚24.02′E

Date	Time	Activities	Remark
	1215-1235	Hauling bottom trawl Op.9 And then proceed for bottom trawl Op.10	12˚27.43′N 101˚22.03′E- 12˚27.68′N 101˚21.80′E
	1305-1310	Oceanographic survey Op.10, sea depth 23.0 m. - CTD	-
	1310-1325	Shooting bottom trawl Op.10 (Rectangular otter board), sea depth 23.6 m.	12˚27.94′N 101˚21.67′E- 12˚27.99′N 101˚21.88′E
	1425-1440	Hauling bottom trawl Op.10 And then proceed to Ban Phe Municipality Pier	12˚28.51′N 101˚23.69′E- 12˚28.72′N 101˚23.75′E
	1655	Alongside at Ban Phe Municipality Pier and all researchers disembark the vessel	-
08 April 23	0600	All researchers embark on the vessel M.V. PLALUNG at Ban Phe Municipality Pier	-
	0615	Left the port for fishing ground	-
	0730-0800	SCANMAR Hydrophone preparation	-
	0815-0820	Oceanographic survey Op.11, sea depth 27.0 m. - CTD	-
	0825-0840	Shooting bottom trawl Op.11 (Rectangular otter board), sea depth 27.0 m.	12˚26.91′N 101˚23.55′E- 12˚26.86′N 101˚23.16′E - Add 1 buoys at front side of both otter boards
	0940-1000	Hauling bottom trawl Op.11 And then proceed for bottom trawl Op.12	12˚26.85′N 101˚21.22′E- 12˚26.94′N 101˚21.12′E
	1005-1020	Shooting bottom trawl Op.12 (Rectangular otter board), sea depth 27.0 m.	12˚26.95′N 101˚21.03′E- 12˚26.97′N 101˚20.59′E - Oil spill in the engine room while operating
	1120-1145	Hauling bottom trawl Op.12 And then proceed for bottom trawl Op.13	12˚27.39′N 101˚18.41′E- 12˚27.57′N 101˚18.06′E
	1215-1220	Oceanographic survey Op.13, sea depth 26.0 m. - CTD	-
	1220-1230	Shooting bottom trawl Op.13 (Rectangular otter board), sea depth 26.3 m.	12˚27.71′N 101˚17.85′E- 12˚27.92′N 101˚18.10′E - Remove 4 buoys at left and right of the wing net (Buoy no. 3, 5, 7, and 9)
	1330-1355	Hauling bottom trawl Op.13 And then proceed for bottom trawl Op.14	12˚30.07′N 101˚17.05′E- 12˚30.50′N 101˚16.73′E
	1400-1405	Oceanographic survey Op.13, sea depth 26.0 m. - CTD	-
	1405-1415	Shooting bottom trawl Op.14 (Rectangular otter board), sea depth 20.8 m.	12˚30.54′N 101˚16.76′E- 12˚30.63′N 101˚17.01′E
	1515-1535	Hauling bottom trawl Op.14 And then proceed to Ban Phe Municipality Pier	12˚32.81′N 101˚16.74′E- 12˚33.31′N 101˚16.53′E
	1815	Alongside at Ban Phe Municipality Pier and all researchers disembark the vessel	-
09 April 23	0610	All researchers embark on the vessel M.V. PLALUNG at Ban Phe Municipality Pier	-
	0620-0805	Left the port for fishing ground	-
	0805-0810	Oceanographic survey Op.15, sea depth 25.5 m. - CTD	-

Date	Time	Activities	Remark
	0810-0840	Change otter boards from Rectangular otter board to Vee type otter board type	-
	0845-0900	SCANMAR Hydrophone preparation	-
	0910-0925	Shooting bottom trawl Op.15 (Vee type otter board), sea depth 26.1 m.	12°27.10′N 101°25.14′E-12°27.04′N 101°24.82′E
	1025-1040	Hauling bottom trawl Op.15 And then proceed for bottom trawl Op.16	12°26.68′N 101°22.97′E-12°26.79′N 101°23.01′E
	1050-1105	Shooting bottom trawl Op.16 (Vee type otter board), sea depth 27.6 m.	12°26.82′N 101°22.93′E-12°26.76′N 101°22.57′E
	1140-1200	Hauling bottom trawl Op.16 (Urgent hauling due to finding a small-scale fishery in the towing direction) And then proceed for bottom trawl Op.17	12°26.19′N 101°21.61′E-12°25.95′N 101°21.90′E
	1210-1215	Oceanographic survey Op.17, sea depth 28.0 m. - CTD	-
	1215-1230	Shooting bottom trawl Op.17 (Vee type otter board), sea depth 28.0 m.	12°25.95′N 101°22.08′E-12°25.99′N 101°22.42′E
	1400-1425	Hauling bottom trawl Op.17 And then proceed to Ban Phe Municipality Pier	12°28.38′N 101°25.04′E-12°28.83′N 101°25.14′E
	1630	Alongside at Ban Phe Municipality Pier and all researchers disembark the vessel	-
	1710	M.V. PLALUNG Left Ban Phe Municipality Pier and then proceed to SEAFDEC/TD	
10 April 23	0900-1030	Clean and properly keep all research equipment	-
	1030	All researchers Left EMDEC for SEAFDEC/TD by SEAFDEC's Van	-
	1530	Researchers arrive at SEAFDEC/TD	-
	1610	M.V. PLALUNG alongside at SEAFDEC/TD's pier	
	1700	All crews disembarked the ship and finished the cruise	

6. Report in general

The cruise experiment was named M.V. PLALUNG Cruise No.5-1/2023. This cruise survey was conducted for the sea trial for trawl monitor system (SCANMAR) and experiments on the comparative efficiency and impact of Vee type and Rectangular otter board for trawl fishing operations. To compare the Catch Per Unit Effort (CPUE) and efficiency between both otter boards, the recorded data included as following:

- Fishes species sampling: bottom otter board trawl
- Water quality: CTD
- Net opening and Net spread: SCANMAR
- The depth of otter board: SENSUS depth recorder
- Otter board underwater observation: GoPro camera

The cruise survey was scheduled from 3 to 9 April 2023. Respecting cruise order M.V. PLALUNG Cruise No.5-1/2023, seventeen (17) operations for bottom trawl for fishery resources and benthic marine debris and ten (10) CTD portable (model. Rikko profiler ASTD103/153) were conducted.

7. Experiment area

The experiment area was conducted within Rayong Province, in the Gulf of Thailand as shown in Figure 1.

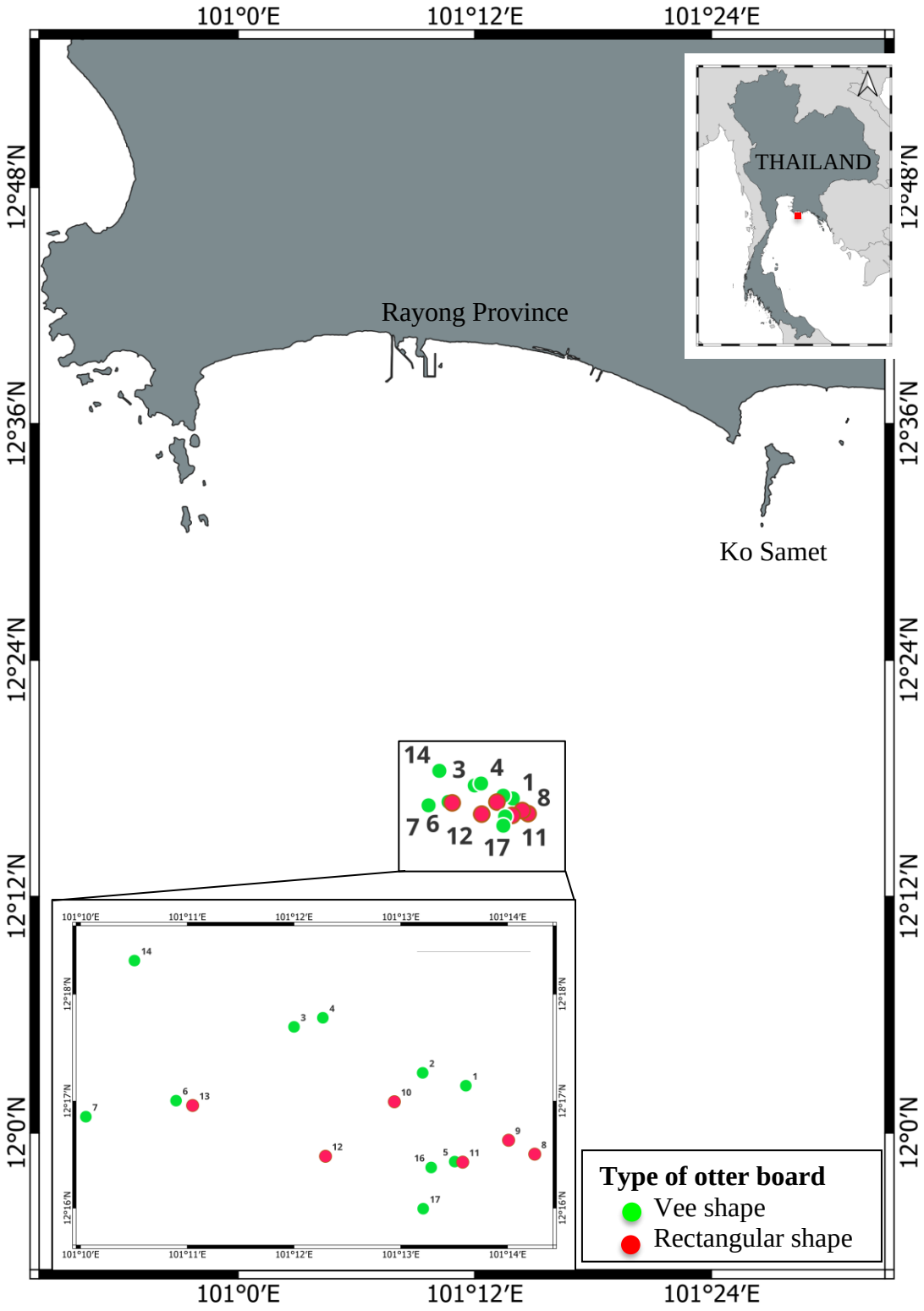


Figure 1. The experiment positions for bottom trawl operations

8. Bottom trawl fishing operation

8.1 Description

The cruise was conducted in the coastal area of Rayong Province in the Gulf of Thailand from 3 to 10 April 2023. The primary objectives were to perform a sea trial for trawl monitor system (SCANMAR) and conduct a comparative study for the catch and efficiency of Vee type and Rectangular type otter board.

In this experiment, the otter board bottom trawl was used with a net composed of two (2) seam designs, the ground rope was 36.0 m in length, the head rope was 33.0 m and the net body was 64.3 m. The ground rope was chained and specially designed for soft bottom condition. The cod-end part was made of polyethylene with a double mesh size of 40 mm (PE 700d/15). The construction of the trawl net is illustrated in Appendix 3.1

The net was spread by two pieces of wooden iron frame otter board, divided into two types; 1) Vee type otter boards with dimension was 989×1910×197 mm, the dihedral angle is 15° (Appendix 3.2 A) and rectangular otter boards with dimension was 990×1910×100 mm (Appendix 3.2 B). The towing line was made from poly-propylene braided rope with a diameter of 30 mm, the sweep line combination had a diameter of 21 mm and 12.5 m long, with the bridle being 17.5 m long. The upper bridle was made from poly-propylene braided rope with a diameter of 24 mm and the lower was made of a combination with a diameter of 21 mm.

Prior to each bottom trawl operation, general essential information on weather and oceanographic condition, towing direction/course (in a straight direction except obstructed by some objects), and safety fishing grounds were inspected. Warp length was released to 100 m, and the towing speed ranged from 1.9-2.0 knots per hour of trawling time. Trawling was conducted during the daytime.

The start of trawling time was defined as the moment when the trawling geometry stabilized, and the end of the haul was defined as the moment when the towing warps hauling began. The underwater monitoring system (SCANMAR) was used to observe net depth, net opening, and net spread. The depth recorder (SENSUS) was used to record the depth of otter boards (Front and Rear) and the trawl net (Head rope and Ground gear). A GoPro camera was attached at the port side of the otter board to observe its movement along with the data from the depth sensor. During an operation, wave conditions, vessel direction, sea depth, and the positions of start and end were recorded using the bottom trawl fishing log sheets.

After hauling, the catches and benthic marine debris were sorted onboard. The catches were identified, and weight measures were taken. The marine debris was dehydrated, preserved, and brought back to the laboratory for further identification and weighing.

8.2 Result

Results from the experiment showed that there were seventeen (17) bottom trawl fishing operations carried out during this cruise. These can be separated into six (6) operations using rectangular otter boards and six (6) operations using Vee type otter boards. Besides this, there were five (5) operations that the results were not included in the analysis (One (1) operation was the equipment testing and the other four (4) operations were unsuccessful). The summary

of the bottom trawl fishing operation is shown in Table 1 (Fishing log sheet in Appendix 1). A towing speed ranging between 1.9 and 2.0 kts was set for each fishing operation, with a towing time of 60 minutes. However, trawl operation 16 and 17 had different towing times (30 and 90 minutes, respectively). The wing spread and net opening estimation of this trial was observed and recorded every 5 minutes from SCANMAR (Figure 2). The range of wing spread was between 6.0 to 10.4 m and 4.2 to 9.8 m for the Rectangular and Vee type otter boards, respectively. The net opening was between 4.4 to 10.0 m and 3.4 to 11.4 m for the Rectangular and Vee type otter board, respectively. More information recorded by SCANMAR is shown in Appendix 2.

Figure 2. The activities of bottom trawl operation onboard

8.2.1 The dynamic of otter boards

Apart from the recorded SCANMAR data, an investigation was conducted into the behavior of the otter boards. The depth of otter boards at both of starboard and port sides was recorded using the depth sensors attached to the front and rear of the otter boards. A GoPro camera was also attached at the port side of the otter board to assess its movement along with the data from the depth sensors. The result showed that the trawl board's movement related to the bottom depth during all operations. However, despite the addition of 8 inches plastic buoy was added to the top-front to increase the buoyant force, the otter boards still moved slightly lower than the rear, results in seabed dragging around the ski at the front of the otter boards as shown in Figure 3. Furthermore, it was observed during some Vee shape operation that otter boards did not always make even contact with the seabed (Figure 4). They lifted and floated intermittently on the port side, dragging the seabed along trawling, in contrast to the starboard side (Figure 5B)

Table 1. The summary of bottom trawl fishing

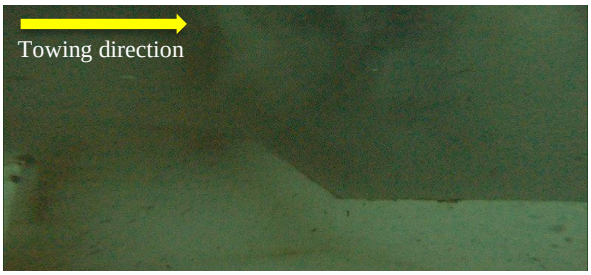
Date	Op.	Otter boards type	Time	Shooting Position		Hauling Position		Depth (m.)	Net spread (m.)	Net opening (m.)	Towing		CPUE (kg./hr.)	Remark
				Latitude	Longitude	Latitude	Longitude				Time (minute)	Distance (nm.)		
4/4/2023	1	V	0940-1050	12°28.20′N	101°24.18′E	12°28.56′N	101°23.14′E	-	-	-	11	0.28	-	In-complete
	2	V	1055-1230	12°28.53′N	101°22.59′E	12°28.99′N	101°20.40′E	23.0	-	-	60	2.02	10.67	-
	3	V	1300-13.37	12°29.39′N	101°20.00′E	-	-	-	-	-	-	-	-	In-complete
	4	V	1339-1417	12°29.52′N	101°20.38′E	12°29.62′N	101°20.49′E	-	-	-	-	-	-	In-complete
6/4/2023	5	V	0929-1130	12˚26.84′N	101˚23.75′E	12˚26.81′N	101˚20.72′E	27.5	9.9	5.7	60	2.34	4.19	-
	6	V	1223-1414	12˚27.66′N	101˚18.72′E	12˚28.11′N	101˚15.88′E	27.0	9.9	5.9	60	2.30	3.47	-
	7	V	1439-1625	12˚27.58′N	101˚15.75′E	12˚29.14′N	101˚15.00′E	26.0	8.4	6.3	60	2.14	4.16	-
7/4/2023	8	R	0916-0945	12˚27.01′N	101˚24.51′E	-	-	-	-	-	-	-	-	In-complete
	9	R	1100-1239	12˚27.29′N	101˚24.65′E	12˚27.43′N	101˚22.03′E	26.0	9.6	6	60	2.50	5.81	-
	10	R	1312-1451	12˚27.94′N	101˚21.67′E	12˚28.51′N	101˚23.69′E	23.6	8.8	5.9	60	1.80	7.37	-
8/4/2023	11	R	0825-1000	12˚26.91′N	101˚23.55′E	12˚26.85′N	101˚21.22′E	27.0	8.4	7.1	60	1.90	4.40	-
	12	R	1001-1147	12˚26.95′N	101˚21.03′E	12˚27.39′N	101˚18.41′E	27.0	8.3	5.9	60	2.00	6.81	-
	13	R	1218-1356	12˚27.71′N	101˚17.85′E	12˚30.07′N	101˚17.05′E	26.3	9.6	4.8	60	2.30	16.05	-
	14	R	1403-1538	12˚30.54′N	101˚16.76′E	12˚32.81′N	101˚16.74′E	28.0	10.3	4.5	60	2.00	9.30	-
9/4/2023	15	V	0910-1042	12°27.10′N	101°25.14′E	12°26.68′N	101°22.97′E	26.1	9.8	4.9	60	2.00	5.49	-
	16	V	1046-1203	12°26.82′N	101°22.93′E	12°26.19′N	101°21.61′E	27.6	8.2	4.6	33	1.10	7.28	Urgent hauling
	17	V	1214-1425	12°25.95′N	101°22.08′E	12°28.38′N	101°25.04′E	23.0	8.1	4.6	90	3.30	10.10	-

Remark: V = Vee type otter board, R = Rectangular otter board

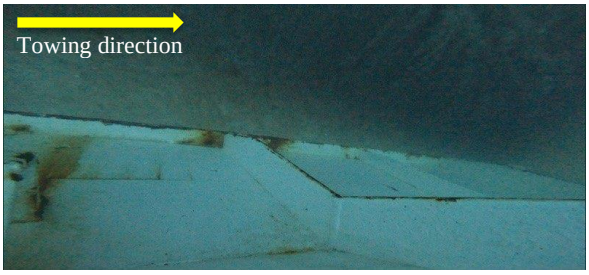
A) Vee type otter board at port side B) Vee type otter board at starboard side

C) Rectangular otter board at port side D) Rectangular otter board at starboard side

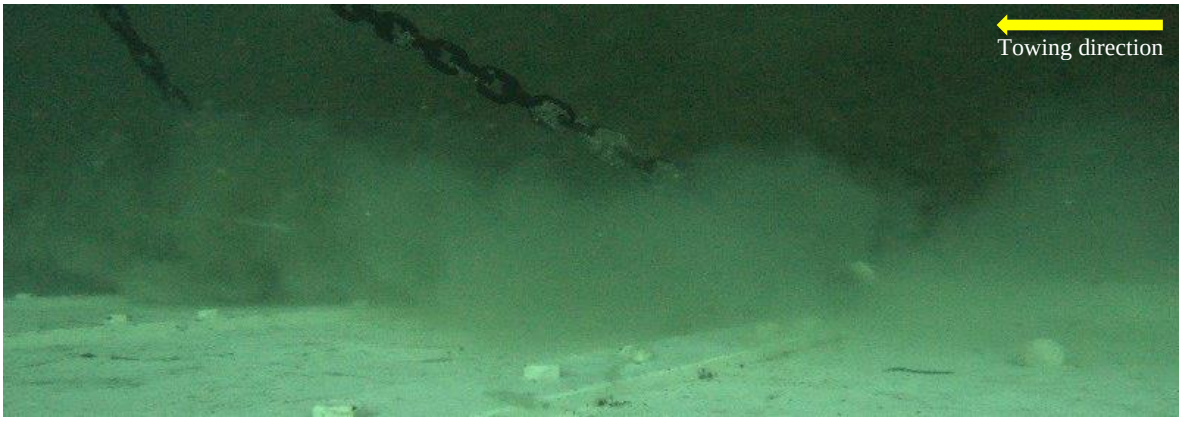
Figure 3. Scratches at the front of otter boards from dragging over the seabed



A) Vee type otter board movement while it was dragging with the seabed

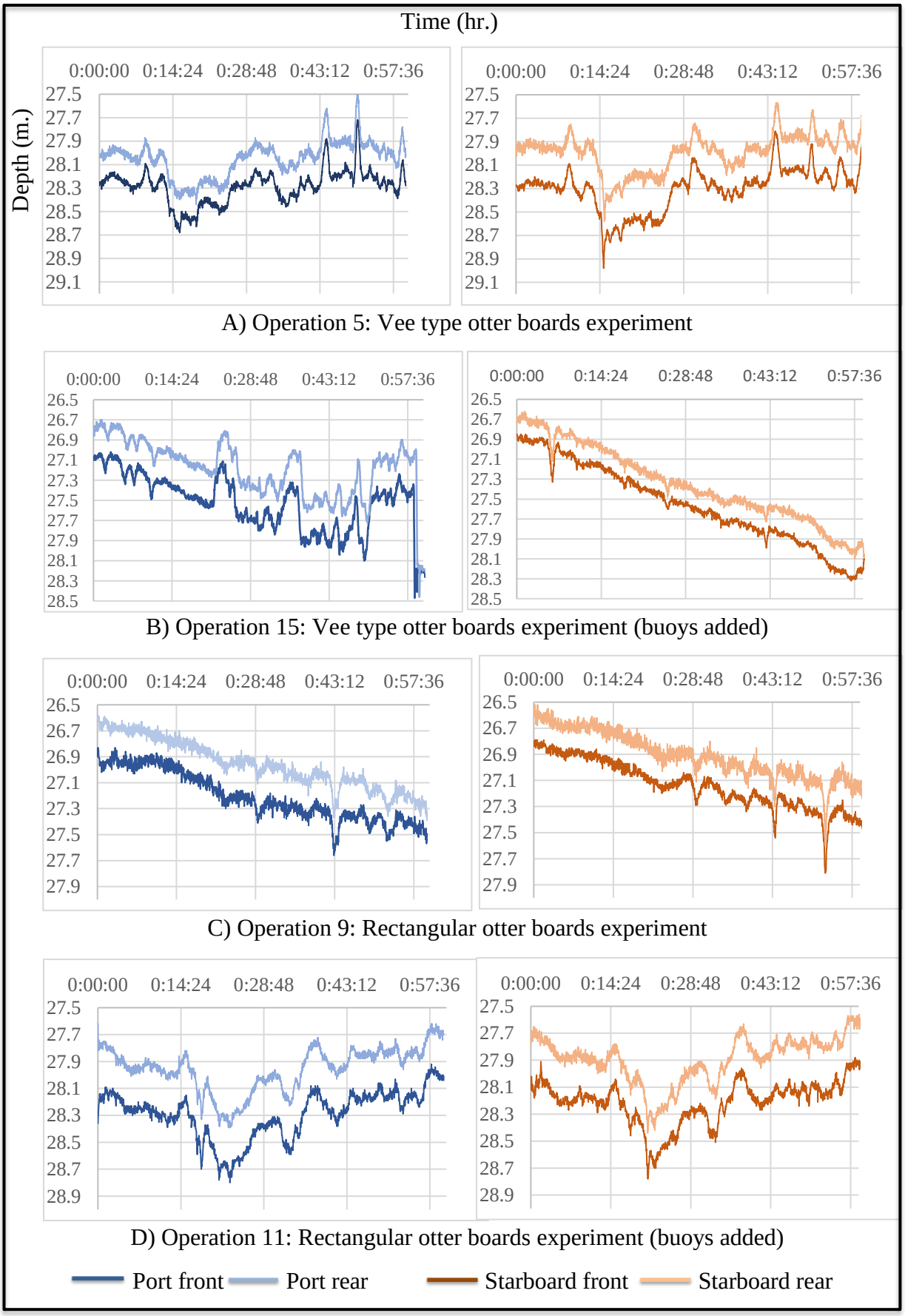


B) Vee type otter board movement while it was floating



C) Rectangular otter board movement with seabed contact

Figure 4. The position of the otter board while trawling



Figures 5. The dynamic of otter boards while trawling

8.2.2 The catches from fishing operation

The fish caught from the cod end were sorted, measured, and identified to the family or species level before being recorded into the fishing log sheets (Appendix 1). The total catch can be divided into around 91 species from about 53 families. The highest weight composition was observed for Sponges and Sea Cucumber (Holothuriidae) with 36.12% and 20.90%, respectively. The most commonly found target species at each station (excluding sponges and Sea Cucumber) were Squid (*Photololigo* spp., 28.03%), Asian moon scallop (*Amusium pleuronectes*, 13.22%), and Monogrammed monocle bream (*Scolopsis monogramma,* 9.49%). The average CPUE for the rectangular and Vee type otter board were 8.24 and 6.02 kg/hour, respectively. The top five catch amounts for all operations are presented in Table 2 and the CPUE by the operations are presented in Table 3.

Table 2. The top five species were caught by weight (kg) from the bottom trawl operation excluding marine debris, sponges, and sea cucumber.

Species	Family	Total	OP5	OP6	OP7	OP9	OP10	OP11	OP12	OP13	OP14	OP15	OP16	OP17
Photololigo spp.	Loliginidae	27.78	2.11	1.40	1.20	2.90	0.90	1.07	2.00	8.50	1.00	2.10	0.60	4.00
Amusium pleuronectes	Pectinidae	11.92	0.50	0.30	0.50	0.70	0.32	0.50	0.90	1.10	1.50	1.00	0.60	3.00
Scolopsis monogramma	Nemipteridae	8.54	0.06	-	0.10	0.30	-	1.00	1.30	1.70	1.00	0.50	0.76	1.82
Sepia recurvirosta	Sepiidae	6.81	0.55	0.50	0.50	0.50	0.90	0.25	0.06	0.65	1.50	0.50	-	0.90
Brevitrygon heterura	Dasyatidae	4.31	-	-	-	-	3.80	0.16	-	0.35	-	-	-	-
Others		27.2	0.97	1.27	1.86	1.41	1.44	1.42	2.55	3.75	4.03	1.39	1.68	5.43

Table 3. Catch per unit effort (CPUE) by operation from M.V. Plalung. The catch of sponges, marine debris, and sea cucumbers.

Operation	Catch (kg.)	Time (hour)	CPUE (kg/hour)
OP5	4.19	1	4.19
OP6	3.47	1	3.47
OP7	4.17	1	4.17
OP9	5.81	1	5.81
OP10	4.37	1	4.37
OP11	4.40	1	4.40
OP12	6.81	1	6.81
OP13	16.05	1	16.05
OP14	9.03	1	9.03
OP15	5.49	1	5.49
OP16	3.64	0.5	7.28
OP17	15.15	1.5	10.10

8.2.3 Marine debris

The sampling of marine debris on the seabed was conducted using a bottom trawl. The collected catches were sorted to separate the marine debris, which was subsequently gathered for further categorization and measurement in the laboratory. This process followed the guidelines outlined in the "Methodology for Monitoring Marine Litter on the Seafloor (continental shelf) Bottom trawl surveys" (Vlachogianni and Somarakis, n.p.) (Figure 6).

Figure 6. Marine debris from bottom trawl

9. Oceanographic Survey (CTD)

The survey was scheduled to be conducted over a period of 9 days, from 4 to 9 April 2023. However, due to issues with the trawling equipment, the survey had to be canceled on 5 April 2023. As a result, a total of ten (10) survey stations were completed (Figure 7).

Figure 7. Oceanographic survey stations

9.1 CTD

A total of ten (10) oceanographic stations were surveyed, and the physical and chemical properties of the water were measured using a CTD. The measurements included density, temperature, salinity, and dissolved oxygen. The CTD profiler, specifically the ASTD153, was deployed from the sea surface to a depth of approximately 3 meters above the sea bottom. The values for these parameters were averaged for every 0.1meter depth interval. The data was then analyzed using Microsoft Excel to assess the water quality of each water column.

9.2 Preliminary analysis of oceanographic parameter

All ten (10) oceanographic stations were conducted during daytime at various sea depths ranging from 14m to 25m. The vertical profiles of temperature (ºC), salinity (PSU) and dissolved oxygen (mg/l) were obtained from the oceanographic stations and are presented in Figure 8. The recorded temperatures ranged between 30.1ºC and 30.9ºC. The highest temperature was observed at Station 14, within a depth range of 0–14 m. Salinity measurements ranged from 30.0 to 31.3 PSU, with the highest salinity recorded at station 7, within a depth range of 0–18 m. Dissolved oxygen ranged between 5.5-5.7 mg/l, and the highest concentration was found at station 10, within a depth range of 0–21 m.

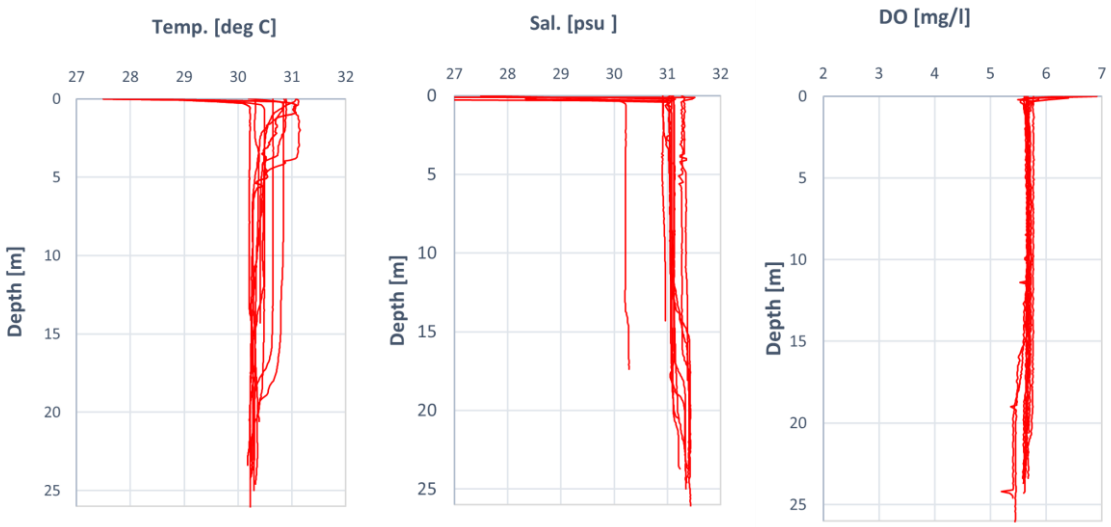


Figure 8. Temperature (°C), salinity (PSU) and dissolved oxygen profile data (mg/l)

10. Problems and suggestions

Although the research team was able to collect and analyze data from these operations, several issues were encountered during the process. To address these challenges, a comprehensive list of problems and corresponding suggestions has been compiled in Table 4.

Table 4. The summary of occurred problems, solutions and suggestions from the cruise

Problems	Solutions and suggestions
1. **SCANMAR**	
1.1 The data transmission issue was encountered on the first day, preventing the signal from being successfully received by the receiver unit. The problem arose due to an unmounted sensors unit, which resulted in an incomplete connection between the sensor and receiving unit.	The problem has been resolved, and the equipment is then functioning properly, displaying accurate and complete results throughout the cruise.
1.2 During the operation, the data was unable to be exported to the computer. The research team	During the operation, the researcher manually recorded the

Problems	Solutions and suggestions
suspected that the data converter unit was not properly converting the signal into electronic data. Despite attempts to find a solution during the vessel repairment on 5 April 2023, problem could not be resolved.	data from the screen display every 5 minutes in each operation. However, it is crucial to resolve this problem as soon as possible.
2. Fishing operation	
2.1 Since the vessel, bottom trawl net, and otter boards used in this cruise were new, and other scientific equipment was installed, such as depth sensors, trawl eye, etc. It is anticipated that operational errors may occur due to the equipment not having been previously adjusted or calibrated.	The scientists and crews agreed to designate the first day of operation (April 4, 2023) as a test operation. This decision aimed to minimize operational errors and refine the workflow for subsequent operations."
3. Fishing vessel (M.V. Plalung)	
3.1 Vessel speed - The cruise activities were unable to achieve the planned total of 4 operations per day due to a limitation in vessel speed. The maximum cruising speed reached only 6 knots, falling short of the anticipated 10 knots. Consequently, the longer travel time between the port and fishing grounds resulted in a reduction of the maximum number of operations per day from 4 to 3. - The main engine lacked sufficient power during the operation. While the cruise plan expected a towing speed of 3 knots, the average towing speed provided by the main engine was only 1.9-2.0 knots. This resulted in lower trawl efficiency than originally anticipated."	To enhance the vessel speed, we recommend conducting a thorough examination of the instruments that directly impact the speed. This evaluation should include adjustments, modifications, or even the removal of equipment as necessary.
3.2 The winch operation on both the port and starboard sides were problematic. The cogs of the port winch consistently slipped, failing to lock at the intended time. On the other hand, the starboard winch was stiff and difficult to operate. Neither winch functioned independently, leading to inadequate control and potential hazards for the operators.. Furthermore, due to the improper operation of the winches, the controller had to manually engage the brake each time the towing line was released. This continuous action has resulted in damage to the brake system.	To ensure safety and mitigate risks on the vessel, it is imperative to investigate the winch issues thoroughly and find suitable solutions.

Problems	Solutions and suggestions
3.3 The cleaning water line used for both catch and vessel cleaning was connected to the line from the toilet's cistern (toilet's waste-containing tank), which contain waste. It is crucial to ensure that these two systems are completely separated to maintain proper sanitation.	Suggest installation of additional water lines for improved hygiene on the vessel.
3.4 Unclear communication between master fisherman and captain during the operations.	Investigation of vessel communication system and implementation of solutions
3.5 Power outage and engine room oil leak during operations. This problem might cause serious damage to the scientific equipment brought along such as SCANMAR. When the data collected by the equipment was completely lost during the mentioned period.	Investigation of power outage source and consideration of solutions.
3.6 Gallow - The collapsible design of the gallows, unlike the fixed gallows found on other fishing vessels, posed an issue during the test day's operation when the port gallow was broken at the base hinge. Further investigation during the repairing day (5 April 2023) confirmed the damage to the gallow (Figure 9). - Folding the gallow is necessary when berthed at the port or during cruising. However, the process of folding and unfolding the gallow proved to be challenging and unsuitable for standby operation. Additionally, it posed potential risks of adverse weather conditions.	To ensure safety and minimize risks on the vessel**,** it is crucial to conduct a thorough investigation of the gallows and promptly address any issues encountered. Finding an appropriate solution as soon as possible is essential.
3.7 Insufficient equipment to support the navigation system and collect scientific data onboard, specifically the wind speed and direction system, as well as a larger GPS display. This equipment play a crucial role in data analysis and should be prioritized for acquisition.	It is recommended to install the necessary equipment to support the navigation system, as it will enable the examination of more environmental condition data for interpretation. This installation would not only enhance the functionality of the navigation system but also contribute to the safety of the onboard crew.
3.8 Currently, there seems to be a difference in the displayed parameters of the engine between the engine room and the bridge. This inconsistency can lead to confusion and potential misinterpretation of	One possible solution is to conduct a thorough inspection and calibration of the engine monitoring systems. This would

Problems	Solutions and suggestions
the engine's status and performance. To rectify this issue, it is crucial to synchronize the display parameters across both locations.	involve verifying the accuracy of the sensors, adjusting the settings, and ensuring that the displayed parameters are consistent and in line with the actual engine performance. It is recommended to make necessary adjustments or clarifications in the mentioned area.
3.9 The hydraulic crane and winches cannot be opertaed simultaneously due to the power source load being shared between them. In this trial, the crane was required for hydrophone installation, resulting in an imbalance of the vessel during the operation.	It is necessary to find a solution to properly allocate power resources and maintain vessel stability during such operations To enhance operational proficiency, such as operating scientific instruments or installing oceanographic equipment, and to prevent vessel imbalance when utilizing a crane, it may be necessary to have a properly prepared and utilized fishing boom.

Figure 9. Broken gallow position and reparation

Appendix: 1

Fishing logsheet

TRAWL FISHING LOGSHEET
Operation No. 1 (V-shape, Incomplete)

Recorded by _Saruttaya Jaroonpongsawat__

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No. -		M.V. PLALUNG				Air Temp. -	(^{o}C)	
Date: 4 April 23						Pressure -	mbar	
Moon age: -		**Start shooting**		**Finish shooting**		Humidity -	%	
Wind		Time	0940	Time	1026	**Water**		
Speed (Kt)	Direction	Latitude	12°28.20N	Latitude	12°28.29N	Surface temp. -	(^{o}C)	
-	180	Longitude	101°24.18E	Longitude	101°23.22E	Bottom temp. -	(^{o}C)	
Weather condition		**Start hauling**		**Finish hauling**		Transparency -		
Sunny		Time	1037	Time	1050	**Current**		
Sea condition: Slight		Latitude	12°28.56N	Latitude	12°28.50N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°23.14E	Longitude	101°23.34N	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 1.8		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1100		Towing time: 11 mins.		Towing distance(nm): 0.28		Depth of capture (m) -		
Pitch: -		Warp angle: -		Warp length (m): -		Type of bottom Mud sand		
Towing direction: 275		Net spread (m): -		Net opening (m): -		Total catch (kg) -		

Remark: In-active scanmar system and (wing distance and trawl eyes)

No.	Species	Number	Weight (kg)	Remark

TRAWL FISHING LOGSHEET
Operation No. 2 (V-shape)

Recorded by _Saruttaya Jaroonpongsawat_____

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No. -		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 4 April 23						Pressure	-	mbar
Moon age: -		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1055	Time	1106	**Water**		
Speed (Kt)	Direction	Latitude	12°28.53N	Latitude	12°28.53N	Surface temp.	-	(°C)
-	180	Longitude	101°22.59E	Longitude	101°22.41E	Bottom temp.	-	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1210	Time	1230	**Current**		
Sea condition: Slight		Latitude	12°28.99N	Latitude	12°29.21N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°20.40E	Longitude	101°20.10E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.1		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1.04 hrs.		Towing distance(nm): 2.02		Depth of capture (m)		23
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 270		Net spread (m): -		Net opening (m): -		Total catch (kg)		10.67

Remark: No scanmar system

No.	Species	Number	Weight (kg)	Remark
1	Dorippid crab	1	0.30	1
2	Podopthalmus vigil	2	0.10	
3	*Amusium pleuronectes*	137	2.80	
4	*Photololigo* spp.	40	1.30	
5	*Sepioteuthis lessoniana*	4	0.20	
6	*Sepia* spp.	16	0.70	
7	*Sardinella* sp.	1	0.40	
8	*Synodon undosquamis*	1	0.20	
9	*Inimicus cuvieri*	3	0.10	
10	*Pomadasys kaakan*	2	0.70	
11	*Parastomateus niger*	15	0.10	
12	*Scolopsis monogramma*	10	0.41	
13	*Nemipterus marginatus*	1	0.30	
14	*Alepes vari* XL	1	0.50	
15	*Alepes vari* S	26	0.45	
16	*Pentaprion elongatus*	5	0.30	
17	*Lutjanus madras* XL	1	0.30	
18	*Lutjanus madras* S	6	0.20	
19	*Upenens tragula*	2	0.80	
20	*Rastrelliger kanagurta*	1	0.01	
21	*Cynoglossus arel*	1	0.30	
22	*Aleuterus monoceros*	1	0.20	

TRAWL FISHING LOGSHEET
Operation No. 3 (V-shape, Incomplete)

Recorded by _Saruttaya Jaroonpongsawat_

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 4 April 23						Pressure	-	mbar
Moon age: -		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1300	Time	1315	**Water**		
Speed (Kt)	Direction	Latitude	12°29.39N	Latitude	-	Surface temp.	-	(°C)
-	180	Longitude	101°20.00E	Longitude	-	Bottom temp.	-	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1315	Time	1339	**Current**		
Sea condition: Slight		Latitude	-	Latitude	12°29.52N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	-	Longitude	101°20.28E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): -		Type of trawl: Bottom trawl				100 m	-	-
RPM: -		Towing time: 0		Towing distance(nm): -		Depth of capture (m)		-
Pitch: -		Warp angle: -		Warp length (m): -		Type of bottom		Mud Sand
Towing direction: -		Net spread (m): -		Net opening (m): -		Total catch (kg)		-
Remark:	In-active scanmar system							

No.	Species	Number	Weight (kg)	Remark

TRAWL FISHING LOGSHEET
Operation No. 4 (V-shape, Incomplete)

Recorded by _Saruttaya Jaroonpongsawat_

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 4 April 23						Pressure	-	mbar
Moon age: -		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1339	Time	1347	**Water**		
Speed (Kt)	Direction	Latitude	12°29.52N	Latitude	12°29.56N	Surface temp.	-	(°C)
-	180	Longitude	101°20.38E	Longitude	101°20.54E	Bottom temp.	-	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1358	Time	1417	**Current**		
Sea condition: Slight		Latitude	12°29.62N	Latitude	12°29.98N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°20.49E	Longitude	101°20.37E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): -		Type of trawl: Bottom trawl				100 m	-	-
RPM: -		Towing time: 10		Towing distance(nm): -		Depth of capture (m)		-
Pitch: -		Warp angle: -		Warp length (m): -		Type of bottom		Mud sand
Towing direction: -		Net spread (m): -		Net opening (m): -		Total catch (kg)		-
Remark:	Broken gallow at port side							

No.	Species	Number	Weight (kg)	Remark

TRAWL FISHING LOGSHEET
Operation No. 5 (V- shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 6 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	0929	Time	0956	**Water**		
Speed (Kt)	Direction	Latitude	12˚26.84N	Latitude	12˚26.87N	Surface temp.	-	(°C)
-	180	Longitude	101˚23.75E	Longitude	101˚23.01E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1100	Time	1130	**Current**		
Sea condition: Slight		Latitude	12˚26.81N	Latitude	12˚27.81N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚20.72E	Longitude	101˚23.49E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.2		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1.04 hrs.		Towing distance(nm): 2.34		Depth of capture (m)		27.5
Pitch: -		Warp angle: -		Warp length (m): 110		Type of bottom		Mud sand
Towing direction: 270		Net spread (m): 9.9		Net opening (m): -		Total catch (kg)		4.19
Remark:	Unavaliable Gopro							

No.	Species	Number	Weight (kg)	Remark
1	Dorippid crab	4	0.11	
2	Calappa clypeata	2	0.06	
3	*Phalangipus longipes*	1	0.01	
4	Portunid crab	3	0.02	
5	*Amusium pleuronectes*	50	0.50	
6	*Photololigo* spp.	60	2.11	
7	*Sepioteuthis lessoniana*	4	0.25	
8	*Sepia recurvirosta*	19	0.55	
9	*Pegasus laternarius*	1	0.01	
10	*Inimicus cuvieri*	1	0.05	
11	*Priacanthus tayenus*	1	0.02	
12	*Nemipterus hexodon*	2	0.12	
13	*Scolopsis monogramma*	1	0.06	
14	*Pentaprion elongatus*	6	0.08	
15	*Rastrelliger kanagurta*	3	0.10	
16	*Pseudorhombus oligodon*	1	0.08	
17	*Lagocephalus suezensis*	1	0.06	

TRAWL FISHING LOGSHEET
Operation No. 6 (V-Shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 6 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1223	Time	1250	**Water**		
Speed (Kt)	Direction	Latitude	12˚27.66N	Latitude	12˚28.01N	Surface temp	-	(°C)
-	180	Longitude	101˚18.72E	Longitude	101˚17.79E	Bottom temp	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1350	Time	1414	**Current**		
Sea condition: Slight		Latitude	12˚28.11N	Latitude	12˚28.41N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚15.88E	Longitude	101˚15.53E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.3		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1		Towing distance(nm): 2.3		Depth of capture (m)		27
Pitch: -		Warp angle: -		Warp length (m): 110		Type of bottom		Mud sand
Towing direction: 270		Net spread (m): 9.9		Net opening (m): -		Total catch (kg)		3.47

Remark: Add front and back chains of otter boards to be 21 and 30 at both port starboard side

No.	Species	Number	Weight (kg)	Remark
1	Dorippid crab	3	0.20	
2	*Calappa clypeata*	4	0.25	
3	*Portunus* sp.	1	0.02	
4	*Charybdis affinis*	2	0.10	
5	*Amusium pleuronectes*	24	0.30	
6	*Photololigo* spp.	26	1.40	
7	*Sepia recurvirosta*	14	0.50	
8	*Saurida undosquamis*	3	0.10	
9	*Lutjanus madras*	1	0.10	
10	*Lutjanus vitta*	1	0.10	
11	*Gerres erythrousus*	2	0.040	
12	ponyfish	1	0.02	
13	*Nemipterus furcosus*	1	0.050	
14	*Alectis ciliaris*	1	0.020	
15	*Upeneus sundaicus*	1	0.060	
16	*Upeneus tragula*	1	0.060	
17	*Rastrelliger kanagurta*	1	0.070	
18	*Pseudorhombus oligodon*	1	0.080	

TRAWL FISHING LOGSHEET
Operation No. 7 (V-shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 6 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1439	Time	1459	**Water**		
Speed (Kt)	Direction	Latitude	12˚27.58N	Latitude	12˚27.71N	Surface temp.	-	(°C)
-	180	Longitude	101˚15.75E	Longitude	101˚16.10E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1600	Time	1625	**Current**		
Sea condition: Slight		Latitude	12˚29.14N	Latitude	12˚29.55N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚15.00E	Longitude	101˚14.66E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.1		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1250		Towing time: 1.1		Towing distance(nm): 2.14		Depth of capture (m)		26
Pitch: -		Warp angle: -		Warp length (m): 110		Type of bottom		Mud sand
Towing direction: 045		Net spread (m): 8.4		Net opening (m): -		Total catch (kg)		4.165
Remark:	-							

No.	Species	Number	Weight (kg)	Remark
1	*Thenus orientalis*	2	0.10	
2	Dromiid crabs	1	0.12	
3	Dorippid crabs	4	0.10	
4	*Calappa clypeata*	1	0.02	
5	*Amusium pleuronectes*	29	0.50	
6	*Photololigo* spp.	8	1.20	
7	*Sepioteuthis lessoniana*	2	0.12	
8	*Sepia recurvirosta*	12	0.50	
9	*Gymnothorax pseudothrysoideus*	2	0.80	
10	*Saurida undosquamis*	3	0.25	
11	*Inimicus cuvieri*	1	0.01	
12	*flatheadfish*	1	0.05	
13	*Epinephelus sexfasciatus*	1	0.01	
14	Ponyfish	10	0.06	
15	*Nemipterus* sp.	2	0.06	
16	*Scolopsis monogramma*	3	0.10	
17	*Upeneus tragula*	2	0.05	
18	*Rastrelliger kanagurta*	3	0.10	
19	*Anacanthus barbatus*	2	0.02	

TRAWL FISHING LOGSHEET
Operation No. 8 (Flat shape, In-complete)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(^{o}C)
Date: 7 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	0916	Time	-	**Water**		
Speed (Kt)	Direction	Latitude	12˚27.01N	Latitude	-	Surface temp.	-	(^{o}C)
-	060	Longitude	101˚24.51E	Longitude	-	Bottom temp.	30	(^{o}C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Cloudy		Time	-	Time	-	**Current**		
Sea condition: Moderate		Latitude	-	Latitude	-	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	-	Longitude	-	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): -		Type of trawl: Bottom trawl				100 m	-	-
RPM: -		Towing time: -		Towing distance(nm): -		Depth of capture (m)		-
Pitch: -		Warp angle: -		Warp length (m): -		Type of bottom		Mud sand
Towing direction: 060		Net spread (m): -		Net opening (m): -		Total catch (kg)		-
Remark:	In-complate trawl shooting due to monsoon							

No.	Species	Number	Weight (kg)	Remark

TRAWL FISHING LOGSHEET
Operation No. 9 (Flat shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 7 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1100	Time	1115	**Water**		
Speed (Kt)	Direction	Latitude	12˚27.29N	Latitude	12˚27.27N	Surface temp.	-	(°C)
-	060	Longitude	101˚24.65E	Longitude	101˚24.02E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Cloudy		Time	1215	Time	1239	**Current**		
Sea condition: Moderate		Latitude	12˚27.43N	Latitude	12˚27.68N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚22.03E	Longitude	101˚21.80E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.0		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1 hrs.		Towing distance(nm): 2.0		Depth of capture (m)		26
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 270		Net spread (m): 9.6		Net opening (m): -		Total catch (kg)		5.81
Remark:	East wind							

No.	Species	Number	Weight (kg)	Remark
1	Hermit crab	1	0.05	
2	Dorippid crabs	3	0.08	
3	*Charybdis affinis*	3	0.15	
4	Portunid crabs	7	0.15	
5	*Amusium pleuronectes*	45	0.70	
6	*Photololigo* spp.	103	2.90	
7	*Sepia recurvirosta*	18	0.50	
8	*Saurida undosquamis*	2	0.06	
9	*Pterois russellii*	1	0.04	
10	*Inimicus cuvieri*	5	0.41	
11	*Scolopsis monogramma*	8	0.30	
12	*Pentaprion elongatus*	10	0.15	
13	Ponyfish	4	0.05	
14	*Rastrelliger kanagurta*	1	0.06	
15	*Pseudorhombus oligodon*	1	0.04	
16	*Zebrius quagga*	2	0.10	
17	*Lagocaphalus suezensis*	5	0.07	

TRAWL FISHING LOGSHEET
Operation No. 10 (Flat shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 7 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1312	Time	1325	**Water**		
Speed (Kt)	Direction	Latitude	12˚27.94N	Latitude	12˚27.99N	Surface temp.	-	(°C)
-	060	Longitude	101˚21.67E	Longitude	101˚21.88E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1425	Time	1451	**Current**		
Sea condition: Slight		Latitude	12˚28.51N	Latitude	12˚28.72N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚23.69E	Longitude	101˚23.75E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 1.8		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1350		Towing time: 1 hrs.		Towing distance(nm): 1.8		Depth of capture (m)		23.6
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 85		Net spread (m): 8.8		Net opening (m): -		Total catch (kg)		7.365
Remark:	-							

No.	Species	Number	Weight (kg)	Remark
1	*Thenus orientalis*	1	0.05	
2	Portunid crabs		0.23	
3	*Amusium pleuronectes*	100	0.32	
4	*Photololigo* spp.	32	0.90	
5	*Sepioteuthis lessoniana*	1	0.10	
6	*Sepia recurvirosta*	22	0.90	
7	*Brevitrygon heterura*	7	3.80	
8	*Inimicus cuvieri*	10	0.10	
9	Flathead	10	0.30	
10	*Epinephelus sexfasciatus*	1	0.05	
11	*Apogon pleurion*	1	0.03	
12	*Eubleckeria jonesi*	2	0.05	
13	*Secutor indicus*	3	0.05	
14	*Equulites oblongus*	3	0.04	
15	*Pentaprion elongatus*	1	0.03	
16	*Upeneus sundaicus*	1	0.06	
17	*Upeneus tragula*	1	0.08	
18	*Rastrelliger kanagurta*	2	0.01	
19	*Pseudorhombus arsius*	8	0.25	
20	*Lagocephalus suezensis*	1	0.03	

TRAWL FISHING LOGSHEET
Operation No. 11 (Flat shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(^{o}C)
Date: 8 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	0825	Time	0840	**Water**		
Speed (Kt)	Direction	Latitude	12˚26.91N	Latitude	12˚26.86N	Surface temp.	-	(^{o}C)
-	180	Longitude	101˚23.55E	Longitude	101˚23.16E	Bottom temp.	30	(^{o}C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	0940	Time	1000	**Current**		
Sea condition: Slight		Latitude	12˚26.85N	Latitude	12˚26.94N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚21.22E	Longitude	101˚21.12E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 1.9		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1 hrs.		Towing distance(nm): 1.9		Depth of capture (m)		27
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 270		Net spread (m): 8.4		Net opening (m): -		Total catch (kg)		4.402

Remark: Add buoys at otter boards (front side)

No.	Species	Number	Weight (kg)	Remark
1	Dorippid crabs	2	0.10	
2	*Phalangipus longipes*	1	0.03	
3	Portunid crabs	13	0.11	
4	*Calappa clypeata*	1	0.05	
5	*Amusium pleuronectes*	42	0.50	
6	*Photololigo* spp.	36	1.07	
7	*Sepia recurvirostra*	12	0.25	
8	*Brevitrygon imbricata*	1	0.16	
9	*Saurida tumbil*	1	0.10	
10	*Pterois russelii*	1	0.05	
11	*Apistus carinatus*	1	0.05	
12	*Inimicus cuvieri*	2	0.09	
13	Flathead	1	0.05	
14	*Scolopsis monogramma*	22	1.00	
15	*Atule mate*	1	0.10	
16	*Pentaprion elongatus*	12	0.50	
17	*Upeneus tragula*	1	0.05	
18	*Grammatobothus polypthalmus*	1	0.06	
19	*Lagocephalus suezensis*	3	0.08	

TRAWL FISHING LOGSHEET
Operation No. 12 (Flat shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 8 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1001	Time	1020	**Water**		
Speed (Kt)	Direction	Latitude	12˚26.95N	Latitude	12˚26.97N	Surface temp.	-	(°C)
-	180	Longitude	101˚21.03E	Longitude	101˚20.59E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1120	Time	1147	**Current**		
Sea condition: Slight		Latitude	12˚27.39N	Latitude	12˚27.57N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚18.41E	Longitude	101˚18.06E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.0		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1		Towing distance(nm): 2.0		Depth of capture (m)		27
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 270		Net spread (m): 8.3		Net opening (m): -		Total catch (kg)		6.813

Remark: Oil spill at engine room while operating

No.	Species	Number	Weight (kg)	Remark
1	*Thenus orientalis*	1	0.13	
2	Hermit crab	1	0.04	
3	Dromid crab	1	0.08	
4	Dorippid crabs	7	0.21	
5	*Prismatopus* sp.	1	0.05	
6	*Phalangipus longipes*	1	0.01	
7	*Podopthalmus vigil*	2	0.09	
8	*Portunus pelagicus*	1	0.48	
9	Portunid crabs	14	0.15	
10	*Amusium pleuronectes*	60	0.90	
11	*Photololigo* spp.	57	2.00	
12	*Sepioteuthis lessoniana*	3	0.15	
13	*Sepia recurvirosta*	16	0.06	
14	Octopus	1	0.05	
15	*Chiloscyllium punctatum*	1	0.03	
16	*Inimicus cuvieri*	2	0.10	
17	Flathead	1	0.06	
18	*Lutjanus vitta*	1	0.35	
19	*Pentaprion elongatus*	5	0.07	
20	*Secutor indicus*	1	0.05	
21	*Scolopsis monogramma*	23	1.30	
22	*Upeneus sundaicus*	5	0.05	
23	*Siganus fuscescens*	1	0.20	
24	*Grammatobothus trispinus*	2	0.13	
25	*Arnoglossus macrolophus*	1	0.05	
26	*Pardachirus parvonicus*	1	0.01	
27	*Aseragodes filiger*	2	0.01	

TRAWL FISHING LOGSHEET
Operation No. 13 (Flat shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 8 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1218	Time	1230	**Water**		
Speed (Kt)	Direction	Latitude	12˚27.71N	Latitude	12˚27.92N	Surface temp	-	(°C)
-	180	Longitude	101˚17.85E	Longitude	101˚18.10E	Bottom temp	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1330	Time	1356	**Current**		
Sea condition: Slight		Latitude	12˚30.07N	Latitude	12˚30.50N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101˚17.05E	Longitude	101˚16.73E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.3		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1350		Towing time: 1 hrs.		Towing distance(nm): 2.3		Depth of capture (m)		26.3
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 000		Net spread (m): 9.6		Net opening (m): -		Total catch (kg)		16.05

Remark: Remove 4 buoys at left and right-wing (Bouy no. 3 5 7 9)

No.	Species	Number	Weight (kg)	Remark
1	*Thenus orientalis*	1	0.12	
2	Dorippid crabs	5	0.04	
3	*Calappa clypeata*	5	0.70	
4	*Parthernope longimanus*	1	0.01	
5	Xanthid crab	1	0.01	
6	*Charybdis affinis*	1	0.15	
7	Portunid crabs	10	0.10	
8	*Amusium pleuronectes*	76	1.10	
9	*Cymbiola nobilis*	1	0.40	
10	*Photololigo* spp.	72	8.50	
11	*Sepia recurvirosta*	23	0.65	
12	*Brevitrygon heterura*	1	0.35	
13	*Saurida undosquamis*	23	0.60	
14	*Pterois russellii*	2	0.07	
15	*Inimicus cuvieri*	2	0.20	
16	*Apistus caudinatus*	1	0.05	
17	Flathead	1	0.04	
18	*Lutjanus vitta*	1	0.50	
19	*Scolopsis monogramma*	36	1.70	
20	*Gerres erythrourus*	4	0.06	
21	*Rachycentron canadum*	1	0.30	
22	*Upeneus tragula*	8	0.20	
23	*Rastrelliger kanagurta*	1	0.06	
24	*Dactylopus dactylopus*	1	0.05	
25	*Engyprosopon* spp.	4	0.03	
26	*Lagocaphalus suezensis*	1	0.06	

TRAWL FISHING LOGSHEET
Operation No. 14 (Flat shape)

Recorded by __Saruttaya Jaroonpongsawat___

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 8 April 23						Pressure	-	mbar
Moon age:		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1403	Time	1415	**Water**		
Speed (Kt)	Direction	Latitude	12°30.54N	Latitude	12°30.63N	Surface temp.	-	(°C)
-	180	Longitude	101°16.76E	Longitude	101°17.01E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
sunny		Time	1515	Time	1538	**Current**		
Sea condition: slight		Latitude	12°32.81N	Latitude	12°33.31N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°16.74E	Longitude	101°16.53E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.0		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1		Towing distance(nm): 2.0		Depth of capture (m)		20.8
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 070		Net spread (m): 10.3		Net opening (m): -		Total catch (kg)		9.3
Remark:	-							

No.	Species	Number	Weight (kg)	Remark
1	*Thenus orientalis*	1	0.12	
2	Dorippid crabs	7	0.18	
3	*Calappa clypeata*	1	0.04	
4	Leucosid crab	3	0.05	
5	*Parthernope longimanus*	7	0.13	
6	Portunid crabs	15	0.15	
7	*Amusium pleuronectes*	84	1.50	
8	*Photololigo* spp.	24	1.00	
9	*Sepioteuthis lessoniana*	8	0.30	
10	*Sepia* spp.	37	1.50	
11	*Sardinella* sp.	1	0.06	
12	*Gymnothorax pseudothrysoideus*	2	1.00	
13	*Saurida undosquamis*	21	0.70	
14	*Inimicus cuvieri*	4	0.16	
15	Flatheaded	1	0.02	
16	*Apogon* spp.	3	0.06	
17	*Scolopsis monogramma*	24	1.00	
18	*Pentaprion elongatus*	4	0.06	
19	*Secutor indicus*	7	0.11	
20	*Equulites stercorarius*	14	0.13	
21	*Rachycentron canadum*	1	0.17	
22	*Upeneus tragula*	5	0.14	
23	*Rastrelliger kanagurta*	1	0.06	
24	*Grammanobothus polypthalmus*	1	0.08	
25	*Engyprosopon* spp.	4	0.08	
26	*Aleuterus monoceros*	1	0.05	
27	*Anacanthus barbatus*	1	0.05	
28	*Lagocephalus lunaris*	1	0.05	
29	*Lagocephalus suezensis*	2	0.08	

TRAWL FISHING LOGSHEET
Operation No. 15 (V-shape)

Recorded by _Saruttaya Jaroonpongsawat_

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 9 April 23						Pressure	-	mbar
Moon age: -		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	0910	Time	0925	**Water**		
Speed (Kt)	Direction	Latitude	12°27.10N	Latitude	12°27.04N	Surface temp.	-	(°C)
-	180	Longitude	101°25.14E	Longitude	101°24.82E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1025	Time	1042	**Current**		
Sea condition: Slight		Latitude	12°26.68N	Latitude	12°26.79N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°22.97E	Longitude	101°23.01E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.0		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1		Towing distance(nm): 2.0		Depth of capture (m)		26.1
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 265		Net spread (m): 9.8		Net opening (m): -		Total catch (kg)		5.49
Remark:	-							

No.	Species	Number	Weight (kg)	Remark
1	Hermit crab	3	0.01	
2	Dorippid crabs	3	0.06	
3	*Calappa clypeata*	2	0.02	
4	Leucosid crab	1	0.01	
5	*Podopthalmus vigil*	1	0.01	
6	Portunid crabs	16	0.10	
7	*Amusium pleuronectes*	68	1.00	
8	*Photololigo* spp.	86	2.10	
9	*Sepia recurvirostra*	23	0.50	
10	Octopus	1	0.03	
11	*Gymnothorax pseudothrysoideus*	1	0.20	
12	*Fistularia petimba*	1	0.01	
13	*Pterois russellii*	1	0.01	
14	*Dactylopterna orientalis*	1	0.01	
15	*Inimicus cuvieri*	4	0.02	
16	Flathead	4	0.06	
17	*Priacanthus maceracanthus*	7	0.03	
18	*Scalopsis monogramma*	12	0.50	
19	*Apogon* spp.	2	0.02	
20	*Pentaprion elongatus*	6	0.05	
21	*Secutor indicus*	1	0.01	
22	*Equulites stercorarius*	8	0.05	
23	*Upeneus tragula*	2	0.05	
24	*Rachycentron canadum*	1	0.07	
25	*Pseudorhombus oligodon*	1	0.10	
26	*Grammanobothus polypthalmus*	6	0.18	
27	*Anacanthus barbatus*	2	0.20	
28	Boxfish	1	0.05	
29	*Lagocephalus suezensis*	2	0.03	

TRAWL FISHING LOGSHEET
Operation No. 16 (V-shape)

Recorded by _Saruttaya Jaroonpongsawat_

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 9 April 23						Pressure	-	mbar
Moon age: -		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1046	Time	1105	**Water**		
Speed (Kt)	Direction	Latitude	12°26.82N	Latitude	12°26.76N	Surface temp.	-	(°C)
-	180	Longitude	101°22.93E	Longitude	101°22.57E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1138	Time	1203	**Current**		
Sea condition: Slight		Latitude	12°26.19N	Latitude	12°25.95N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°21.61E	Longitude	101°21.90E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.0		Type of trawl: Bottom trawl				100 m	-	-
RPM: -		Towing time: 33		Towing distance(nm): 1.1		Depth of capture (m)		27.6
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: -		Net spread (m): 8.2		Net opening (m): -		Total catch (kg)		3.64

Remark: Urgent hauling due to finding small scale fishery in the area

No.	Species	Number	Weight (kg)	Remark
1	Dorippid crabs	3	0.06	
2	Leucosid crabs	15	0.40	
3	*Parthernope longimanus*	5	0.06	
4	*Phalangipus longipes*	1	0.01	
5	Portunid crabs	19	0.11	
6	*Amusium pleuronectes*	39	0.60	
7	*Photololigo* spp.	30	0.60	
8	*Sepioteuthis lessoniana*	1	0.03	
9	*Saurida undosquamis*	1	0.30	
10	*Pterois russellii*	1	0.04	
11	*Inimicus cuvieri*	2	0.20	
12	*Scolopsis monogramma*	26	0.76	
13	Flathead	2	0.05	
14	*Apogon* sp.	1	0.01	
15	*Priacanthus tayenus*	2	0.01	
16	*Alectis ciliaris*	1	0.01	
17	*Secutor indicus*	1	0.01	
18	*Equulites oblongus*	1	0.01	
19	*Pentaprion elongatus*	13	0.10	
20	*Upeneus sundaicus*	2	0.10	
21	*Apogon pleuron*	1	0.02	
22	*Pseudorhombus oligodon*	1	0.07	
23	*Grammanobothus polypthalmus*	2	0.05	
24	*Lagocaphalus suezensis*	2	0.03	

TRAWL FISHING LOGSHEET
Operation No. 17 (V-shape)

Recorded by _Saruttaya Jaroonpongsawat_

Certified by _____

Cruise no: 5-1/2023		**Name of Vessel**				**Air**		
Survey station No.		M.V. PLALUNG				Air Temp.	-	(°C)
Date: 4 April 23						Pressure	-	mbar
Moon age: -		**Start shooting**		**Finish shooting**		Humidity	-	%
Wind		Time	1214	Time	1230	**Water**		
Speed (Kt)	Direction	Latitude	12°25.95N	Latitude	12°25.99N	Surface temp.	-	(°C)
-	180	Longitude	101°22.08E	Longitude	101°22.42E	Bottom temp.	30	(°C)
Weather condition		**Start hauling**		**Finish hauling**		Transparency	-	
Sunny		Time	1400	Time	1425	**Current**		
Sea condition: Slight		Latitude	12°28.38N	Latitude	12°28.83N	Depth (m)	Spd (kt)	Direction
Vessel		Longitude	101°25.04E	Longitude	101°25.14E	5 m	-	-
Eng. Mode: Trawl		**Fishing gear**				10 m	-	-
Speed (kt): 2.2		Type of trawl: Bottom trawl				100 m	-	-
RPM: 1300		Towing time: 1.3 hrs.		Towing distance(nm): 3.3		Depth of capture (m)		23
Pitch: -		Warp angle: -		Warp length (m): 100		Type of bottom		Mud sand
Towing direction: 090		Net spread (m): 8.1		Net opening (m): -		Total catch (kg)		15.15 kg.

Remark: No TEY signal between 13400-1400

No.	Species	Number	Weight (kg)	Remark
1	*Thenus orientalis*	2	0.06	
2	Dorippid crabs	9	0.16	
3	*Calappa clypeata*	8	0.12	
4	*Parthernope longimanus*	56	0.40	
5	*Cryptopodia fornicata*	1	0.01	
6	*Phalangipus longipes*	1	0.01	
7	*Amusium pleuronectes*	147	3.00	
8	*Photololigo* spp.	111	4.00	
9	*Sepioteuthis lessoniana*	4	0.20	
10	Bobtail Squid	1	0.01	
11	*Sepia recurvirostra*	38	0.90	
12	*Saurida undosquamis*	1	0.10	
13	*Pterois russellii*	1	0.05	
14	*Inimicus cuvieri*	3	0.20	
15	*Apistus carinatus*	1	0.02	
16	Flathead	10	1.00	
17	*Epinephelus bleekeri*	1	0.03	
18	*Apogon* spp.	10	0.05	
19	*Priacanthus tayenus*	8	0.02	
20	*Scolopsis monogramma*	37	1.82	
21	*Nemipterus* sp.	3	0.09	
22	*Alectis ciliaris*	2	0.01	

No.	Species	Number	Weight (kg)	Remark
23	*Atule mate*	5	0.20	
24	*Megalaspis cordyla*	1	0.01	
25	*Gerres erythrousus*	2	0.02	
26	*Pentaprion elongatus*	85	0.60	
27	*Eubleekeria jonesi*	20	0.30	
28	*Photopectolaris bindus*	7	0.05	
29	*Secutor indicus*	2	0.02	
30	*Equulites oblongus*	47	0.18	
31	*Rachycentron canadum*	1	0.17	
32	*Echenius naucrates*	2	0.05	
33	*Upeneus sundaicus*	9	0.28	
34	*Antennarius nummifer*	1	0.02	
35	Dragonet	1	0.04	
36	*Pseudorhombus oligodon*	2	0.29	
37	*Grammanobothus polypthalmus*	4	0.14	
38	*Aleuterus monoceros*	2	0.13	
39	*Anacanthus barbatus*	1	0.20	
40	*Lagocephalus suezensis*	23	0.21	

Appendix: 2

Information from SCANMAR

Table 1. The data information from SCANMAR Catch Control System (Recorded every 5 minutes)

Date	6 April 2023
Operation no.	6
Otter board type	Vee-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	6.0	20.8	9.3
00:05			
00:10	6.1	20.9	9.8
.00:15			
00:20	6.1	20.4	9.7
00:25			
00:30	5.9	20.9	8.8
00:35			
00:40	6.3	20.8	9.0
00:45			
00:50	6.1	20.4	8.6
00:55			
01:00	6.7	20.4	8.8

Date	6 April 2023
Operation no.	7
Otter board type	Vee-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	11.4	15.3	4.2
00:05			
00:10	6.3	20.1	8.4
.00:15			
00:20	6.3	19.6	8.9
00:25			
00:30	6.1	19.7	9.4
00:35			
00:40	6.0	17.8	9.7
00:45			
00:50	6.1	18.2	9.6
00:55			
01:00	6.1	18.8	9.3

Date	7 April 2023
Operation no.	9
Otter board type	Rectangular otter board-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	10.0	14.9	7.4
00:05	5.9	21.0	9.4
00:10	6.1	21.1	9.6
.00:15	6.0	20.9	9.8
00:20	6.1	20.9	9.6
00:25	6.0	21.1	9.6
00:30	6.1	20.9	9.6
00:35	5.9	21.2	9.6
00:40	5.9	21.1	9.4
00:45	6.0	21.1	9.5
00:50	5.9	21.4	9.6
00:55	6.0	21.3	9.7
01:00	6.0	20.9	9.6

Date	7 April 2023
Operation no.	10
Otter board type	Rectangular otter board-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	7.5	19.4	8.9
00:05	6.0	19.3	8.5
00:10	5.9	19.2	8.7
.00:15	6.0	18.8	8.5
00:20	5.9	18.8	8.5
00:25	5.9	18.8	8.6
00:30	6.0	18.6	8.4
00:35	6.0	18.4	8.1
00:40	6.0	18.1	7.8
00:45	6.0	18.3	7.8
00:50	5.9	17.9	7.4
00:55	5.8	18.0	7.9
01:00	7.8	17.6	7.9

Date	8 April 2023
Operation no.	11
Otter board type	Rectangular otter board-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	8.3	15.1	6.9
00:05	5.8	22.6	8.4
00:10	5.8	22.6	8.6
.00:15	5.8	22.4	8.6
00:20	5.8	22.7	8.3
00:25	5.9	22.8	8.0
00:30	5.9	23.3	8.1
00:35	5.7	22.8	8.2
00:40	5.9	22.3	8.1
00:45	5.8	22.3	8.2
00:50	5.9	22.4	8.1
00:55	5.8	22.3	8.2
01:00	5.8	22.0	8.2

Date	8 April 2023
Operation no.	12
Otter board type	Rectangular otter board-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	8.9	12.0	6.0
00:05	5.9	21.9	8.3
00:10	5.9	21.7	8.4
.00:15	5.8	21.7	8.6
00:20	5.8	21.5	8.6
00:25	5.8	21.4	8.8
00:30	5.8	21.3	8.6
00:35	5.8	21.8	8.4
00:40	5.4	22.1	8.6
00:45	5.6	21.6	8.1
00:50	5.6	21.6	8.4
00:55	5.6	21.3	8.8
01:00	5.6	21.4	8.5

Date	8 April 2023
Operation no.	13
Otter board type	Rectangular otter board-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	4.8	21.9	9.4
00:05			
00:10	The electricity outage for awhile		
.00:15			
00:20	4.6	20.2	9.4
00:25	4.8	19.8	9.9
00:30	4.8	19.8	10.2
00:35	4.6	19.2	10.0
00:40	4.5	18.8	9.8
00:45	4.8	18.5	9.9
00:50	4.8	18.3	10.0
00:55	4.8	17.9	9.9
01:00	4.6	18.0	10.0

Date	8 April 2023
Operation no.	14
Otter board type	Rectangular otter board-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	4.5	15.1	10.3
00:05	4.5	15.0	9.9
00:10	4.5	14.5	10.2
.00:15	4.5	14.3	10.1
00:20	4.5	14.1	10.4
00:25	4.5	13.6	10.4
00:30	4.5	13.4	10.4
00:35	4.5	13.2	10.1
00:40	4.5	13.0	10.0
00:45	4.4	13.3	10.3
00:50	4.5	12.7	10.3
00:55	4.4	12.9	10.4
01:00	4.5	13.0	10.3

Date	9 April 2023
Operation no.	15
Otter board type	Vee-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	3.4	11.0	5.3
00:05	4.9	21.8	8.7
00:10	5.1	22.1	8.8
.00:15	4.9	22.4	8.6
00:20	5.0	22.3	8.6
00:25	5.1	22.3	8.6
00:30	4.9	22.3	8.7
00:35	5.0	22.6	8.1
00:40	5.0	22.8	8.7
00:45	5.0	22.8	7.4
00:50	5.1	22.7	7.3
00:55	5.2	22.8	7.3
01:00	5.2	22.9	7.0

Date	9 April 2023
Operation no.	16
Otter board type	Vee-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	4.9	22.3	7.3
00:05	4.8	23.4	8.4
00:10	4.8	23.2	8.3
.00:15	4.6	23.2	8.3
00:20	4.8	23.1	8.2
00:25	4.6	23.4	8.6
00:30	4.8	23.4	8.5
00:35			
00:40	Urgent hauling due to the local fishing gear obstructing the towing direction		
00:45			
00:50			
00:55			
01:00			

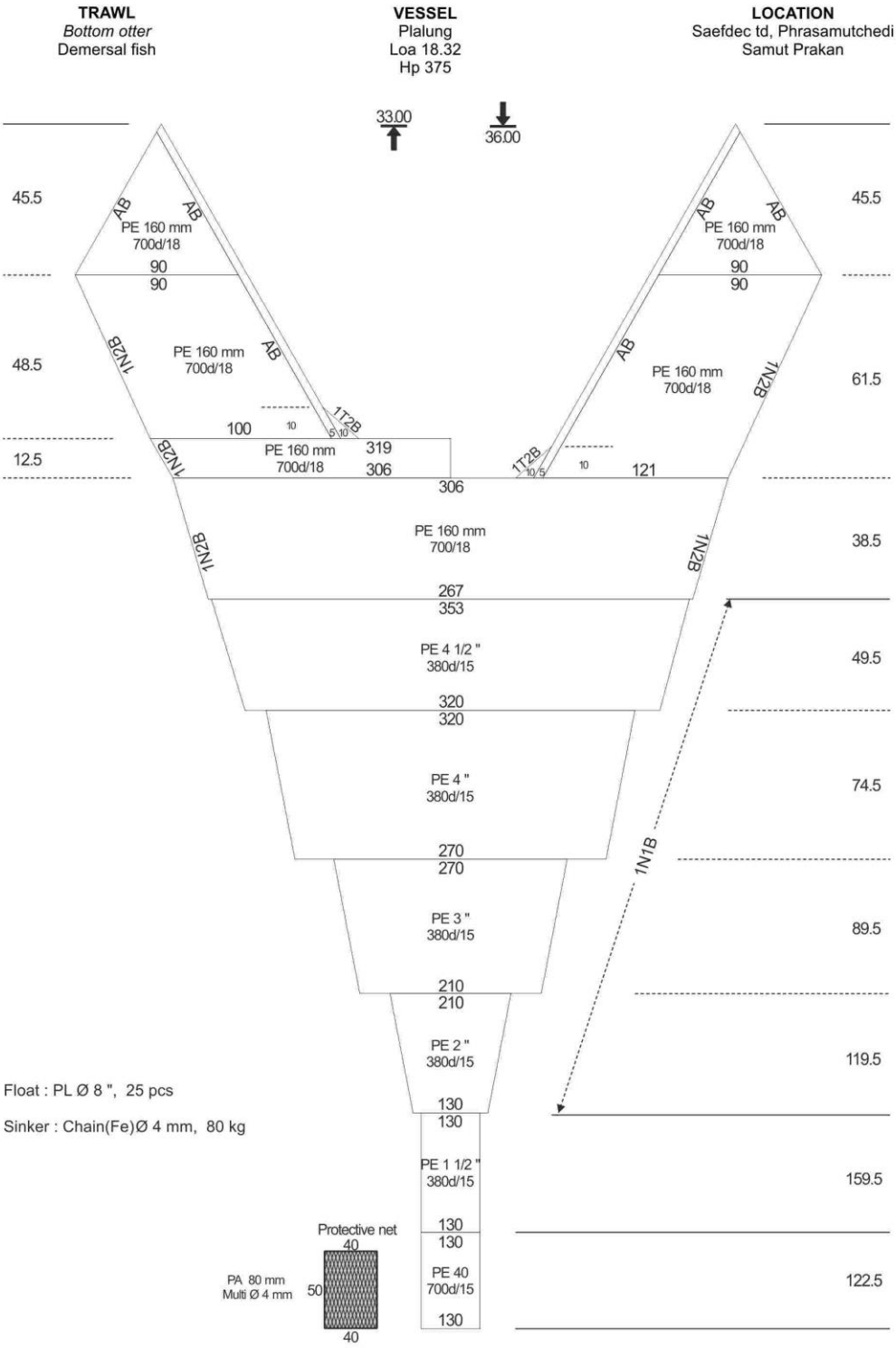
Date	9 April 2023
Operation no.	17
Otter board type	Vee-shape

Towing time (min)	Height opening (TEY)	Depth (m)	Net spread (DST)
00:00	4.5	20.0	4.8
00:05	4.6	24.3	8.1
00:10	4.9	24.4	8.1
.00:15	4.6	24.4	8.6
00:20	4.6	24.4	8.8
00:25	4.6	24.1	8.4
00:30	4.6	24.1	8.4
00:35	5.6	23.5	8.7
00:40	4.8	23.5	8.5
00:45	4.9	23.1	8.6
00:50	4.6	22.9	8.8
00:55	4.6	22.8	8.6
01:00	4.8	22.5	8.9
01:05	4.6	21.9	8.8
01:10	4.8	21.6	9.0
01:15	The TEY signal was not able to detect	21.3	8.9
01:20		20.5	9.2
01:25		20.3	9.2
01:30		20.0	9.3
01:35	4.8	19.3	9.2

Appendix: 3

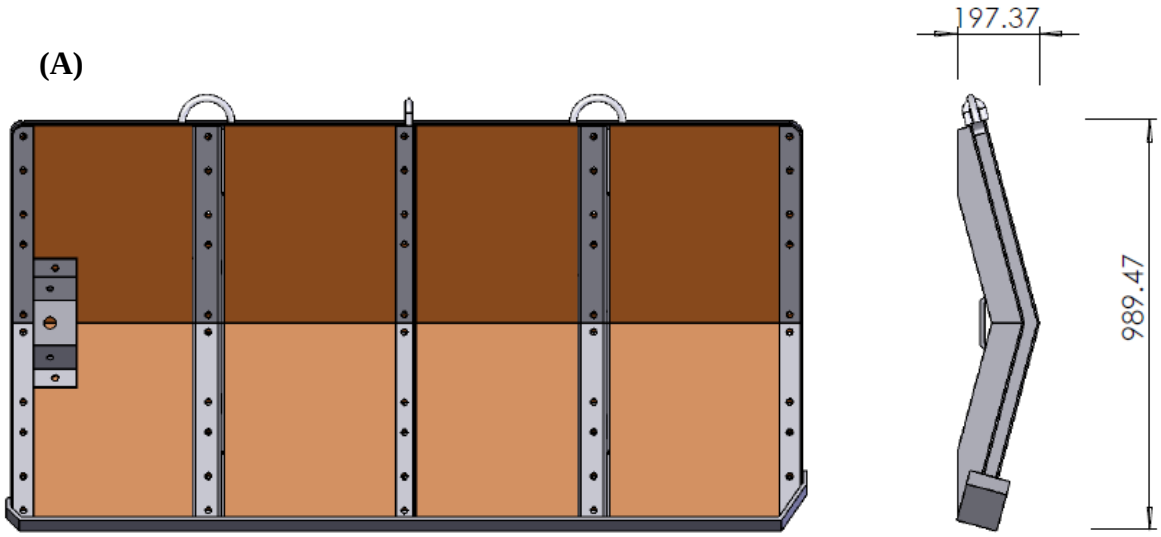
Diagram of bottom trawl Materials

Appendix: 3.1 Diagram of bottom trawl nets

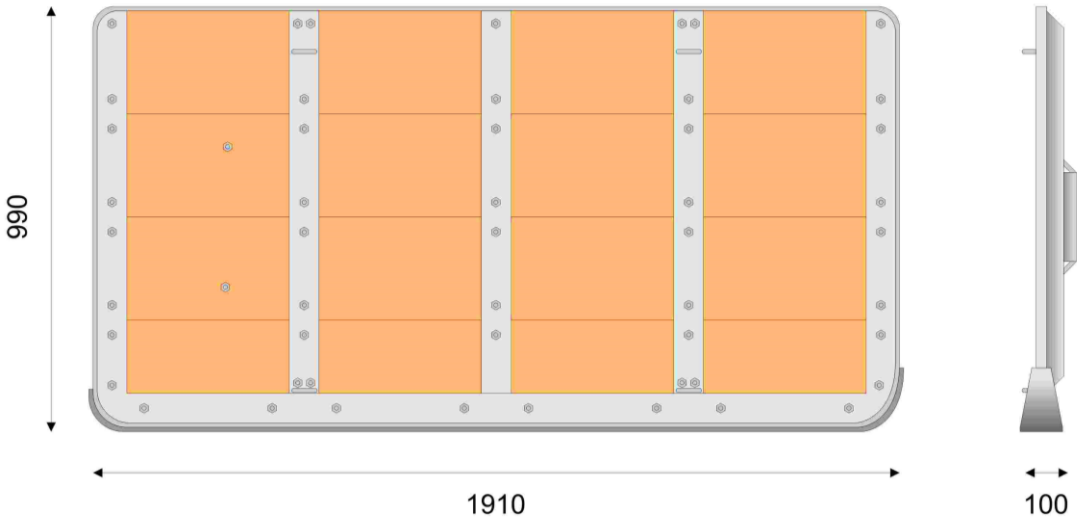


Appendix: 3.2 Diagram of Vee shape (A) and Rectangular otter board (B)

(A)



(B)



Appendix 4: SENSUS recorder data

Figure A The summary of SENSUS recorder data from Vee-shape otter boards experiment

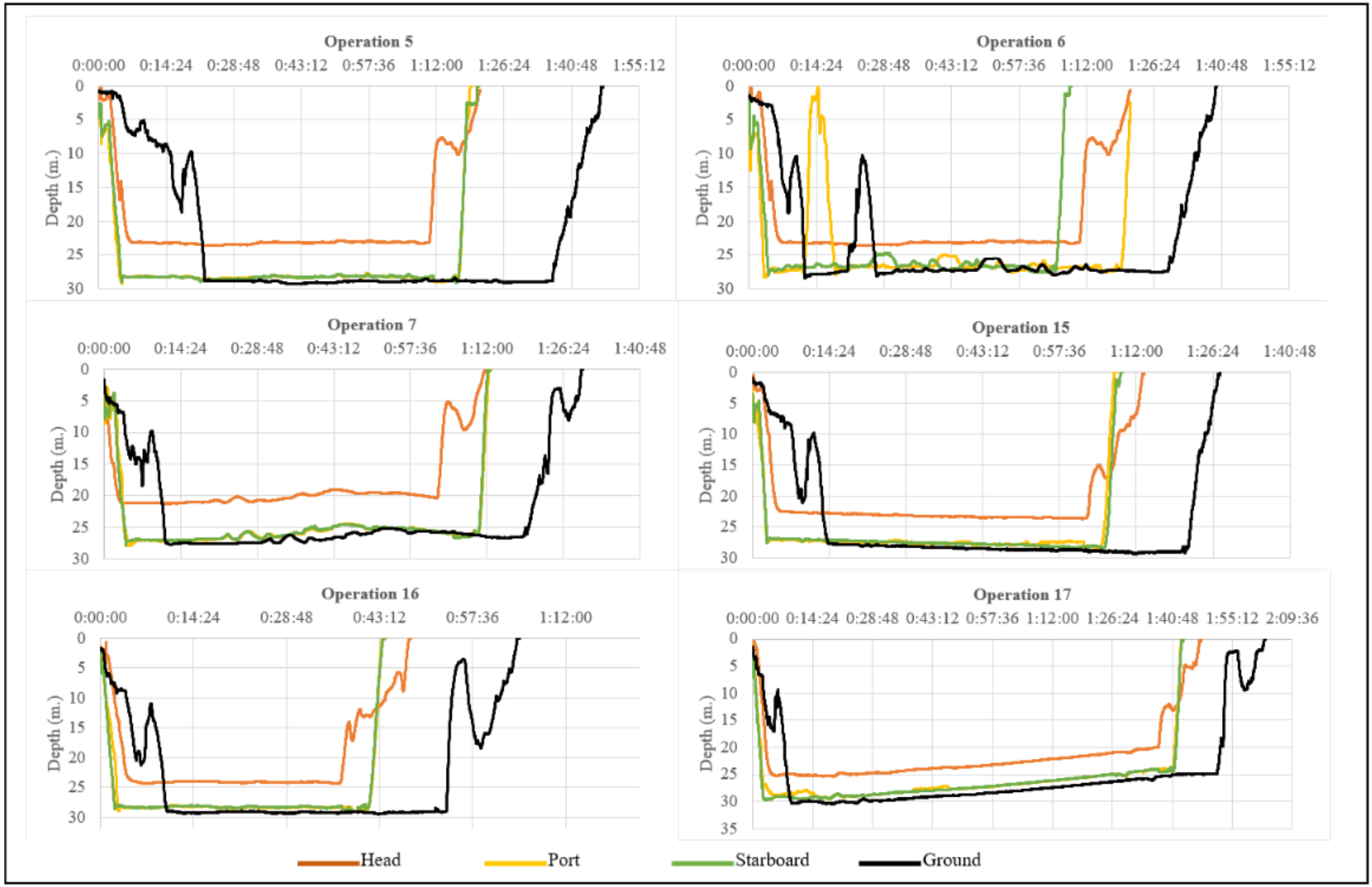
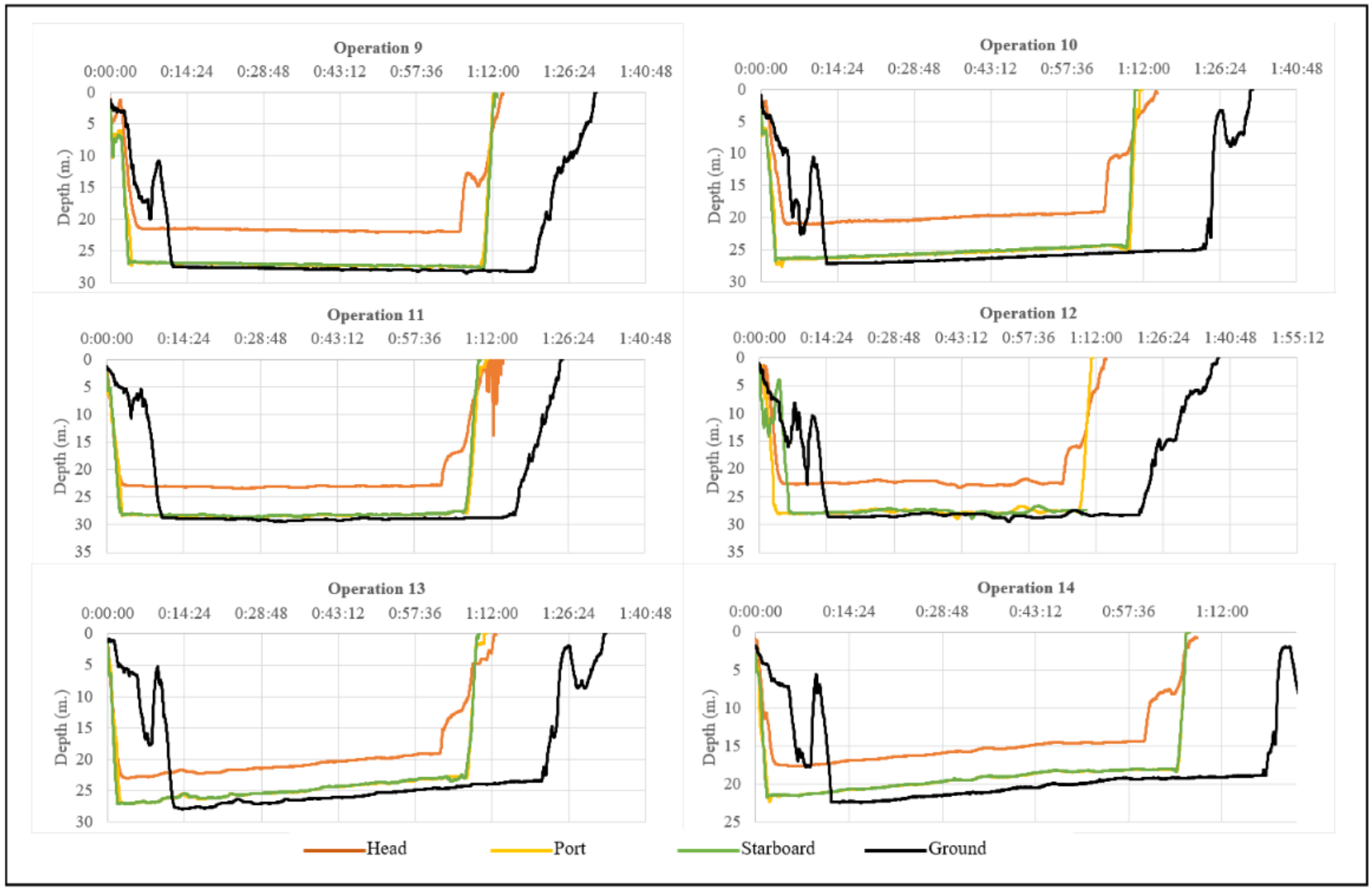


Figure B The summary of SENSUS recorder data from Rectangular otter boards experiment



Appendix 5: Species diversity by operation

Table A Species diversity of catch from each operation, O is the presence of specimen in which operation.

Species	**Family**	**Test1**	**OP5**	**OP6**	**OP7**	**OP9**	**OP10**	**OP11**	**OP12**	**OP13**	**OP14**	**OP15**	**OP16**	**OP17**
Sponges	Sponges	O	O	O	O	O		O	O	O	O	O	O	O
Thenus orientalis	Scyllaridae				O		O		O	O	O			O
Hermit crab	Diogenidae					O			O			O		
Dromid crabs	Dromiidae				O				O					
Dorippid crabs	Dorippidae	O	O	O	O	O		O	O	O	O	O	O	O
Calappa clypeata	Calappidae		O	O	O			O		O	O	O		O
Leucosid crab	Leucosidae										O	O	O	
Parthernope longimanus	Parthernopidae									O	O		O	O
Cryptopodia fornicata	Parthernopidae													O
Prismatopus sp.	Majidae								O					
Phalangipus longipes	Majidae		O					O	O				O	O
Xanthid crab	Xanthidae									O				
Podopthalmus vigil	Portunidae	O							O			O		
Portunid crabs	Portunidae					O	O	O	O	O	O	O	O	
Portunus pelagicus	Portunidae								O					
Portunus sp.	Portunidae		O	O										
Charybdis affinis	Portunidae			O		O				O				

Table A Species diversity of catch from each operation, O is the presence of specimen in which operation. (continue)

Species	Family	Test1	OP5	OP6	OP7	OP9	OP10	OP11	OP12	OP13	OP14	OP15	OP16	OP17
Cymbiola nobilis	Volutidae									O				
Amusium pleuronectes	Pectinidae	O	O	O	O	O	O	O	O	O	O	O	O	O
Photololigo spp.	Loliginidae	O	O	O	O	O	O	O	O	O	O	O	O	O
Sepioteuthis lessoniana	Loliginidae	O	O		O		O		O		O		O	O
Bobtail Squid	Sepiolidae													O
Sepia recurvirosta	Sepiidae		O	O	O	O	O	O	O	O		O		O
Sepia spp.	Sepiidae	O									O			
Octopus	Octopodidae								O			O		
Sea cucumber	Holothuriidae	O	O	O	O		O	O		O	O	O	O	O
Chiloscyllium punctatum	Hemiscyllidae								O					
Brevitrygon heterura	Dasyatidae						O			O				
Brevitrygon imbricata	Dasyatidae							O						
Gymnothorax pseudothrysoideus	Muraenidae				O						O	O		
Sardinella sp.	Clupeidae	O									O			
Saurida tumbil	Synodontidae							O						
Saurida undosquamis	Synodontidae	O		O	O					O	O		O	O
Antennarius nummifer	Antennaridae													O

Table A Species diversity of catch from each operation, O is the presence of specimen in which operation. (continue)

Species	Family	Test1	OP5	OP6	OP7	OP9	OP10	OP11	OP12	OP13	OP14	OP15	OP16	OP17
Pegasus internarius	Pegasidae		O											
Fistularia petimba	Fistulariidae											O		
Dactylopterna orientalis	Dactylopteridae											O		
Apistus carinatus	Apistidae							O		O				O
Pterois russelii	Scorpaenidae					O		O		O		O	O	O
Inimicus cuvieri	Synanceiidae	O	O		O	O	O	O	O	O	O	O	O	O
Flatheaded	Platycephalidae				O		O	O	O	O	O	O	O	O
Epinephilus bleekeri	Serranidae													O
Epinephilus sexfasciatus	Serranidae				O		O							
Priacanthus maceracanthus	Priacanthidae											O		
Priacanthus tayenus	Priacanthidae		O										O	O
Apogon pleuron	Apogonidae						O						O	
Apogon sp.	Apogonidae												O	
Apogon spp.	Apogonidae										O	O		O
Rachycentron canadum	Rachycentridae									O	O	O		O
Echenius naucrates	Echeneidae													O

Table A Species diversity of catch from each operation, O is the presence of specimen in which operation. (continue)

Species	Family	Test1	OP5	OP6	OP7	OP9	OP10	OP11	OP12	OP13	OP14	OP15	OP16	OP17
Alactis ciliaris	Carangidae			O									O	O
Alepes vari	Carangidae	O												
Atule mate	Carangidae							O						O
Parastomateus niger	Carangidae	O												
Megalaspis cordyla	Carangidae													O
Equulites oblongus	Leiognathidae						O						O	
Equulites stercorarius	Leiognathidae										O	O		
Eubleckeria jonesi	Leiognathidae						O							O
Secutor indicus	Leiognathidae						O		O		O	O	O	O
Photopectolaris bindus	Leiognathidae													O
ponyfish	Leiognathidae			O		O								
Lutjanus madras	Lutjanidae	O		O										
Lutjanus vitta	Lutjanidae			O					O	O				
Gerres erythrourus	Gerridae			O						O				O
Pentaprion elongatus	Gerridae		O			O	O	O	O		O	O	O	O
Pomydasys kaakan	Hemulidae	O												
Nemipterus furcosus	Nemipteridae			O										
Nemipterus hexodon	Nemipteridae		O											

Table A Species diversity of catch from each operation, O is the presence of specimen in which operation. (continue)

Species	Family	Test1	OP5	OP6	OP7	OP9	OP10	OP11	OP12	OP13	OP14	OP15	OP16	OP17
Nemipterus marginatus	Nemipteridae	O												
Nemipterus sp.	Nemipteridae				O									O
Scolopsis monogramma	Nemipteridae	O	O		O	O		O	O	O	O	O		O
Upeneus sundaicus	Mullidae			O			O		O				O	O
Upeneus tragula	Mullidae	O		O	O		O	O		O	O	O		
Dactylopus dactylopus	Callionymidae									O				
Dragonet	Callionymidae													O
Sigganus fuscescens	Siganidae								O					
Rastrelliger kanagurta	Scombridae	O	O	O	O	O	O				O			
Pseudorhombus arsius	Paralichthyidae						O							O
Pseudorhombus oligodon	Paralichthyidae		O	O		O						O	O	
Arnoglossus macrolophus	Bothidae								O					
Engyprosopon spp.	Bothidae									O	O			
Grammanobothus polypthalmus	Bothidae							O	O		O	O	O	O
Aseragodes filiger	Soleidae								O					
Pardachirus parvonicus	Soleidae								O					

Table A Species diversity of catch from each operation, O is the presence of specimen in which operation. (continue)

Species	Family	Test1	OP5	OP6	OP7	OP9	OP10	OP11	OP12	OP13	OP14	OP15	OP16	OP17
Zebrius quagga	Soleidae					O								
Cynoglossus arel	Cynoglossidae	O												
Aleuterus monoceros	Monacanthidae	O									O			O
Anacanthus barbatus	Monacanthidae				O						O	O		O
Boxfish	Ostracidae											O		
Lagocephalus seuzensis	Tetraodontidae		O			O	O	O		O	O	O	O	O
Lagocephalus lunaris	Tetraodentidae										O			