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SEAFDEC

Training Department

SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

TD/RES/30

April 1992

OBSERVATION REPORT ON TUNA LONGLINE FISHING OPERATIONS  
IN THE BAY OF BENGAL ON BOARD "R.V. SUMRUATPRAMONG 4"

24 FEBRUARY - 16 MARCH 1992

by

Mr. Aussanee Munprasit

Mr. Pisanu Siripittrakool

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## I. Introduction

Our first observation cruise to study new design tuna-longline operations was on board the Shinyo-Maru in the Bay of Bengal from Feb. 9-28 1991. In order to continue this study we proposed to the SEAFDEC Council Committee that further studies be carried out on this fishing gear in 1992-1994. The proposal was approved.

During the period 24 February to 25 March 1992, R.V. Sumruatpramong 4 was scheduled to carry out a survey using tuna-longline in the Indian Ocean. As we wanted to accumulate as much information as possible for our studies we took this opportunity to join R.V. Sumruatpramong 4.

R.V. Sumruatpramong 4., is a 518 GT research-vessel belonging to the Oceanic Fisheries Division, Department of Fisheries, Thailand. Her activities are generally to carry out research projects on tuna and offshore fisheries and to search for their fishing grounds. In 1992, R.V. Sumruatpramong 4 with 46 ship's staff and researchers carried out a survey and research projects in the Indian Ocean and Andaman Sea, looking especially at tuna resources.

Tuna-longline fishing gear used on board R.V. Sumruatpramong 4 was different from the Shinyo-Maru fishing gears. There was an experiment using three ply nylon monofilament but mostly the original popular design of tuna-longline which is used throughout the world, was used. The tuna resource survey, using tuna-longline, was scheduled from 25 February to 15 March 1992 in the Bay of Bengal. (Fig. 1)

To collect more information on tuna-longline fishing operations and the fishing ground conditions, we got approval to be on board R.V. Sumruatpramong 4 from 25 February to 15 March 1992 as observers. We embarked and disembarked the Phuket research vessel at the Phuket Marine Biological Center pier, Leam-Punva.



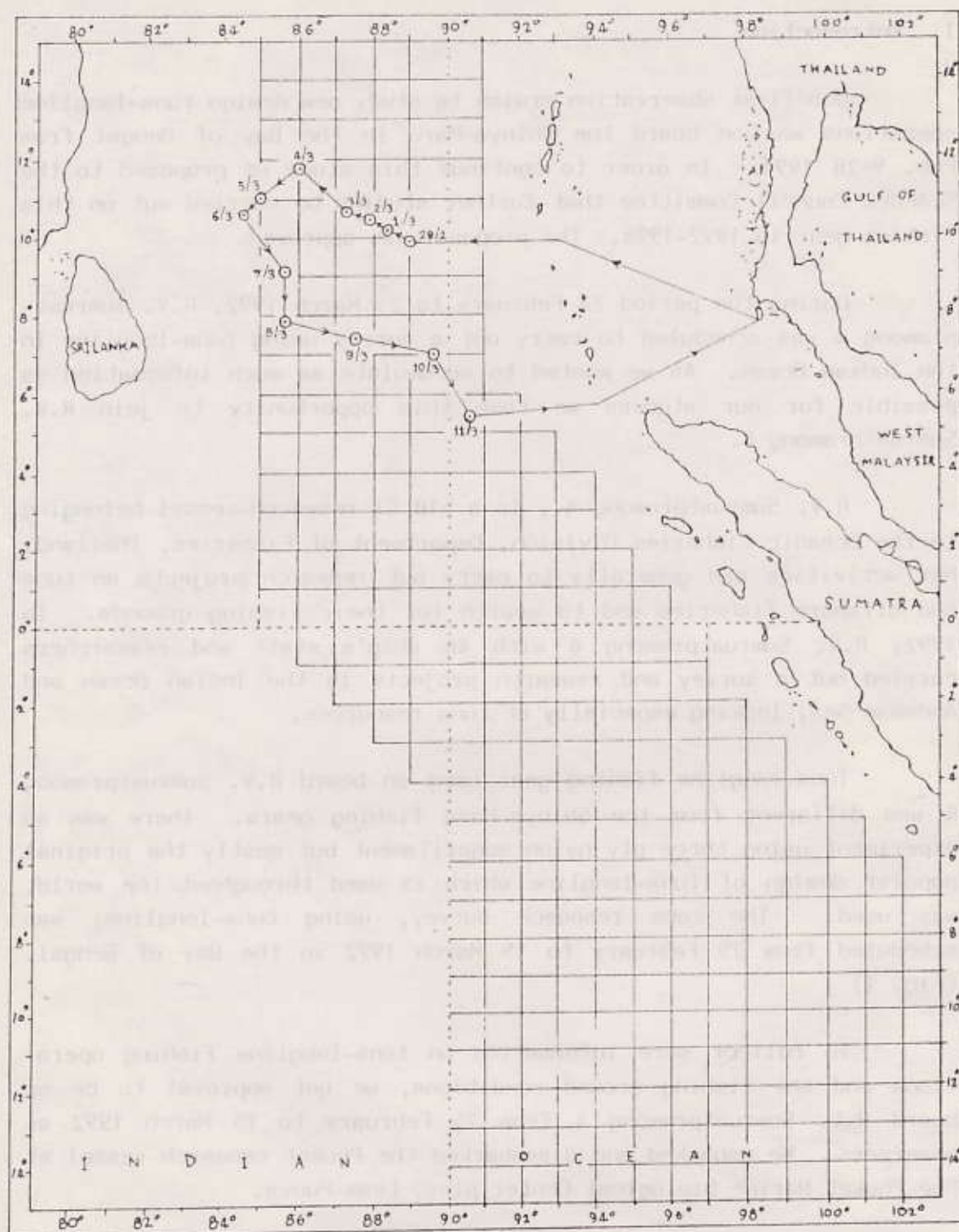


Fig. 1 Survey station of the R.V. Sumruatpramong 4 for Tuna Long-line - 1992 (26/2-15/3/1992)

## II. DoF's Officers and Observers

### Officers of the Department of Fisheries

#### - Researchers

Mr. Yongyoot Sinthupinyo	Chief Scientist
Mr. Thongdee Parnnium	Biologist
Mr. Weera Pokaphut	"
Mr. Sophon Raungpan	"
Mr. Paumsuk Sriploy	"
Miss Chamchoy Tharnpong	"
Miss Sopana Boonyapiwat	"

#### - Ship's Officers

Mr. Vichit Ketwan	Captain
Mr. Somphote Inbumroong	Chief engineer
Mr. Chaleaompong Chaiwong	Chief officer

### Observers

Mr. Aussanee Munprasit	SEAFDEC/TD's Researcher
Mr. Pisanu Siripitrakool	SEAFDEC/TD's Assit. Researcher

## III. Schedule

- 24-2-1992 : Left Bangkok for Phuket by bus.
- 25-2-1992 : Arrived in Phuket.
- 26-2-1992 : Embarked R.V. Sumruatpramong 4 at the Phuket Marine Biological Center pier.
- : 0900 pm. left Phuket for fishing ground in the Bay of Bengal.

- 29-2-1992 : Arrived at the fishing ground, central area of the Bay of Bengal.
- 29/2-12/3/92 : Tuna resources survey in the Bay of Bengal by tuna-longline.
- 12-14/3/92 : Returned to Phuket.
- 15/3/92 : Left Phuket for SEAFDEC/ID by bus.
- 16/3/92 : Arrived SEAFDEC/ID

#### IV. Observation activities

##### 1) Tuna resource survey method

R.V. Sumruatpramong 4 was appointed to conduct a tuna resource survey in the Indian Ocean, Bay of Bengal by tuna-longline, from 26 February to 15 March 1992. The program was as follows:

- 26-29/2/92 : Proceeded to the central area of the Bay of Bengal.
- 29/2-11/3/92 : Conducted tuna resources survey using tuna-longline fishing gear.
- 11-14/3/92 : Returned to Phuket.

The survey program for each day was as follows:

- Shot 150-185 baskets of tuna-longline from early morning at 04:00 am.
- Oceanographic observation of fishing ground condition was conducted at 09:00 am.; this included water temperature, dissolved oxygen, salinity, transparency, color and plankton at different layers.



- Hauling was from 12:00 am. until 06:00 pm.
- The catches were recorded by species, length, weight and stomach content.

## 2) Survey Area

The survey was carried out in the central area of the Bay of Bengal which is in International waters. Twelve operations of tuna-longline fishing were conducted at 12 stations in 12 days, starting from 29 February 1992 to 11 March 1992 as follows.

Station No.	Date	Latitude		Longitude		Number of baskets		Number of hook
		Start	Fin.	Start	Fin.	5 hooks/B	7 hooks/B	
1	29/2/92	10°-02.95'	09°-43.93'	89°-10.54'	88°-55.51'	144	10	790
2	1/3/92	10°-23.92'	10°-00.03'	88°-24.48'	88°-23.51'	148	26	922
3	2/3/92	10°-46.01'	10°-21.78'	87°-55.16'	87°-56.18'	138	31	907
4	3/3/92	10°-45.12'	10°-23.87'	87°-17.25'	87°-17.14'	147	35	980
5	4/3/92	11°-42.95'	11°-53.73'	85°-47.76'	86°-14.64'	151	35	1,000
6	5/3/92	11°-13.56'	10°-48.34'	85°-01.13'	84°-59.06'	137	35	930
7	6/3/92	10°-24.59'	10°-50.54'	84°-41.14'	84°-28.44'	150	24	918
8	7/3/92	09°-11.18'	09°-01.45'	85°-54.08'	85°-29.64'	149	35	990
9	8/3/92	07°-58.61'	07°-44.55'	85°-55.67'	85°-32.36'	147	36	987
10	9/3/92	07°-35.24'	07°-07.36'	87°-37.26'	87°-30.51'	147	35	980
11	10/3/92	07°-05.34'	06°-53.83'	89°-78.83'	89°-50.31'	129	30	855
12	11/3/92	05°-33.44'	05°-17.10'	90°-36.11'	90°-31.69'	112	30	770

The survey area covered latitude  $5^{\circ}$  to  $12^{\circ}$  North, and longitude  $85^{\circ}$  to  $90^{\circ}$  East, as shown in Fig. 1.

### 3) Fishing Gear Construction

There were two kinds of basket arrangements and two types of branch line: 35 baskets of 7 branches and 120-150 baskets of 5 branches in a basket; branch lines were of the original type and three ply nylon monofilament type. (Fig. 2-3).

Station No.	Depth (m)	No. of baskets	Longitude		Latitude		Remarks
			East	North	East	North	
001	10	100	85-25-25	10-25-25	85-25-25	10-25-25	
002	20	100	85-25-25	10-25-25	85-25-25	10-25-25	
003	30	100	85-25-25	10-25-25	85-25-25	10-25-25	
004	40	100	85-25-25	10-25-25	85-25-25	10-25-25	
005	50	100	85-25-25	10-25-25	85-25-25	10-25-25	
006	60	100	85-25-25	10-25-25	85-25-25	10-25-25	
007	70	100	85-25-25	10-25-25	85-25-25	10-25-25	
008	80	100	85-25-25	10-25-25	85-25-25	10-25-25	
009	90	100	85-25-25	10-25-25	85-25-25	10-25-25	
010	100	100	85-25-25	10-25-25	85-25-25	10-25-25	
011	110	100	85-25-25	10-25-25	85-25-25	10-25-25	
012	120	100	85-25-25	10-25-25	85-25-25	10-25-25	
013	130	100	85-25-25	10-25-25	85-25-25	10-25-25	
014	140	100	85-25-25	10-25-25	85-25-25	10-25-25	
015	150	100	85-25-25	10-25-25	85-25-25	10-25-25	



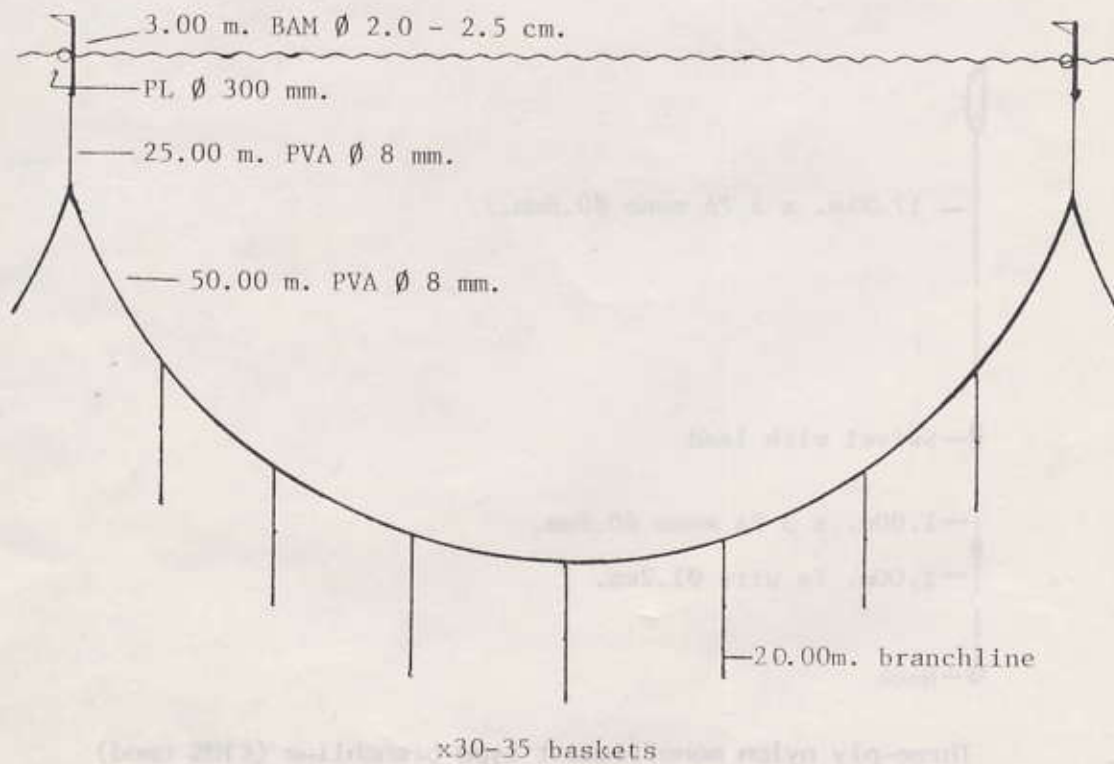
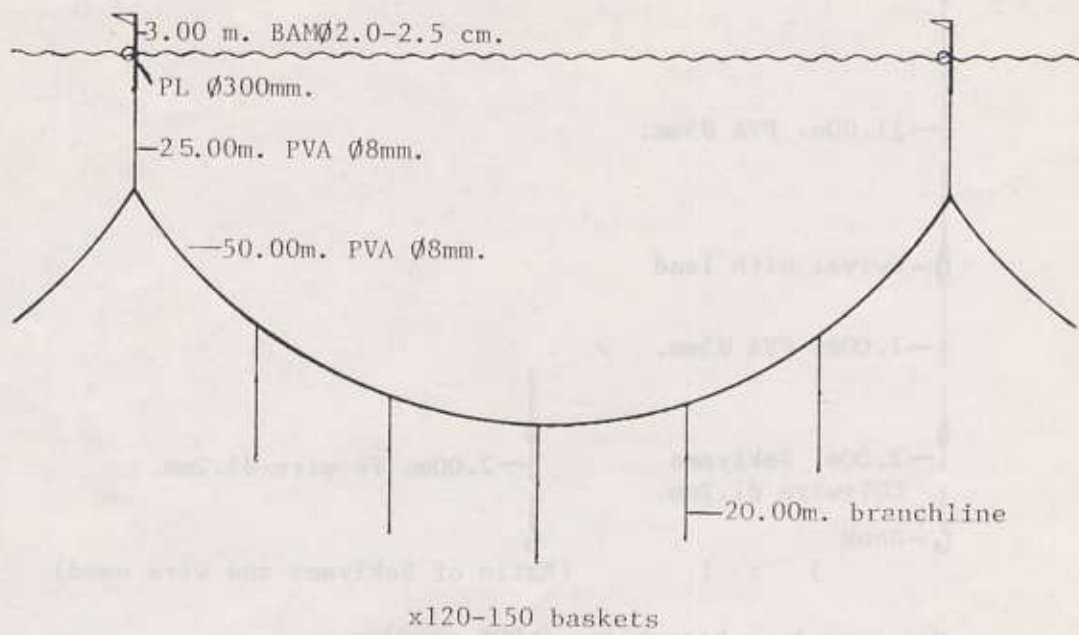
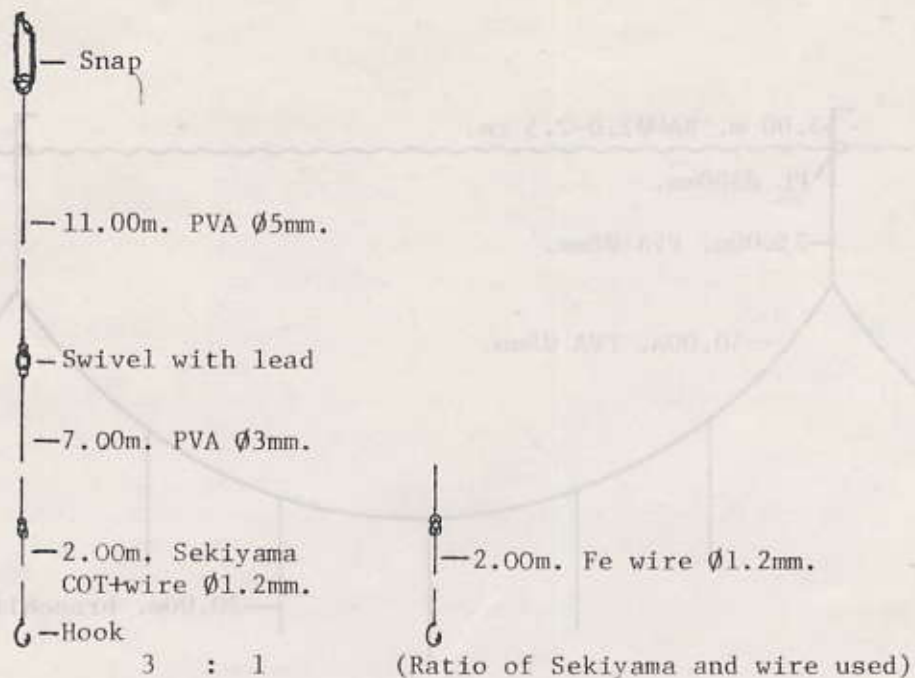
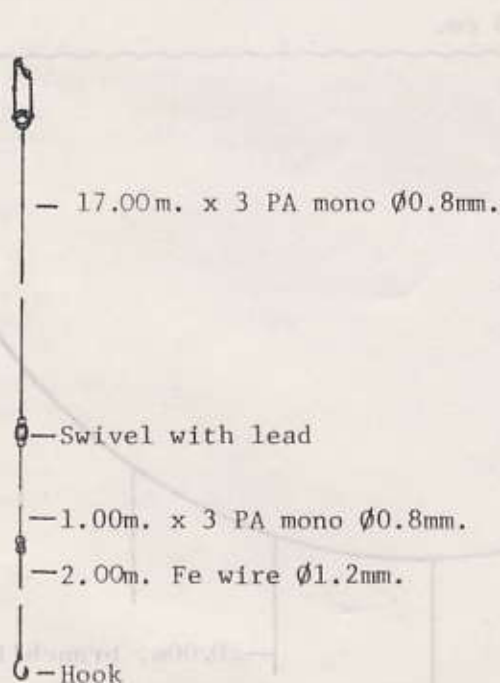


Fig. 2 Two different types of basket arrangement



Original type branchline (>90% used)



Three-ply nylon monofilament type branchline (<10% used)

Fig. 3 Two different types of branchline

The tuna-longline fishing gear construction on R.V. Sumruat-pramong 4 consisted of a 3 meter long bamboo pole and flag with a plastic buoy- $\phi$  300 mm. for buoy; 25 meters long cremona, 8 millimeters diameter (20.00 PVA  $\phi$  8 mm) for buoy line; 6 and 8 pieces of 50 meters long cremona, 8 millimeters diameter (6-8 x 50.00 PVA  $\phi$  8 mm.) for mainline in a basket; and 5-7 pieces of two different types of 20 meters long branch line.

The original type branch line consisted of 11 meters of cremona, 5 millimeters in diameter (11.00 PVA  $\phi$  5 mm), connected to 7.0 meters of cremona, 3 millimeters in diameter (7.00 PVA  $\phi$  3 mm) with brass swivel, joined to a 2.0 meter long leader which was of two different materials - sekiyama (cotton + Fe wire  $\phi$  1.2 mm) and Fe wire  $\phi$  1.2 mm in the proportion 3:1. The three ply monofilament branch line consisted of 17.5 meters of three ply nylon monofilament (x3 PA mono  $\phi$  0.8 mm), connected to 1 meter of three ply nylon monofilament with brass swivel, joined to 2.0 meters of wire leader -  $\phi$  1.2 mm. (Fig. 2 & 3).

#### 4) Fishing Operation

All fishing gear was arranged for operation at the stern deck. Horse mackerel (*Decapterus*, spp.), 15-20 centimeter in length, were prepared as bait under frozen conditions. 6-7 trays of bait were taken from the refrigerator at midnight of the day before operations and defrosted under air temperature conditions. The hook was fixed on the head of the bait. (Fig. 4).

Shooting started at four o'clock in the morning from the stern deck with a sailing speed of about 9 knots. 150-185 baskets were set in the sea before 06.00 hours; so it took about 2 hours for setting. Arrangement of the shooting operation is shown in Fig. 5.

Hauling was started at noon also from the stern deck; working space was limited on R.V. Sumruatpramong 4. Hauling on this vessel was inconvenient; it was difficult to control the vessel because the hauling position was very close to the stern and propeller. Sometimes the line got entangled in the propeller. The catch was lost quite often because the vessel could not slow down in time when the catch was found.

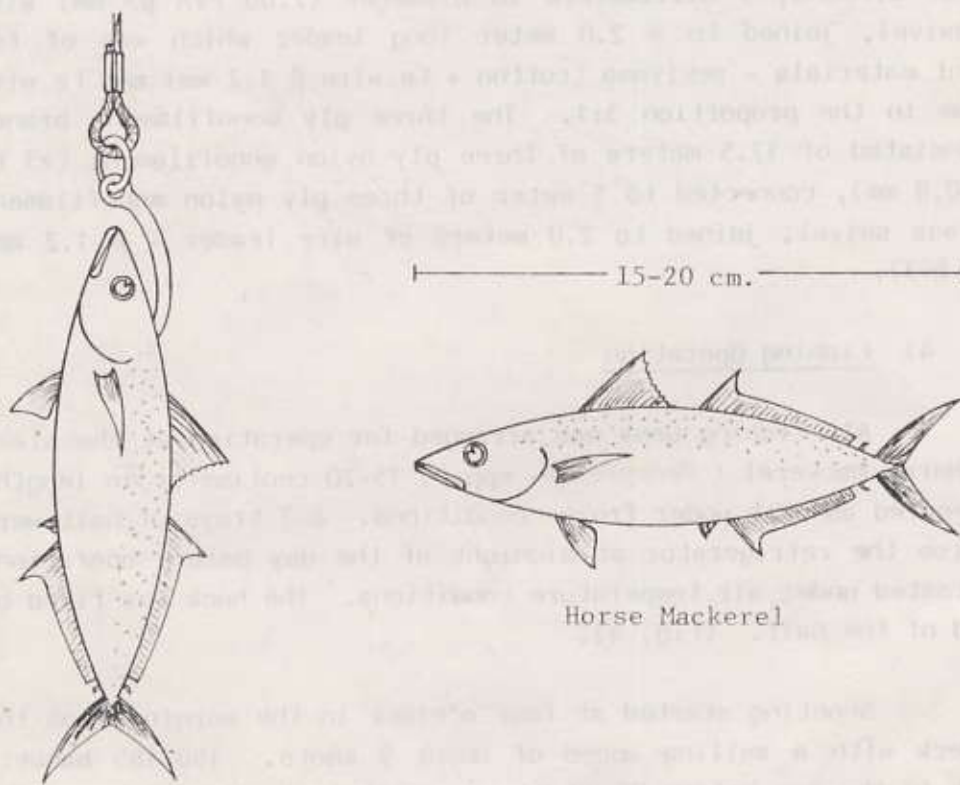


Fig. 4 Bait and baiting method



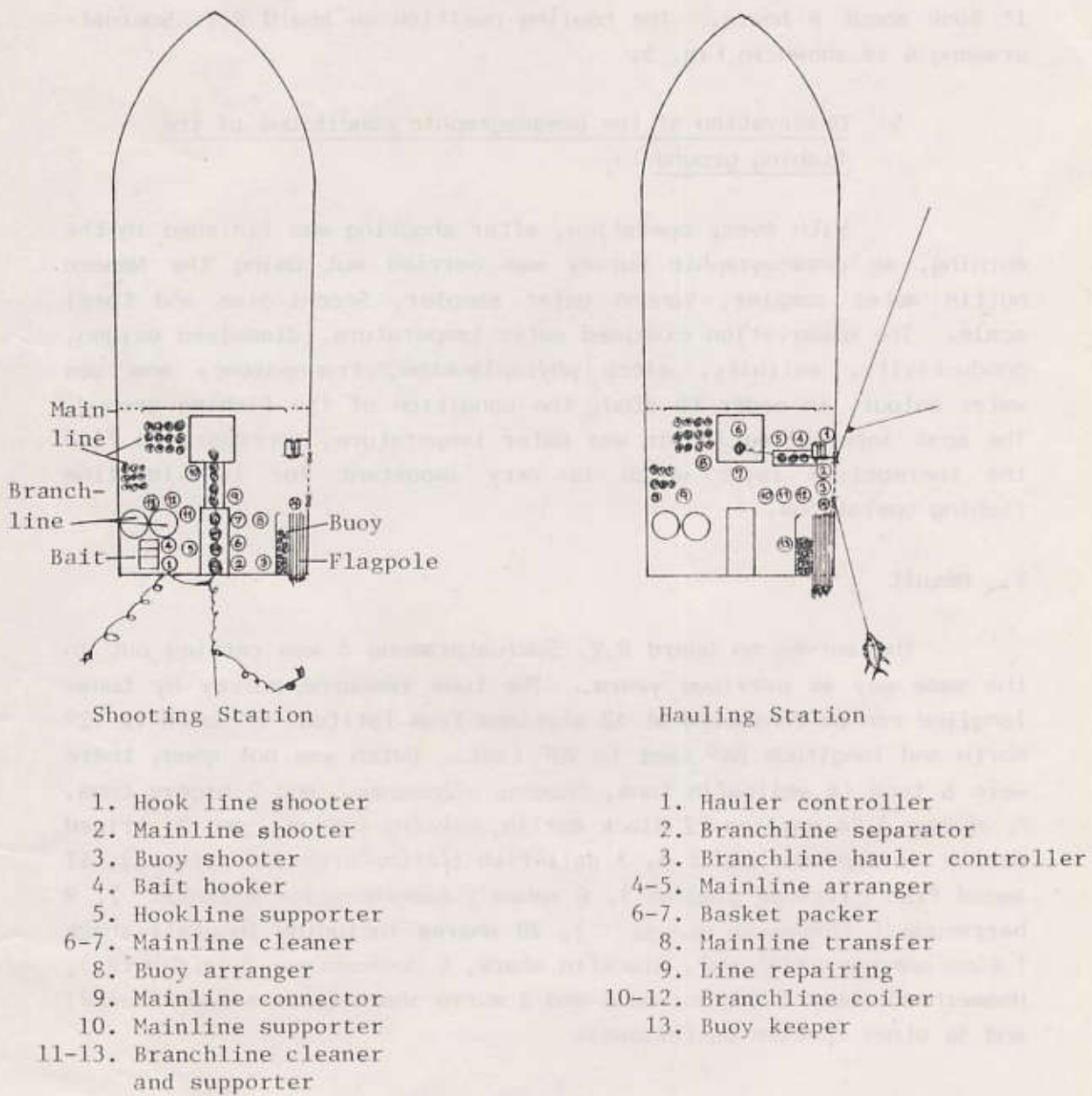


Fig. 5 Fishing Operation Crew station

Hauling was continued until finished, at around 6:00 pm.; it took about 6 hours. The hauling position on board R.V. Sumruatpramong 4 is shown in Fig. 5.

5) Observation of the oceanographic conditions of the fishing ground

With every operation, after shooting was finished in the morning, an oceanographic survey was carried out using the Nansen bottle water sampler, Vandon water sampler, Secchi-disk and Forel scale. The observation examined water temperature, dissolved oxygen, conductivity, salinity, micro phytoplankton, transparency and sea water colour, in order to study the condition of the fishing ground. The most interesting factor was water temperature, necessary to find the thermocline layer which is very important for tuna-longline fishing operations.

V. Result

The survey on board R.V. Sumruatpramong 4 was carried out in the same way as previous years. The tuna resource survey by tuna-longline can be conducted at 12 stations from latitude 5° North to 12° North and longitude 84° East to 90° East. Catch was not good, there were 6 tuna (4 yellowfin tuna, *Thunnus albacares* and 2 bigeye tuna, *T. obesus*.), 4 marlins (2 Black marlin, *Makaira indica* and 2 striped marlin *Tetropterus audax*), 3 sail-fish (*Istiophorus platypterus*), 17 sword fish (*Xiphias gladius*), 6 wahoo (*Acanthocybium solandri*), 9 barracuda (*Sphyraena picuda*), 20 sharks including longtail shark (*Alopias superciliosus*), Blackfin shark, (*Carcharhinus falciformis*), Hammerhead shark (*Sphyrna* sp.) and 2 murro shark (*Isurus paucus*) and 36 other species as follows:-

Station No.	Tuna pcs./ (kg.)	Marlin pcs./ (kg.)	Sail F. pcs./ (kg.)	Sword F. pcs./ (kg.)	Wahoo pcs./ (kg.)	Barracuda pcs./ (kg.)	Shark pcs./ (kg.)	Other pcs./ (kg.)	Total pcs./ (kg.)
1	1/(27)	-	-	1/(2)	1/(6)	-	1/(60)	-	4/(95)
2	-	1/(65)	-	-	2/(5,5)	1/(12.5)	2/(60)	1/(3)	7/(150.5)
3	2/(70,64)	-	1/(30)	1/(5)	-	-	3/(100)	3/(14)	10/(283)
4	1/(70)	-	1/(20)	-	-	3/(30)	3/(120)	8/(60)	16/(300)
5	-	1/(80)	-	2/(80,3)	-	-	4/(80)	7/(40)	14/(283)
6	1/(27)	-	-	1/(5)	1/(7.5)	2/(19)	2/(25)	-	7/(83.5)
7	-	-	-	2/(20)	-	-	2/(33)	4/(20)	8/(73)
8	-	1/(70)	-	2/(49)	-	2/(14)	1/(50)	1/(4)	7/(187)
9	1/(148)	1/(52)	-	2/(50)	1/(8)	-	2/(100)	1/(4.5)	8/(262.5)
10	-	-	-	1/(25)	1/(8)	-	-	3/(20)	5/(53)
11	-	-	1/(20)	-	-	-	-	3/(50)	4/(70)
12	-	-	-	5/(15)	-	1/(8)	-	5/(25)	11/(48)
Total	6/(306)	4/(267)	3/(70)	17/(254)	6/(39.5)	9/(83.5)	20/(628)	36/ (240.5)	101/ (1888.5)

Catch by groups for each operation

Other catch was mostly Lancet fishes, ( *Alepisaurus ferox-lowe* ), string ray, snake mackerels ( *Ruvettus pretiosus* ) and Ridley's turtle ( *Lepidochelys olivacea* ).

Most of the tuna catch were large size; two bigeye tuna of 64 and 70 kilogram and four yellowfin tuna of 70, 48, and 27 kilogram. The other interesting catch was sword fish, most were small size 2-25 kilogram. There was only one big sword fish of 80 kilogram body weight. Many of them were lost from the hook, with only the lower jaw or gill left on the hooks. These were all small size too.

#### Fishing gear operation

120-185 baskets of tuna-longline were set in the sea for 6-7 hours. The hook layer was determined by using PICARD's method (ship speed and model chain experiment). Three operations were taken as the samples for both types of mainline arrangement (5 hooks and 7 hooks per basket). The hook layer of 5 hooks per basket was from 85 to 130 meters depth, and 125 to 159 meters depth for 7 hooks per basket from the sampling on the fourth and the seventh operation. The detail is as shown in Annex I.

#### Water temperature of the fishing ground;

Water temperature was investigated in the morning for every operation. According to the oceanographic survey of the fishing ground, the thermocline layer was mostly found at the 100 to 150 meter depth. But in the last three operations at a lower latitude (05°-07° N), the thermocline was more shallow at 70 to 100 meters depth. The thermal profile of the fishing ground is shown in Annex II.



## VI. Discussion

The survey's results were quite poor, however there were many factors to be taken into consideration. The results of tuna-longline fishing operations by TV. Shinyo-Maru in 1991, (TD/RES/28) have shown that 44 tuna were caught within seven fishing operation in the Bay of Bengal during the period of 9-16 February 1991. 100-150 baskets of tuna-longline were used on each operation, with 6 hooks in a basket. Mainline, branch line and buoy line were 40, 28 and 10 meters long. The hook layer was checked at 66 to 80 meter depth by PICARD's method too.

The fishing ground for TV. Shinyo-Maru was of a higher latitude than this survey, ( $9^{\circ}$  North to  $16^{\circ}$  North) and in the central area of the Bay (longitude  $86^{\circ}$ - $87^{\circ}$  East). The thermocline layer was found at 50 to 150 meter depth. Bait used was good size pacific mackerel and pike mackerel (saury) 20-25 centimeters in length.

From the above information, it can be seen that there were some differences from the operation on board Shinyo-Maru in 1992 as follows.

- 1) The hook layer was deeper, 85-150 meters depth.
- 2) Nylon monofilament was more effective for catch efficiency but was not used on R.V. Sumruatpramong 4.
- 3) The fishing ground was on a lower latitude, from  $05^{\circ}$  North to  $12^{\circ}$  North (the best catch of TV. Shinyo-Maru was on latitude  $14^{\circ}$  North and longitude  $87^{\circ}$  East).
- 4) Bait used on R.V. Sumruatpramong 4 was small horse mackerel (15-20 centimeters).
- 5) Duration of the operation was only two weeks later in the year than the period of operation of TV. Shinyo-Maru (mid of February).

## VII. Acknowledgements

These observations were very interesting and very useful. We gained a lot of knowledge and experience which will be applied to training material at SEAFDEC/ID. It was a very good opportunity to observe the fishing operation on another fishing vessel, and have different samples to study and make comparisons, giving good, fresh material for training on tuna-longline fishing.

We would like to express our thanks to The Oceanic Fisheries Division, The Department of Fisheries, Thailand for allowing us to make these observations on board RV. Sumruatpramong 4. Thanks also to Dr. Thiraphan Bhukaswan, The Secretary-General of SEAFDEC for kindly approving our request for this observation trip.

Thanks to Mr. Yong-Yoot Sinthupinyo, Mr. Thongdee Parnium, Mr. Veera Pokaphut, Mr. Vichit Ketwan (Captain), Officers and Crew who were very hospitable to us while on board Sumruatpramong 4.

How to find the approximate hook depth by PICARD's method

From. Catenary curve

$$S = a \sinh \frac{x}{a} \dots\dots\dots (A)$$

$$Y = a \cosh \frac{x}{a} \dots\dots\dots (B)$$

$$\text{From A \& B} = \frac{1}{a} [S + d - (l_1 + l_2) + a] \dots\dots\dots (C)$$

I. 5 hooks in a basket

By speed of boat checking:-

$$\begin{aligned} \checkmark \text{ Buoy interval} &= 230 \text{ m.} \\ \therefore x &= 115 \text{ m.} \end{aligned}$$

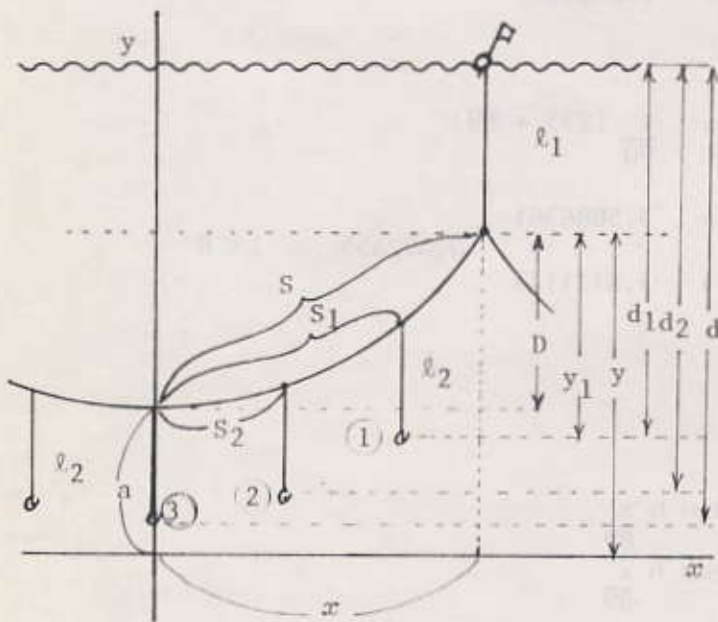
$$\begin{aligned} \text{By model chain experiment method} \\ \therefore D &= 85 \text{ m.} \end{aligned}$$

$$\begin{aligned} \checkmark \text{ Maximum depth of hook} \\ d &= D + l_1 + l_2 \end{aligned}$$

$$\text{Buoy line } (l_1) = 25 \text{ m.}$$

$$\begin{aligned} \text{Branch line } (l_2) &= 20 \text{ " } \\ d &= 85 + 25 + 20 \\ &= 130 \text{ m.} \end{aligned}$$

$$S = 150 \text{ m.}$$



$$\begin{aligned} \text{From (C).....} \quad e^{\frac{x}{a}} &= \frac{1}{a} [S + d - l_1 + l_2 + a] \\ &= \frac{1}{a} [150 + 130 - (25+20) + a] \\ &= \frac{1}{a} (235 + a) \end{aligned}$$

Test for a constance

$$\text{If } a = 88 \quad e^{\frac{115}{88}} = \frac{1}{88} (235 + 88)$$

$$\begin{aligned} \text{left } e^{1.306818} &= 3.694400 \\ \text{right } \frac{1}{88} (235 + 88) &= 3.670454 \quad 0.023946 \quad L > R \\ \text{If } a &= 88 \quad e^{\frac{115}{88}} = \frac{1}{88} (235 + 88) \\ \text{left } e^{1.306818} &= 3.69400 \end{aligned}$$

If  $a = 89$

$$\begin{aligned} e^{\frac{115}{89}} &= \frac{1}{89} (235 + 88) \\ \text{left } e^{1.2921348} &= 3.640550 \quad 0.00101 \quad L > R \\ \text{right } \frac{1}{89} (235 + 89) &= 3.640449 \end{aligned}$$

If  $a = 90$

$$\begin{aligned} e^{\frac{115}{90}} &= \frac{1}{90} (235 + 88) \\ \text{left } e^{1.277778} &= 3.5886561 \quad 0.022455 \quad L < R \\ \text{right } \frac{1}{90} (235 + 90) &= 3.6111111 \end{aligned}$$

$a = 89$  is adopted

From Catenary Curve equation

$$\begin{aligned} \text{(A) } S &= 89 \sinh \frac{x}{89} \\ \text{(B) } Y &= 89 \cosh \frac{x}{89} \end{aligned}$$

$$x = 115 \text{ m.}, \quad Y = 89 \cosh 1.29213 = 174.227 \text{ m.}$$

1) Hook No. 1

$$\text{From (A) } S_1 = 100 \text{ m.} \\ 100 = 89 \sinh \frac{x_1}{89}, \quad \frac{100}{89} = \sinh \frac{x_1}{89}$$

$$\begin{aligned} \frac{x_1}{89} &= \sinh^{-1} \left[ \frac{100}{89} \right] \\ &= \sinh^{-1} 1.123545 \end{aligned}$$

$$\begin{aligned} \frac{x_1}{89} &= 0.966126 \\ x_1 &= 89 \times 0.966126 = 85.9852 \text{ meters} \end{aligned}$$



$$(B) \quad Y_1 = 89 \cos h \frac{x_1}{89} = 89 \cos h \frac{85.9852}{89}$$

$$= 89 \times 1.5042 = 133.87 \text{ m.}$$

$$d_1 = i + (y - y_1) + 2$$

$$= 25 + (174.23 - 133.87) + 20 = 85.36 \text{ m.}$$

=====

2) Hook No. 2  $S_2 = 50 \text{ m.}$

by the same method  $d_2 = 112.20 \text{ m.}$

=====

3) Hook No. 3  $d_3 = \ell_1 + D + \ell_2 = 25 + 85 + 20 = 130 \text{ m.}$

## II. 7 hooks in a basket

Buoy interval checked = 305 m.

$$x = 152.5 \text{ m.}$$

By model chain experiment method

$$D = 114 \text{ m.}$$

$$S = 200 \text{ m.}$$

From Catenary Curve equation

$$(C) \dots e^{\frac{x}{a}} = \frac{1}{a} (314 + a)$$

then  $a = 117$  was adopted

$$(A) \quad S = 117 \sinh \frac{152.5}{117}$$

$$(B) \quad Y = 117 \cosh \frac{152.5}{117}$$

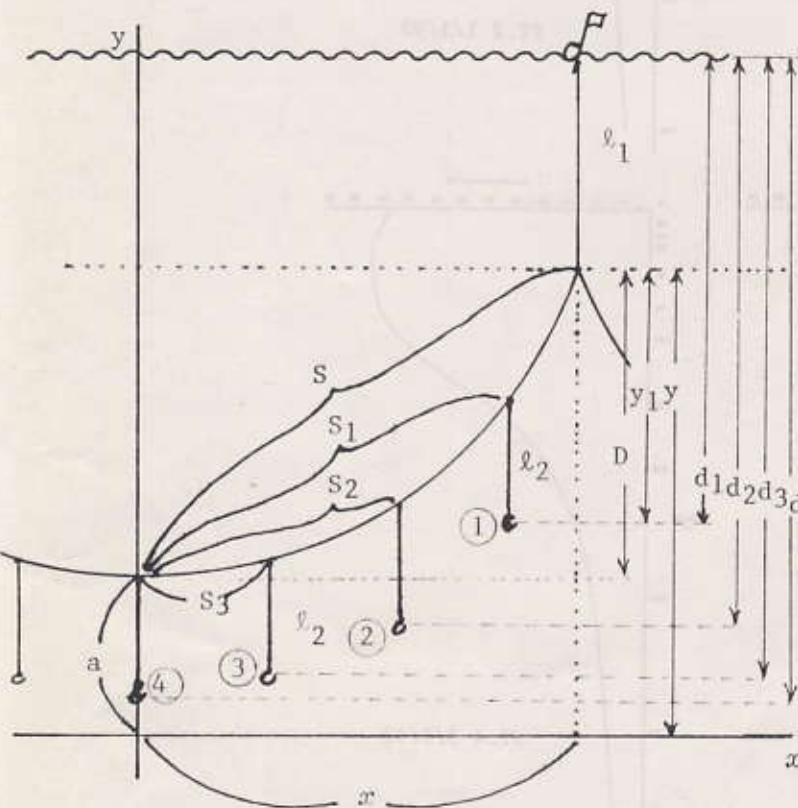
Then

1) Hook No. 1  $S_1 = 150 \text{ m.}$   
 $d_1 = 86.05 \text{ m.}$

2) Hook No. 2  $S_2 = 100 \text{ m.}$   
 $d_2 = 122.37 \text{ m.}$

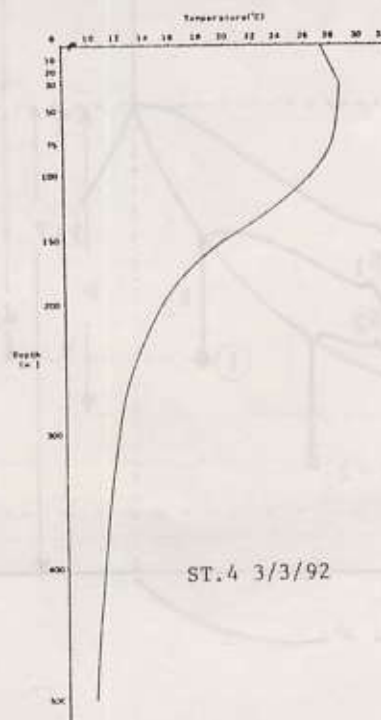
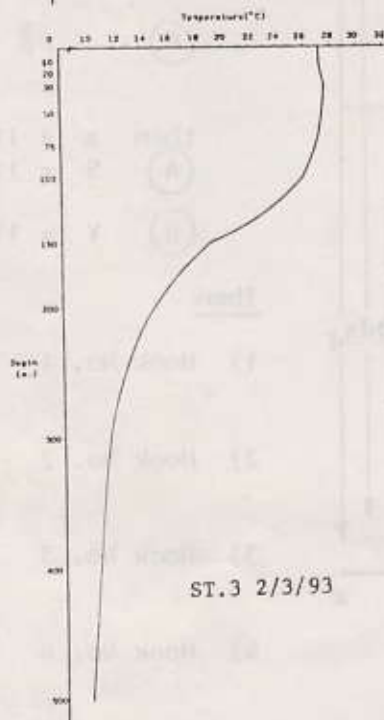
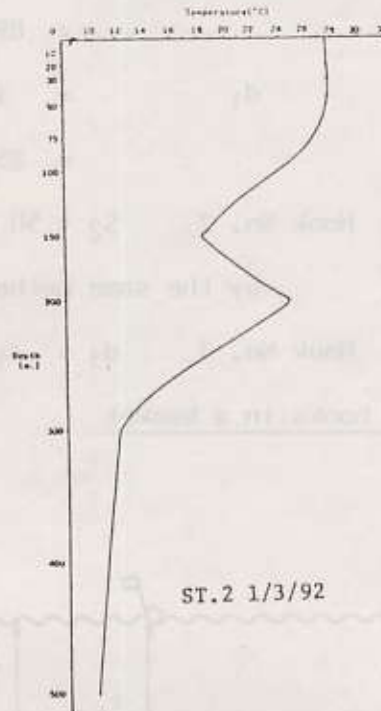
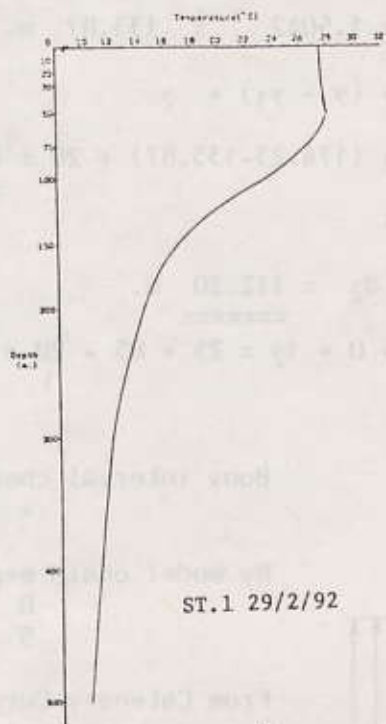
3) Hook No. 3  $S_3 = 50 \text{ m.}$   
 $d_3 = 149.04 \text{ m.}$

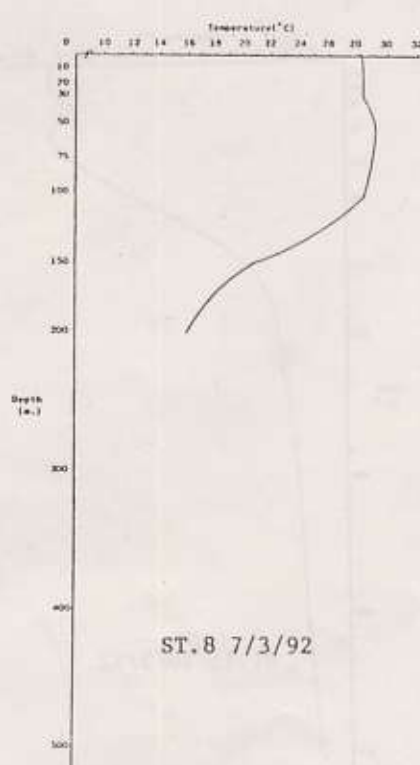
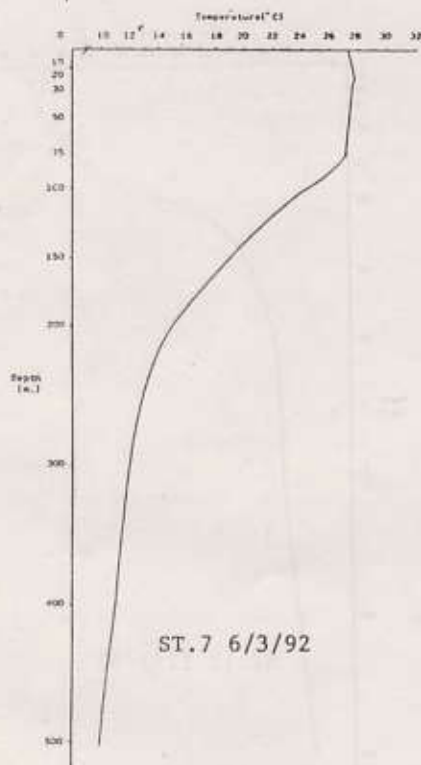
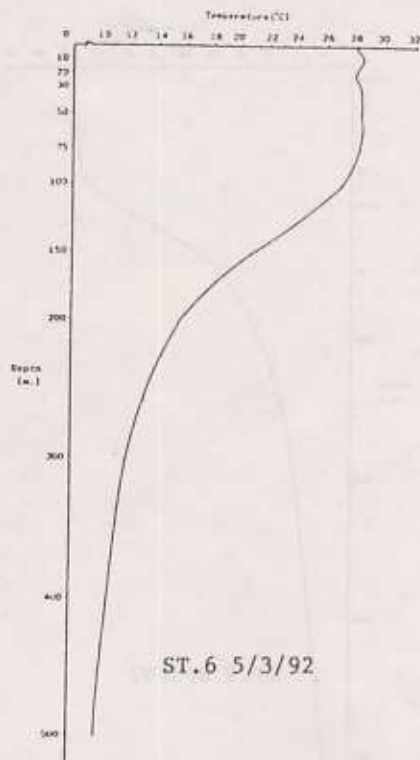
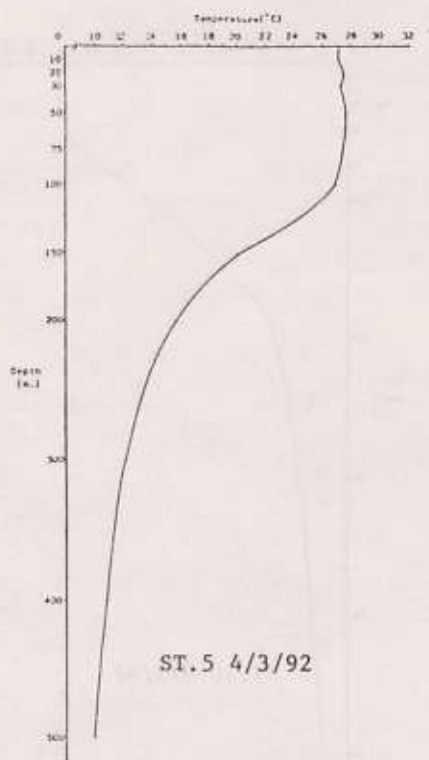
4) Hook No. 4  $S_4 = 0$   
 $d_4 = 25 + 114 + 20$   
 $= 159 \text{ m.}$

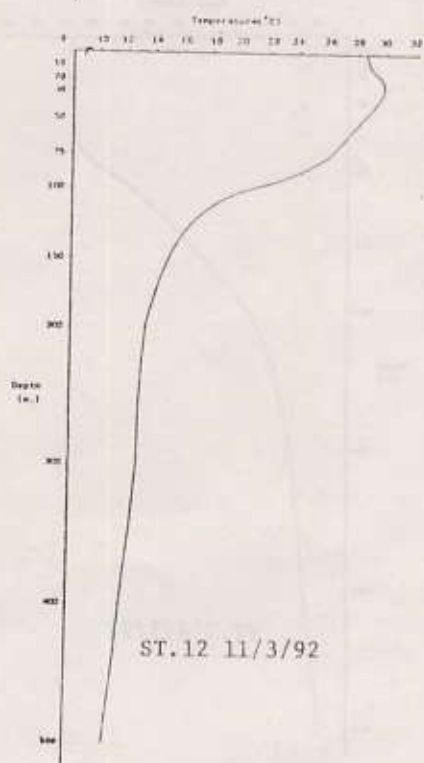
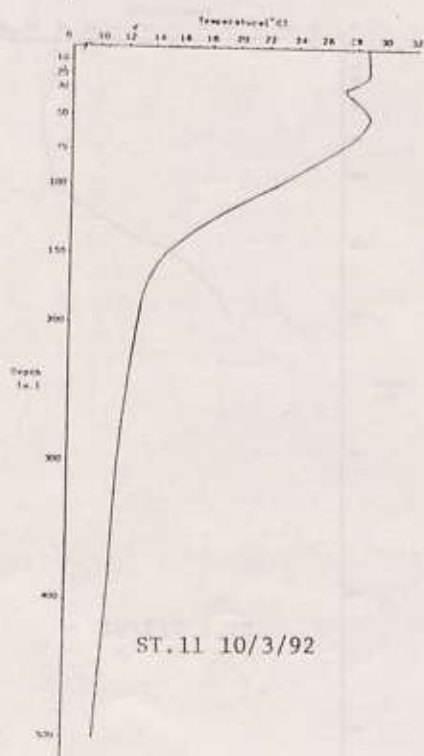
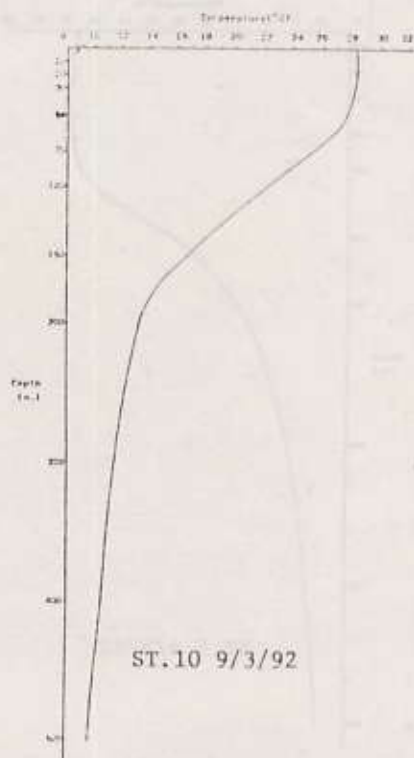
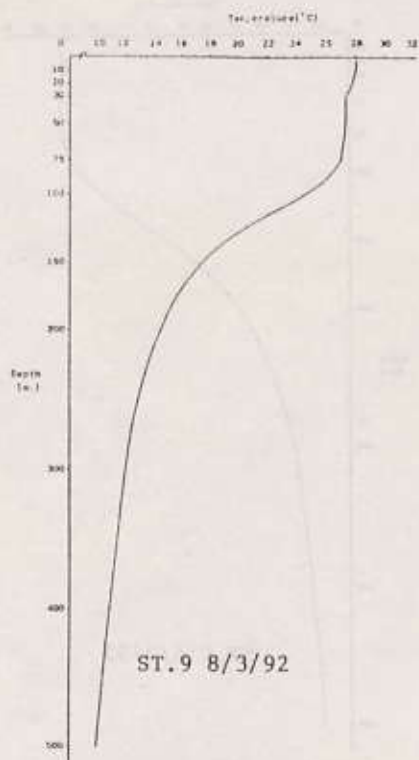


Annex II

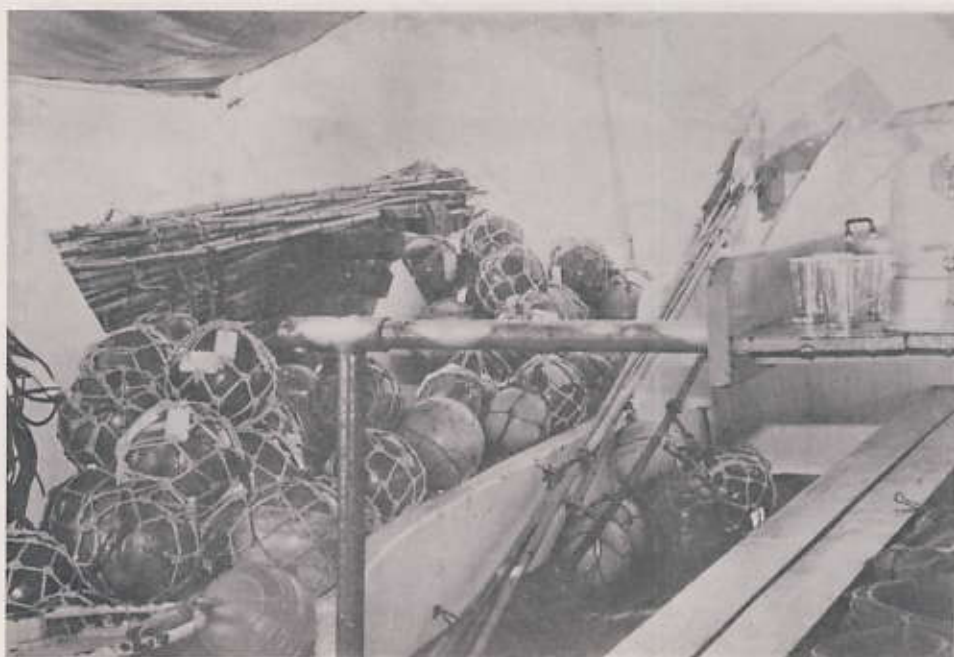
Thermal profile at fishing ground of each station  
RV. Sumruatpramong 4 Cruise 1/1992 (29/2-11/3)



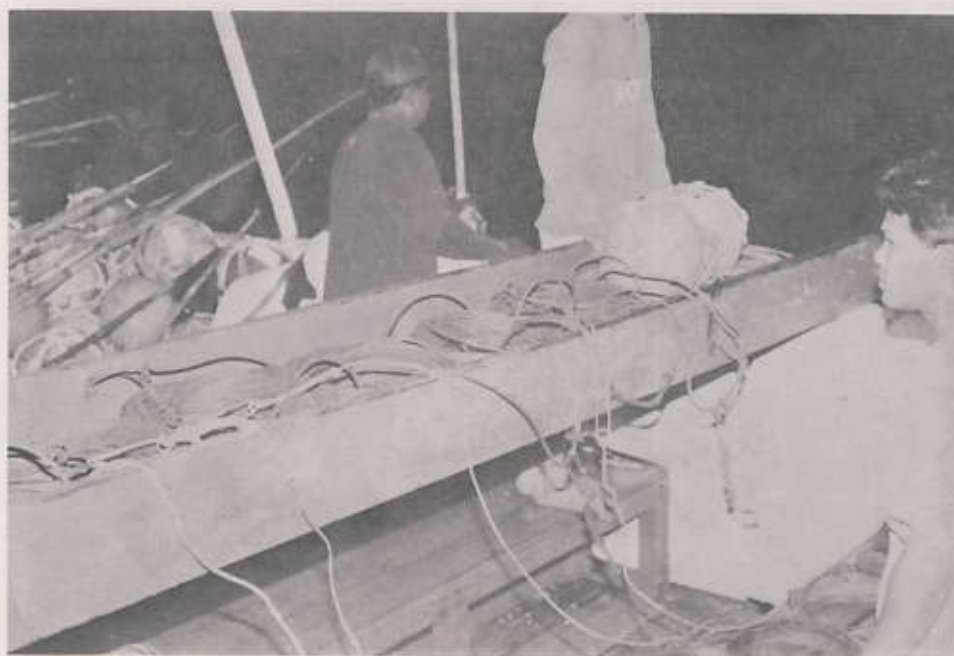




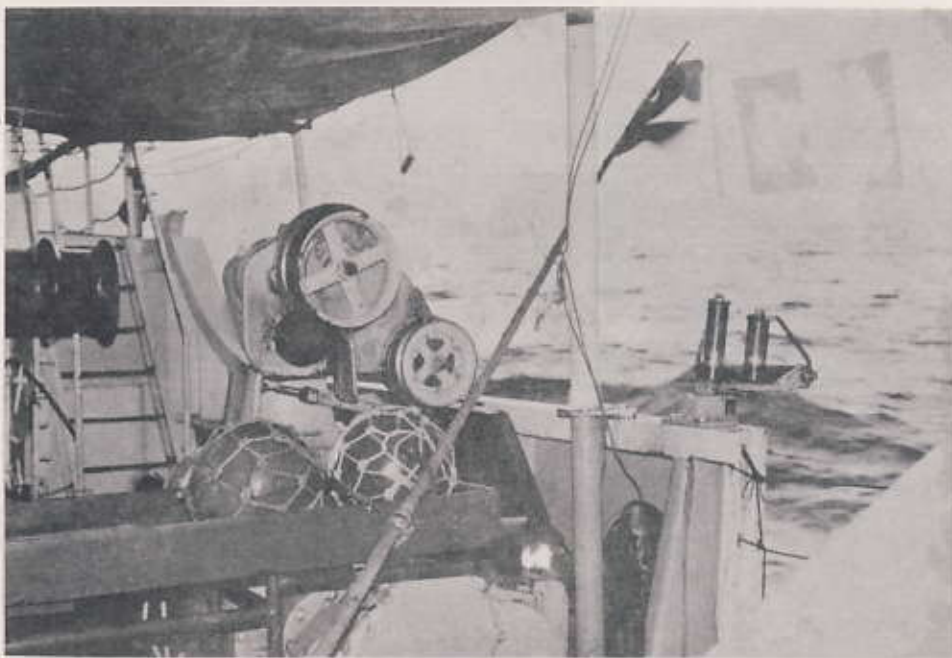




Buoys and flags on standby for shooting at stern deck



Standby for shooting at 4 o'clock in the morning



Line hauler and roller at stern deck on  
standby for hauling



Hauling of tuna-longline at stern deck of  
RV. Sumruatpramong 4 in the afternoon



Medium size yellowfin tuna ( *Thunnus albacares* ),  
30 kilogram



Small size sword fish ( *Xiphias gladius* ), 7 kilogram