TROLL LINE NERITIC TUNAS FISHERIES IN ALAS STRAIT, EAST LOMBOK (FMA 573)

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ABSTRAK

The potential of fish resources in the waters of the Indian Ocean in south of Java to the Nusa Tenggara amounted to 491.7 thousand tons per year which is 40.95 % of them (about 201.4 thousand tons per year) is large pelagic fish such as Tunas. The coastal area of Tanjung Luar, which located, which is located in Keruak District, East Lombok, is one of the centers of small -scale tuna fisheries in West Nusa Tenggara. One of the fishing fleet which is developed at Tanjung Luar to exploit the resources of tuna is "jukung/ketinting". The fleet has a variety of gear types. The objectives of this this study was to describe the diversity of fishing gear, fishing locations, the composition of the catch, CPUE, length distribution, length - weight relationship of neritic tuna caugh and water temperature information based on data from the observer trip report in 2014. Data was collected through observation in June, August and October 2014 at the Fish Landing Base of Tanjung Luar. Observations were carried out by following the one day of fishing activity. In a total, there were 38 trips to obtain the data. Biological aspects of the collected data covering the length and weight of the fish caught. Water temperature at the location of the data collection area is obtained by using minilogger. The Jukung (small boat) fleet in Tanjung Luar had five types of troll line and three of the was used to catch neritic tuna.Bullet tuna is the highest CPUE, followed by kawakawa and frigate tuna. Most of the bullet tuna caught were allegedly had ever spawn, whereas the little and frigate were in immature size. The bullet, little and frigate tuna were negative allometric. The average temperature of Alas Strait was $26,1^0$C.

Keywords: Neritic tuna, fishing gear, small-scale, Alas Strait, Indian Ocean, Indonesia

INTRODUCTION

The potention of fish resources in south of Java to Nusa Tenggara Indian Ocean amounted to 491.7 thousand tons per year which is 40.95% of them (about 201.4 thousand tons per year) is large pelagic fish. Tunas group is one of the large pelagic group (Center for Data, Statistics and Information, 2011).

The coastal area of Tanjung Luar, which is located in Keruak District, East Lombok, is one of the center of small-scale tuna fisheries in West Nusa Tenggara. The coordinate of this area is $8^0$48`South Latitude – $116^0$02` East Longitude include the Alas Strait in the east, Indian Ocean in the south (FMA 573), Java Sea in the north and Lombok Strait in the west (Ardi, 2002). One of the growing fishing fleet in Tanjung

Luar exploit the tuna resources is jukung (traditional boat). The fleet used various type of troll lines.

There were a connectivity between the various fishing gears and the availability of fish in an area. Therefore, it is required the availability of sufficient data to analyze the status of fish resources of the region to anticipate the possibility of the lack of proper decision-making in the management of fish resources.

The objectives of this study were to describe the diversity of fishing gear, fishing locations, catch composition, CPUE, length distribution, length-weight relationship of caught neritic tuna and water temperature information in Alas Strait.

METHODS

Data Collecting

The data was collected from observation activity on June, August and October 2014 in Tanjung Luar Port, East Lombok, West Nusa Tenggara. The observations were done by joining the *one day fishing* trip in total 6 jukung fleets (38 trips) to gain fishing aspect data and water temperature. The collected biological aspects included the measurement of the fork length and weight of the fish at Tanjung Luar Fishing Port. The temperature of the catching area was gained using minilogger/Temperature Depth Recorder (TDR) NKE type SP2T-1200 merk *NKE Instrumentation*. At specified interval of time, the minilogger recorded the water temperature data based on the reached water level. Water temperature measurement was carried out in the morning and noon during the observation.

Data analysis

Catch Per Unit Effort (CPUE)

Catch data and unit effort was tabulated to determine the value of catch per unit effort. In this research, the unit effort was the amount of the operational catching trip of the traditional boat and the amount of setting. The formula for calculating the CPUE based on Gunarso & Wiyono (1994) was:

$$CPUE = \frac{C_i}{E_i}$$

Note:

C_i (*Catch*$_i$) = Catching result in trip i (individual)

E_i (*Effort*$_i$) = Catching effort in trip i (trip/*setting*)

Length-Weight Relationship

To find the relationship about length and weight relationship, length and weight data were regressed using the following formula as written in Effendie (2002):

$$W = aL^b$$

Note:

W = fish weight (gr)

L = Fish fork length (cm)

a = *intercept*

From the formula, the growth pattern of the fish could be determine. The equation furthermore was tested using t-test. If b=3, the fish was isometric, otherwise if the b ≠3, the the fish was allometric.

Result and Discussion

Jukung (traditional boat) fleet

Jukung fleet (Figure 1) is a *multi gear* fleat which using more than one fishing gear in the boat. The main material of this boat is wood, the length is 8 m, width 0,8 m, depth 0,4 m and equipped with balancer in the left side of the boat to keep the balance. The capacity of the hold is 0,2 ton and using two 6,5 PK machines. The fleet was operated by one person and the duration is a day (*one day fishing*) (Table 1).

Figure 1. Jukung fleet based on Tanjung Luar port.

Table 1. Jukung fleet specification

No.	Boat specification	Boat A	Boat B
1	Main material	Wood	Wood
2	Balancer material	Bamboo	Bamboo
3	Length (m)	8	7,5
4	Width (m)	0,66	0,60
5	Depth (m)	0,54	0,50
6	Length of balancer (m)	6,3	5,8
7	Hold (ton)	0,2	0,2
8	Driving machine	Honda GX 200	Honda GX 200
9	Machine power (PK)	2 (@ 6,5)	2 (@ 6,5)
10	Fuel	Benzene	Benzine
11	Fuel capacity (liter)	(@ 3,5)	(@ 3,5)
12	Maximum speed (*knot*)	12	12
13	Speed while *setting* (*knot*)	2 – 3	2 – 3
14	Crew (person)	1	1
15	Trip (day)	1	1

Fishing Gear

During the observations, jukung fleet operated five kinds of troll lines with different specification each other. In principle, troll lines which were used by the jukung fleet were operated by pulling a series of fishing rods at the stern of the boat by cutting or against the current. Based on the operation and the catching target, there were 5 types of troll lines used by jukung fleet. They were rintak, moncoh, pengulur, rapala and parabola. Every troll lines catched neritic tunas but pengulur and rapala.

1. Rintak

Rintak was operated in the morning. This gear had 100-120 branch line and also called as "thousand lines". Rintak consisted of stretching line, ballast, main line and branch line. When operating or pulling down the line, the main branch was connected to ballast and stretching line. The function of the ballast was to ensure the main line is under the water surface (Figure 2). The setting of the line under the surface was done on the stern of the ship with 3-4 knots speed, cut or against the current. The catching target of this gear was small tuna <50 cm, such as bullet tuna (*Auxis rochei*), frigate tuna (*Auxis thazard*) and kawakawa (*Euthynnus affinis*). The specification of rintak could be seen on Table 2.

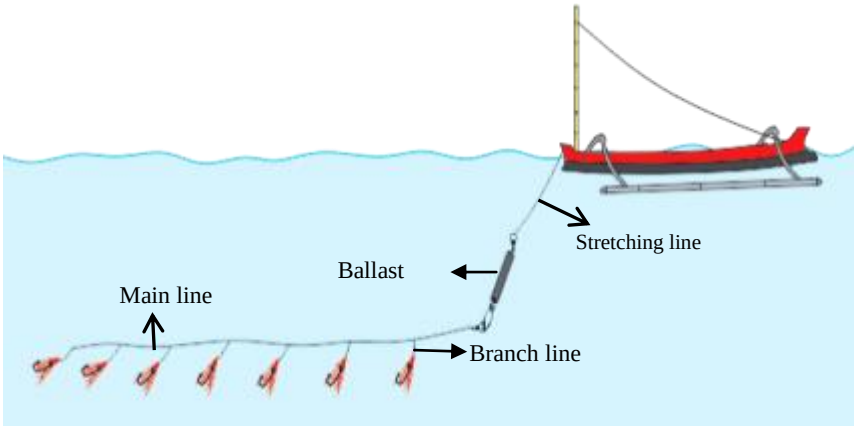


Figure 2. The illustration of rintak operation

Table 2. The specification of rintak

No.	Specification	Explanation
1	Stretching line	Monofilamen string No. 3000, diameter 1,8 mm
2	Length of stretching line	10,5 m
3	Ballast	Lead 0,5 – 1 kg
4	Main line	Monofilamen string No. 300, diameter 0,5 mm
5	Length of the main line	130 m
6	Branch line	Monofilamen string No.150, diameter 0,3 mm
7	Length of the branch line	13 cm
8	Interval between branch line	1 m
9	Branch line amount	120 lines
10	Hook	J type, No. 14
11	Bait	Fabric feathers

2. Moncoh

Moncoh is a series of connected single main line with two swivels and ended with hook with fabric feather as the bait. The fabric feathers strung with shiny ribbon (Figure 3). The catching target of moncoh was fish with size> 70 cm such as skipjack, lemadang, and kawakawa. The specification of moncoh was showed on Table 3.

Tabel 3. The spesification of moncoh

No.	Specification	Explanation
1	Main line	Monofilamen string No. 500, diameter 1 mm
2	Swivel	2 swivels, interval: 10,5 m
3	Length of the main line	45 – 50 m
4	Hook	J type, no. 6
5	Bait	Fabric feathers strung with shiny ribbon

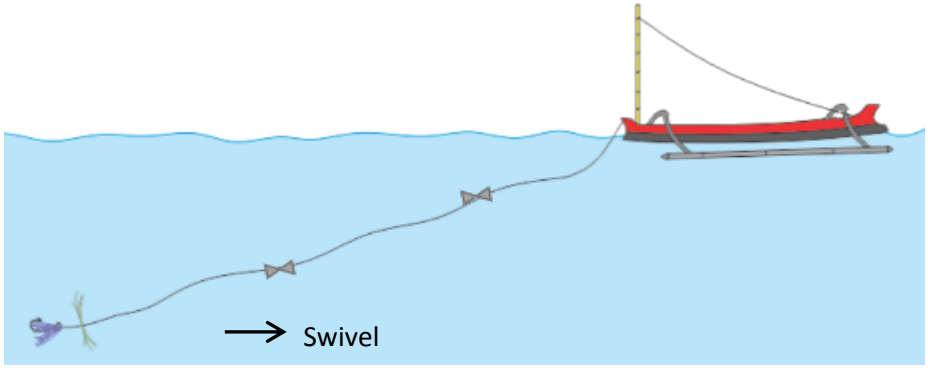


Figure 3. The illustration of rintak operation

3. Parabola

Parabola has spesific characteristic. The line was installed on the bamboo pole, about 3.5 m height, in the stern of the boat and connected with the snape, swivel, then main line (Figure 4). Along the main line, there were 10 branch lines with different lengths. The distance interval between each branch line was 9 m. At the end of the main line, cylinder buoy was mounted. The material of the buoy was plastic or cork and equipped with lead or iron stick ballast. This gear was operated when schooling of fish (skipjack and kawakawa) found in surface water first. The stretching line pulled the main line made and made it loped in the water. This way attracted the schooling fish grabbed the artificial bait attached in the line.

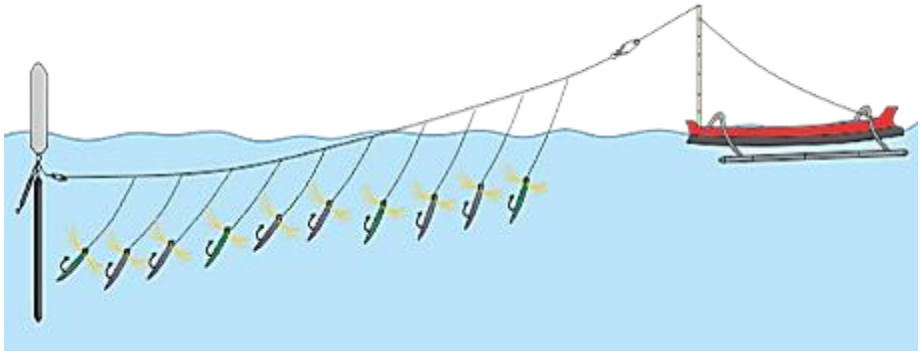


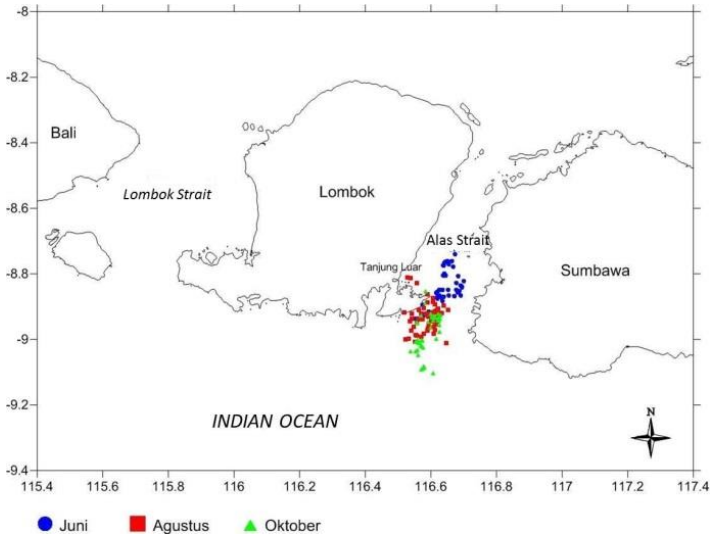
Figure 4. The illustration of parabola operation

Catching Area

Jukung fleet catching area using the troll lines was around Alas Strait to Indian Ocean, at the southeast of Tanjung Luar Port, exactly in $08^0$48` – $09^0$00` South Latitude and $116^0$31` – $116^0$39` East longitude. (Figure 5).

Tabel 4. The spesification of parabola

No.	Specification	Explanation
1	Pole	Wood/Bamboo; height 3,5 m
2	Stretching line	Monofilament string No. 2000, diameter 1,3 mm
3	Stretching line length	10,5 m
4	Main line	Monofilament string No. 1500, diameter 1,5 mm
5	Main line length	110 m
6	Branch line	Monofilament string no. 1500, diameter 1,5 mm
7	Amount of branch line	10 lines
8	Branch line length	5 m, 4,5 m, 4 m, 3,5 m, 3 m, 2,5 m, 2 m, 1,5 m, 1 m, 70 cm
9	Branch line interval	9 m
10	Buoy	Cork
11	Buoy line length	18 m
12	Ballast	Stone (2 kg)
13	Hook	Tipe J, No. 6 (target: skipjack) Tipe J, No. 4 (target: kawakawa)
14	Bait	Artificial squid



Gambar 5. The fishing ground of Jukung Fleet in Tanjung Luar Fishing Port

Catch Composition

There were some variations in the catch composition on from June, August and October 2014 observations. Total caught fish were 1786 individuals, consist of bullet tuna (*Auxis rochei*) 1593 fish, followed by kawakawa (*Euthynnus affinis*) 134 fish, frigate tuna (*Auxis thazard*) 110 fish, common dolphin fish (*Coryphaena hippurus*) 2 fish, skipjack tuna (*Katsuwonus pelamis*) and barracuda (*Sphyraena barracuda*) respectively a fish. On June, the catch composition was dominated by kawakawa

(45.11%), whereas on August and October was dominated by bullet tuna (99.59% on August and 99.99% on October) (Figure 6).

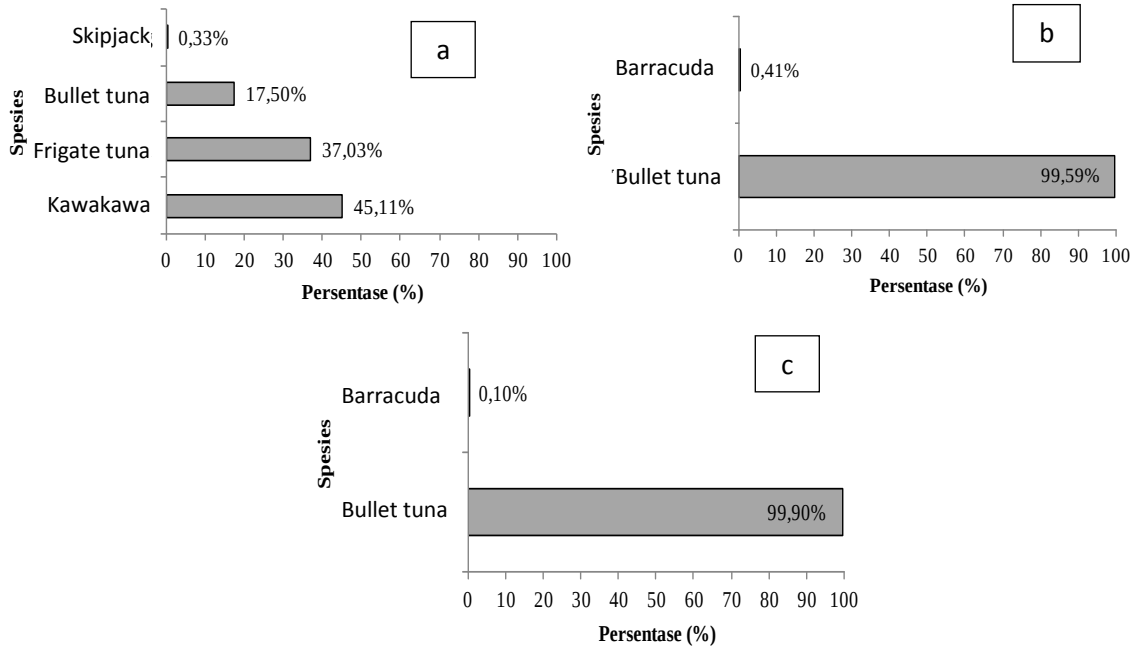
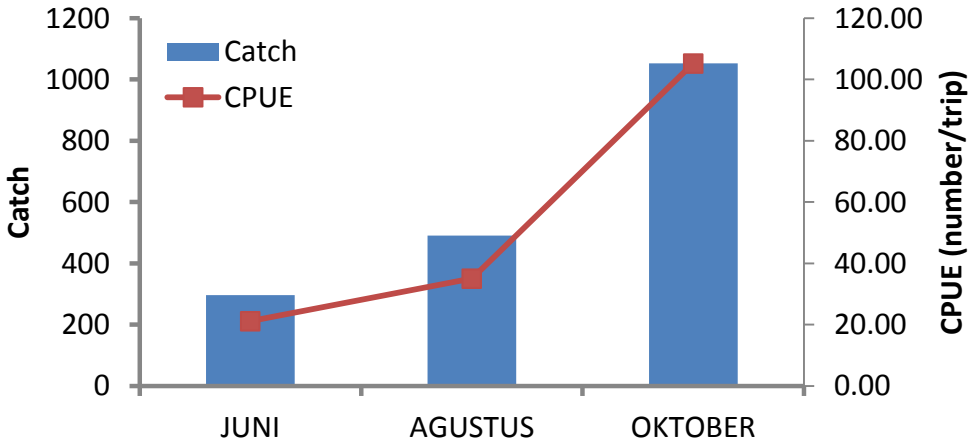


Figure 6. Catch composition of jukung fleet during the observation (a) June 2014, (b) August 2014, (c) October 2014

CPUE

Neritic tuna (bullet tuna, kawakawa and frigate tuna) CPUE increased during the observations. (Figure 7). The highest CPUE was on October 105,20 individuals/trip, followed by August (35,00 individuals/trip) and June (21,14 individuals/trip).



Gambar 7. Neritic tuna CPUE

The observation of jukung fleet A and B in June was held 14 trips and the amount of settings were 27 times for fleet A and 32 times for fleet B. The CPUE for bullet tuna was 5.28 fish/trip (1.37 fish/setting) for fleet A, whereas for fleet B was 2.14 fish/trip (0.46 fish/settings). CPUE for frigate tuna was 9.42 fish/trip (2.44 fish/setting) and for kawakawa was 11 fish/trip (2.85 fish/settings) in fleet A. In fleet B, frigate tuna CPUE was 6.28 fish/trip (1.37 fish/settings) and for kawakawa was 8.14 fish/trip (1.78 fish/settings).

On August, observation was held 14 trips with 32 times settings for fleet A and 16 times for fleet B. The CPUE for bullet tuna was 44.29 fish/trip (9.69 fish/setting) for fleet A, whereas for fleet B was 25.71 fish/trip (11.25 fish/settings). The highest CPUE for bullet tuna was in the third trip (19.50 fish/settings) and the lowest was the second one (5.50 fish/settings). For fleet B, the highest CPUE was in first trip (35.66 fish/setting) and the lowest one was in sixth trip (5 fish/setting) (Figure 8).

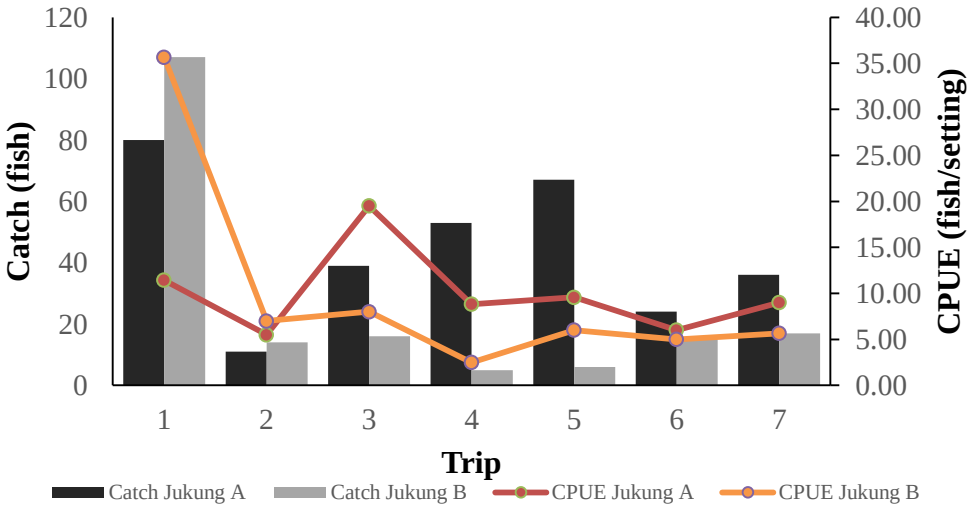


Figure 8. Comparison between CPUE in Jukung Fleet A and B to bullet tuna catch in August 2014

Jukung fleet A and B on October was operated 10 time to gain the data. The amount of total settings were 20 time for fleet A and 24 times for fleet B. Bullet tuna got the highest CPUE (62 fish/trip; 15,5 fish/*setting*), whereas in fleet B it was 148,40 fish/trip (30.91 fish/*setting*). The highest CPUE for fleet A was in the third trip, which was 26 fish/*setting* and for fleet B was also in third trip with 72 fish/*setting* (Figure 9).

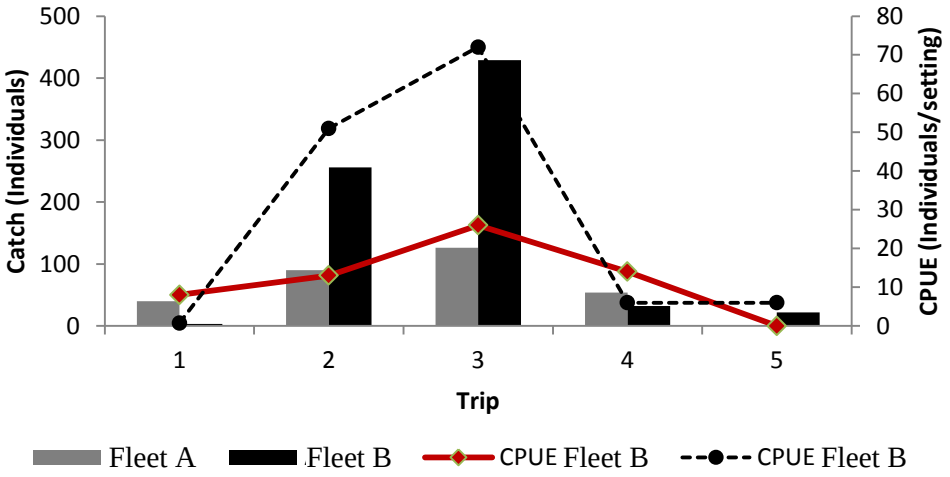


Figure 9. Comparison between CPUE in Jukung Fleet A and B to bullet tuna catch in October 2014.

Size Distribution

The fork length was measured from 377 bullet tunas and it was 22 – 33 cmFL. The average of the fork length was 25,91 cmFL and the mode was in 25 – 27 cmFL length class (Figure 10). The size of the fish is important to be noted. By knowing the length of the fish, the maturity of the fish can be determined.

The bullet tuna size of maturity in India waters was 23,6 cmFL (Jasmine *et al*., 2013). According to the reference, the bullet tuna which had been caugh in this study were dominated by the fish that have ever spawned before.

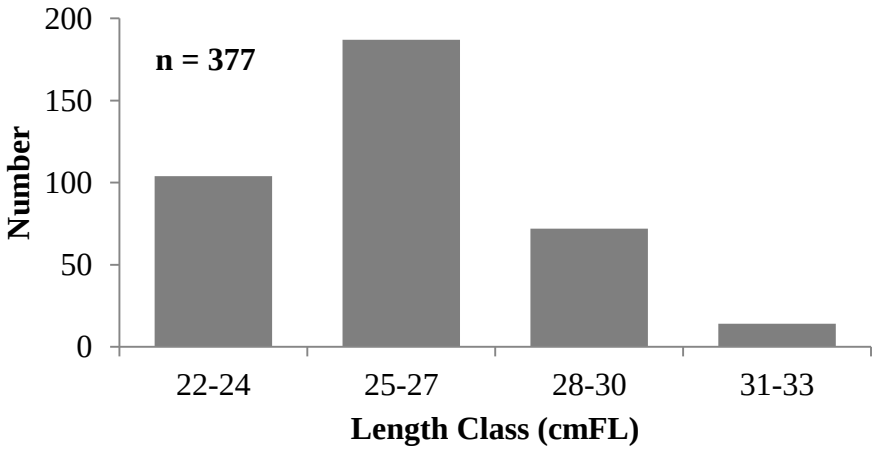


Figure 10. Bullet tuna size distribution

Fork length of 91 kawakawa were measured. They distributed from 22 – 33 cmFL. The average fork length was 26,91cmFL, while the mode was in 25 – 27 cmFL

length class (Figure 11). The mature size of kawakawa in Pakistan was start from 37,7 cm (Ahmed *et al*. 2014). According to the reference, all of the kawakawa caught during this study were immature fish.

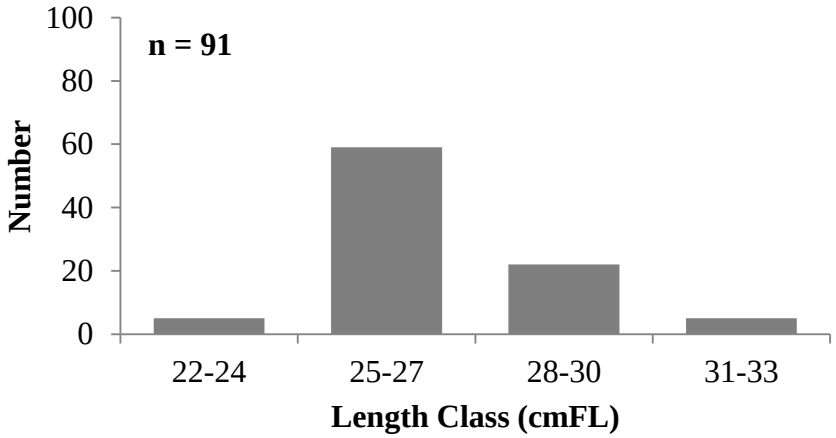


Figure 11. Kawakawa size distribution

Fork length was measured from 91 frigate tunas. The size of caught frigate tuna distributed from 25 – 33 cmFL with averafe length was 27,43 cmFL and the mode is in 25 – 27 cmFL length class (Figure 12). The mature size of frigate tuna is around 29-35 cm (IOTC, 2014). Based on that reference, the caught frigate tuna were dominated by immature fish.

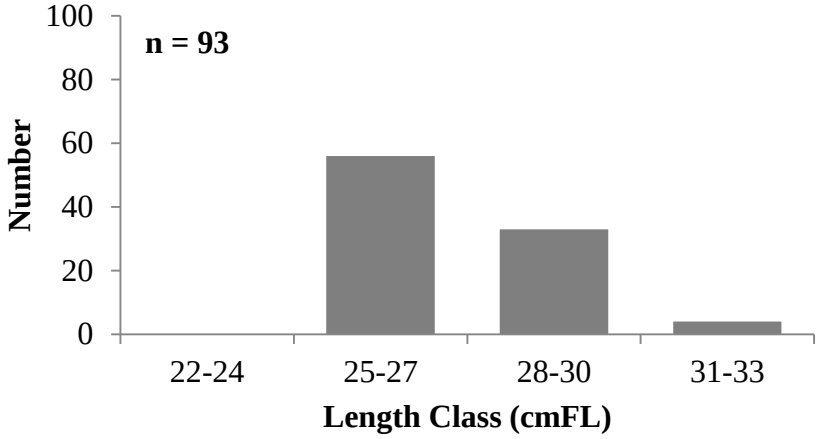


Figure 12. Frigate tuna size distribution

Length-Weight Relationship

The result of length weight relationship analysis from 340 bullet tuna showed equation $W=0{,}0543FL^{2{,}5883}$ with determination coefficient (r^2) was 0.9425 (Figure 13). The t-test stated that $t_{counted} > t_{table}$ (11,820<1,977) with confidence level 95%. This

stipulated that bullet tuna was negative allometric. The fish growth is affected a lot by environmental factor such as the size of the food, amount of fish in the area, food type, oceanographic condition and fish condition (age, heredity, genetic) (Dagorn *et al.* 2000; Effendie 2002).

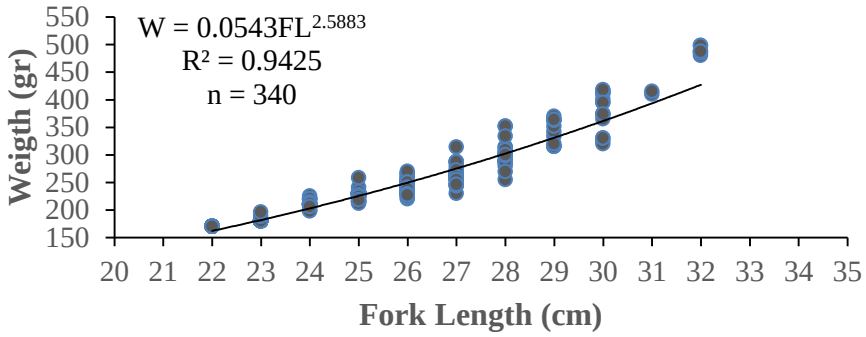


Figure 13. Length weight relationship of bullet tuna

There were 91 individuals of kawakawa measured during the study. The equation of the length weight relationship was $W=0{,}2035FL^{2{,}2021}$ with determination coefficient (r^2) was = 0.9135 (Figure 14). The t-test showed that $t_{counted} > t_{table}$ (11,106<1,977) with confidence level 95%. This stipulate that kawakawa is negative allometric.

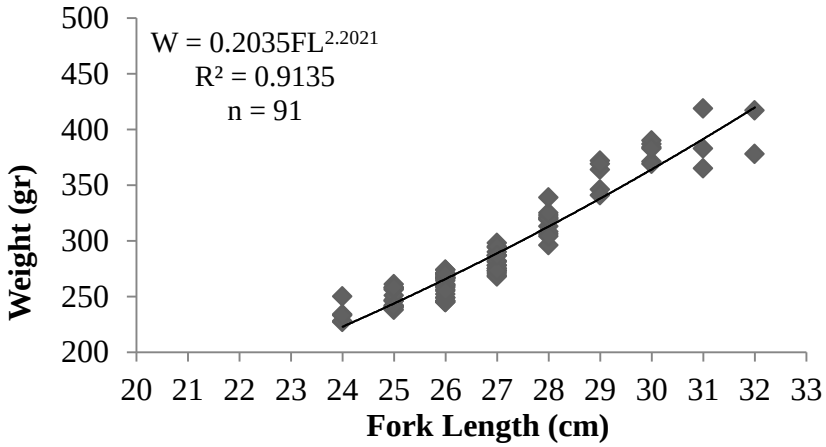


Figure 14. Length weight relationship of kawakawa

Length weight relationship from 93 individuals frigate tuna formed equation $W=0{,}0566FL^{2{,}6225}$ with determination coefficient (r^2) = 0,9065 (Figure 15). Based on the t-test, it is known that $t_{counted} > t_{table}$ (4,275<1,977) with confidence level 95%. The growth of frigate tuna is negative allometric.

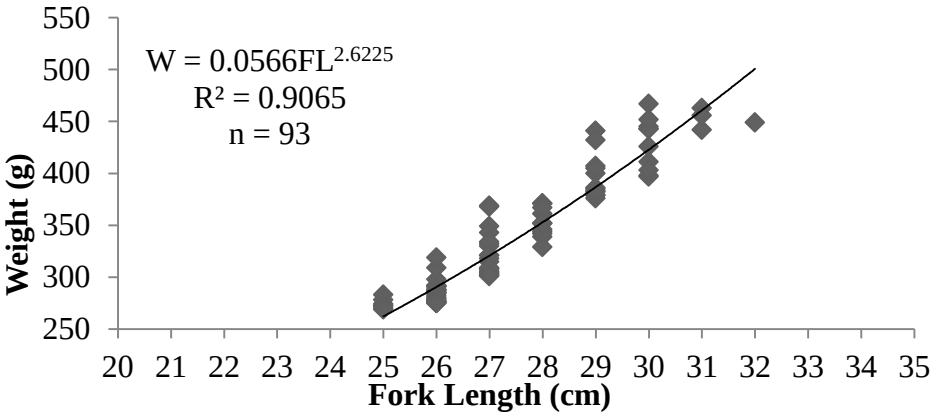


Figure 15. Length weight relationship of frigate tuna

Temperature

Water temperature is one of the factors which influence the distribution of fish vertically. The temperature at each depth level also affect the abundance or habitat for fish in the water. The jukung catching target is the fish on the surface level so that the temperature measurement is only done on the surface level.

The water temperature was measured in the morning starting at 06:00, with a range of minilogger depths ranging from 5.7 to 53.6 m and a temperature between 24.8 - 26,8^{0}C. During the day started at 09:00, with minilogger depth range from 6.5 to 51.1 m and a temperature between 24.6 - 27,2^{0}C. The average temperature around the Alas Strait and the Jukung fleet fishing areas is 26,1^{0}C.

Catch composition was dominated by bullet tuna which is one of the neritic tuna group. Neritic zone is a relatively shallow zone, with depth about 200 meters, contains and enough oxygen, low pressure, stable temperature and salinity. In neritic zone, light can well penetrate so that there are photosynthetic life such as phytoplankton and sargassum (APA, 2014)

CONCLUSION

1. Tanjung Luar traditional boat fleet has five types of troll line which three of them are used for neritic tuna catching
2. Bullet tuna is the highest CPUE, followed by kawakawa and frigate tuna.
3. Based on the size, the caught bullet tuna are allegedly mature, whereas kawakawa is in immature size.
4. Bullet tuna, kawakawa and frigate tuna are negative allometric

5. The average temperature in Alas Strait is 26,1^{0}C.

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