Neritic tuna fishery and some biological aspects of kawakawa (*Euthynnus affinis*) in the Malacca Straits

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ABSTRACT

Neritic tuna species are among the important pelagic fish caught by commercial and traditional fishing gears. The main neritic tuna found in Malaysian waters were longtail (*Thunnus tonggol*) and kawakawa (*Euthynnus affinis*) while frigate tuna (A*uxis thazard*) were rarely caught because they were mostly found toward the offshore area. In 2016, neritic tuna contributed 10% of the total Malaysia's marine fish landings. Purse sienes are the most important fishing gear in neritic tuna fisheries, especially the 40-69.9 GRT and >70 GRT vessel size. It contributed more than 80% of the annual catches of neritic tuna in Malaysia. Monthly length weight measurement of the three species of neritic tuna showed a relationship of $W = 0.000020\ L^{2.9678}$ for kawakawa in the Malacca Straits. Monthly length distribution analysis indicated that larger kawakawa are more readily available in September/October and November, respectively. This present study will also include information on biological aspects of *E. affinis* such as growth parameters and length distribution.

Keywords : neritic tuna, purse seine, growth parameters

1.0 INTRODUCTION

1.1 Exploitation of neritic tuna in Malaysia

In Malaysia, neritic tuna consists of longtail tuna (*Thunnus tonggol*), kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*). Fishing for neritic tunas is mainly confined to the coasts of the Peninsular Malaysia, with only small fisheries off Sabah and Sarawak (Effarina *et al*. 2014). This is due to the continental shelf areas being limited in both of these states. Fishing grounds here are generally deep which ranging from 200 m up to 2,000 m. Generally, neritic tuna were caught mainly by purse seines, trawl nets, drift nets and hook and lines. Purse seines are the main fishing gears that catch neritic followed by trawl nets and for drift nets and hook and lines, they were widely used in the

South China Sea areas compare to other sub-areas. There are two types of purse seiners vessels; purse seiners using FAD (FAD purse seiners) and free school purse seiners (FS purse seiners) (Sallehudin *et al.* 2014) with a majority of purse seine in the west coast using FADs. Application of FAD has facilitate and increase efficiency for tuna fishing (Noraisyah and Raja Bidin, 2009). For hook and lines in the South China Sea, such gears using trolling technique. The trolling are carried out around FADs or floating objects and sometimes the fishermen are searching for wild schools.

1.2 Annual catches of neritic tuna in Malaysia

Neritic tuna contributed 4.7% of the total marine landings in Malaysia. Landings of neritic tuna in Malaysia showed a generally increasing trend from the year 2006 to 2016 (Figure 1). In the Malacca Straits, it can be observe that there is a slight decrease in the neritic tuna landings starting from 2013-2016. About 50% of the neritic tuna landings comes from Malacca Straits and the rest of the landings came from the South China Sea area, Sabah and Sarawak. However, in 2016 neritic tuna from the Malacca Straits only contribute 22% of the total landing, decreasing by 28% compared to 2006.

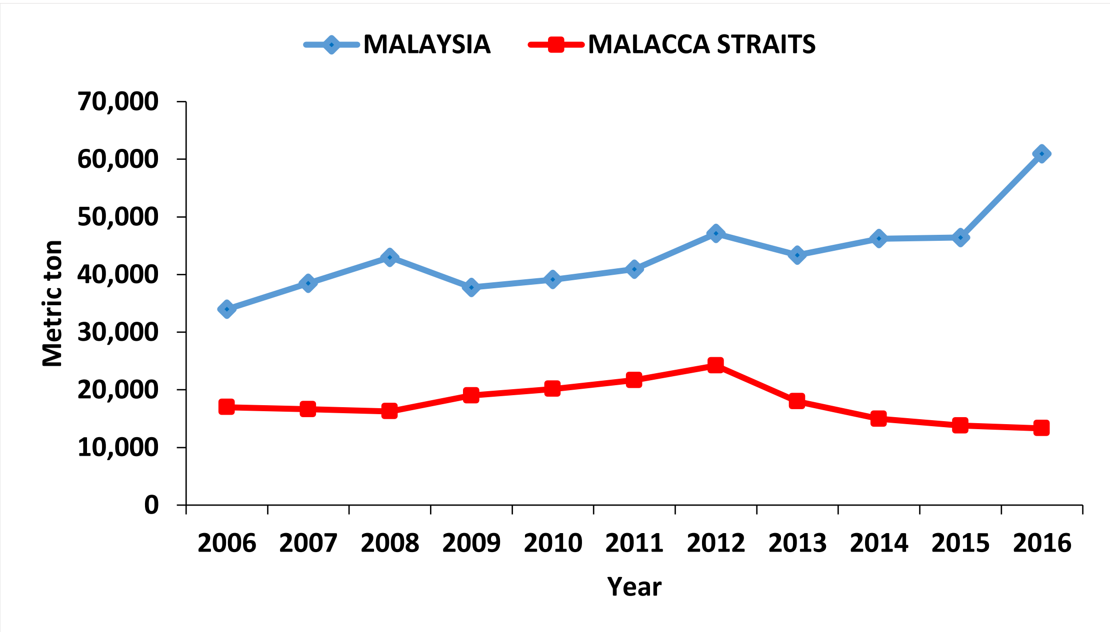

Figure 1 : Landing trends of neritic tuna in Malaysia and Malacca Straits, 2006-2016

1.3 Neritic tuna catch by purse seine

The total catch of marine fish by all gears in the Malacca Straits in 2016 was 813,758 mt, about 50% of total marine catch in Malaysia. Purse seines were the second most effective commercial fishing gears after trawlers. Almost 90% of the neritic tuna landing in the Malacca Straits are caught by the purse seines and it accounted nearly 20% of the total catch in Malacca Straits. The neritic tuna comprise of 15% of the purse seines catch in the Malacca Straits (Figure 2).

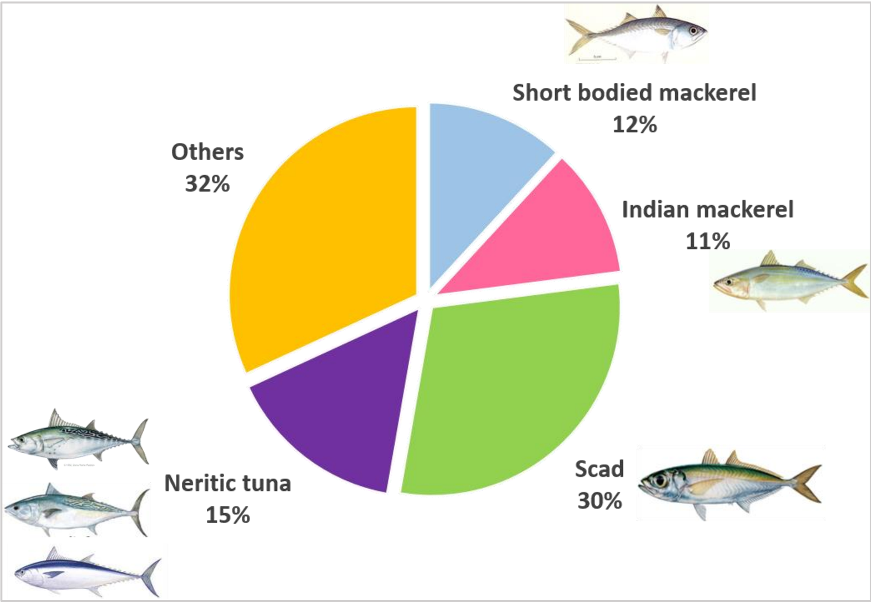

Figure 2: Fish composition by purse seine in the Malacca Straits

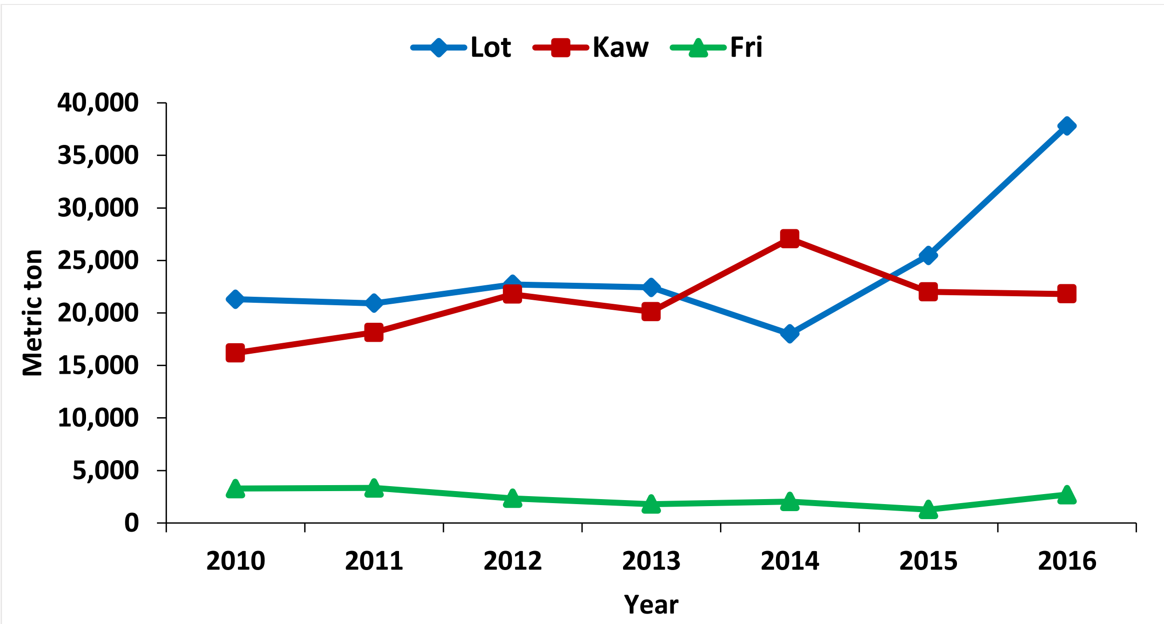

Figure 3 : Landings of neritic tuna species by purse seine in Malaysia, 2010-2016

Landings of longtail tuna, kawakawa and frigate tuna in Malaysia are generally stable from 2010-2016, except a sudden increase in landings of longtail tuna in 2015-2016 (Figure 3). For longtail tuna and kawakawa, a majority of the species were caught by purse seine > 70 GRT that operating beyond 30 nm from the shore with the landings more than 15,000 mt (Figure 4). However, frigate tuna were mostly caught by smaller purse seine of less than 40 GRT.

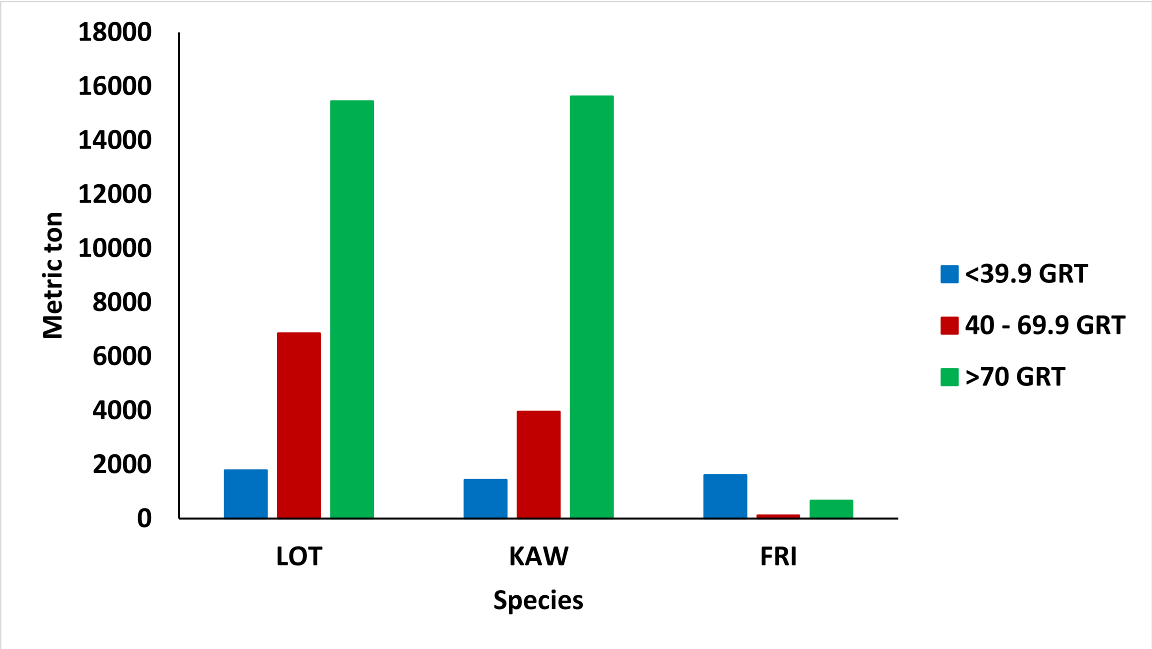

Figure 4: Landings by species landed by purse seine vessels with different vessel size (GRT)

2.0 METHODOLOGY

2.1 Sampling at landing jetty

Two enumerators were stationed in Kuala Perlis landing jetty for the purposes of recording data on landings and biological data as required (Figure 5). For each sampled purse seine boats, the information as below must be recorded.

i) Vessel registration number
ii) Name of boat skipper
iii) Fishing day
iv) Catch amount

After the basic information is recorded, the enumerators were then collect data on the biology. A basket of fish were taken as sub sample to obtain the catch composition of the boat. The fish in the basket were sorted into species. Each fish were weighted and measured to be recorded. Specimens were measured to the nearest 10 mm fork length (FL). Enumerators were also recorded the weight and length of 100 selected tuna species for the biological study.

Figure 5 : Sampling station located in the Malacca Straits area

2.2 Procedures in the laboratory

A total of 100 fish were sampled and brought back to the laboratory. Each individual fish will be weighed and measured the length and recorded in the forms provided.

2.3 Data analysis

Population parameters were estimated from the length frequency data using computer program ELEFAN 1 of FiSAT II software and the Powell-Wetherall plot (Gayanilo et al. 2005). The VBGF model was used to evaluate age and growth. Growth was investigated from length frequency data using the von Bertalanffy growth function:

$$L_t = L_\infty (1 - \exp[-K\ 9t - t_0])$$

Where L_t is the length at age t, L_∞ is the theoretical maximum (or asymptotic) length that the species would reach if it lived indefinitely, K is the growth coefficient and t_0 is the theoretical age at zero length (Sparre and

Venema, 1998). FiSAT II program only provided estimates of L∞ and K, t0 was estimated using Pauly's equation (Pauly, 1980) :

$$\text{Log}(-t0) = -0.3922 - 0.2752 \text{ Log } L_\infty - 1.038 \text{ Log } K$$

Length-converted catch curves were developed from the length frequencies to estimate the total mortality (Z) (Gayanilo et al., 2005). Natural mortality (M) was determined using Pauly's equation by taking the mean sweater temperature as 30°C (Pauly, 1983):

$$\text{Log } M = -0.0066 - 0.279 \text{ Log } L_\infty + 0.6543 \text{ Log } K + 0.4634T$$

3.0 RESULT

3.1 Neritic tuna landings in Kuala Perlis

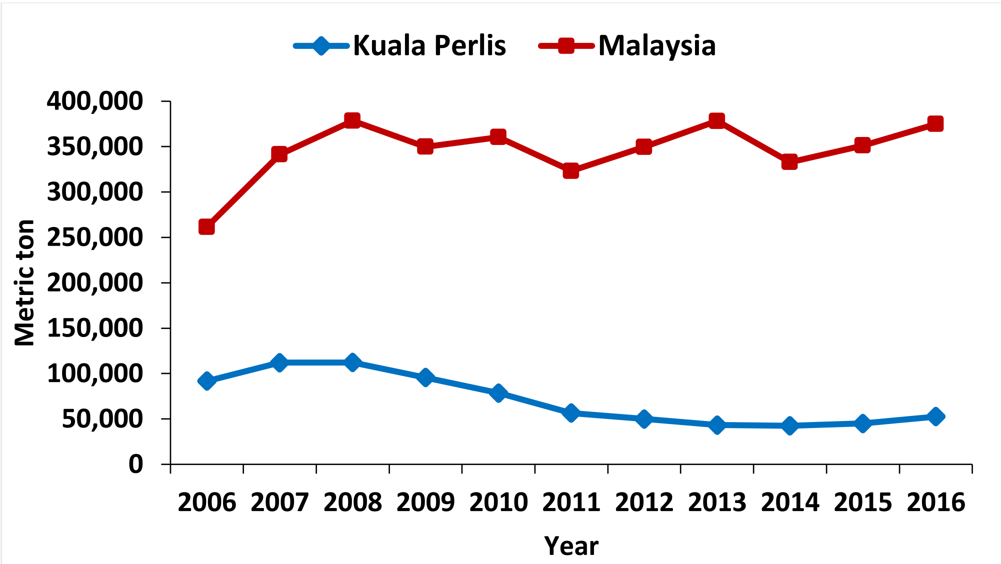

Figure 6: Landing trends of purse seine in Kuala Perlis and Malaysia, 2006-2016

Figure 6 shows landing trends of purse seine in Kuala Perlis and Malaysia from year 2006-2016. Kuala Perlis is one of the fishing district that have a high number of registered purse seine operating in the Malacca Straits. Overall, purse seine landings in Kuala Perlis were stable with a minimal decrease starting from 2009. Longtail tuna were the dominant neritic tuna species caught in Kuala Perlis from 2006-2016 (Figure 7). However, landings of longtail tuna seems to have a significant drop in 2010 onwards before stabilizing in 2013 until 2016. On the other hand, kawakawa landings are generally steady with range of 40 – 1,116 mt for the last 10 years. Frigate tuna have the lowest catch as it is not a target species for purse seiners in Kuala Perlis (38 – 496 mt).

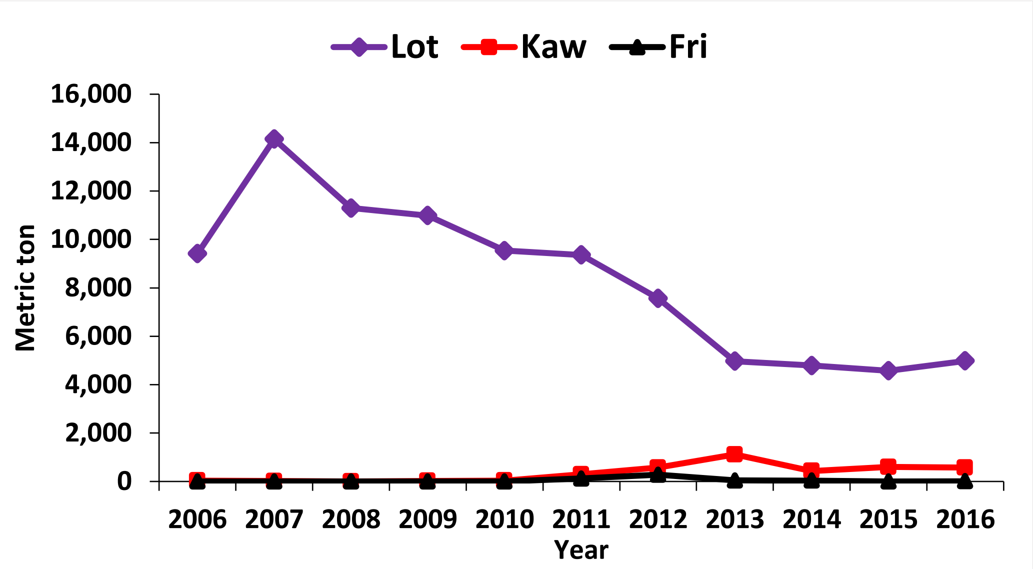

Figure 7: Landing trends of neritic tuna in Kuala Perlis, 2006-2016

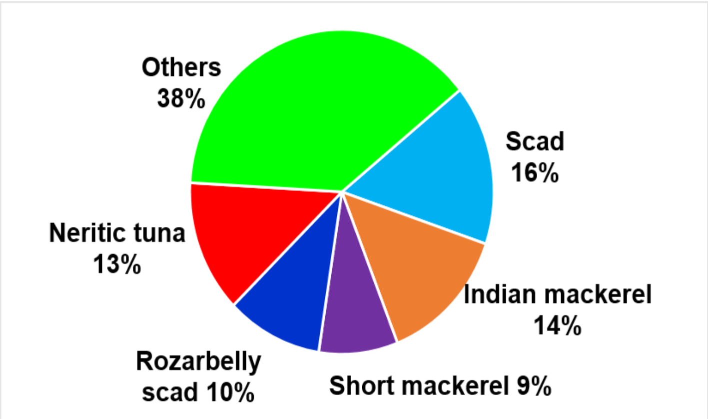

Figure 8: Species composition from landings of purse seine in Kuala Perlis

Figure 8 indicates the composition of species caught by purse seiners in Kuala Perlis. From the species composition, it is observed that in Kuala Perlis neritic tuna species were the second most abundant (13%) after scads (16%). Among the species of fish that were categorized as others were shads, shrimps and trash fish.

3.2 Population dynamics

3.2.1 Length frequency

The length frequency distribution of kawakawa in Kuala Perlis is 200-560 mm with major modes were at 340 mm. Length at first maturity for kawakawa is 430 mm (Figure 9). Thus, this means that 95% of kawakawa landed in Kuala Perlis was caught before reaching its first maturity.

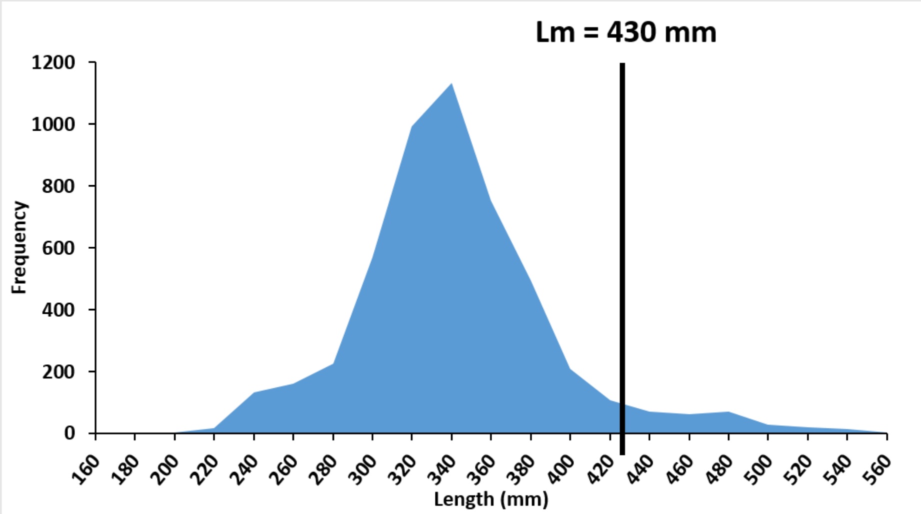

Figure 9: Length at first maturity (Lm = 430 mm) and length frequency distribution of kawakawa (*Euthynnus affinis*) caught in Kuala Perlis

3.2.2 Length-weight relationship

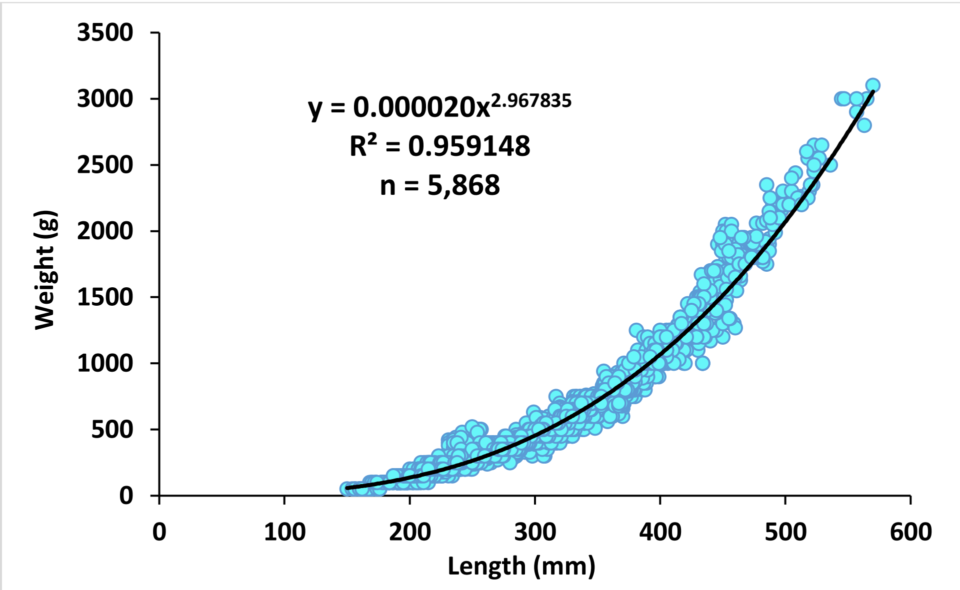

Figure 10: Length-weight relationship of kawakawa (*Euthynnus affinis*) in Kuala Perlis

The length-weight relationship of kawakawa in Kuala Perlis was estimated as W = 0.000020 L $^{2.9678}$, where 'W' is the weight of the fish in g and 'L' is fork length in mm. (Figure 10).

3.2.3 Growth parameters

The estimated von Bertalanffy growth parameter of kawakawa for the Kuala Perlis are $L\infty$ = 588.53 mm, and K = 0.70 (Table 1). The majority of captured fish was within the size of 175 – 575 mm (Figure 11). The estimate growth performance index (Ø) for kawakawa were 4.78, which gave indication that the parameters estimated confirmed the von Bertalanffy condition. The $L\infty$ and K found using this process were within the ranges estimated in FiSAT II.

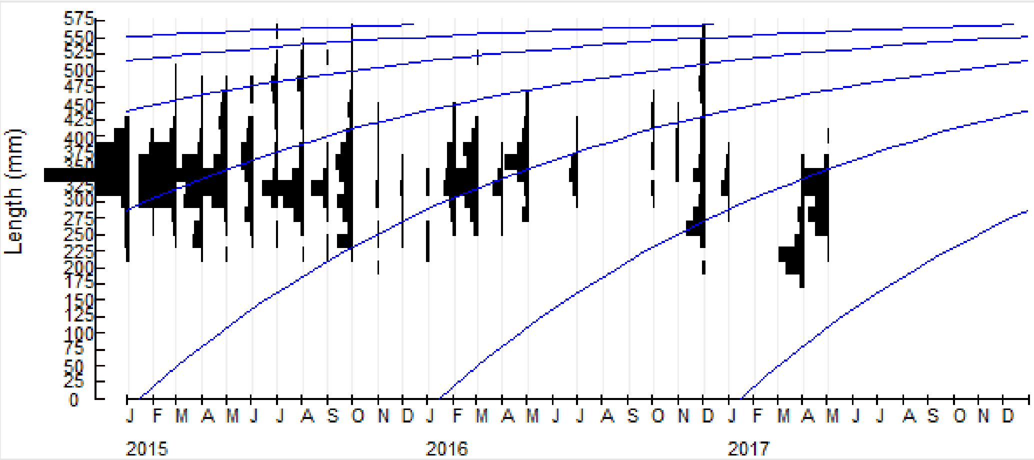

Figure 11: The Von-Bertalanffy graph plot of kawakawa (*Euthynnus affinis*) in Kuala Perlis

Table 1 showed the growth parameters of kawakawa in Kuala Perlis. The natural mortality rate (M), fishing mortality rate (F) and total mortality (Z) of kawakawa in Kuala Perlis were 0.64, 1.75 and 0.73, respectively (Figure 12). The exploitation rate of kawakawa in Kuala Perlis (E = 0.73) was considered high in which indicated that kawakawa was heavily exploited in Kuala Perlis.

Table 1 : Growth parameters of kawakawa in Kuala Perlis

Species name	Common name	Location	L∞ (mm)	K	Z	M	F	E
Euthynnus affinis	Kawakawa	Kuala Perlis	588.53	0.70	2.39	0.64	1.75	0.73

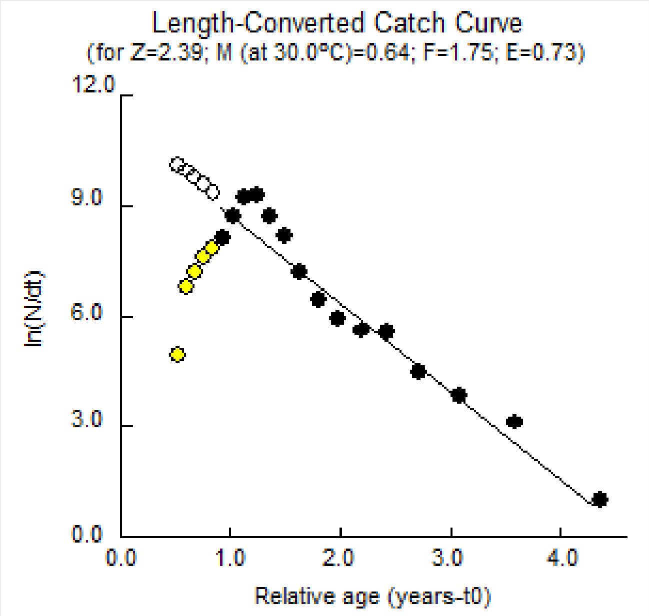

Figure 12: Mortalities and exploitation rate of kawakawa (*Euthynnus affinis*) in Kuala Perlis estimated using length converted catch curve

4.0 DISCUSSION & CONCLUSION

Neritic tuna in Malaysia is considered as a bycatch of commercial fishing gears, purse seiners and trawlers. This species group is distributed almost throughout the continental shelf of Malaysia waters. These species have traditionally been caught in Malaysia at subsistence levels by fisherman using a variety of fishing gears (Chee, 1995). Purse seine is the most important fishing gear in neritic tuna fisheries and contributed more than 82% of the annual catches of neritic tuna in Malaysia (Ahmad Adnan, *et. al*. 2015).

The length weight relationship of kawakawa caught from different regions has been estimated by several earlier studies and the values of ‘a’ and ‘b’ obtained are as in Table 2. For the present study, kawakawa in Kuala Perlis exhibit isometric growth with the ‘b’ value close to 3. Growth parameters in the von Bertalanffy equation as estimated by earlier studies and present study are given in Table 3. Kawakawa is a fast growing fish attaining a maximum length of around 580 mm (Kuala Perlis). However the L∞ estimated from other regions are much higher which ranged from 810 – 890 mm, than the estimated value obtained in the present study. The ‘K’ value obtained from this study also revealed a much bigger value than earlier studies in other regions.

Table 2 : Estimated value of ‘a’ and ‘b’ of kawakawa in the length-weight relationship

Region	**‘a’ value**	**‘b’ value**	**Reference**
Philippines waters	0.0334	2.838	Ronquillo, 1963
South China Sea	0.0885	2.5649	Williamson, 1970
Indian waters	0.0191	2.95	James et. al. 2003
Veraval, India	-1.9313	3.056	Ghosh et. al. 2010
Indian waters	0.0254	2.889	Pratibha et. al. 2012
Kuala Perlis, Malaysia	0.000020	2.968	Present study

Table 3 : Estimates of growth parameters of kawakawa from earlier and present studies in the regions

Region	**L∞(mm)**	**K**	**Reference**
Maharashtra, India	817	0.79	Khan, 2004
Persian Sea of Oman	877	0.51	Taghvai, 2010
Veraval, India	725	0.56	Ghosh et.al. 2010
Indian waters	819	0.56	Pratibha et.al. 2012
Kuala Perlis	588.53	0.70	Present study

In Kuala Perlis, kawakawa of size range 200 – 560 mm fork length represented the catches throughout the year. Common size in commercial catches ranged from 230 – 400 mm FL. Peak period of occurrence of commercial size is March to June. In sampling areas, kawakawa were mostly caught below the size of first maturity (Lm = 430 mm), thus indicating that the fish did not have the chance to spawn for the first time in their life.

Data collection and recording system for neritic tuna species need improvement as they are important for future stock assessment analysis that will provide the scientific information for sustainable management of the neritic tuna species in Malaysian waters. As neritic tuna are shared stocks, thus managing it need a regional management. To manage the shared stocks, it need systematic cooperation and shared management between the bordering countries such as Malaysia, Thailand and Indonesia.

5.0 REFERENCE

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