Received: 24 & 29 June 2013

Analysis of Kawakawa (*Euthynnis affinis*) landings in Sri Lanka and estimation of the length-weight and length-length relationships

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Abstract

Large Pelagic fish landings, including neritic tuna landings made by the fishing vessels operated in Sri Lankan waters and high seas were monitored during 2005-2012 period at fishery harbours and major fish landing centres. The neritic tuna is one of the important groups in the commercial marine fish landings of Sri Lanka since it contributes more than 10% of the total landings of tuna and tuna like species. Three species of neritic tunas are frequently found in Sri Lankan waters, namely, *Auxis thazard* (frigate tuna), *Auxis rochei* (bullet tuna), *Euthynnis affinis* (kawakawa) with one prominent neritic tuna associated species *Scomberomorus commerson* (narrow- barred spanish mackerel). Kawakawa contributes only about 15% to the neritic tuna production. Gillnet has effectively been contributing for catching kawakawa since around 68% of the total landings are from gillnets. Ring net and gillnet - long line combination contribute about 17% and 8% of the total kawakawa landings respectively. However, the highest average kawakawa catch in terms of catch per trip was recorded for the boats operated with ring nets (31Kg per trip). The boats operated with gillnets had a catch of about 17 kg per trip. A considerable variation of kawakawa catch was also noted among the different vessels. The vessels mostly operated in offshore waters reported more catches than the vessels operated in coastal waters and high seas. Different length measurements (Total length – TL, Fork length – FL and Standard length – SL) and weight measurements of the fish were obtained and were used to estimate the Length - Weight and Length - Length relationships of kawakawa. All relationships were significant at 0.01.

Introduction

Sri Lanka is one of the oldest and most important tuna producing island nations in the Indian Ocean. Skipjack tuna (*Katsuwonus pelamis*) and Yellowfin tuna (*Thunnus albacares)* are the key tuna species found in Sri Lankan waters while neritic tuna is also one of the important groups in the commercial landings. Three species of neritic tuna are frequently found in Sri Lankan waters, namely, *Auxis thazard* (frigate tuna), *Auxis rochei* (bullet tuna) and *Euthynnis affinis* (kawakawa). *Scomberomorus commerson* (narrow-barred spanish mackerel) is dominating the catch of other species associated with neritic tunas. Annual landings of neritic tunas contribute more than 10% of all tuna and tuna like species landed in the country. The relative contribution of each neritic tuna species varied throughout the past decades where *Auxis thazard* has been prominent for many years (Sivasubramanium, 1973; Bandaranayake and Maldeniya, 2012). For the period of 2005-2009, *Euthynnis affinis* has become dominant and this may be due to multiple reasons: expansion of the fishing zone and new fishing practices etc (Bandaranayake and Maldeniya, 2012). However, the total catch of *Euthynnus affinis* has decreased considerably after 2009.

Objective

To analyse kawakawa landings in Sri Lanka and to estimate different length-length relationships and the length-weight relationship of kawakawa

Methodology

PELAGOS database of the National Aquatic Resources Research and Development Agency (NARA) of Sri Lanka was used for this analysis. Catch and effort data of Kawakawa by gear and craft were analyzed for the period of 2005-2012. A total of hundred individuals taken from the western coastal landings was analyzed to obtain the length-length and length-weight relationships. Lengths of the fish (Standard Length - SL, Fork Length -FL and Total Length - TL) were measured to the nearest 1 mm using a measuring board while weights of the fish were measured for the nearest 0.1 g.

Results and Discussion

Fishing crafts and Catch rates of Kawakawa

A range of fishing crafts which includes single day and multiday fishing crafts make catches of kawakawa while they are targeting key tuna species. Apart from that, few single day boats engaged in tuna fishery target neritic tunas (mainly frigate tuna and bullet tuna). However, the fishery is seasonal. Multiday fishing vessels mostly target yellowfin tuna and skipjack tuna. A classification of single day and multiday vessels which may catch kawakawa is shown in Table 1. UN1 and UN2A are single day boats whereas others are multiday boats. In general, single day boats operate within the continental shelf. The catch rates of the different vessels in terms of kawakawa catch in kg per trip is shown in Table 2. The vessels operating in coastal waters (UN1 and UN2A) reported relatively lower catch rates of kawakawa and the lowest catch rates were recorded by the vessels mostly operating in the high seas (UN4).

Fishing gear and catch rates

Before the 1980s handline and trolline were important for kawakawa production in the country (Maldeniya et al., 1988). Motorization of crafts and the introduction of synthetic nets resulted in gillnet as a key fishing gear in the tuna fishery, while the other gears have become seasonally important in certain areas (Joseph and Moyiadeen, 1985; Joseph and Moyiadeen, 1986). The average catch of 68% by gillnet from 2005-2012 reveals that at present gillnet has effectively been contributing to catching kawakawa (Table 3). Ring net and gillnet - long line combination contribute about 17% and 8% of the total kawakawa landings respectively. However, the highest average kawakawa catch (catch per trip) was recorded for the boats operating with ring nets (31 Kg per trip) (Table 4). The boats operating with gillnet catch only about 17 kg per trip.

Table 1. Classification of single day and multiday fishing vessels in Sri Lanka

Boat category	Boat Description
UN1	5.5 - 7.2 M (17' - 21') FRP dinghy Outboard engine - 8-40 HP (usually 15 - 25 HP) Single day boats - assumed to be fishing in coastal waters
UN2A	8.8 - 9.8 mm (28' - 34') displacement hull. FRP or wooden. Inboard engine (single) - 40 HP No ice box or insulated fish hold, no gear hauler, navigational or acoustic equipments. Single day boats - assumed to be fishing in coastal waters
UN2B	8.8 - 9.8 m (28' - 34'). FRP or wooden, Inboard engine (single) - 40 HP Insulated fish hold - no gear hauler, may have GSP/sounder/fish finder
UN3A	9.8 - 12.2 m (34' - 40'). FRP or wooden. Inboard engine (single) - 60 HP Insulated fish hold and may have gear- hauler/ GSP/sounder/fish finder
UN3B	12.2 m – 15.2 m (40' - 50'). FRP or wooden. Inboard engine (single) - 60 + HP. Insulated fish hold and may have freezer facilities. Gear Hauler/GSP/sounder/fish finder
UN4	15.2 - 18.3 m (50' - 60') Inboard engine, fish storage facility, may have RSW or CSW or freezing facility, gear hauler, GPS, echo-sounder/fish finder, radio communication

Table 2. Kawakawa catch rates (catch in kg per trip) of different craft types

Craft type	Catch rate (in Kg per trip)
UN1	2.95
UN2A	8.25
UN2B	23.39
UN3A	13.70
UN3B	5.47
UN4	0.80

Table 3. Percentage landings of kawakawa by major gear

Gear	Percentage catch
Ring net	17.31
Gillnet & Handline	0.7
Gillnet	68.0
Gillnet & Longline	8.17
Other gears	5.82

Table 4. Average catch rates of kawakawa by gear

Gear	Average catch rate (catch in Kg per trip)
Ring net	30.88
Gillnet & Handline	12.87
Gillnet	16.94
Gillnet & Longline	7.70

Length-Weight relationship of Kawakawa

There is a growing need to develop weight-on-length (WL) predictors not only for the target fish species caught but also for species caught as a bycatch or incidental catch (Uchiyama and Kazama, 2013). Biomass dynamics models used in fish stock assessment typically require the prediction of body weight from some measure of length.

The length (total length) and weight measurements of around hundred fish with a wide size range (25.0-61.0 cm of total length) were measured for estimating the length – weight relationship of kawakawa. Log transformed weight vs. log transformed length were plotted in order to derive the length – weight relationship (Figure 1). Results indicate a strong linear correlation between the parameters.

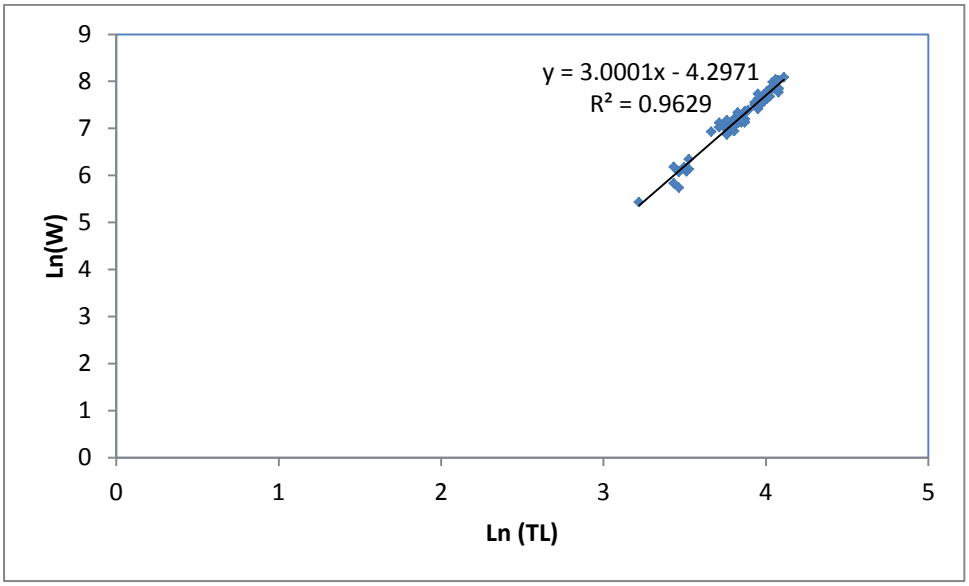


Figure 1. Log transformed weight vs. log transformed length

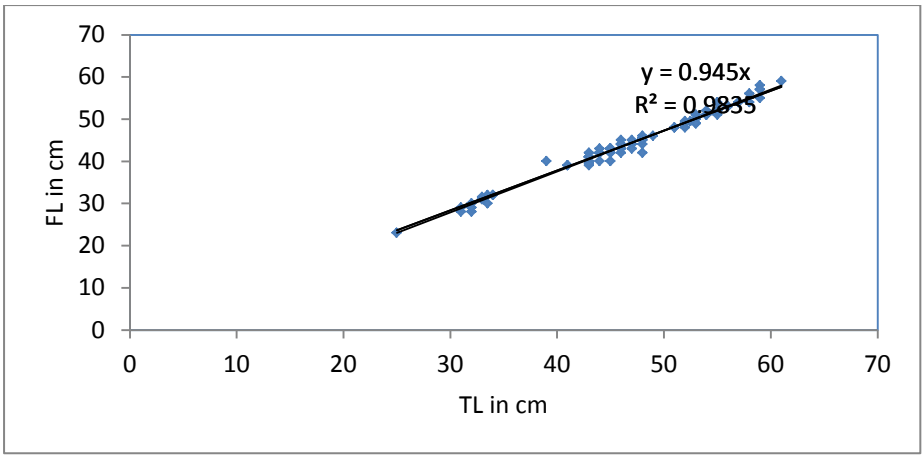
Following length – weight relationship was obtained:

$$W = 0.013L^3$$

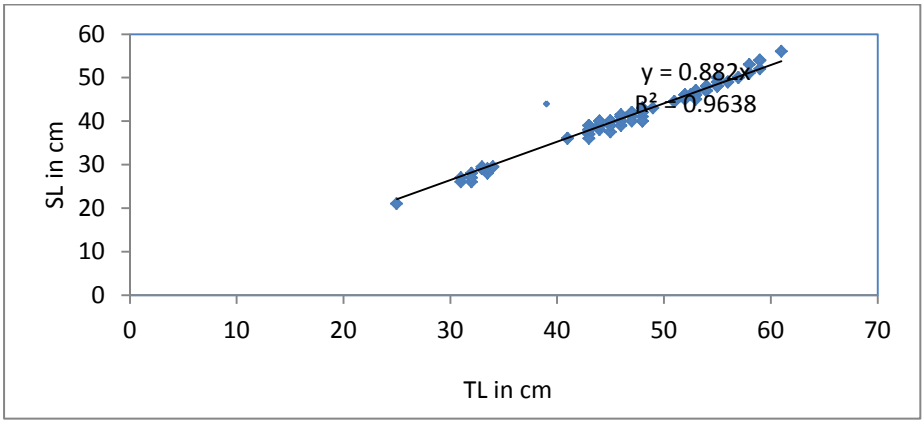
Length – Length relationships of Kawakawa

Different length measurements (Total length – TL, Fork length – FL and Standard length – SL) of the fish were obtained and they were used to derive the Length - Length relationships of kawakawa (Figure 2).

(a)



(b)



(c)

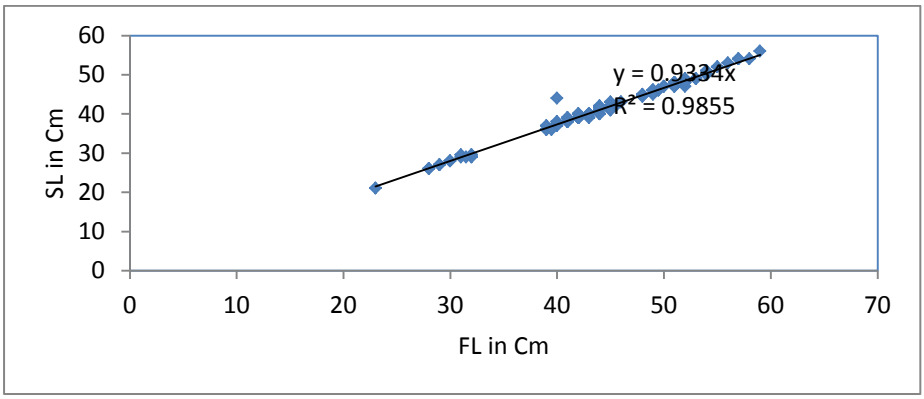


Figure 2. Length –Length relationships of Kawakawa: (a) TL & FL (b) TL & SL and (c) FL & SL

Following L-L relationships were obtained:

FL= 0.945TL

SL= 0.882TL

SL= 0.9934FL

All Length - Length relationships were significant at 0.01.

Acknowledgements

The support given by the staff members of the Marine Biological Resources Division, NARA is highly appreciated. Special thank is due to Mr. Malith Anupama and Mr. M.D.I.C. Kumara for their fullest support given in the field.

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