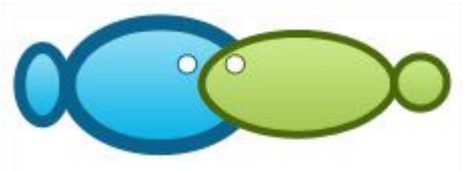

# Biological aspects of jumping halfbeak (*Hemiramphus archipelagicus*) in the waters of Kelang Island, Western Seram, Indonesia

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**Abstract**. A research to study biological aspects i.e. size distribution and growth pattern of jumping halfbeak (*Hemiramphus archipelagicus*) was conducted in the waters of Kelang, Western Seram Indonesia on April to June 2018. The sample was collected every two weeks interval from the catch of fishers in the area. Totally, there were 217 individuals of jumping halfbeak collected during the research with total length ranged from 15 to 33.3 cm ($\bar{x}$ = 26.72±3.41 cm) while the weight ranged between 12 and 75g ($\bar{x}$ = 41.38±13.00 g). Mid-length class of 24.5-29.5 cm dominated the fish caught as many as 71.4% of the samples collected. Jumping halfbeak (*H. archipelagicus*) in Kelang waters, Western Seram showed negative allometric and isometric growth pattern.
**Key Words:** size distribution, length-weight relationship, growth pattern, Maluku waters.

**Introduction**. Kelang Island is a small island located in Western Seram Regency, Maluku Province, Indonesia. Like other islands in Maluku, the waters of Kelang Island have various living marine resources especially small pelagic fish. One of the small pelagic fish resources in Kelang waters is jumping halfbeak or locally called *ikan julung*. This small pelagic fish is not an economically important fish but it can be found abundantly in Maluku waters and its production tend to increase over time i.e. 7355 tons in 2012 and increase to 11191 tons in 2015 (BPS Maluku 2015). Jumping halfbeak is sold in the traditional market in Maluku in the form of fresh fish or in preserved one as smoked fish (Tapotubun et al 2017) or locally called *ikan julung kering*.

Biological aspects of small pelagic fish in Maluku waters has been studied by several researchers, but mainly focus for mackerel (*Decapterus* spp.) in Ambon Island waters (Ongkers et al 2016; Pattikawa et al 2017; Pattikawa et al 2018). Information of jumping halfbeak especially its biological aspects is very limited although production of jumping halfbeak tend to increase and it often caught by local fishers as well as consumed by the local community in Maluku Province. This limitation does not only occur in Maluku but also in other parts of Indonesia. Therefore, this research was conducted to study the biological aspects of jumping halfbeak (*Hemiramphus archipelagicus*) which are focused on size distribution and growth pattern in the waters of Maluku, Indonesia.

**Material and Method**. The research to study biological aspects of *H. archipelagicus* was carried out at Kelang waters, Regency of Western Seram, Maluku Province Indonesia (Figure 1) on April to June 2018.

Samples of *H. archipelagicus* were collected randomly every two weeks from the fishers of mini purse seine during the fishing operation at the fishing ground or after the fishing operation at the fish landing site in Kelang Island. Samples of fish collected were then measured in which total length was measured to nearest mm from the tip of the jaw to the end of the tail using plastic ruler while weight was weighted to the nearest g by using a 5 kg digital balance blue LCD blacklight.

Data collected was analysed by using software of Microsoft Excell 2010. The length and weight data were analysed descriptively and summarized in the form of tables and figures. Length distribution was presented in the form of a figure with length class is 1 cm.

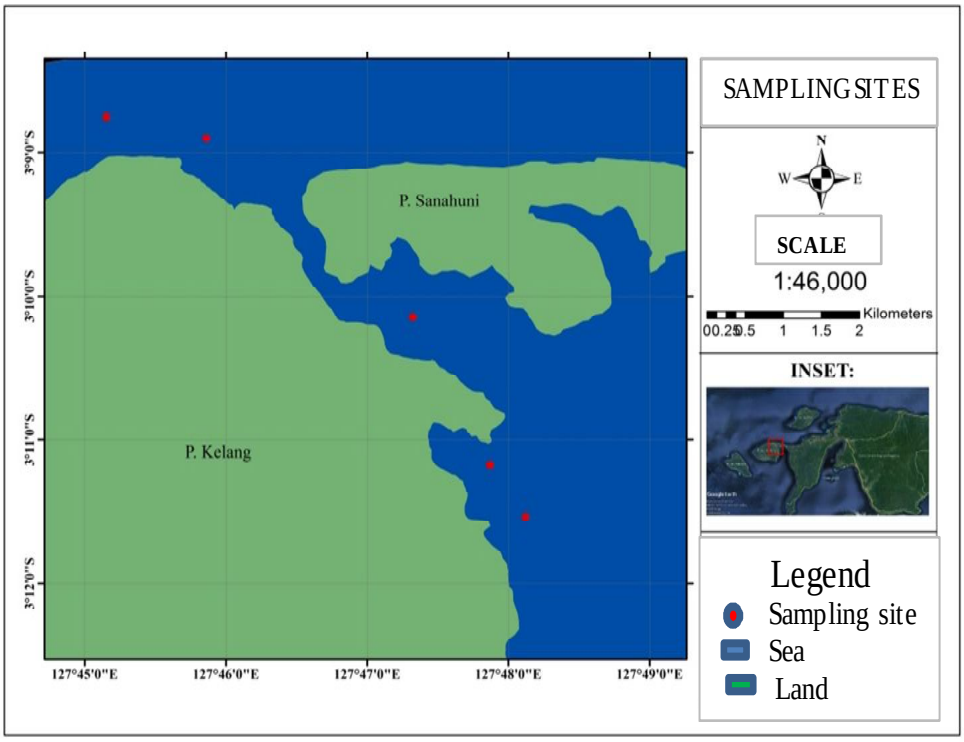


Figure 1. The map showing sampling sites (red circles).

Length-weight relationship was analyzed using power function according to Pauly (1984), Ongkers et al (2014), Ongkers et al (2016), Pattikawa et al (2017) and Pattikawa et al (2018):

$$W = a L^{b}$$

Where: W = weight (g);
L = length (cm);
a = intercept;
b = slope.

The value of b estimated from length-weight relationship was then used to determine the growth pattern of fish. To test deviation of b from a cubic function, interval value of b at p = 0.05 was used (Sparre & Venema 1992; Ongkers 2014; Ongkers et al 2016; Pattikawa et al 2017; Pattikawa et al 2018):

$$b \pm t \times sb$$

Where: t = t table (p = 0.05; df = n-2);
sb = standard deviation of b.

## Results and Discussion

***Size distribution***. The total number of *H. archipelagicus* sampled for five periods from April to June 2018 was 217 individuals. Size distribution of *H. archipelagicus* is presented in Table 1 while its length frequency is shown in Figure 2.

Sizes of fish collected vary in which for total sample the total length was ranging from 15.0 to 33.3 cm ($\bar{x}$ = 26.72±3.41 cm) while its weight was ranging from 12 to 75 g ($\bar{x}$ = 41.38±13.00 g) (Table 1). It can be seen in Table 1 that minimum size for length (15.0 cm) and weight (12 g) was found in the period II while the maximum length (33.0 cm) and the maximum weight (75 g) occurred in period III and period II, respectively.

Length frequency distribution in Figure 2 showed that *H. archipelagicus* in mid-class 24.4-29.5 dominated fish caught i.e. 155 individuals (71.4%).

Table 1

Length and weight distribution of *H. archipelagicus*

| Period | n (ind.) | Total length (cm) | | | | Weight (g) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | $\bar{x}$ | SD | Min | Max | $\bar{x}$ | SD |
| I | 38 | 18.6 | 32.5 | 26.38 | 3.28 | 16 | 72 | 40.82 | 14.20 |
| II | 58 | 15.0 | 32.5 | 27.55 | 3.69 | 12 | 75 | 43.14 | 14.53 |
| III | 36 | 21.8 | 33.3 | 28.52 | 2.99 | 22 | 68 | 40.86 | 12.98 |
| IV | 43 | 19.0 | 30.0 | 26.29 | 2.40 | 17 | 57 | 42.42 | 10.26 |
| V | 42 | 18.5 | 32.0 | 24.81 | 3.33 | 15 | 64 | 38.88 | 12.29 |
| Total | 217 | 15.0 | 33.3 | 26.72 | 3.41 | 12 | 75 | 41.38 | 13.00 |

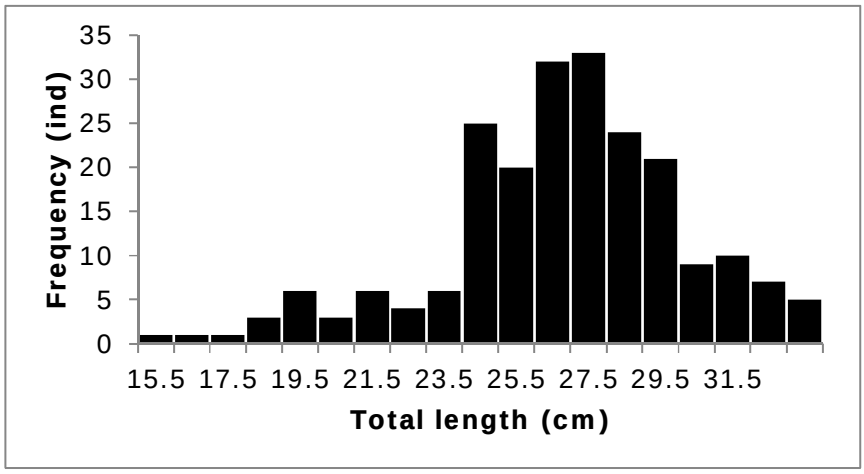


Figure 2. Length frequency distribution of *H. archipelagicus*.

Study on biological aspects of *H. archipelagicus* is very limited in Indonesia. Up to now, there is only one research of *H. archipelagicus* in Indonesian waters i.e. in seagrass bed of Ekas Bay, East Lombok (Suryawan et al 2016). The total length of *H. archipelagicus* in Ekas Bay ranged from 5.1 to 19.0 cm ($\bar{x}$ = 13.34±2.32 cm) in which mid-length 12.0-16.0 cm dominated total sample (85.45%) with mode at mid-length 14.0 cm (36.36%) while mid-length 18.0 cm has the lowest frequency (1.2%) (Suryawan et al 2016). Tabassum et al (2015) reported total length ranged from 14.0 to 26.0 cm (19.5±2.93 cm) with the weight ranged from 9 to 27 g (16±4.87 g) for the population of *H. archipelagicus* in the coastal waters of Karachi, Pakistan in the period of July 2010 to August 2011. Meanwhile, it was found for the same location at period January to December 2014 total length ranged from 14.0 to 23.5 cm with the weight ranged from 8.0 to 27.4 g (Tabassum et al 2017). Up to now, the largest *H. archipelagicus* was reported from Iran waters with a total length of 34.0 cm (Collette 1999).

Relative cumulative frequency in Figure 3 showed that Lc i.e. length which has 50% to be caught occurs at mid-length of 22.5 cm. This value is higher than the maximum total length of *H. archipelagicus* from Ekas Bay, Indonesia (Suryawan et al 2016) and almost similar to the maximum total length of the same species from Karachi, Pakistan (Tabassum et al 2017).

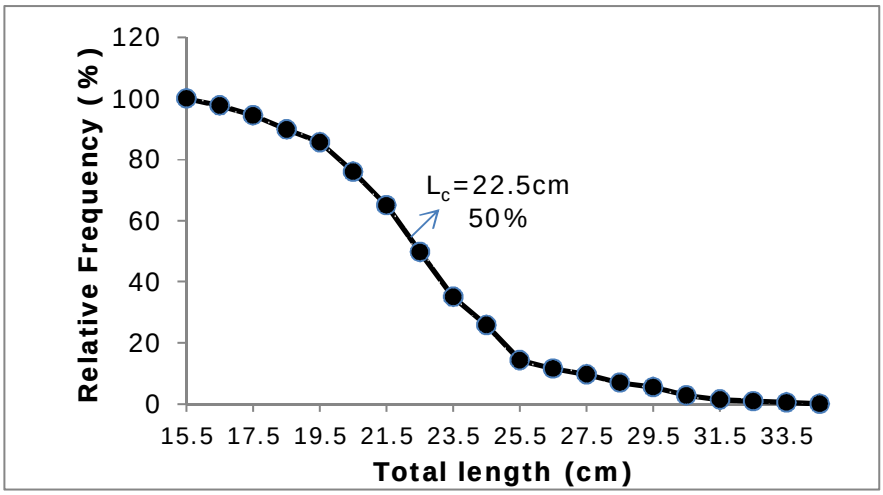


Figure 3. Relative cumulative frequency of *H. archipelagicus*.

***Length-weight relationship***. Length-weight relationships of *H. archipelagicus* are presented in Table 2 and Figure 4. It can be seen in Table 2 that correlation coefficient (*r*) which describes the degree of association between length and weight ranged from 0.890 to 0.943. These values indicated that there is a strong correlation between length and weight and the contribution of length to weight which is determined by the coefficient of determination ($R^2$) (Figure 4) ranging from 79.2 to 88.9%. The strong or significant correlation also indicated that the relationship between length and weight can be used for further analysis (Ongkers et al 2014; Pattikawa et al 2017).

Table 2

Length weight relationship of *H. archipelagicus*

| *Period* | *W = a L $^b$* | *r* | *Interval b (p = 0.05)* | *Growth pattern* |
|---|---|---|---|---|
| I | W = 0.006 L $^{2.681}$ | 0.943 | 2.360 - 3.000 | Isometric |
| II | W = 0.016 L $^{2.375}$ | 0.934 | 2.132 - 2.618 | Negative allometric |
| III | W = 0.003 L $^{2.819}$ | 0.921 | 2.402 - 3.235 | Isometric |
| IV | W = 0.003 L $^{2.890}$ | 0.934 | 2.541 - 3.238 | Isometric |
| V | W = 0.019 L $^{2.539}$ | 0.919 | 2.190 - 2.888 | Negative allometric |
| Total | W = 0.007 L $^{2.337}$ | 0.890 | 2.178 - 2.497 | Negative allometric |

The values of b presented in Table 2 and Figure 4 ranged from 2.337 to 2.890. Table 2 also showed an interval value of b at p = 0.05 to test significance deviation of b from 3. The b is not significantly different from 3 if its interval value at p = 0.05 includes 3.00 (King 2007; Ongkers et al 2014; Pattikawa et al 2017). Table 2 showed that there are three interval values of b at p = 0.05 which are including 3.00 i.e. b values for the period I, III and IV, meaning b for those periods equal to 3 (b = 3).

The value of b in length-weight relationship can be used to determine growth pattern of fish (Pauly 1984; Sparre & Venema 1992; King 2007; Ongkers et al 2014; Ongkers et al 2016; Pattikawa et al 2017; Pattikawa et al 2018). If the value of b equal to three (b = 3), growth pattern of fish under studied is isometric in which growth of length and weight occurs at the same rate. On the contrary, if the value of b ≠ 3, the growth pattern of fish is called allometric i.e. negative allometric (b < 3), length grows faster than weight or positive allometric (b > 3), weight grows faster than length.

Based on the statement above, it can be said that *H. archipelagicus* in Kelang Island waters has isometric growth pattern for fish in sampling periods I, III and IV and negative allometric growth pattern for fish in sampling periods II and V as well as for total fish collected during the study (Table 2). Negative allometric growth pattern has been reported for *H. archipelagicus* in the coastal waters of Karachi, Pakistan (Tabassum et al 2015).

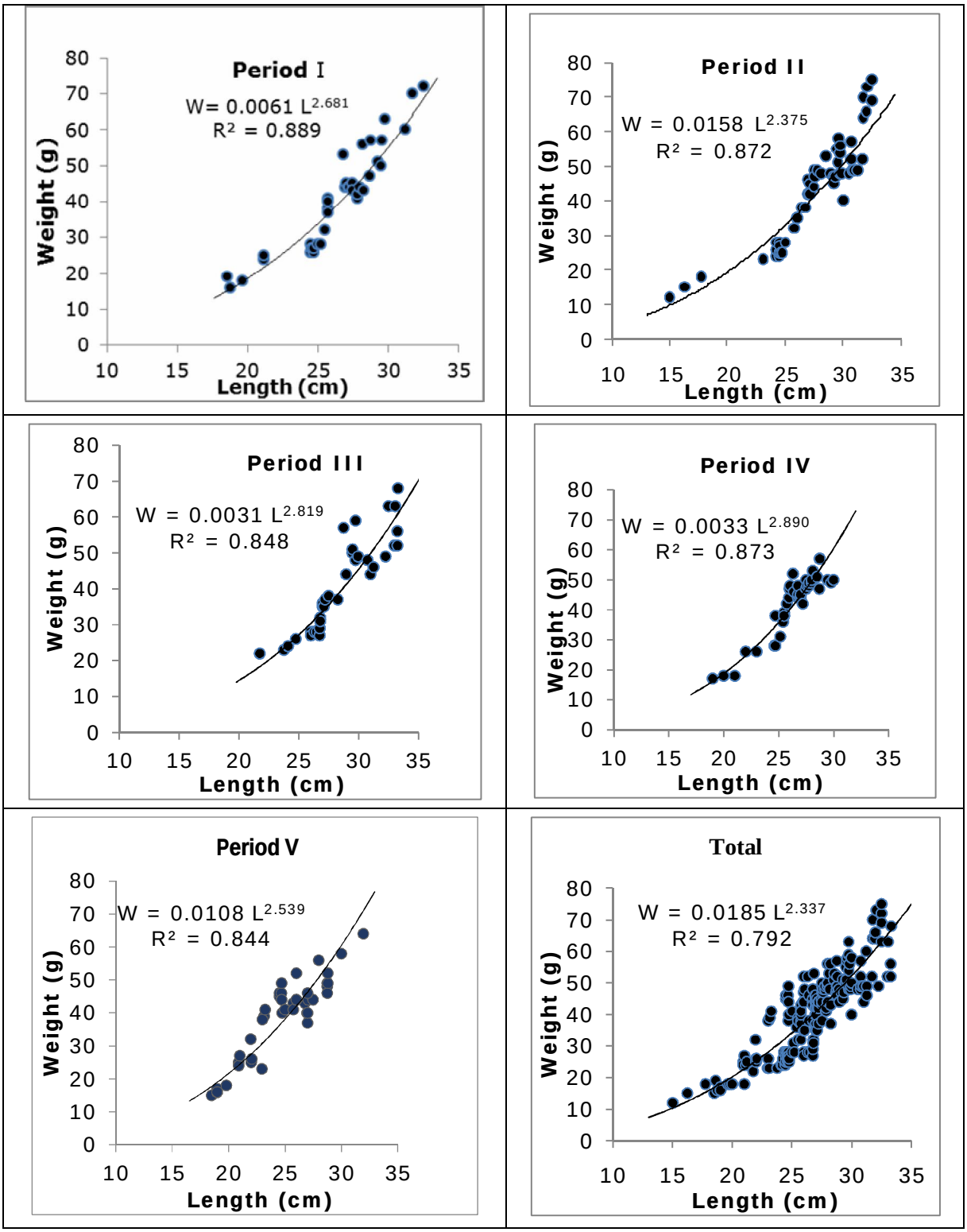


Figure 4. Length-weight relationship of *H. archipelagicus* during the period of study.

Growth pattern of marine organisms including fish varies and it might be influenced by environmental conditions (food availability, temperature, salinity etc.), sex and life stages (larva, juvenile, adult) of fish (LeCren 1951).

The length-weight relationship is very useful in fisheries biology because it can be used to determine the growth pattern, condition factor and conversion factor (Effendie 1997). Thus, if only one variable for example length is available, then this variable can be converted to weight and vice versa.

**Conclusions**. Totally, there were 217 individuals of *H. archipelagicus* collected during the study with the length ranging from 15 to 33.3 cm ($\bar{x}$ = 26.72±3.41 cm) while the weight ranging from 12 to 75g ($\bar{x}$ = 41.38±13.00 g). *H. archipelagicus* in Kelang Island waters shows isometric and negative allometric growth pattern.

As information of *H. archipelagicus* is limited, future work is really needed especially to study population dynamics and biological reproduction of this species in order to manage this resource properly.

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