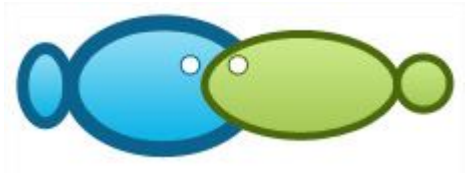

The expression of the body shape in fish species *Harpadon nehereus* (Hamilton, 1822) in the waters of Juata Laut, Tarakan city, North Kalimantan

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Abstract. *Harpadon nehereus*, also known as nomei/pepija fish from Juata Laut, North Kalimantan, Indonesia used to be caught by fish trawlers which obtained huge quantities of fish of various sizes and from various biological conditions. This study aims to examine the relationship between weight and length (linear and exponential logarithm) and between Le Cran (Kn value) and Fulton (K value) condition factors for the interpretation of fish body expression. In total, 480 samples of *H. nehereus* were used, with the male-female ratio of 1.3 (57.5%/276 fish):1 (42.5%/204 fish). Length-weight relationship (LWR) analysis of male samples yielded b = 2.7027 (negative allometry), while female samples yielded b = 3.5019 (positive allometry). The relative condition factor (Kn) of *H. nehereus* males ranged from 0.499 to 4.289 with a mean value of 1.054. Overall, 55.07% of male fish (152 individuals) expressed a flat/thin body, and as many as 37.68% (104 fish) expressed a plump body shape. Meanwhile, the relative condition factor (Kn) of *H. nehereues* female ranged from 0.660 to 2.056 with an average value of 1.013. The results demonstrated that as many as 47.55% of fish (97 individuals) have a flat/thin body, while 49.02% (100 fish) have a plump body shape. On the other hand, Fulton's condition factor of male fish showed a range of 1.180-2.045 and an average K value of 1.474. There were 69.2% (191 male fish) samples representing a low K value, while the rest (85 fish) represented a high K value. Fulton's condition factor of female samples ranged from 0.094 to 0.120, with an average K value of 0.107; in total, 48.5% (99 female fish) represented a high K value and 51.5% (105 fish) a low K value.

Key Words: the length-weight relationship, condition factors, nomei fish (*Harpadon nehereus*), *Pukat Hela* (small trawls).

Introduction. *Harpadon nehereus*, also locally known as nomei or pepija fish, is caught in the waters of Juata Laut Tarakan (Saleh 2005; Firdaus 2005; Nugroho et al 2012; Laga et al 2015). *H. nehereus* belongs to the Synodontidae family, Actinopterygii class (Amin 2001; Froese & Pauly 2017). Nomei fish caught in Tarakan city are morphometrically similar to lomek fish found in the Dumai waters (Nugroho et al 2012; Putri et al 2013). In Bengal estuary waters, the Indian Sea, Bangladesh, and Pakistan, *H. nehereus* is called Bombay duck (Khan et al 1992; Kurian & Kurup 1992; Fernandez & Devaraj 1996; Amin 2001; Ghosh et al 2009; Kalhoro et al 2013). *H. nehereus* is generally caught using small trawls which are locally known as *pukat hela*. This equipment is very suitable with the characteristics of Juata Laut waters which contain mud substrate, and also the use of trawls refers to the Regulations of the Minister of Maritime Affairs and Fisheries of the Republic Indonesia No. 6 the year 2008. Trawls used for catching this species are usually installed once (for 3-5 days) every two weeks during the neap tide period (Saleh 2005; Firdaus 2010; Nugroho et al 2012). This fish is usually processed as dried salted fish products which are important and potential for the improvement of the fishing economy in Juata Laut (Firdaus et al 2012). Trawls can catch *H. nehereus* of various sizes (weight,

length, and body parameters) which will affect the biological condition of the fish, such as the length-weight relationship (LWR), length-body depth relationship (LBDR), and condition factor. The biological condition of *H. nehereus* in Indian waters has been studied by Ghosh et al (2009), confirming that the LWR measured by the growth pattern approach represented an allometric growth in male and female fish with b = 2.81 (male) and b = 2.87 (female). *H. nehereus* in Dumai waters, Riau, also has been studied by Putri et al (2013), which focused on LWR variables and condition factors. The results of LWR measured with a growth approach illustrated that male fish had negative allometry (b = 2.36) and a rounded/plump body (K = 0.89), while female fish had positive allometry (b = 3.29) and a rounded/plump body (K = 0.77). Both samples were supported by adequate food in Dumai waters (relative weight (Wr) > 100). Previous studies about *H. nehereus* (nomei/pepija) in Tarakan water (Firdaus et al 2013) and pepija fish in Juata Laut waters (Laga et al 2015) have also been conducted. The results showed that the LWR analysis and condition factors of nomei fish in Tarakan waters need more scientific data in order to upgrade the information related to the biological condition. Furthermore, those data can be used to compose policies related to the utilization of sustainable fisheries resources. Length and weight are two basic components in species biology at the individual and population levels (Naeem et al 2012). In this case, LWR is one of the important factors in the fisheries industry used for predicting the best length and the most suitable time to collect certain fish species (Abobi & Ekau 2013). Length-weight relationship (LWR) is used to regulate the caught quantity so that the most appropriate number of caught fish can be estimated. In addition, it also utilizes population in terms of place and time as an estimate (Singh et al 2011). The LWR value is not constant throughout the year due to various factors, such as temperature, salinity, food, habitat, gonadal development, spawning period, sex, seasons, lack of small individuals, and fish health (Pauly 1984; Safran 1992; Froese 2006). Therefore, the aim of this study was to reveal the expression of nomei fish body shape (*H. nehereus*) in Juata Laut waters of Tarakan city depicted from LWR analysis (linear and exponential logarithmic relationship) and condition factor (Kn value), which in this paper is proportional to the Effendie (2002) modification. The high K value indicated fish with a good condition (proportional and plump) (Abobi & Ekau 2013). The K value was also represented as relative weights in terms of the appropriate condition factor between species and population (Froese 2006).

Material and Method. The study of fish body shape expression with LWR approach and condition factor of *H. nehereus* in Tarakan waters was conducted for 6 months (February-July 2016). The study site was in the fishing base of the trawl fishery in Juata Laut subdistrict, Tarakan city, with Juata Laut waters in northern Tarakan used as a fishing ground for *H. nehereus* (Figure 1). Data of *H. nehereus* were collected by purposely aiming at this during 12 times of the sampling. Approximately 20 fish samples/day were collected for two days every two weeks, so there were 80 fish per month. Each collection was performed by different fishermen at a different location. Observations and measurements were performed in each individual in the field, including total length (TL), weight (W), and body depth (BD). Body shape expression was analyzed using the LWR approach in the form of cubic patterns and the LBDR in the form of a simple linear with simple regression equation: $Y = a + X^b$ became $W = a\,L^b$; $ln\,W = ln\,a + b\,ln\,L$; $L_b = a + b\,L$ (Efendie 2002; Merta & Badruddin 1992). B value in LWR, in terms of growth, represented the fish body shape, such as flat/thin, ideal (isometric), or rounded/plump. If b = 3, then the growth is categorized as isometric (balanced growth). If b is more or less than 3, then the growth is categorized as allometric (unbalanced growth) which is divided into negative allometry (b < 3) with a flat/thin body shape and positive allometry (b > 3) with a rounder/plump body shape (Effendie 2002). In order to obtain a *b* value, LWR was analyzed using the F test (data distribution) and continued with the t-test (equal test). Meanwhile, the value of condition factor was determined by accepting hypothesis H_0 (b = 3, isometric growth, the length increase will be followed by weight gain) or accepting H_1 (b ≠ 3, allometric growth, the length increase will not be followed by weight gain) with the following requirement: if $t_{statistic} < t_{table\ ((a/2);(n-2))}$, then accept H_0 and reject H_1; if $t_{statistic} > t_{table\ ((a/2);(n-2))}$, then accept H_1 and reject H_0. In order to describe the fish body shape in

detail, then Lagler's condition factor was used for isometric growth (K value in metric system with 10^5 until K value get near to 1). $K_{(TI)}$ was obtained from 10^5 multiplied with weight (W) which is divided by length cube three (L^3). The value of Le Cren's condition factor (Raeisi et al 2011) was used for allometric growth where Kn = W (actual weight)/$\hat{W}$ (predicted weight obtained from Log W = a + b * Log L), and condition factor modified from Fulton's (Abobi & Ekau 2013), where K is obtained by dividing fish weight (W) multiplied by 100 with fish length cube b value (L^b). W and L values are the absolute size of fish samples.

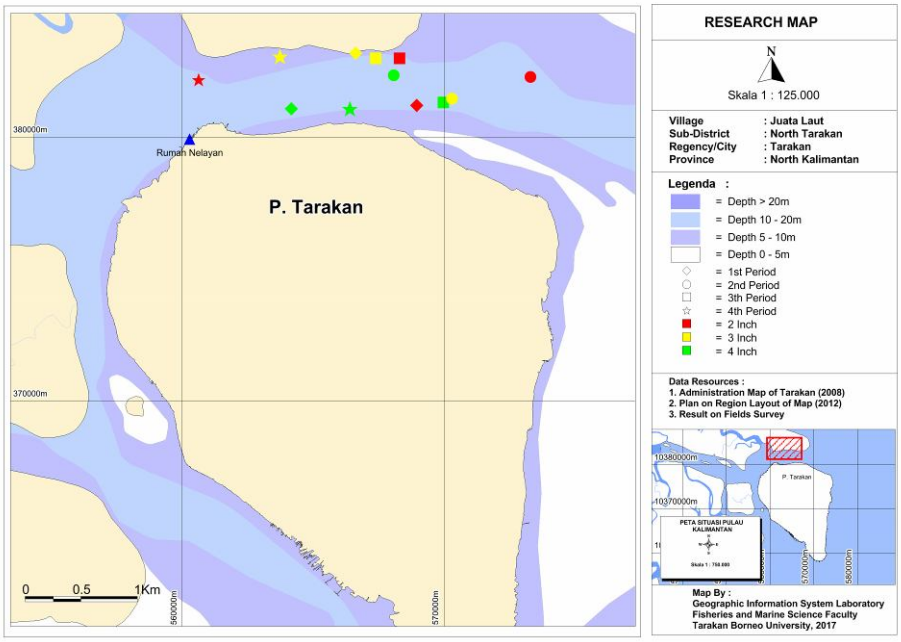

Figure 1. Sampling location *H. nehereus* by small trawler at Juata Laut waters.

Results. This study collected 480 fish consisting of 204 female fish samples (42.5%) and 276 male fish samples (57.5%). The measurements showed diverse average values for length, weight, and a body depth of nomei fish, both male, and female (Table 1).

Table 1

Variation in the body size of *H. nehereus*

Sample		*Size variable*		
		Length (cm)	*Weight (gram)*	*Body girth (cm)*
Male	*Max.*	31.0	150	18.4
	Min.	14.6	13.5	4.4
	Mean	22.09	65.2	9.3
Female	*Max.*	33.0	233	16.5
	Min.	17.0	20	4.5
	Mean	25.02	89.4	9.4

The linear logarithmic of the LWR of the male fish sample resulted in the regression as follows (Figure 2):

$$\text{Log } W = 2.7027 \text{ Log } L - 4.5516 \ (R^2 = 0.5802;\ r = 0.7617)$$

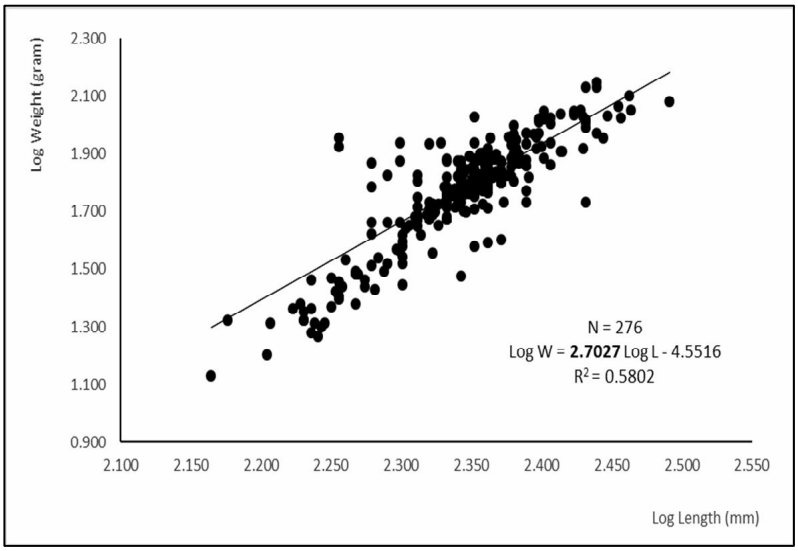

Figure 2. Logarithmic length weight relationship in males of *H. nehereus.*

Meanwhile, the exponential relationship between the length and weight of male samples resulted in the regression equation as follows (Figure 3):

$$W = 3E\text{-}05*L^{2.7027} \ (R^2 = 0.5863;\ r = 0.6944)$$

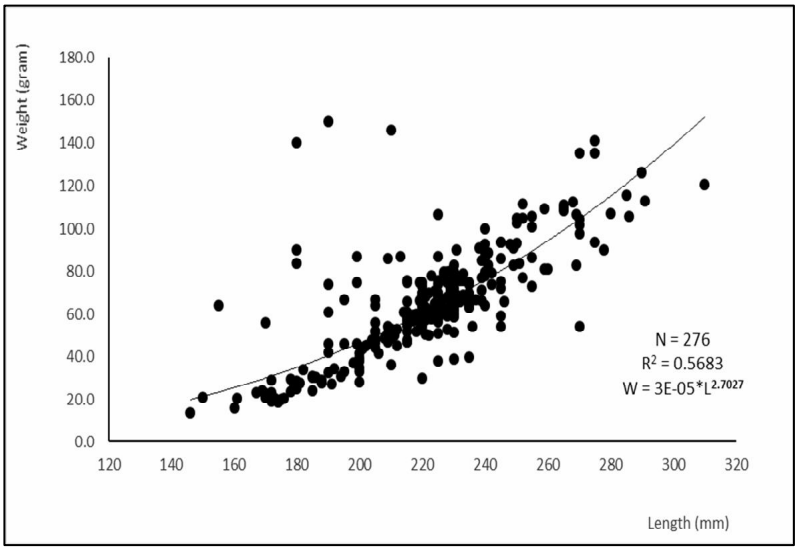

Figure 3. Parabolic length weight relationship in males of *H. nehereus.*

The LWR value of male samples was b = 2.7027 (close to 3) which meant that it was less than 3 (b < 3). This result indicated that the growth model based on LWR was categorized as negative allometry (flat/thin body shape). On the other hand, the log-linear relationship between length and weight in female samples resulted in the regression equation as follows (Figure 4):

$$\text{Log } W = 3.5019 \text{ Log } L\text{-}6.4783 \ (R^2 = 0.8804;\ r = 0.9383)$$

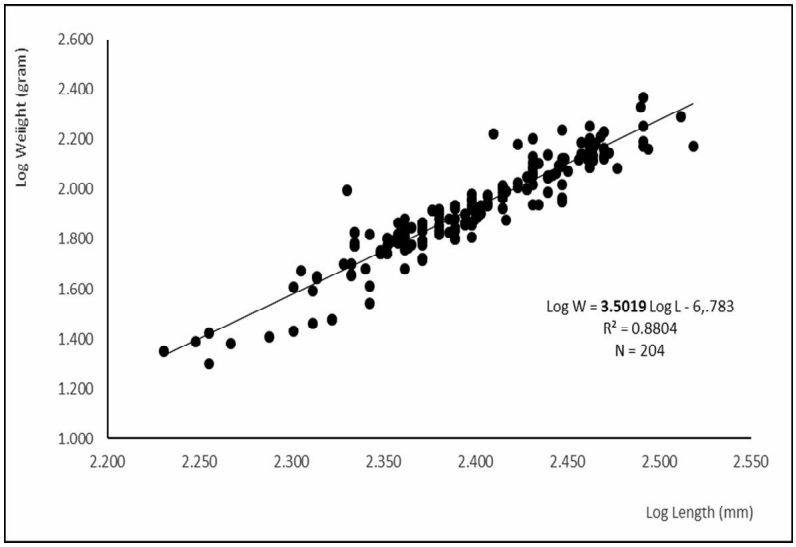

Figure 4. Logarithmic length weight relationship in females of *H. nehereus*.

In the exponential relationship, the regression equation was (Figure 5):

$$W = 3E\text{-}07 * L^{3.5019} \ (R^2 = 0.8804;\ r = 0.9236)$$

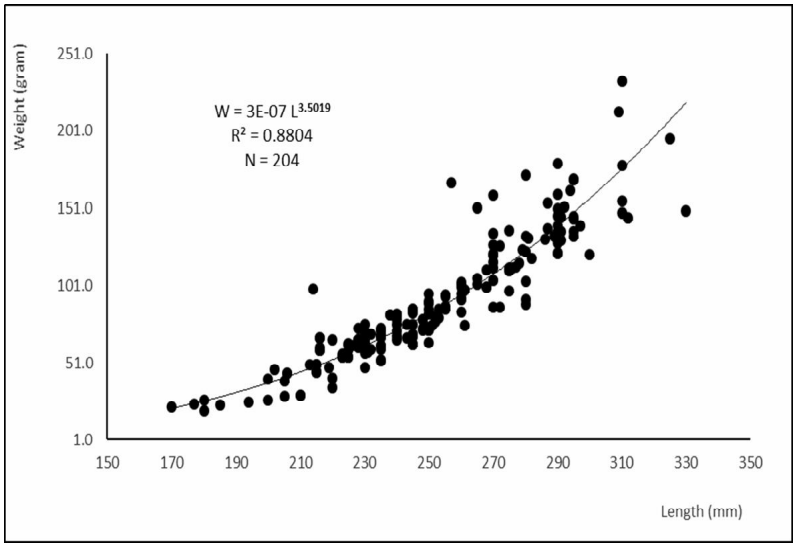

Figure 5. Parabolic length weight relationship in females of *H. nehereus*.

Analysis of the LWR in female samples showed b = 3.5019 (more than 3) which indicated that growth model based on LWR was categorized as positive allometry (rounded/plump body shape). Then, the F-test and T-test were applied to examine whether the b value obtained from LWR has the same or a different value to 3. The results of the F-test for nomei males were $f_{statistic}$ = 0.07943 and f_{table} = 0.81978, while for nomei females were $f_{statistic}$ = 0.07179 and f_{table} = 0.79340. The statistical rule used in decision-making is that if $f_{statistic} < f_{table}$, then H_0 will be accepted, which means that the data distribution is not identical and needs to be analyzed further using the t-test (equal test). The t-test performed in male samples resulted in $t_{statistic}$ = 59.57360 and t_{table} = 1.96863, while in female samples it was $t_{statistic}$ = 46.50825 and t_{table} = 0.97172. The statistical rule used in decision-making is that if $t_{statistic} > t_{table}$, then H_1 will be accepted (H_1 / b ≠ 3). The results of t-test examining the length-weight relationship of nomei fish are presented in Table 2.

Table 2

T-test result of length-weight relationship of *H. nehereus*

H. nehereus	*Pearson correlation*	*P(T<=t) two-tail*	*t Stat*	*t Critical two-tail*	*Decision rule*	*Commentary*
Male (♂)	0.762 (> 0.5/76.2%)	0.00000 (p < 0.01)	59.574	1.969	$t_{statistic} > t_{table}$ H_1 accepted	L & W is correlated (allometric, b ≠ 3)
Female (♀)	0.938 (> 0.5/93.8%)	0.00000 (p < 0.01)	46.508	1.972	$t_{statistic} > t_{table}$ H_1 accepted	L & W is correlated (allometric, b ≠ 3)

The Kn result (linear logarithmic equation model of condition factor) in male fish ranged from 0.499 to 4.289 with an average of 1.054. This average Kn value illustrated that the body shape of male fish samples was flat (ranged from 1 to 3; Effendie 2002). The proposed proportion of nomei fish body shape expression refers to the modification of Effendie (2002); therefore, approximately 55.43% of the male nomei body shape was categorized as flat/thin (153 individuals), and 43.8% of male samples were categorized as rounded/plump (121 individuals) (Table 3).

Table 3

Category of fish body shape based on the value of Le cran's factor condition in male *H. nehereus*

Body shape	*Kn*	*∑ sample*	*Percentage (%)*	
Very flat/thin	≤ 0.49	1	0.36	55.43
Flat/thin	0.50-0.99	152	55.07	
Proportional	1	2	0.73	
Rounded/fat	1.01-1.49	104	37.68	43.84
Very rounded/fat	≥ 1.50	17	6.16	

Analysis of the factor condition (Kn) of female samples showed that the Kn value ranged from 0.660 to 2.056 with an average of 1.013. According to Effendie (2002), body shape with a Kn value of 1.358 is categorized as flat (ranged from 1 to 3). For females, 47.5% of them were categorized as flat/thin (97 individuals), and 50% were categorized as rounded/plump (102 individuals) (Table 4).

Table 4

Category of fish body shape based on the value of Le cran's condition factor in female *H. nehereus*

Body shape	*Kn*	*∑ sample*	*Percentage (%)*	
Very flat/thin	≤ 0.49	0	0.00	47.5
Flat/thin	0.50-0.99	97	47.55	
Proportional	1	5	2.45	
Rounded/fat	1.01-1.49	100	49.02	50.0
Very rounded/fat	≥ 1.50	2	0.98	

The results of the K value (exponential equation model of condition factor) showed that 191 male individuals (69.20%) had a lower condition factor than the average K value, which ranged from 1.516 to 2.045, while 85 male individuals (30.80%) showed a high condition factor with a range of 1.180-1.473. With 12 times sampling, the high average values of condition factor on male fish were obtained at the 1st, 8th, 10th, and 11th sampling times, while the low average values were obtained at the 3rd and 4th sampling times (Figure 6).

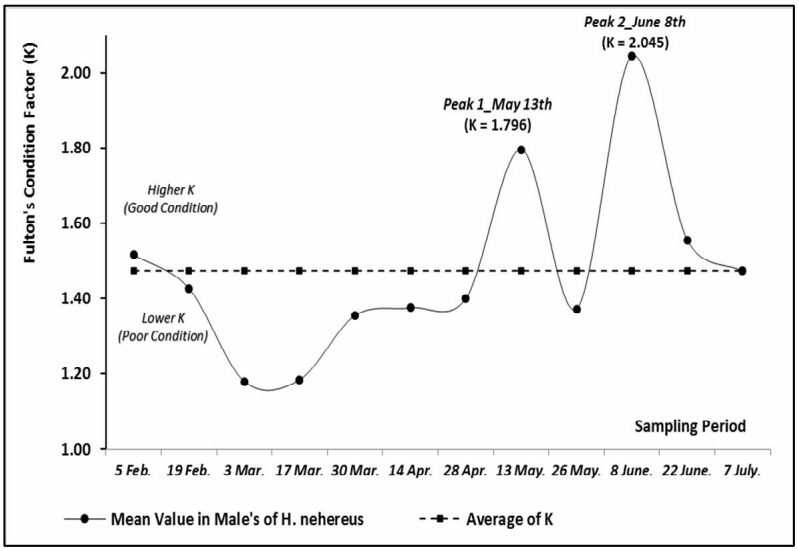

Figure 6. Mean values at Fulton's condition factor (K) in males of *H. nehereus*.

The average K value of 99 female individuals (48.53%) indicated a higher condition factor than the average K value with a range of 0.109-0.230, while 150 female individuals (51.47%) showed a low condition factor with a range of 0.094-0.105. The high average values for condition factor were obtained in the 1st, 2nd, 7th, 9th, and 10th samplings, while the low average values were obtained in the 3rd, 4th, 5th, 6th, 8th, and 11th samplings (Figure 7).

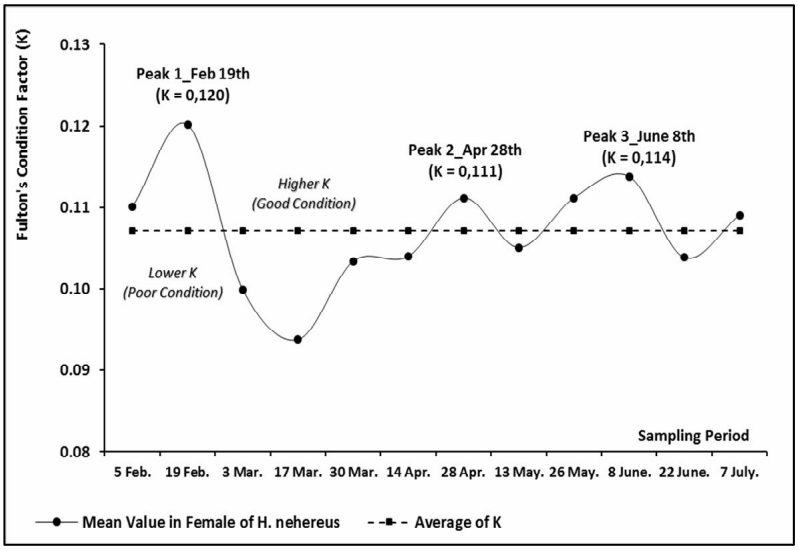

Figure 7. Mean values at Fulton's condition factor (K) in females of *H. nehereus*.

Discussion. Total samples of *H. nehereus* in Juata Sea waters of Tarakan city were collected, including as many as 480 individuals, with the male-female ratio of 1.3:1. There were 57.5% male samples (276 individuals) with an average of total length of 22.09±8.0 cm, the weight of 65.2±68.3 g and a body depth of 9.3±6.0 cm. An amount of 42.5% of *H. nehereus* female (204 individuals) were collected in the range of total length of 25.02±8.2 cm, weight 89.4±106.5 g and body depth 9.4±6 cm. The collected data indicated that females have longer and heavier sizes than males. The ratio between male and female fish collected in this study was different to that of *lomek* fish (*H. nehereus*) collected in Dumai Riau, which comprised 67% males and 33% females (Putri et al 2013). This result is also different to the research conducted by Firdaus et al (2013) in Tarakan waters with a total sample of 720 individuals of *H. nehereus,* comprised of 481 males (67%) and 239 females (33%).

Meanwhile, *H. nehereus* collected in Indian and Bangladeshi waters showed a similar sex ratio of 1:0.95 (male: female) (Khan et al 1992; Fernandez & Devaraj 1996; Amin 2001; Ghosh et al 2009). Referring to the results of LWR analysis on the male sample, the result of linear and exponential logarithmic equations were b = 2.7027. The b value was less than 3 (b < 3) which meant that the growth of *H. neherues* males in the waters of Juata Laut Tarakan city was allometrically negative. This result means that the length growth was not followed/imbalanced with weight gain. The b value in the male *H. nehereus* was higher than those in *lomek* fish (*H. nehereus*) in Dumai waters (b = 2.36) which also represented negative allometric growth (Putri et al 2013).

The previous study by Laga et al (2015) reported a lower b value of male pepija fish (*H. nehereus*) in 2013 compared to the present study (b = 2.700; negative allometry; R^2 = 0.826). Meanwhile, the b value of male *H. nehereus* in the waters of India and Bangladesh were as follows: b = 3.051 (positive allometry, R^2 = 0.997), when fish were collected from the coastal waters in Bangladesh (Amin 2001); b = 3.638 (positive allometry, R^2 = 0.913), when fish were collected from Mumbai-India waters (Balli et al 2006); b = 2.810 (negative allometry, R^2 = 0.90) fish were collected from Saurasthra-India waters (Ghosh et al 2009); and b = 3.426 (positive allometry, R^2 = 0.930), when fish were collected from the estuary waters of the western Kakdwip-Bengal (Behera et al 2015). The interpretation of b value of *H. nehereus* in the current research was supported by the coefficient of determination (R^2 = 0.5802 in linear logarithm; and R^2 = 0.5863 in exponential). This result indicated that the length can be used to predict approximately 60% of the weight variation in male samples, with a correlation coefficient (r) of 0.7617 (linear logarithm) and 0.6944 (exponential).

The correlation coefficient value in this study represents a strong correlation between length and weight as referring to Sarwono (2006) who stated that the correlation coefficient (r) ranged between 0.5 and 0.75, indicating a strong correlation between variables. The female sample calculated using linear and exponential logarithms resulted in a b value = 3.5019. This value is greater than 3 (b > 3) which indicates positive allometric growth and an unbalanced growth in length and weight. The b value of female *H. nehereus* in this study was higher than the b value of *lomek* fish (*H. nehereus*) collected in Dumai waters (b = 3.929 (positive allometry) (Putri et al 2013). The b value of female *H. nehereus* collected in 2013 was lower than the recent study, b = 2.695 (negative allometry, R2 = 0.827) (Laga et al 2015). In comparison to the present study, here are the b values of female *H. nehereus* obtained in India: from Mumbai-India waters the result was 3.558 (positive allometry, R^2 = 0.947) (Balli et al 2006); and from Saurasthra-India waters the result was 2.871 (negative allometry, R^2 = 0.90) (Ghosh et al 2009). The b value of female samples in the current study was supported by the coefficient of determination (R^2) of 0.8804 (linear and exponential logarithms), which means that more than 80% weight variation can be predicted using length data. The analysis in this study also obtained a correlation coefficient (r) of 0.9383 (linear logarithm) and 0.9236 (exponential), which indicates a strong correlation between length and weight. This result refers to Sarwono (2006) who stated that a strong correlation between variables has a correlation coefficient (r) ranging between 0.75 and 0.99.

Based on the slope in b values of *H. nehereus*, both current and previous studies represent unstably or the same LWR, although, in fact, this result is different to that which has been assumed due to various factors. The current study assumed that the main factor affecting this result was the changes in aquatic environment regarding the application of new policies prohibiting the establishment of the new fishpond and mangrove deforestation (since 2005). In addition, there was also the establishment of a spawning ground for pepija/nomie fish by the Tarakan government in 2014.

Food availability has also become one of the important factors supported by the existence of an active shrimp pond in estuary waters adjacent to the Juata Laut waters of Tarakan city. Moreover, the fishing ground in Juata Laut is located in front of the estuary of the large river called Sesayap which always supplies nutrients from the river into the sea.

The unstable LWR value throughout the year is probably affected by various factors, such as temperature, salinity, food (number, size and quality), gonadal habitat

and development, spawning period, sex, seasons, lack of small individuals, and fish health (Pauly 1984; Safran 1992; Froese 2006). Bagenal & Tesch (1978) and Froese (2006) added that the b value also depends on the conditions during the development of fish physiology, such as environment, fish biology, geography, time differences and fish sampling locations. The differences in b value of LWR not only depend on the body shape but also on various factors that may be responsible for this difference, such as years and seasons (Pauly 1984). Muchlisin et al (2010) assumed that the b value is influenced by food availability and environmental conditions, such as temperature, pH, and dissolved oxygen.

The b value obtained in this study corresponds with the previous studies about tropical fish that ranged between 2.5 to 3.5 (Carlender 1969; Froese & Pauly 2017). Moreover, the b value in this study was confirmed to the Indonesian fish data center (Anonim 2016). The analysis result of a paired two-sample t-test of *H. nehereus* collected in Tarakan waters confirmed that the b value ≠ 3 and represented a strong correlation (0.762, male samples) and a very strong correlation (0.938, female sample) between length and weight variables.

The LWR of *H. nehereus* in this study was confirmed to be significant with a p-value of $p < 0.01$. The expression of fish body shape was analyzed using Le Cren's condition factor approach (Raeisi et al 2011) as the LWR analysis resulted in b ≠ 3 or categorized as allometric growth.

Overall, the range of Kn values obtained from the male sample was 0.499-4.28 with the average condition factor (Kn) of 1.054. In this case, Effendie (2002) stated that the Kn value which ranged from 1 to 3 is categorized as a flat body shape. The body shape expression of male *H. nehereus* was classified as a flat body shape as it had a Kn value of 1.054. The values of relative condition (Kn) in female *H. nehereus* ranged from 0.660 to 2.056 with a mean of 1.013; therefore, it was classified as flat body shape (ranged 1-3, Effeindie 2002).

Based on the Kn value of *H. nehereus* caught in Juata Laut waters and the explanation of body category by Effendie (2002) towards Kn value and a b value of LWR, we assumed that there is an ambiguity in the interpretation of Kn value towards body shape category. If Kn values are less than 1 or more than 4, then there will be confusion in the interpretation of body shape. Therefore, based on the results of this study, we proposed modified body shape expressions according to the Kn value of male and female *H. nehereus*.

There are 5 categories in this new body shape category for *H. nehereus*: very flat/thin (Kn < 0.49); flat/thin (Kn = 0.50-0.99); proportional (Kn = 1); rounded/plump (Kn = 1.01-1.49); and very rounded/plump (Kn > 1.49). This modified category for body shape expression is based on the consideration that the value of condition factors would be useful in comparison to other individual values (Effendie 2002). Furthermore, the relative condition factor (Kn) of each individual can be used to compare the weight of each fish sample (gram) with the average weight (obtained from the long-weight relationship) towards length (Froese 2006).

The average weight (of LWR) is the estimated/relative weight of the fish (gram). The accuracy of fish body categorization according to condition factor value (Kn) can be verified by comparing the actual weight value (W) and the estimated/relative weight value ($\hat{W}$) with the Kn value (actual value or percentage). Analysis of the relative condition factor (Kn) of 276 male *H. nehereus* showed that 55.07% (152 individuals) belonged to the flat/thin category and 37.68% (104 individuals) belonged to the rounded/plump category.

The percentage of body shape expression in male fish samples in the current research was expressed more in the flat/thin category. On the other hand, the condition factor value (Kn) of 204 female *H. nehereus* revealed that 47.55% of samples (97 individuals) belonged to the flat/thin category, while 49.02% (100 individuals) belonged to the rounded/plump category. In contrast with the percentage body shape expression in males, female *H. nehereus* represented a slightly different result of rounded and flat body shape. Fulton's condition factor value (K) was used in order to explain in detail the expression of body shape in *H. nehereus* from Juata Laut waters. The results of Fulton's

condition factor analysis on male fish fluctuated during 12 sampling periods with a range of 1.180-2.045 and an average equal to 1.474.

Referring to the average K value, approximately 69.2% (191 individuals) had a low K value and 30.8% (85 individuals) had a high K value. This indicated that the condition of male *H. nehereus* used in this study was mostly not in a good condition (flat/thin). Fulton's condition factor values in female samples showed a range of 0.094-0.120 with an average of 0.107. Referring to the average K value, there were 48.5% (99 individuals) female samples with a high K value and 51.5% (105 individuals) with a low K value. This indicated that most female *H. nehereus* used in this study were in poor condition (thin/flat). In this case, fish with good condition (rounded/plump) has a higher value of condition factor (K) compared to fish in poor conditions (flat/thin) (Abobi & Ekau 2013).

The value of condition factor (K) of *H. nehereus* in Tarakan waters in 2013 ranged from 0.81 to 1.06 (male) and 0.84 to 1.10 (females), with a peak value occurring in June and the lowest value in May and August (Laga et al 2015). The study of Laga et al (2015) represented a lower K value in the male sample than in the female sample, and a higher K value than that obtained by the current research. On the other hand, the result of the condition factor (K) for *H. nehereus* in Bangladesh waters ranged from 0.5-1.4 with the peak K value occurred in June and the lowest K values in July and December (Amin 2001). The K value of *H. nehereus* in Bangladesh waters was much lower than the K value obtained in this study. This study showed that the peak of K value occurred in the 8th sampling period (mid-May) and the 10th sampling (early June), while female samples reached the peak of K value in the 2nd sampling (mid-February), 7th sampling (end of April) and 10th sampling (early June).

The differences in the K value of *H. nehereus* from various places and times are assumed to result from various factors, such as changes in the aquatic environment as well as the food availability. Anibeze (2000) explained that different K values in fish indicate the presence of sexual maturity and food availability in some species. The increasing condition factor value (K) reflects an improvement in the nutritional status of the fish, while the decreasing condition factor value means nutritional deficiencies (Koskela et al 1997). Nomei fish found in Tarakan waters mainly consume white shrimp with an IBT 78.10% (Astuti et al 2005). White shrimp are mainly found in the estuary and coastal water with mangrove ecosystem in good condition. Nomei fish in Tarakan waters were caught using trawls operated in mud-based waters and in the estuary (Saleh 2005; Firdaus 2010).

Conclusions. The result of LWR analysis showed that the growth of *H. nehereus* in the Juata Laut waters of Tarakan city indicated negative allometry (male sample) and positive allometry (female samples). The percentage of body shape expression in male fish samples was mostly flat/thin, while slightly more female samples were rounded/plump. Fulton's condition factor (K) of *H. nehereus* represented that most male fish used in this study were in poor condition (flat/thin), while there were slightly more female samples with a poor condition (flat/thin) compared to the samples in good condition (rounded/plump).

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