Length-weight relationship and condition factor of yellow tail scad *Atule mate* (Cuvier 1833) from Andaman waters, India

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ABSTRACT

Atule mate is a commercially important carangid fish resource of the Indian coast and one of the much-demanded food fish. A study on the length-weight relationship and condition factor of *A. mate* from Andaman waters was carried out from January 2019 to December 2019. A total of 702 specimens were collected for the study and grouped into male, female and immature 219, 216 and 267, respectively. The length-weight data showed that the growth pattern of the immature and pooled data is positively allometric (b value > 3) with b values 3.10 & 3.17, and for male and female b value shows negative allometry (b value < 3) with b values 2.99 and 2.98 respectively. The significance of variation found that the t value for pooled and immature clusters are significant, and for male & females, the t value is not substantial. The mean condition factor shows 1.00 and 1.01 for the total population & immature, Kn value for females and males was the same as 1.00 and, indicating that the value of Kn is equal to 1; hence, fishes are in good condition. The present study provides vital information for the fishery management of *A.mate* from Andaman waters.

1. Introduction

Andaman and Nicobar Islands are the largest archipelago in the Bay of Bengal, consisting of 572 islands, islets and rocky outcrops (Planning Commission Report 2007). The family Carangidae comprises a diverse group of fishes known by common names such as trevallies, jacks, amberjacks, scads, pompanos, Kingfish, rainbow runners and pilot fish (Honebrink 2000). (Nair et al. 2000; Kasim, 2003). Carangids are one of the most economically important fish groups throughout the world due to their wide distribution and high commercial value (Nair et al., 2000; Kasim, 2003; Mukherjee et al. 2017) and are one of the important pelagic fishery resources as it is constituted by a wide variety of species and being exploited by different gears like trawl net, gill net, hook and line, Boat seine and shore seine along the Indian coast (Kasim and Hamza, 1994). The yellow tail scad *Atule mate* is a small pelagic carangid fish resource distributed in coastal waters throughout the tropical regions of the globe (Clark 1996), and it is a smaller schooling fish having greater importance in both artisanal and mechanised fishery in the Indian coast (Joshi et al., 2011).

The length-weight relationship of fish is important for fish stock assessment modelling and the relative condition of the fish (Lai and Helser, 2004). Length weight relationships are essential because they are used in estimating biomass from length observation, fish condition and distribution comparisons of life histories of a particular species (Moutopoulos and Stergiou, 2002). Length-weight regression helps predict the weight of fish from its length when direct weight measurements are convenient from the field. The condition factor of fish gives information on the physiological state in relation to its welfare. It is based on the hypothesis that heavyweight fishes of a given length are in a healthier condition. The condition factor is influenced by sex, age of fish, season and maturity stages (Ayo-Olalusi 2014). Condition factor is an organism level response to factors such as nutritional status and serves as an indicator of a fish's well-being. The reduction in condition factor is considered as a depletion of energy reserves. The condition factor of fish reflects the feeding condition and reproductive status of a population (Khajuria and Langer 2014). The studies on carangids from the Andaman coast are inadequate compared to India's east and west coast. This study aims to provide information on length weight relationship and its significance of variation and condition factor of *Atule mate* from Andaman waters, India.

2. Materials and Methods

A total of 702 specimens were collected bimonthly for a year from January 2019 to December 2019. The specimens were brought to the laboratory and dissected. The total length was measured from the tip of the snout to the end of the caudal fin ray to the nearest mm using a measuring scale, and the weight of the fish was estimated to the nearest gram by using a weighing balance. The data were grouped into four sets of samples male, female, juvenile and pooled.

The length weight relationship (LWR) was calculated by using Le Cren's (1951) formula

$$W = a L^b$$

Where 'W' is the weight of the fish in grams (g), L is the total length of the fish in centimetres (cm), 'a' is a constant and 'b' is the exponent of growth. A linear relationship formula can be acquired by expressing a logarithmic function

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Where 'W' is weight of the fish in grams (g), 'L' is the length in mm. 'Log a' is the intercept of the regression line and 'b' is the slope of the regression line.

The relative condition factor Kn, is a measure of the well-being or plumpness of a fish was determined using length weight data of fish samples and is calculated by Le Cren (1951) formula:

$$Kn = W / a L^b$$

Where 'W' is the observed weight and 'a L^b' is the calculated

weight

The significance of difference in the estimate of 'b' in males, and females. Juveniles and pooled data from the expected value of 3 were tested by Bailey's t – test (Snedecor and Cochran, 1967)

$$t = \frac{b - 3}{sb}$$

3. Results and Discussion

A total of 702 fishes were analysed for length weight relationship, out of which 219 were males, 216 were female and 267 were immature. The total length and weight of *Atule mate* varied from 102mm to 260mm and 12g to 197.5g. In the case of males, the size and weight range varies from 167mm to 251mm and 48.78g to 197.5g; in the case of females, the length range is between 149mm to 260mm and weight varies between 35.09g to 185g and for immature size varies from 102mm to 236mm and weight varies from 12g to 140g. Linear length regression equation between total length and weight of pooled, male, female and immature plotted.

Pooled: Log W= -53472+3.1704 Log L (R^2= 0.9812)

Immature: Log W=-5.2184+3.1077 Log L (R^2= 0.9761)

Male: Log W=-1.93+2.9897 Log L (R^2=0.9377)

Female: Log W=-1.9289+2.9838 LogL (R^2=0.946)

The b value of length-weight relationship ranged between 2.98 and 3.17. It was found that b value of immature was higher. The correlation coefficient obtained for *A. mate* are total population (r=0.969), immature (r= 0.965), male (r=0.963) and female (r=0.9675). A strong positive correlation exists between the variables length and weight; weight increases according to the increase in the length.

The growth is considered as isometric when b=3; this is always the case in an ideal fish that retains its shape without any change (Vivekanadan and James 1984, Sajana and Nandan 2017). When a species exhibits isometric growth, b value will be close to 3. The weight of the fish will increase eight times when there is a double increase in the length of the fish i.e., the length and weight follow cubic relationship. A difference in b value 3 indicates the direction and rate of change of condition or form; b < 3 shows a reduction in condition or elongation of the fish with an increase in length; hence it is negatively allometric in nature. Whereas b > 3 indicates an increase in length or condition, positively allometric in nature. Greater the difference from 3 shows greater the variation in condition or form. The value of b usually tends to be vary between 2.5 and 3.5 (Froese, 2006).

In the present study, the estimated b values of *Atule mate* were 3.17 (pooled) and 3.10 (immature), indicating positive allometric growth in which the fish body weight grows faster in relation to their length. The b value for male and female was 2.98 and it is close to the expected value of the regression coefficient for isometric growth, i.e., b=3; hence, the species exhibits an isometric growth pattern. Bailey's t-test showed that the b value for both male and female fishes did not deviate significantly from the ideal value b=3. However, significant variation from the ideal value was reported for immature and pooled data sets. Similar observations were made by (Reuben et al. 1992) from Kerala coast for *Atule mate* and from Marudu Bay, Malaysia with b value of 3.14 and Bhaskar (2020) from Chennai coast. Dhanya et al. (2004) reported that *C.dussumieri* collected from Mumbai waters shows a lower b value for matured fishes and described that fish grow quickly in terms of length before attaining maturity; therefore, energy is side-tracked for the growth of gonadal tissues instead of somatic tissues. Hence, the growth of matured fishes is slower than that of immature fishes. From the present study, it can be concluded that in *Atule mate* the length increases in equivalent proportions to body weight and the growth of fishes reduces when they attain maturity.

Relative condition factor was introduced by Le Cren (1951), Kn measures the individual deviation of the fish from the average weight for the length. It represents the health of a fish during a particular period of time. The condition factor of *Atule mate* varied between 0.66 and 1.32 for pooled data with average value 1.00; in the case of male 0.81 to 1.26
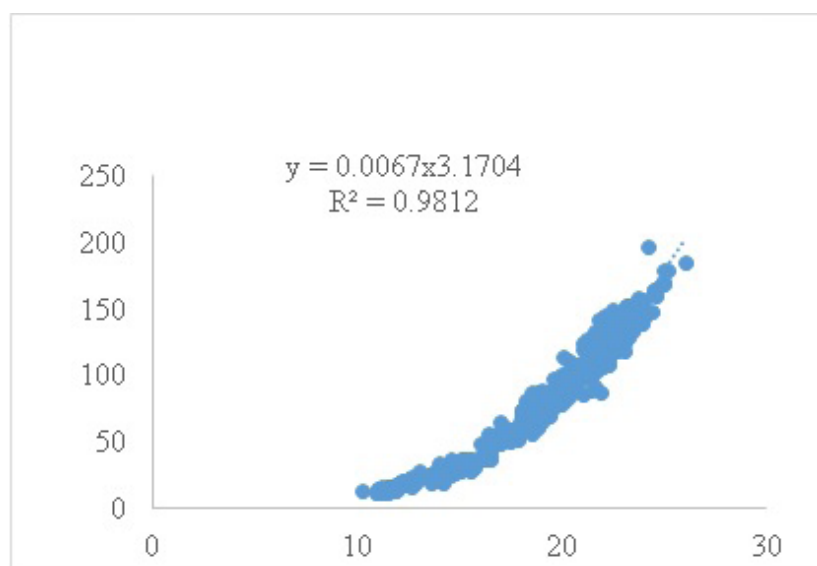

$y = 0.0067x^{3.1704}$
$R^2 = 0.9812$

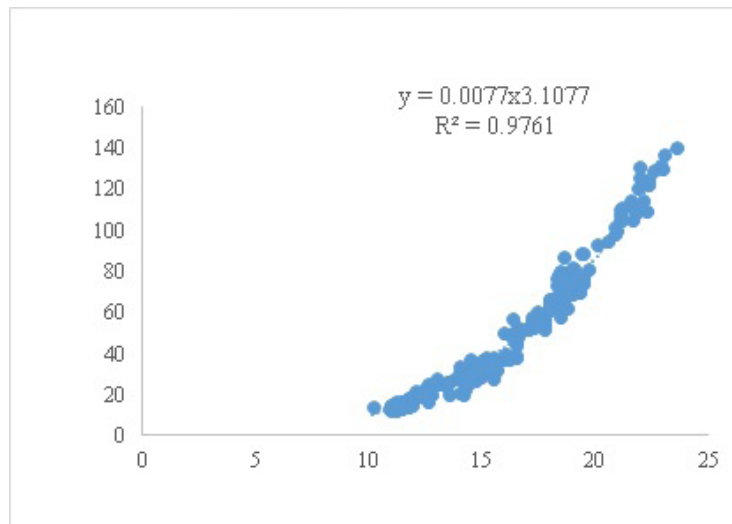**Fig. 1.** Length weight relationship of *Atule mate* for pooled

Fig. 2. Length weight relationship of Atule mate for immature
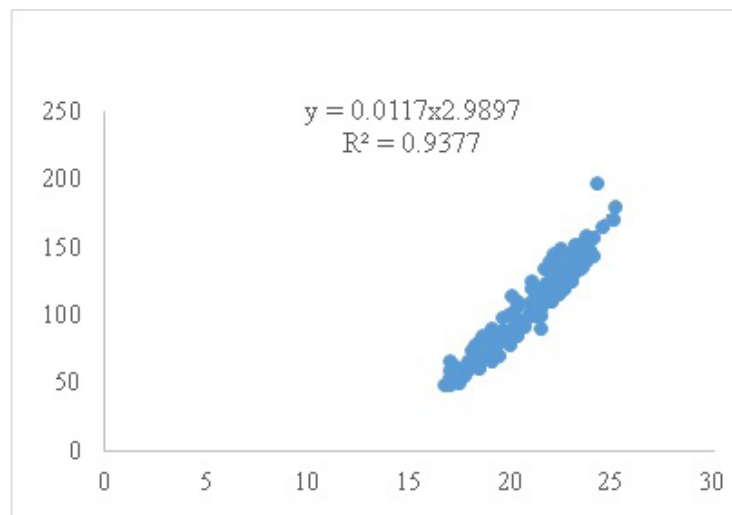

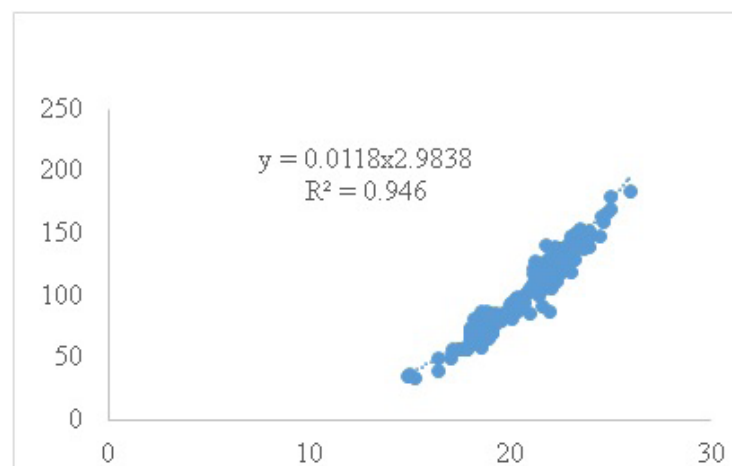**Fig. 3.** Length weight relationship of male *Atule mate*

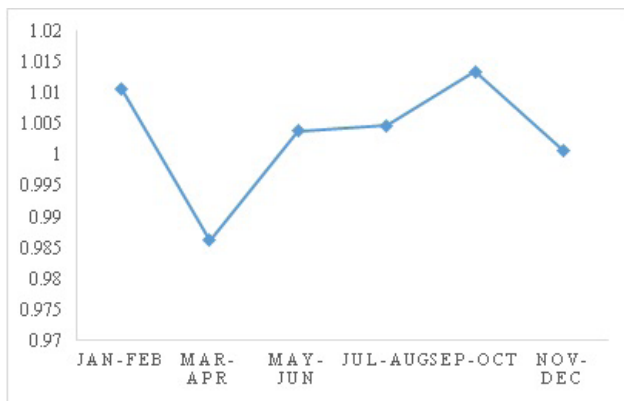**Fig. 4.** Length weight relationship of female *Atule mate*

Fig. 5. Condition factor of *Atule mate* - Bimonthly

with an average value of 1.01, for females, 0.75 to 1.23 with an average value of 1.00 and for immature 0.65 to 1.33 with average value 1.00. The bimonthly average data of Kn has given in the figure; during the study not much fluctuations were reported in different months. The least condition factor was recorded in the month of March-April, and it may be due to the spawning of the fish. Similar observations were reported by Sajana and Nandan (2017) for *Alepes djedaba* from the Cochin coast. Kalita and Jayabalan (1997) of *Caranx kalla* from the Mangalore coast reported a rise in Kn value in September and a decline in April, which shows similar results to the present study. Dadzie et al. (2008) also reported similar findings for *Parastromatus niger* from Kuwait waters. The fluctuation recorded in the condition factor during the present study may be associated with fluctuation in food items in the surrounding environment and spawning of the species.

Acknowledgements

4. References

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