



### Short Communication

#### The biology of a newly discovered sardine: Length-weight relationship and condition factor of *Amblygaster indiana* Mary, Balasubramanian, Selvaraju & Shiny, 2017 from the South-west coast of India

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Length-weight relationship (LWR) was estimated for *Amblygaster indiana* from Eraviputhenthurai, south-west coast of India. The fish samples were collected from March 2018 to February 2019 from the fish landing centres and fish markets of Eraviputhenthurai, Kanyakumari district of Tamil Nadu. Altogether, 82 specimens were collected from gill nets and shore seines during the period. The value of parameter  $b$  in the equation of LWR was estimated to be 3.36 and provides the first estimate of LWR for *A. indiana*. The value of the condition factor  $K$  (1.15) and relative condition factor  $K_n$  (1.003) in the present study indicates that the fish is in good condition in terms of health, growth, physical, and biological environmental conditions and there seems to be no adverse factor for *A. indiana* in its current habitat. The current study is also one of the first documented reports on the biological aspects of *A. indiana* and will be helpful for future research, conservation and sustainable management of the species.

[**Keywords:** Allometric growth, *Amblygaster indiana*, Condition factor, Growth parameter, Length-weight relationship]

#### Introduction

Length-weight measurement is an important parameter in fishery biology studies, to estimate the well-being of the individual fish<sup>1</sup>. It also helps to compare the growth conditions of different stocks and diverse populations of the species based on morphometry<sup>2-5</sup>. Length-weight relationship (LWR) is a useful parameter in the assessment of fisheries' sustainability, as well as for predicting weight from the more easily measurable parameter, length. LWR is also necessary for yield assessment, age at maturity,

stock composition and standing stock biomass calculation for the effective management of fishery resources<sup>6-13</sup>. To assess the soundness of the fish in its habitat, two parameters, the condition factor ( $K$ ) and the relative condition factor ( $K_n$ ) are frequently employed<sup>14</sup>. The ponderal index or condition factor ( $K$ ) is used to assess the 'condition' or 'well-being' of the fish population which is based on the assumption that the growth of fish in ideal conditions maintains equilibrium in length and weight<sup>15-18</sup>.  $K$  measures the deviation of measured weight/length ratio from an ideal fish, whereas  $K_n$  describes the deviation of measured weight from the expected average weight for the given length. These factors depend on food availability, gears used, seasons, environmental conditions, degree of parasite infestation, length, physiological conditions and developmental stages of the individuals<sup>18</sup>.

Three species of the genus *Amblygaster* (*A. clupeioides*, *A. leiogaster* and *A. sirm*) have been previously reported from the Indian waters. A new species, *A. indiana* was described by Mary *et al.*<sup>19</sup>. *A. indiana* is found mainly along the south-west coast of India, forming a small-scale clupeoid fishery in the coastal region. There are no reports in the published literature attributed to this species regarding the biology including LWR<sup>20</sup>. Thus, baseline information was generated on the LWR of this recently discovered species to understand its biology and population dynamics. The study also provides the condition factor of *A. indiana* from the south-west coast of India.

#### Materials and Methods

Fish specimens were collected from the fish landing centres and fish markets of Eraviputhanthurai (latitude and longitude of fishing ground (8°15' N, 76°55' E) were obtained from the fishermen) from March 2018 to February 2019 on monthly basis (Fig. 1). *A. indiana* is a small-sized fish forming medium to very large shoals in the nearshore waters within a distance of 25 – 30 km and up to 40 m depth. It is mostly captured by using gill nets (mesh size 18 – 30 mm) and shore seines. Although samples were taken sometimes from gill net returns, given their selective nature, and to have uniformity, mainly the shore seine data were utilized for the present

analyses. Specimens chosen for the study were randomly selected and ranged from 20.9 to 25.72 cm. Specimens were identified based on the original description given by Mary *et al.*<sup>19</sup>. The total length (TL) was measured from the tip of the snout to the tip of the caudal fin using a digital Vernier caliper with 0.1 cm accuracy. The total wet body weight (W) was measured by an electronic weighing balance with 0.1 g accuracy.

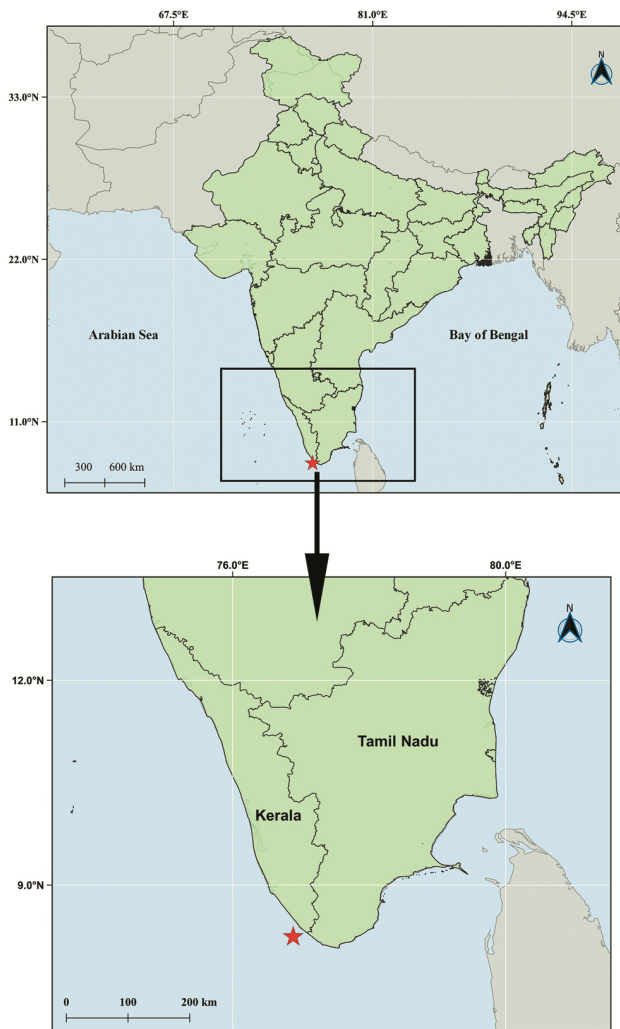


Fig. 1 — Map showing the study area

The length-weight relationship (LWR) was calculated using the formula given by Le Cren<sup>14</sup>.

$$W = a L^b$$

Where, W = body weight (g), L = total length (cm); 'a' is the intercept, 'b' is the slope of the relationship.

The same can be written in the logarithmic form as

$$\ln W = \ln a + b \ln L$$

The growth parameters *a* and *b* were estimated using the least square regression method and the coefficient of determination ( $r^2$ ) was analyzed for testing the robustness of the sample. The condition factor, which shows the degree of the well-being of the fish in their habitat was determined by Fulton's condition factor (*K*) using the equation,  $K = 100W/L^b$ , whereby *K* = condition factor; W = weight of fish (g); L = total length of the fish (cm); *b* = value obtained from the length-weight equation. The relative condition factor ( $K_n$ ) was estimated by using the equation  $K_n = W_o/W_c$ , where  $K_n$  = relative condition factor,  $W_o$  = observed weight and  $W_c$  = calculated weight. The significance of the regression was assessed by ANOVA, and the *b*-value was tested by Student's t-test to verify that it was significantly different from the predictions for isometric growth ( $b = 3$ ).

## Results

The body weight and total length ranged from 82 g to 194 g and 20.9 cm to 25.72 cm, respectively (Table 1, Fig. 2). Analysis of covariance revealed that the regression coefficient *b* was highly significant. The regression slopes or growth coefficients, *b*, were estimated to be 3.36. The results of the t-test showed that the growth exponent, *b* was significantly different ( $p > 0.05$ ) from the expected value of 3.0 (Table 1). The value of the condition factor, *K* and relative condition factor,  $K_n$  estimated in the present study was found to be 1.15 and 1.003, respectively.

Table 1 — Descriptive statistics and length-weight relationship parameters and condition factor for *Amblygaster indiana* from Kanyakumari waters, south coast of India

| Species                    | N  | Total length (cm) |           | Total weight (g) |              | LWR parameters         |                    |       |           |            |
|----------------------------|----|-------------------|-----------|------------------|--------------|------------------------|--------------------|-------|-----------|------------|
|                            |    | Min-Max           | Mean±SD   | Min-Max          | Mean±SD      | <i>a</i> (95 % CL)     | <i>b</i> (95 % CL) | $r^2$ | <i>K</i>  | $K_n$      |
| <i>Amblygaster indiana</i> | 82 | 20.9-25.72        | 23.89±0.9 | 82-194           | 158.76±21.04 | -2.43 (-3.05 to -1.82) | 3.36 (2.91 to 3.8) | 0.73  | 1.15±0.08 | 1.003±0.07 |

N = Number of individuals, *K* = Mean Fulton's Condition Factor,  $K_n$  = Mean Relative Condition Factor, *a* = Regression constant, *b* = coefficient,  $r^2$  = Correlation coefficient

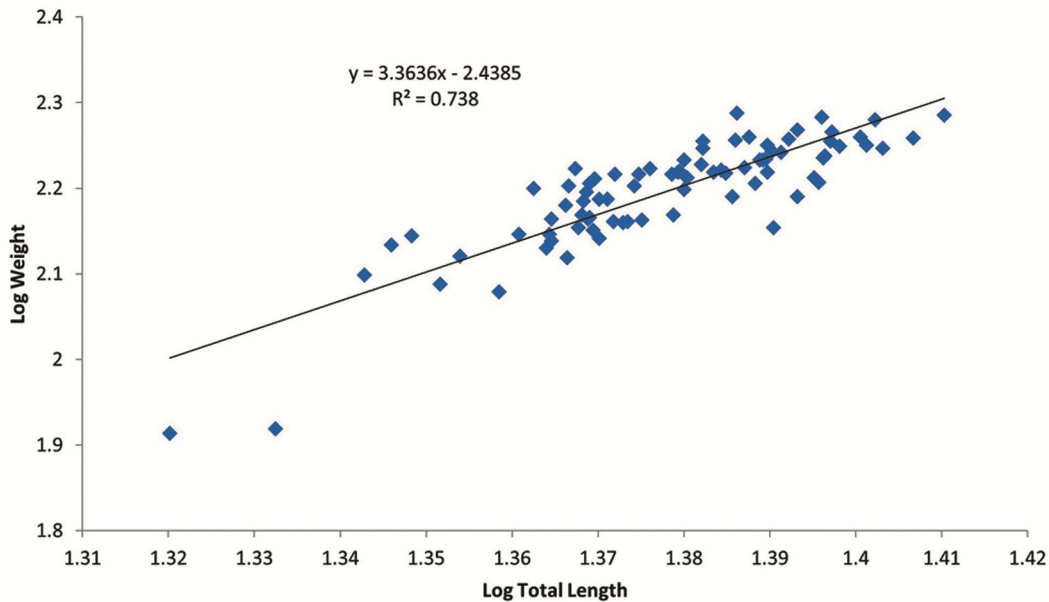


Fig. 2 — Length-weight relationship of *Amblygaster indiana*

## Discussion

The length-weight relationship helps in estimating growth rates, length and age structures and exploitation of populations<sup>21</sup>. In the present study, the value of LWR parameter  $b$  (3.36) showed allometric growth for *A. indiana*. Various factors such as the number of specimens examined, degree of fullness of stomach of individual fishes, sex, stage of gonadal maturity, type of habitat, ontogenetic development and differences in length ranges of specimens observed, may cause variations in the  $b$  value of fishes<sup>7</sup>. The LWRs of the close congener, *A. sirm* have been estimated from Sri Lankan waters<sup>22</sup>, Gulf of Mannar<sup>23</sup> and Andaman waters<sup>24</sup>. These three LWR studies have reported positive allometric growth for *A. sirm* as evident from the estimated value of growth coefficients, i.e. ( $b = 3.438$  for males;  $b = 3.386$  for females) for waters of Sri Lanka, ( $b = 3.207$ ), Gulf of Mannar and Andaman ( $b = 3.216$ ). Thus, the value of growth coefficient ( $b = 3.36$ ) for *A. indiana* is close to the highest value of growth coefficient among these three habitats studied for *A. sirm*. It implies that the habitat of *A. indiana* near the Kanyakumari district of Tamil Nadu appears to be one of the best habitats. The value of growth coefficient  $b$  is indirectly correlated to the condition factor of the fish, which in turn depends on the reproductive cycle and age of the species<sup>22,25,26</sup>. The value of the condition factor  $K$  (1.15) and relative condition factor  $K_n$  (1.003), reveals the good condition of the fish in terms of its

health, physical and biological environmental conditions, feeding intensity, food reserve, growth and reproductive cycle<sup>14</sup>. The relative condition factor is affected by the development of gonad and feeding intensity<sup>27</sup>.

Thus, the results of LWRs and condition factor obtained in the study reveals that the growth pattern for the species is quite satisfactory in the particular environment in which the fish dwells.

## Conclusions

It is one of the first documented reports on the biological aspects of *A. indiana*. The value of LWR parameter  $b$  displayed allometric growth for *A. indiana*. The value of the condition factor and relative condition factor revealed the good condition of the fish in terms of the health, physical and biological environmental conditions, feeding intensity, food reserve, growth and reproductive cycle. The study would act as baseline information for the biological and population studies of the species. It would also serve as a reference for future research, conservation and sustainable management of the species in the Indian waters.

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### Conflict of Interest

All authors declare that there is no conflict of interest regarding this study.

### Author Contributions

TJ carried out sample collection, taxonomic identification, measurement of length and weight. MS analyzed data, AAK carried out sample collection and taxonomic identification. TTAK carried out work design and sample collection, AM involved in manuscript writing, MS assisted in data analysis and work design, and KKL designed work and overall guidance.

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