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Title: Age and Growth Based on the Scale Readings of the Two Carangid Species *Carangoides bajad* and *Caranx melampygus* from Shalateen Fishing Area, Red Sea, Egypt.

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Introduction

The determination of age and growth is of great importance to both fisheries biology and management as it provides some information pertaining to the growth rate. In addition, it forms the basic knowledge required for the estimation of mortality, recruitment and yield. Also, these parameters constitute the basic information needed for the construction of a management strategy for any exploited stock (Mehanna, 1996).

The family *Carangidae* comprises four subfamilies with 32 genera and 148 species in the world oceans (Al-Marzouqi *et al*., 2013 and Mehanna *et al*., 2013). In the Egyptian sector of the Red Sea, Shalateen fishing area, at least 10 Carangid species were recorded from which *Carangoides bajad* and *Caranx melampygus* are the most common. *C. bajad* and *C. melampygus* represent an important component of local artisanal catch.

The present work will provide the age and growth information of both carangid species for the first time from Shalateen fishing area, Red Sea, Egypt as the basic parameters needed for their management.

Materials and Methods

Study area:

Shalateen fishing port, in the southern Red Sea lies at 520 Km south of Hurghada, Egypt (Fig. 1). The fishing landing site location latitude (N: 23° 09' 07.31") and longitude (E: 35° 36' 51.14"). Shalateen port is considered as one of the productive fishing grounds along the Egyptian coasts of Red Sea.

Collection of samples:

A total of 1103 specimens (145–515 mm in SL) of *Carangoides bajad* and 796 specimens (145–631 mm in SL) of *Caranx melampygus* were randomly collected monthly from the commercial landings at Shalateen fishing port in the city of Shalateen during the period from November 2013 to October 2014.

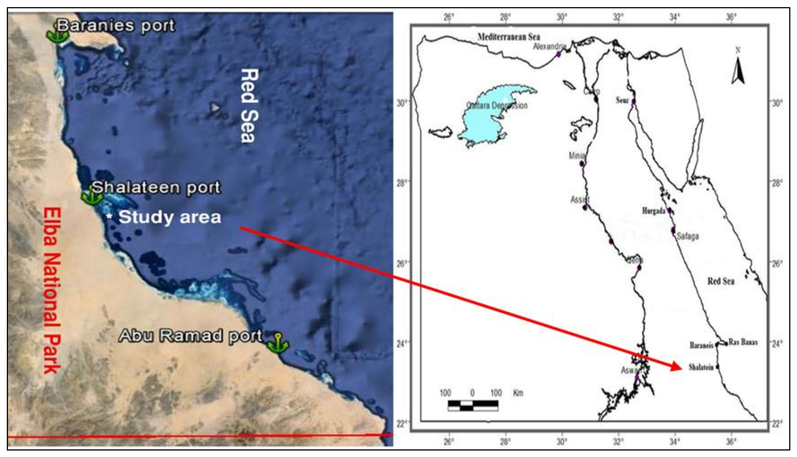

Figure 1: Egyptian Red Sea map showing the study area

Age determination:

Scales were taken from the area below the lateral line at a level behind the pectoral fin on the left side of the fish. The relationship between the scale radius (R) and the standard length (SL) was studied to estimate the necessary correction factor for back calculation. On the bases of scatter diagrams, such a relationship is represented by the following equation:

$$SL = a + b\,R$$

The calculated growth in length was determined by the calculation of length at the end of each year of life using the following formula (Lee, 1920): $SL_n = a + (R_n / R)(SL - a)$

Length-weight relationship:

The length–weight relationships of *C. bajad* and *C. melampygus* considered through the whole period of investigation were described by the power function equation:

$W = a\,SL^b$ (Hile, 1936 and Le Cren, 1951)

Or it's logarithmic form: $\log W = \log a + b * \log SL$

Growth parameters:

The von Bertalanffy growth model was applied to describe the theoretical growth of *C. bajad* and *C. melampygus.* The constants of the von Bertalanffy model ($L\infty$ and K) were estimated by using the methods of Ford (1933)-Welford (1946) plot as the follows: $L_t+1 = L_\infty (1- e^{-k}) + e^{-k} L_t$

Growth Performance Index (Ø'):

Growth performance index was computed to compare the von Bertalanffy growth of carangid fish with other fish species according formula of Pauly and Munro (1984) as follow:

$Ø' = \log_{10} K + 2 \log_{10} L_\infty$

Results & Discussion

Age composition:

From the direct examination of the scales of the two species under investigation; *C. bajad* and *C. melampygus*, it was found that they are a reliable tool for age determination of these species (Fig. 2). Based on the number of annuli on the scales, the oldest individuals were 8 and 12 years old for *C. bajad* and *C. melampygus* respectively.

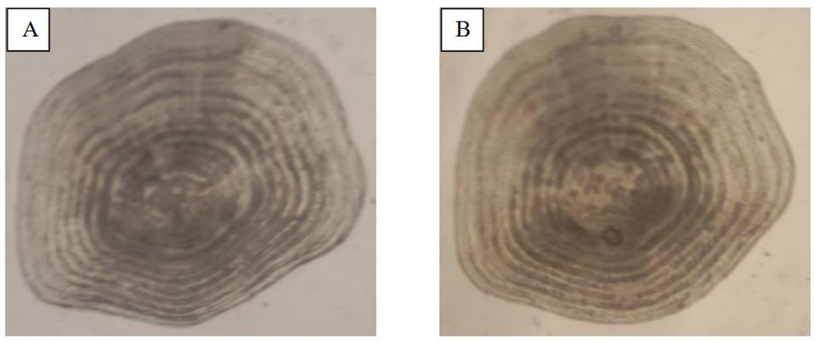

Fig. 2: Shape of scales for the two Carangid species as an age determination tool. **(A):** Shape of scale of *Carangoides bajad* (SL= 465 mm; Age 6 years). **(B):** Shape of scale of *Caranx melampygus* (SL= 490 mm; Age 6 years).

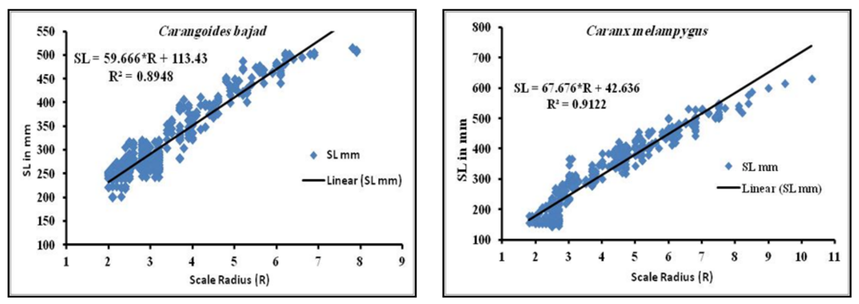

Fig. 3: Standard length (SL)–scale radius relationships of *Carangoides bajad* and *Caranx melampygus*, from the southern Red Sea of Egypt.

The growth study of the present work revealed that the two Carangid species attained their highest growth rate in length (annual increment) during the first year of life, then this increment sharply decreased by the end of the second year (Fig. 4 & Fig. 5).

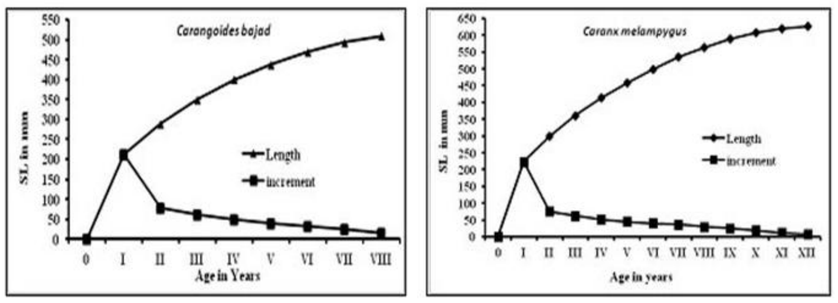

Fig. 4: Growth in standard length (SL in mm) and annual increment of *Carangoides bajad* and *Caranx melampygus*, from the southern Red Sea of Egypt.

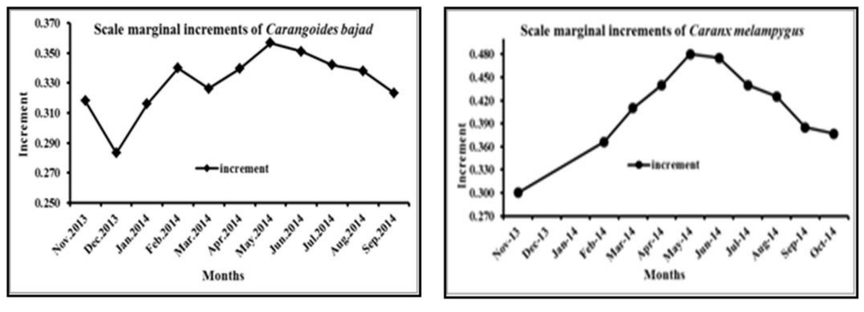

Fig. 5: Monthly average of scale marginal increments of *Carangoides bajad* and *Caranx melampygus*, from the southern Red Sea of Egypt.

Time of annulus formation

Figure 4 shows the mean values of the monthly increments of distance between the last annulus and the scale margin for the age group (II) of *C. bajad* and age group (III) of *C. melampygus* through the period of investigation. The minimal increment occurred in December for *C. bajad* and November for *C. melampygus*; whereas the maximal increments were in June for *C. bajad* and May for *C. melampygus*. This means that the time of annulus formation on the scales takes place in December for *C. bajad* and in November for *C. melampygus*.

Length-weight relationship:

The length-weight relationship is considered as an essential tool in the studies of fish stock assessment and management of fisheries resources (Rodriguez-Romero *et al*., 2009). The length and weight measurements of 1103 and 796 specimen of *C. bajad* and *C. melampygus* were used to estimate the length-weight relationships. The length-weight relationships of the two Carangid species are best described by the following power equations (Fig. 6):

Carangoides bajad: $W = 0.00005 * SL^{2.8827}$ $R^2 = 0.98$ SL in mm

Caranx melampygus: $W = 0.00004 * SL^{2.9333}$ $R^2 = 0.99$ SL in mm

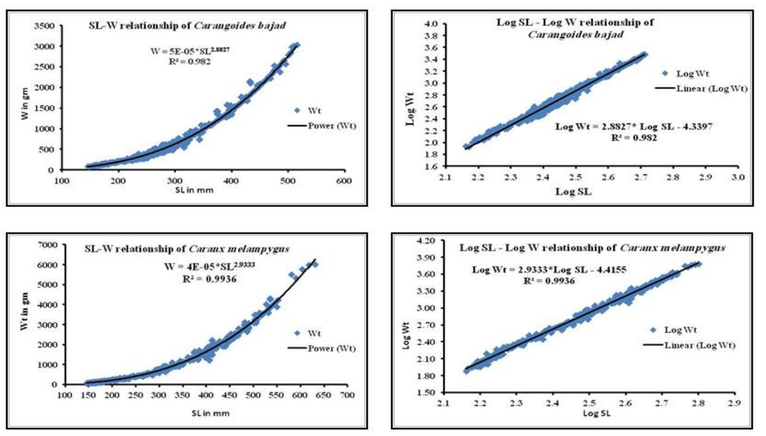

Fig. 6: Standard length (SL)–weight relationship and its logarithmic form for *Carangoides bajad* and *Caranx melampygus* from the southern Red Sea of Egypt.

It is obvious that the growth in weight for both species is isometric i.e. b is not statistically significant differ from 3 (b= 2.883; CI = 2.860-2.9057 for *C. bajad*) and (b= 2.933; CI = 2.9168-2.9496 for *C. melampygus*). Based on the L-Wt relationship, the back calculated lengths were transformed to weights (Fig. 7). The growth rate in weight exhibited its higher values in age groups IV for *C. bajad* and VII for *C. melampygus*.

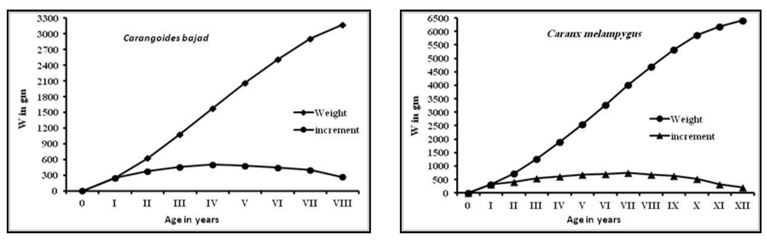

Fig. 7: Growth in weight (W in g) and annual increment of *Carangoides bajad* and *Caranx melampygus*, considered from the southern Red Sea of Egypt.

Growth parameters:

The growth parameters "$L\infty$, K, $W\infty$ and t_0" for *Carangoides bajad* and *Caranx melampygus* were given in table 1. The only study dealing with the growth parameters of those species is those of Smith and Parrish (2002) from Hawaii and Grandcourt *et al*. (2004) from the Southern Arabian Gulf Abu Dhabi, United Arab of Emirates. In Hawaii, $L\infty$ = 97.3 cm; K = 0.19 year^{-1}; t_0 = -0.20 years for *C. melampygus*, while in Abu Dhabi, $L\infty$ = 40.38 cm; K = 0.598 year^{-1}; t_0 = -0.35 years for *C. bajad*.

Species	$L\infty$	K	$W\infty$	t_0
C. bajad	576.88	0.24	4553.56	-0.86
C. melampygus	701.08	0.17	8903.28	-1.013

Table 1: Growth parameters for *Carangoides bajad* and *Caranx melampygus*, from Shalateen fishing area, Red Sea, Egypt.

Accordingly, the estimated von Bertalanffy growth equations in both length and weight were as follows:

Carangoides bajad

For growth in length $L_t = 576.88\ (1 - e^{-0.24\ (t\ +0.86)})$

For growth in weight $W_t = 4553.56\ (1 - e^{-0.24\ (t\ +0.86)})^{2.8827}$

Caranx melampygus

For growth in length $Lt = 701.08\ (1 - e^{-0.17\ (t\ +1.013)})$

For growth in weight $Wt = 8903.28\ (1 - e^{-0.17\ (t\ +1.013)})^{2.9333}$

Growth performance index:

The values obtained for the computed growth performance index (Ø') for the two Carangid species under investigation were 2.91 and 2.93 for *Carangoides bajad* and *Caranx melampygus*, respectively.

Recommendations

This study should be completed to assess the fishery status of both species and propose a future plan for their management and how to conserve and exploit them rationally.

Contact Information

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