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LENGTH-WEIGHT RELATIONSHIP AND GROWTH OF THE STRIPED SEABREAM *LITHOGNATHUS MORMYRUS* (LINNAEUS, 1758) FROM AL HANEAH FISH LANDING SITE, MEDITERRANEAN SEA, EASTERN LIBYA

Ramadan A. S. Ali[1], Eyman Faraj Abd Alssalam[1], Sayed Mohamed Ali[1*], Mohammad El Sayed El Sayed El Mor[1,2] and Mohammed El-Mabrouk[1]

[1]Department of Zoology, Omar Al-Mukhtar University, Al Bayda, Libya
[2]Suez Canal University, Department of Marine Biology, Egypt

ABSTRACT: *Length-weight relationship and growth characteristics of the striped Seabream Lithognathus mormyrus (Linnaeus, 1758) was established using 164 fish collected from Al-Haneah (eastern Libya, Mediterranean Sea) artisanal catch during March to October 2015. The power relationship between total weight (W in gm) and total length (L in cm) for L. mormyrus was highly isometric: $W = {}_{0.0132}L^{\wedge 3.0008}$ (R2 = 0.8291). The length based von Bertalanffy equation of the order: $L_t = L\infty\ (1 - exp\ (-K\ (t - t_0\ )))$ was Lt = 30.465 (1 – exp (- 0.159 (t + 2.5435))). The weight based equation was W_t = 374.2523 (1 – exp (- 0.159 (t + 2.5435))) $^{3.0008}$. The growth index was low: ϕ = 2.169.*

KEYWORDS: Striped Seabream, Sand Steenbras, *Lithognathus Mormyrus,* Length-Weight Relationship, Von Bertalanffy Growth Equation, Mediterranean Sea, Libya

INTRODUCTION

L. mormyrus, Family: Sparidae, is a medium size fish demersal on sandy bottoms of subtropical littoral waters of the eastern Atlantic Ocean, the Mediterranean sea, the Red sea and the southwestern Indian Ocean. It feeds on worms, mollusks, small crustaceans and detritus. It is protandrous hermaphrodite and breeds in summer (Russell *et. al.,* 2014).

In Libya the fish is present along the whole coast and is common in the artisanal catch (Khamis, 2008).

The objective of the present work was to establish length- weight relationship and growth characteristics of this fish based on specimens obtained from Al-Haneah, eastern Libya Mediterranean Sea.

Procedure

One hundred sixty four *L. mormyrus* fish were collected from Al-Haneah ($32^0\ 50^1$ N, $21^0\ 31^1$ E) artisanal catch during March to October 2015. Total lengths and corresponding total weights were obtained in mm and 0.0 gm for each fish. About 10 scales were removed from the pectoral region of 82 fish chosen randomly, cleaned thoroughly with running water and 20% H_2O_2 and mounted on glass slides. The annuli were counted under the microscope.

The length-weight relationship was derived from Ricker, 1975, equation: $W = aL^b$

W: total fish weight (g), L: total fish length (cm),

"a": the intercept, and "b": the slope

The von Bertalanffy parameters (K) and (L∞) were estimated according to Ford-Walford (Sparre and Venema, 1992) and (t_0) according to von Bertalanffy,1934.

RESULTS

The length – weight relationship

The power relationship between total weight (W in gm) and total length (L in cm) for *L. mormyrus* was highly isometric (Figure 1):

$W = {}_{0.0132}L^{\wedge 3.000}$ $R^2 = 0.8291$ n= 164

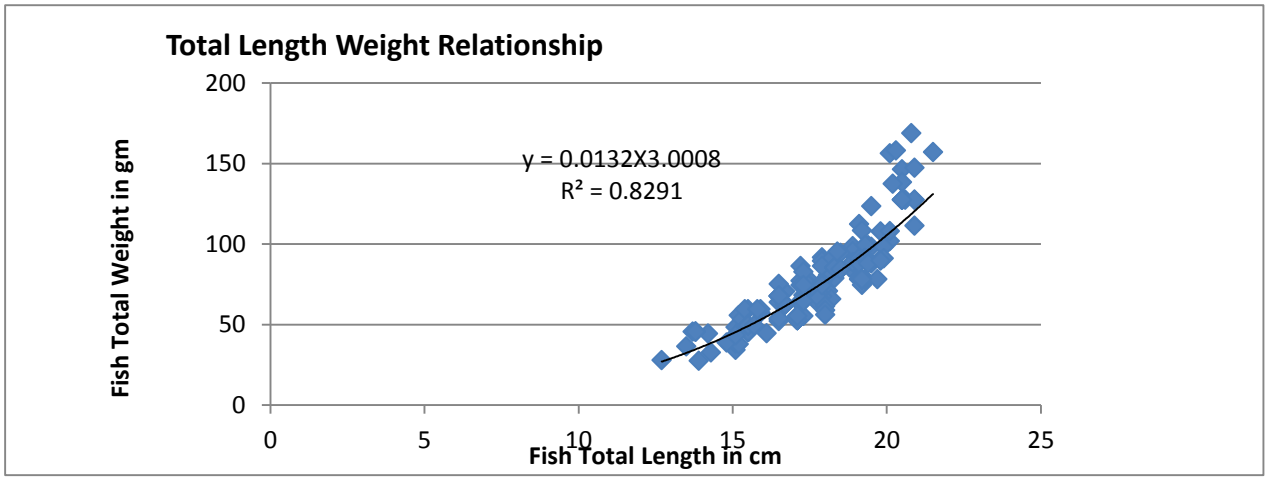


Figure 1. The relationship between length and weight derived from 164 *L. mormyrus* collected from Al-Haneah coast during March to October 2015.

Comparison between actual and calculated weight-at-length derived from the above equation is shown in figure 2. The fit between the actual and the calculated was good.

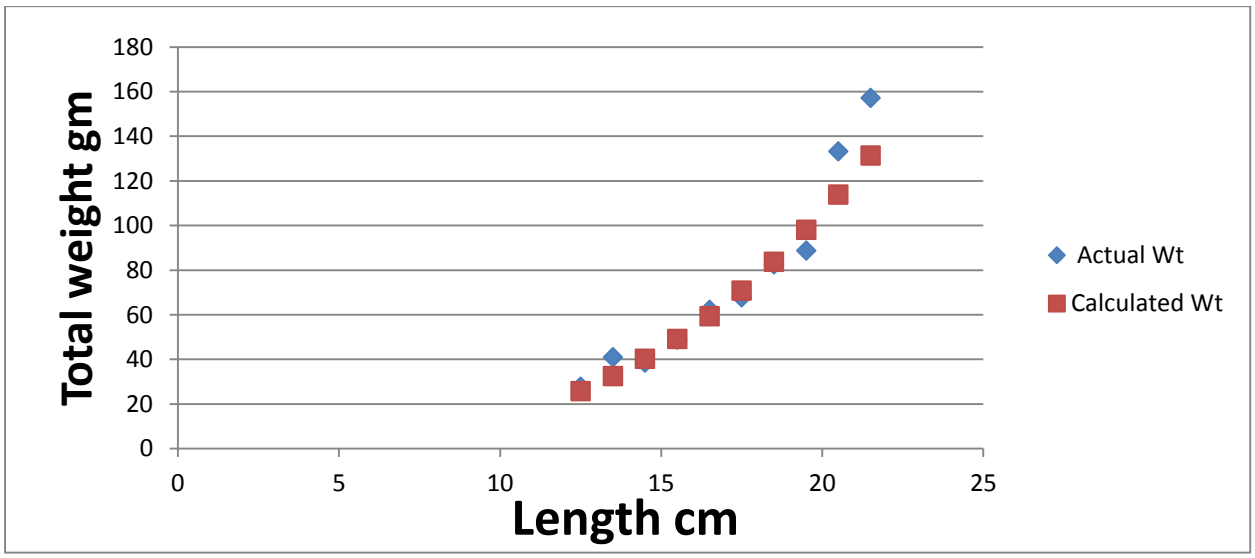


Figure 2. Comparison between actual and calculated weight-at-length derived from the above equation.

The growth: Estimation of the von Bertalanffy parameters

i- Aging

Length (L_t) at age (t) derived from reading the annuli is shown in table 1.

ii- Estimation of (K) and (L_∞):

(K) and (L_∞) were estimated according to Ford-Walford (Sparre and Venema, 1992). A table (table 1) of age, length of fish at age t (Lt) and length of fish at next age $L_{(t+\Delta t)}$ was prepared. Then the plot of (L_t) vs. $L_{(t+\Delta t)}$ was made to calculate (K) and (L_∞), (figure 3).

Table (1) . Age in years, Length of fish at age (L_t) and Length of fish at next age $L_{(t+\Delta t)}$.

t (years)	L_t (cm) (x)	$L_{(t+\Delta t)}$ (cm) (y)
1	12.833	15.5
2	15.5	17.776
3	17.776	19.077
4	19.077	21.167
5	21.167	

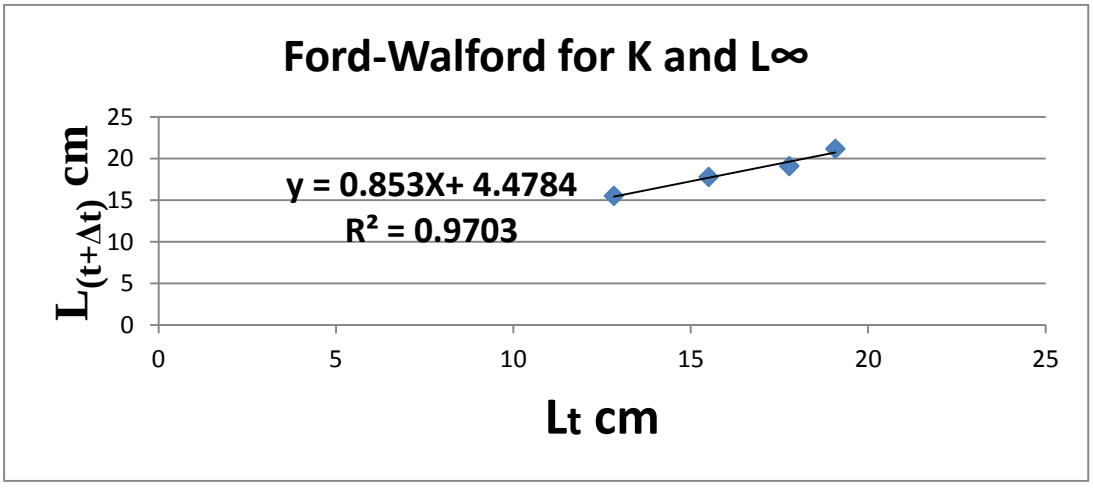


Figure (3). Estimation of (K) and (L∞) according to Ford-walford (Sparre and Venema, 1992). The plot of L_t vs. $L_{(t+\Delta t)}$ for *L. mormyrus*.

$y = 0.853X + 4.4784$ $R^2 = 0.9703$

$K = - (1/\Delta t) \text{ Ln } (b) = - (1/1) \text{ Ln } (0.853) = 0.159 \text{ year}^{-1}$

L_∞ = a / (1-b) = 4.4784 / (1- 0.853) = 30.465 cm

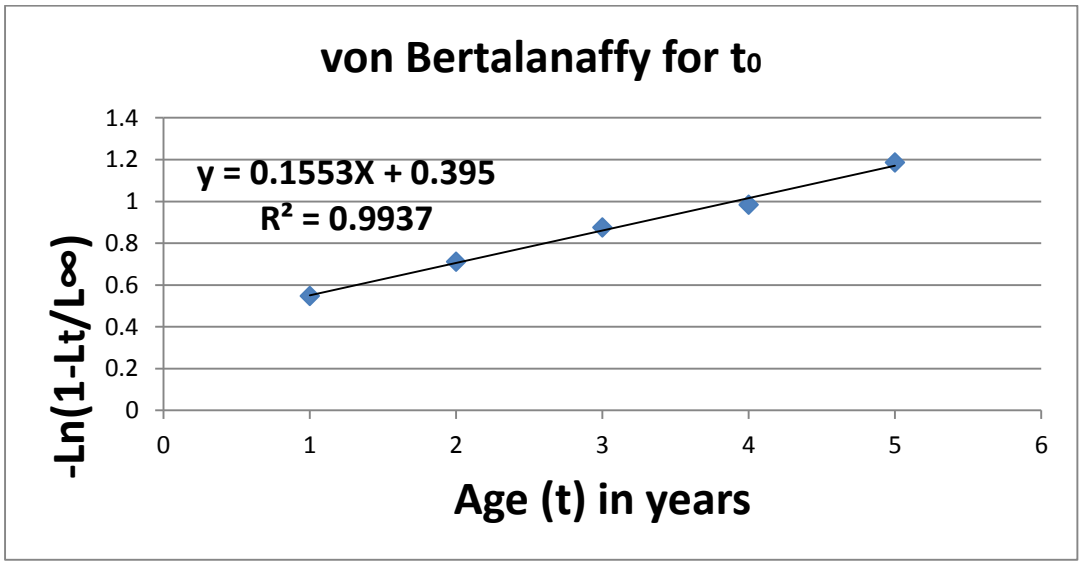
iii- Estimation of (t_0)

The von Bertalanffy parameter (t_0) was estimated according to von Bertalanffy, 1934. A table of age (t), L_t and – Ln (1 – L_t/L_∞) was prepared (table 2). Then a plot of (t) vs. – Ln (1 – L_t/L_∞) was made to obtain t_0 (Figure 5).

Table (2) . Estimation of t_0 according to von Bertalanffy, 1934.

Age (t) (X)	Lt	- LN(1-Lt/ L∞) (Y)
1	12.833	0.5469
2	15.5	0.7109
3	17.776	0.8758
4	19.077	0.984
5	21.167	1.1868

Figure (5) . Estimation of t_0 according to von Bertalanffy, 1934. The plot of (t) vs. – Ln (1 –L_t/L_∞).



y = 0.1553X + 0.395 R^2=0.9937

t_0 = - a/b = - 2.5435

The established von Bertalanffy equation for *L. mormyrus:*

$L_t = L\infty\ (1 - \exp\ (-K\ (t - t_0\ )))$

$L_t =$ 30.465 (1 – exp (-0.159 (t + 2.5435)))

The plot of the equation is shown in Figure 6.

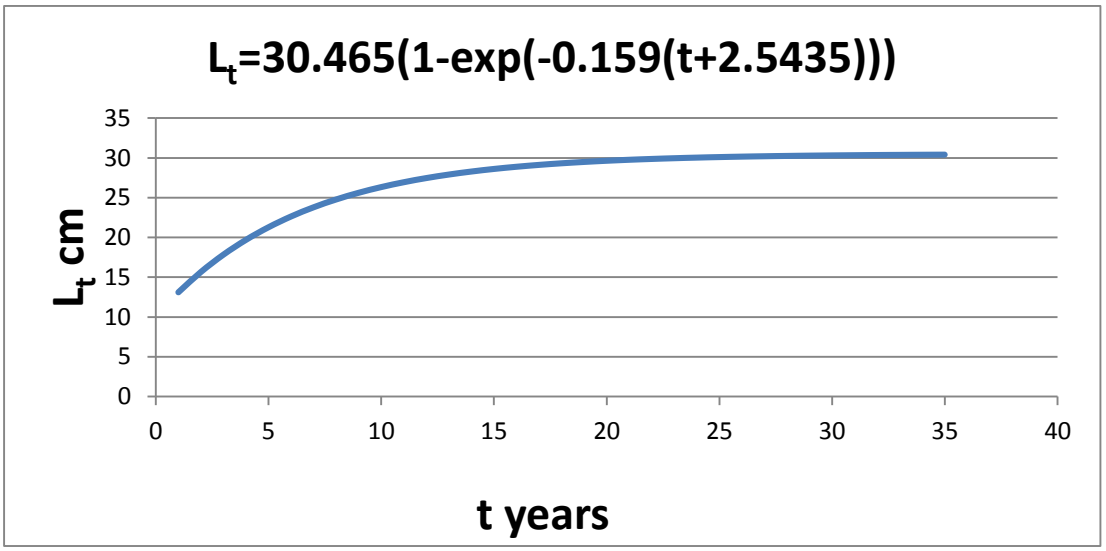


Figure (6). The plot of fish lengths (Lt) at different ages (t) calculated from the above equation.

A comparison between the actual length-at-age obtained in the present study and that calculated from the obtained von Bertalanffy equation is shown in Table 3.

Table (3). Comparison between actual Lt obtained in the present study and Lt calculated from the von Bertalanffy equation

Age (t)	L_t actual	L_t calculated
1	**12.833**	13.122
2	**15.5**	15.672
3	**17.776**	17.847
4	19.077	19.701
5	21.167	21.284

The weight based von Bertalanffy growth equation:

Combining the length based von Bertalanffy growth equation:

$L_t =$ 30.465 (1 – exp (-0.159 (t + 2.5435)))

with the length-weight relationship: $W = 0.0132L^{\wedge 3.0008}$ gave the weight based von Bertalanffy equation as:

$Wt = 374.2523 \ (1 - \exp(-0.159 \ (t + 2.5435)))^{3.0008}$

The plot of fish weights (Wt) at different ages (t) calculated from the above equation is shown in figure 7.

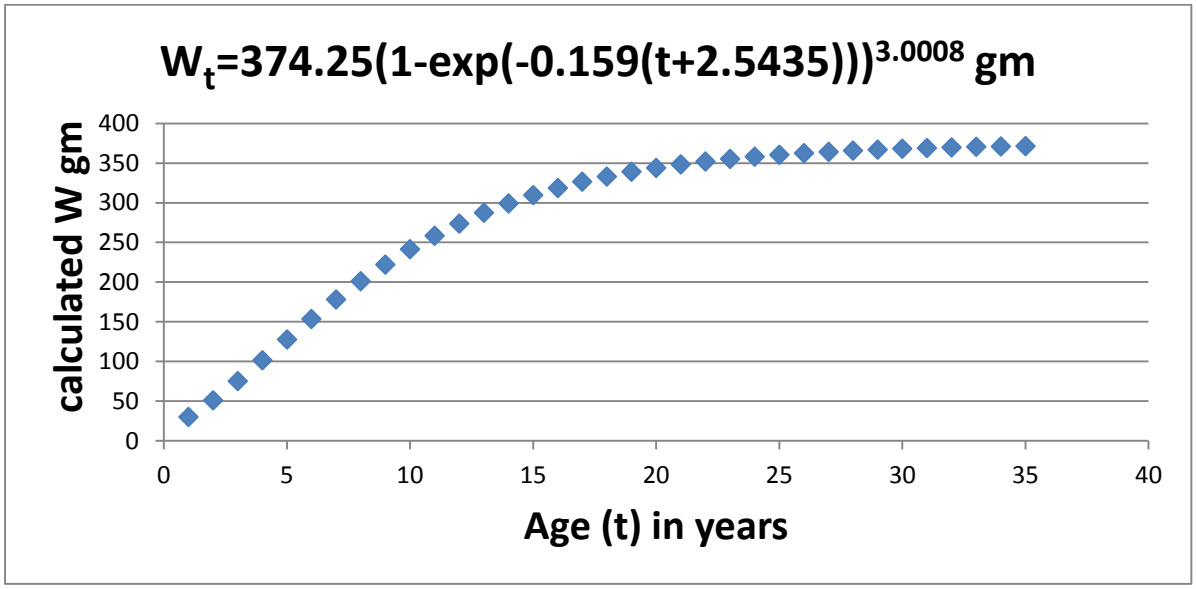


Figure (7). Graphic presentation of the weight based von Bertalanffy growth equation.

DISCUSSION

The length-weight relationship obtained in the present study reflects highly isometric growth (b=3.0008). The following is a summary of the "b" value (between two brackets) obtained by various authors for the same species:

- Suau, 1970, in eastern Spain (3.43);
- Kraljevic« *et al*., 1995 in the northern Adriatic (3.05) and in the middle Adriatic (2.69);
- Kraljevic« *et al*., 1996, in the northern Adriatic for males (3.02) and females (3.06);
- Lorenzo *et al*., 2002, off in the Canary Islands (2.91);
- Santos *et al*., 2002, in the Algarve coast (3.020);
- Turkmen and Akyurt, 2003, in Iskenderun Bay (3.046);
- Turkmen and Ihsan, 2003, in Üskenderun Bay for males (3.042) and females (3.069);
- Morey *et al*., 2003, off Balearic Islands and in the Iberian coast (3.0327);
- Kallianiotis *et al*., 2005, in the coastal waters of the Thracian Sea for immature individuals (3.242) and for mature males, females and intersexual (2.960);
- Verdiell-Cubedo *et al*., 2006, in western Mediterranean Sea (3.285);
- Mariani, 2006, in Fagliano Lagoon (2.85) and in Caprolace Lagoon (3.04);
- Gokce *et al*., 2007, in the Northern Eagean (3.10);
- Matić-Skoko *et al*., 2007, in eastern Adriatic Sea (3.141);

- Emre *et al*., 2010, in the Beymelek Lagoon (Turkey) for both males and females (3.1599 and 3.2187 respectively).
- **In the present study, eastern Mediterranean Sea (3.0008)**

The von Bertalanffy growth parameters of *L. mormyrus* established in various studies including the present one is listed below for comparison:

Location	**Authority**	**L∞ cm**	**K year^{-1}**	**t_0 cm**
eastern Spain	Suau, 1970	33.27	0.27	-0.057
northern Adriatic	Kraljevic« *et al*.,1995	37.3	0.262	-0.39
middle Adriatic		36.2	0.297	-0.08
western Istrian	Kraljević *et al*, 1996	40.05	0.196	-0.945
central-East Atlantic	Lorenzo *et al*., 2002		0.88	
central-East Atlantic	Pajuelo *et al*., 2002	42.7	0.19	1.46
Üskenderun Bay (males)	Turkmen and Akyurt, 2003	26.55	0.20	-1.81
(females)		32.6	0.13	-2.12
Thracian Sea	Kallianiotis *et al*2005	30.94	0.21	-0.996
south Portugal	Monteiro *et al*., 2010	35.30	0.264	-0.809
Beymelek Lagoon (males)	Emre *et al*., 2010	28.3	0.456	-1.859
(females)		28.1	0.466	-1.982
(male, female, and immature)		31.5	0.319	-2.201
Canakkale Strait	Ayyildiz *et al*., 2014	growth rate=0.325 mm d^{-1}		
Present study: Eastern Mediterranean Sea	**Ali *et al*., 2016**	**30.465**	**-0.159**	**-2.543**

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