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Morphometric characteristics and biometric relationships of twin spot snapper from the Sudanese Red Sea coast

E M Elamin[1], S M Elamin[2], Halla Gindeel A[1], Amani H T[1], M E Ali[1]
[1] Fisheries Research Centre, Red Sea Fisheries Research Station, Sudan
[2] Faculty of Marine Science and Fisheries, Red Sea University, Sudan
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Abstract
The present study concentrated on some morphometric data of *Lutjanus bohar*, which emphasize the relationship between Total length and the other body measurements to show correlation and significant differences between species from Dungonab and Sawakin. The fish samples were purchased from traders. A Monthly sample in range of 10-15 specimens were collected. The present study shows that there was a linear correlation between different morphometric measurements vs. total length with no significant difference between the two areas. All of these relationships showed highly significant correlation (r= 0.943 to 0.999) ($p<0.01$) in both locations.

Keywords: Twin spot snapper, morphometric, total length, Sudanese Red Sea

Introduction

The Red Sea is globally known for its unique beautiful marine environments, the diversity of species and tourism (PERSGA, 2002) [8]. The coast of Sudan in the middle contains the most diverse reefs of the Red Sea (PERSGA, 2006) [9].

Reed, (1964) [10] divided the Sudanese coast into eight fishing areas: the mars as and inlets, the boat channel, the fringing reef, the deep channel, the barrier reef, the pelagic zone, the open sea and the trawling areas. The marine fisheries of the Sudan are small scale artisanal in nature. Most of the fish production comes from the coral reef fishes where fishers mainly use hook and line targeting groupers, snappers and emperors, and some of them use gill nets for pelagic species such as mackerels, barracuda, jacks and tuna as stated by Marine Fisheries Administration. According to the Marine Fisheries Administration (MFA) records *Lutjanus bohar* Foorsskal 1775 forms about 3% to 4.3% of total catch 2011 to 2015 respectively.

Despite the great importance of Lutjanidae in the Sudanese Red Sea fisheries, little information is available on it. Mokhtar, (2013) [6] studied some biological aspects of *Lutjanus ehrenbergi* and Ormond, 1980 studied the occurrence and feeding behaviour of the Red Sea coral reef fishes. In population studies, morphometric analysis provides a powerful complement to genetic and environmental stock identification approaches (Cadrin, 2000) [1] and length-weight relationships allow the conversion of growthin-length equations to growth-in-weight for use in a stock assessment model (Moutopoulos and Stergiou, 2002) [7] and the mathematical length-weight relationship thus yields information on the general well-being of individuals, variation in growth according to sex, size at first maturity, gonadal development, and breeding season. The mathematical length-weight relationship thus yields information on the general well-being of individuals, variation in growth according to sex, size at first maturity, gonadal development, and breeding season. Study of the length-weight relationship in aquatic animals has wide application in delineating the growth patterns during their developmental pathways (Gindeel, 2019) [3]. The present study focussed on some morphometric relationships of *L. bohar* from Dungonab (DBNP) and Sawakin to show is there any difference between the two stocks.

Materials and Methods

The present study was carried out in Dungonab and Sawakin in the Sudanese Red Sea Coast. The fish samples were purchased from traders. A Monthly sample in range of 10-15 specimens of *L. bohar* were purchased and then transferred to the research laboratory of Fisheries Research Station- Port Sudan for different measurements and studies.

Morphometric data followed FAO, (1993). Different measurements using measuring board and Vernier to the nearest 0.1mm for the total length (TL), standard length (SL) and forked length (FL), Body depth (D) measured (refers to the greatest vertical depth) at level of pelvic-fin origin, Body girth (G) is the greatest width measured just behind the head at the level of the pectoral-fin base, Head length (HL) is measured from the snout tip to the posterior most extension of the opercula membrane, Snout (S) is measured from the anterior most extension of the upper lip to the anterior edge of the eye, The eye diameter (ED) is measured horizontally across the orbital cavity, The maxilla is measured from its rear margin to the snout tip, Caudal peduncle depth (CD) is measured as the least depth, Pectoral fin length (PFL) and pelvic fin length (PVL) are measured from the base to the tip of the longest ray. The relationships plotted by Excel and the variables analyzed by SPSS 17.

Results and Discussion

Morphometric characteristics are easily used to differentiate between fish species because each species has its own magnitude of growth (Mekkawy and Mohammed, 2011) [5]. In the present study all samples of *L. bohar* from DBNP with sizes ranging from 23-72 cm, and 161 from Sawakin with sizes ranging from 17.5 – 70.6 cm total length (TL) were sampled. The results of 12 morphometric measurements for the *L. bohar* populations sampled at DBNP and Sawakin showed no significant difference

between the two areas (Table 1). There is a linear correlation between various morphometric measurements vs total length. From (Table 2) all these relationships showed a highly significant correlation (r= 0.943 to 0.999) ($p<0.01$) in the two areas (Figures 1 to 10). Elamin (2012) [2] reported no significant differences in the morphometric characters or body proportion indices between the DBNP and Sawakin populations of *Plectropomus pessuliferus.* The relationships of depth (D) and girth (G) vs total length showed a very strong correlation. Body depth and girth are very essential in fisheries to estimate the suitable fish size and suitable mesh size to catch. The body depth and girth vs. total length have shown highly significant correlation for *Lutjanus bohar* from DBNP and Sawakin in the present study. Mokhtar (2013) [6] observed that values of body depth and body girth increased with the increasing of total length for both males and female *Lutjanus ehrenbergi* in the Sudanese Red Sea coast.

Table 1: Shows twelve body measurements of the minimum, maximum and average length of *L. bohar* from DBNP and Sawakin.

Measurement	*L.bohar* DBNP		*L.bohar* Sawakin		
	Min- Max	Average±SD	Min-Max	Average±SD	t-test
TL	23-72	41.79±10.86	17.5-70.6	43.97±11.73	0.094
FL	21.4-66.8	38.33±10.14	15.7-65.7	40.37±10.94	0.093
SL	18.2-59	33.49±9.00	13.4-57	35.20± 9.66	0.093
HL	7-22	12.53± 3.18	5.2-22	13.13± 3.38	0.092
TL	23-72	41.79±10.86	17.5-70.6	43.97±11.73	0.112
G	7.4-26	13.83± 3.82	5-23.7	14.65±4.04	0.111
D	15.8-55	29.28± 8.12	10.8-49.1	31.04±8.60	0.115
Snout	2.2-8.8	4.69±1.40	1.8-8.7	4.85±1.45	0.114
PFL	5.9-18.3	10.41 ± 2.67	4.1-17.5	10.93±2.88	0.288
PVL	4-11.3	6.62±1.51	3.2-11.1	6.89±1.63	0.286
CPD	1.9-6.4	3.62± 0.97	1.4-6.4	3.782±1.03	0.069
LUJ	3-9.2	5.35±1.33	2.3-9.1	5.625±1.45	0.069

$p>0.05$=not significant, $p<0.05$= significant, $p<0.01$= highly significant.

TL=Total Length; FL = Forked Length; SL= Standard Length; HL=Head Length; ED=Eye Diameter; D=Depth; G=Girth; Snout=Snout Length; PFL=Pectoral Fin Length; PVL=Pelvic Fin Length; CPD=Caudal Peduncle Depth; LUJ=Length of Upper Jaw

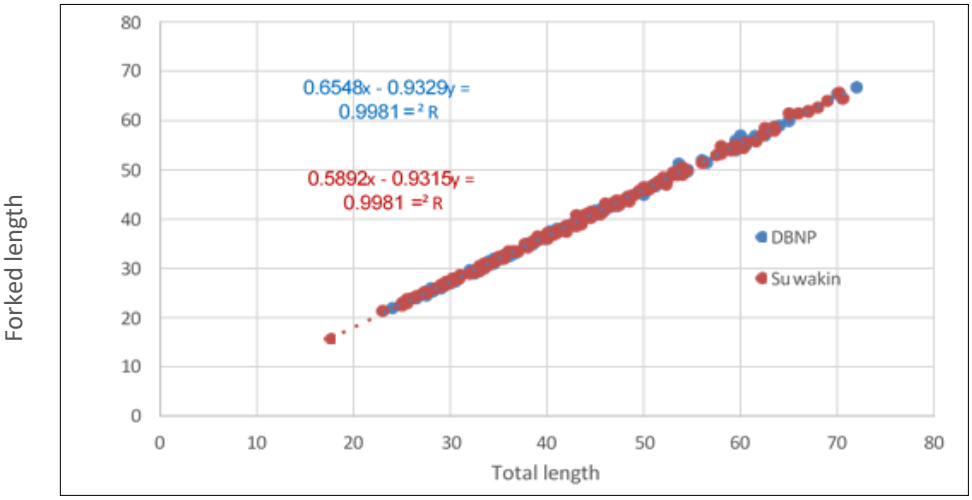


Fig 1: Relationship between forked length vs. total length (TL) of *L. bohar* in DBNP.

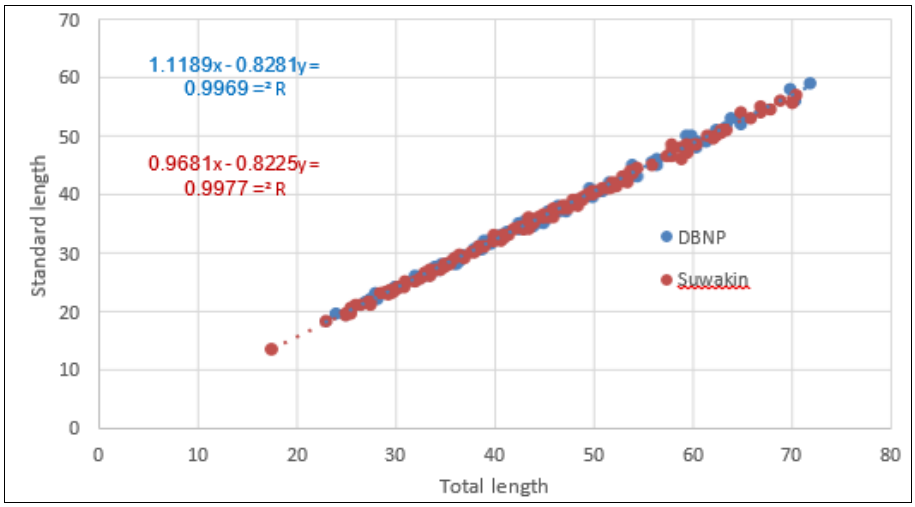


Fig 2: Relationship between standard length vs. total length (TL) of *L. bohar* in DBNP.

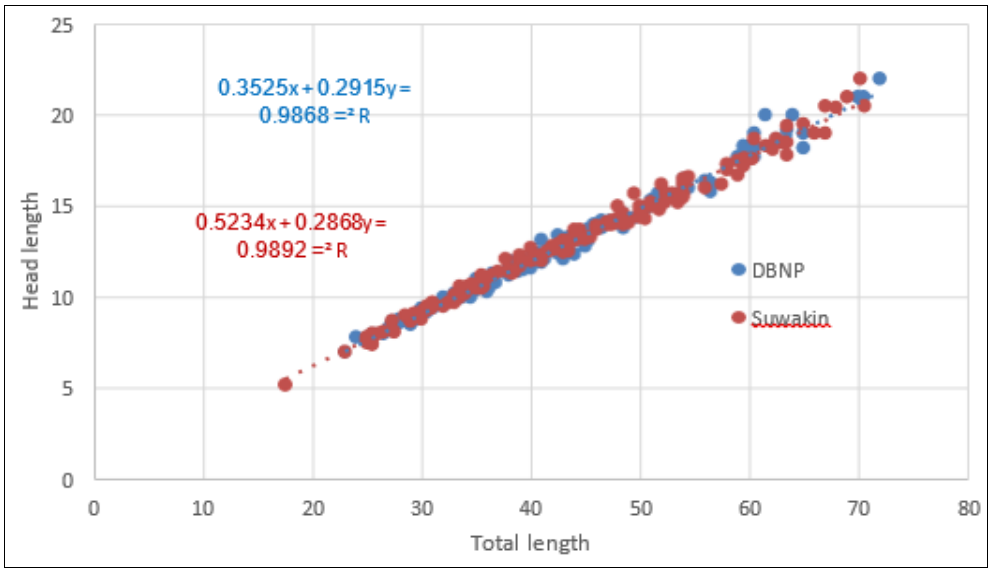


Fig 3: Relationship between head length vs. total length (TL) of *L. bohar* in DBNP.

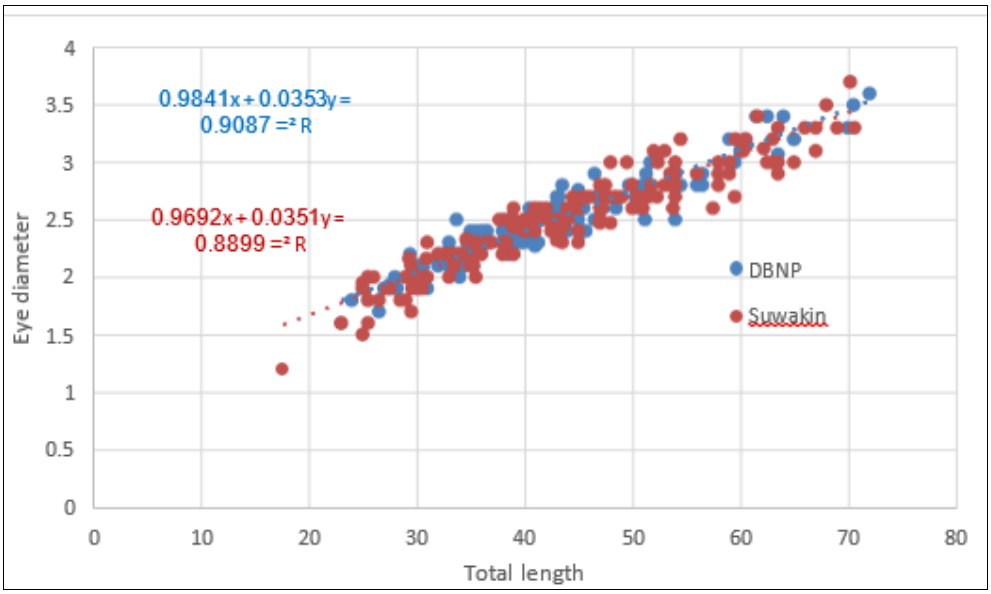


Fig 4: Relationship between eye diameter vs. total length (TL) of *L. bohar* in DBNP.

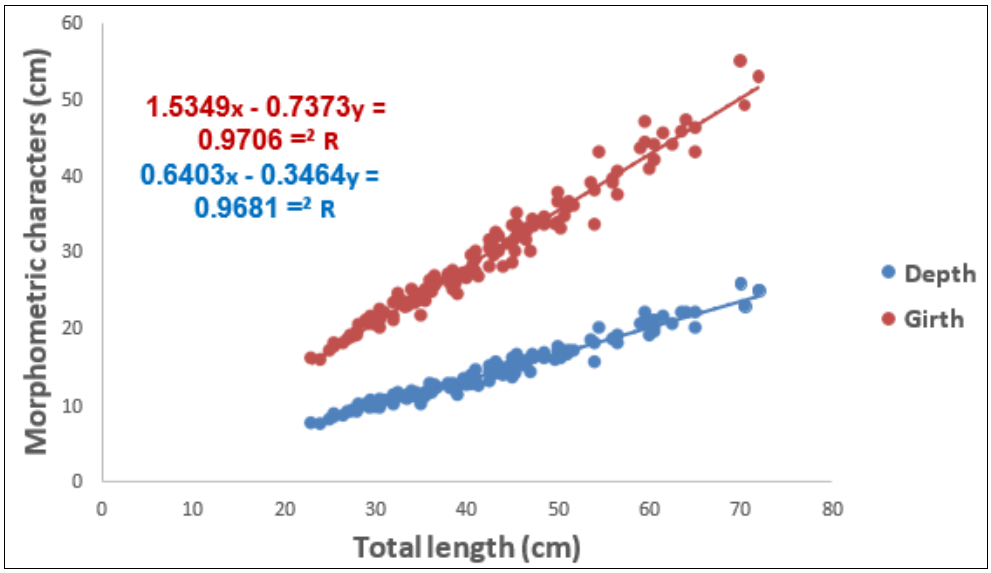


Fig 5: Show relationship between depth (D) and girth (G) vs. total length (TL) of *L. bohar* in DBNP.

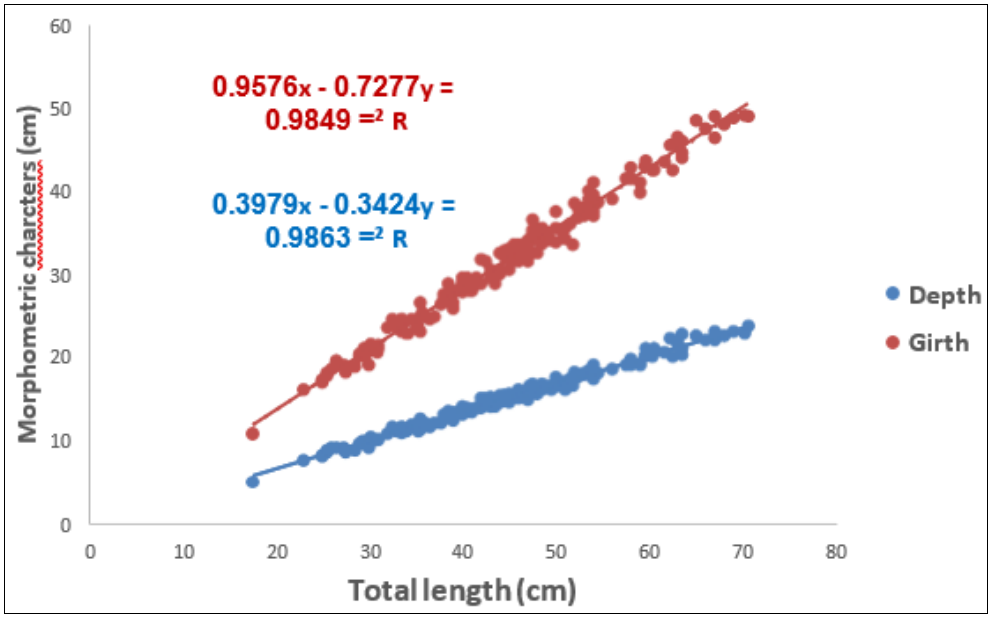


Fig 6: Show relationship between depth (D) and girth (G) vs. total length (TL) of *L. bohar in Sawakin.*

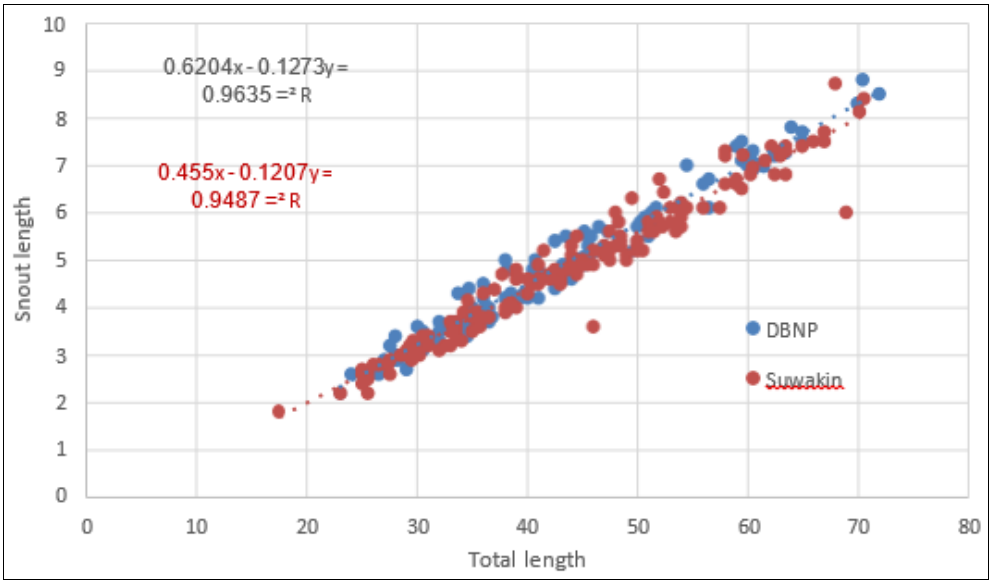


Fig 7: Relationship between snout length vs. total length (TL) of *L. bohar* in DBNP.

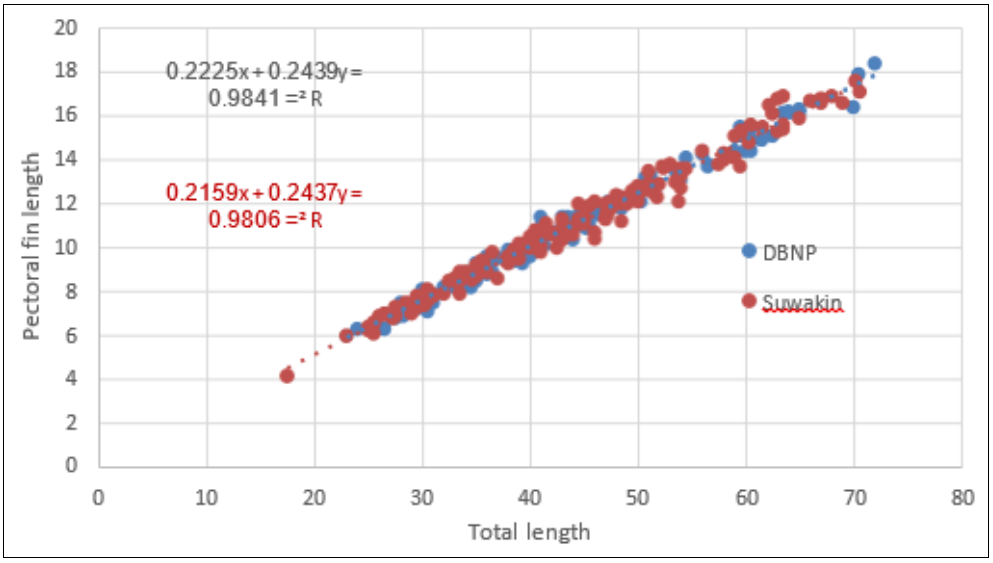


Fig 8: Relationship between pectoral fin length vs. total length (TL) of *L. bohar* in DBNP.

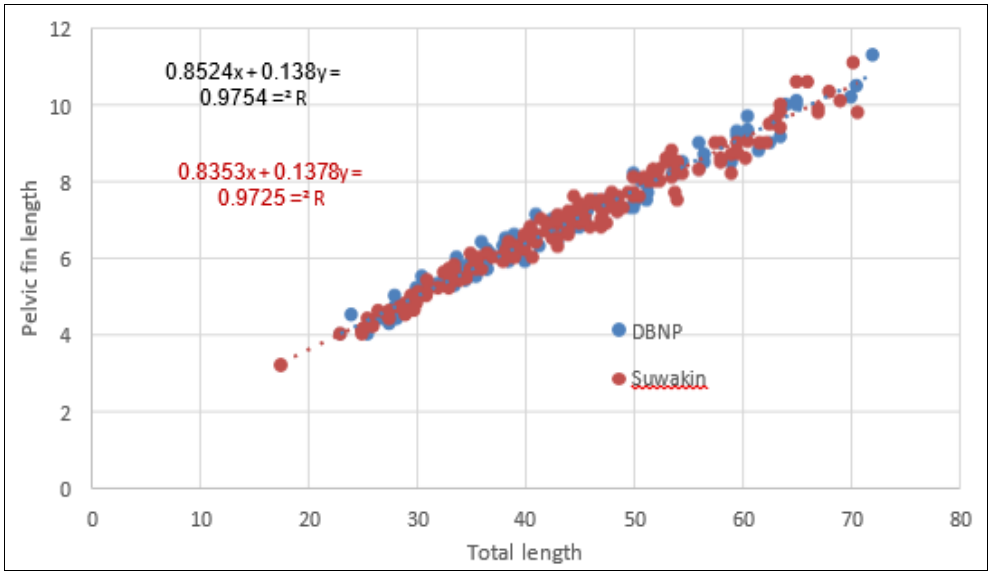


Fig 9: Relationship between pelvic fin length vs. total length (TL) of *L. bohar* in DBNP.

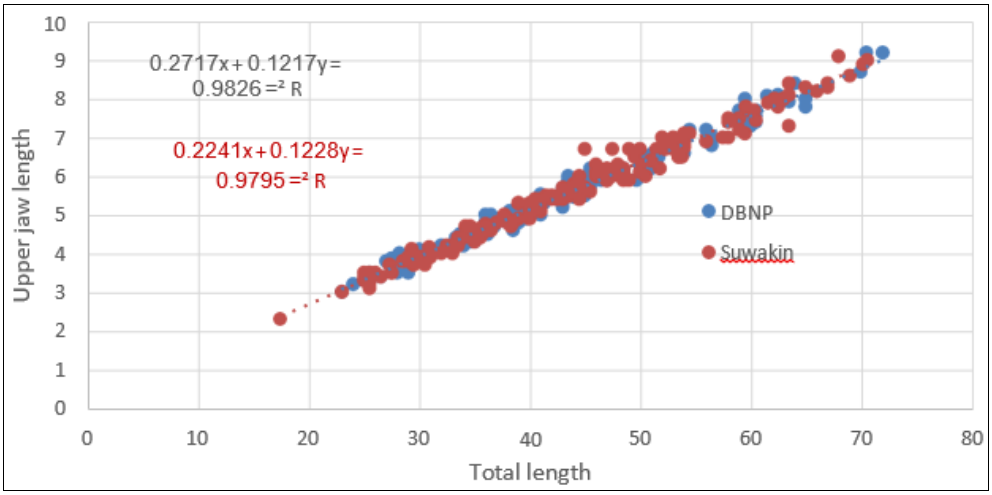


Fig 10: Relationship between upper jaw length vs. total length (TL) of *L. bohar* in DBNP.

Table 2: The relationship between total length and other morphometric measurements.

Relationship	DBNP		Sawakin	
	r	Correlation	R	Correlation
TL vs FL	0.999**	0.00	0.999**	0.00
TL vs SL	0.998**	0.00	0.998**	0.00
TL vs HL	0.993**	0.00	0.994**	0.00
TL vs ED	0.953**	0.00	0.943**	0.00
TL vs Depth	0.983**	0.00	0.993**	0.00
TL vs Girth	0.985**	0.00	0.992**	0.00
TL vs Snout	0.981**	0.00	0.974**	0.00
TL vs PFL	0.992**	0.00	0.990**	0.00
TL vs PVFL	0.987**	0.00	0.986**	0.00
TL vs CD	0.987**	0.00	0.972**	0.00
TL vs UJL	0.972**	0.00	0.989**	0.00

**Correlation is significant at .01 level

Conclusions

- The relationship between morphometric measurements vs total length showed highly significant correlation in both locations.
- There was no significant difference between the species inhabiting both areas.

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