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SHORT COMMUNICATION

First report on length-weight relationships of five reef associated fish species from Ratnagiri coast (Arabian Sea; central west coast of India)

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Abstract
Length-weight relationships (LWRs) for five reef-associated marine finfishes, namely, *Lutjanus johnii* (Bloch, 1792), *Lutjanus argentimaculatus* (Forsskal, 1775), *Acanthurus dussumieri* (Valenciennes, 1835), *Priacanthus hamrur* (Forsskal, 1775) and *Kyphosus vaigiensis* (Quoy & Gaimard, 1825) were studied. A total of 944 specimens were measured to obtain the LWRs. The range of slope '*b*' (2.606 to 2.824) was within the expected range of 2.5-3.5. The intercept '*a*' ranged from -1.273 to -1.555. LWRs were obtained from well-adjusted linear regressions with $r^2 \geq 0.90$. Data presented herein expand the knowledge base for these species in west coast of India, as they have limited or no LWRs data available.

Keywords: Reef associated fishes, Length-weight relationship, Ratnagiri, Arabian Sea

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INTRODUCTION

Fisheries management and research often require the use of biometric relationships to transform field data into appropriate indices (Ecoutin & Albaret 2003). Among them, length-weight relationships (LWR) are useful for weight prediction and estimation of fish biomass from length data (Froese 2006; King 2007; Mouludi-Saleh et al. 2023). This is particularly relevant in data-poor species and stocks where novel studies are significant to improve species-specific estimates and increase the reliability of online databases (Froese et al. 2014).

Ratnagiri is a major fishing harbour along the west coast of India. A variety of reef-associated marine species are landed by a multitude of gears including trawl nets, purse seines, gill nets, long lines, stake nets, etc. along the Ratnagiri coast (Abdurahiman et al. 2004, Rakhunde et al. 2023, Shetkar et al. 2024). Several studies on LWRs along the Ratnagiri coast have been conducted, including those on *Escualosa thoracata* (Gurjar et al. 2017), *Alepes kleinii, Cynoglossus macrostomus, Epinephelus diacanthus* and *Opisthopterus tardoore* (Kolhe et al. 2018), *Siganus canaliculatus* (Metar et al. 2017), *Alepes djedaba* (Bandkar et al. 2020), *Sphyraena obtusata* (Ranaware et al. 2023) and *Atropus atropos* (Rakhunde et al. 2023). In the present study, we estimated LWRs for five species, namely, John's snapper, *Lutjanus johnii* (Bloch, 1792), mangrove red snapper, *Lutjanus argentimaculatus* (Forsskal, 1775), eyestripe surgeonfish, *Acanthurus dussumieri* (Valenciennes, 1835), moontail bullseye, *Priacanthus hamrur* (Forsskal, 1775) and brassy chub, *Kyphosus vaigiensis* (Quoy & Gaimard 1825). Reef associated species hold significant economic value due to their high demand as food fish in domestic and export markets, contributing substantially to livelihoods in coastal fisheries (Reddy et al. 2015). Also, to the best of our knowledge, this study offers the first reference on the LWR of five fish species from the region. Length-weight relationships (LWR) represent one of the most useful and used life history traits because they allow to estimate biomass based on the length of individuals (Holden & Raitt 1975; Gulland 1983). Hence, when one fish stock is in consideration, the more accurate is this information, the more reliable will be the assessment results.

This study aims to establish the length-weight relationships (LWRs) of five reef-associated fish species from the Ratnagiri coast to understand their growth patterns and provide baseline data for sustainable fisheries management. The findings are crucial for stock assessment, biodiversity conservation, and supporting ecosystem-based management in the Arabian Sea.

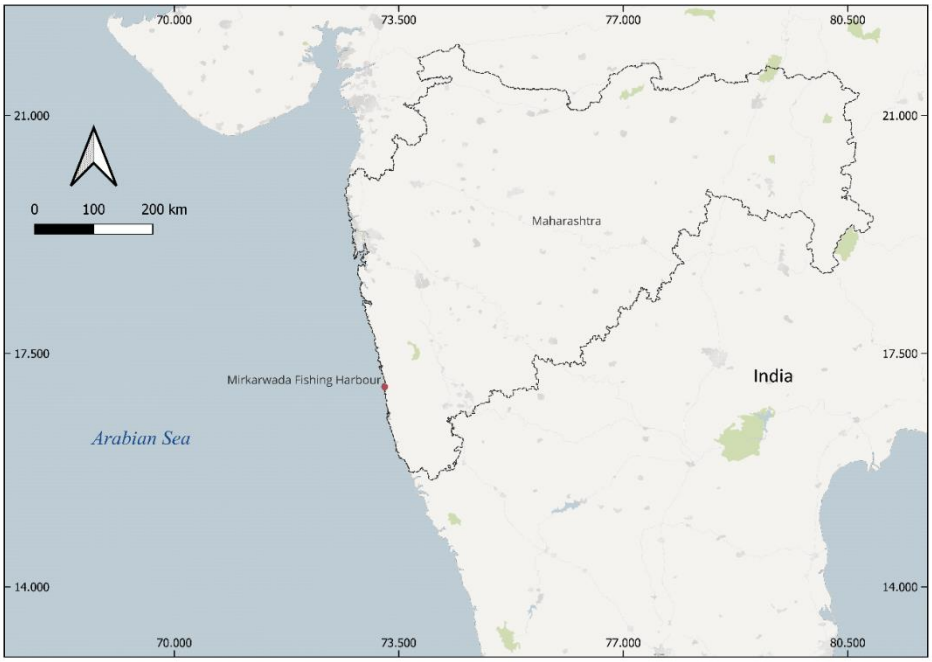

Fig.1. Map of the study site.

MATERIALS AND METHODS

Specimens were collected at fortnightly interval between March 2023 and July 2024 from Ratnagiri (Arabian Sea; central west coast of India) landing center (16°59′42" N and 73°16'14" E) (Fig. 1). *Priacanthus hamrur* (Family: Priacanthidae) and *Kyphosus vaigiensis* (Family: Kyphosidae) are landed by trawl gear, while *Lutjanus johnii* (Family: Lutjanidae), *Acanthurus dussumieri* (Family: Acanthuridae), and *Lutjanus argentimaculatus* (Family: Lutjanidae) are landed by stake nets and gill nets. The collected specimens were iced, packed in labelled nylon bags, and transported to the laboratory, where they were identified up to species level following standard identification keys (Fischer & Bianchi 1984; Froese & Pauly 2023). The total length of each fish was measured (TL) i.e., the length from the tip of the snout to the tip of the caudal fin to the nearest 1 mm using a standard measuring board and the weight was recorded to the nearest 0.5 g using analytical balance ACZET make (Model no. CY223). The relationship between the length and weight is expressed by the regression equation $W= aL^b$ (Le Cren 1951), which will be converted into its logarithmic form Log W= Log a + b Log L. W is the total body weight, L is the total length, and '*a*' and '*b*' are constants. The power of the relationship was calculated as r^2 (coefficient of determination). All statistical analysis was carried out using SPSS software.

RESULTS AND DISCUSSION

Estimated parameters of the LWRs and descriptive statistics of the same are given in Table 1. Length-weight relationships for all species were highly significant (Table 1; $P< 0.01$) and the coefficient determination (r^2) ranged between 0.901 for *P. hamrur* to 0.949 for *A. dussumieri.* All fish species had the allometric coefficient '*b*' in the LWRs equations between 2.606 (*K. vaigiensis*) and 2.824 (*A. dussumieri*) and the intercept values ranged between -1.273 (*K. vaigiensis*) and -1.555 (*A. dussumieri*).

In present study, allometric growth was observed in all fish species, indicating that they grow more in length than in weight as they age. This growth pattern suggests specific ecological strategies and environmental adaptations, which are important for understanding species dynamics and informing fisheries management (Jaiswar et al. 2004; Shetkar et al. 2024).

For the selected fish species, calculated "*b*" values were within the estimated range of 2.5 to 3.5 (Froese

Table 1. Estimated length-weight relationship parameters and descriptive statistics for five species captured off Ratnagiri (Arabian Sea; West Coast of India).

Family	N	TL range (cm)	BW range (g)	Regression parameters		
				a (95% CI)	b (95% CI)	r^2
Lutjanidae						
Lutjanus johnii (Bloch, 1792)	258	15-29	70-200	-1.309 (-1.498 to -1.120)	2.629 (2.499- 2.758)	0.912
Lutjanus argentimaculatus (Forsskal, 1775)	164	14.5-45	80-500	-1.425 (-1.605 to -1.246)	2.697 (2.582-2.813)	0.927
Acanthuridae						
Acanthurus dussumieri (Valenciennes, 1835)	180	12-43	30-118	-1.555 (-1.772 to -1.339)	2.824 (2.674-2.974)	0.949
Priacanthidae						
Priacanthus hamrur (Forsskal, 1775)	230	20-36	106-420	-1.497 (-1.904 to – 1.090)	2.779 (2.496-3.062)	0.901
Kyphosidae						
Kyphosus vaigiensis (Quoy & Gaimard, 1825)	112	15-45	120-654	-1.273 (-1.45 to -1.09)	2.606 (2.48 to 2.73)	0.937

*N, sample size; TL, total lengths in cm; BW, body weight in g; *a* and *b*, parameters of length weight relationship; CI, confidence interval; r^2, coefficient determination.

2006). The earlier reported slopes of *b*= 2.126 for *L. johnii* from central east coast of India (Swain et al. 2023) and b= 2.836 for *P. hamrur* from the Mangalore coast (Anjanayappa et al. 2013) were similar to the findings in the present study. However, the *b* value for *L. argentimaculatus* from central east coast of India exhibited isometric growth contradicting the results obtained in the present study (Swain et al. 2023). This could be possible due to stock level differences.

All r^2 values were >0.90, indicating a strong effect size or influence of length on the weight in all the studied species. Indeed, many of the LWRs available on Fishbase are based on small sample sizes and/ or limited length ranges. It is well known that the obtention and use of the specific stock's life history traits is used to describe the population geographical structures of species, because they reflect genetic or environmental differences (Begg 2005). Therefore, the information provided here will allow the assessors to assay more reliable stock assessments of the biomass of these species, by converting length samplings obtained in the region into biomass (Froese 2006). In conclusion, this study provides LWRs and maximum length values for five reef associated marine species belonging to the four families and it is expected that the results acquired from this study will contribute to the understanding dynamics of fish population from the region.

CONCLUSIONS

This study establishes length-weight relationships (LWRs) for five reef-associated marine species, namely *Lutjanus johnii, Lutjanus argentimaculatus, Acanthurus dussumieri, Priacanthus hamrur,* and *Kyphosus vaigiensis*, from the Ratnagiri coast along the west coast of India. The calculated allometric coefficients (*b*) were within the expected range, indicating allometric growth patterns across the studied species. The high coefficient of determination ($r^2 > 0.90$) confirmed a strong relationship between length and weight, reflecting reliable data quality. These findings contribute to the limited LWR data for these species in the region, offering a baseline for further studies. By providing insights into growth patterns and population dynamics, this study aids in improving species-specific stock assessments and

biomass estimations. The results will be crucial for sustainable fisheries management, biodiversity conservation, and ecosystem-based management strategies in the Arabian Sea.

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مقاله کوتاه

اولین گزارش در مورد روابط طول-وزن پنج گونه ماهی صخره‌ای از ساحل راتناگیری (دریای عرب؛ سواحل مرکزی غربی هند)

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چکیده: روابط طول-وزن (LWRs) برای پنج گونه ماهی دریایی سواحل صخره‌ای، یعنی *Lutjanus johnii* (Bloch, 1792)، *Lutjanus argentimaculatus* (Forsskal, 1775)، *Acanthurus dussumieri* (Valenciennes, 1775)، *Priacanthus hamrur* (Forsskal, 1775) و *Kyphosus vaigiensis* (Quoy & Gaimard, 1835) مورد مطالعه قرار گرفت. در مجموع ۹۴۴ نمونه برای به دست آوردن LWR ها اندازه‌گیری شد. دامنه شیب *b* (۲/۶۰۶ تا ۲/۸۲۴) در محدوده مورد انتظار ۳/۵-۲/۵ بود. مقادیر 'a' از ۱/۲۷۳- تا ۱/۵۵۵- بود. LWR ها از رگرسیون‌های خطی به خوبی تنظیم شده با مقادیر $r^2 \geq 0/9$ به‌دست آمد. داده‌های ارائه‌شده در اینجا پایگاه اطلاعاتی این گونه‌ها را در سواحل غربی هند گسترش می‌دهد، زیرا داده‌های LWR آنها محدود یا در دسترس نبودند.

کلمات‌کلیدی: ماهی‌های صخره‌ای رابطه طول و وزن، راتناگیری، دریای عرب