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Review Paper

A review on the length-weight relationship of *Pampus argenteus*, a commercially important and high-valued fish from different regions of the world

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Abstract

*Silver Pomfret (Pampus argenteus) is an important marine fish species all over the world, whose fatality is strongly affected by marine salinity. The purpose of this review paper is to provide information on the production trends of silver pomfret from Indian waters and estimated length-weight relationships from different geographical regions of the world. The production of silver pomfret from Indian waters showed a decline of 8.82% from 1998 to 2019. The all-time high production of 0.37 lakh tonnes was reported during 2009. The landings of P. argenteus in India during 2019 was 28,606 tonnes which showed an increase of 7640 tonnes compared to 2018. The b value ranged from 2.*485 in Karnataka waters, India to 3.519 in Pakistan waters. Silver pomfret showed negative allometric growth in most of the regions of the world. Isometric growth was observed only from Persian Gulf & Oman Sea and Gujarat, India regions. Knowledge of length-weight relationships is imperative for sustainable management of the fishery resources in whichever zone.

Keywords: Allometric, growth coefficient, length, silver pomfret, weight.

Introduction

The fisheries sector in India is set in a unique and diverse set of resources ranging from the pristine waters of the Himalayas to the sprawling Indian Ocean. The oceans are the lifeblood of our planet. They are important source of energy and food, as well as providing transport routes and key ecosystem services to the world. Fish being a high-protein food is an essential dietary component. Fisheries and aquaculture provides livelihoods to around 820 million people worldwide. Although, the sector is quite foundering in few domains of the world in spite of attempts to sustain a healthy marine environment and protecting fish biomass and biodiversity[1]. Most of the world fisheries occur in the Exclusive Economic Zone (EEZ), but some are out on the high seas. Management of fisheries addresses the social, economic and biotic constituents persuading fish stocks instead of embracing a policy that accomplish the livelihoods of mankind without utilizing fish stocks[2]. Also "open access" nature of fisheries does not encourages the fishermen to leave fish in the water[3]. Regulating fisheries is essential for sustainability.

The silver pomfret, *Pampusargenteus* (Euphrasen, 1788), is amongst the highly-priced fishes of the world belonging to family Stromateidae. The species if found in the near shore coastal waters within the depths of 5 – 100m. The species is habitually sighted in shoals analogous with different other deep water fishes over the muddy bottoms[4]. The length-weight relationships (LWRs) is an important factor in the fish biology study and their stock assessments. Determining LWRs in fish has become an important part of the biology study which has been emphasized by various researchers. It bestow knowledge about the growth marking, domain conditions, memoir, general health, fish heaviness, and morphological characteristics of the fish[5,6]. Comparison of LWRs indicates changes in the body shape or in the condition of the fish. It is also an important parameter to understand the health of the ecosystem.

LWRs are stated in a formula $W = a L^b$ (where W and L are the weight and length of the fish respectively, a is the intercept and b is the growth coefficient), which is useful for assessment of the weight of fish (W) using a regression curve of LWRs, and can be implemented to feeding and reproductive studies[7]. Based on the assumed shape of body and the corporal elements for example spawning and maturity, LWRs may differ among fish species and also deviate among seasons and size of fishes[5 8]. It is asserted that b value may change from 3 (ideal value) entirely depicting an isometric or allometry growth[9], because of the different environmental circumstances or robustness of the fish themselves.

It can be negative allometric (b<3) or positive allometric (b>3) which further reflects conditions for growth[10]. In addition, the growth pattern of the species can change within the species

residing different locations, influenced by various abiotic and biotic factors. Thus the paper presents the production trends and LWRs of *P. argenteus* from different regions of the world.

Materials and methods

Data on production of silver pomfret, *P. argenteus* from India and LWRs were collected from the secondary sources through different research papers, articles and annual reports of ICAR – Central Marine Fisheries Research Institute. Data on LWRs from different regions were compared to find the changes in the growth patterns of this species. All the statistical analysis were done in Microsoft Excel ver. 2013.

Results and discussion

Production of silver pomfret from Indian waters has decreased from 0.31 lakh tons in 1998 to 0.29 lakh tons in 2019 showing a decline of 8.82% from 1998 to 2018 (Figure-1). There are various reasons contributing to decline in production which includes overfishing, harvesting of small-sized fishes, pollution, illegal fishing, climate change, etc. But at the same time, the estimated marine fish production of the country has substantially surged from 2.67 million tons in 1997 to 3.56 million tons in 2019[11].

The comparative results of length weight relationship of *P. argenteus* is shown in Table-1. The critical review has been made from different locations like India (Gujarat, Karnataka, Andhra Pradesh, and West Bengal), Pakistan, Kuwait, Oman, China, Indonesia, and Bangladesh. The b values range from 2.3719 (Pangandaran waters, Indonesia) to 3.519 (Pakistan waters) and the average value of *b* was 2.82 ± 0.33 (Figure-2). The deviation in the *b* value may be correspond with numerous conditions like sample size, length range covered, condition (robustness) of fish, geographical location, ecological differences, changes in water quality parameters, food availability, ontogeny development, season and sex[12-16]. Forese[6] reported that the expected range of *b* value is 2.5 to 3.5, but in the present review b<2.5 was reported from the Pangandaran waters, Indonesia as well as b>3.5 was reported from Pakistan waters. The isometric growth was obtained only from Gujarat and Persian Gulf & Oman Sea, otherwise all the regions showed a negative allometric growth except the Pakistan waters where the relationship was positively allometric.

The coefficient b of length-weight relationship of *P. argenteus* reported from Pangandaran waters, Indonesia and Karnataka, India were 2.3719 and 2.485 respectively (Table-1). Both the values from Indonesia and India are significantly lower than the value of Pakistan waters (b=3.519) indicating that the weight gained by the fish with increasing size is much rapid in Pakistan than in Indonesia or India. In the Persian Gulf and Oman Sea, the largest sized specimen was recoded (Total weight = 1500 g).Based on the critical review surveyed the coefficient of determination (r^2) ranged from 0.7585 (Indonesia) to 0.994 (Northern South China Sea). The peak values of the coefficient of determination (r^2>0.9) for all the locations except Gujarat, Persian Gulf and Indonesian waters describes the reliable estimates of LWRs. This also indicates superior interrelationship, ideal correlation and excessive grade of association between weight and length (r^2>0.9). Furthermore the relationship of silver pomfret will be relevant to contrast the critical stages of life and biology of populations of various geographical locations.

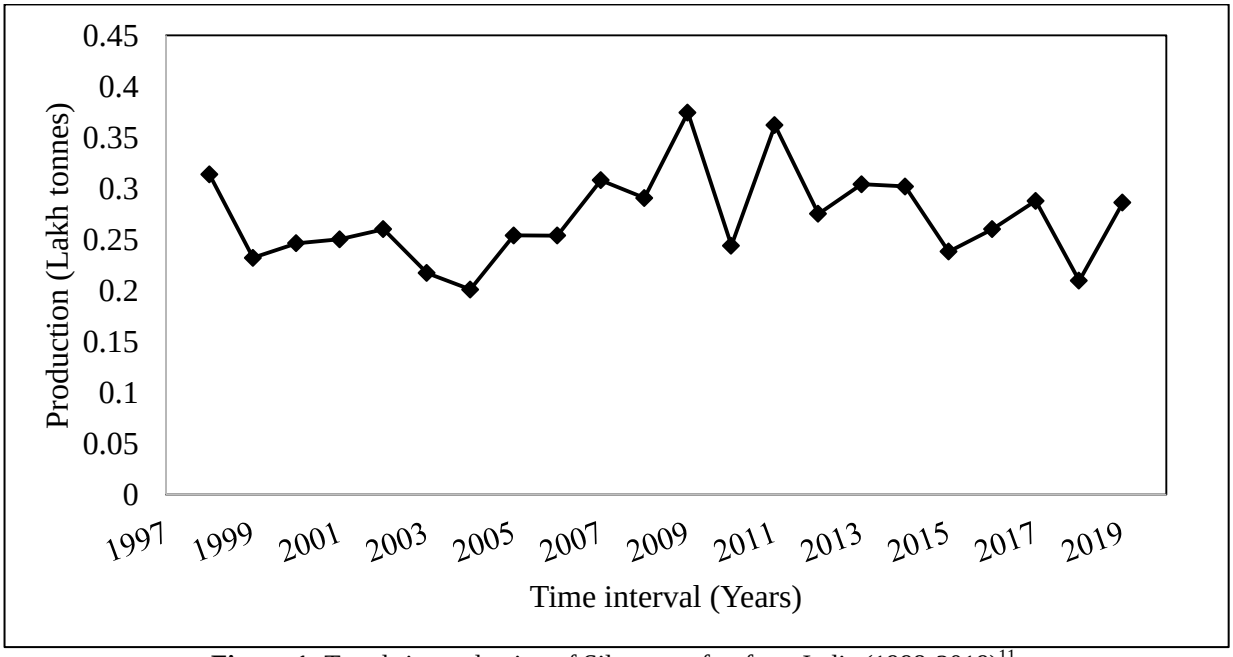

Figure-1: Trends in production of Silver pomfret from India (1998-2019)[11].

Table-1: Length-weight relationship and statistical analysis of *Pampusargenteus* from different regions of the world (The source is otherwise stated).

Location	Sex	N	Length range (cm)		Weight (g)		Regression parameters			Relationship	Reference
			Min	Max	Min	Max	a	b	r^2		
Karnataka, India ($W=aTL^b$)	M	90	9.0	25.5	23.0	289.0	0.120	2.485	0.9216	Negative allometry	17
	F	54	10.3	28.2	33.4	382.0	0.387	2.306	0.9604		
Veraval, Gujarat, India ($W=aTL^b$)	P	551	14.0	38.9	50.0	840.0	0.01566	3.0504	0.8464	Isometric	4
Northern Bay of Bengal, West Bengal, India ($W=aTL^b$)	P	467	-	-	-	-	0.00004	2.841	0.9873	Negative allometry	18
Visakhapatnam, Andhra Pradesh, India ($W=aTL^b$)	P	421	21.0	40.0	-	-	0.04820	2.940	0.927	Negative allometry	19
Pakistan waters ($W=aSL^b$)	P	307	6.8	21.8	9.4	450.0	0.011	3.519	0.96	Positive allometry	20
Kuwait waters ($W=aSL^b$)	M	222	11.2	28.0	-	-	0.121	2.669	0.9120	Negative allometry	21
	F	934	15.0	31.5	-	-	0.064	2.914	0.9158		
Persian Gulf and Oman Sea ($W=aFL^b$)	P	1089	6.5	37.5	10.0	1500.0	0.023	2.995	0.847	Isometric	22
Beibu Gulf, Northern South China Sea ($W=aFL^b$)	P	631	8.2	20.5	17.0	291.0	0.0381	2.94	0.994	Negative allometry	23
Pangandaran waters, Indonesia ($W=aTL^b$)	P	1200	19.3	36.8	100.0	798.0	0.1184	2.3719	0.7585	Negative allometry	24
Southwestern region of Bangladesh ($W=aSL^b$)	P	317	10.0	25.0	40.0	570.0	0.079	2.7931	0.9781	Negative allometry	25

Note: TL: total length; SL: standard length; FL: fork length; W: total weight in g; M: male; F: female; P: pooled; N: sample size; a: intercept; b: slope; r^2: Coefficient of determination.

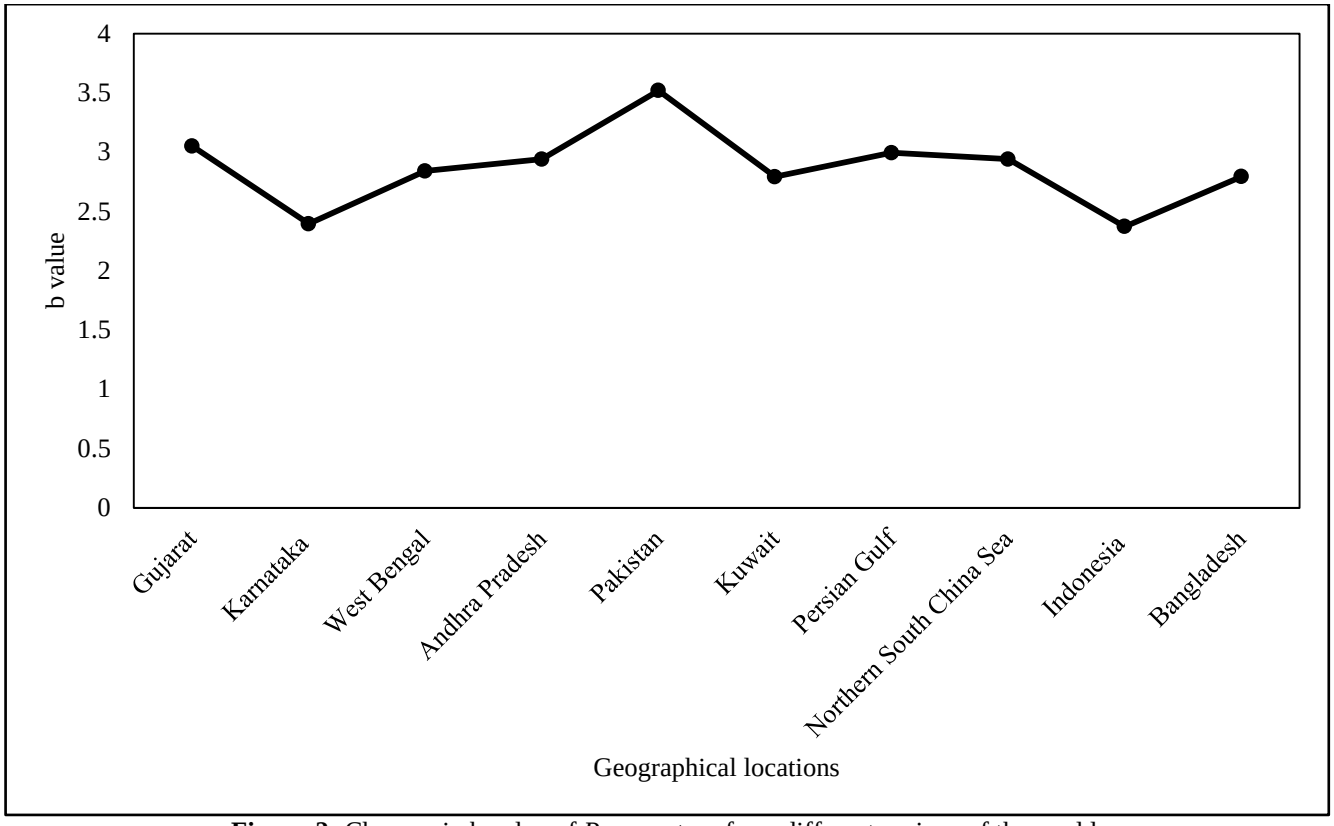

Figure-2: Changes in b value of *P. argenteus* from different regions of the world.

Conclusion

The LWRs impersonate a crucial role in discovering the yield by converting one variable to another. This review study provided enlightenment on the length-weight relationship and growth pattern of *P. argenteus* from different regions of the world indicating how the fish responds to growth in different geographical regions of the world. Also study will be helpful for easy comparison of LWRs of particular species to different researchers that will be ultimately helpful for the management of particular fishery resources.

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