Journal of Advanced Zoology

ISSN: 0253-7214

*Volume **45** Issue **5 Year 2024** Page **161:169***

Investigating The Biological Parameters Of Black Pomfret (*Parastromateus Niger*) In The Coastal Area Of Balochistan, Pakistan

Zahoor Ahmed Khetran[1], Sher Ahmed[2*], Javed Ahmed Abro[3], Abid Hussain[4], Zaheer Ahmed[5], Muhammad Yaqoob[6]

[1] PARC-Balochistan Agricultural Research and Development ARI, Jaffarabad, Pakistan
[2,3,4,5] PARC-Balochistan Agricultural Research and Development Center, Quetta, Pakistan*
[6]PARC-Horticultural Research Institute, Khuzdar, Pakistan

***Corresponding Author:** Sher Ahmed*
**Email: shershahwani@parc.gov.pk*

Abstract

The pomfret fish, particularly the black pomfret *(Parastromateus niger)*, serves as a significant economic resource in South Asia, particularly in the coastal regions of Balochistan, Pakistan. This study investigates various biological parameters of *Parastromateus niger* collected from the Gaddani coastal area of Pakistan, focusing on length-weight relationships, gut fullness, and population demographics. A total of 117 fish specimens were collected, with females dominating the samples. Length and weight data were analyzed separately for males and females, with statistical calculations revealing strong correlations (r2 values ranging from 0.918 to 0.985) between length and weight for both sexes. Gut fullness was categorized into five levels, with the highest percentage observed during July, suggesting potential breeding activity during this period. The zooplanktons were identified as primary dietary components of *Parastromateus niger*. The study also highlights the importance of regulatory measures to sustainably manage fish populations, especially during breeding seasons, and calls for further research into the intensive culturing and feeding regimes of black pomfret to enhance its production. Overall, these findings contribute to a better understanding of the biological characteristics and potential for aquaculture development of *Parastromateus niger* in the region.

Key Words: Black Pomfret (Parastromateus niger), Biological Parameters, Zooplanktons

Introduction

The Pomfret is a vital commercial fish in South Asia, primarily found in the Indo-Pacific Ocean and Atlantic regions. Locally known as "flyer," common species include Black pomfret (*Parastromateus niger*), Gray pomfret (*Pampus chnesis*), and Sliver pomfret (*Pampus argentius*). Sliver pomfret dominates production, with Black pomfret more prevalent on the east coast and rare on the west coast. (http://www.indianetzone.com/44/pomfret.htm). Dark pomfret (*Parastromateus niger*) has a place with the family Carangidae and it is found in the tropical, sub-tropical and mild oceans of the world, Indo Pacific Ocean, China and Malay Archipelago. (Yadollahv *et al.*, 2014). The dark pomfret *Parastromateus niger* (Bloch, 1795), is a pelagic fish that possess the shallower inshore waters of the Indian Ocean toward the

western Pacific Ocean, it is appropriated off East Africa to southern Japan and Australia (Liu, 2008). The frigate fish, Auxisthazard (Lacepède, 1800), is a little pelagic fish like individual from the family Scombridae which incorporates fishes, mackerels and bonitos. It is a very transient animal group with an overall appropriation all through all tropical and subtropical oceans (Liu, 2008). In China, the dark pomfret and frigate fish are appropriated in the East China Sea and South China Sea. They are more copious in the Taiwan Strait, and are critical for the lighting handbag seine fishery in Taiwan, Fujian and Guangdong Province (Lu *et al.*, 1985; Lu *et al.*, 1991). Fishes fill in as an imperative wellspring of nourishment and salary for individuals. We have to profit by our water sources at an ideal level. For a superior control of fish populaces at a specific water body, some imperative organic attributes, for example, condition factors, and development and generation qualities ought to be known exceptionally well (Mert, 2008). Fish growth, influenced by genetics, food availability, and environmental conditions, is crucial in understanding fish physiology. Measurement and correlation of length and weight parameters are key for assessing fish development (Prasad *et al.*, 2012). These two parameters of the development are profoundly corresponded (Shakir *et al.*, 2010). The length-weight relationship of fish is a basic fishery asset, administration instrument and valuable for looking at life history and morphological qualities of fish populaces occupying diverse areas (Negi *et al.*, 2015). This is a quantitative part of fisheries to consider the fish science. (Nehemia *et al.*, 2012). Weight length relationship and condition factor of fish is the reason for breaking down physiological states of populace and furthermore assume a noteworthy job in fishery stock evaluations (Naeem *et al.*, 2010). Occasional varieties in a fish development can be investigated through length weight relationship (Taiwo 2010).

Geological Characters

It is a little headland 87 m high, extending towards the Arabian Sea, which is anything but difficult to recognize from the other geographic highlights of the drift on account of the pinkish shade of the Parh Limestone developments that portray the zone. Area status was set up on 30 June, 1954. Anticipated populace of the area assessed in 2014 was 504,000.

Target

In this study, the focus was on the dark pomfret, scientifically named *Parastromateus niger*, a carnivorous fish prevalent in South Asia. It predominantly inhabits the Indo-Pacific Ocean and the Atlantic region, known locally as "Poplet" in Sindh and "Pitho" in Balochistan, Pakistan (Khan *et al.*, 2012). The species additionally adds to the business fisheries of different nations flanking the Arabian Sea (Cleric, 2003).

Body Portrayal

The body of the investigation angle is firm, profound, oval, and along the side packed. The operculum is missing; and gill opening is lessened to a vertical opening in favor of the body. The pelvic blades are missing on the back side of the fish.

Distribution

It is appropriated from over the Persian Gulf and Oman Sea, in tropical, sub-tropical and mild oceans of the world, Indo Pacific Ocean, china and Malay Archipelago (Yadollahv *et al.*, 2014).

Migration

The fishery of *Parastromateus niger* is influenced by its migratory behavior, often seen swimming in schools of 10-15 individuals on their sides. Typically caught using drift gill nets, they are poorly represented in bottom trawls.

This study aims to analyze the Length-Weight relationship (LWR) of silver and dark pomfret to understand population development. Specifically, it seeks to: Determine the Length-Weight relationship and Condition factor of black pomfret. Investigate the Food and Feeding habits of black pomfret, including Gut contents analysis, Feeding habits, and Seasonal variations in food consumption.

Materials and Methods

Study Area and Sample Size

The fish samples for the study were collected from Gaddani coastal area of Balochistan, Pakistan located some 50 km northwest of Karachi, in Lasbela district of Balochistan, Pakistan. The samples for the study were collected from the month of early March 2016 to the end of October of the same year. A total of 117

fish specimens of *Parastromateus niger* containing 46male samples and 71 females sample fish were randomly collected from the study area for the experiment.

Weight and Length of the Sample Fish

Each fish was dried with the help of a paper towel carefully. The samples were weighted on a portable digital balance having accuracy level of 0.5 g. The dried fish after weight analysis were measured with the help of measuring tray. The accuracy level and nearest point of the measuring tray was 0.1cm (Achakzai *et al.*, 2013).

The relationship between weight and length was analyzed by applying statistical tool of co-relation of the previously obtained data. The relationship of the length and weight were calculated through equation Log w = a + b Log L described by Le Cren.

Condition Factor (K)

Fulton's Condition factor was determined as per equation $K = \frac{W \times 10^5}{L^3}$ suggested by Froese (2006).

Gut and Gut Content Analysis

Gut analysis of black pomfret (*Parastromateus niger*) followed Hynes' (1950) frequency and occurrence method. The occurrence method expressed the presence of each food item as a percentage in gut contents, categorized into five levels: full (100%), three-quarter (75%), half (50%), quarter (25%), and (0%). The contents of the black pomfret gut were analyzed under microscope.

Statistical Analysis

Following Statistical analysis was applied on the present data, regression and correlation of coefficient and, two way ANOVA test at 95% of level of significance using statistical package for social sciences (SPSS) version 21.

Results

Male and Female Ratio

The male female ratio was 1: 1.54 between the collected samples from the coast of Gaddani, respectively. The female sexes were completely dominant in the samples collected as shown in **figure 1.**

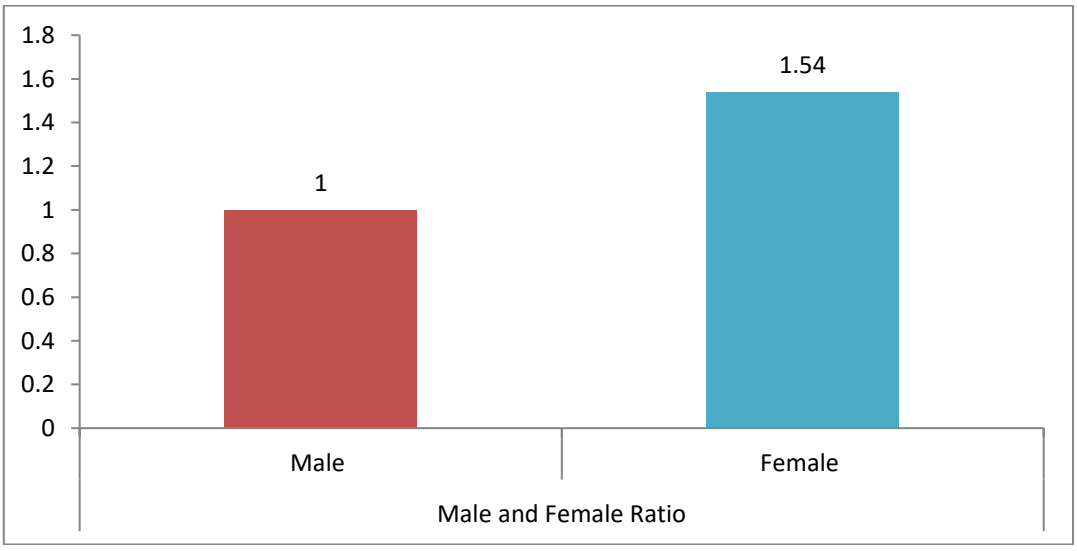

Figure 1: **Male and Female Ratio of Black Pomfret**

In **Table 1.1.,** length and weight ranges are provided for all three categories (Male (M), Female (F), and Combined (C)) of experimental groups. Length ranged from 13 cm to 43 cm across all categories, with the highest frequency observed between 23 and 25 cm. For weight, the minimum recorded was 62.65 g and the maximum was 515 g across all categories. In male samples, the mean length ranged from 14.43 cm to 33.07 cm, while in female samples it ranged from 14.5 cm to 42.3 cm. For combined samples, mean length ranged from 14.46 cm to 42.3 cm.

Table 1: Length-Weight Relationship Equations

Length groups	Males				Females			Combine		
	(cm)	*n*	Mean Length	Mean weight (g)	*n*	Mean Length	Mean weight (g)	*n*	Mean Length	Mean weight (g)
	13-16	4	14.65	64.775	2	14.5	62.65	6	14.6	64.0667
	16-19	5	16.9	86.98	8	17.4875	97.475	13	17.261	93.4385
	19-22	6	20.966	164.533	12	20.758	153.625	18	20.827	157.261
	22-25	11	23.99	237.855	19	23.794	239.463	30	23.866	238.873
	25-28	11	26.1818	303.673	13	26.353	303.908	24	26.275	303.8
	28-31	3	29.5667	364.567	9	28.6	355.444	12	29.437	363.375
	31-34				1	33.4	390.2	1	33.4	390.2
	34-37				2	35.78	413.78	2	35.3833	409.85
	37-40				2	38.85	478.05	2	38.85	478.05
	40-43				2	40.75	501.325	2	40.75	501.325

Table 2: Descriptive Statistics and Estimated Parameters of Length-Weight and Condition Factor (K)

Sex	N	Length Range (cm)	Weight Range (cm)	a	B	r2	K
M	46	13.9-35.2	58.6-408	-1.21	2.58	0.98	1.75
F	71	14.1-42.3	59.1-515	-0.45	2.0	0.91	1.48
C	117	39.9-42.3	58.6-515	-0.46	2.0	0.92	1.40

In **Table 2,** For male black pomfret, 46 samples were measured with lengths ranging from 13.9 cm to 35.2 cm and weights from 58.6 g to 408 g. Calculated "a" and "b" values were -1.2127 and 2.5881, respectively, resulting in an "r2" value of 0.985, indicating a strong positive correlation. For females, 71 samples had lengths from 14.1 cm to 42.3 cm and weights from 59.1 g to 515 g. Calculated "a" and "b" values were -0.4533 and 2.001, respectively, resulting in an "r2" value of 0.918. In combined samples (117), lengths ranged from 13.9 cm to 42.3 cm and weights from 58.6 g to 515 g. Calculated "a" and "b" values were -0.4616 and 2.005, respectively, with an "r2" value of 0.929.

Log Equation of Length and Weight Relationship

The length-weight equations were computed separately for male, female and combined population of *Parastromateus niger*. The equations for calculating the log values of the length weight relationship are given below.

Log W= – 1.2127 + 2.5881 Log L(Male population),

Log W= – 0.4533 +2001 Log L(Female population)

Log W= – 0.4616+2.005Log L(Combine population)

The length and weight relationship, assessed using log-transformed values, showed a nearly linear trend, with an "r2" correlation coefficient of 0.985, indicating a strong positive relationship in male *Parastromateus niger*. This suggests that as the weight or length of the sample increases, both length and weight increase. Negative allometric growth was observed across all categories: male, female, and combined populations.

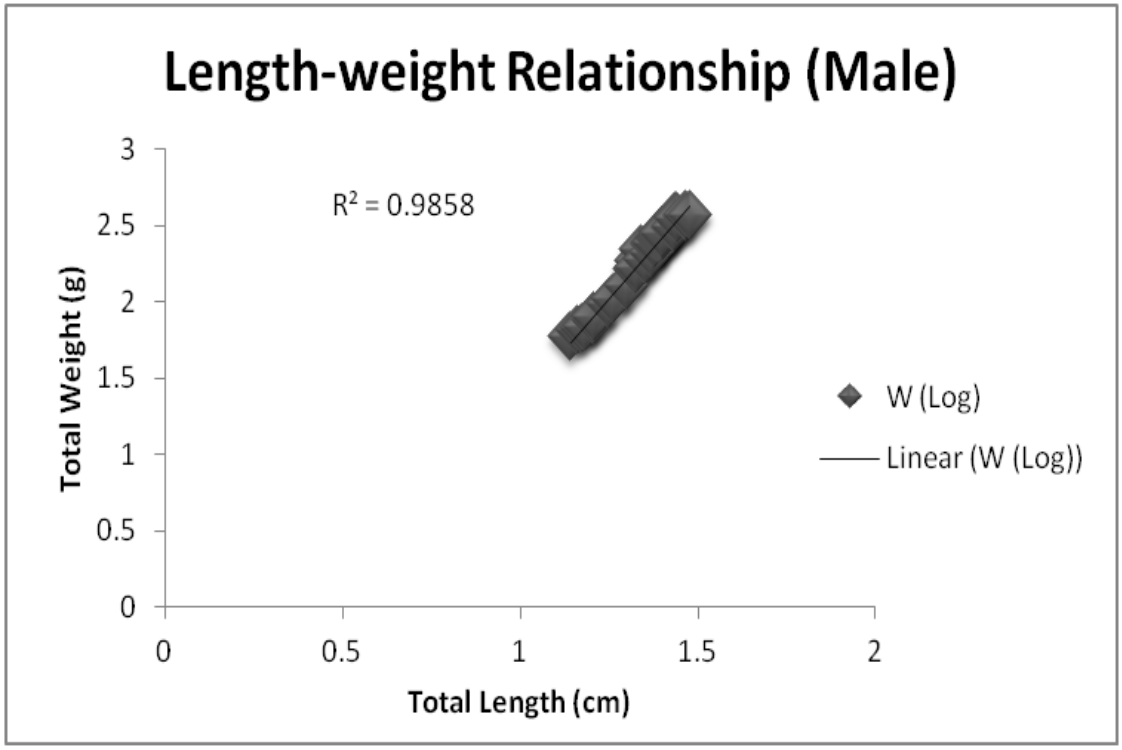

Figure 2: **Length- Weight Relationship in Black Pomfret (Male)**

Length-weight relationship, assessed using log-transformed values, showed a nearly straight graph. With an "r2" coefficient of correlation of 0.918, indicating a strong positive relationship in female *Parastromateus niger*, implying that as weight or length increases, both length and weight increase.

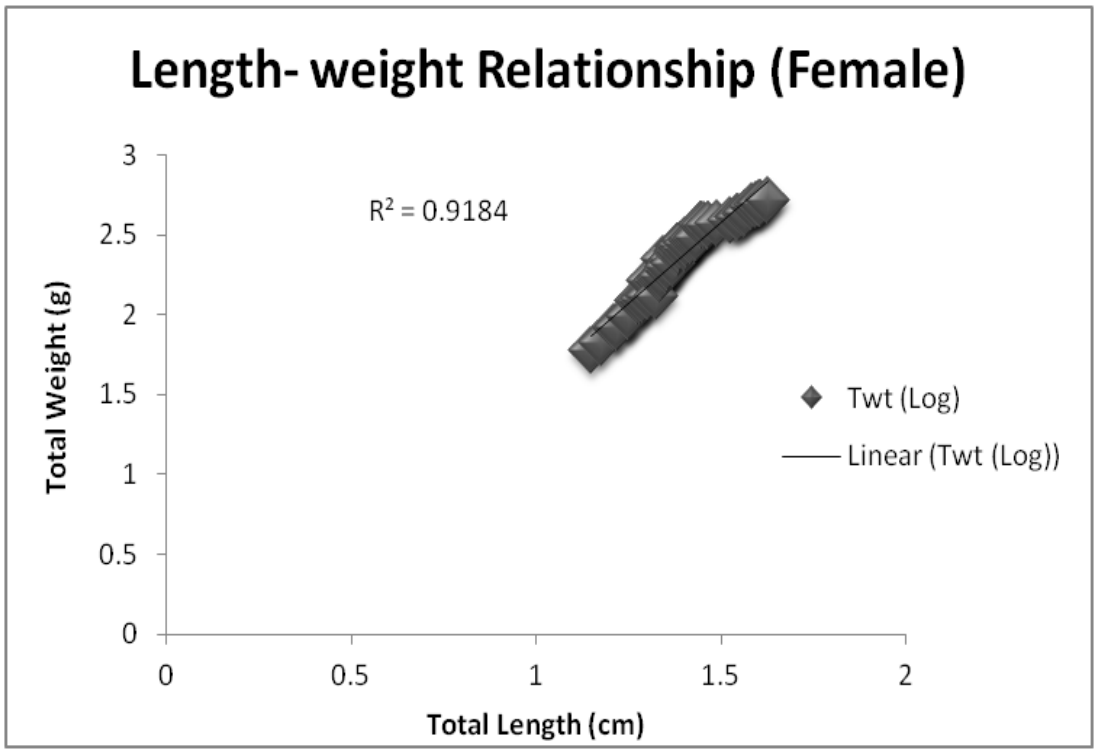

Figure 3: **Length- Weight Relationship in Black Pomfert (Female)**

Length-weight relationship, assessed using log-transformed values, showed a nearly straight graph. With an "r2" coefficient of correlation of 0.929, indicating a strong positive relationship in combined *Parastromateus niger*, implying that as weight or length increases, both length and weight increase.

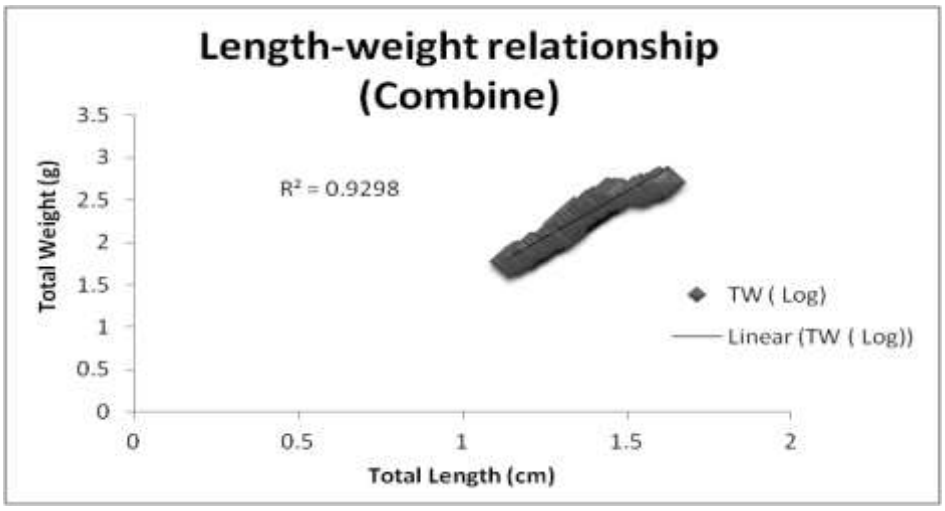

Figure 4: Length-Weight Relationship in Black Pomfert (Combine Population)

Condition Factor

The condition factor was calculated for male, female and combined sex was calculated separately as per Equation given by Fulton. The average value is 1.75 for male 1.48nfor female whereas 1.40 was for combined sexes

Gut Categories and Identification of Gut Contents

Guts fullness was categorized into five levels as full, three quarter, half, quarter and empty (100 %, 75 %, 50 % 25 %, 0 %, respectively). The gut contents were then placed in a Petri dish and identified under a binocular microscope (Nikon Eclipse E200, Japan) to the lowest possible taxon using identification keys (Wards and whipple, 1959; Lewmanomont*et al.,* 1995; Morse *et al.,* 1996; Pennak, 1989; Sangpradub and Boonsoong, 2006).

Gut Fullness and Gut Contents Analysis

Gut fullness of black pomfret was observed over eight months (March to October). The highest percentage, 60%, was noted in July, significantly higher than other months. Fullness ranged from 40% (March) to 60% (July), with variations observed across the study period. The stomach contents were analyzed under microscope, after dissection. The contents were categorized under four different names. The contents were zooplanktons, crustacean (prawn) scales, and semi digested food. Black pomfret is a carnivorous fish species. The highest contents analyzed were zooplankton. Monthly wise, July was the month with fullness of the gut.

Discussion

The length-weight relationship is crucial for marine fish species. For males, lengths ranged from 13.9cm to 35.2cm and weights from 58.6g to 408g. The correlation coefficient (r2) was 0.985, indicating a strong positive relationship. Female lengths ranged from 14.1cm to 42.3cm and weights from 59.1g to 515g, with an r2 of 0.918, also suggesting a positive relationship. 117 combined (male and female) black pomfret samples were analyzed for length-weight relationship. Lengths ranged from 13.9cm to 42.3cm, and weights ranged from 58.6g to 515g. The correlation coefficient (r2) was 0.929, indicating a positive relationship between length and weight. Studies by Dadzai *et al*. (2008), in Kuwaiti waters showed a positive allometric growth in black pomfret, with a strong correlation between length and weight. (Shabir *et al*. 2012) found similar results in silver pomfret, with an R2 value of 0.96 indicating a strong relationship. Shah *et al*. (2013) also observed a strong positive correlation (R2 = 0.9968) in rainbow trout. *Thaila catlacatla* exhibited a direct proportional growth to the cube of its length (Zafar *et al.,* 2003). (Dutta *et al.,* 2012) studied four species, showing strong positive correlations between length and weight. Similarly, (Kzamei *et al*. 2013) and (Sedaghat *et al*. 2013) found strong positive correlations in Cyprinus carpio.

The study revealed peak gut fullness of black pomfret during July and August, possibly linked to breeding activity (Van *et al.,* 2015; Shah *et al.,* 2011). This pattern mirrors observations in other species like silver pomfret (Abdurahiman *et al.,* 2006) and Olive barb (Hossain *et al.,* 2012), highlighting increased nutritional

needs during breeding months. Understanding feeding behavior in relation to reproductive cycles is crucial for fisheries management (Van *et al.*, 2015).
Stomach content analysis of black pomfret revealed predominance of zooplankton, indicative of its carnivorous diet. Similar studies on silver pomfret (Abdurahiman *et al.*, 2006) and omnivorous fish like *Cyprinus carpio* (Gul *et al.*, 2010) showed varying dietary compositions. This underscores the importance of understanding feeding habits for effective fisheries management (Hossain *et al.*, 2012; Mondol *et al.*, 2013).

Conclusion

The important factors of black pomfret fish such as the female-dominated sex ratio, length-weight relationship, gut fullness, stomach content analysis and sustainable culturing techniques are crucial for its survival, market demand, breeding activity, feeding habitat, and conservation, respectively, in coastal area of Balochistan, Pakistan.

Suggestions

Future research on black pomfret should focus on understanding the strong relationship in the length-weight equation and the causes of negative allometric growth in males. Investigating seasonal feeding dynamics and nutritional requirements can offer insights into habitat suitability. Collaboration among researchers, policymakers, and industry stakeholders is key for effective management and conservation. Strict enforcement of regulatory laws, especially during breeding seasons, is essential for long-term fishery viability.

Declaration

Data Availability Statement
All data generated or analyzed during the study are included in the manuscript.

Ethics Approval and Consent to Participate
Approved by concerned department.

Consent for Publication
The study was approved by authors.

Funding Statement
Not applicable

Conflict of Interest
There is no conflict of interest among the authors regarding this study.

Authors Contribution
Zahoor Ahmed Khetran
Conceptualized the research idea, performed the research and wrote the thesis and paper.
Sher Ahmed
Assisted in conceptualizing the research idea and drafting the paper.
Javed Ahmed Abro and Abid Hussain
Assisted in data analysis.
Zaheer Ahmed and Muhammad Yaqoob
Assisted in data collection.

References

1. Clark, F.N. (1934). Maturity of the California Sardine (*Sardinella caerulea*), determined by ova diameter measurement. Fish. Bull. Sacramento, 42: 1-49.
2. Das, S.K. and S.K. Moitra (1955). Studies on the feeding of some commercial fish of Uttar Pardesh, India. The surface feeder, the mid feeder and the bottom feeder, *Proc.Nat. Acad. Sci. India* 25B (1&2):1-6.

3. Dixit, R. K. (1960). Proc. nat. Acad. Sci. India,. 1959. *J. zool. Soc. India*. 30, 241-245
4. Dobriyal, A.K., Kumar, N., Bahuguna, A.K. and Singh, H.R. 2000. Breeding ecology of some cold water minor carps from Garhwal Himalayas, 177-186.
5. Doha, S. and Hye, M.A.(1970). Fecundity of the Padma river *Hilsa ilisha*(Ham.). *Pak. J. Sci.*, 22: 176-183.
6. Eklöv P, Persson L (1995) Species-specific antipredator capacities and prey refuges: interactions between piscivorous perch (*Percafluviatilis*) and juvenile roach (*Rutilusrutilus*). *BehavEcolSociobiol* 37:169–178.
7. Etnier, D. A. (1971). Food of three species of sunfish (*Lepomis*, Centrarchidae) and their hybrids in three Minnesota lakes.*Trans. Am. Fish. Soc.* 100, 124-128.
8. Fernandes, M. N., Rantin, F. T., Kalinin, A. L. and Moron, S. E (1994). Comparative study of gill dimensions of 3 Erythrinid species in relation to their respiratory function. *Can. J. Zool*. 72, 160-165.
9. Fraser, D. F., and J. F. Gilliam. (1992). Nonlethal impacts of predator invasion: facultative suppression of growth and fecundity. Ecology 73:959-970.
10. Frost, W**.** E**.** & Went, A**.** E. J. 1940. River Liffey survey. 111**.** The growth and food of young salmon. *Proc. R. Ir. Acad.* 46B, 53-80.
11. Achakzai,W.M., Saddozai.S, Baloch,W.A.,Memon.N. (2013). Length-weight relationships and condition factor of Oreochromis mossambicus(peters, 1852) from Manchar Lake Distt. Jamshoro, Sindh, Pakistan. *Sindh Univ. Res. Jour. (Sci. Ser.)*, 45(2), 201-206.
12. Çetinkaya.S , Yegen .V, Bilgin.F, Uysal.R and Bostan.H. (2015).Variations of some Growth Characteristics and Length-Length relationships of Sakarya Bleak (Alburnus esherichii Steindachner, 1897) in Different Habitats. *LimnoFish*, 1(1), 29-35.
13. Daliri.M, Paighambari,S.Y,Shabani,M.J and Davoodi.R. (2012). Length - weight relationship and condition of five marine fish species collected by shrimp trawls in Bushehr coastal waters, Northern Persian Gulf. *Afr. J. Agric. Res*, 7(28).
14. Froese R. (2006). Cube law, Condition factorand Weight-length relationship: history, meta-analysis and recommendations. Journal of Applied Ichthyology 22: 241-253.
15. He, J. X., Bence,J.R,Johnson,J.E, Clapp,D.Fand Ebener,M.P. (2008).Modeling Variation in Mass-Length Relations and Condition Indices of Lake Trout and Chinook Salmon in Lake Huron: A Hierarchical Bayesian Approach.***Trans. Am. Fish. Soc.***,137(3), 801-817.
16. Jones,R.E , Petrell, R. J., Pauly.D. (1999).Using modified length-weight relationships to assess the condition of fish. *Aquacultural Engineering* **,** 20, 261-176.
17. Kahraman, A.E, Göktürk .D and Aydin.E. (2014). Length-Weight relationships of Five Fish Species from Sakarya River , Turkey. *ARRB* ,4(15), 2476-2483.
18. Kazemi,S.H, Paighambari.S.Y, Daliri.M and Naderi,R.A. (2013). Length-Weight and length-length relationships, condition factors and optimal length of some fish species from the Persian Gulf and Oman Sea.***IJAB***, 1(4), 167-174.
19. Mert. R, Bulut.S, Solak.K.(2008). Some Biological Characteristics Of Cyprinus Carpio (L.,1758) Inhabiting Apa Dam Lake (Konya-Turkey).*AKU Fen Bilmleri Dergisi*,02, 47-60.
20. Naeem.M, Salam.A, Ishtiaq.A and Shafique.S. (2010). Length-Weight And Condition Factor Relationship Of Farmed Hybrid (Catla catla X Labeo rohita) From Multan, Pakistan. *Sindh Univ. Res. Jour. (Sci. Ser.)*, 42(2), 35-38.
21. Negi,R.K and Maurya.A. (2015). Length-Weight relationship and Condition Factor of Labeo rohita and Hypophphalmichthys molitrix. *RJPBCS* , 6(2), 1506.
22. Negi,R.K. (2013). Length-Weight Relationship AndCondition Factor Of Labeo rohita From Bhagwanpur Fish Pond Roorkee Uttarkhand, India. *Biolife*, 1(41), 70-171.
23. Nehemia. A , Maganira,J.D andRumisha.C. (2012). Length-Weight relationship and condition factor of tilapia species grown in marine and fresh water ponds.*Agric. Biol. J. N. Am.*, 3(3), 117-124.
24. Prasad.U, Satanand.P, Prasad,P.D, Amitabh.P.(2012). Length-Weight Relationship And Condition factor of Labeo rohita in Govindgarh Lake,Rewa(M.P). PIJR, 1, 2250-1991.
25. Rasool.F, Qureshi,N.A, Parveen.S, Saddique.M, Hameed.A, Khan.N and Iqbal,K.J. (2013). Morphometric Parameters Based Study of the Hatchery Raised and Natural Populations of Labeo rohita. *Pakistan J. Zool.*, 45(4), 903-907**.**
26. Renjini P. K. and Bijoy Nandan S. (2011). Length-Weight Relationship, condition Factor and morphometry of gold spot mullet Liza parsia(Hamilton, 1822) from Cochin estuary. *INDIAN J.MAR.SCI.*, 40(4), 567-571.

27. Sedaghat, S., Hoseini,S. A, Larijani .M and Ranjbar, K.S .(2013).Age and Growth of Common Carp(Cyprinus carpio Linnaeus, 1758) in Southern Caspian Sea, Iran. *World J. Fish & Marine Sci*, 5(1), 71-73.
28. Shakir,H.A,Qazi,J.I, Hussain.A and Ali.S. (2010). Growth Coefficient And Condition Factor Of Three Carp species Reared Under SemiI-Intensive Culture, *Punjab Univ. J. Zool.*, 25(1-2), 13-20.
29. Siyal.F.K and Amir.S.A. (2012). Length-Weight Relationship and relative Condition Factor (Kn) oF Silver Pomfret, Pampus argenteus in Pakistani Waters. *J.Fish. Soc. Taiwan,* 39(2), 83-90.
30. Taiwo, O. P. (2010). Length Frequencey Distribution And Length Weight Relationship Of Schilbe mystus From Lekki Lagoon In Lagos, Nigeria***.JAVS***, 2. 144-151.
31. Tao.Y, Mingru. C.,Jianguo.D, Zhenbin.L,and Shengyu.Y. (2012). Age and growth changes and population dynamics of the black pomfret (parastromateus niger) and the frigate tuna (Auxis thazard), in Taiwan Strait.*Lat. Am. J. Aquat. Res*, 40(3), 649-656.
32. Ujjania,N.C., Kohli, M. P. S. and Sharma,L.L. (2012). Length-Weight relationship and Condition Factors of Indian Major Carps (C. catla, L.rohita and C. mrigala) in Mahi Bajaj Sagar, India. *Reseacrh journal of Biology* , 02, 30-36.
33. Yadollahv.R and Rahnama.B. (2014). The Age determination of black pomfret (Parastromateus niger), based on Otolith Cross sections in Iranian Coast of Oman Sea.*J Aquac Res Development,* 5. 110-121.
34. T. E. sivaprakasam.,Obesrvatioon the food and feeding habits of *parastromateus niger*(bloch) of the saurashtra coast (Central Marine Fisheries Research Institute). 1(2): 134-144.