Research Article

Assessment of Fish Biodiversity in Sonmiani Bay, Balochistan, Pakistan (North Arabian Sea)

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Abstract | The current study aimed to evaluate fish biodiversity from Sonmiani Bay of Balochistan, Pakistan during January to December 2019. Total 36 families, 68 genus and 91 species were recorded from this research work. Out of which, 4 species were reported as dominant species namely *Liza subviridis* (24.88%; TL 1.8-35.0±0.2 cm), *Sardinella longicep* (15.83%;2.8-20.4±0.3 cm), *Sillago sihama* (9.04%; TL 3.5-20.3±0.4 cm) and *Acanthopagrus berda* (7.99%; TL 1.47-28.5± 0.5 cm). The Simpson's biodiversity index (1-D=0.223) shows that the Sonmiani water noted as low in terms of fish diversity, growth and propagation. Length-weight relationship of four dominant species was calculated as follows. *Liza subviridis*: Log a -0.23+2.20, *Sardinella longicep*: Log a -0.78+2.92. *Silago sihama*: Log a -0.70+2.20, *Acanthopagrus berda*: Log a -0.5+2.12. It was noted that from the equation above that *Sardinella longicep* were found in ideal condition in comparison to the other three dominant species, *Liza subviridis*, *Silago sihama*, *Acanthopagrus berda*. Since the area investigated is nearly free of pollution as compared to Karachi and Sindh coast. Therefore, there is need for the development of fish culture in Sonmiani to fill gape, increase food resources and income generation of the local people.

Introduction

Fish possess a significant part for the food in large populations of under developed regions and solely source of cheap animal protein (Kullachi *et al.*, 2014). It contains reasonable amount of protein as required by ordinary human. The existing estimate suggests that about one billion people around the globe greatly depend on fish as primary animal protein source. It is medically as well as economically nutritious. Variety of fish available that is full with fatty acids omega-3 (Khan *et al.*, 2017). In addition, Hashim *et al.* (2016)

suggested that aquatic biota especially fauna of different fish species possess great importance in the aquatic ecosystem in a variety of ways like status, composition and provide basis for the sustainable management of the aquatic systems. Fauna refers as diversity of specimen dependent on environment and factors. Pakistan referred as the most prospective states possess diversity and number of fauna in fish specimen by them freshwater specimen termed as useful to examine factors influencing the structure of fish community (Dastagir *et al.*, 2014). The analysis of weight versus length exhibited strong correlation in modern aquaculture practices to convert length in to weight and one way to other (Jamali *et al.*, 2018). It frequently used as mathematically as well as empirically to determine the growth pattern in different fish stocks from the same environment. It helps to calculate fish population dynamics, to estimate relative condition or well- being of the fish either isometric or allometric and to know the correlation between two variables Baloch *et al.* (2019). According to Narejo *et al.* (2003) the association between weight and length helps to determine population structure, ecological, physiological state and longevity of the aquatic animals. There is paucity of published information on the fish diversity of Sonmiani Bay from Balochistan. So, the present assessment on fish diversity was undertaken to supply baseline information about the status and fish potential of the bay.

Materials and Methods

Samples of various kinds of fish, about 884 species, were obtained indiscriminately from four stations (1) Safe dora (St, 1), (2) Maroli dora (St.2), (3) Bad kasha (St.3), (4) Bhera (St. 4) of Sonmiani Bay and its adjoining areas in District Labella. The fish samples were procured from local fisherman on monthly basis during January –December 2019.Caught through gill net. Then samples were fixed with 5% formaldehyde and transported to Freshwater Biology and Fisheries Department for identification and confirmation. The identification of fish was done by using different keys to recognize up to species level as recommended by various authors (Talwar and Jhingran, 1991; Mirza and Sandhu, 2007). According to above mentioned keys each fish was identified on the basis of size shape of the body, color pattern, fin structure and different marks and spots on the surface of the body. Then each sample was placed in a separate labeled

plastic jar. The experimental fish was tested for the association of length versus its weight. The procured sample from experimental locality was fixed with 10% formaldehyde in disposable bags. Below given equation recommended by LeCren (1951) was used to determine the analysis of LWR for the experimental fish.

$$W = a\,L^b \ or Log a + b\,Log\,L$$

Results and Discussion

Fish diversity
In current study, the fish biodiversity calculates from Sonmiani Bay of Balochistan, Pakistan during January to May 2019. 36 families, 68 genus and 91 species were recorded from this work. A total of 4 species were reported as dominant species namely *Liza subviridis* (24.88%), *Sardinella longicep* (15.837%), *Sillago sihama* (9.04%) and *Acanthopagrus berda* (7.99%) presented at (Table 1). The Simpson's biodiversity index (1-D= 0.223) shows that the Sonmiani water noted as low in terms of fish diversity, growth and propagation.

Table 1: *Fish biodiversity of Sonmiani bay from Balochistan.*

S. No.	Fish Species	Total (n*)	n-1	n (n-1)
1	*Sardinella longicep*	140	139	19460
2	*Drepan punctata*	22	21	462
3	*Coila dussumeiri*	12	11	132
4	*Liza subviridis*	222	221	49062
5	*Mugil cephalis*	35	34	1190
6	*Sillago sihama*	80	79	6320
7	*Acathanthopha-grus berda*	70	69	4830
8	*Acathanthopha-grus latus*	12	11	132
9	*Bolep thalamus*	12	11	132
Total		N** = 605 N-1 = 604 N (N-1) = 365420		Σn (n-1) = 81720 D*** = Σn (n-1)/ n (n-1) = 0.223 1-D = 0.777 1/D**** = 1.28

n: * number of species; N: **Total number of specimens; 1-D: *** Simpson's Biodiversity Index; 1/D: **** Simpson's reciprocal index.

Length–weight study
The length-weight analysis for four dominant fish species like *Acanthopagrus berda*, *Sillago sihama*, *Liza subviridis* and *Sardinella longiceps* from Sonmiani was enumerated, calculated and presented in (Table 2).

The length-weight equation of four dominant species of Sonmiani was calculated as below:

Liza subviridis: Log a -0.23 + 2.20 Log L
Sardinella longiceps: Log a -0.78 + 2.92 Log L
Sillago sihama: Log a -0.70 + 2.20 Log L
Acanthopagrus berda: Log a -0.54 + 2.12 Log L

Table 2: *Data on length and weight of four dominant fish species from Sonmiani.*

Length group (cm)	Acanthopagrus berda		Sillago sihama	
	M.T.L (cm)	M.T.W (g)	M.T.L (cm)	M.T.W (g)
0.1-2.0	1.47±0.3	1.7± 0.3	-----	-------
2.1-4.0	2.94± 0.4	1.2± 0.8	3.5± 0.9	2.5± 0.5
4.1-6.0	4.4± 0.6	1.6± 0.4	4.8± 0.2	0.8± 0.2
8.1-10.0	-----	------	9.1± 0.9	6.1± 1.0
10.1-12.0	15.2± 0.8	51.0± 1.0	5.6± 0.4	7.3± 0.7
12.1-14.0	12.5± 0.5	46.1± 1.0	12.6± 0.4	14.6± 0.4
14.1-16.0	14.8± 0.2	64.5± 0.5	14.7± 0.3	23.6± 0.4
16.1-18.0	16.9± 0.1	67.8± 0.2	16.7± 0.3	37.4± 0.6
18.1-20.0	19.3± 0.7	160.1± 0.9	19.5± 0.5	66.0± 1.0
20.1-22.0	20.5± 0.5	213.0± 1.0	20.3± 0.8	76.5± 1.5
22.1-24.0	22.5± 0.5	272.0± 1.0	------	------
24.1-26.0	26.0± 1.0	320.0± 1.0	-------	------
26.1-28.0	27.1± 0.9	325.0± 1.0	-------	------
28.1-30.0	28.5± 0.5	405.0± 1.0	-------	-------
	Liza subviridis		Sardinella longiceps	
0.1-2.0	1.8± 0.5	0.14± 0.6	-----	----
2.1-4.0	3.5± 0.5	0.24± 0.4	2.8± 0.2	0.7± 0.3
4.1-6.0	5.4± 0.6	2.39± 1.0	5.4± 0.6	2.3± 0.7
6.1-8.0	7.3± 0.7	4.49± 0.9	12.5± 0.5	4.8± 0.2
8.1-10.0	9.1± 0.9	8.90± 1.0	8.7± 0.3	8.6± 0.4
10.1-12.0	10.5± 0.5	13.95± 0.5	11.3± 0.7	16.8± 0.1
12.1-14.0	-----	---	12.0± 1.0	30.0± 1.0
14.1-16.0	15.3± 0.3	41.8± 0.2	15.1± 0.9	41.7± 0.3
16.1-18.0	17.0± 1.0	57.5± 0.5	17.1± 0.9	53.1± 0.9
18.1-20.0	18.9± 0.1	71.4± 0.6	18.7± 0.7	65.9± 0.1
20.1-22.0	21.0± 1.0	95.1± 0.9	20.4± 0.4	85.0± 1.0
24.1-26.0	25.1± 0.9	173. 2± 0.8	------	-----
26.1-28.0	-----	-------	-----	-------
28.1-30.0	29.5± 0.5	274.0± 1.0	-----	-------
30.1-32.0	30.4± 0.4	303± 1.0	------	-------
34.1-36.0	35.0± 1.0	334.0± 1.0	-----	-------

MTL: Mean Total Length (cm); MTW: Mean Total Weight (g).

As it turns out from the equations that the values of regression coefficient (b) found to be (2.92) very close to ideal positive allometric type of growth in case of *Sardinella longiceps* and other species were found to be satisfactory growth from Sonmiani (Table 2). For length-weight analysis it was concluded that the *Sardinella longicep* were found in ideal condition in comparison to the other three dominant species, *Liza subviridis*, *Silago sihama*, *Acanthopagrus berda* and other species.

The study was design to elucidate fish diversity in relation to aquatic biota in terms of fish diversity and length-weight analysis during January to December 2019 from Sonmiani, Balochistan, Pakistan. During the course of studies, 884 fish samples were analyzed with 36 families, 68 genus and 91 species. Out of which, 4 species were reported as dominant namely *Liza subviridis* (40.43%), *Sardinella longicep* (29.57%), *Sillago sihama* (15.0%) and *Acanthopagrus berda* (15.0%). The number and kinds of fish species available in any aquatic environment referred as its potential directly or indirectly related to biota (Hashim *et al.*, 2016). The change in aquatic ecosystems is greatly influenced by number of water quality parameters, especially sudden increase and decrease of temperature values. So, it is essential to monitor aquatic diversity regularly that intern benefits for human welfare and species composition (Díaz *et al.*, 2006). Various authors published information on the fish potential of different water bodies from Pakistan such as Navid *et al.* (2017) from River Etai; (Junaid and Rehman, 2017) from Nashpa dam Bahadur Khel; (Asmat *et al.*, 2014) from Dam Baran, Balochistan; (Rehman *et al.*, 2015) from Darmalak Dam, Kohat and (Hashim *et al.*, 2016) from Karez Sarawan, Balochistan and they commented that order cyprinformes (carps) found to be most dominant species during their investigations followed by channiformes, perciformes and siluriformes. The observations of the above authors support the finding of present studies. Similarly, Hashim *et al.* (2016) suggests that the conservation and richness is mainly significant, because habitat deprivation of waters remains to go faster world wid. The empirical models for predicting the abundance of numerous fish from wild environment in various geographical areas of the world could be developed. The Simpson's biodiversity index was calculated as (I-D= 0.223) showed that the environment of Sonmiani was found to be lower in terms of fish diversity, growth and propagation. Therefore, there is need to develop culture system for the rearing of commercial species that will fill the gap, increase food resources and income generation of local people. Many researchers

also found similar biodiversity index values from different aquatic environments (Boseto *et al.*, 2007; Hashim *et al.*, 2016). The observation of above authors is in accordance with the present findings. The low to moderate ichthyo fauna from various reservoirs also reported by Rehman *et al.* (2015) from Darmalak Dam, Kohat and (Amos and Linus, 2017) from Nijoboliyo Lake, Nigeria. The findings of these authors are in accordance with the present observation. According to Narejo *et al.* (2003), the association between weight and length helps to determine population structure, ecological, physiological state and longevity of the aquatic animals. Riedel *et al.* (2007) are of the view that the links among growth parameters like weight and length and for the determination of age, spawning activity, suitability of environment for the rearing of fish species. The length-weight relationship of four dominant species were taken in to account and resulted as *Liza subviridis* (b= 2.20), *Sardinella longicep* (b= 2.92), *Sillago sihama* (b= 2.20) and *Acanthopagrus berda* exhibited (b= 2.12) out of four experimental fish *S. longicep* showed regression analysis close to ideal 3 and termed as positive allometric types of growth rest of the fish exhibited negative allometric growth pattern. Mastoi *et al.* (2005) suggested that the analyses of L/W are useful not only as tool to determine the growth pattern but also serve as basis for the categorization of aquatic environment where fish population live. The degree of well-being or co-efficient of condition in fish possess great importance for the analysis of environmental factors, nutritional position and physiological effect on the growth Naeem *et al.* (2015). Number of scientists has reported negative allometric growth in different fish species Narejo *et al.* (2002) in *Monopterus cuchia*, Mastoi *et al.* (2005) in *Labeo calbasu*, Dars *et al.* (2010) in *Labeo gonius*, Laghari *et al.* (2011) in *Tilapia niloticus*, Dastagir *et al.* (2014) in *Schizothorex* sp., Baloch *et al.* (2019) in *Liza subviridis* and *Acanthopagrus berda*, Vohra *et al.* (2021) from Kori Lake, the results of above workers are in agreement with the present analysis. LeCren (1951) the length-weight relationship and its regression coefficient b values in fish usually lies in between 2 to 4. In the present study the regression values of *Sardinella longicep* (b= 2.92) and *Sillago sihama* (b= 2.20) were found to be within the range as suggested.

Conclusions and Recommendations

The present survey was conducted on fish biodiversity from Sonmiani Bay of Balochistan from January to December 2019. A total of 36 families, 68 genus and 91 species were recorded from this work. Out of which 4 species were reported as dominant species namely *Liza subviridis* (24.88%), *Sardinellalongicep* (15.83%), *Sillagosihama* (9.04%) and *Acanthopagrusberda* (7.99%). Statistical analysis showed that *Sardinellalongicep* were found in ideal condition in comparison to the other three dominant species, *Liza subviridis*, *Silago sihama*, *Acanthopagrusberda*. Therefore, there is a need for the development of fish culture in Sonmiani to fill the gape, and increase food resources and income generation of local people.

Acknowledgments

Novelty Statement

Sardinellalongicep were found in ideal condition in comparison to the other three dominant species, *Liza subviridis*, *Silago sihama*, *Acanthopagrusberda*.

Author's Contribution

Nasratullah Baloch: Performed the experiment and prepared initial draft of the manuscript.
Naeem Tariq Narejo: Designed and conceived the idea of this experiment.
HamidaNarejo: Helped in checking of data.
Muhammad Farooq Hassan: Data analysis.
Muhammad Hanif Chandio: Helped in literature and data acquisition.
Faheem Saddar and Dharti Shahnawaz Thebo: Collected fish and eggs samples for the research.
Ghulam Abbas and Shahnaz Rashid: Helped in the relevant literature and assisted in formatting setting.
Majida Parveen Narejo: Conducted research and analysis of the sampled fishes.

Conflict of interest
The authors have declared no conflict of interest.

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