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DEFORMITIES IN SOME FRESH WATER FISH OF RIVER TAWI IN JAMMU (J&K)

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ABSTRACT
In the present study five abnormal specimens of five different species of fish were noticed in collection made from River Tawi which included *Barilius bendelisis, Cirrhinus mrigala, Puntius sarana, Tor putitora,* and *Heteropneustes fossilis*. The deformities in these fish were studied through radiographic examinations. The major deformities observed in these species include truncated body, abnormal body height and disposition of fins. All these deformities in the collected fish specimens are probably due to some injury, developmental error and disease.

INTRODUCTION

The pollution of major Indian rivers has gone so high that in spite of best efforts made by government and other agencies, there is no improvement observed in water quality. Increasing pollution load caused by irrigation, industries, thermal power plants, sewage discharge and indirect sources such as atmospheric pollutants, is ultimately faced by the biological communities inhabiting lotic and lentic water bodies. Among aquatic organisms, fish is the most important and is eaten worldwide. It is considered as a rich source of protein, vitamins, minerals, carbohydrates and fats. The economy of some coastal countries largely depends on fishing industry. Pollutants in various water bodies may cause direct mortality and even extinction or may induce anomalies through change in the chromosomal structure of the cell in fish and other aquatic organisms. This pollution may cause direct mortality of aquatic organisms inhabiting the water body. Some pollutants may even reach higher trophic level through biomagnification. In certain cases, abnormalities are such that it is very difficult to identify them correctly and this leads to creation of new Taxa (Devadoss, 1983). Day (1878) has given a description of malformed specimen of *Gymnura poecilura* and *Ceratoptera cherenbergi* which is a typical example of this type of anomaly.

Much of the research work has been carried out across the globe over study of anomalies in different fish species. Predominantly, it includes the work of Boglione *et al*. (2013) on reared European ûsh larvae and juveniles, Prestinicola *et al*. (2013) on Gilthead Seabream (Sparus aurata L., 1758) Juveniles and Boglione *et al*. (2014) on Rainbow Trout (Oncorhynchus mykiss, Walbaum 1792).

Jammu and Kashmir state support a very rich and diverse fish fauna of oriental and paleartic origin, due to variable ecological characteristics of lotic and lentic water bodies. Valenciennes (1840, 1842), Day (1876, 1878), Silas (1960), Das and Subla (1963, 1964) have studied fish fauna of Kashmir and reported about 45 fish specimen inhabiting Kashmir water bodies.

From Jammu province, 114 fish species have been reported by Das and Nath (1966, 1971), Jyoti and Gupta (1978), Malhotra *et al*. (1975, 1980), Guglani (2000).

Various records of fish teratology of commercially important fresh water fishes like *Catla catla, Cirhinus mrigla* and *Labeo rohita* inhabiting lotic and lentic water bodies of Jammu province are provided by Chowdhary *et al*. (1975), Dutta and Malhotra (1984), Dutta and Kour (1998), Gulgani (2000) and Dutta *et al*. (1995 a, 1997, 1999, 2002 b, 2003, 2005 and 2006), Gupta *et al*. (2002), Verma (1998), Bala (1999), Sharma (1999), Khan (2001) and Trishla (2001).

As far as fish teratology of Kashmir fish is concerned, except for reports by Dutta *et al*. (1995 and 1999), Ara (2002), there is no record available on this aspect of fish biology.

During the icthyofaunitic survey of various lotic and lentic water bodies of Jammu, some deformed specimens of commercially important food fishes were seen in collection made from River Tawi and have been described to add to the existing knowledge of fish teratology from this subtropical part of country.

MATERIALS AND METHODS

Study area

Jammu and Kashmir, the crown of India, lies in the north western side of India, located between 32°15// to 37°05// North latitude and 73°26// and 80°30// East longitude. Jammu city is drained by River Tawi which is also considered sacred and holy and is also locally known as "Surya-Putri". Tawi river transverses through and divides Jammu city in two parts. The old Jammu town is located on the hill overlooking river Tawi. The new town is across the river. Tawi river is a major source of drinking water for the old city. Untreated sewage in Jammu pollutes Tawi river as it passes through the city. Tawi River originates from the lapse of Kali Kundi glacier and adjoining area southwest of Bhadarwah in Doda District. Its catchment is delineated by latitude 32°35'-33°5'N and longitude 74°35'-75°45'E. The catchment area of the river up to Indian border (Jammu) is 2168 km² and falls in the districts of Jammu, Udhampur and a small part of Doda. Elevation in the catchment varies between 400 and 4000 m. The length of Tawi River is about 141 km (88 mi). The river in general flows through steep hills on either side excepting the lower reach for about 35 km (22 mi). The river is about 300 m (980 ft) wide at the bridge in Jammu city. After transversing Jammu city, the river crosses into Pakistan's Punjab and joins Chenab River. Tawi is a major left bank tributary of river Chenab.

Methodology

Morphological examination

Fresh fish specimens were examined grossly for morphological abnormalities. Notable morphological deformities were photographed with Digital Camera and fish was preserved in 10% neutral buffered formalin.

Morphometric examination

A total of 27 morphometric measurements were recorded for each Fish (Table 1).

Radiological examination

These deformed specimens were examined by radiography using Fuji Green Base Film with SOFTEX CMB-2 at 10 milliamps and 50kv for 0.25 sec. For comparison, normal fish specimen was also radiographed.

RESULTS AND DISCUSSION

In the present study five deformed fish specimens belonging to order Cypriniformes (*Barilius bendelisis, Cirrhinus mrigala, Puntius sarana* and *Tor putitora*) and Siluriformes (*Heteropneustes fossilis*) were netted from lotic water of Jammu and have been described.

***Barrilus bendelisis* (Ham. Buch)**

Figs. 1a and 1b represent photograph and X-Ray photo of normal specimen of *Barrilus bendelisis* respectively. An abnormal specimen of the fish was netted from River Tawi, Jammu. It was recognized by a bulge in the throat region. X-Ray examination shows a break in the lower jaw causing bulging on the ventral side of the head region. This aberration appears to be the result of some injury.

***Cirrhinus mrigala* (Ham. Buch)**

Table 1: Comparison of morphological features of abnormal and normal specimen different specimen

S. No.	Characteristic feature (all values in cm)	*Barilius bendelisis*		*Cirrhinus mrigala*		*Puntius sarana*		*Tor putitora*		*Heteropneu-stes fossilis*	
		A	N	A	N	A	N	A	N	A	N
1.	Head length in total body length	4.84	5.08	4.80	5.90	4.75	5.16	4.57	3.42	6.78	6.16
2.	Head length in standard body length	4.11	4.28	4.07	4.70	3.43	4.16	3.87	3.11	6.39	5.56
3.	Eye diameter in head length	6.50	6.25	4.80	6.20	4.57	6.20	4.42	4.5	7.0	8.33
4.	Head height in head length	1.23	1.13	1.57	1.10	1.18	1.06	1.55	1.5	1.82	1.92
5.	Pre-ocular length in head length	3.71	3.12	4.20	4.00	3.20	3.87	2.81	3.0	4.0	2.77
6.	Post-ocular length in head length	2.60	2.77	-	-	1.88	1.82	2.21	2.45	1.75	1.92
7.	Body height in total body length	4.66	4.70	3.44	5.20	2.53	3.72	5.8	3.11	5.93	5.31
8.	Body height in standard body length	3.96	3.96	2.92	4.40	1.83	3.02	4.8	2.47	5.59	4.79
9.	Pre-dorsal length in total body length	2.03	2.04	2.48	2.80	2.53	2.90	2.5	2.52	3.45	3.34
10.	Pre-dorsal length in standard body length	1.72	1.72	2.10	2.40	1.83	2.36	2.06	2.0	3.25	3.02
11.	Post dorsal length in total body length	3.70	4.23	4.04	2.10	1.97	2.05	3.22	3.65	1.55	1.71
12.	Post dorsal length in standard body length	3.14	3.56	3.42	1.80	1.42	1.66	2.66	2.89	1.46	1.54
13.	Pre-anal length in total body length	1.80	1.73	1.44	1.60	2.02	1.86	1.70	1.70	2.62	2.75
14.	Pre-anal length in standard body length	1.52	1.46	1.22	1.30	1.46	1.54	1.41	1.35	2.52	2.48
15.	Post anal length in total body length	3.60	3.52	5.50	3.30	2.33	2.31	4.83	4.41	1.72	1.77
16.	Post anal length in standard body length	3.05	2.97	4.67	2.90	1.69	1.88	4.0	3.5	1.62	1.59
17.	Height of caudal peduncle in standard length	10.6	9.72	8.29	9.00	5.50	7.62	10.0	7.0	7.92	11.5
18.	Length of dorsal fin in total length	5.70	6.04	4.88	5.30	5.06	5.33	4.83	4.24	10.5	9.62
19.	Length of dorsal fin in standard length	4.86	5.09	4.14	4.50	3.66	4.33	4.0	3.36	9.94	8.68
20.	Length of pectoral fin in total length	5.47	6.04	5.50	4.10	5.24	6.40	7.25	5.3	11.2	9.05
21.	Length of pectoral fin in standard length	4.65	5.09	4.67	3.50	3.79	4.20	6.0	4.2	10.0	12.8
22.	Length of pelvic fin in total length	7.87	7.76	6.18	6.90	6.08	7.69	7.25	7.06	9.42	11.6
23.	Length of pelvic fin in standard length	6.68	8.23	5.24	5.90	4.40	6.19	6.0	5.6	12.6	14.0
24.	Length of anal fin in total length	5.72	5.08	5.41	6.50	8.44	9.14	8.52	8.15	12.6	14.0
25.	Length of anal fin in standard length	4.68	4.28	4.58	5.50	6.11	7.64	7.05	6.46	11.9	12.6
26.	Length of caudal fin in total length	5.04	6.35	4.61	4.80	3.61	5.33	4.53	4.81	17.2	10.2
27.	Length of caudal fin in standard length	4.28	5.35	4.75	4.10	2.61	4.33	3.75	3.81	16.2	9.26

A = Abnormal (deformed specimen) ; N = Normal specimen

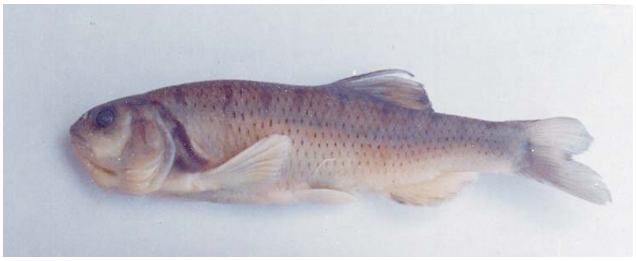

Figure 1a: Normal specimen of *Barrilus bendelisis*

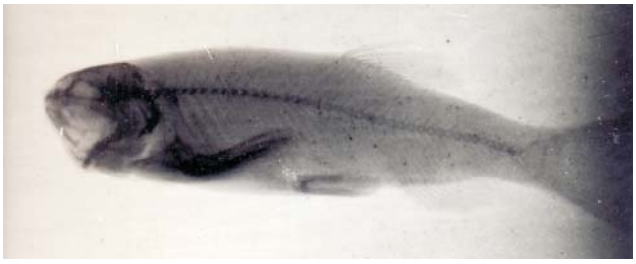

Figure 1b: X-Ray photograph of normal *Barrilus bendelisis*

Figure 1c: Abnormal specimen of *Barrilus bendelisis*

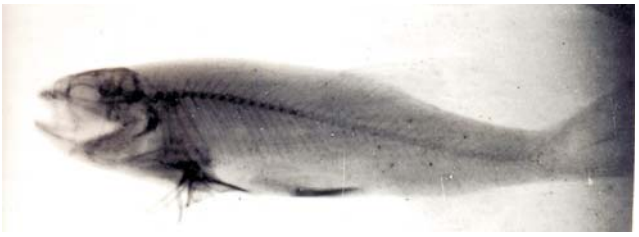

Figure 1d: X-Ray photograph of abnormal specimen of *Barrilus bendelisis*

Figure 2a: Normal specimen of *Cirrhinus mrigala*

Figure 2b: X-Ray photograph of normal specimen of *Cirrhinus mrigala*

Figure 2c: Abnormal specimen of *Cirrhinus mrigala*

Figure 2d: X-Ray photograph of abnormal specimen of *Cirrhinus mrigala*

Figure 3a: Normal specimen of *Puntiussarana*

Figure 3b: X-Ray photograph of normal specimen of *Puntius sarana*

Figure 3c: Abnormal specimen of *Puntius sarana*

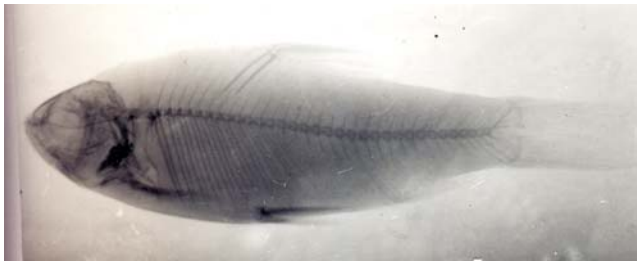

Figure 3d: X-Ray photograph of abnormal specimen of *Puntius sarana*

Figure 4a: Normal specimen of *Tor putitora*

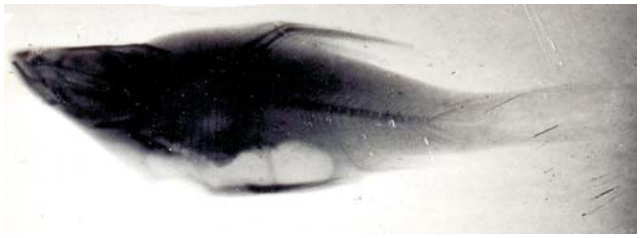

Figure 4b: X-Ray photograph of normal specimen of *Tor putitora*

Figure 4c: Abnormal specimen of *Tor putitora*

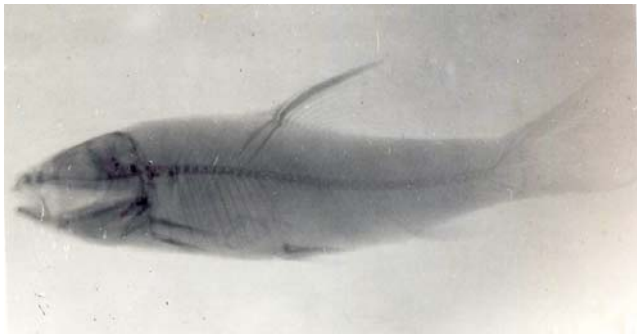

Figure 4d: X-Ray photograph of abnormal specimen of *Tor putitora*

Figure 5a: Normal specimen of *Heteropneustes fossilis*

Figure 5b: X-Ray photograph of normal specimen of *Heteropneustes fossilis*

Figure 5c: Abnormal specimen of *Heteropneustes fossilis*

Figure 5d:X-Ray photograph of abnormal specimen of *Heteropneustes fossilis*

Figs. 2a and 2b represent photograph and X-Ray photo of normal specimen of *Cirrhinus mrigala* respectively. A single specimen of the fish was netted from River Tawi, Jammu and was recognized by the truncated body, globular body shape, abnormal body height, disposition of fins and shorted overlapping scales in the caudal region. An X-Ray analysis revealed that truncated body and disposition of fin is caused by vertebral fusion, reduced thickness and inter-vertebral space. Neutral and haemal spines in aberrant fish are irregular and wavy. This aberration appears to be due to developmental error.

***Puntius sarana* (Ham. Buch)**

Figs. 3a and 3b represent photograph and X-Ray photo of normal specimen of *Puntius sarana* respectively. A specimen of the fish netted from River Tawi, Jammu was recognized from its truncated body, abnormal body height, disposition of fins, reduced scales in caudal region. An X-Ray analysis revealed that truncated body is due to vertebral fusion in 5th and 6th vertebrae and from 24th and 25th vertebrae. In aberrant fish, neutral and haemal spines were bifurcated and wavy. This aberration appears to be due to development error.

***Tor putitora* (Ham. Buch)**

Figs. 4a and 4b represent photograph and X-Ray photo of normal specimen of *Tor putitora* respectively. An abnormal specimen of the fish netted from River Tawi, Jammu was recognized by its truncated body, abnormal body height, disposition of fins, reduced scales and various morphological ratios. An X-Ray analysis revealed that truncated body was caused by vertebral fusion (4th to 7th, 20th to 23rd vertebrae), reduced thickness and inter-vertebral spaces. In aberrant fishes, neutral and haemal spines were bifurcated (from 1st to 7th) vertebrae. This aberration appears to be due to developmental error.

***Heteropneustes fossilis* (Muller)**

Figs. 5a and 5b represent photograph and X-Ray photo of normal specimen of *Heteropneustes fossilis* respectively. A single deformed specimen of the fish was netted from River Tawi, Jammu. It was recognized from its reduced caudal fin, abnormal body shape, disposition of fins, reduced caudal fin and fusion of caudal fin with anal fin. X-Ray photograph of the specimen revealed that first five vertebrae are degenerated and vertebral column is not straight but shows slight upward and downward curves. This anomaly of reduced caudal fin is attributed to some injury.

The comparison of morphological features of normal and deformed specimens of species under study has been described in Table 1. Fish teratology due to developmental error has also been described by Gupta and Tilak (1962), in *Heteropneustes fossilis* (caudal fin deformity); Banerji and Singh (1978) in *Cirrhinus mrigala* (truncated body); Saxena and Tyagi (1978) in *Clarias batrachus* (absence of left pelvic fin); Devadoss (1983) in *Dasyastis jenkensii* (absence of pectoral fin), Dutta *et al*. (2005) in *Cirrhinus mrigala* (truncated body, reduction of lower jaw); Dutta *et al*. (2006a) in *Ctenopharyngodon idella*, *Eutropicthyes vacha* (short truncated body and disposition of fins), Dutta *et al*. (2011) in *Cirrhinus mrigala* and Bhagat *et al*. (2013) in *Cirrihinus mrigala, Catla catla* and *Labeo rohita*.

CONCLUSIONS

From the present study, it is clear that the fish teratology is very complex and cannot be attributed to a single factor but is the result of multiple factors such as pollution, salinity fluctuations, low level of dissolved oxygen, radiation, U. V. radiation, dietary Vitamin deficiency, parasitic injection, defective embryonic development and injury etc. The possible cause of fish anomalies observed in fishes of present investigation seems to be some injury, developmental error and disease. However genetic study of these fishes would help us to find out the exact possible reasons for these errors and still further study is needed to eradicate the same so that we can commercially exploit the man-made ecosystem to its full and save the further deterioration of these fishes.

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