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Research Article

Multiple Skeletal Deformities in Natural Population of *Cirrhinus mrigala* from River Tawi of Jammu Region

Gurpreet Kour, Jyoti Sharma*, Ritika Bhan and Rahul Kait

Department of Zoology, GDC Udhampur, G. G. M. Science College Jammu, J&K 180004

*Corresponding Author E-mail: jyotis632@gmail.com

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ABSTRACT

The presence of skeletal anomalies in teleost is currently a major problem in aquaculture. The common occurrence of skeletal deformities in fish and the absence of effective solution for avoiding their onset highlighted the need to improve our knowledge on basic processes regulating fish skeleton and skeletal tissues. Severe skeletal anomalies occur throughout the entire life cycle of fish but the development often begins with slight aberrations of internal elements. During the present study the fish Cirrhinus mrigala was collected from various parts of river Tawi of Jammu region and two major abnormal skeletal deformities were recorded. Deformities were diagnosed using a variety of clinical and radiographic techniques. Witnessed deformities include Kyphosis, Lordosis, Scolosis and Ankylosis. In addition to these deformities, deformed swim bladder was also observed. No single cause can be attributed to such but most probably pollution, mechanical injury and some genetic factors may be the main causes of such abnormalities.

Keywords: *Skeltal deformities, Kyphosis, Lordosis, Scolosis, Ankylosis.*

INTRODUCTION

Fish like other vertebrates also show skeletal deformities. They majorly witnessed skeletal deformities especially of swim bladder and vertebral column like Scoliosis (abnormal lateral curvature), Lordosis (excessive inward curvature), Kyphosis (excessive outward curvature) and Ankylosis (abnormal stiffening and immobility of joint due to fusion of bones). Though rare but these anomalies have been well studied in various species of teleost.

As we know that inland fishing industry in India relies on carps especially on Indian Major carps (*Catla*, *Labeo* and *Cirrhinus*) and record of deformed carps are not very common but still get reports of deformities in them.

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But of all IMC *Cirrhinus* which is well distributed in lotic and lentic water of Jammu (Dutta & Kour, 2005), moreover J&K Fishery Department also stocked this fish in various water bodies including Mansar, Surinsar, Sanasar lakes as well as various streams of Jammu region and is showing high growth efficiency. Anomalies in *C. mrigala* have earlier been reported by Sarkar and Konar (1993), Gupta et al. (1998, 2000 & 2002), Dutta et al. (2006), Dutta and Gupta (2010) and Nazir et al. (2022) but no one has revealed multiple anomalies. Therefore, present study was undertaken to study multiple deformities in fish *C. mrigala* and highlight the reason why deformed species fetch low price in market.

MATERIALS AND METHODS

During present study fish *C. mrigala* was collected from different parts of river Tawi using cast net. A total of 200 specimens were collected and brought to laboratory and analyzed for morphological, meristic and radiological examination. Out of 200 specimens only 2 specimen of *C. mrigala* showed skeletal deformities. For morphological examination specimens were preserved in 10% neutral buffered formalin and noticeable morphological deformities were photographed with digital camera. In addition meristic examination (calculation of rays and spines of paired and unpaired fins, total scales along lateral line, total vertebrae) was carried out. After morphological and meristic examination, radiological examination was done using Fugi Base Film with SOFTEX CMB-2 at 10 miliamps and 50kv for 0.25 sec. Finally a comparison was made between normal and these two fishes showing skeletal anomalies (deformed fishes).

RESULTS

Normal *Cirrhinus mrigala*

Body is streamlined and its depth is almost equal to length of head. Body is covered with cycloid scales but head is scaleless. Snout is blunt, often with pores. Mouth broad, transverse upper lip entire and not continuous with lower lip. Lower lip more indistinct, single pair of short rostral barbels. Lower jaw has a small post-symphysial knob or tubercle. Origin of dorsal fin nearer to end of snout than base of caudal fin. Dorsal fin as high as body; pectoral fins shorter than head, caudal fin deeply forked and anal fin not extending to caudal fin.. There is a wide space between longest pectoral fin ray and pelvic fin origin and anal fin ray and caudal fin base (Figure). Pectoral fin has 16 rays, pelvic 11 rays, dorsal 13 rays, anal 10 rays and caudal fin 27 rays (Table 1). Lateral line has 45 scales. X ray reveals 36 amphicoleous vertebral column. Air bladder is bilobed whose anterior lobe is globular and large while posterior lobe elongated (Figure 1 and 4).

Fishes with skeletal deformities (Deformed fishes)

Abnormal specimens were recognized by a ventral buldge; abnormal shape of body in caudal region and disposition of anal fins (Figure 2, 3, 5 and 6).

The specimen 1 with skeletal deformity was about 550 gms while specimen 2 was about 475 gms.

Abnormal specimen 1 has 40 scales along the lateral line while specimen 2 has 43 scales; moreover scales near ventral bulge are greatly compressed.

Head of abnormal specimen 1 is large as compared to normal specimen, upper jaw elongated and larger than lower jaw while head of abnormal specimen 2 is shorter than normal specimen; upper jaw is slightly protruded out on the lower jaw and is compressed.

Specimen 1 shows disposition of pectoral, pelvic and caudal fin due to ventral buldge near abdomen. Specimen 2 has normal pectoral and pelvic fin but anal and dorsal fin slightly tilted towards caudal region.

Number of rays in paired and unpaired fin also varies in normal and abnormal specimen. Abnormal specimen has 16, 10, 14, 24 and 3 rays in pectoral, pelvic, dorsal, caudal and anal fin while abnormal specimen 2 has

16, 9, 12, 21 and 6 rays in pectoral, pelvic, dorsal, caudal and anal fin.

Accumulation of muscular tissue near ventral abdomen which can be clearly seen in X-rays. Moreover ventral part is reddish colored that can be because of haemorrage in particular area.

Swim bladder of abnormal specimens also shows anomalies. Anterior lobe of swim bladder of specimen 1 expands to become a sac like structure but posterior is shortened, compressed which can be attributed to muscular concentration near ventral abdomen (Edema). Anterior lobe of specimen 2 was triangular and shorter while poster lobe was elongated reaching up to caudal peduncle.

Urostyle is expanded hence feather like in appearance in abnormal specimen 1 and 2.

Vertebral column of abnormal specimen 1 reveals 36 vertebrae in X-rays in both normal and abnormal specimens, in abnormal fish first 12 vertebrae were normal but after that have increased intervertebral space, 13-30 vertebrae are compressed i.e. are fused and have irregular shape also as a result of compression of vertebral column neural and haemal spines also become dispositioned, 30 onwards also have more intervertebral space.

No. of vertebrae in specimen 2 is 35 as compared to normal 36 of which first 8 vertebrae were normal, between 9-35 are irregular as after 8th vertebrae vertebral column starts bending downwards, 9-12 vertebrae show vertebral fusion (Ankylosis). From 12-18 vertebral column bends downwards but vertebrae have highly extended width, vertebrae 19-22 are highly fused and form bend, from 23-35 vertebrae is directed upwards giving a V-shaped structure (lordiosis), but urostyle is normal.

Figure 1: Showing normal specimen of *Cirrhinus mrigala*

Figure 2: showing Abnormal (deformed) specimen 1 of *C. mrigala*

Figure 3: showing abnormal (deformed) specimen 2 of *C. mrigala*

Figure 4: showing x-ray of normal specimen of *C. mrigala*

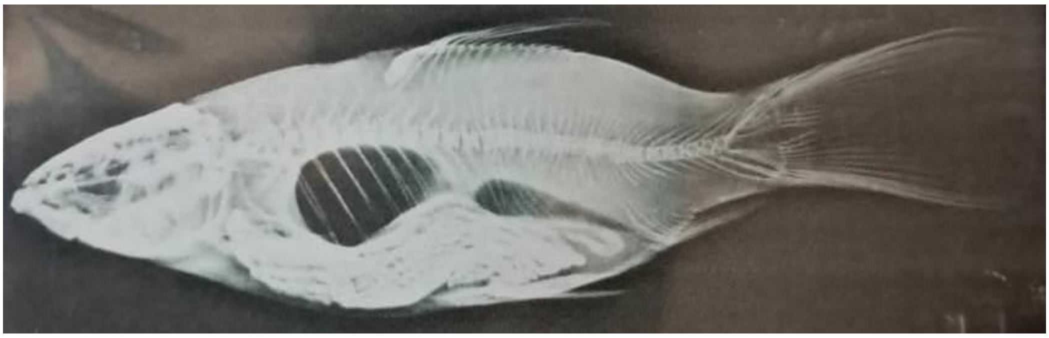

Figure 5: showing x-ray of abnormal specimen 1 of *C. mrigala*

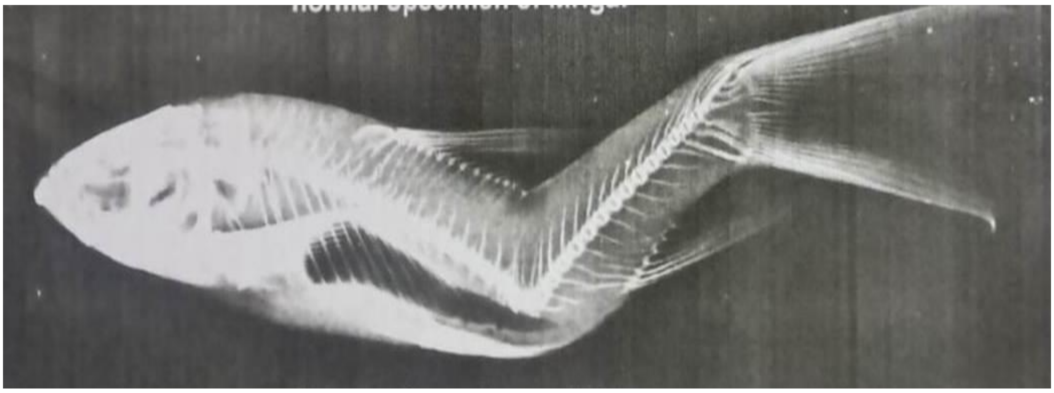

Figure 6: showing x-ray of abnormal specimen 2 of *C. mrigala*

Table 1: showing fin rays of normal and abnormal *C. mrigala* (Specimen 1 and specimen 2)

S. No	Fin	Normal	Abnormal specimen 1	Abnormal specimen 2
1	Pactoral	16	16	16
2	Pelvic	11	10	9
3	Dorsal	13	14	12
4	Caudal	27	24	21
5	Anal	10	06	06

DISCUSSION

During present study out of 200 wild specimen of *C. mrigala* only 2 showed deformities, suggests a negligible percentage of deformed fish in river tawi. A possible reason for their low number is either they are less abundant or they easily fall prey to predators. Fish anomalies were described time to time by numerous workers and they attributed various factors for these anomalies like currents (Hilger, 1992; Divanch et al., 1997; & Cerezo et al., 2005), Temperature varition (Milton 1971; Gluth and Hanke 1983), salinity fluctuation, low dissolved oxygen (Turner & Farley, 1971) high CO_2 concentration in water (Martens et al., 2006) pollutants like chlorinated hydrocarbons, organophosphates, pesticides, heavy metals (Kessabi et al., 2009 & Lin Sun et al., 2009) exposure of ultraviolet radiations, dietary vitamin deficiency (Newsome & Piron, 1982: Kanoazawa, 1993 & Darias et al., 2011), parasitic infection (Stauth, 2004; Yokoyama et al., 2005 & Cunningham et al., 2005) inbreeding (Panday & Awasthi, 1994) and dense rate of stoking (Pearsons & Hopley, 1999), heredity factors (Evan & Neff, 2009), developmental error (Shankar & Dutta, 1993 & Gupta et al., 2000) and injury (Dutta & Kumar, 1991).

Presently fishes were collected from a site which is near to residential area, therefore this site receives household waste and laundry wastewater hence pollutants may be responsible for these deformities. Further it has observed that these deformities have not affected their growth or swimming efficiency, it means these deformities were probably induced during embryonic and post embryonic period. These deformities have also attributed to water current and stress as these two factors seems to prevail in study area.

Fish deformities also ascribed to dietary factors and stocking density but presently neither diet analysis was done nor stocking density was high hence role of these factors is unexplainable. Parasitic infection is also responsible for abnormal skelton is also ruled out in present case as there was no visible infection on any deformed specimen of *C. mrigala.*

Vertebral deformities in *C. mrigala* probably arise due to air bladder deformity and such findings were reported earlier by workers like Couch et al. (1979) Kitajima et al. (1994), Trotter et al. (2004), Grotmol et al. (2005) and Nazir et al. (2022). Further when it was investigated it was found that these deformed fishes fetch low amount as compared to normal ones. The possible reasons for this is that these fishes appear bad in looks e.g. twisted, have less meat, hard to processed and due to their looks people think that these fishes may suffer from some disease.

From above discussion it is clear that no single factor is responsible for these deformities in *Cirrhinus mrigala* and therefore, more research is needed where maximum factors should be analyzed to exactly identify the possible factors responsible for these deformities.

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Author Contribution:

All authors have participated in critically revising of the entire manuscript and approval of the final manuscript.

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