

## POPULATION DYNAMICS OF *TOR MACROLEPIS* (TELEOSTEI: CYPRINIDAE) AND OTHER FISHES OF ATTOCK REGION, PAKISTAN

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### ABSTRACT

A survey was conducted in Attock region, Pakistan to study the population dynamics of *Tor macrolepis* and other fish species. *Tor macrolepis* specimens were 133 of the total 2839 fishes collected. *Tor macrolepis* varied in total length and lateral line scales from 5.0 to 45.0cm and 24 to 28 respectively. Out of 60 fish species identified, 38 species comprised < 1% individually. Seventeen species were from 1.0 to 5.0%; 4 species such as; *Devario devario*, *Puntius conchoniis*, *Puntius sophore* and *Cyprinus carpio* were 5-10% and one species *Crossocheilus diplochilus* comprised 16.06%. *Tor* and *Glyptothorix* are endemic genera to this area. There were 22 commercially important species. The population of 10 highly commercial indigenous fishes was very low and has fallen drastically. These species are, *Labeo rohita* (0.38%), *Cirrhinus mrigala* (0.52%), *Gibelion catla* (0.06%), *Mystus bleekeri* (2.57%); *Rita rita* (0.03%), *Sperrata sarwari* (0.24%), *Wallago attu* (0.10%), *Clupisoma naziri* (2.04%); *Channa marulius* (0.24%), and *T. macrolepis* (4.68%). The decline in population of commercial fishes is attributed to indiscriminate overfishing, habitat degradation, aquatic pollution and abundance of competitive exotic species. The IUCN status of fish fauna of Attock is also discussed. Effective conservation measures are suggested to sustain *Tor macrolepis* and the fish fauna in Attock region.

**Keywords:** Attock region, fish fauna, *Tor macrolepis*, decline population, economic status.

### INTRODUCTION

Pakistan has large and widely spread inland water resources. The rivers and their tributaries, network of irrigation canals, dams and lakes constitute these aquatic resources. The Indus drainage system is the biggest river system of Pakistan and it consists of the mighty Indus River and its associated rivers and streams. Pakistan has a very rich and diversified freshwater fish fauna. The variation in fish fauna may be attributed to the fact that the area of Pakistan constitutes a transitional zone between Oriental, Palearctic and Ethiopian zoogeographical regions. Hence, these geographical entities also influenced the fish fauna of Pakistan (Mirza, 1994). Number of comprehensive studies have been done on the freshwater fish fauna of Pakistan from various natural waters bodies; (Mirza, 1975, 1980, 1994, 2003, 2004; Qurashi *et al.*, 1998; Rafique, 2000, 2001; Ahmad and Mirza, 2002; Rafique *et al.*, 2003; Javed *et al.*, 2005; Pervaiz, 2011). Khan *et al.* (2011) and Mirza (2003) reported 183 freshwater fishes in Pakistan and Kashmir which belongs to 11 orders, 26 families and 83 genera. However, freshwater fish fauna of Pakistan are represented by not less than 193 fish species (Rafique and Khan, 2012).

Family cyprinidae supersede rest of the families with regards to its number of genera and species in Pakistan

(Mirza, 2003). Many species of this family are highly commercial and have significance in aquaculture too. The economically important inland fish fauna comprise 16 species (Peter, 1999). Thirty freshwater fishes of Pakistan have high economic value (Rafique and Khan, 2012). The population of commercial fishes is declining in Pakistan (Pervaiz, 2011; Rafique and Kahn, 2012). Worldwide, fishes and fisheries are in severe decline, driven in large part by economic and population growth (Limburg *et al.*, 2011). Densely populated and rapidly expanding urban areas contribute significantly to aquatic habitat change and water pollution (Brown *et al.*, 2005). Agricultural runoff also degrades and continues to degrade fish habitat. Decline in population of some of the commercially important fish species of Pakistan is associated to overexploitation, pollution and habitat fragmentation (Rafique and Khan, 2012).

Most of the studies done in Pakistan mainly described species diversity and composition of freshwater fishes, but lack important characteristics of the fish fauna, such as population dynamics of economically valued species and their conservation status. Rafique and Khan (2012) have described freshwater fish fauna of special importance, with regard to endemism, IUCN status and its rarity. The aim of present study was to investigate population dynamics, economic and conservation status of fish fauna of Attock region, Pakistan and suggest steps

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to conserve and enhance production of *T. macrolepis*, the Indus Golden Mahseer.

## MATERIALS AND METHODS

Fish sampling was conducted from July 2008 to June 2009. Collections was made from different sites of Attock district and adjoining areas which included Indus River, Haro River and Hassan Abdaal area. For this purpose, the Haro River was divided into four sampling zones. Each part consisted of about ten kilometer area starting from upstream of the Haro River Toll Plaza at G.T road and ending at Garyala junction with the Indus River. Fish samples were also collected from Hasan Abdaal area around Nalah Kala and adjoining water streams. At main Indus River samples were collected from two different sites. Many different methods were used to collect the fishes depending upon the circumstances like pond net, cast net, scoop net, gill net drag net and cover pot with the assistance of local fishermen. Fish specimens in field were fixed in 10% formalin. Larger specimens were also given intra-peritoneal injection of formalin. The samples were packed in soaked cotton with pure formalin and were transported to laboratory and shifted in 70% ethanol for further investigation. Each specimen was numbered and tagged in the dorsal fin. Classification was followed after Mirza and Sharif (1996) and Mirza (2004).

## RESULTS

### Sampling site Haro River

The Attock district is located along the main Indus River. The land of this district is sub-mountainous and with typical barani features. The Haro is the main river in this district, which originate from Murree hills (foot hills of Himalayas) flow meandering downhill and reaches Khan Pur Dam (35km from Islamabad). From Khan Pur Dam downstream, this River covers about 40km area in district Attock, and finally confluence with main Indus River at Garyala Junction near Ghazi-Brotha hydropower electric generation station. The main Haro River from Ghazi to Garijala represents transition from snow carp region to mahseer region (Mirza, 1994). There is a great diversity in water depth, width and current in different regions and different seasons in River Haro. During rainy season the river is flooded. But in other seasons, it is quite shallow and water has slow velocity. The river bed varies from sandy and gravel to sandy and rocky. The substratum of the Haro River consists of gravel covered with sand, silt and detritus, which form an excellent substrate for Mahseer breeding (Pervaiz, 2011).

### Fish fauna of Attock region

A total of 2839 fish specimens were collected in six batches. The whole collection included 14 families, 39 genera and 60 species (Table 4). There were 133

Table 1. *Tor macrolepis* and other fish species from Attock Region.

Batch No.	Total fish Collected	No. of <i>Tor macrolepis</i>	% <i>Tor macrolepis</i>	% of other species
1	562	25	4.44	95.56
2	587	24	4.08	95.92
3	583	27	4.63	95.37
4	432	20	4.62	95.38
5	470	22	4.68	95.32
6	205	15	7.31	92.69
Total	2839	133	4.68	95.32

Table 2. Length wise Six *Tor macrolepis* sampling groups from Attock Region.

Length group (Cm)	Group-1	Group-II	Group-III	Group-IV	Group-V	Group-VI	Total
5-10	-	2	2	2	2	-	8
11-15	22	7	18	9	18	-	74
16-20	2	13	7	9	2	7	40
21-25	1	1	-	-	-	-	2
26-30	-	1	-	-	-	3	4
31-35	-	-	-	-	-	3	3
36-40	-	-	-	-	-	1	1
41-45	-	-	-	-	-	1	1
Total	25	24	27	20	22	15	133

specimens of *Tor macrolepis*, which comprised 4.68% of the entire catch. The total length of *T. macrolepis* was from 5.0 to 45.0cm. The fish of length from 5.0 to 20cm dominated the sample (122 specimens) (91.24%) and fishes from 21-45cm total length were 8.27%. The lateral line scales varied from 24 to 28 in this fish (Tables 1-3).

From 60 fish species identified in this study, thirty eight species comprised < 1% individually. Seventeen species were from 1.0 to 5.0%. Four species such as *Devario devario*, *Puntius conchonius*, *Puntius sophore* and *Cyprinus carpio* were 5-10%. Only one species

*Crossocheilus diplochilus* was most abundant comprising 16.06%. Family Cyprinidae dominated the present collection with 21 genera and 35 species. The family Bagridae with 3 genera and 4 species, family Siluridae, Chandidae, and Schilbeidae with 2 genera and 2 species each, family Sisoridae with two genera and 4 species, Channidae one genus and 3 species, family Cichlidae with one genus 2 species, families Notopteridae, Nemacheilidae, Heteropneustidae, Belontiidae, Gobiidae and Mastacembelidae are represented by only one species each (Table 4).

Table 3. Lateral line scales in six groups of *Tor macrolepis* from Attock Region.

Lateral line scales	Group-I	Group-II	Group-III	Group-IV	Group-V	Group-VI
24	2	1	-	-	-	-
25	22	20	-	-	4	-
26	-	2	3	6	8	2
27	-	1	7	8	9	13
28	-	-	17	6	1	-
Total	24	24	27	20	22	15

Table 4. Population dynamics, Economic and IUCN status of fishes of Attock Region (E. S; Economic status; \*\*\* very good; \*\*good; \*Fair; - None): (Heck: Heckle)

S. No.	Family and species	Common name	No. / % of fish	E.S	IUCN Status
<b>I</b>	<b>Family Cyprinidae</b>				
1	<i>Labeo rohita</i> (Hamilton)	Rahu	11(0.38)	***	Least concerned
2	<i>Labeo calbasu</i> (Hamilton)	Kalbas	03(0.10)	**	Least concerned
3	<i>Labeo boga</i> (Hamilton)	Bhangan	03(0.10)	-	Least concerned
4	<i>Labeo diplostomus</i> (Heckel)	Mountain rahu	95(3.34)	-	Least concerned
5	<i>Labeo dyocheilus pakistanicus</i> Mirza & Awan	Thick lip labeo	11(0.38)	**	Least concerned
6	<i>Labeo angra</i> (Hamilton)	Buttar	06(0.20)	-	Least concerned
7	<i>Cirrhinus reba</i> (Hamilton)	Sunni	07(0.24)	**	Least concerned
8	<i>Cirrhinus mrigala</i> (Ham.)	Mori	15(0.52)	***	Least concerned
9	<i>Gibelion catla</i> (Hamilton)	Thaila	02(0.06)	***	Least concerned
10	<i>Tor macrolepis</i> (Heckel)	Indus golden mahseer	133(4.48)	***	Not evaluated
11	<i>Crossocheilus diplocheils</i> (Heck.)	Dogra	456(16.06)	*	Least concerned
12	<i>Cyprinus carpio</i> L.	Gulform	150(5.28)	**	Vulnerable
13	<i>Chela cachius</i> (Hamilton)	Bidda	03(0.10)	-	Least concerned
14	<i>Chela laubuca</i> (Hamilton)	Bidda	07(0.24)	-	Least concerned
15	<i>Salmophasia bacailia</i> (Ham.)	Small chal	40(1.40)	-	Least concerned
16	<i>Salmophasia punjabensis</i> (Day)	Punjab razor belly minnow	25(0.88)	-	Not evaluated
17	<i>Securicula gora</i> (Hamilton)	Big chal	02(0.06)	-	Least concerned
18	<i>Aspidoparia morar</i> (Hamilton)	common chilwa	140(4.93)	-	Least concerned
19	<i>Barilius modestus</i> Day	Lahori chilwa	58(2.04)	-	Not evaluated
20	<i>Barilius pakistanicus</i> Mirza & Sadiq	Pakistani chilwa	22(0.77)	-	Not evaluated

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Table 4 continued

S. No.	Family and species	Common name	No. / % of fish	E.S	IUCN Status
21	<i>Barilius vagra</i> (Hamilton)	Lahori chilwa	73(2.57)	-	Least concerned
22	<i>Devario devario</i> (Hamilton)	Patha makhni	190(6.69)	-	Least concerned
23	<i>Esomus danricus</i> (Hamilton)	Soomare	11(0.38)	-	Least concerned
24	<i>Rasbora daniconius</i> (Hamilton)	Charl	12(0.42)	-	Least concerned
25	<i>Systomus sarana</i> (Hamilton)	Kharni	14(0.49)	-	Least concerned
26	<i>Osteobrama cotio</i> (Hamilton)	Palero	07(0.24)	-	Least concerned
27	<i>Puntius chola</i> (Hamilton)	Chola popra	99(3.48)	-	Least concerned
28	<i>Puntius conchonius</i> (Hamilton)	Rosy barb	168(5.91)	-	Least concerned
29	<i>Puntius sophore</i> (Hamilton)	Sophara popra	264(9.29)	-	Least concerned
30	<i>Puntiu ticto</i> (Hamilton)	Ticto popra	18(0.63)	-	Least concerned
31	<i>Garra gotyla</i> (Gray)	Pathar chat	03(0.09)	-	Least concerned
32	<i>Racoma labiata</i> McClelland & Griffith	Kunar snow trout/chun	21(0.73)	-	Not evaluated
33	<i>Racoma fedtschenkoi</i> Kessler	Chunni	01(0.01)	-	Not evaluated
34	<i>Schizothorax plagiostomus</i> Heckel	Swati	62(2.18)	**	Not evaluated
35	<i>Carassius auratus</i> L.	Goldfish	110(3.87)	**	Not evaluate
<b>II</b>	<b>Family Notopteridae</b>				
36	<i>Notopterus notopterus</i> Pallas	Pari	08(0.28)	**	Least concerned
<b>III</b>	<b>Nemacheilidae</b>				
37	<i>Triplophysa microps</i> (Steindachner)	Singhat	02(0.06)	-	Least concerned
<b>IV</b>	<b>Family Bagaridae</b>				
38	<i>Mystus bleekeri</i> (Day)	Bleekri Tingara	73(2.57)	***	Least concerned
39	<i>Mystus vittatus</i> (Bloch)	Kingar	01(0.03)	-	Least concerned
40	<i>Rita rita</i> (Hamilton)	Khagga	01(0.03)	***	Least concerned
41	<i>Sperrata sarwari</i> (Mirza <i>et al</i> )	Singhari	07(0.24)	***	Least concerned
<b>V</b>	<b>Family Sisoridae</b>				
42	<i>Gagata pakistanica</i> Mirza, <i>et al</i> ,	Sanglai	77(2.71)	-	Not evaluated
43	<i>Glyptothorax naziri</i> Mirza & Naik	Sulemani khagga	21(0.73)	-	Not evaluated
44	<i>Glyptothorax punjabensis</i> Mirza & Kashmiri	Sulemani khagga	03(0.10)	-	Not evaluated
45	<i>Glyptothorax stocki</i> Mirza & Nijssen	Sulemani khagga	22(0.77)	-	Not evaluated
<b>VI</b>	<b>Family Siluridae</b>				
46	<i>Ompok padba</i> (Hamilton)	Mountain Pafta	44(1.44)	-	Near threatened
47	<i>Wallago attu</i> Bloch & Schneider	Mullee	03(0.10)	***	Near threatened
<b>VII</b>	<b>Family Heteropneustidae</b>				
48	<i>Heteropneustes fossilis</i> (Bloch)	Singhi	04(0.14)	**	Least concerned
<b>VIII</b>	<b>Schilbeidae</b>				
49	<i>Ailia coila</i> (Hamilton)	Patari	03(0.10)	-	Near threatened
50	<i>Clupisoma naziri</i> (Hamilton)	Naziri bachcha	58(2.04)	***	Not evaluated
<b>IX</b>	<b>Family Belontiidae</b>				
51	<i>Xenentodon cancila</i> (Hamilton)	Kaan	03(0.10)	-	Least concerned

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Twenty three commercially important fish species were recorded in this collection. Ten species have “very good” and 13 species have “good” economic value. The indigenous commercially “very good” fishes were *L. rohita* (0.38%), *C. mriagla* (0.52%), *G. catla* (0.06%), *M.*

*bleekeri* (2.57%); *R. rita* (0.03%), *S. sarwari* (0.24%), *W. attu* (0.10%), *C. naziri* (2.04); *C. marulius* (0.24%), and *T. macrolepis* (4.68%). The four introduced species; *C. carpio* (5.28%), *C. auratus* (3.87%), *O. aureus* (0.88%) and *O. mossambicus* (1.93%) are well establishes in this

Table 4 continued

S. No.	Family and species	Common name	No. / % of fish	E.S	IUCN Status
<b>X</b>	<b>Family Channidae</b>				
52	<i>Channa punctata</i> (Bloch)	Daula	16(0.56)	**	Least concerned
53	<i>Channa marulia</i> (Hamilton)	Soul	07(0.24)	***	Not evaluated
54	<i>Chana striata</i> (Bloch)	Soul	15(0.52)	-	Least concerned
<b>XI</b>	<b>Family Chandidae</b>				
55	<i>Chanda nana</i> (Hamilton)	Sheesha	48(1.49)	-	Least concern
56	<i>Paramabassis ranga</i> (Hamilton)	Sheesha	44(1.54)	-	Least concern
<b>XII</b>	<b>Family Gobiidae</b>				
57	<i>Glossogobius giuris</i> (Hamilton)	Guleo	11(0.38)	-	Not evaluated
<b>XIII</b>	<b>Family Cichlidae</b>				
58	<i>Oreochromis aureus</i> (Steindachner)	Blue tilapia	25(0.88)	**	Not evaluated
59	<i>Oreochromis mossambicus</i> (Peters)	Mozambique tilapia	55(1.93)	**	Near threatened
<b>XIV</b>	<b>Family Mastacembelidae</b>				
60	<i>Mastacembulus armatus</i> (Lecepede)	Zig-zag eel/ Bam	54(1.90)	**	Least concerned

area. In spite of stocking of Chinese carps in public waters of Attock district (Nawaz personal communication) none of the three Chinese carps, grass carp *Ctenopharyngodon idella* (Valenciennes), silver carp *Hypophthalmichthys molitrix* (Valenciennes) and big head carp, *Aristichthys nobilis* (Valenciennes) was not recorded in this collection. There is much probability that these species have not been able to establish in the area. The chances of their missing from the catch seem very little. The main component of present collection is of non commercial fishes which comprised 63.33%.

The IUCN status of important fishes *T. macrolepis*, *S. plagiostomus*, *C. naziri*, *O. aureus*, *R. labiata*, *C. auratus* and four species of *Glyptothorax*, are not evaluated yet. Whereas, *O. pabda*, *W. attu* are near threatened and *C. carpio* is vulnerable. But the important fishes *L. rohita*, *C. mrigala*, *G. catla*, *M. bleekeri*, *S. sarwari*, *R. rita*, *C. marulius* are mentioned least concerned in IUCN list.

## DISCUSSION

Freshwater fish fauna of Pakistan is dominated by family cyprinidae. Mirza (2003) listed 74 species from family Cyprinidae in Pakistan. The same trend is exhibited in fish fauna of Attock region, as 58.33% of the fish species belonged to family cyprinidae. The Golden Mahseer of Indus system had been assigned to *Tor putitora* (Hamilton), *Tor tor* (Hamilton) and *Tor mosal* (Hamilton) by various authors. Actually the Mahseer studied in this collection is different from all these three species. According to Mirza (2003) the name used by Heckel (1838) for Indus Mahseer appears to be correct name. Hence, the same name *Tor macrolepis* for the Indus Golden Mahseer after Mirza (2003) has been used.

Pervaiz (2012a,b) has done very detailed work on the taxonomic and morphometric analysis of this fish and has shown that *T. macrolepis* of Indus drainage system is different from the Mahseer present in Ganges Brahmaputra drainage system.

The Attock region is characterized by presence of some endemic species like Golden Mahseer of Indus, *Tor macrolepis*, *Gagata pakistanica*, *Glyptothorix naziri*, *Glyptothorix punjabensis*, and *Glyptothorix stocki* (Javed *et al.*, 2005). Three cold water species *Schizothorax plagiostomus*, *Racoma labiata* and *Racoma fedtschenkoi* are also represented in the present collection. The occurrence of some endemic species like genus *Glyptothorix* in this area corresponds to the typical topography of the fast flowing streams and rivers, which are shallow, clear and with rocky beds. The members of genus *Glyptothorax* have evolved special adhesive suckers on their abdomen to adhere to substrate in fast flowing water. This character of attachment at the river bed was a prime factor in survival of these fishes in high velocity rivers and streams (Jayarm, 1982).

The presence of carnivore species like *W. attu* and *R. rita* and other carnivore fishes are probable hazard to co-habiting fishes. These fishes are piscivorous and feed on fry, fingerlings and even big fishes. Hence, this is constant threat to other fishes. The missing Chinese Carps might have escaped during the sampling process. The exotic species *O. aureus* and *O. mossambicus*, *C. carpio*, *C. auratus* are omnivores that feed on plankton and aquatic vegetation. These species are fast breeder and compete for food and space to native species especially commercial fishes, the major carps, both in rearing facilities and wild. These four species seems well

established in Attock region. Khan *et al.* (2011) have pointed out that exotic species are becoming invasive in freshwaters of Punjab and other provinces of the country and are competing with local fauna. This adverse situation is one of the probable reasons of decline of commercially important fishes, which showed the lowest composition (0.03 to 0.24%) in the present collection. Even the majority of non-commercial fishes are also flourishing at the cost of the most valued and important fishes. The indiscriminate over exploitation of fisheries resources, habitat degradation due to flooding and illegal digging from river banks have contributed to decline of important and commercial fishes from Attock region. The majority of fishes are categorized as least concerned in IUCN Red List (IUCN, 2012). *Tor macrolepis* is not evaluated by IUCN. Only three species, *O. pabda*, *W. attu* and *O. mossambicus* are near threatened (IUCN, 2012).

The following steps are suggested concisely, not only for conservation and preservation of *T. macrolepis* but also for its sustainable production in the country. Enforcement of ban on illegal fishing methods such as; dynamiting, electrocuting and poisoning may be implemented. Save Mahseer campaign may be launched for public awareness at government level and private sector. Healthy brood stocks should be collected from suitable sites as this is the backbone of replenishment program. Scientific studies on important biological aspects such as racial analysis, disease diagnosis and health management regarding *Tor macrolepis* are suggested along its distribution region in Pakistan. A comprehensive and unified strategy for conservation of this fish be designed and adapted at country level.

## CONCLUSION

Attock region of Pakistan is rich in commercial fish fauna, but its population is low and falling drastically. Measures to conserve and enhance natural fish production may prove beneficial.

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