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Article

Re-description of *Luciobarbus barbulus* Heckel 1849 a *Cyprinidae* species of Persia

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Abstract: Western Iran barb species are scientifically, environmentally, and economically important. Some of them are the largest riverine freshwater species, which will grow in size and weight to 170 cm, and 120 kg respectively. There is little information on taxonomy or environmental status of these species *Luciobarbus barbulus* is one of the important large species. During the resent year since 2013, in order to find the new record of large barb species, sampling program carried out in western Iran,. *Luciobarbus barbulus* briefly described by Heckel (1849) but during the time, have been synonymized with other related species or vice versa, other similar species miss-identically have been known as this species. Also the synonymy of *Luciobarbus barbulus* with *L. pectoralis* remains uncertain. The possible syntypes of *L. barbulus* in Vienna Museum (NMW 53957 and NMW 6596) are in too poor condition to be of any value, being mostly bones, and are dried, and. The fleshy lip of NMW 6596, (measures 119.3 mm standard length) fold of the original description could not be discerned, teeth are missing and the dorsal fin is broken off short. In 1997 this was the only syntype recognized. The catalog in Vienna lists only 1 fish, while Heckel's description refers to several fishes!. So designing of Lecotype and re-description of *L. barbulus* is essential. In this paper the details of description and differences between these species are given.

Keywords: *Cyprinidae; Luciobarbus barbulus; Luciobarbus*, taxonomy, Iran.

1. Introduction

Luciobarbus barbulus was one of 15 species among specimens collected by Theodor Kotschy 1841 – 1842, in the water system around Shiraz, and was sent to Heckel in Vienna Museum (NMW).
Luciobarbus barbulus briefly described by Heckel (1849) [2]. The possible syntype of *Luciobarbus barbulus* (NMW 53957) as stated by Almaça (1986) [4] and Coad (1997)[5] is in too poor condition.
Coad (1997) states that the synonymy of *Luciobarbus barbulus* with *L. pectoralis* remains uncertain [3]. The possible syntype of *L. barbulus* (NMW 53957) was seen by B. W. Coad (1997) he states that: it is in too poor condition to be of any value, being mostly bones. Coad state, another syntype is listed as NMW 6596 and measures 119.3 mm standard length. He continued that in 1997 this was the only syntype recognized. The catalog in Vienna lists only 1 fish, while Heckel's description refers to several fishes. NMW 6596 is mostly bones and is dried. The fleshy lip fold of the original description could not be discerned, teeth are missing and the dorsal fin is broken off short [3].
As some of the morphological and meristic characters of *Luciobarbus barbulus* Heckel (1849) overlap with other similar species such as *L. mystaceus*, *L scheich*, *L. kersin*, *L. pectoralis*, *L. longiceps*, *L. rajanorum.* These species have been put a problematic group of barb species and the stated nominal species, more or less have a similar shape with *Luciobarbus barbulus*. So the re-description of this species is given in this paper, may assist the describing of other related species.
In addition, recently arises more critical view on morphological classifying of fish species or on some less studied genus. "Like many other Cyprinids, the *Brabus* genus was long included in *Barbus*. It

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appears to be a very close relative of the typical barbells – which include that genus type species *Barbus barbus*, and may well warrant inclusion in *Barbus*. Many modern authors prefer to consider it a subgenus instead. It is, moreover, not entirely clear what species to place in *Luciobarbus* if it is deemed valid. The IUCN argues for a rather inclusive circumscription. Non withstanding the taxonomy and systematics of this ill-defined assemblage, their closest living relative is probably *Aulopyge huegelii*." [6].

There isn't any available paper or significant new information about *Luciobarbus barbulus* and other related species, except some chick list in databases of California University Catalog of Fishes. [10] and this article is the first full paper on some taxonomical features and present status of this taxa.

2. Results

2.1 Diagnosis

The inferior mouth is moderate in size, lips are very thick and well developed, sometimes extraordinarily so; lower lip very broad, with a short lobule at symphysis. As stated by Heckel (1849) this species is distinguished from all other barbs of Iran and Syria by its very wide fleshy lip fold which forms a small median lobe below the symphysis of the lower jaw and, the back adjoins with a slight protuberance directly to the posterior part of the head (fig 1. and 2). Barbells are relatively thick.

2.2 Similarity and synonyms

Is more resemble with *L. mystaceus*, but differ from this species and other related species such as: *L scheich, L. kersin, L. pectoralis,*and *L. rajanorum* .(see Heckel 1843,1846,1849b)[1, 7, 23,24]

Although there is the high degree of overlap in some of the meristic and morphometric characters these taxa differ from each other. *L. barbulus* is not a subspecies of *Luciobarbus mystaceus* (Heckel 1846). *Luciobarbus barbulus* differs from *L. mystaceus* in having the:

- Thick and wide lips (vs. smaller and thin head and lips), an inferior mouth (vs. sub-terminal).
- A slightly shorter head (3.7 SL/HL vs 3.9 SL/HL). (fig. 1,2,4).
- In *L. barbulus* the back adjoins with a slight bump directly to the posterior part of the head, so the head is more inferior (fig. 1-6) but in *L. mystaceus* with thinner lips pointed head, a mouth is sub-terminal [2].
- The body depth after dorsal fin in *L. mystaceus* is thicker and the trunk joins to caudal fin with more slope than in *L. barbulus* [15].
- *L. barbulus* have the more cylindrical body but in *L. mystcus* body depths is wider. (fig.11).

These fishes have more variable features and sometime abnormality in the vertebra or in size of fins. There is probably hybrid between these fishes and other related species, but stated feature is more stable and *Luciobarbus barbulus* is a distinct species that retain its shape from fingerling to a giant fish (fig-6, 11)

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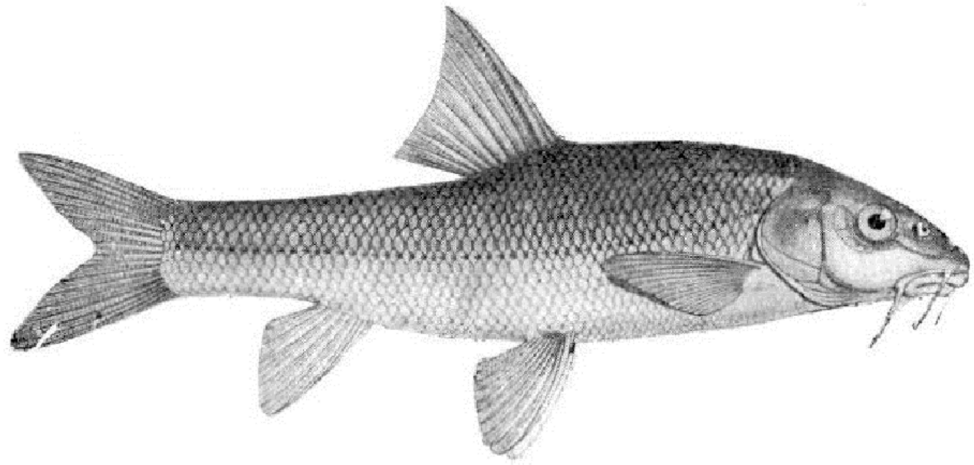
85 **2.3. Figures, and Tables**



86

87 Fig 1. *Luciobarbus barbulus* Heckel 1849., No 24021, size. 170 mm. Karun basin, After L.S. Berg 1949.

88

89 Fig 2 - *Luciobarbus barbulus* TL 560 mm, Gamasiab River. Image kindly provided by Mohammad

90 Ghazi, (1996)[17].

91 Fig 3- *L. barbulus* at lesser Zab river in Iran, Peerdanan Station, newly caught specimen by Mohamad
92 Shakiba, 2015, Name of this species at Peranshaher, Mahabad, is PollKey Lowt Kover, = curved head
93 and snout. Image kindly provided by Mohamad Shakiba, 2015,[16]

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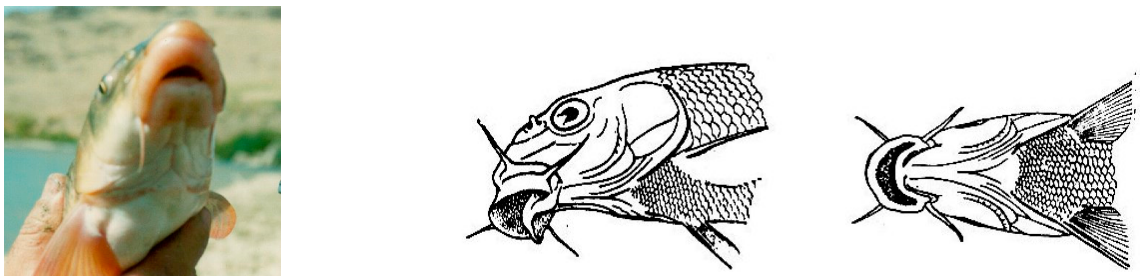

Fig. 4 - Right: Head of *L. barbulus* Gamasiab River, image kindly provided by Mohammad Ghazi, (1996) Left: Head of the specimen (No. 24021) lateral and partly ventral views, After Berg 1949.

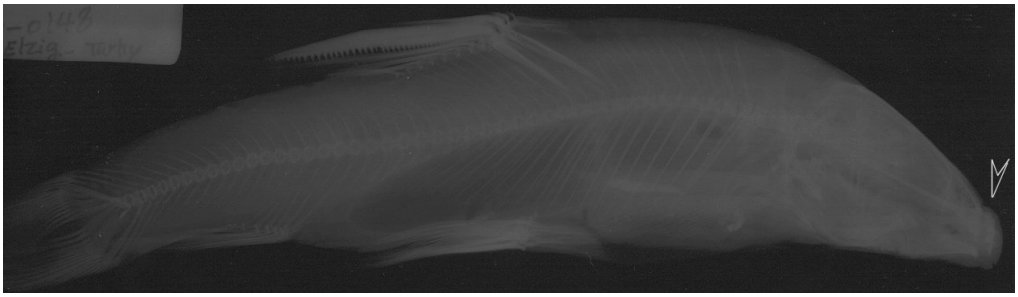

Fig. 5- Xray of *Luciobarbus barbulus*, 138 mm, SL, Tag No. 40, Shiraz, Firozabad. Below: image provided by: Valiallahi, J. 2000

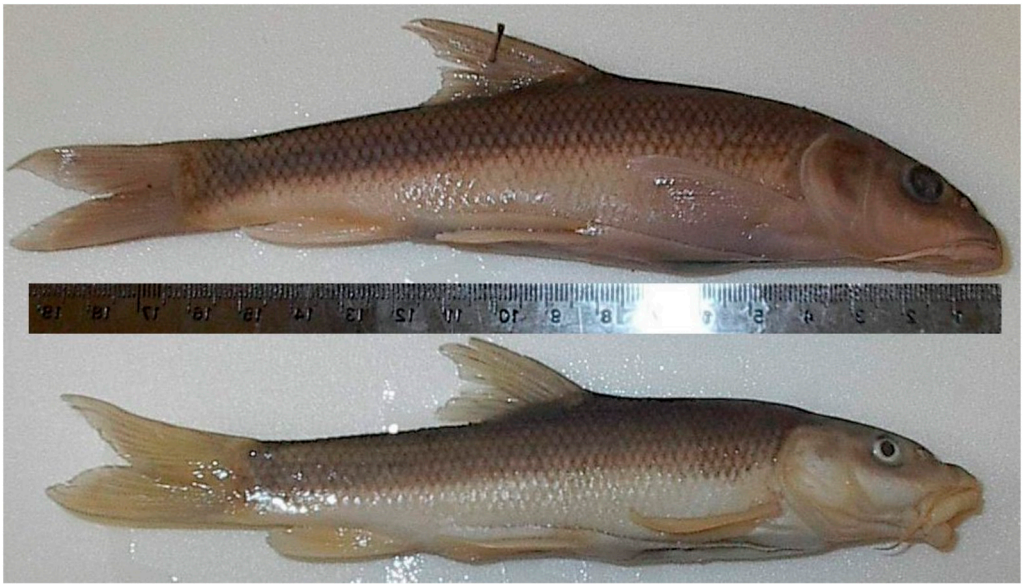

Fig. 6- Above: *Luciobarbus barbulus*, 138 mm, SL, Tag No. 40, Shiraz, Firozabad image provided by Below: Luciobarbus persicus Valiallahi, 2000. Holotype, 139 mm SL, Shiraz, Sepidan-Peer district, image kindly provided by G. Izadi 2001

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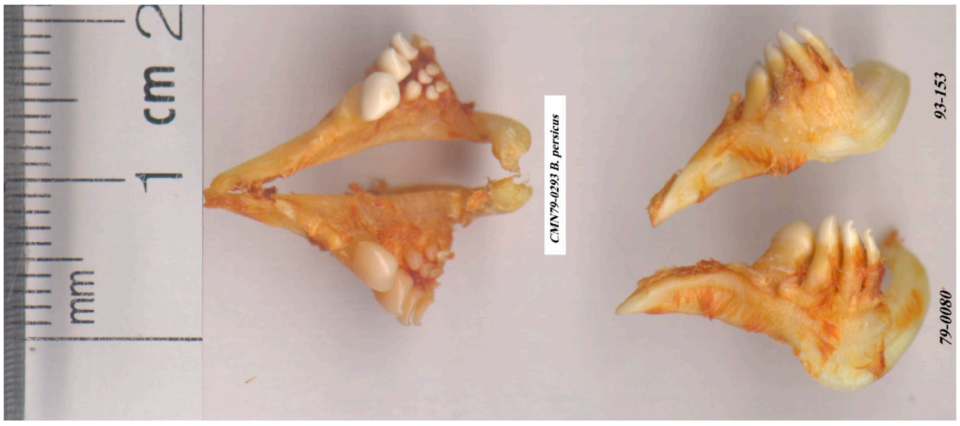

Fig. 7- pharyngeal teeth of *L. barbulus* and *L. persicus*, image provided by Valiallahi, 2000.

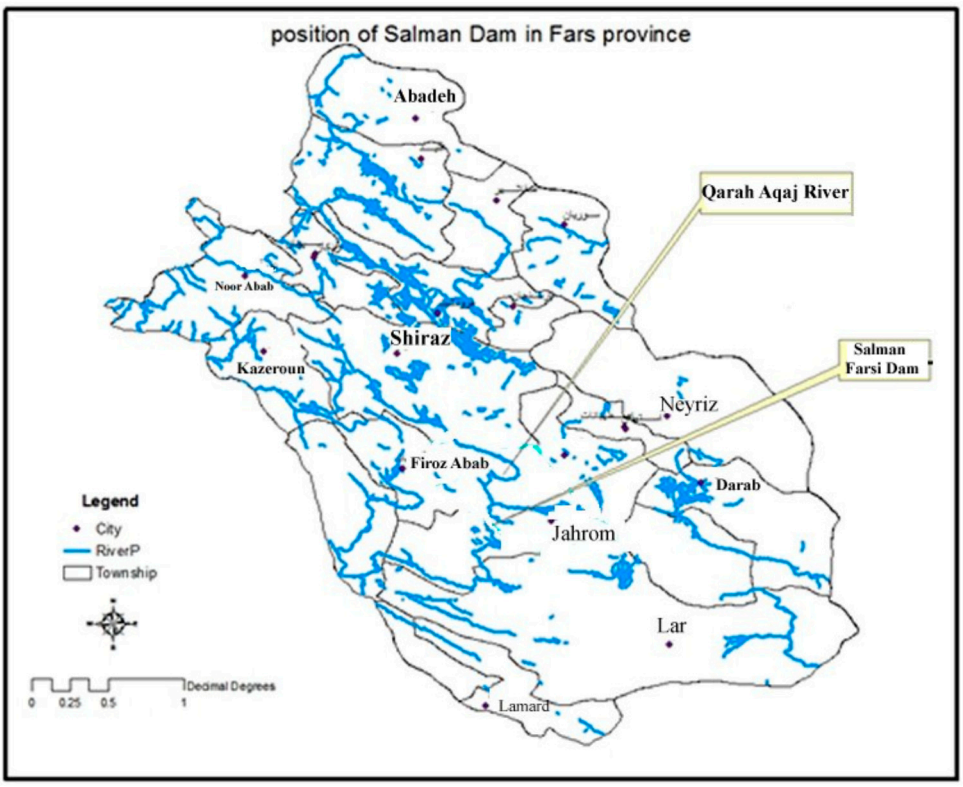

Fig. 8- The layout of Qarah Aqaj River and Salman Farsi dam at Shiraz in Far province, Iran, image kindly provided by Moradi Ismaeil, 2015.

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Fig.9 – A typical habitats of *L. barbulus*, Qarah Aqaj River, in Fars province, Iran, image kindly provided by Moradi Ismaeil, 2015.

Fig. 10- A typical habitats of *L. barbulus*, Qarah Aqaj River, 20 km, far from the Salman dam in Fars province, Iran, image kindly provided by Moradi Ismaeil, 2015.

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Fig 11. *L. barbulus* recently caught specimen by Sayed Mohamad Mokhtar Jasemi 2016, from Sirvan river Kurdistan summer 2016, one of the giant fishes of Iran that retain its shape and character's from a fingerling to a giant fish, Image kindly provided by Sayed Mohamad Mokhtar Jasemi, 2016.

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Table 1. Range, mean(x)and standard deviation (S.D.) for selected morphometric and meristic characters in *Lucioarbus barbulus*.

Morphometric and Meristic variables(mm)	**Range**	**Average**	SD	cv	n
Total length:	108-610	297.8	120.7	0.41	25
Standard length :	87-505	242.4	99.6	0.41	25
body depth:	20-114	55	20	0.36	25
Maximum body width:	13-82	36.1	15	0.42	25
Caudal peduncle length:	17-75	37.4	13. 3	0.35	25
Head length:	25-130	64	24. 5	0.38	25
Diameter of eye:	13-Jan	9	2.6	0.29	25
Preorbital distance:	Sep-58	24.8	10.1	0.41	25
Postorbital distance:	Jan-67	30.4	12.8	0.42	25
Dorsal fin height:	22-100	52.9	16.7	0.32	25
Dorsal fin base length:	Nov-70	32.6	13.1	0.40	25
Anal fin height:	16-91	41	15.2	0.37	25
Length of anterior barbell	18-Jul	12		0.00	7
Length of posterior barbell	22-Aug	13.3		0.00	7
Pectoral fin length:	17-97	44.3	16.7	0.38	25
Ventral fin length:	16-83	41.3	15.1	0.37	25
Distance pectoral - ventral fin:	20-145	65.9	29.4	0.45	25
Distance ventral- anal fin:	20-150	64	29.3	0.46	25
Distance dorsal - pectoral fin:	18-161	77.1	32.2	0.42	25
Distance dorsal - ventral fin:	21-113	54	20	0.37	25
Distance dorsal- anal fin:	29-177	80.8	34.4	0.43	25
Distance dorsal - caudal fin:	37-251	118.3	48.3	0.41	25
Distance anal - caudal fin:	20-115	54.4	20.7	0.38	25
Pairs of denticles on last unbrached dorsal ray	22-36	29		0.00	7
Gill racker	17-24	20		0.00	7
HL/Snout	2.2-3.1	2.6	0.2	0.08	25
HL/Orbit	5.49	8.5	8.6	1.01	25
HL/BD	1-1.4	1.2	0.1	0.08	25
HL/PecFin	0.9-1.5	1.2	0.2	0.17	25
TL/HL	4.1-5.1	4.5	0.2	0.04	25
BD/DFL	0.9-1.3	1	0.1	0.10	25
SL/HL	3.5-4.2	3.7	0.2	0.05	25
SL/BD	3.8-5.3	4.4	0.4	0.09	25
Weight	**12 g-2100 g**	**349.1 g**			

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Table 1 continued: selected morphometric and meristic characters in *Lucioarbus barbulus*.

Dorsal fin branched rays						Ventral fin branched rays						
N	7	8	9	x	S.D.	N	7	8	9	10	X	S.D.
25	3	14	8	8	0.6	25	1	6	17	1	8	0.6

Anal fin branched rays							Pectoral fin branched rays					
N	6	7	8	9	x	S.D.	N	16	17	18	X	S.D.
25	3	14	7	1	7	0.7	25	10	10	5	16	0.8

Lateral line scales									
N	52	53	54	55	56	57	58	X	S.D.
25	1	5	5	7	3	1	3	54	1.7

Scale between lateral line and dorsal fin origin										Scale between lateral line and anal fin origin				
N	8	9	10	11	12	13	X	S.D.	n	7	8	9	x	S.D.
25	1	3	9	8	3	1	10	1.1	25	8	14	3	7	0.6

Vertebra						Proximal pterygiophore						
N	44	45	46	x	S.D.	N	23	24	25	26	x	S.D.
6	1	3	2	45	0.8	6	1	1	2	2	24	1.2

3. **Re-description**

Two pairs of barbells, the anterior barbell does not extend past the anterior eye margin level and the posterior one not past the posterior eye margin in all sizes of fish, rostral 1.3; maxillary 1.45 times the diameter of the eye. Head comprised 3.7 times in the standard length and including 2.6(2.2-3.1) times the snout and 8.5 times of the orbit. Standard length including 4.4 (3.8-5.3) times the body depth. Dorsal fin with 4 unbranched 7-9, the average of 8, branched rays, Anal fin with 3 unbranched and range of 6-9 average of 7 branched rays (Table 1).

Upper profile of the dorsal fin rectilinear, slightly concave, and oblique. Last unbranched ray of the dorsal fin and denticles of its rear edge strong. Denticles long and spread over the 9/10 of the depth of the ray. In older fishes, the last unbranched ray contains 36 denticles and in younger 23. Average 29 range 22-36 denticles. When the dorsal fin is pushed back its tip, will not reach or extends scarcely to the origin of anal fin. Origin of the dorsal fin at the same level or slightly forward the origin of the ventral fin.

Pectoral fin branched rays 11-20(average 16), ventral fin branched rays 7-10, average 8. Lateral line scales 52-58, an average of 54, S.D. 1.7, mode 55. Above lateral line range 8-13 average 10 below lateral line 7-9 average 7, (see table 1).

Dorsal fin length and proportion of standard length with body depth and head length are the important characters for *Luciobarbus barbulus* and other related species, in this species, dorsal fin height among 25 specimens with the total length of 108-610 average of 298 cm is between 22-100 mm, the average of 52 mostly 56. (With body Weight from 12 to 2100 g and average of 349.1 g) see Table 1. Gill rakers, 17 24, average 20. Phnryngea1 teeth mostly compressed, otherwise with the pointed tip, mostly 4-3-2. The fifth tooth very small and rounded and sometimes absent apparently independent of size. The results are as follow and the measurement are summarized in Table 1:

3.1 **Color**

The back and upper flank are dark greyish. The lower flank and the belly whitish. Upper flank scales are outlined with pigment, and the anterior edge of the dorsal fin and the caudal fin margin are

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yellow bright red in fresh fish specimens. The color in the different locality is slightly different and mostly is uniform (Fig. 2,3,5, and 11). The back is dark greyish and the lower part of body whitish. The overall color is silvery and the anal and caudal fin lobe sometimes are bright red. The dorsal fin is grey and the pectoral and pelvic fins yellowish to bright red. The peritoneum is black.

4. Distribution and present status

According to Heckle,(1849) *Luciobarbus barbulus* is a species of Persia and is differ from *L. mysaceus* that was seen both from Shiraz, Iran and in the Kueik (Queik) near Aleppo in Syria. This species has widespread distribution in Tigris Euphrates basin, from western Iran to Mussel Iraq, to south parts of Turkey and the north west of Syria, Aleppo.

Recent record on the present status of these species shows that for now (2017) it may be caught from some of the locality are mentioned in this paper. But because of habitat degradation, pollution and over expedition of water and damming at paths for spawning, all of these valuable species are rare and their habitats are under pressure, these species require précises protection. [13, 14, 15. 16]. As our catch efforts indicate the stock of this species are declining from Azerbaijan Gharbi, Mahabad, Kurdistan, Kermanshah, Elam, Lorestan, Khuzestan and Fars province.

The details on distribution may be the subject of another article. In this paper, the locality of examined specimens indicates the distribution of this species.

5. MATERIALS AND METHODS

Calculating for morphometric and meristic characters for *Luciobarbus barbulus* was carried out on 7 specimens in CMN and 18 specimens among J.V.C. Measurement carried out according to Hubbs, & Lagler methods 1964. Lecotype and three Paratype were designated and were kept in Shahid Rajaee Teacher Training University fish collection museum. These specimens have been caught at Saymareh River from Darb Gombad locality. Collector Valiallahi J. et al, 2014.

5.1 Examined Materials

Acronym: CMN = Canadian Museum of Nature, J.V.C = Jalal Valiallahi Collection, refer to specimen's collected by J. Valiallahi et. al. from Iran during 1985 to 2015. SRTTU-JVC, Shahid Rajaee Teacher Training University Jalal Valiallahi Collection.

(1) Catalog number CMN 93-0153, 280 mm TL, 230, SL ♀ Khuzestan-Zohreh R. collector; I. Sharifpour, 1991.

(2,3,4) CMN, 131(231).[small ,108mmTL,87mmSL; medium,112mm TL,90 mm SL; big 160 mm TL, 140 mm SL, ♀ 4.3.2 PT; Kurdistan - Qeshlaq R. south of Sanandaj, 35/16 N 47/01 E ;Coad 1976.

(5) CMN Tag- M 2188; 223 mm TL 178 mm SL,♀, Kermanshah, Gamasiab R. Qharah Su or GHARAH SO 34 10 N 47 21 E , Jalal Vaiallahi ,28 Apr. 1997-8.

(6)CMN 88-0148; 236mm TL,194mm SL. Turkey, Elazig, Keban dam,on Euphrates, 38 48 N,38 45 E, Sarieyyüpoğlu 1987;

(7)CMN, Shiraz, Noor Abad-Garab 2001; 195mm, TL; 159mm SL, ♂

(8) J.V.C GM-76, 301 mm TL, 237 mm SL, Gamasiab River 1997.

(9)J.V.C J-7, 295mmTL,250mm SL, Gamasiab-Garous1999, 38 18 N 46 02 E.

(10) J.V.C J-6, 304mm TL, 244 mm SL, Sirvan R.-1999

(11) J.V.C 610 Alvand , 610 mm TL, 500 mm SL, Alvand R. 1999 34 /18 N 45 /11E

(12) J.V.C 50 Sirvan, 610 mm TL,505 mm SL, Sirvan-Daryan2000

(13) J.V.C 29/6, 283 mm TL, 225 mm SL, Garrous, Gamasiab River 1999- 38 /18 N 46 / 02

(14) J.V.C GM-80, 375 mm TL, 295 SL, Gamasiab -1999

(15) J.V.C 16687, 373 TL, 297 SL, Gamasiab river have been caught in 1998.

(16) J.V.C 273Garrous , 273 mm TL, 237 SL , Gamasiab-Garrous 1999- 38 /18 N 46 / 02

(17) J.V.C CH-3, 166 mm TL, 145 mm SL, Gamasiab River-2000

(18) J.V.C 222, 225 mm TL, 183 mm SL, Sirvan-Shakhan-1999

(19)J.V.C 1669; 237mm TL, 196 mm SL, Zimkan R.-1999

(20)J.V.C J-3, 290 mm TL, 239 mm SL, Sarab Nilofar

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(21)J.V.C GM-77, 296 mm TL,247 mm SL, Gamasiab-1999;
(22)J.V.CGarruos,325mm TL,270 mm SL. Lived for 2 month in aquarium;
(23)J.V.C Rika 2000, 327mm TL,271 mm SL, Rika, Ravansar, 34 43 N 46 40 E 2000
(24)J.V.C, GM- 79, 340mm TL, 286 mm SL, Gamasiab-1999.
(25) J.V.C GH-34, 370 mm TL, 305 SL, Gamasiab R. 2000.

Disengaged Lecotype and Paratype specimens:

1- Lecotype SRTTU, JVC 1, SL = 138 TL= 168 Saymareh Darb Ghonbad, 2014
2- Paratype SRTTU, JVC 2, SL=135, TL= 167 Saymareh Darb Ghonbad, 2014
3- Paratype SRTTU, JVC 3, SL= 132 TL= 155 Saymareh Darb Ghonbad, 2014
4- Paratype SRTTU, JVC 4, SL=139 TL= 158 Saymareh Darb Ghonbad, 2014

4.2 Comparative material

For comparative material measurement carried out on 26 specimens that were distinguished as *L. mystacius* 24 specimen imperfectly have been named as *L. barbulus* and 2 specimens as *Luciobarbus pectoralis*, these specimens are:
CMN 91-0154 big one, 340 mm TL. 280 mm SL; Hour-Al-Azim; Sep. 1991.
CMN, 91-0154, the small one, 330 mm TL, 265 mm SL. Same locality and collector as big one.
Also comparative material were 4 specimens of *Barbus longiceps* Valenciennes,(1842),
with the catalog number of 80-0835, from Israel, Lake of Galilee, Jul 1981. With 187 – 286 mm TL length, 154-229 mm SL.

5. Acknowledgments:

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6. Author Contributions:

For this research articles Valiallahi J. wrote the paper, comprehended, designed and performed the experiments; analyzed the data; Coad Brian W. contributed reagents, materials, analysis tools and supervised the Ph.D. Thesis, ethnically edited and revised draft manuscript, and has given advise and critical suggestions" So the corresponding author affirms that: if this article has any scientific value, is belonging to Brian W. Coad and if in this article has any insufficiency and inadequacy, is belonging to corresponding author: Jalal Valiallahi.

7 . Conflicts of Interest:

"The authors declare no conflict of interest." Authors identify and declare that: are ready for give explanation to any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results; any role of the funding sponsors in the design of the study; in the collection, analysis or interpretation of data; in the writing of the manuscript, or in the decision to publish the results. "The founding sponsors had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results".

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