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FISH FAUNA OF DISTRICT SAHARANPUR (UTTAR PRADESH) WITH NOTES ON ECOLOGY AND ZOOGEOGRAPHY

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INTRODUCTION

Saharanpur district is an important geographical area which presents a variety of topographical realms, comprising nontane, submontane and plain areas. The area is contained within the parallels of 29°34′ and 30°24′ north latitude and of 77°7′ and 78°12′ east longitude. Ganga and Yamuna reivers form the east and west boundaries of the district, while it is surrounded by Siwalik hills on its northern side, extending in south east direction upto Hardwar, a distance of about 62 kms. Muzaffarnagar district is situated on its southern side. The length and width of the district are nearly 104 and 90 kilometres respectively. On either side of two main rivers of the district, there is a broad and low lying valley full of swamps, in addition to grassy plains and forests. The hills are abrupt and rugged on its southern side, but has a small slope towards north. Sal, Sain, Chir, Sheesham, Eucalyptus, Zizyphus trees are mostly found in the hills. The important peaks in the district are Mohund Pass 2916 feet, Doiwala peak 2947, Sahansra 3011, Bahansia 3059 and Amsot 3140 feet.

The fish fauna of this district has considered ecological and zoogeographically very important. The various varieties of ecological niches contribute to the great variety of fish fauna. Hugh Falconer (1868) named a small fish from the district as *Esox hindustanicus* which was later on identified as *Xenentodon cancila*. This reference was forgotten for almost a centurey when Myer's (1960) pointed out the existence of this reference about a fresh water belonid fish. So far, 39 species have been recorded from the district by Day (1875-78), Fowler (1924) and Husain (1975). Tilak and Husain (1974, 1980) have described new species from the district such as *Laguvia riberiroi kapuri*, and *Psilorhynchus sucatio nudithoracisus* and discovered the distribution of eastern Indian forms in the streams of this area and confirmed their taxonomic status. The present authors have collected, studied and identified 86 species from the district, thus adding 47 species to the fish fauna already known through literature. These species belong to 48 genera, 18 families and 7 orders, which are categorised according to the most recent classification available in the literature.

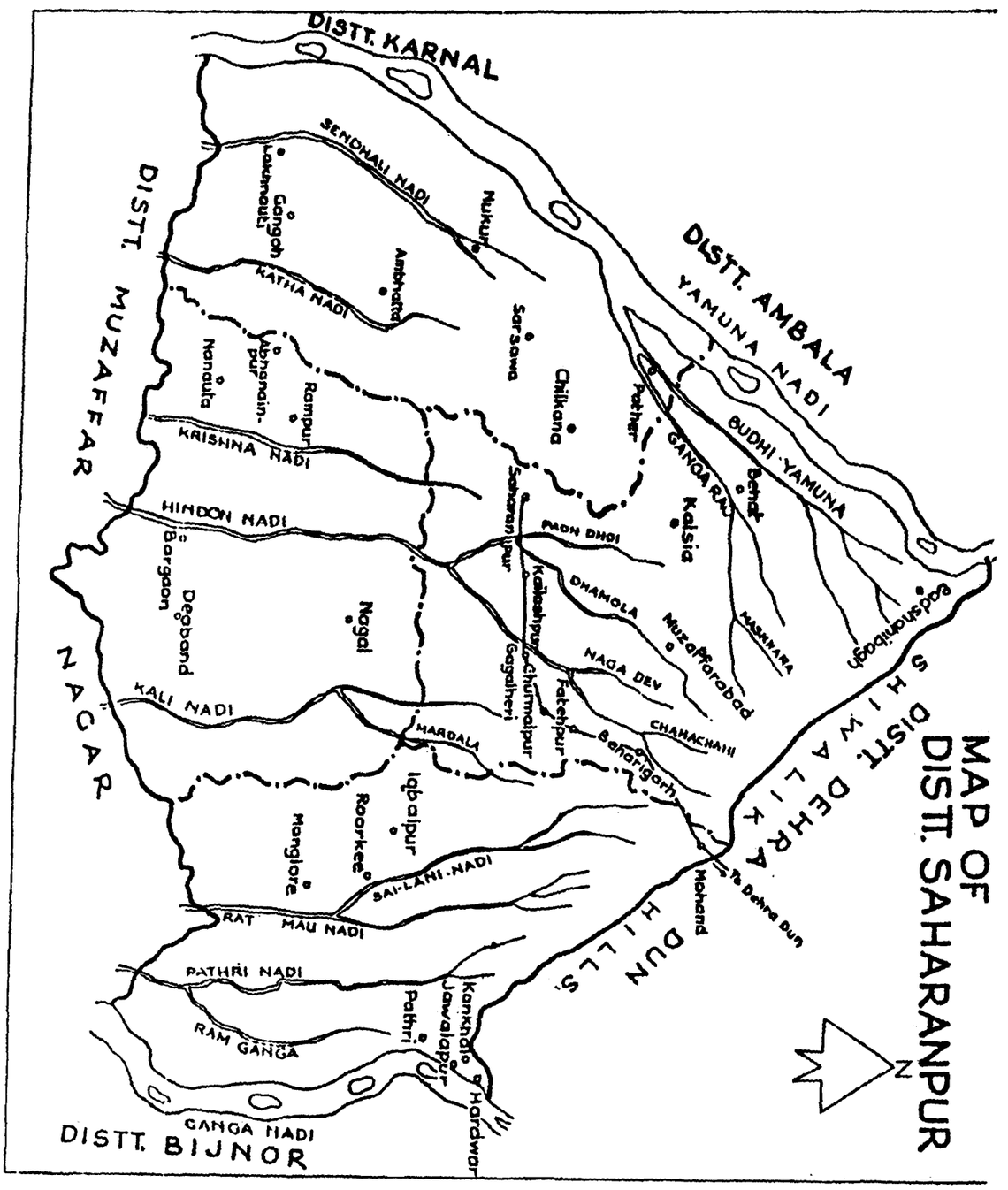

Fig. 1. Map of Distt. Saharanpur (Uttar Pradesh).

MATERIAL COLLECTED

The collection was made from the Ganga and the Yamuna rivers bordering the eastern and western boundary of the district besides rivers, streams such as Ram Ganga, Ganga Rao, Pathri, Ratmau, Sailani, Kali Hindon, Krishna, Katha, Sendhali, Budhi Yamuana, Maskhara, Dhamola, Paondhoi, Chahachahi and Nagadev as depicted in the Map (Fig. 1). Besides this, collection has also been made from the various ponds, seasonal streams and ditches in the district during the last four years duration in all seasons. The fishes were collected with the help of cast net, hand net, drag net, sweep net etc.

SYSTEMATIC LIST OF FISHES

Class PISCES
Sub class Teleostomi
Cohort ARCHAEOPHYLACES
Superorder OSTEOGLOSSOMORPHA
Order OSTEOGLOSSIFORMES
Family NOTOPTERIDAE
Genus **Notopterus** Lacepede

1. *Notopterus chitala* (Hamilton)
2. *Notopterus notopterus* (Pallas)

Cohort EUTELEOSTEI
Superorder OSTARIOPHYSI
Order CYPRINIFORMES
Subfamily SCHIZOTHORACINAE
Genus **Schizothorax** Heckel

3. *Schizothorax richardsonii* (Gray)

Genus **Schizothoraichthys** Misra

4. *Schizothoraichthys (Racoma) progastus* (McClelland)

Subfamily RASBORINAE
Genus **Amblypharyngodon** Bleeker

5. *Amblypharyngodon mola* (Hamilton)

Genus **Aspidoparia** Heckel

6. *Aspidoparia jaya* (Hamilton)
7. *Aspidoparia morar* (Hamilton)

Genus **Barilius** Hamilton

8. *Barilius barila* Hamilton
9. *Barilius barna* Hamilton
10. *Barilius bendelisis* Hamilton
11. *Barilius shacra* Hamilton
12. *Barilius vagra* Hamilton

Genus **Raiamas** Jordan

13. *Raiamas bola* Hamilton

Genus **Brachydanio** Weber and Beaufort

14. *Brachydanio rerio* (Hamilton)

Genus **Danio** Hamilton

15. *Danio devario* Hamilton

Genus **Esomus** Swainson

16. *Esomus danricus* (Hamilton)

Genus **Parluciosoma** Howes

17. *Parluciosoma daniconius daniconius* (Hamilton)

Subfamily CULTRINAE
Genus **Chela** Hamilton

18. *Chela (Chela) cashius* Hamilton
19. *Chela (Chela) laubuca* Hamilton

Genus **Salmostoma** Swainson

20. *Salmostoma bacaila* (Hamilton)

Subfamily CYPRININAE
Genus **Catla** Valenciennes

21. *Catla catla* (Hamilton)

Genus **Chagunius** Smith

22. *Chagunius chagunio* (Hamilton)

Genus **Cirrhinus** (Oken) Cuvier

23. *Cirrhinus mrigala* (Hamilton)
24. *Cirrhinus reba* (Hamilton)

Genus **Labeo** Cuvier

25. *Labeo calbasu* (Hamilton)
26. *Labeo dero* (Hamilton)
27. *Labeo dyocheilus* McClelland
28. *Labeo gonius* (Hamilton)
29. *Labeo pangusia* (Hamilton)
30. *Labeo rohita* (Hamilton)

Genus **Osterobrama** Hecrel

31. *Osteobrama cotio* (Hamiton)

Genus **Oriechthys** Smith

32. *Oriechthys cosuatis* (Hamilton)

Genus **Puntius** Hamilton

33. *Puntius carletone* Fowler
34. *Puntius chola* Hamilton
35. *Puntius conchonius* Hamilton
36. *Puntius sarana sarana* Hamilton
37. *Puntius sophore* Hamilton
38. *Puntius terio* Hamilton
39. *Puntius ticto* Hamilton

Genus **Tor** Gray

40. *Tor putitora* (Hamilton)
41. *Tor tor* (Hamilton)

Subfamily GARRINAE
Genus **Crossocheilus** Van Hasselt

42. *Crossocheilus latius* (Hamilton)

Genus **Garra** Hamilton

43. *Garra gotyla gotyla* (Gray)

Family PSILORHYNCHIDAE
Genus **Psilorhynchus** McClelland

44. *Psilorhynchus sucatio nudithoracicus* Tilak and Husain

Family HOMALOPTERIDAE
Subfamily NOEMACHEILINAE
Genus **Noemacheilus** Van Hasselt

45. *Noemacheilus denisoni denisoni* Day
46. *Noemacheilus botia* (Hamilton)
47. *Noemacheilus corica* (Hamilton)
48. *Noemacheilus montanus* (McClelland)
49. *Noemacheilus rupecula* (McClelland)

Family COBITIDAE
Subfamily BOTIINAE
Genus **Botia** Gray

50. *Botia lohachata* Chaudhuri

Subfamily COBITINAE
Genus **Lepidocephalus** Bleeker

51. *Lepidocephalus (Lepidocephalichthys) annandalie* Chaudhuri
52. *Lepidocephalus (Lepidocephalichthys) caudofurcatus* Tilak and Husain
53 *Lepidocephalus (Lepidocephalichthys) guntea* (Hamilton)

Order SILURIFORMES
Family BAGRIDAE
Genus **Mystus** Scopoli

54. *Mystus bleekeri* (Day)
55. *Mystus cavassius* (Hamilton)
56. *Mystus vittatus* (Bloch)

Genus **Pseudeutropius** Bleeker

57. *Pseudeutropius atherinoides* (Bloch)

Genus **Aorichthys** Wu

58. *Aorichthys seenohala* (Sykes)

Genus **Rita** Bleeker

59. *Rita rita* (Hamilton)

Family SILURIDAE
Genus **Ompok** Lacépéde

60. *Ompok bimaculatus* (Bloch)

Genus **Wallago** Bleeker

61. *Wallago attu* (Schneider)

Family SISORIDAE
Genus **Bagarius** Bleeker

62. *Bagarius yerrellii* Sykes

Genus **Gagata** Bleeker

63. *Gagata cenia* (Hamilton)

Genus **Glyptothorax** Blyth

64. *Glyptothorax pectinopterus* (McClelland)
65. *Glyptothorax saisii* (Jenkins)
66. *Glyptothorax telchitta* (Hamilton)

Genus **Laguvia** Hora

67. *Laguvia ribeiroi kapuri* Tilak and Husain

Family SCHILBEIDAE
Subfamily SCHILBEINAE
Genus **Clupisoma** Swainson

68. *Clupisoma garua* (Hamilton)

Family AMBLYCIPITIDAE
Genus **Amblyceps** Blyth

69. *Amblyceps mangois* (Hamilton)

Family CLARIIDAE
Genus **Clarias** Scopoli

70. *Clarias batrachus* (Linnaeus)

Family HETEROPNEUSTIDAE
Genus **Heteropneustes** Mueller

71. *Heteropneustes fossilis* (Bloch)

Super order ATHERINOMORPHA
Order ATHERINIFORMES
Family BELONIDAE
Genus **Xenentodon** Regan

72. *Xenentodon cancila* (Hamilton)

Order CHANNIFORMES
Family CHANNIDAE
Genus **Ophiocephalus** Bloch

73. *Ophiocephalus gachua* Hamilton
74. *Ophiocephalus marulius* Hamilton
75. *Ophiocephalus punctatus* (Bloch)
76. *Ophiocephalus striatus* (Bloch)

Order PERCIFORMES
Family NANDIDAE
Genus **Nandus** Valenciennes

77. *Nandus nandus* (Hamilton)

Subfamily BADINAE
Genus **Badis** Bleeker

78. *Badis badis* (Hamilton)

Family BELONTIDAE
Subfamily TRICHOGASTRINAE
Genus **Colisa** Cuvier

79. *Colisa fasciatus* (Schneider)
80. *Colisa lalius* (Hamilton)

Family CHANDIDAE
Genus **Chanda** Hamilton

81. *Chanda ranga* Hamilton
82. *Chanda nama* Hamilton

Family GOBIIDAE
Subfamily GOBINAE
Genus **Glossogobius** Gill

83. *Glossogobius qutum* (Hamilton)

Order MASTACEMBELIFORMES
Family MASTACEMBELIDAE
Genus **Mastacembelus** Scopoli

84. *Mastacembelus armatus* (Lacépéde)
85. *Mastacembelus pancalus* (Hamilton)

Genus **Macrognathus** Lacépéde

86. *Macrognathus aculeatus* (Bloch)

Note :- Besides, those species which are recorded in this paper, there are two pecies i.e. *Pseudogaster gora* (Hamilton) and *Salmostama phulo* (Hamilton) vhich are also likely to occur in the district according to local information but ould not be collected for study hence included in the key to the identification of he fishes.

KEY FOR THE IDENTIFICATION OF THE FISHES OF SAHARANPUR DISTRICT (U.P.)

1. The maxilla forms the gape of the mouth ; the pterygoid teeth developed ; swim bladder connected to otic region (Otophysic connection) without intercalation of bony elements ; hypurals supported on 1-5 centra .... (Taeniopaedia and Archaeophylaces) (2)

   The maxilla completely or partially excluded from the gape of the mouth by the pre-maxilla ; pterygoid teeth absent ; swim bladder connected to otic region (Otophysic connection) involving in many cases the intercalation of bony elements ; hypurals supported on a half centrum ... (Euteleostei) (3)

2. Opercular scales much larger than those on body ; maxille not extending beyond the hind edge of the orbit ; no black spot at the tail ; dorsal part of body less humped ; 28-33 scutes along the abdominal edge .... (*Notopterus notopterus* (Pallas)

Opercular scales not larger than those on the body ; maxilla extending far beyond the hind edge of the orbit ; a few black spots at the tail end ; dorsal part of body much humped ; 50-51 scutes along abdominal edge
Notopterus chitala (Hamilton)

3. The anterior vertebrae modified to form the weberian apparatus . . .
Ostariophyceae (4)

The anterior vertebrae not modified to form the weberian apparatus
(82)

4. Body with scales (Cycloid) Cypriniformes (5)

Scales usually absent except in some forms, where they are modified to form bony plates Siluriformes (63)

5. Pectoral with more than one or two unbrached rays ; mouth always ventral *Psilorhynchus sucatio nudithoracicus* Tilak & Husain

Pectoral with one or rarely a second rudimentary unbranched ray ; mouth dorsal, terminal or ventral (6)

6. Barbels one to two pairs or absent ; No sub-ocular spine ; mouth terminal or inferior ; gill openings wide ; scales generally large ; eyes never covered with skin Cyprinidae (7)

Barbels 3-4 pairs ; sometimes with a simple or bifid movable spine present in a groove before or below the eye ; mouth inferior ; gill openings small or moderate ; scales small or rudimentary ; eyes sometimes covered with skin
Cobitidae

7. Scales always small in size or absent ; anal sheath covered with enlarged tile like scales Schizothoracinae (54)

Scales may be small or big but always present ; anal without enlarged scales
(8)

8. Abdomen round or flat ; dorsal fin not in the posterior half of body
Rasborinae (13)

Abdomen or part of it keeled but not serrated ; dorsal fin always in the posterior half of the body Cultrinae (9)

9. Pelvic fins originate nearer to pectoral base than to anal base ; outer pelvic rays produced ; predorsal scales do not extend to the inter-orbital space ; lateral line abruptly curved downwards above the pectoral fin
Chela Hamilton (10)

Pelvic fins originate nearer to anal base than to pectoral base ; outer pelvic rays not produced ; predorsal scales extend to the inter-orbital space ; lateral line gently curves down above the pectoral ; a knob at the symphysis of lower jaw fitting into a corresponding depression in the upper jaw present (11)

10. Lateral line scales 51-56 ; predorsal scales 23-29 ; no shoulder spot present
Chela (chela) cachius Hamilton

Lateral line scales 34-37 ; predorsal scales 15-20 ; a dark shoulder spot

present ..... *Chela (Chela) laubuca* Hamilton

11. Bones of pectoral girdle support the edge of the hardened and muscular thorax ; lateral line scales more than 100 ... *Pseudogaster gora* (Hamilton)

Bones of pectoral girdle do not support the edge of the thorax ; lateral line scales less than 100 ..... *Salmostoma* Swainson (12)

12. 16-18 branched rays in the anal fin ; lateral line scales 80-87 .....
..... *Salmostoma phulo* (Hamilton)

11-13 branched rays in the anal fin ; lateral line scales more than 85 .....
..... *Salmostoma bacaila* (Hamilton)

13. Origin of dorsal fin nearly opposite the ventral fin or a little before ... (27)

Origin of dorsal fin clearly behind the ventral fin ..... (14)

14. Lateral line incomplete ..... *Amblypharyngodon mola* (Hamilton)

Lateral line complete ..... (15)

15. Dorsal fin does not extend to above the anal fin ; anal fin with 5-11 branched rays ..... (16)

Dorsal fin generally extending over the anal ; anal fin with 7-33 branched rays ..... (19)

16. A symphysial knob present in the lower jaw fitting into the upper jaw ; mouth oblique ; both lips present ..... (18)

Abdomen or part of it keeled but not serrated ; dorsal fin always in posterior half of the body ..... (17)

17. 8-10 branched rays in the anal fin ; lateral line scales 38-42 .....
..... *Aspidoparia morar* (Hamilton)

7 branched rays in the anal fin ; lateral line scales 52-60 .....
..... *Aspidoparia jaya* (Hamilton)

18. Barbels absent ..... *Parluciosoma daniconius daniconius* (Hamilton)

Maxillary barbels very long ..... *Esomus danricus* (Hamilton)

19. Anal fin long (25-38) rays ; body laterelly much compressed .....
..... *Osteobrama cotio* (Hamilton)

Anal fin short (7-15 rays) ; body not so much laterally compressed ... (20)

20. Sub-orbital ring of bones distinctly broad and prominent ; cleft of the mouth often extending beyond anterior margin of eye ; mandibles rather broad ..... (21)

Sub-orbital ring of bones not broad ; cleft of mouth extending beyond anterior margin of eye ; Jaws compressed ..... *Barilius* Hamilton (22)

21. Dorsal fin with 7 branched rays ; anal with 11-13 rays .....
..... *Brachydanio rerio* (Hamilton)

Dorsal fin with more than 7 branched rays ; anal fin with 14-19 rays .....

..... *Danio devario* Hamilton

22. Cleft of the mouth extending beyond the post-orbital margin ..... *Raiamas bola* (Hamilton)

Cleft of the mouth not extending beyond the post-orbital margin ..... (23)

23. Cleft of the mouth extending upto below the middle of the orbit ..... *Barilius vagra* Hamilton

Cleft of the mouth extending upto below the anterior third of the orbit ... (24)

24. Anal fin with 7-8 branched rays ..... (25)

Anal fin with 10-13 branched rays ..... (26)

25. Lateral line with 60-70 scales ; lateral transverse 10-11/9 ; sexual dimorphism not well marked ..... *Barilius shacra* Hamilton

Lateral line with 40-43 scales ; lateral transverse 7-8/5 ; sexual dimorphism well marked (male with prominent pectoral fins and colour) ..... *Barilius bendelisis* Hamilton

26. 16 rows of scales before the dorsal fin ; no barbels present ..... *Barilius berna* Hamilton

18 rows of scales before the dorsal fin ; only a small rostral pair of barbels present ..... *Barilius barila* Hamilton

27. Upper lip separated from the skin of the snout by a deep groove ; lower lip without a suctorial disc ..... (29)

Upper lip continuous with the skin of the snout ; lower lip with or without a suctorial disc ..... (28)

28. Upper and lower lips continuous at the angles of the jaws ; lower lip with a suctorial disc ..... *Garra gotyla gotyla* (Gray)

Upper and lower lips not continuous ; lower lip without a suctorial disc ..... *Crossocheilus latius* (Hamilton)

29. The last undivided ray of the anal fin posteriorly serrated ..... (30)

The last undivided ray of the anal fin unserrated ..... (33)

30. Dorsal fin long (with more than 15 rays) ..... (31)

Dorsal fin short (with less than 15 rays) ..... (32)

31. Head with four barbels ..... *Cyprinus carpio* Linnaeus

31.a Scales on the body irregular, large and fewer in number ..... *Cyprinus carpiospecularis* Lacépéde

31.b Body uniformly scaled ; scales of normal size and more in number ..... *Cyprinus carpio commurs* Linnaeus

31.c Body partly or wholly devoid of scales ..... *Cyprinus carpio nudus* Bloch

Head without barbels ..... *Carassius carassius* (Linnaeus)

32. Body deep ; anal fin long ; dorsal fin slightly behind that of the pelvic fin *Hypophthalmichthys molitrix* (Valenciennes)

Body less deep ; anal fin short ; origin of dorsal fin before pelvic *Ctenopharyngodon idella* (Valenciennes)

33. Upper lip absent *Catla catla* (Hamilton)

Upper lip present (34)

34. A symphysial knob in the lower jaw present (35)

No symphysial knob in the lower jaw (36)

35. Lateral line scales 35-38 ; dorsal fin rays 10-12 *Cirrhinus reba* (Hamilton)

Lateral line scales 40-45 ; dorsal fin rays 15-16 *Cirrhinus mrigala* (Hamilton)

36. Lower lip with an inner transverse fold ; mouth inferior (37)

Lower lip without an inner transverse fold ; mouth terminal (43)

37. Branched dorsal rays 11-18 (38)

Branched dorsal rays 8-10 (42)

38. Head with four barbels (39)

Head with two barbels (40)

39. Diameter of eye contained 4.5-5.5 times in the length of head *Labeo pangusia* (Hamilton)

Diameter of eye contained 6-9 times in the length of head *Labeo dyocheilus* McClelland

40. A cartilaginous or horny covering over jaws present *Labeo gonius* (Hamilton)

A cartilaginous or horny covering over jaws absent (41)

41. Branched dorsal rays 13-15 ; colour uniformely dark *Labeo calbasu* (Hamilton)

Branched dorsal rays 12-13 ; colour brownish on back and silvery on sides *Labeo rohita* (Hamilton)

42. A tubercle inside lower jaw present above the symphysis ; no horny covering on jaws *Labeo bata* (Hamilton)

No tubercles inside lower jaw above the symphysis ; both jaws covered with a horny layer *Labeo dero* (Hamilton)

43. Lower lip with an uninterrupted posterior groove continuous around corners of mouth (44)

Lower lip with posterior groove interrupted (46)

44. Lateral line complete; last undivided ray of dorsal fin ossified and simple barbels present (45)

Lateral line incomplete, piercing only 6-7 anterior scales ; last undivided ray of

dorsal fin simple and nonosseous ; barbels absent ; head with numerous pores mostly parrallel in groups ..... *Oriechthys cosuatis* (Hamilton)

45. Head length greater than the depth of the body ; fins yellow ..... *Tor putitora* (Hamilton)

Head length shorter than the depth of the body : fins reddish ..... *Tor tor* (Hamilton)

46. Snout with median and lateral lobes ; snout and cheeks beset with horny tubercles ; gill rakers a few, triangular ; branched dorsal rays 6 ; last anal ray elongated in male, normal in female : barbels rostral and maxillary ..... *Chagunius chagunio* (Hamolton)

Snout entire ; snout and cheeks without horney tubercles ; gill rakers numerous, usually lanceolate ; branched dorsal rays 7-9 ; branched anal rays not elongated in males ; barbels four two or none ..... *Puntius* Hamilton (47)

47. Barbels present ..... (48)

Barbels absent ..... (49)

48. Four barbels ; last undivided ray of dorsal fin serrated, dorsal without colour markins ..... *Puntius sarana sarana* Hamilton

Two maxillary barbels ; last undivided ray of dorsal fin bony and smooth: dorsal with colour spot ..... *Puntius chola* Hamilton

49. Last undividual ray of drosal fin bony ..... (50)

Last undivided ray of dorsal fin articulated and weak ..... (55)

50. The bony last undividual ray of dorsal fin smooth ..... (51)

The bony last undivided ray of dorsal fin posteriorly serrated ..... (52)

51. Lateral line complete and with 23-36 scales a dark mark at the base of middle dordal rays ; a black spot at the end of lateral line ..... *Puntius sophore* Hamilton

Lateral line incomplete and with 21-23 scales ; dorsal rays without a mark : a large black blotch above anal fin ..... *Puntius terio* Hamilton

52. The dorsal spine dark stained ; a few dark spots at the base of anal fin present ..... *Puntius carletoni* Fowler

Neither dorsal spine stained nor anal base bears spots ..... (53)

53. Depth of body 2.7-2.9 times in total length ; a spot on lateral side of the body near the base of caudal ..... *Puntius conchonius* Hamilton

54. Mouth ventral with a sharp edge ; a horny plate covers the lower jaw and a transverse labial papillated plate at the chin present ..... *Schizothorax richardsonii* (Gray)

Mouth terminal ; no horny plate or a papillated plate on the lower jaw or the chin ; lower labial groove continuous ..... *Schizothoraichthys* (Racoma) *progastus* (McClelland)

55. An erectile spine present near the orbit ..... Botiinae (56)

Without any erectile spine near the orbit *Noemacheilus* Van Hasselt (59)

56. BOdy oblong ; eyes not covered with skin head without scales ; dorsal fin with 10-15 rays ..... *Botia lohachatta* Chaudhuri

Body elongated ; eyes covered with skin ; head with scales ; dorsal fin with 8-9 rays *Lepidocephalus (Lapidocephalichthys)* (57)

57. Caudal forked or deeply emarginate whole of the lateral and ventral sides of head scaled
. . *Lepidocephalus* (Lepidocephalichthys) *caudofurcatus* Tilak & Husain

Caudal convex cut square ; slightly emarginate or notched ; lateral and ventral sides of head naked (58)

58. Caudal fin notched or concavely lunate ; caudal fin obliquely banded with three faint grey bands on each side of the middle line ; two intensely dark spots encircled in white rims, one slightly above the middle of the base of caudal fin and the other at the notch present
. . . . *Lepidocephalus (Lepidocephalichthys) annandalei* Chaudhuri

Caudal convex, cut square or slightly emarginate ; bands on caudal not oblique ; only one dark spot slightly above the middle of the base of caudal fin present *Lepidocephalus (Lepidocephalichthys) guntea* (Hamilton)

59. Dorsal fin with 10-12 branched rays *Noemacheilus botia* (Hamilton)

Dorsal fin with 7-8 branched rays (60)

60. Third and fourth rays of pectoral fin produced and reach upto the ventrals *Noemacheilus corica* (Hamilton)

None of the rays of pectoral fin produced (61)

61. Scales absent on the anterior part of body ; head and anterior part of body somewhat depressed *Noemacheilus denisonii* Day

62. 11-12 dark verticle bands on the body ; bands nearly three times as broad as the buff interspace . . *Noemacheilus montanus* (McClelland)

12-17 brown verticle bands, narrower than the intermediate ground space *Noemacheilus rupecula* (McClelland)

63. Anal fin long . . . (64)

Anal fin short or of moderate length . . (67)

64. Dorsal fin spineless and long, has more than 30 rays Clariidae ; *Clarias batrachus* (Linnaeus)

Dorsal fin with or without a spine but short . . . . (65)

65. Dorsal fin with a spine ; either a second dorsal or an adipose fin present
. . . . . Schilbeidae ; *Clupisoma garua* (Hamilton)

Dorsal fin spineless ; neither a second dorsal nor an adipose dorsal fin present . . (66)

66. Two pairs of barbels present ; nasal barbels absent Siluridae (69)

Four pairs of barbels present ; nasal barbels present
. Heteropneustidae ; *Heteropneustes fossilis* (Bloch)

67. Nostrils widely separated Bagridae (70)

Nostrils close together (68)

68. Lower surface of the head and body flat ; paired fins horizontal
. . . Sisoridae (76)

Lower surface of the head and body not greatly flattened ; paired fine

subhorizontal ; dorsal fin lies between bases of pectorals and ventrals .. Amblycipitidae ; *Amblyceps mangots* (Hamilton)

69. Eyes with a free orbital margin and lie above the level of the corner of the mouth and not visible from underside of head ; gape of mouth oblique, wide and very long reaching to or beyond anterior border of eye ; pectoral not reaching beyond origin of anal .. *Wallago attu* (Schneider)

Eyes sub-cutaneous, lie posterior to the level of corner of mouth and visible from underside of head ; pectoral usually surpassing the origin of anal fin ; pectoral spine pectinate or smooth *Ompok bimaculatus* (Bloch)

70. Anal fin long *Pseudeutropius atherinoides* (Bloch)

Anal fin short (71)

71. Six barbels ; eyes sub-cutaneous *Rita rita* (Hamilton)

Eight barbels ; eyes with free orbital margins (72)

72. Interneural shield in between the occipital process and the basal bone ot dorsal fin absetn *Mystus* Scopoli (73)

Internueral shield present *Aorichthys seenghala (Sykes)*

73. Occipital process 1.5-2.0 times as long as wide at the base *Mytus bleekeri* (Day)

Occipital process 3-5 times as long as wide at the base (74)

74. Maxillary barbels extend beyond pelvic fins (75)

Maxillary barbels do not extend beyond pelvic fins ; lateral side of body with three longitudinal dark stripes *Mystus vittatus* (Bloch)

75. Occipital process 3.5-4.0 times as long as wide at the base. Maxillary barbels extend even beyond caudal base ; inter-orbital width 1.0-1.5 times in eye diameter *Mystus mendo* (Hamilton)

76. Head somewhat compressed and elevated (77)

Head depressed (78)

77. Gill opening wide and gill membranes not or only slightly adherent in the skin of the isthmus ; dorsal rays 6-8 .. *Nangra viridescens* (Hamilton)

Gill opening narrow and gill membranes confluent with the skin of the isthmus; dorsal rays 6 *Gagata cenia* (Hamilton)

78. In the caudal region, the upper lobe or its rays significantly prolonged *Bagarius yarrellii Sykes*

Caudal lobes not prolonged (79)

79. Humero-cubital and scapular process and bony tubercles on sides of the body present ; the adhesive apparatus on the chest not well developed *Laguvia ribeiroi kapuri* Tilak and Husain

Humero-cubital and scapular process and bony tubercles on sides of the body absent ; the adhesive thoracic apparatus well marked .. .. *Glyptothorax* Blyth (80)

80. Skin coarsely tuberculated or denticulated adhesive thoracic aparatus prominent, elongated and without a central pit ; occipital process distinctly separated from the basal bone of the dorsal fin *Glyptothorax telchitta* (Hamilton)

Skin granulated ; adhesive thoracic apparatus not very long (81)

81. Occipital process touching basal bone of dorsal ; adhesive thoracic apparatus broader than long or the breadth equal to its length
Glyptothorax pectinopterus (McClelland)

Occipital process distinctly separated from basal bone of dorsal ; adhesive thoracic apparatus longer than broad *Glypothorax saisii* (Jenkins)

82. Fishes of usually small size ; secondary sexual dimorphism pronounced ; branchiostegal rays 4-15 ; opercular bones unarmed ; or thoracic ; commonly viviparous ; ctenoid scales only in a few species
Atherinomorpha ; Atheriniformes ; *Xenentodon cancila* Hamilton

Fishes or normal or large size ; secondary, sexual dimorphism not such pronounced ; branchiostegal rays 4 and the anterior hair, like branchiostegal rays may be present on ceratohyal ; opercular bones armed in many species ; pelvic fins, if present, thoracic or jugular ; vivipary, uncommon ; ctenoid scales common Acanthopterygii (83)

83. Head snake like ; supra branchial organs always present ; only one elongated dorsal fin present Channiformes (84)

Head not snake like ; supra branchial organs absent except in anabantoidei ; dorsal fin normally short and second dorsal fin usually present
Perciformes (87)

84. 15-20 scales between the snout and the origin of dorsal fin ; 9-10 scales between the orbit and the angle of the preoperculum ; dorsal rays 37-55. (85)

12-13 scales between the snout and the origin the dorsal fin ; 4-5 scales between the orbit and the angle of the preoperculum ; 37-45 rays in the dorsal fin *Ophiocephalus striafus* (Bloch)

85. 18-20 scales between the snout and the origin of dorsal fin; 9 scales between the orbit and the angle of preoperculum; 37-45 rays in the dorsal fin
Ophiocephalus striatus (Bloch)

15-16 scales between the snout and the origin of dorsal fin; 10 scales between the orbit and the angle of preoperculum; 45-55 rays in the dorsal fin
Ophiocephalus marulius Hamilton

86. Ventral fin 2/5th the length of pectoral ; dorsal fin with 32-37 rays ; pectoral fin with alternating orange and blue transverse bands in fresh specimens ; no bands on the body *Ophiocephalus gachua* Hamilton

Ventral fin 2/3rd-3/4th of the length of pectoral ; dorsal fin with 29-32 rays; pectoral without transverse bands and with uniform colouration; several bands or patches from back pass down the abdomen
Ophiocephalus punctatus (Bloch)

87. Body cylindrical and elongated Mastacembelidae (88)

Body neither cylindrical nor much elongatyed (90)

88. Snout oblong, fleshy, concave beneath and transversely striated ; no preorbital spine ; a few white bordered black ocellii along the base of soft dorsal present *Macrognathus aculeatus* (Bloch)

Snout not transversely striated beneath ; a distinct preorbital spine present ; no black ocellii along the soft dorsal ..... (89)

89. Anal and dorsal fins confluent with the caudal .....
..... *Mastacembelus armatus* (Lacépéde)

Anal and dorsal fins distinct from the caudal .....
..... *Mastacembelus pancalus* (Hamilton)

90. Pelvics united to form a sucking disc .... *Glossogobius gutum* (Hamilton)

Pelvics not united to form a sucking disc ....(91)

91. Accesory respiratory organs absent ..... Percoidei (92)
Accessory respiratory organs present ..... Anabantoidei : Belontiidei (95)

92. Spinous and soft dorsals connected at base (or separated) ; procumbent spine before dorsal fin present ; caudal fin furcate ; scales cycloid ; dorsal with 7 spines ..... Centropomidae ; *Chanda* Hamilton (93)

Spinous and soft dorsal continuous ; no procumbent spine before dorsal fin ; caudal fin entire ; dorsal with more than 7 spines ..... (94)

93. Lower jaw with two pairs of large crooked canniniform teeth .....
..... *Chanda nama* Hamilton

No such teeth on the lower jaw, all teeth small and normal .....
..... *Chanda ranga* Hamilton

94. Hyomandibular does not articulate with the metapterygoid ; prevomer bears teeth ; parietal and frontal crests are absent ; an ascending process of premaxillary not reaching the frontal .... Badidae : *Badis badis* (Hamilton)

Hyomandibular articulates with the metapterygoids ; prevomer bears no teeth ; parietal and frontal crests present ; a process of pre-maxillary reaches the frontal ..... Nandidae *Nandus nandus* (Hamilton)

95. Dorsal fin with 7-8 soft rays ..... (96)

Dorsal fin with 9-13 soft rays ..... *Colisa fasciatus* (Schneider)

96. A dark band from eye to the caudal base present .. *Colisa sota* (Hamilton)

Body vertically banded with scarlet and azure blue bands ; sexual dimorphism very prominent ..... *Colisa lalius* (Hamilton)

DISCUSSION

Zoogeographical Remarks :

The fish fauna of the district Saharanpur is of great zoogeographical importance. The species collected from the area can be categorised into three for zoogeographical studies.

I. Species endemic to district Saharanpur
   a) *Laguvia ribeiroi kapuri* Tilak and Hussian
   b) *Psilorhynchus sucatio nudithoracicus* Tilak and Hussain

II. Species earlier recorded from Eastern India but now found in district Saharanpur

a) *Glyptothorax saisii* (Jenkins)

b) *Lepidocephalus (Lepidocephalichthys) annandalei* Chaudhuri

III. Species recorded from other parts of India

The remaining 82 species are widely distributed in many other States of India.

The presence of the species falling under category I and II above in Saharanpur district at the base of Western Himalayas in Uttar Pradesh indicates that the species got dispersed from east to west India during and earlier geological eras, most probably during pliocene or Pliestocene. Due to differences in the ecological conditions of the habitat of the species i.e. *Laguvia ribeiroi kapuri* Tilak and Husain and *Psilorhynchus sucatio nudithoracicus* Tilak and Husain, in eastern India on one hand, and western part of India on the other and long separation from the parent stock, the species in district Saharanpur developed into different taxa.

Species Recorded from other parts of India

Among the species of this district, which are distributed in other parts of India also, *Schizothorax richardsonii* and *Schizothoraichthys* (*Racoma*) *progastus* are also important schizothoracids, which are governed by a different principal of fish distribution in India. Tilak (in press) while writting the fauna of India on schizothoracinae has remarked that the fishes of the subfamily schizothoracinae have infiltrated into the Indian sub continent from the adjoining Palaearctic region through Ladakh, Kashmir valley and further west across the Pir Panjal ranges to southern face of Himalaya. The distribution of *S. richardsonii* is interesting in this respect because the same species exist at an altitude of 4,000 metres in Jammu & Kashmir while on the south face of Himalaya, it is not recorded from above an altitude of 1,500 metres, suggesting that the existence of *S. richardsonii* in the streams on southern face of Himalaya is a subsequent introduction. This suggests that the route of migration of schizothoracids is from north (in the Palaearctic region) to the south (along the base of Himalaya in Oriental region). During the course of migration of Schizothoracids, the two species *Schizothorax richardsonii* and *Schizothoraichthys* (*Racoma*) *progastus* entered streams along Siwaliks in Saharanpur district.

From the foregoing discussion, it is clear that Saharanpur district appears to be the meeting point of the fish fauna from two directions, one from the eastern India and other from the Palaearctic region in the north. The fauna of district Saharanpur, therefore, has a great significance in the zoogeography of fish fauna of India as a whole and has been responsible for strongly supporting the modified hypothesis on the introduction of fish fauna into India.

Correlation of fish species with their Ecological conditions

District Saharanpur is clearly divisible into three ecological zones, viz., montanus,

submontanus and plains.

1. Montanus area :

The montanus area in Saharanpur district comprises the hills in Siwalik ranges, where the streams gather water from the springs and cascade down through the submontane region to plains. Because of the fast current and boulders, rooted and submerged or floating vegetation in the streams is absent. The pH of the water ranges between 7.35 — 7.90. The water was higher dissolved oxygen which ranges between 11.2 — 11.6 ppm and the water is clear and the turbidity is almost nil. The species such as *Glyptothorax pectinopterus* (McClelland), *Glyptothorax saisii* (Jenkins), *Barilius benedelisis* Hamilton and *Barilius vagra* Hamilton, need higher dissolved oxygen to inhabit hill streams. These feed on food occurring in fast streams in between the boulders.

2. Submontanus area :

In the submontanus region along Siwalik ranges in district Saharanpur, the streams flow over stony bed which has a vast stretch and the soil is highly porous. As a result, the little amount of water in the streams normally seeps down into the earth and the streams in majority of the cases are dry throughout the year except during monsoon season, when some of the species which can enter regions of higher dissolved oxygen contents are also found. Such species are the following :

1. *Barilius bendelisis* Hamilton
2. *Aspidoparia jaya* (Hamilton)
3. *Aspidoparia morar* (Hamilton)
4. *Glyptothorax telchitta* (Hamilton)
5. *Garra gotyla gotyla* (Gray)
6. *Crossocheilus latius* (Hamilton)
7. *Labeo dero* (Hamilton)
8. *Labeo dyocheilus* McClelland
9. *Amblyceps mangois* (Hamilton)
10. *Heteropneustes fossilis* (Bloch)

3. Plain Area :

The streams in the plains become slow and gradually harbour rooted, submerged and floating vegetation in addition to algae. The water in the streams has a pH range between 7.0 — 7.55, the temperature 20.9°C — 36.5°C and the dissolved oxygen 8.9 — 11.6 ppm.

In this region, there are a large number of ponds of various dimensions in which rooted and sumerged, rooted and floating and floating type of vegetation are commonly found. Majority of the species in the plains find this habitat very convenient for living and breeding. All those species mentioned in the systematic list other than those mentioned above, are found in the plains.

The categorisation of the ecological niches in district Saharanpur such as the montanus, the submontanus and the plain areas are only roughly demarcated from one another. The ecological conditions of the two contiguous ecological niches merge and accordingly, there is a certain amount of intermingling of fish species of the two contiguous ecological niches. The species existing in the two

ends of the series i.e. the montanus on the one hand and the plains on the other differ greatly from each other because of the vast amount of differences in the ecological conditions of the two niches. The submontanus region on the other hand acts as a buffer zone between the montanus and the plain areas and this region is frequented by the species of both the montanus and the plain areas.

The ecological conditions, depicting three types of ecological zones, as remarked above, distinguish district Saharanpur from majority of the other areas, where such a ecological diversity does not exist. The study of the fish fauna of Saharanpur district is, therefore, very important from ecological point of view and should serve as a base for study of the fish fauna in relation to various ecological conditions elsewhere in the country.

The species of the montane and submontane region of the district represent 4.6% and 13.9% respectively, while the species inhabitating the plain area are represented by 81.5%.

SUMMARY

The Saharanpur district has been surveyed in montane, submontane and plain areas for four years, covering all seasons. More than 10,000 examples belonging to 86 species, 48 genera, 18 families and 7 orders have been collected. The species occurring in different zones have been analysed. A dichotomous key to the identification of species of the district is also given. The zoogeographical importance of fish taxa has been mentioned.

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