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FISH GEOGRAPHY OF MEGHALAYA

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INTRODUCTION

The science of zoogeography is concerned with the geographical distribution of animals. Physiographically Meghalaya represents a remnant of the ancient plateau of precambrian Indian Peninsular shield. The plateau standing as a water shed between the Surma Valley of Bangladesh on the south and the Brahmaputra Valley on the north, is dissected by several rivers and a net-work of their tributaries. The drainage pattern in the region represents a good number of torrential streams. The fish fauna of Meghalaya comprising of 104 species exhibit a combination of both hill stream and plain water forms occupying diverse ecological conditions in their distributional ranges in the twin drainage systems of the northern or Brahmaputra and southern or Barak.

MATERALS AND PROCEDURES

For convenience of study the entire drainage system of Meghalaya investigated has been divided into four Gradient Zones based on the altitudinal levels. The zones with their altitudinal coverages are : I (2000-1501 M), II (1500-1001 M), III (1000-500 M) and IV (Below 500 M). The justification of selecting such altitudinal gradation within the purview of the study lies in the fact that the tributaries of twin drainage system of Meghalaya exhibit individual variation in their topographical courses. Unless some uniformity in spatial zonation is made, the diverse findings may manoeuvre unavoidable complications to make a comparative assessment.

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Zoogeographical Classification

Zoogeographically Meghalayan fish fauna have been categorised into Primary and Peripheral forms. In fact the secondary form has not been found in the Maghalayan fauna.

1. *Primary freshwater fishes* :

95 species under 19 families and 49 genera have been grouped under present division.

95 species include 1 species of the genus *Notopterus*, 1 sp. of *Oxygaster*, 1 sp. of *Salmostoma*, 5 spp. of *Barilius*, 6 spp. of *Danio*, 1 sp. of *Esomus*, 2 spp. of *Rasbora*, 1 sp. of *Acrossocheilus*, 1 sp. of *Amblypharyngodon*, 1 sp. of *Chagunius*, 2 spp. of *Cirrhina*, 1 sp. of *Crossocheilus*, 8 spp. of *Garra*, 6 spp. of *Labeo*, 1 sp. of *Osteobrama*, 7 spp. of *Puntius*, 2 spp. of *Tor*, 3 spp. of *Psilorhynchus*, 2 spp. of *Botia*, 4 spp. of *Lepidocephalus*, 1 sp. of *Acanthocobitis*, 1 sp. of *Schistura*, 1 sp. of *Mesonoemacheilus*, 1 sp. of *Physoschistura*, 1 sp. of *Somileptes*, 4 spp. of *Mystus*, 1 sp. of *Ompok*, 1 sp. of *Wallago*, 1 sp. of *Ailia*, 1 sp. of *Pseudeutropius*, 1 sp. of *Amblyceps*, 1 sp. of *Bagarius*, 1 sp. of *Conta*, 2 spp. of *Gagata*, 3 spp. of *Glyptothorax*, 1 sp. of *Hara*, 1 sp. of *Pseudecheneis*, 1 sp. of *Clarias* 1 sp. of *Heteropneustes*, 1 sp. of *Olyra*, 3 spp. of *Channa*, 1 sp. of *Badis*, 1 sp. of *Nandus*, 1 sp. of *Anabas*, 2 spp. of *Colisa*, 1 sp. of *Pillaia*, 2 spp. of *Mastacembelus*, 1 sp. of *Macrognathus* and 1 sp. of *Tetraodon*.

2. *Peripheral freshwater forms* :

Only 9 spp. under 7 genera and 6 families have been grouped under this division.

9 species include 1 sp. of the genus *Gadusia*, 1 sp. of *Setipinna*, 1 sp. of *Xenontodon*, 3 spp. of *Chanda*, 1 sp. of *Sicamugil*, 1 sp. of *Rhinomugil* and 1 sp. of *Glossogobius*.

Distributional Trend

Distributional pattern of the fish fauna of the twin drainge systems incidentally forms a unique feature of Meghalaya. Following categories have been selected for various studies on the Distributional trend of the fishes of Meghalaya : 1) General, 2) Inter-drainage distribution, 3) Intra-drainage distribution, 4) Altitudinal distribution, 5) Indian and Extra Indian distribution and 6) Ichthyological division.

1. *General :* Of the 104 species collected, 32 spp. are restricted to the northern tributary system, 25 spp. to southern river system while 47 spp. are having overlapping distribution.

2. *Inter-drainage distribution* : All the species observed have been presented below according to their broad and restricted occurrence between the twin drainages.

a) *Widely distributed species* :

1. *Salmostoma bacaila*, 2. *Barilius barila*, 3. *B. barna*, 4. *B. bendelisis*, 5. *Danio (D) aequipinnatus*, 6. *D (D) dangila*, 7. *D (B) rerio*, 8. *Esomus danricus*, 9. *Rasbora daniconius*, 10. *Acrossocheilus hexagonolepis*, 11. *Ambly pharynogodon mola*, 12. *Crossocheilus latius latius*, 13. *Garra naganensis*, 14. *Osteobrama cotio cotio*, 15. *Puntius chola*, 16. *P. shalynius*, 17. *P. sophore*, 18. *P. ticto*, 19. *Psilorhynchus balitora*, 20. *Lepidocephalus guntea*, 21. *Schistura rupecola*, 22. *Mystus cavasius*, 23. *Amblyceps mangois*, 24. *Clarias batrachus*, 25. *Heteropneustes fossilis*, 26. *Channa orientalis*, 27. *C. punctata*, 28. *C. stewartii*, 29. *Chanda ranga*, 30. *Badis badis*, 31. *Pillaia indica*, 32. *Mastacembelus armatus*.

b) *Species having restricted occurrence* :

Occurring only in R. Umiam and Simsang : *Tor tor*. Occurring only in R. Umiam and Umsohryngkew : *Garra lissorhynchus* and *G. rupecula*.

Occurring only in R. Jingiram and Umlew : *Gadusia chapra*, *Pseudeutropius atherinoides* and *Chanda nama*.

Occurring only in R. Jingiram and Simsang : *D. devario*, *Puntius sarana*, *Botia dario*, *Lepidocephalus menoni*, *Acanthocobitis botia*, *Tetraodon cutcutia*.

Occurring only in R. Didram and Simsang : *Chagunius chagunio*.

Occurring only in R. Dudhnoi and Umlew : *Gagata viridescens*.

Occurring only in R. Dudhnoi and Ronga : *Olyra longicaudata*.

3. *Intra-drainage distribution* ;

BRAHMAPUTRA DRAINAGES :

a) *Widely distributed species* :

1. *Garra gotyla gotyla*, 2. *G. lamta*, 3. *Tor putitora*, 4. *Somileptes gongota*, 5. *Mystus bleekeri*, 6. *M. vittatus*, 7. *Hara hara*, 8. *Nandus nandus*, 9. *Glossogobius gutum*, 10. *Colisa sota*, 11. *C. fasciatus*, 12. *Mastacembelus pancalus*.

b) *Species restricted to particular river only* :

R. Umiam : *Danio deyi*, *D. meghalayensis*, *Garra annandalei*, *G. mcClel-*

landi, Psilorhynchus homaloptera, Lepidocephalus berdmorei, Mesonoemacheilus reticulofasciatus, Physoschistura elongata, Glyptothorax striatus, Pseudecheneis sulcatus.

R. Jingiram : *Setipinna phasa, Ompok bimaculatus, Gagata cenia, Glyptothorax telchitta, Xenontodon cancila, Macrognathus aculeatus.*

R. Umtrew : *Puntius filamentosus.*

R. Ganol : *Garra nasutus.*

R. Dudhnoi : *Barilius tileo, Lepidocephalus annandalei.*

Barak Drainages :

a) *Widely distributed species* :

1. *Oxygaster gora*, 2. *Labeo boga*, 3. *L. calbasu*, 4. *L. pangusia.*

b) *Species restricted to particular river only* :

R. Simsang : *Notopterus chitala, Barilius bola, Rasbora elanga, Cirrhina mrigala, C. reba, Labeo dero, L. gonius, L. rohita, Puntius clavatus, Psilorhynchus sucatio, Botia rostrata, Mystus seenghala, Wallagonia attu, Bagarius bagarius, Conta conta, Chanda baculis, Sicamugil cascasia, Rhinomugil corsula.*

R. Umlew : *Ailia coila.*

R. Ronga : *Glyptothorax shawi* and *Anabas testudineus.*

4. *Altitudinal distribution* :

Altitudinally, the whole region of Meghalaya, investigated, has been divided into four gradient zones : these are G. Zone I (1501-2000 M), G. Zone II (1001 M-1500 M), G. Zone III (501-1000 M) and G. Zone IV (below 500 M).

Twin Drainages :

a) *Species of G. Zone* I :

1. *Danio (D) aequipinnatus*, 2. *D (D) dangila*, 3. *D (B) rerio*, 4. *Acrossocheilus hexagonolepis*, 5. *Garra rupecula*, 6. *Puntius shalynius*, 7. *Lepidocephalus berdmorei*, 8. *L. guntea*, 9. *Schistura rupecola*, 10. *Heteropneustes fossilis*, 11. *Channa orientalis*, 12. *C. stewartii*, 13. *Badis badis.*

b) *Species of G. Zone* II :

1. *D (D) aequipinnatus*, 2. *D (D) dangila*, 3. *D. deyi*, 4. *D. meghalayensis*, 5. *D (B) rerio*, 6. *Esomus danricus*, 7. *Rasbora daniconius*, 8. *A. hexagonolepis*, 9. *Amblypharyngodon mola*, 10. *Crossocheilus latius latius*, 11. *Garra annandalei*, 12. *G. lissorhynchus*, 13.

G. mcClellandi, 14. *G. naganensis*, 15. *Osteobrama cotio cotio*, 16. *Puntius shalynius*, 17. *Tor putitora*, 18. *T. tor*, 19. *Psilorhynchus balitora*, 20. *Psilorhynchus homaloptera*, 21. *Lepidocephalus berdmorei*, 22. *L. guntea*, 23. *Schistura rupecola*, 24. *Mesonoemacheilus reticulofasciatus*, 25. *Physoschistura elongata*, 26. *Mystus cavasius*, 27. *M. vittatus*, 28. *Glyptothorax striatus*, 29. *Hara hara*, 30. *Pseudecheneis sulcatus*, 31. *Clarias batrachus*, 32. *Heteropneustes fossilis*, 33. *Channa orientalis*, 34. C. *punctata*, 35. *C. stewartii*, 36. *Chanda baculis*, 37. *C. ranga*, 38. *Badis badis*, 39. *Glossogobius gutum*, 40. *Colisa sota*, 41. *C. fasciatus*, 42. *Pillaia indica*, 43. *Mastacembelus pancalus*.

c) *Species of G. Zone* III :

1. *Barilius barila*, 2. *B. bendelisis*, 3. *D (D) aequipinnatus*, 4. *D (D) dangila*, 5. *D (B) rerio*, 6. *Esomus danricus*, 7. *Rasbora daniconius*, 8. *Acrossocheilus hexagonolepis*, 9. *Garra gotyla*, 10. *G. lamta*, 11. *G. naganensis*, 12. *G. nasutus*, 13. *Puutius chola*, 14. *P. filamentosus*, 15. *P. shalynius*, 16. *Tor putitora*, 17. *Lepidocephalus guntea*, 18. *Schistura rupecola*, 19, *Amblyceps mangois*, 20. *Glyptothorax shawi*, 21. *Heteropneustes fossilis*, 22. *Channa orientalis*, 23. *C. punctata*, 24. *C. stewartii*, 25. *Badis badis*, 26. *Colisa sota*, 27. *C. fasciatus*, 28. *Pillaia indica*.

d) *Species of G. Zone* IV :

1. *Gadusia chapra*, 2. *Setipinna phasa*, 3. *Notopterus chitala*, 4. *Oxygaster gora*, 5. *Salmostoma bacaila*, 6. *Barilius barila*, 7. *B. barna*, 8. *B. bendelisis*, 9. *B. bola*, 10. *B. tileo*, 11. *Danio (D) aequipinnatus*, 12. *D (D) dangila*, 13. *D (D) devario*, 14. *D (B) rerio*, 15. *Esomus danricus*, 16. *Rasbora daniconius*, 17. *R. elanga*, 18. *Acrossocheilus hexagonolepis*, 19. *Amblypharyngodon mola*, 20. *Chagunius chagunio*, 21. *Cirrhina mrigala*, 22. *C. reba*, 23. *Crossocheilus latius latius*, 24. *Garra gotyla gotyla*, 25. *Labeo boga*, 26. *L. calbasu*, 27. *L. dero*, 28. *L. gonius*, 29. *L. pangusia*, 30. *L. rohita*, 31. *Osteobrama cotio cotio*, 32. *Puntius chola*, 33. *P. clavatus*, 34. *P. sarana sarana*, 35. *P. shalynius*, 36. *P. sophore*, 37. *P. ticto*, 38. *Psilorhynchus balitora*, 39. *P. sucatio*, 40. *Botia dario*, 41. *B. rostrata*, 42. *Lepidocephalus annandalei*, 43. *L. guntea*, 44. *L. menoni*, 45. *Acanthocobitis botia*, 46. *Schistura rupecola*, 47. *Somileptes gongota*, 48. *Mystus bleekeri*, 49. *M. cavasius*, 50. *M. seenghala*, 51. *M. vittatus*, 52. *Ompok bimaculatus*, 53. *Wallago attu*, 54. *Ailia coila*, 55. *Pseudeutropius atherinoides*, 56. *Amblyceps mangois*, 57. *Bagarius bagarius*, 58. *Conta conta*, 59. *Gagata cenia*, 60. *G. viridescens*, 61. *Glyptothorax shawi*, 62. *G. telchitta*, 63. *Hara hara*, 64. *Clarias batrachus*,

65. *Heteropneustes fossilis*, 66. *Olyra longicaudata*, 67. *Xenontodon cancila*, 68. *Channa orientalis*, 69. *C. punctata*, 70. *C. stewartii*, 71. *Chanda nama*, 72. *C. ranga*, 73. *Badis badis*, 74. *Nandus nandus*, 75. *Sicamugil cascasia*, 76. *Rhinomugil corsula*, 77. *Glossogobius gutum*, 78. *Anabas testudineus*, 79. *Colisa fasciatus*, 80. *Mastacembelus armatus*, 81. *M. pancalus*, 82. *Macrognathus aculeatus*, 83. *Tetraodon cutcutia*.

BRAHMAPUTRA DRAINAGES :

a) *Species of G. Zone* I :

1) *Danio (D) aequipinnatus*, 2. *D (D) dangila*, 3. *D (B) rerio*, 4. *Acrossocheilus hexagonolepis*, 5. *Garra rupecula*, 6. *Puntius shalynius*, 7. *Lepidocephalus berdmorei*, 8. *L. guntea*, 9. *Heteropneustes fossilis*, 10. *Channa orientalis*, 11. *C. stewartii*.

b) *Species of G. Zone* II :

1. *D (D) aequipinnatus*, 2. *D (D) dangila*, 3. *D. deyi*, 4. *D. meghalayensis*, 5. *D (B) rerio*, 6. *E. danricus*, 7. *R. daniconius*, 8. *A. hexagonolepis*, 9. *A. mola*, 10. *C. latius latius*, 11. *G. annandalei*, 12. *G. lissorhynchus*, 13. *G. mcClellandi*, 14. *G. naganensis*, 15. *O. cotio cotio*, 16. *P. shalynius*, 17. *T. putitora*, 18. *T. Tor*, 19. *P. balitora*, 20. *P. homaloptera*, 21. *L. berdmorei*, 22. *L. guntea*, 23. *S. rupecola*, 24. *M. reticulofasciatus*, 25. *P. elongata*, 26. *M. cavasius*, 27. *M. vittatus*, 28. *G. striatus*, 29. *H. hara*, 30. *P. sulcatus*, 31. *C. batrachus*, 32. *H. fossilis*, 33. *C. orientalis*, 34. *C. punctata*, 35. *C. stewartii*, 36. *C. ranga*, 37. *B. badis*, 38. *G. gutum*, 39. *C. sota*, 40. *C. fasciatus*, 41. *P. indica*, 42. *M. pancalus*.

c) *Species of G. Zone* III :

1. *B. barila*, 2. *B. bendelisis*, 3. *D (D) aequipinnatus*, 4. *D (D) dangila*, 5. *D (B) rerio*, 6. *E. danricus*, 7. *R. daniconius*, 8. *A. hexagonolepis*, 9. *G. gotyla, gotyla*, 10. *G. lamta*, 11. *G. naganensis*, 12. *G. nasutus*, 13. *P. chola*, 14. *P. filamentosus*, 15. *P. shalynius*, 16. *T. putitora*, 17. *L. guntea*, 18. *S. rupecola*, 19. *A. mangois*, 20. *H. fossilis*, 21. *C. orientalis*, 22. *C. punctata*, 23. *C. stewartii*, 24. *B. badis*, 25. *C. sota*, 26. *C. fasciatus*, 27. *P. indica*.

d) *Species of G. Zone* IV :

1. *G. chapra*, 2. *S. phasa*, 3. *S. bacaila*, 4. *B. barila*, 5. *B. barna*, 6. *B. bendelisis*, 7. *B. tileo*, 8. *D (D) aequipinnatus*, 9. *D*

(*D*) *dangila*, 10. *D* (*D*) *devario*, 11. *D* (*B*) *rerio*, 12. *E. danricus*, 13. *R. daniconius*, 14. *A. hexagonolepis*, 15. *A. mola*, 16. *C. chagunio*, 17. *C. latius latius*, 18. *G. gotyla gotyla* 19. *O. cotio cotio*, 20. *P. chola*, 21. *P. sarana sarana*, 22. *P. shalynius*, 23. *P. sophore*, 24. *P. ticto*, 25. *P. balitora*, 26. *B. dario*, 27. *L. annandalei*, 28. *L. guntea*, 29. *L. menoni*, 30. *A. botia*, 31. *S. gognota*, 32. *M. bleekeri*, 33. *M. cavasius*, 34. *M. vittatus*, 35. *O. bimaculatus*, 36. *P. atherinoides*, 37. *A. mangois*, 38. *G. cenia*, 39. *G. viridescens*, 40. *G. telchitta*, 41. *H. hara*, 42. *C. batrachus*, *H. fossilis*, 44. *O. longicaudata*, 45. *X. cancila*, 46. *C. orientalis*, 47. *C. punctata*, 48. *C. stewartii*, 49. *C. nama*, 50. *C. ranga*, 51. *B. badis*, 52. *N. nandus*, 53. *G. gutum*. 54. *C. fasciatus*, 55. *M. armatus*, 56. *M. pancalus*, 57. *M. aculeatus*, 58. *T. cutcutia*.

BARAK DRAINAGES :

a) *Species of G. Zone* I :

1. *D* (*D*) *aequipinnatus*, 2. *D* (*D*) *dangila*, 3. *D* (*B*) *rerio*, 4. *A. hexagonolepis*, 5. *G. rupecula*, 6. *P. shalynius*, 7. *L. guntea*, 8. *S. rupecola*, 9. *C. orientalis*, 10. *C. stewartii*, 11. *B. badis*.

b) *Species of G. Zone* II :

1. *D* (*D*) *aequipinnatus*, 2. *D* (*D*) *dangila*, 3. *D* (*B*) *rerio*, 4. *A. hexagonolepis*, 5. *G. naganensis*, 6. *P. shalynius*, 7. *Ttor*, 8. *L. guntea*, 9. *S. rupecola*, 10. *C. orientalis*, 11. *C. stewartii*, 12. *C. baculis*, 13. *C. ranga*, 14. *B. badis*.

c) *Species of G. Zone* III :

1. *D* (*D*) *aequipinnatus*, 2. *D* (*D*) *dangila*, 3. *L. guntea*, 4. *G. shawi*, 5. *H. fossilis*, 6. *C. punctata*, 7. *C. stewartii*, 8. *B. badis*, 9. *P. indica*.

d) *Species of G. Zone* IV :

1. *G. chapra*, 2, *N. chitala*, 3. *O. gora*, 4. *S. bacaila*, 5. *B. barila*, 6. *B. barna*, 7. *B. bendelisis*, 8. *B. bola*, 9. *D* (*D*) *aequipinnatus*, 10. *D* (*D*) *dangila*, 11. *D* (*D*) *devario*, 12. *D* (*B*) *rerio*, 13. *E. danricus*, 14. *R. daniconius*, 15. *R. elanga*, 16. *A. hexagonolepis*, 17. *A. mola*, 18. *C. chagunio*, 19. *C. mrigala*, 20. *C. reba*, 21. *C. latius latius*, 22. *L. boga*, 23. *L. calbasu*, 24. *L. dero*, 25. *L. gonius*, 26. *L. pangusia*, 27. *L. rohita*, 28. *O. cotio cotio*, 29. *P. chola*, 30. *P. clavatus*, 31. *P. sarana sarana*, 32. *P. sophore*, 33. *P. ticto*, 34. *P balitora*, 35. *P. sucatio*, 36. *B. dario*, 37. *B. rostrata*, 38. *L. guntea*, 39. *L. menoni*, 40. *A. botia*, 41. *S. rupecola*, 42. *M. cavasius*, 43. *M. seenghala*, 44. *W. attu*, 45. *A. coila*,

46. *P. atherinoides*, 47. *A. mangois*, 48. *B. bagarius*, 49. *Conta conta*, 50. *G. viridescens*, 51. *G. shawi*, 52. *C. batrachus*, 53. *H. fossilis*, 54. *O. longicaudata*, 55. *C. orientalis*, 56. *C. punctata*, 57. *C. stewartii*, 58. *C. nama*, 59. *C. ranga*, 60. *B. badis*, 61. *S. cascasia*, 62. *R. corsula*, 63. *A. testudineus*, 64. *M. armatus*, 65. *T. cutcutia*.

5. *Indian and Extra Indian distribution* :

Zoogeographically fish fauna of Meghalaya have been classified into 4 groups : I) Widely distributed species II) Species of Northern India III) Species of the Himalayas and IV) Species of southern India.

a) *Widely distributed species* :

It includes 60 species known to occur widely in all parts of India, Pakistan, Bangladesh, Sri Lanka, Burma and Malaya and are, therefore, of no significance. Fishes of different sub-division are as follows :

i) *Present in India, Pakistan. Bangladesh, Sri Lanka, Burma and Malaya* : *Esomus danricus, R. daniconius, P. sarana sarana, O. bimaculatus, W. attu, C. batrachus, X. cancila, C. orientalis, C. punctata, G. gutum, A. testudineus, M. armatus, M. aculeatus.*

ii) *Present in India, Pakistan, Bangladesh, Burma, Malaya but absent in Sri Lanka* : *G. chapra, N. chitala, C. chagunio, M. cavasius, A. mangois, B. bagarius, C. ranga, N. nandus.*

iii) *Present in India, Pakistan, Sri Lanka, Bangladesh, Burma but absent in Malaya* : *S. phasa, B. bendelisis, D (D) aequipinnatus, D (B) rerio, P. chola, P. ticto, A. botia, M. vittatus, H. fossilis.*

iv) *Present in India, Pakistan, Bangladesh, Burma except Sri Lanka and Malaya* : *S. bacaila, B. barila, B. barna, D (D) devario, A. mola, C. mrigala, C. reba, C. latius latius, G. gotyla ggtyla, L. boga, L. calbasu, L. gonius, L. rohita, O. cotio cotio, P. sophore, M. seenghala, P. atherinoides, C. nama, B. badis, C. fasciatus, M. pancalus,*

v) *Present only in India, Bangladesh and Burma* : *P. clavatus, and G. viridescens.*

vi) *Present only in India, Pakistan and Bangladesh : A. coila.*

vii) *Present only in India and Pakistan* : *L. pangusia.*

viii) *Present only in India and Burma* : *G. lamta, G. nasutus, C. conta* and *O. longicaudata.*

ix) *Present only in India and Bangladesh* : *S. gongota,*

b) *Species of Northern India* :

It includes 24 species having somewhat restricted distribution :

i) *Present in Northern India, Sri Lanka, Pakistan, Bangladesh, Burma and Malaya* : Nil.

ii) *Present in Northern India, Sri Lanka, Pakistan, Bangladesh and Burma but absent in Malaya* : *L. guntea.*

(iii) *Present in Northern India, Pakistan, Bangladesh, Burma and Malaya but absent in Sri Lanka* : *M. bleekeri.*

(iv) *Present in Northern India, Sri Lanka, Bangladesh and Burma* : *D. dangila.*

(v) *Present in Northern India, Bangladesh, Burma and Malaya* : *A. hexagonolepis.*

(vi) *Present in Northern India, Pakistan, Bangladesh and Burma* : *B. bola, L. dero, T. tor, G. cenia, C. baculis, R. corsula.*

(vii) *Present in Northern India, Bangladesh and Burma* : *R. elanga, P. balitora* and *H. hara.*

viii) *Present in Northern India, Bangladesh and Pakistan* : *O. gora, T. putitora* and *B. dario.*

ix) *Present in Northern India, Bangladesh and Malaya* : *T. cutcutia.*

x) *Present in Northern India, Pakistan and Sri Lanka* : *S. cascasia.*

xi) *Present in Northern India and Burma* : *L. berdmorei.*

xii) *Present in Northern India and Bangladesh* : *G. telchitta,* and *C. sota.*

xiii) *Present in Northern India only* : *G. lissorhynchus, P. sucatio* and *S. rupecola.*

c) *Species of Southern India* :

Under the present division only those species restricted to southern region have been mentioned. Of these 57 species which are common to Meghalaya and Southern India, 55 are common to Northern India also, only 2 are restricted in southern region.

i) *Present in southern India and Sri Lanka* : *P. filamentosus.*

ii) *Present to southern India* : *G. mcClellandi.*

d) *Species of Himalayas* :

18 species are found under this group which are generally of hill stream or swift water habitat found along the Himalayas and its foot hills.

According to Burrard and Hayden (1933) the Himalayan rivers can be divided into four groups : 1) Assam Himalayas or Eastern Himalayas i. e. all the rivers between Brahmaputra and Teesta ; 2) Nepal Himalayas between R. Teesta and Kali, 3) Kumaon Himalayas between R. Kali and Sutlej and 4) Punjab Himalayas i. e. rivers west to Sutlej. Fishes of the subdivisions are as follows :

i) *Found in all the four section of Himalayas* : Nil.

ii) *Found in Eastern, Nepal and Kumaon Himalayas* : *B. rostrata.*

iii) *Found in Eastern and Nepal Himalayas* : *G. annandalei, P. sucatio, C. stewartii.*

iv) *Endemic in Eastern Himalayas* : 1. *B. tileo,* 2. *D. meghalayensis,* 3. *D. deyi,* 4. *G. naganensis,* 5. *G. rupecula,* 6. *P. shalynius,* 7. *P. homaloptera,* 8. *L. annandalei,* 9. *L. menoni,* 10, *M. reticulofasciatus,* 11. *P. elongata,* 12. *G. shawi,* 13. *G. striatus,* 14. *P. indica.*

6. *Distribution on Ichthyological division :*

Under the present category all the Meghalayan fishes available have been grouped under different Ichthyological divisions and distribution of each group has been analysed.

Clupeids

Of the two species recorded from Meghalaya, under the present group, *G. chapra* exhibits overlapping distribution while *S. phasa* is restricted to Brahmaputra drainage only. Both the species are restricted to lower altitude (below 500 M).

Notopterids

N. chitala is found only in the Barak drainage and at a lower altitude (below 500 M).

Major Carps

All the four species of Indian Major carps recorded from Meghalaya are collected from Barak drainages and only from lower altitude (below 500 M).

Other Carps and Minnows

Of the 45 species recorded under the present group, 11 spp. (*B. tileo, D. deyi, D. meghalayensis, G. annandalei, G. gotyla, G. lamta, G.*

mcClellandi, *G. nasutus*, *P. fialmentosus*, *T. putitora*, *P. homaloptera*) are restricted to northern tributary system and 9 spp. (*O. gora*, *B. bola*, *R. elanga*, *C. reba*, *L. boga*, *L. dero*, *L. pangusia*, *P. clavatus*, *P. sucatio*) to southern tributary system while the remaining 25 species (55.56%) are having overlapping distribution.

Altitudinally, *G. rupecula* is restricted to above 1500 M, 7 spp. (*D. meghalayensis*, *D. deyi*, *G. annandalei*, *G. lissorhynchus*, *G. mcClellandi*, *T. tor*, and *P. homaloptera*) between alt. 1000 M to 1500 M. 3 spp. (*G. lamta*, *G. nasutus*, *P. filamentosus*) restricted to alt. between 500 M to 1000 M and 17 spp. (*O. gora*, *S. bacaila*, *B. barna*, *B. bola*, *B. tileo*, *D. devario*, *R. elanga*, *C. chagunio*, *C. reba*, *L. boga*, *L. dero*, *L. pangusia*, *P. clavatus*, *P. sophore*, *P sarana*, *P. ticto* and *P. sucatio*) below 500 M alt. Five species i. e. *D. aequipinnatus*, *D. dangila*, *D. rerio*, *A. hexagonolepis* and *P. shalynius* are having wide range of distribution (beiow 500 to 2000 M). *E. danricus* and *R. daniconius* have been recorded between alt. below 500 to 1500 M. 4 species (*B. barila*, *B. bendelisis*, *G. gotyla* and *P. chola*) between alt. below 500 to 1000 M. *G. naganensis* and *T. putitora* are restricted between alt. 500 to 1500 M. 4 spp. (*A. mola*, *C. latius latius O. cotio cotio* and *P. balitora*) shows some discontinuous distribution and have been recorded between alt. 1000 to 1500 M and below 500 M.

COBITIDS

Of the 11 species recorded in Meghalay, 5 spp. (*L. annandalei*, *L. berdmorei*, *M. reticulofasciatus*, *P. elongata*, and *S. gongota*) are restricted to northern tributary system, *B. rostrata*, to southern river system whereas the remaining 5 species (op. cit.) are having overlapping distribution.

Altitudinally, 6 spp. (*B. dario*, *B. rostrata*, *L. annandalei*, *L. menoni*, *A. botia* and *S. gongota*) are restricted to lower altitude (below 500 M), 2 spp. (*M. reticulofasciatus* and *P. elongata*) between 1000 to 1500 M, 1 sp. (*L. berdmorei*) between 1000 to 2000 M whereas *L. guntea* and *S. rupecola* are widely distributed (between alt. below 500 to 2000 M).

CATFISHES

Out of the 21 species recorded under this group from the State, 8 spp. (*M. bleekeri*, *M. vittatus*, *O. bimaculatus*, *G. cenia*, *G. striatus*, *G. telchitta*, *H. hara*, *P. sulcatus*) are restricted to northern tributary system, 6 spp. (*M. seenghala*, *W. attu*, *A. coila*, *B. bagarius*, *C. conta*, *G. shawi*) to southern river system and 7 spp. (op, cit.) are having overlapping distribution.

Altitudinally, 12 spp. (*M. bleekeri*, *M. seenghala*, *O. bimaculatus*, *W. attu*, *A. coila*, *P. atherinoides*, *B. bagarius*, *C. conta*, *G. cenia*. *G. viridescens*, *G. telchitta*, and *O. longicaudata*) are recorded to be restricted to lower altitude (below 500 M), 2 spp. (*G. striatus*, *P. sulcatus*) between 1000 to 1500 M. 4 spp. (*M. cavasius*, *M. vittatus*, *H. hara* and *C. batrachus*) are showing some discontinuous distribution and recorded between alt. 1000 to 1500 M and below 500 M. *A. mangois* is restricted between alt. below 500 to 1000 M and *G. shawi* and *H. fossilis* between altitude below 500 to 1500 M.

Belonids

Only single species *X. cancila* recorded under the present group of Meghalaya has been recorded from northern tributary system and from lower altitude only (below 500 M).

Murrels

3 spp. (*C. orientalis*, *C. punctata*, *C. stewartii*) recorded under the present group from the State are occurring widely among the twin drainages and in all the G. Zones ; except only one species, *C. punctata*, which has not been recorded above 1500 M alt.

Perciformids

Of the 11 spp. recorded under the present group from Meghalaya, 4 spp. (*N. nandus*, *G. gutum*, *C. sota*, *C. fasciatus*) are occurring only in northern tributary system, 4 spp. (*C. baculis*, *S. cascasia*, *R. corsula* and *A. testudineus*) to southern river system whereas remaining 3 spp. (op, cit.) are having overlapping distribution.

Altitudinally, 5 spp. (*C. nama*, *N. nandus*, *S. cascasia*, *R. corsula* and *A. testudineus*) are restricted to lower alt. (below 500 M). *C. baculis* between 1000 to 1500 M. *C. fasciatus* is restricted between alt. below 1500 M. *B. badis* is widely distributed between various alt. below 500 to 5\0 to 2000 M. *C. sota* is restricted betweed alt. 500 to 1500 M. *C. ranga* and *G. gutum* are showing some discontinuous distribution and recorded between alt. 1000 to 1500 M and below 500 M.

Discussion

From the general trend of the fish species studied in Meghalaya, it is interesting to note that major percentage (45.19%) of fishes are having overlapping distribution. Occurrence of endemic forms are more (30.77%) in Brahmaputra drainage than in Barak drainage (24.04%).

The present investigation portrays some new traits of distribution of the fishes of Meghalaya.

From the foregoing analysis of Inter and Intra drainage distribution it can be concluded that all the regional species of Meghalaya may partly be distributed in Indian and Extra Indian regions, and partly restricted within E. Himalayan regions. Similarly widely distributed species are also partly distributed in India and Extra Indian regions and a few species (e. g. *G. naganensis*, *P. shalynius*, *C. stewartii* and *P. indica*) are restricted to Eastern Himalayas only. The reason for such type of incompatible distribution may be partly due to the altitudinal variation and partly due to the different ecological condition of water bodies.

After analysing the altitudinal distribution of the fish from the twin drainages it has been observed that minium percentage (12.50%) of the total species occurs in gradient zone I and maximum (79.81%) in gradient zone IV whereas G. zone II and III represent 41.35% and 26.92% respectively leaving an overlapping percentage of fishes (60.58%) among the four gradient zones. It agrees with Yazdani's (1977) view that the distributional pattern of fishes is ralated to the altitude and habitat of the species and the sudden decline of species number over an elevation of 4000 ft.

It is interesting to note that in the Meghalayan fish fauna north Indian elements are more (79 spp) than Penisular elements (57 spp.)

From the foregoing zoogeographical analysis it is to be noted that not a single Punjab Himalayan or Western Himalayan species is represented in Meghalaya. However, only a single species, *Botia rostrata*, is represented in first three sections of Himalayan rivers namely Eastern, Nepal and Kumaon Himalayas ; only 3 species in Eastern and Northern Himalayas whereas 14 species are endemic to E. Himalayas only. So it is clear that maximum number of endemic species are present in E. Himalayas and the number of Himalayan species decreases towards west, which otherwise agrees with the view of Menon (1954).

Geologically it is an established fact that the Shillong plateau is merely a severe portion of the peninsular region which has been isolated by the alluvium of the lower Ganges and Brahmaputra (Hora, 1944, p. 431). 79 species of Meghalaya are common to northern India and 57 species to southern India. Combination of northern and southern species in Meghalayan fauna reveals the fact clearly. Krishnan (1953) pointed out that "thougth now separated from the main peninsular area by a broad strip of the Ganges-Brahmaputra alluvium there is no doubt that the Assam plateau is part of the peninsular shield".

The fact that many freshwater fiishes of India which are normally found in Eastern Himalayas and farther east did not extend westward along the southern face of Himalaya particularly beyond the Teesta river system initiated Hora in 1937 to propound a Hypothesis, known as Hora's "Satpura Hypothesis". Of the 40 species recorded from Satpura trend of mountains (Hora and Nair, 1941), 23 species are common to Meghalaya and Satpura range. From a zoogeographical view point the occurrence of *Amblyceps* in Satpura range, Hoshangabad district (Hora and Nair, op. cit.) shows the affinity of fish fauna of that region with that of the E. Himalayas. The remaining species are widely distributed and are of little zoogeographical importance. The above fact also suggests that Meghalayan hills are only spurs of the once extended part of Satpura mountains. The recent record of *Amblyceps* from Tungabhadra river (Govind and Rajagopal, 1977) reveals the fact that the species must have been dispersed along the Assam hills and Satpura mountains during the earlier waves of migration (Menon, 1951). Occurrence of *Mesonoemacheilus* in Meghalaya and also in Western Ghats (Singh, Sen, Banarescu and Nalbant, 1981) reveals the positive results of Satpura Hypothesis.

Fishes of Meghalaya occurring in twin drainages may broadly be classified into four distinct groups on the basis of their body form, adaptive modifications, habitat and ecological adjustment :

Group 1 : *True hill stream dwellers* (TH) : Fishes with specific modification to rheophilic abode. These are the fishes belonging to the genera *Garra*, *Glyptothorax*, *Pseudecheneis* and *Psilorhynchus*.

Group 2 : *Semitorrential forms* (ST) : Fishes having minimal body modifications and weakly body form belong to this group. They protect themselves by hiding under the boulders and other shelter. These are *Lepidocephalus*, *Acanthocobitis*, *Schistura*, *Mesonoemacheilus*, *Physoschistura*, *Somileptes*, *Botia*, *Crossocheilus*, *Gagata*, *Amblyceps*, and *Pillaia*.

Group 3 : *Migratory forms* (MF) : Well built fishes having the power of overcoming adverse and changed ecological conditions are included in this group. These are : *Acrossocheilus*, *Barilius*, *Chagunius*, *Danio* (except *devario*), *Labeo pangusia*, *Tor*, *Badis* and *Channa*.

Group 4 : *Plainwater forms* (PF) : This group includes fishes having minimal body modifications and insignificant migratory habits. *Gadusia*, *Setipinna*, *Notopterus*, *Amblypharyngodon*, *Chela*, *Cirrhina*, *Esomus*, *Labeo*, *Osteobrama*, *Oxygaster*, *Puntius*, *Rasbora*, *Ompok*, *Wallago*, *Clarias*, *Heteropneustes*, *Mystus*, *Hara*, *Ailia*, *Pseudeutropius*, *Bagarius*, *Conta*,

Olyra, *Xenontodon*, *Nandus*, *Anabas*, *Colisa*, *Chanda*, *Glossogobius*, *Tetraodon*, *Sicamugil*, *Rhinomugil*, *Mastacembelus*, *Macrognathus* are the genera of the fishes belonging to this group.

104 species of fishes of Meghalaya represent 15 TH, 16 ST, 19 MF and 54 PW forms.

The distributional pattern of the above mentioned groups in different G. Zones has also been analysed. In northern tributary system 11 species which are occurring above 1501 M altitude include 1 TH, 2 ST, 6 MF and 2 PW. 42 species occurring between 1001 to 1500 M include 8 TH, 7 ST, 12 MF, 15 PW ; 27 species occurring between 500 to 1000 M include 4 TH, 4 ST, 11 MF, 8 PW and 58 species occurring below 500 M include 3 TH, 10 ST, 13 MF and 32 PW. In southern tributary system 11 species occurring above 1501 M, include 1 TH, 2 ST, 7 MF, and 1 PW ; 14 species occurring between 1001 to 1500 M include 1 TH, 2 ST, 8 MF and 3 PW ; and 65 species occurring below 500 M include 3 TH, 9 ST, 14 MF and 39 PW.

The above analysis further shows that true hill stream fishes are more (16 spp.) in Brahmaputra drainages than Barak drainage (6 spp.) ; maximum number of true hill stream fishes (8 spp) occur between 1001 to 1500 M in northern tributary system whereas in southern river system, maximum number (3 spp) occurs below 500 M which is somewhat unusual. Another interesting point to be noted that all the 7 species which are only restricted to Meghalaya are found in Brahmaputra drainage only, out of which 6 occur between 1001 to 1500 M whereas only one below 500 M.

An overall analysis on the distributional trend of Meghalayan fishes based on ichthyological divisions reveals that the Clupeids, Notopterids, Belonids, Indian major carps and Tetraodontids are found only below 500 M. Other carps and minnows, Cobitids, Catfishes, Murrels and Perciforms are distributed widely covering all gradient zones. Interestingly Eels are found only within gradient zones II, III and IV. Besides the altitudinal distribution the ichthyological groups of Meghalaya do exhibit interesting trend of inter-drainage dispensation. Notopterids and Indian Major Carps are localised to Barak drainage, Belonid to Brahmaputra drainage and the remaining group portray more or less an overlapping distribution.

SUMMARY

Meghalaya which physiographically represents a remnant of the ancient plateau of pre-cambrian Indian Penninsular shield is gifted

with twin drainage system, the Brahmaputra and the Barak to signify its ichthyological prospects. The fish fauna of the province exhibit a combination of both torrential and plain water forms occupying diverse ecological regime in their distributional ranges.

Zoogeographically the ichthyospecies of Meghalaya are categorised in the present communication into Primary and peripheral forms. Of the 104 good species of fishes recorded, 95 species under 49 genera belong to primary form while the peripheral form includes 9 species belonging to 7 genera. In addition to this detailed analysis on the distributional trend of the fish fauna of the state from various perspectives namely inter drainage and intra drainage, altitudinal, Indian and Extra Indian as well as on the basis of Ichthyological division have been discussed in the paper under report.

References

BURRARD, S. C. AND HAYDEN, H. H. 1933. A sketch of the Geography and Geology of the Himalayan mountains and Tibet (Revised by Burrard and Heron) 1-x+1-359+xxxi pp. 52 pls. -Delhi.

GOVIND, B. V. AND RAJAGOPAL, K. V. 1977. A new record of Himalayan catfish, *Amblyceps mangois* (Ham) in the Peninsular Tungabhadra river (Karnataka State) ; *Sci. Cult.*, 43 (10) : 448-449.

HORA, S. L. 1944. On the Malayan affinity of the freshwater fish fauna of Peninsular India and its bearing on the probable age of Garo-Rajmahal gap ; *Proc. natn. Inst. Sci. India* X : 423-439.

HORA, S. L. AND NAIR, K. K. 1941. Fishes of the Satpura ranges, Hoshangabad District, Central Provinces : *Rec. Indian Mus.* **43** (3) : 361-374.

KRISHNAN, M. S. 1953. The structure and tectonic history of India ; *Mem. geol. Surv. India* ; Calcutta, **81** : 11-109.

MENON, A. G. K. 1951. The role of the Eastern Ghats in the distribution of the Malayan fauna and flora to Peninsular India, *Proc. natn. Inst. Sci. India*, **17** (6) : 475-497.

MENON, A. G. K. 1954. Fish geography of the Himalayas : *Proc. natn. Inst. Sci. India* : New Delhi, **20** (4) : 467-493.

SINGH, A ; SEN, N ; BANARESCU, P. M. and NALBANT, T, 1981. New Noemacheiline loaches from India (Pisces, Cobitidae) ; *Trav. Mus. Hist. nat. "Grigore Antipa"* xxiii. 201-212.

YAZDANI, G. M. 1977. Fishes of Khasi hills, Meghalaya (India), with observations on their distributional pattern ; *J. Bombay Nat. Hist. Soc.* **74** (1) : 17-28.