

## STUDIES ON FISH DIVERSITY IN GARHWAL HIMALAYA



J.V.S. Rauthan<sup>1</sup>, Geeta Rauthan<sup>2</sup> and Shepali Chalotra<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Zoology, D.A.V. (P.G.) College, Dehradun, Uttarakhand.

<sup>2</sup>Department of Zoology, M.K.P (P.G.) college, Dehradun.

<sup>3</sup>Research Scholar, Department of Zoology, D.A.V. (P.G.) College, Dehradun, Uttarakhand.

### ABSTRACT:

Garhwal Himalaya is endowed with a rich fisheries potential in the form of riverine resources. The main streams, glacier fed Bhagirathi, Alaknanda, Yamuna and some of their tributaries originate in the Greater Himalaya which is under perpetual snow cover. A large number of tributaries of this river system originate as springs in the lesser Himalaya. Since a majority of these streams are perennial their resource value from view point of fish production is immense. Besides the extensive network of the riverine system. There are a number of lakes in the region having a promising potential. Most of these lakes in Garhwal and located above an elevation of about 15,000 ft. like Roopkund, Brahm Tal, Vasuki Tal, Hemkund, Sahastra Tal group of lakes. Those below the timberline include Deoria, Bhekal and Sukh tal etc. The semi-stagnant waters of reservoirs are equally suitable for fish production.



J.V.S. Rauthan

**Key words:** Fish diversity, glacier fed Bhagirathi, fish production.

### INTRODUCTION :

The term cold water fisheries are generally used for the fisheries inhabiting the coldwater streams, rivers, lakes and reservoirs. Although no hard and fast limits of the water temperature may be given, coldwater fisheries is usually described as the fisheries occurring in the water bodies having a temperature not more than 18 to 20°C, the temperature may be anywhere from 0 to 50°C. There are number of physical, chemical, geochemical and biological parameters of the respective water bodies which influence the distribution and abundance rivers, lakes, the main factors which exert availability are water temperature, velocity of streams, turbidity, nature of substratum, food items, dissolved oxygen and dissolved carbon dioxide.

Fishes are among the earliest vertebrates



going back to the devoning period, also called the age of fishes. About 30,000 species of fishes are known. Some live in freshwater many are marine, other live partly in fresh water, while others prefer brackish water. According to Talwar and Jhingran (1991) 21723 fish species known to Ichthyologist over 40% in fresh waters. Indian inland fishes represented 930 species. Baloda (2009). The credit fish taxonomy of Indian freshwater fishes goes to Francis Buchanan well known Francis Hamilton (1922) in his pioneering work. An Account of the fishes found in the river Ganges and its branches gave a well illustrated account of 269 species from the Gangetics system. Francis Day (1878) has given an extensive account on the taxonomy of the Indian continental freshwater and marine water fishes. A notable contribution on the Indian fresh water fishes systematic is credited to Hora (1920-1956). His work includes extensive survey of different parts of the country and report of many new species of fishes from the Indian sub continent. The study on the fresh fauna of Garhwal Himalaya have been initiated by Badola and Pant (1973) with reporting of 18 species later Badola (1975), and Baroda and Singh (1973), recorded 43 species from Pauri Garhwal and Chamoli Grahwal. Menon (1974) had given a systematic account of fishes. In a checklist of fishes of the Himalayan and Indo-Gangetic plain, Some of the notable studies on fish taxonomy from the Uttarakhand region include the description of fish fauna of Dehradun by Hora and Mukerjee (1936) who reported 21 species, Lal and Chaterjee (1962) recorded 32 species from Doon valley, Singh (1964) described the taxonomy and habitat of 47 species from same area and Grover et.al. (1994) noted 40 species in Doon valley.

Information on coldwater fish species and several other aspects of coldwater fisheries are available from the work and studies of Hora (1936, 1939), Raj (1941), Menon (1971, 1974, 1992 ab), Mishra (1959), Sehgal (1989, 1990, 1992), Lal and Chatterjee (1962), Singh (1970), Badola and Pant (1973), Badola (1975), Badola and Singh (1977, 1981), Dobriyal (1983, 1991).

### **Taxonomic Studies of Coldwater Fishes**

Fishes are among the earliest vertebrates going back to the devonian period, also called the age of fishes. About 30,000 species of fishes are known. According to Talwar and Jhingran (1991) 21723 fish species known, Ichthyologists, over 40% live in freshwaters. Indian inland fishes represented 930 species. The credit fish taxonomy of Indian fresh waters fishes goes to Francis Buchanan, well known Francis Hamilton (1922) in his pioneering work. "An account of the fishes found in the river Ganges and its branches" gave a well illustrated account of 269 species from the Gangetic system. Later McClelland (1939) described 136 species of fishes from Eastern Himalayan part of the upper Assam on "Indian Cyprinidae", in Asiatic Research of Bengal catalogue of the fishes in the collection of the British Museum Vol. I to VIII by Gunther (1859-1870), provide information regarding the fish of sub continent. Beaven (1877) has described 413 species of fishes in his book "Handbook of the freshwater fishes of India". Francis Day (1878, 1889) has given an extensive account on the taxonomy of the Indian continental freshwater and marine fishes (1340 species).

A notable contribution on the Indian freshwater fish systematic is credited to Hora (1920-1956). Heckel (1838) described the fishes from Kashmir himalaya, giving their taxonomical characters. Das and Sulba (1963) also reported 38 species from Kashmir. Sehgal et.al. (1971) reported 63 species from different rivers and tributaries the Kangara Valley (H.P.). Some of the notable studies on fish taxonomy from the Uttarakhand region include the description of fish fauna of Doon Valley by Hora and Mukerjee (1936) who reported (1936) noted 32 species from Doon Valley, while Singh (1964) described the taxonomy and habit of 47 species from the same part. Grover (1971) reported 30 species of fishes in Song River. Grover et.al. (1994) also recorded 33 species in Doon Valley.

The study on fish fauna of Garhwal Himalaya have been initiated by Badola and Pant (1973) with

reporting of 18 species from Uttarkashi District. Badola (1975), Badola and Singh (1977) recorded 43, 28 and 33 species from Pauri, Chamoli and Tehri Garhwal district respectively. Singh et.al. (1987) also described 64 species from the region. Grover and Baloni (1977) also described the hill stream fishes of Tehri Garhwal.

**Table 1 :**

**Family : Cyprinidae, Sub-family : Cyprininae**

1. *Esomus danricus* (Hamilton)
2. *Danio devario* (Hamilton)
3. *Danio rerio* (Hamilton)
4. *Danio aequipinnatus* (McClelland)
5. *Rasbora daniconius* (Hamilton)
6. *Schizothorax richardsonii* (Gray)
7. *Schizothorax plagiostomus* (Heckel)
8. *Schizothorax sinuatus* (Heckel)
9. *Schizothorax curvifrons* (Heckel)
10. *Schizothorax niger* (Heckel)
11. *Schizothorax intermedius* (McClelland)
12. *Schizothorax micropogon* (McClelland)
13. *Schizothorax progastus* (McClelland)
14. *Schizothorax esocinus* (Heckel)
15. *Tor Tor* (Hamilton)
16. *Tor putitora* (Hamilton)
17. *Tor chilinoides* (McClelland)
18. *Labeo dero* (Hamilton)
19. *Labeo dyocheilus* (McClelland)
20. *Labeo boga* (Hamilton)
21. *Garra gotyla gotyla* (Gray)
22. *Garra lamta* (Hamilton)
23. *Garra prasadi* (Hora)
24. *Garra mullya* (Sykes)
25. *Puntius sophore* (Hamilton)
26. *Puntius ticto* (Hamilton)
27. *Puntius chola* (Hamilton)
28. *Puntius conchonus* (Hamilton)
29. *Puntius sarana* (Hamilton)
30. *Puntius phutunio* (Hamilton)
31. *Crossocheilus latius latius* (Hamilton)
32. *Chagunius chagunio* (Hamilton)
33. *Barilius bola* (Hamilton)
34. *Barilius bendelisis* (Hamilton)
35. *Barilius barna* (Hamilton)
36. *Barilius vagra* (Hamilton)
37. *Barilius barila* (Hamilton)

38. *Barilius shacra* (Hamilton)

**2. Family : Cobitidae**

- 39. *Noemacheilus botia* (Hamilton)
- 40. *Noemacheilus montanus* (McClelland)
- 41. *Noemacheilus rupicola* (McClelland)
- 42. *Noemacheilus bevani* (Gunther)
- 43. *Noemacheilus savona* (Hamilton)
- 44. *Noemacheilus scaturigina* (McClelland)
- 45. *Noemacheilus zonatus* (McClelland)
- 46. *Noemacheilus corica* (Hamilton)
- 47. *Noemacheilus multifasciatus* (Day)
- 48. *Botia geto* (Hamilton)
- 49. *Botia dario* (Hamilton)
- 50. *Lepidocephalus guntea* (Hamilton)

**3. Family : Homalopteridae**

- 51. *Balitora brucei* (Gray)

**4. Family : Amblycipitidae**

- 52. *Amblyceps mangossis* (Hamilton)

**5. Family : Scilbedae**

- 53. *Mystus vittatus* Bloch

**6. Family : Sisoridae**

- 54. *Glyptothorax trilineatus* (Blyth)
- 55. *Glyptothorax pectinopterus* (McClelland)
- 56. *Glyptothorax cavia* (Hamilton)
- 57. *Glyptothorax conirostries* (Steindacner)
- 58. *Glyptothorax madraspatanum* (Day)
- 59. *Glyptothorax telchilta* (Hamilton)
- 60. *Glyptothorax brevipinnis* (Hora)
- 61. *Glyptothorax reticulatum* (McClelland)
- 62. *Pseudecheneis sulcatus* (McClelland)
- 63. *Euglyptosternum lineatum* (Bleekers)

**7. Family : Scilbedae**

- 64. *Clupisoma garua* (Hamilton)
- 65. *Clupisoma montana* (Hora)

**8. Family : Channide**

- 66. *Channa gachua* (Hamilton)

**9. Family : Balonidae**



67. *Xenentodon cancila* (Hamilton)

## 10. Family : Mastacembelidae

68. *Mastacembalus armatus* (Lacepede)

## 1. Family Cyprinidae:

Among the cyprinids better known as carps, there are 8 species of the genera *Schizothorax* followed by 6 each of *Barilius* and *Puntius*, 3 each of *Tor*, *Labeo*, *Garra* and *Danio*, 2 of *Schizothoraichthys* and 1 each of *Crossocheilus*, *Chagunius*, *Rasbora* and *Esomus*.

**(i) Genus:** *Schizothorax*, snow trout. These are : *S. richarsonii* (Gray), *S. plagiostomus* (Heckel), *S. sinuatus* (Heckel), *S. niger* (Heckel), *S. intermedius* (McClelland), *S. micropogon*, *S. curvifrons* (Heckel), *S. esocinus* (Heckel) true to their name, snow trout, abound the different glacier fed torrential stenothermal system of Alaknanda, Bhagirathi, Ganga and Yamuna. These species are fairly well adopted for torrents and thus distributed throughout the river, except the headwaters near glaciers, where the water temperature is almost at the freezing point. *Oreinus richardsonii* species with a suckorial lip should bear the name *oreinus*, *oreinus* should not be considered as synonym of *schizothorax* as treated by Mishra and his genus *Schizothraichthys* is a junior synonym of *schizothorax*. Of the above mentioned schizothoracids, most common species is *oreinus richardsonii*. It occurs in snow fed stream of Garhwal fish, spawns from March to June in Uttarakhand in the water temperature range 14-20°C.

**2. Genus: Schizothoraichthys :** The genera *schizothoraichthys* and *schizothorax* are commonly referred to as schizothoracids. The former has only two species – *S. progastus* (McClelland) and *S. esocinus* (Heckel) which naturally inhabit the glacier fed torrential steno thermal system like Alaknanda Bhagirathi Ganga and Yamuna. They unlike their contemporaries inhabit the middle and lower reaches of the system and can be easily distinguished due to lack of adhesive and many characteristics to the *schizothorax*.

**3. Genus: Garra :** All four species of *Garra*, *G. lamta* (Hamilton), *G. prasadi* (Hora), *Garra mullya* (sykes) and *G. gotyla gotyla* (Hamilton) are essentially coldwater inhabitants, well adapted ventral adhesive pad for torrents. They abound the upper and middle section of the torrential stenothermal streams fed by glaciers. Of those the most common species is *G. gotyla gotyla*. This suckerhead (common name) is found in turbid hill streams of Garhwal Himalaya. The presence of an adhesive apparatus on the ventral side of the head and thorax enables the fish to live at the bottom of the hill streams.

**4. Genus : Tor :** Several species of Mahseer have reported but three common species are found in coldwater of Garhwal Himalaya *Tor tor*, *T. putitora* and *T. Chilinoidea*. The Mahseer is considered as the most valuable game fish of India. The native names 'Mahseer', 'Mahasaula' and 'Tora' etc. probably refer to the large size of the scales or head.

*Tor putitora* (Hamilton) or yellow fin mahseer occurs all along the base of the Himalayas. It has a pointed head. The length of the head is considerably greater than the depth of the body. The number of scales along lateral line may be 23-28. *Tor tor* (Hamilton) occurs foot hills of Himalayas. In the so called for Mahseer or red fin mahseer, the head is invariably shorter than the depth of the body. There are 22-28 scales along the lateral line. The *T. chilinoidea* is an inhabitant of placid eurythermal springfed,

streams. Owing to their attractive size and other factors they are also known as prized game fish. The Mahseer thus have a potential for commercial as well as recreational fishery.

**5. Genus: Barilius :** These minor carps occurs in shallows waters of spring-fed hillstream (Badola and Singh (1980)). The 6 species recorded in Garhwal Himalaya like *B. bendelisis*, *B. bola*, *B. barna*, *B. vagra*, *B. barila* and *B. shacra*. Badola et.al. (1982) the two varieties 'cocsa' and 'chedra' appear to be the sexually different forms of the same species. 'Cocsa' being the female and 'chedra' the male. *B. bola* or *Raimas bola* is called Indian trout or hill trout and occurs head waters of Ganga. It is the game fish of the Himalayas, growing up to 30cm in length. However its population is now steadily declining and is in the endangered list.

**6. Genus: Labeo :** Though some species of *Labeo* are well known major carps, those found in this region *L. dero*, *L. dyocheilus* and *L. boga*. These like mahseer inhabit the lower reaches of Ganga and exhibit a tendency to migrate. They together with mahseer constitutes 30% of fish landing's annually. The scales smaller than those of mahseer give a light greenish appearance to the fish.

**7. Genus: Danio :** The genus *Danio* is also represented by three species viz. *D. rerio*, *D. acuinatus* and *D. devario* which are abundant in the placid eurythermal water and common in the lower reaches of torrential stenothermal streams. They are also exploited for commercial gains though as minor fisheries.

**8. Genus : Puntius :** The genus *puntius* is represented by six species viz. *P. chola*, *P. ticto*, *P. sarana*, *P. phutunio*, *P. sophore* and *P. chonchonius*. These species hardly attain a large size and though exploited commercially along foothills do not contribute significantly to fisheries of the region. The species of *puntius* exhibited a small range of distribution.

**9. Genus : Crossocheilus :** *C. latius latius* (Ham.) inhabits the middle reaches of galcier fed – torrential stenothermal waters. It is a bottom inhabitant in the fast current of water flowing over stones and pebbles covered with slimy algae matter. It is found in association with *Garra gotyla gotyla*.

**10. Genus : Rasbora :** *R. daniconius* (Hamilton) are often found in the lower reaches of Ganga or in placid eurythermal waters. *Chagunius chagunio* (Ham.) and *Esamus danricus* (Ham) are other cyprinids recorded in lower reaches or Ganga. None of them are much commercial consequence though exploited for the purpose.

## **2. Family : Cobitidae,**

**1. Genus : Noemacheilus :** The eight species recorded in cobitidae family viz. *Noemacheilus rupicola*, *N. montanus*, *N. savana*, *N. bevani*, *N. corica*, *N. multifasciatus*, *N. Zonatus* and *N. scaturigina*. All these loaches (common name) are bottom feeder's and occurs in very small spring – fed streams. They may be omnivorous and insectivorous. They spawn during July-August in small streams. They attain small size but can be exploited commercially on large scale owing to their abundance in these waters.

**2. Genus : Botia :** The two species of *Botia*, *B. dario* and *B. geto* are inhabitants of torrents.

## **3. Family : Sisoridae :**

**(i) Genus : Glyptothorax –** The eight species represent in the Sisoridae family. viz. *Glyptothorax cavia*,

*G. reticulum*, *G. telchilta*, *G. pectinopterus*, *G. madraspatnum*, *G. trilineatus*, *G. brevinnis* and *G. conirostris* and one species are coldwater form well adopted for torrents and found in for torrents and found in the upper and middle sections of torrential stenothermal Bhagirathi, Alaknanda, Ganga and Yamuna river system, *G. reticulatum*, *G. pectinopterus*, *G. cavia*, *G. conirostris*, are mostly occurs in snow-fed hillstreams. In *P. sulcatus*, a bottom dwelling carnivorous fish, the adhesive apparatus is highly developed. It breeds in turbid streams during April and August. (Badola and Singh 1984). These are considerable differences in the shape and size of the adhesive apparatus of the *Glyptothorax* species among other things this helps in their identification. The species *Euglyptosternum lineatum*, is a sisorid also adapted to torrents is not quite common.

#### 4. Family Amblycipidae

(i) **Genus: Amblyceps** : There are two species – *A. mangosis* (Hamilton) and *A. laticeps* (McClelland) are found in river bed with sand and pebbles in slow running hill streams. *A. laticeps* occurs only amongst boulder outcrops at base of hills.

#### 5. Family: Bagridae

(i) **Genus: Mystus and other related species :**

These are *Mystus cavisius* (Hamilton), *M. bleekeri* (Day), *Aorichthys aor* (Hamilton), *A. seenghala* (sykes), *Batasio batasis* (Hamilton), *Mystus* species have been reported mainly from foot hill streams.

#### 6. Family: Channidae

(i) **Genus: Channa** : These are *Channa gachua* (Hamilton), *C. orientalis* (Bloch – schneider) and *C. punctatus* (Bloch). These species do not occur in upland hills but have been observed at foot hills.

#### 7. Family: Mastacembelidae :

(i) **Genus:** Of the several species of *Mastacembelus* only *M. armatus* has been reported authors from foot hills and in some cases from turbid hillstreams in the uplands.

#### 8. Family: Schibeidae

(i) **Genus: Clupisoma** : The two species – *Clupisoma montana* (Hora) and *C. garua* (Hamilton) are reported in snowfed river of Garhwal Himalaya. These are bottom feeder and insectivorous species.

#### 9. Family: Belonidae

(i) **Genus: Xenentodon** : Also described by names such as *Esos cancila* and *Belon cancila*, *Xenentodon cancila* (Hamilton), inhabits some foot hill streams. In this species both the Jaws forming the long beak are provided with sharp teeth.

#### 10. Family: Homalopteriridae

(i) **Genu : Balitora** : Only one species of *Balitora brucei* (Gray) is recorded in coldwaters of Garhwal Himalaya.

#### 11. Family: Amblycipitedae

(i) **Genus: Amblyceps** : This family represent only one species *A. mangois* (Hamilton) in hillstreams of Garhwal Himalaya.

**12. Family : Cyprinidae, (Exotic species)**

**(i) Genus: Cyprinus :** These are *cyprinus carpio specularis* (Linnaeus) and *C. carpio nudus* (Linnaeus). The mirror carp was transplanted for the first time in 1947 in Kumaun hills. It was introduced in 1955 in Himachal Pradesh. The introduction of this exotic lakes and reservoirs of uplands of Garhwal Himalayas.

**13. Family: Salmonidae**

**(i) Genus: Salmo :** The exotic fish brown trout, *Salmo trutta fario* (Linnaeus) and rainbow trout, *Salmo gairdnerii* (Richardson) now occur in some upland streams and lakes of the country. The *Salmo trutta fario* is being reared at Kalayani hatchery in Uttarkashi, from where it is introduced into the waters of Dodital, Asiganga and in the upper reaches of river Bhagirathi. Now the seeds of another trout i.e. the Rainbow trout have been introduced at Talwani hatchery Chamoli Garhwal. Considering the habit and habitat of this fish, there are enough possibilities of its exploitation in commercial context too.

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**References**

1. Badola, S. P. (1975) : Fish fauna of Garhwal Hills III Pauri Garhwal. **Indian Journal Zootomy**. 16(1) : 57-70.
2. Badola, S.P. and Pant, M. C. (1973) : Fish fauna of Garhwal Hills. Part I, **Indian Journal Zootomy**, 14(1) : 37-44.
3. Badola, S.P. and Singh, H.R. (1977a) : Fish fauna of Garhwal Hills Part IV. **Indian Journal Zootomy**, 18(2) : 115-118.
4. Badola, S. P. and Singh, H.R. (1977b) : Fish fauna of the Garhwal hills part III **Indian Journal, Zootomy** 18(2) : 118-122.
5. Badola, S.P. (2009) : Ichthyology of the central Himalaya. Trans Media Publication, Srinagar Garhwal; 1-226.
6. Day, F. (1889) : Fauna of British India including Ceylon and Burma. Fishes, Taylor and Francis, London.
7. Day, F. (1878) : The fishes of India being a natural history of the fishes known to inhabit the seas, and freshwaters of India, Burma and Ceylon.
8. Day, F. (1879) : The fauna of British India, including Ceylon, and Burma fishes. Vol. I, London Tolyor and Francis.
9. Das, S.M. and Subla, B.A. (1963) : The Ichthyo – fauna of Kashmir Part II, History, Topography, Origin Ecology and general distribution **Ichthyologica**. II (1-2) : 87-106.
10. Grover, S.P., (1971) : On the collection of fishes of the Song River in Doon Valley. Uttar Pradesh, Gurukul Kangri Vish. **J. Sci. Res.** 2 : 115-118.
11. Grover, S.P. and Baloni, S.P. (1977) : Some biological notes on the hill stream fishes of Tehri Garhwal. **Geobios**. 4 : 246-251.
12. Grover, S.P., Aggarwal, B.S. and Rauthan, J.V.S. (1994) : Ichtyyo-fauna of Doon Valley. **Him. J. Env. Zool.** 8 : 128-133.



13. Gunther, A. (1859-1870) : A catalogue of the fishes of the British Museum 1-VIII. Vols. London.
14. Hamilton, F. (1882) : An account of the fishes in river ganges its branches. Edinburgh.
15. Hamilton, Buchanan, F. (1822) : An account of the fishes found in the river Ganges and its Macuhs. Edinburgh and Lonad.
16. Heckel, J. (1838) : Fische aus coschmir. Sttulgart. Gedrukt. Bei Dep. pp. Mechitoristen.
17. Hora, S. L. and Mukerjee, D.D. (1936) : Fish fauna of the Eastern Doon united provinces with introduction and remark on Mahseer. Fisheries records of **Indian Museum**, 39 : 338-342.
18. Hora, S. L. (1936) : Fish of the Naga Hill. **Rec. Indian Mus.** 38(1) : 328-330.
19. Hora, S. L. (1939) : The game fishes of India VIII. The Mahseer or the large scaled barbels of India I. The Putitora Mahseer, *Barbus* (Tor), *Putitora* (Ham.). **J. Bombay. Nat. Hist. Soc.** 41 : 272-285.
20. Jhingran, V. G. and Sehgal, K. L. (1978). Coldwater fisheries of India. Inland fish. soc. India **Barrackpore**. India 1-239.
21. Khanna, D.R. and Badola, S.P. (1990) : Ichthyofauna of the river Ganga at foot hills of Garhwal Himalaya. **Journal of Natural Phy. Sci.** 4(1-2) : 153-162.
22. Lal, M. B. and Chatterjee, P. (1962) : Survey of eastern Doon Fishes with certain notes on their biology. **Journal of Zoological Society of India**, 14(112) : 229-243.
23. Menon, A.G.K. (1949a) : Fishes of Kumaun Himalaya **J. Bombay and Nat. Hist. Soc.** 48(3) : 535-542.
24. Menon, A.G.K. (1949b) : Fishes from Kosi Himalaya, Nepal. **Rec. Indian Mus.** 47(3-4) : 231-237.
25. Menon, A.G.K. (1962) : A distribution list of fishes of the Himalayas. **J.Zool.Soc. India**, Culcutta, 14 : 23-32.
26. Menon, A.G.K. (1971) : Taxonomy of fishes of the genus *schizothorax* heckel, with the discription of a new species from Kumaun Himalayas. **Rec. Zool. Surv.** 63(1-4) : 195-208.
27. Menon, A.G.K. (1974) : A chick list on the fishes of Himalayan and Indo Gangetic plains. Indian Fisheries Society of India. Barrackpore.
28. Pant, M. C. (1970) : Fish fauna of Kumaun hills. **Rec. Zool. Surv.** India, 64(1-4) : 85-96.
29. Sehgal, K. L. (1978) : Coldwater fish culture in uplands of India. **Proc. Summer Institute on inland Aquaculture**, CJFRL, 170-179.
30. Sehgal, K. L. (1971) : Fisheries survey of himachal pradesh and some adjacent areas with special reference to trout, mahseer and allied species. **J. Bombay. Nat. Hist. Soc.** 70(3) : 458-487.
31. Sharma, R. C. and Singh, H. R. (1981-82) – An appraisal of the coldwater fisheries of the Bhagirathi , Jharsard, U : 35-37.
32. Sharma, R.C. (1984) : Ichthyofauna of the snow fed river, Bhagirathi of Garhwal Himalaya. **Proc. Nat. Acad. Sci., India B** : 58 : 181-192.
33. Singh, H. R., Joshi, C.B. and Prasad, R. (1983). The trout fishing of Garhwal, present status management problems and prospects. (In Singh T.V. and Kaur, J. Eqs.) **Studies in Eco. Development, Himalayas Mountains and Men.** Print House (India), Lucknow.
34. Singh, P.P. (1964) : Fishes of the Doon Valley, **Ichthyologica**, 3(1-2) ; 86-92.
35. Singh, W, Agarwal, N.K. and Singh, H. R. (1987) : Present status of snow trout in Garhwal Himalaya, Uttar Pradesh. **J. Zool.** 7 : 85-88.
36. Talwar, P.K. and Jhingran, A.G. (1991) : Inland fisheries of India and adjacent countries Vol. I & II, 1-1158. Oxford and IBH Publishers Co. Pvt. Ltd.