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INDIAN FISHERIES ABSTRACTS

Central Inland Fisheries Research Institute
(Indian Council of Agricultural Research)
Barrackpore, Kolkata 700 120, West Bengal, India

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ENTRIES

1. Abdel-Tawwab, Mohsen (Fish Ecology Department); El-Marakby, Hany I.; Ahmad, Mohammad H. (Fish Nutrition Department) (Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharqia, (Egypt)). **Cannibalism in *Oreochromis niloticus* (Linnaeus): effect of stocking density, feed quality and submerged macrophytes.** Indian Journal of Fisheries (2006) v. 53(3) p. 245-251.

   Three experiments were conducted in glass aquaria to determine the occurrence of cannibalism in Nile tilapia, *Oreochromis niloticus* fry/fingerlings combinations in response to stocking density, artificial feeding and submerged macrophytes. Fish with average body weight of 1.2, 5.4, 10.3, 20.4 and 30.1 g/fish in combinations designed as G1, G2, G3, G4 and G5, respectively were used. In experiment 1, each aquarium containing 100 L freshwater was stocked with either 10 or 20 fish of Gl and 5 fish of G2, G3, G4 or G5 to obtain the ratio of 2: 1 or 4: 1 fry/fingerlings. In experiment 2, in each aquarium, 20 fry and 5 fingerlings were stocked. Fish were fed frequently to satiation with diet containing either 20% crude protein (CP) or 25% CP. In experiment 3, in each aquarium, 20 fry and 5 fingerlings ratio was randomly distributed. Fish were fed frequently to satiation with diet containing 25% CP in experiments 2 and 3. Leaf-less stem of phragmites plant (0.7 m long and 0.5 cm diameter) was used at densities of 0, 5, 10, 20, 30 and 50 stems/m^2. The number of eaten fry in all experiments was observed closely after 6, 24, 48, 72 and 96 hours. Each treatment in all experiments was represented by five replicates. The results revealed that there was an increase in the cannibalistic rate as the size difference increased; however, the bigger fish are highly cannibalistic compared with smaller ones. The number of eaten fry significantly increased as the stocking ratio increased ($P<0.05$). Moreover, the cannibalistic rate reduced when the fish were fed to satiation by 20 or 25% CP diet. The fish fed with 25% CP diet did show slight reduction in the cannibalistic rate over that fed with 20% CP diet during the same stocking periods. The fry used the submerged macrophytes as a refuge to protect themselves from fingerlings attack, and the presence of submerged macrophytes at moderate density (20-30 stem/m^2) reduced the number of eaten fry.

2. Abraham, T. Jawahar (West Bengal University of Fishery Sciences, Faculty of Fishery Sciences, 5-Budherhat Road, Chakgaria, P.O. Panchasayar, Kolkata – 700 094, West Bengal (India). Department of Fishery Pathology and Microbiology). **Virulence of *Vibrio Harveyi* possessing a transferable chloramphanicol resistance determined of larvae of Indian white shrimp *Fenneropenaeus indicus* (Decapoda).** Indian Journal of Marine Science (2006) v. 35(3) p. 275-278.

The virulence of luminous *Vibrio harveyi* possessing a transferable chloramphenicol-resistance determinant to Indian white shrimp, *Fenneropenaeus indicus* larvae was studied. The *V. harveyi* strains isolated from luminous *F. indicus* larvae produced extracellular virulence factors such as haemolysin, chitinase, proteinase, lipase and phospholipase were resistant to at last four of six antibiotic tested. The choloramphenicol-resistance determinant was transferred from *V. harveyi* to *Escherichia coli* at frequencies of $6.69 \times 10^{-4} – 4.72\ 10^{-3}$. The concentration of *V. harveyi* cells capable of causing 50% mortality differed strains were more virulent to shrimp larvae compared to chloramphenicol-sensitive strain. Prevalence of highly virulent *V. harveyi* strains harbouring a transferable chloramphenicol-resistance determinant together with other extracellular virulence factor may hamper the hatchery production of penaeid shrimp larvae.

3. Agrahari, Shweta; Pandey, K. C. (University of Lucknow, Lucknow – 226 007 (India). Department of Zoology); Krishna, Gopal (Industrial Toxicology Research Centre, Lucknow – 226 001 (India)). **Biomarkers of monocrotophos in a freshwater fish *Channa punctatus* (Bloch).** Journal Environmental Biology, (India) (2006) v. 27(2) p. 453-457.

   Activity of few biomarkers have been investigated on freshwater fish *Channa punctatus* treated with monocrotophos for acute exposure to 18.56 ppm at 96 hr and subacute viz. 0.46 ppm, 0.96 ppm and 1.86 ppm for 30 days. Biomarkers such as total protein lipid peroxidation and acetylcholinesterase have been measured in different tissues of fish viz. gills, liver, brain and muscles. The protein levels were found to be depleted in all the tissues after pesticide exposure to lethal and sublethal concentration over the control, where as the lipid levels showed an increase under the stress of pesticide monocrotophos. The increased lipid level may be due to inhibition of lipase activity and other biomarkers of lipid metabolism. A significant inhibition of brain acetylcholinesterase (AChE) indicating its effects on nervous system have also been observed. These parameters can be used as biomarkers to predict the early toxicity of monocrotophos added to aquatic ecosystem.

4. Ahmed, Riaz; Hasanain, Absar-ul (Laboratory of Biochemical Genetics, Department of Zoology, Aligarh Muslim University, Aligarh – 202 002 (India)). **Correlation between biochemical properties and adaptive diversity of skeletal muscle myofibrils and myosin of some air-breathing teleosts.** Indian Journal of Biochemistry & Biophysics. (2006) v. 43 p. 217-225.

   Functional properties myofibrils and relative stability of myosin of five teleosts *Channa punctatus, Clarias batrachus, Mastacembalus armatus, Labeo rohita and Catla catla* adapted to different different breathing modes were compared. Myofibrillar contractility and m-ATPase of air-breathing organ (ABO) possessing *C. punctatus* and *C. batrachus* were low and least affected by pH in the range of 7.1-8.5. However, their myosin isoforms were relatively thermostable, more

soluble at sub-neutral pH values, between 0.1 to 0.15 M KCl concentrations and less suspictible to a-chymotryptic digestion. In contrast, myofibrils and myosin of water-breather major carps *L. rohita* and *C. catla* were more contractile and suspectible to pH and salt concentrations. Thus, correlation between catalytic efficiency and relative stability of myofibrils and myosin of ABO-possessing teleosts was of reverse order and magnitude, as compared to water-breathers. Interestingly, myofibrils and myosin of the behavioral air-breather *M. armatus* showed intermediate properties. The specific level of in-ATPase of all the five teleosts were in cinfirmity with the levels of metabolic marker, the lactate dehydrogenase . The effect of chymotryptic cleavage of 94 and 173 kDA domains on ATPase, individually of pesticide maps of MyHC isomers and perturbation of phenylalanine residues by urea implicated hydrophobic residues in stabilizing myosin structure in these fish. The present study suggests two apparent evolutionary modifications of myofibrils and myosin in ABO-possessing teleosts: (i) ‘down-regulations of ATPase that explains sluggishness of such species and, (ii), more stable molecular structure to support stress of air-breathing modes of life.

5. Athikesavan, S.; Vincent, S.; Ambrose, T.; Velmurugan, B. (Unit of Environmental Health and Biotechnology, Department of Advanced Zoology and Biotechnology, Loyola College, Chennai – 600 034 (India)). **Nickel induced histopathological changes in the different tissues of freshwater fish, *Hypophthalmichthys molitrix* (Valenciennes).** Journal Environmental Biology (India) (2006) v. 27(2) p. 391-395.

   Nickel chloride, heavy metal widely used in industries was investigated in the present study for histopathological studies in silever carp (*Hypophthalmichthys molitrix*). Fish were exposed for 10, 20, and 30 days in sublethal concentration of nickel 5.7 mg/l. The histopathological changes were studied in gill, liver, intestine and kidney of the nickel treated freshwater fish. *H. molitrix*. The nickel showed a tissue specific alteration in the tissues. Mucus proliferation, fusion of the gill lamellae and hypotrophy of gill tissues were observed. Lack of normal palisade arrangement was followed by necrosis in hepatocytes. Degeneration of blood vessels, vacuolation, hypertrophy, pyknotic nuclei and lesion were observed in liver tissues. Degeneration of tubular cells, hyperplasia was observed in kidney tissues.

6. Athikesavan, S.; Vincent, S.; Velmurugan, B. (Unit of Environmental Health and Biotechnology, Department of Advanced Zoology and Biotechnology, Loyola College, Chennai – 600 034 (India)). **Investigation of acute toxicity of Nickel chloride on *Hypophthalmichthys molitrix*.** Journal of Nature Conservation. (India). (2006) v.18 (2) p. 239-246.

   Nickel chloride, heavy metal widely used in industries was investigated in the present study for acute toxicity. *Hypophthalmichthys molitrix* were selected for the bioassay experiments. The static test method of acute toxicity was used and the 96-h LC_{50} was determined for the silver carp. The data obtained from the

Nickel acute toxicity test were evaluated using the probit analysis statistical method, developed by USEPA. The 96-h LC_{50} value for silver carp was estimated as 57.06 mg/l.

7. Badul Huq, M. A.; Srinivasan, M.; Murugan, M. (Centre of Advanced Study in Marine Biology, Annamalai University, Parangipetti - 608 502, Tamilnadu (India)). **Observations on parasites of *Epinephelus malabaricus* (Bloch and Schneider).** Journal of Indian Fisheries (2006) v. 53(4) p. 459-61.

   Cage culture of *Epinephelus malabaricus* in fixed net cages was carried out in the south east coast of India. Fishes were fed with different diets like, prawn waste head, *Sardinella longiceps*, squid waste, crab (*Portunus* spp.) and beef liver. During 184 days culture, several types of parasites were observed and studied. External parasites such as isopods and copepods and internal parasites such as trematodes and nematodes were collected and studied.

8. Benarjee, G.; Reddy, B. Laxma (Fisheries Research lab, Department of Zoology, Kakatiya University, Warrangal – 560 009, Andhra Pradesh (India)). **Histopathological and histochemical changes in the liver of *Clarias batrachus* due to trematode, *Euclinostomum heterostomum*.** Journal of Nature Conservation (India) (2006) v. 18(2) p. 251-259.

   The trematode parasite, *Euclinostomum heterostomum* is found infected to the freshwater fish, *Clarias batrachus*. The parasite infects to the liver. The parasite brought morphological histophysiological and histopathological changes in the liver of fish. The pathological changes observed in the liver initially indicates with change of colour and oedema. The histopathology indicated by enlargement hepatocytes resulting in the loss of their polygonal appearance, rupture of cell membrane. Enlargement of bilary passages and Necrosis of hepatocytes were observed. The histochemical changes indicated by the increase of carbohydrate, protein and fat contents in the infected than uninfected fish.

9. Bhaumik, Utpal; Paria, T. (Central Inland Fisheries Research Institute, Barrackpore, Kolkata - 700 120 (India); Mittal, I. C (Department of Zoology, University of Kurukshetra, Kurukshetra, Haryana (India); Das, P. (Indraloke Estate, Kolkata (India)). **Structure of benthic fauna in two floodplain wetland ecosystems of West Bengal.** Journal of Inland Fisheries Society of India (2006) v. 38(2) p. 31-37.

   An investigation was carried out in two floodplain wetlands with open (Amda) and closed (Suguna) system. The density of benthic population varied between 42 no. m^{-2} and 94 no. m^{-2} in Amda whereas in Suguna it ranged from 60 no. m^{-2} and 106 no. m^{-2}. Seasonal fluctuations in water column were conspicuous and mostly dependent on the replacement resources and volume. A mixed and balanced population of diversified fauna constituted the benthic population of the investigated ecosystems. The diversity was maximum during winter season with

coincidence of favourable temperature, dissolved oxygen and other physico-chemical parameters besides, optimum solar radiation. Richness of benthic structure in closed system resulted in higher production (1,570.05 kg $ha^{-1}yr^{-1}$) than that of the open system (384.4 kg $ha^{-1}yr^{-1}$).

10. Chakarborty, Lokenath (119/4/1, Neogi Para Road, Baranagar, Kolkata – 700 036 (India)). **The Breeding of ornamental fishes**. Fishing Chimes, (India) v. 26(5) p. 40-41.

    Indian waters possess a rich diversity of ornamental fishes. There are over 100 varieties of indigenous species available in nature. In addition, there are similar numbers of exotic species that are bred in captivity. The author describe about the breeding technology of ornamental fishes in the article.

11. Chakraborty, Suman Bhusan ; Sarbajna, Aditya; (Serampore College, Serampore – 712 201, Hooghly (India). Department of Zoology) Banerjee, Samir (Aquaculture Research Unit, University of Calcutta, 35, Ballygunge Circular Road, Kolkata – 700 019 (India). Department of Zoology). **Effect of differential doses of gamma irradiation on sex reversal of Nile tilapia, *Oreochromis nilot*icus.** Environment & Ecology (India) (2006) v. 24S (3A) p. 809-912.

    An experiment is conducted to study the effect of differential radiation does not sex reversal of fish to produce monosex all male population. Three days old mixed sex juveniles of Nile tilapia *Oreochromis niloticus* are subjected to 0 Gy, 5 Gy, 10 Gy, 15 Gy of Co 60γ radiations and then reared for 60 days under optimal cultural conditions. After that period they are sexed and analyzed for proportion of males in the surviving populations. It is found that the untreated group of fish shows the highest percentage of survivors which is significantly more compared to that in all the irradiated groups. Treatment with 15 Gy males in the population increases significantly in the treated groups than that in control. This it may be concluded that radiation treatment with a dose of 5 Gy or less can be used as mean to induce sex reversal successfully for producing all male population in Nile tilapia.

12. Dasgupta, M.; Goswamy, S.; Goswamy, A. (Bidhan Chandra Krishi Viswavidyalaya, Regional research station (NAZ), Gayeshpur, Nadia (W.B.), - 741 234 (India)). **Effect of jute retting on the physic-chemical and biological condition of water.** Indian Journal of Fisheries. (2006). v. 53(4), p. 455-457.

    An investigation was carried out to find out the effect of jute retting on the physico-chemical and biological condition of water of an experimental water body. There was no significant variation in the physic-chemical parameters except for the increase of COD and BOD for a short period when fish mortality was observed. There was no qualitative variation in the plankton population. However, plankton population decreased during the jute retting period and increased in the post jute retting period. Hence jute retting has both detrimental and favourable

effect on the aquatic system. For a short period it creates an anaerobic condition and there may be fish mortality if the retting is done in a small closed water body. But with the passage of time the nutrients released from the body decaying jute, help the growth of the aquatic life.

13. Datta, M. K.; Nandeesha, M. C. (College of Fisheries, Lelmbucherra, Tripura (India)). **Pacu (*Piaractus brachyomus*), water loving exotic finfish, enter Indian aquaculture scene.** Fishing Chimes (India) (2006) v. 26(6) p. 10-12.

In the wake of illegal entry of several exotic fish species into Indian waters, the most recent of which are *Pangasius gariepinus* (African/Thai Magur) and *Pangasius sutchi* (pangus), there is the disturbing report of another fish, Pacu, also known as Red Pomfret (*Piaractus brachypomus*), entering into Indian Aquaculture scene from Bangladesh. There is information that this fish is now under farming in India, atleast in a village pond of Andhra Pradesh. A redeeming aspect, however, seems to be that the fish has not yet become popular with consumers, the stated reason for this being its deficiency. Dutt and Nandeesha, the authors of this contribution, discuss the known aspects of culture of Pacu and also tell about its entry into India.

14. Dhawan, Asha; Kaur, Vaneet Inder (Department of Zoology and Fisheries, Punjab Agricultural University, Ludhiana – 141 004 (India)). **Efficiency of starter diets on the survival of larvae of Indian magur, *clarias batrachus*.** Journal Inland Fisheries Society of India (2006) v. 38 (2) p. 9-13.

The study was conducted to observe the effect of different starter diets (live and dry) on the larval survival of Indian magur, *Clarias batrachus*. 8 diets were fed to larvae of *C. batrachus* for 10 days under continuous aeration system. Live food (mixed zooplankton) feeding resulted in 100% larval survival. In all the other (dry) diets, overall percentage mortality ranged from 37.5 to 80.0%. This revealed low acceptance of dry diets by the larvae. However, late acceptance of dry diets by the larvae was observed (as mortality rates rate decreased after 7 days), suggesting that larvae of *C. batrachus* also required a period of live food feeding, which can, gradually be replaced by dry compound diets. The water quality parameters such as temperature, dissolved oxygen and pH, remained in the range of 27-30^{0}C, 6.6-8 mg1^{-1} and 8.5-9.0, respectively.

15. Dua, Anish; Kumar, Kanwaljit (Aquatic Biology Lab., Guru Nanak Dev University. Amritsar – 143 005 (India)). Department of Zoology). **Age and growth patterns in *Channa marulius* from Harike wetland (A Ramsar site), Punjab, India**. Journal of Environmental Biology (India) (2006) v. 27(2) p. 377-380.

Scales samples of *Channa marulius* were collected and studied for age determination and calculation of growth parameters. The fish were sampled from Harike wetland during 1998 to 1999. Linear relationship with a high degree of

correlation was observed between total fish length and the lateral scale radius. Age determination studies revealed 5 age groups. The table size falls just below the 2nd year. The regression equation is given. Various growth parameters indicate hardy nature of the fish and the suitability of habital ecology for its optimum growth.

16. Ghosh, Amitabha ; Karmakar, H. C.; Misra R. N.; Chatterjee, T; Das, B. B.; Saha, D. (Central Inland Fisheries Research Institute, Barrackpore, Kolkata – 700 120 (India)). **Ecology of freshwater and low saline sewage-fed wetlands of West Bengal with reference to bio-diversity and aqua-crop production.** Journal of Inland Fisheries Society of India. (2006) v. 38(2) p. 20-25.

    Physico-chemical and biological conditions of water in two types of sewage-fed wetlands *viz*. freshwater and low-saline investigated during 2001 to 2003 revealed variation in fish, macro-zoo-benthos and plankton diversity in relation to differences in limno-chemical parameters. Mean salinity in the low-saline wetlands was higher than the freshwater bheri. The primary production (Mean 502.72 mg $Cm^{-3}hr^{-1}$) in the freshwater sewage-fed wetland was higher compared of the low-saline wetlands. Production of fish and prawn was found to be higher in the freshwater wetland. *Oreochromis niloticus* and *O. mossambicus* contributed substantiality to fish production from both these wetlands. Net zooplankton in both types of wetlands had an edge over phytoplankton. In the freshwater wetland gastropods were the principal macro-benthic fauna while in the low-saline bheris and tanaids mainly constituted the benthic macro-fauna.

17. Ghosh, Shubhadeep (Central Marine Fisheries Research Institute, Indian Council of Agricultural Research, PB No. 1603, Tatapuram, Kochi – 682 014, Kerala (India). Sasmal, Debasis; Abraham, T. Jawahar (Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata – 700 094 (India), Department of Fishery Pathology and Microbiology). **Efficiency of commercial shrimp farm biomediators in removing ammonia in microsom experiments.** Indian Journal of Fisheries. (2006) v. 53(4), p. 469-473.

    The efficacy of two commercial aquaculture bioremediators to remove ammonia was tested under laboratory conditions. The bioremediators were capable of removal total ammonical nitrogen (TAN) to the tune of 86-90% (max) at 1-3 ppm initial level of ammonia (NH_3) and the removal rate decreased thereafter. Significant differences in nitrite (NO_3) levels in treated and control tanks were observed probably due to the differences in the levels in treated and control tanks were observed probably due to the differences in the levels of resident nitrifying bacteria that utilize NH_3 and oxidize it to NO_2. The nitrate levels increased in all the treatment tanks, but showed a general decreasing trend in control tanks. Among the tanks with varied NH_3 concentrations, the levels of NO_3 between the control and treatment tanks differed insignificantly ($P>0.05$). The results of the present study revealed that the commercial bioremediators failed to remove majority of the total ammonical nitrogen when the NH_3 level is high initially.

18. Gopalakrishnan, A.; Basheer, V. S. (NBFGR Cochin Unit, CMFRI Campus, Kochi - 682 018, Kerala.(India)); Abdul Muneer, P. M.; Lal, Kuldeep Kumar; Mohindra, Vindhya; Kapoor, D. (National Bureau of Fish Genetic Resources (NBFGR), P.O. Dilkusha, Lucknow - 226002, (India)); Thomas, P. C. (Central Marine Fisheries Research Institute (CMFRI), Kochi - 682018, Kerala.(India)); Ponniah, A. G. (The World Fish Centre, Penang, (Malaysia)). **Identification of polymorphic allozyme markers for population structure analysis in *Horabagrus brachysoma* (Gunther, 1864).** Indian Journal of Fisheries (2006) v. 53(3) p. 253-261.

    Fourteen polymorphic allozyme loci were identified in yellow catfish, *Horabagrus brachysoma*. The genetic variation detected at each allozyme locus was assessed for samples collected from three rivers. The observed heterozygosities per locus ranged from 0.0286 to 0.4000. Significant genotype heterogeneity indicated that the samples are not drawn from same gene pool. The results suggest the potential of the identified loci to analyze stock structure of natural populations of *H. brachysoma*.

19. Gorai, B. K.; Choudhury, M. (Northen Regional Centre, Central Inland Fisheries Research Institute, Guwahati – 781006, Assam (India)); Jha, B. C.; Nath, D (Central Inland Fisheries Research Institute, Barrackpore, Kolkata -700 120 (India)). **Culture of carps in pens in a wetland of Assam – A case study.** Journal Inland Fisheries Society of India. (2006) v. 38(2) p. 53-58.

    Culture of carps in pen enclosures was carried out at three sites (I, II and III) in Dek beel of Kamrup District, Assam. Local Bamboo variety was used as the basic material for pen construction. The pens were stocked with fingerlings *Catla catla, Labeo rohita, Cirrhinus mrigala* and *L. gonius* @ 36,000 ha^{-1} in a ratio of 3:2:2:1. The average stocking sizes of *C. catla, L. rohita, C. mrigala* and *L. gonius* 5.4 cm (2.1 g), 5.2 cm (2.0 g), 4.8 cm (1.8 g) and 5.0 cm (1.8 g), respectively. Supplementary feed was given @ 5% body weight apart from natural food available in the system. The pens were harvested after 88 (Site I & II) and 97 (site III) days of rearing. The growth of *C. catla. L. rohita, C. mrigala* and *L. gonius* was 20-26 cm (125-265 g), 15-28 cm (60-295 g), 13-20 cm (30-110 g) and 15-19 cm (45-75 g), respectively. The abiotic factors of water and soil, studied during the period, were conducive for fish growth. The plankton population was relatively low. The fish yield was 1797, 1870 and 2659 kg^{-1} at site-I, II and III, respectively. The benefit of ratio (B: C) of the pen culture was estimated at 1.7.

20. Goswami, T. K.; (B. P. Chaliha College, Nagarbera – 781 127, Kamrup, Assam (India). Department of Zoology); Goswami, M. (Gauhati University, Guwahati – 781 014 (India)). (Department of Zoology) **Ichthyofaunal diversity and catch statistics of Jamlai wetland in Kamrup District of Assam, India**. Journal of Inland Fisheries Society of India (2006) v. 38(2) p. 38-44.

The present study has been conducted from July 2004 to June 2005 in Jamlai Wetland in Kamrup District of Assam. The wetland is a seasonal floodplain connected with two sub-tributaries of the River Brahmaputra, namely, Jaljali and Deoshila that act as connecting channels of the wetland. Fish diversity of the wetland has been studied with its annual fish statistics. Fifty four species were recorded, which belonged to 36 genera fewer than 22 families. Based on the size and configuration of the adult, the fishes were categorized into major, intermediate and minor group comprising 18, 14 and 22 species, respectively. The fish catch was 80.9 t of 210.4 kg ha^{-1} during the study period. The present study indicated that the major groups 35.76 percent; intermediate group 12.61 percent and minor group 51.63 percent had share in the catch.

21. Halder, R. S.; Raina, H. S. (National Research Centre on Coldwater Fisheries (ICAR), Bhimtal – 263 136, District – Nainital, Uttaranchal (India)); Vass, K. K. (Central Inland Fisheries Research Institute, Barrackpore, Kolkata – 700 120 (India)). **Limnology and fisheries of Doyang reservoir in Nagaland, India.** Indian Journal of Fisheries. (2006) v. 53(4) p. 475-479.

The paper embodies the recent limnological and fisheries investigations made on the Doyang reservoir in Nagaland, to propose an effective fishery management. The impoundment was constructed in July 2000 across the river Doyang and still in the process of getting stabilized. During the investigation no thermal or oxygen stratification was recorded. In the reservoir, fishery exploitation is aimed at the larger fishes, primarily Cyprinids, while other fish species are small in size and less economical value, but are significant from biodiversity viewpoint. The experimental fishing in the reservoir revealed main contribution of *Cyprinus carpio* var. communis, *Catla catla, Labeo dero* and *Tor putitora* in the order of their dominance. Majority of these species must be sustaining as self-recruits. Some approaches for reservoir fisheries management have been proposed.

22. Ittoop, Gijo; Jose, Susheela (College of Fisheries, Pannagad, Kochi – 682 506 (India)). **Effect of vitamin C on the survival, moulting and whole body ascorbic acid content of *Macrobrachium rosenbergii* (de Man) juveniles.** Indian Journal of Fisheries. (2006) v. 53(4) p. 367-372.

An experiment was conducted to find out the influence of dietary vitamin C on the survival, moulting rate and tissue ascorbic acid content of *Macrobrachium rosenbergii* juveniles. Vitamin C was fed in a semi purified diet at eight levels @ 0, 45, 67.5, 90, 112.5, 135, 180 and 450 mg AAE (ascorbic acid equivalent/kg to the experimental animals for 56 days. The results showed that below a level of 67.5 mg AAE/kg diet, the survival rate was very poor mainly due to incomplete moulting. Black lesions were observed at the tip of the appendages of dead animals. Above 90 mg AAE/kg diet, survival and moulting rates were satisfactory. The whole body ascorbic acid content reached a steady state only at 135 mg AAE/kg diet and hence the minimum amount of ascorbic acid recommended in the diet *M. rosenbergii* is 35 mg AAE/kg.

23. James, R.; Sampath, K. (Department of Zoology, V.G. Chidambaram College, Tuticorin – 628 008, Tamilnadu (India)). **Effect of dietary administration of methyl-testosterone on the growth and sex reversal of two ornamental fish species.** Indian Journal of Fisheries (2006) v. 53(3) p. 283-290.

Efficacy of androgenic hormone, methyl testoterone (MT) on growth, sex reversal and reproductive performance of two ornamental fishes, red swordtail *Xiphophorus helleri* and siamese fighting fish *Betta splendens* were investigated. 30 day old juveniles were fed ad libitum on diets containing different levels of MT (0, 10, 20, 40 and 60 mg kg^{-1} diet) during the experimental period. The mean body weight and length and specific growth rate of *X. helleri* and *B. splendens* were higher in the MT 10 mg kg^{-1} treated groups than other levels of MT treated groups, and hence 10 mg kg^{-1} is considered as optimum dose for attaining higher growth rate. Sex determination of the fishes based on the secondary sexual characteristics showed increased percentage of males with higher dose levels of MT-treated groups. *B. splendens* treated with 20, 40, 60 mg kg^{-1} produced 100% male population on day 84, 56 and 56 respectively, while *X. helleri* treated with 40 and 60 mg kg^{-1}produced 100% male population on day 70 and 56.

24. Kailasam, M.; Thirunavukkarasu, A. R.; Sundaray, J. K.; Abraham, Mathew ; Sarda, C.; Subbaraj, R.; Thiagarajan, G.; Karaiyan. K. (Central Institute of Brackishwater Aquaculture, No. 75, Santhome High Road, R. K. Puram, Chennai – 600 028 (India)). **Daily growth and length-weight relationship of *Lates calcarifer* (Bloch) larvae during hatchery rearing**. Indian Journal of Fisheries. (2006) v. 53(4) p. 487-491.

Daily growth and length-weight relationship of Asian seabass *Lates calcarifer* was studied in the hatchery reared larvae. Larvae attained mean total length, standard length and total weight of 10.96 ± 0.49 mm, 8.97 ± 0.47 mm and 31.93 ± 3.63 mg respectively at the age of 21 days of post hatching. Growth rate was higher when the feed was changed from rotifer (*Brachionus plicatilis*) to Artemia naupili and Artemia biomass with increased size variation among the larvae. The correlation coefficient of total length and standard length with total weight were highly significant. Log transformed regression were used to study the length-weight relationship. Total length-weight and standard-length weight relationship indicated the allometric growth in seabass larvae during hatchery rearing phase.

25. Keshavnath, P.; Patil, Prakash (College of Fisheries, Karnataka Veterinary, Animal and Fisheries Science University, Mangalore – 575 002 (India)). **Nutrition in ornamental fishes**. Fishing Chimes, (India) (2006) v. 26(8) p.13-18.

Maintenance of Ornamental fish in good health is depandant on deveral parameters, of which one is that of providing nutritious feed that is acceptable to the fish, in predetermined quantities, adequate for their well being. This implies that most of the hobbyists need exposure to the nutritional requirements of

ornamental fishes to enable them to choose feed of the desire quality for feeding these fishes in needed quantities. The authors provide this contribution a very informative account of not only protein requirements but also of lipids and fatty acids, carbohydrates, minerals and carotenoids, of important varieties of ornamental fishes. Besides dealing with additives used to enrich feeds, but also elaborated on various types of feeds used for feeding ornamental fishes.

26. Khan, M. Feroz ; Panikkar, Preetha (Reservoir Fisheries Division, Central Inland Fisheries research Institute, Heesaraghatta lake Post, Bangalore – 560 089 (India)). **Indian fisheries scenario: A peep into constraints needs of its future development.** Fishing Chimes, (India) (2006) v. 26(9) p. 1-19.

The authors endavour to present visualized "Future Indian Fisheries scenario', taking into account the constraints that can impede progress of Indian fisheries development and the ways to strengthen the scenario.

27. Kiran, B. R.; Puttaiah, E. T. (Department of Environmental Science, Kuvempu University, Shankarghatta, 577 541, Karnataka, (India)). **Biology of Salmostosoma untrahi from Bhadra Reservoir, Karnataka.** Journal Inland Fisheries Society of India. (2006) v. 38(2) p. 1-8.

Specimens of Salmostoma untrahi (Day) collected from backwaters of Bhadra reservoir were studied for their biology during 1998-1999. The length-weight relationship calculated from 719 specimens were Log W= -5.2766 + 3.0392L and Log W +-5.1110 + 2.9606 L for males and females, respectively. The seasonal fluctuations in the relative condition factor (K_n) of both the sexex could be attributed to the seasonal sexual cycle, spawning and intake of food. Qualitative and quantitative analysis of food revealed that the fish was predominantly a herbivore feeding mainly on desmids and blue-greens. Higher gonado-somatic indexex values were noticed in the month of October, April & une. Ova diameter studies indicated more than one modal group of developing ove in the advanced stage of maturity. Males matured at 108-113 mm, while females matured at 88 mm. The fish has got prolonged spawning season extending throughout the year. The peak spawning occurred in July, October and February. The fish spawned more than once in a year. The sex-ratio (male: female) was 1: 0.50 with males dominating on most of the size groups and months.

28. Krishan Ram, H.; Mohan, Ramchandra (Water quality Research Laboratory, Department of Zoology, Bangalore university, Bangalore – 560056 (India)). **Monthly fluctuation of physico-chemical parameters of Byramangala Lake Bangalore Rural District. Karnataka (India).** Environment & Ecology (India). (2006) v. 24S (4) p. 1007-1010.

Byramangala Lake was done for a period of one year from January 2003 to December 2003. The present investigation was carried out to assess pH, temperature, TDS, salinity, conductivity, total hardness, alkalinity DO, BOD,

COD, phosphates, sulfates, nitrate, iron and potassium. The study revealed marked fluctuation of values of different parameters in the lake. The water of Byramangala lake was extremely polluted as indicated by low level of DO and high load of BOD, COD, conductivity, phosphates, sulfates, TH, TA and nitrates.

29. Kulshrestha, H.; Sharma, S. (Department of Microbiology, Division of Life Sciences, Sardar Bhagwan Singh Post Graduate Institute of Bio-medical and Research Balawala, Dehradun – 248 161 (India)). **Impact of mass bathing during ardhkumbh on water quality status of river Ganga.** Journal Environmental Biology (India) (2006) v. 27(2), p. 437-440.

    The study highlighted that mass bathing during Ardhkumbh caused the changes in the river water quality and indicated that water is not fit for either drinking or bathing purposes. The presence of faecal colofirms in water also hints at the potential presence of pathogenic microorganisms, which might cause water borne diseases. Although the water was found to be safe with respect to dissolved oxygen content, the valued of BOD and COD exceeded the maximum permissible limit during bathing.

30. Kumar, Naresh ; Kumarm Virendra ; Gupta, Reeta ; Agarwal, Sarika; Gupta, A. K. (Environmental Research Laboratory, Department of Zoology, S.S.V. (P.G) College, Hapur – 245 101 (India)). **Sub-acute stress induced by two anionic synthetic detergents Rin advanced and geepol on certain haematological parameters in *Clarias batrachus* (Magur).** Journal of Nature Conservation (India) (2006) v. 18(2) p. 217-223.

    The fish *Clarias batrachus* was exposed to various sub-lethal concentrations of Rin Advanced (15.00 and 7.5 mgl^{-1}) and Geepol (11.75^{-1} and 5.88^{-1}) for periods of 10, 20 and 30 days. Various stresses in haematological parameters were investigated. Coagulation time (CT), Erythrocyte sedimentation rate (ESR), Mean corpuscular volume (MCV) decreased significantly ($P<0.05$). A significant increase ($P<0.05$). It was observed in porthrombin time (PT), Haemoglobin percentage (HB %), RBC's count and Packed cell volume (PCV) at all syndet levels and exposure periods. Stress in the haematological parameters in the blood of fishes exposed to Geepol was higher than those exposed to Rin advanced.

31. Kumari, Anitha S.; Ramkumaran, Sree (Cell and Molecular Biology Laboratory, Department of Zoology, Nizam College, Basheerbagh, Hyderabad - 500 001, Andhra pradesh, (India)). **Chromosomal aberrations in *Channa punctatus* (Bloch) from Hussainsagar Lake, Hyderabad (A.P).** Indian Journal of Fisheries (2006) v. 53(3) p. 359-362.

    A study was conducted to assess the cytogenetic changes in an airbreathing fish, *Channa punctatus* inhabiting the polluted water of Hussainsagar Lake. Several structural chromosomal aberrations such as chromatid breaks and gaps, fragments, sister-chromatid exchanges, dicentric and ring type of chromosomes

were observed in these fishes in comparison to the fishes collected from other non-polluted water bodies thus indicating induced mutation in fishes living in Hussainsagar waters.

32. Kushwaha, Yachna (P. G. Department of Zoology, D. A. V. College, Kanpur (India)); Saxena, K. K. (P. G. Department of Zoology, Janta Mahavidyalaya, Ajitmal (Auraiya) – 206 121, U. P. (India)). **Studies on the zooplankton of the river Sengar in District Etawah (U. P.).** Journal of Nature Conservation (India). (2006) v. 18(2) p. 403-408.

Zooplanktons are the consumers of the phytoplankton, as four major groups protozoa, rotifera, nematode, crustacean and larvae represent them. The zooplanktons were collected at five stations from river Sengar at Etawah. At Station 'A' the minimum number of zooplankton recorded was 46.3/litre in December 2001 and maximum 596.7/litre in June 2002. At Station 'B' the minimum number of zooplankton was 52.0/litre in December 2002 and maximum 686.7/litre in June 2001. Whereas in station 'C' the minimum number of zooplankton was 30.2/litre in December 2001 and maximum 691.8/litre in June 2003. At station 'D' the minimum number of zooplankton was 31.5/litre in December 2002 and maximum 366.3/litre in June 2001. While station 'E' the minimum number of zooplankton was 52.8/litre in December 2001 and maximum 493.2/litre in June 2003.

33. Mishra, D. K. (Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar – 751004 (India)); Bohindar, K (Department of Zoology, Deoghar College, Deoghar – 768119 (India); Pandey, A. K. (Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar – 751 002 (India)). **Effect of sublethal exposure of carbaryl and cartap on chromaffin cells of freshwater teleost, *Channa punctatus* (Bloch).** Journal of Nature Conservation (India). (2006). v. 18(2) p. 271-276.

In order to record the responses of chromaffin cells due to sublethal (30% of LC_{50} for 96 hours) exposure carbaryl (5.20 $mg1^{-1}$) and cartap (0.18 $mg1^{-1}$), *Channa punctatus* were exposed 24, 48, 72 and 96 hours under static bioassay condition. Chormaffin cells, distributed in head kidney of fish, possessed nuclei with sparse chromatin and eccentric nucleous. There was a partial loss of staining affinity in chromaffin cells of both the treated groups at 24 hours. At 48 hours of exposure to both the pesticides there were significant increases in the size of chromaffin cells of both the treated groups at 72 hours. Though hypertrophy and hyperplasia were prominent by 96 hours, marked vacuolization as well as pyknotic nuclei were frequently observed in the chromaffin cells of carbyl- as well as cartap-treated fish.

34. Mohan, Devendra; Singh, Surjeet (Department of Zoology, Jai Narain Vyas University, Jodhpur – 342005, Rajasthan (India)). **Fish faunal diversity of Thar**

Desert of Rajasthan. Journal of Nature Conservation (India) (2006) v. 18(2) p. 261-270.

The Thar desert of Rajasthan comprises 13 districts stretching from Sri Ganganagar in North to Sirohi in South and and Jaisalmer in tis West. Eighty fish species were collected during 2000 to 2005 from here, belonging to 6 orders, 20 families and 37 genera. Three new records for the Thar Desert were: *Mystus tangra, Erethistes pussilus and Nangra viridscens.* Four north and north western districts of the state namely Sri Ganganagar, Hanumangarh, Bikaner and Jaisalmer have a high fish diversity due to presence of Sub-Himalayan water and Ghaggar river, while Pali and Sirohi district have a substantial number of fish fauna due to the extension of lift canal upto Kaliana lake. The Sikar and Charu districts are devoid of the fish fauna during the study. Cypriniformes remained most dominating order with 41 fish species followed Perciformes with 19 species and Siluriformes with 15 species. The maximum numbers of species were collected from Jaislmer district.

35. Mohanty, Rajeeb K. (Water Technology Centre for Eastern Region (ICAR), Chandrasekrarpur, Bhubaneswar – 751 023 (India); Mohanty, S. K.; Mohapatra, A; Bhatia, K. S.; Patnaik, A. K. (Chilka Development Authority, Bhubaneswar – 751 014 (India)). **Post-ecorestoration impact on fish and shellfish biodiversity in Chilka Lake.** Indian Journal of Fisheries. (2006). v. 53(4) p. 397-407.

The hydrological intervention in Chilka Lake during the year 2000, restored the unique coastal wetland ecosystem, which was under severe threat due to continued natural changes and unabated anthropogenic pressure. Fish yield and biodiversity of the lake, has spectacularly been enhanced due to the eco-restoration measures particularly, after opening of the new mouth at a shorter distance of 11 km from the lake proper. Apart from significant increase in the average yield of fish and shellfish during post-mouth period (2000-01 to 2003-04) by 431.78% and 1198.11% respectively, in comparison to pre-mouth period (1996-97 to 1999-2000), there has been significant improvement in fish biodiversity with new records of 56 species, totaling to 268 fish species, 28 prawn and 35 crab species. Two species of Indian spiny lobsters (*Panulirus ornatus* and *Panulirus polyphagus*) have been collected from the lake for the first time during 2003. Total records of species of fish and shellfish (277) during pre-restoration phase indicating 20.22% increase. In total, 221 species (187 fish, 18 prawns and shrimps, 2 lobsters and 14 crabs) were collected during inventorisation survey, which indicated that migratory species constitute 74.55% and marine-brackish fish fauna constitute 72.73%. Outer channel sector exhibited the maximum species richness (62.44%) and southern sector exhibited the minimum (14.93%) during summer and monsoon respectively. Greater contribution by migratory species of fish, prawns and crabs to the bulk of catches establishes that the recruitment of juveniles from the sea and maintenance of estuarine character of the Chilka ecosystem are the key factors for enhancement of fisheries resources.

36. Pandey, P. K.; Kumar, Niranjan (Central Institute of Fisheries Education, Fisheries University Road, Versova, Mumbai – 400 061 (India)). **Occurrence of nitrogen fixing aerobic bacteria and azotobacter spp. In a freshwater lake and a pond at Mumbai.** Journal Inland Fisheries Society of India. (2006) v. 38(2) p.14-19.

Biological nitrogen fixation is an important process in nitrogen cycle in aquatic environment. In the present study, enumeration of nitrogen-fixing bacteria and effect of physico-chemical parameters of water and soil from Powai lake and Aarey fishpond, Mumbai, on their distribution has been studied. Five species of nitrogen-fixing Azotobacter (*Azotobacter chroococcum, A. vinelandii, A. beijerinckii, A. nigricans and A. armeniacus*) were characterized from water and soil. Higher number of nitrogen-fixing Azotobacter population could be observed in soil than in water. The nitrogen-fixing capacity of *A. chroococcum*, isolated from soil was higher than the nitrogen-fixing capacity of *A. vinelandii* and *A. nigricans* isolated from water.

37. Paria, Tapas ; Chakraborty, Chinmoy ; Neogi, Anindya ; Roy, Chayan; Bhadra, Partho Pratim; Sahu, S. K; Mondal, S. K. (Central Inland Fisheries research Institute, Barrackpore, Kolkata – 700 120 (India)). **Geographical Information System (GIS) as tool for assessment of inland fisheries resources.** Fishing Chimes, (India). (2006) v. 26(2) p. 43 – 47.

The author and his associates tell us that Geographical Information System (GIS) is an important modern tool to utilize the spatially referenced data for monitoring, management, modeling and decision making in the assessment of the production potential of given inland fisheries resource.

38. Parthiban, F.; Christopher, I. Maria Michael; Selvaraj, S.; Surendraraj, A.; Venkataramani, V. K. (Fisheries College and Research Institute, Thoothukudi-628 008, Tamilnadu (India)). **Enhancement of ovulation in goldfish (*Carassius auratus*) by a supplementary feed incorporated with polychaete worm (*Marphysa gravelyi*).** Indian Journal of Fisheries (2006) v. 53(3) p.307-312.

Live feeds play a vital role in the enhancement of growth, maturity in ornamental fish culture and production of brood stock. An experimental trial was conducted to study the effect of supplementary feed incorporated with locally available polychaete worm (*Marphysa grauelyi*) on feed intake, conversion, coloration and fecundity of gold fish (*Carassius auratus*). Fishes were fed with polychaete worm incorporated iso-protein feed at the rate of 0%, 5%, 10%, 15% and 20%. Significant growth increment was observed between experimental feed and the control ($P< 0.01$). Among the experimental animals fed with polychaete worm incorporated feed, more than 80% of them were observed to have matured within a period of 60 days. The fecundity was more in gold fish fed with polychaete worm incorporated in the conventional feed at 15% and 20% level.

39. Prabhakar, Surya Kumar; Sardar, Parimal; Shah, Mukhtar Hussain (Central Institute of Fisheries Education (Deemed University), Kolkata Center, ICAR, Salt Lake City, Kolkata - 700 091 (India)). **Effect of feed restriction followed by realimentation on nutrient utilization, biochemical and hematological changes of Indian major carp, Rohu (*Labeo rohita* H.).** Environment & Ecology. (India). (2006) v. 24S (4) p. 1192-96.

Result of the present study indicated that deprived fish showed compensatory growth (data not shown) had still lower values of Hb, hematocrit value total erythrocytic count, total plasma protein, plasma glucose, total plasma lipid and liver glycogen as compared to control at the end of 90 days trial but total leucocytic count did not change between any groups. All hematological and biochemical parameters studied were proportionately lowered in the experiment group got higher degree of deprivation.

40. Raj Kumar; B. K. ; Sharma, L. L. (Department of Acquaculture, College of Fisheries, Maharana Pratap University of Agriculture & Technology, Udaipur – 313 001.(India)) **Application of sex manipulation techniques in aquaculture.** Fishing Chimes (India). (2006) v. 26(9) p. 50-52.

There are some problems associated with sex manipulation, considering the advantages; the known way of solving the associated problems should be followed. The recent results in this direction are very encouraging and indicate that these techniques have the potential to make useful contributions in enhancing farmed aqua production. Hence, this technology is an attractive choice for application. It holds great promise in improving aquaculture productivity on a sustainable basis.

41. Rajan, M. R. (Department of Biology, Gandhigram Rural University, Gandhigram – 624 302 (India)). **Effect of live and compounded feeds of on feed utilization, growth and intestinal bacterial flora of gold fish *Carassius auratus.*** Environment & Ecology, (India). (2006) v. 24S(4) p. 1150-52.

The present study deals with the effect of live feed and compounded feeds on feed utilization, growth and intestinal bacterial flora of Gold Fish *Carassius auratus* for a period of 60 days. Live feed (chironomous fly larvae) and four different feeds which are having animal and plant protein in the ratio such as 1:0, 1:1, 1:2 and 0:1 were prepared by using prawn meal, soyabean meal and ground nut oil cake with a protein level of 40%. The results showed that the feed consumption, feed conversion efficiency and ratio, growth, percentage growth and relative growth rate, assimilation, gross and net growth efficiency of gold fish were higher in feed I (livefeed – chironomous fly larvae). Two species of intestinal bacteria namely *Pseudomonas stutzeri* and *Sphingomonas pancibacilus* were identified in the intestine of the gold fish. Among the different feeds live feed (feed I) was suitable for food utilization and growth of gold fish *Carassius auratus*.

42. Ramanathan, N.; Padmavathy, P.; Francis, T.; Athithan, S. (Department of Aquaculture, Fisheries College and Research Institute, Veterinary and Animal Sciences University, Thoothukkudi - 628 008, (India)). **Growth performance of *Penaeus monodon* (Fabricius) and carps in freshwater ponds under polyculture.** Indian Journal of Fisheries (2006) v. 53(3) p.313-319.

The present paper deals with the polyculture of tiger shrimp, *Penaeus monodon* and carps in freshwater ponds. *P. monodon* seeds (PL 20) were stocked at the rate of 1500 and 5000 no./0.1 ha under extensive and semi-intensive systems respectively. The carp fingerlings (catla, rohu, mrigal, silver carp, common carp and grass carp) were stocked at the rate of 400 and 800 no./0.1 ha under extensive and semi- intensive culture ponds respectively. Under extensive culture, the shrimp production obtained was 162.00 kg/ha/122 days and it was 484.00 kg/ha/123 days from semi-intensive culture. The carp production was 2409.40 and 4855.00 kg/ha/yr under extensive and semi-intensive systems respectively.

43. Reddy, Laxma; Benerjee, G.; Rajender, G. (Fisheries Research Lab, Department of Zoology, Kakatiya University, Warangal – 506 009, Andhra Pradesh (India)). **Biostatistical indices on the occurrence of cestode parasite, *Lytocestus indicus* infection in the freshwater cat fish *Clarias batrachus* at Warangal region of Andhra Pradesh**. Journal of Nature Conservation (India) (2006) v. 18(2) p. 343-348.

The freshwater cat fish, C*larias batrachus* often found infected with *Lytocestus indicus*. A survey has been conducted for two consecutive years on the freshwater bodies of the district to study the incidence of parasitic infection, intensity of infection, density of infection index of infection and the seasonal variation of this parasite. The data obtained during two consecutive years reveals that the parasitic infection varies from season to season. The intensity, density and index of infection are also influenced by the ecological factors.

44. Saha Sanjib; Ray, Saja (Department of Zoology, University of Calcutta, Kolkata – 700 019, (India)). **Hemocyte profile of the estuarine mud crab, *Scylla serrata*.** Environment & Ecology, (India). (2006) v. 24S (3A) p. 818-819.

Three types of hemocytes namely hyalinocyte, semigranulocyte and granulocyte were identified in the estuarine mud crab *Scylla serrata*. Scheme of classification of hemocytes on the bais of cytoplasmic granules is in agreement with previous reports. No report of total and differential hemocyte count of *Scylla serrata* is available in the current literature. Therefore, the values of THC and DHC obtained in this study would provide a useful source for other cell biological studies. Alteration of total differential count of circulating hemocyte is marker ambient water. Thus THC and DHC of *Scylla serrata* inhabiting in controlled environment would provide a base for assessing the degree of contamination of water bodies by various xenobiotics and pathogens.

45. Saha Suman; Das, P.; Bhaumik, Utpal; Paria, T. (Central Inland Fisheries research Institute, Barrackpore, Kolkata – 700 120 (India); Qureshi, T. A.; Susan, Monahar (Barkatullah University, Bhopal (India)). **Status of fish biodiversity in North 24 Parganas District of West Bengal.** Environment & Ecology. (India). (2006) v. 24S (4) p. 1075-1078.

North 24 Parganas district of West Bengal is blessed with a number of the mighty rivers viz. Ganga, Ichhamati, Bidyadhari, Matla, Raimangal, Kalindi. The total geographical area of the district is 4,094 km^2. About 90% people of the district are fish eaters. Fishery resources include 27,207.98 ha of fresh water areas and 33,466.00 ha of brackish water areas characterizing one of the mega biodiversity arena of the state. The district processes a vast and varied fish germaplasm resources distributed widely in different aquatic ecosystems. An investigation was carried out to collect data on past and present status of fish availability from different landing centers and related personnel through a structured schedule. A sharp declining trend was observed on the availability of some important fish species. A status list, thus prepared indicated 14 critically endangered, 19 endangered 13 vulnerable, 6 near vulnerable, 2 lower risk. The main reasons of the declining of those species are habitat destruction, wanton destruction and pollution. The different threatened statuses of the fishes were linked with specific causative factors or combination of factors. A concerted effort with appropriate conservation strategies including a support of the common people is warranted to save the fish biodiversity for the district.

46. Sahoo, S. K.; Giri, S. S.; Sahu, A. K.; Gupta, S. D. (Central Institute of Freshwater Aquaculture Kausalyaganga, Bhubaneswar-751 002. (India)). **Effect of feeding and management on growth and survival of *Wallago attu* (Scheneider) larvae during hatchery rearing.** Indian Journal of Fisheries (2006) v. 53(3) p. 327-332.

Experiments on larval rearing of large freshwater catfish, *Wallago attu* were conducted by feeding plankton alone or in combination with minced fish, mollusc or goat liver. The performance of larvae fed on different feeds during non-segregation and segregation was analysed with respect to survival. The larvae fed on goat liver along with plankton attained significantly higher ($P<0.05$) weight, length, specific growth rate, percent weight gain and survival compared to other groups. The survival of larvae fed on liver with plankton was highest (52%) compared to that of other dietary treatments (26 - 36%). The size grading decreased the cannibalism among the larvae. The final weight and length, specific growth rate, percent weight gain and survival in liver with plankton fed larvae were significantly higher ($P<0.05$) than other treatments. Segregation of larvae during rearing enhanced their rate of survival.

47. Sarkar, Bikash; Tiwari, G.N. (Centre for Energy Studies, Indian Institute of Technology Delhi Hauz Khas, New Delhi -110 016, (India)); Ayyappan, S. (Indian Council of Agricultural Research KAB-II, Pusa, IARI Campus, New

Delhi-110 0l2 (India)). **Modeling and experimental validation of water temperature in a fish rearing tank.** Indian Journal of Fisheries (2006) v. 53(3) p. 237-243.

This study describes the modeling of a fish rearing tank. Numerical computations have been performed for a typical day in the month of January, 2005 for the composite climate of New Delhi. This model has been developed by considering the effect of heat losses e.g. conduction, convection, radiation and evaporation. The governing equations are numerically solved with Matlab-7.0 software to predict the water temperature. The model has been validated with the experimental data. It is inferred that the predicted and experimental values of water temperature exhibited fair agreement with coefficient of correlation (r = 0.90) and root mean square percent deviation is (e = 1.67%).

48. Shankar, D. S.; Kulkarni, R. S. (Fish Endocrinology Research Unit, Department of Zoology, Gulbarga University, Gulbarga - 585 106. (India)). **Effect of cortisol on the condition factor in *Notopterus notopterus* (Pallas) during reproductive phases.** Indian Journal of Fisheries (2006) v. 53(3) p. 321-326.

The condition of the male *Notopterus notopterus* was studied during four phases of reproductive cycle in control and after cortisol hormone treatment. The condition of the fish including condition factor (K) and somatic condition factor (Ks) was determined based on weight of the body, length of the fish and gonad weight. The condition factors decreased during spawning and post spawning, while increased during preparatory and pre-spawning phases. The hormone cortisol level estimated by Radioimmunoassay (RIA) technique indicated that the hormone was high during pre-spawning and spawning phases as compared to other phases which may be due to the hormone involvement in metabolic activity for spermatogenesis. In 60 µg cortisol treated fish further reduction in these factors was noticed indicating that there is an active involvement of the whole body towards expenditure of energy for reproductive activity. Since cortisol is a metabolic hormone, its treatment may result in the extra expenditure of energy for progressing reproductive activity such as spermatogenesis.

49. Sharma, C. S.; Bedi, S. K.; Gill, J. P. S.; Aulakh R. S.; Sharma, J. K. (Department of Veterinary Public Health, College of Veterinary Science, Punjab Agricultural University, Ludhiana 141004, Punjab. (India)). **Prevalence of enteropathogens of zoonotic significance in fish and fish products from Ludhiana.** Journal of Indian Fisheries (2006) v. 53(3) p. 341-344.

Bacteriological examination of 23 raw fresh water fish and 8 fish pakoda samples revealed incidence of *Escherichia coli, Salmonella, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Enterobacter aerogenes, Enterobacter agglomerans* and unidentified gram negative bacilli in 9.6, 3.2, 19.3, 6.4, 6.4, 9.6, 3.2 and 9.6% samples, respectively. Three E. coli isolates belonging to serotypes 0: 8 (2) and 0: 106 (1) were detected and the only *Salmonella* isolate was

serotyped as *Salmonella typhimurium*. All the 21 isolates of various enteropathogens were tested for enterotoxigenicity by rabbit illeal loop method and skin permeability factor assay, which demonstrated that 38% of the isolates were enterotoxigenic. Enterotoxigenic response observed in *S. typhimurium, E. coli, K. pneumoniae and P. mirabilis* was 100.0, 66.6, 66.6 and 50.0 per cent, respectively. Majority of these bacteria are important from human health point of view due to their pathogenicity and direct association with the onset of diarrhea in man.

50. Sharma, O. P.; Kishan, R. (Department of Aquaculture, College of Fisheries, MPAUT, Udaipur – 313 001 (India)). **Growth of common carp, *Cyprinus carpio* var. communis (L.) fingerlings with various fermented meals.** Journal Inland Fisheries Society of India. (2006) v. 38(2) p. 45-52.

Flours of bajra, wheat, barley and soyabean were used as fish feed fermented forms for fingerlings of common carp at the rate of 4% body weight. Growth parameters such as weight gain, digestibility, food conversion ratio, protein efficiency ratio, were better in fermented meals compared to their non-fermented ones. The fish caracass indicated an increase in body protein for fermented meals than non-fermented. The cost of fish production was significantly less for fermented meals compared to their non fermented forms. The fermented diets were more economical compared to their non-fermented ones.

51. Siddagangiah (Cost of Cultivation Scheme, University of Agriucultural Sciences, Hebbal, Bangalore 560 024 (India); Vasavaraju, Y; Veerabhandrappa, B. P.;. (Inland Fisheries Unit, Main Research Station, KVASFU, Hebbal, Bangalore – 560 024 (India); Arunkumar, Y. S. (Directorate of Research University of Agricultural Sciences, GKVK, Bangalore – 560 065, (India)); Penman, D. J. (Institute of Aquaculture, University of Sterling, Sterling FK19 4LA, Scotland, (UK); Mair, M. C. (School of Biological Sciences, Finders University, PO Box 2100, Adelaide (Australia)). **An economic analysis of inland fisheries in Karnataka.** Environment & Ecology (India). (2006) v. 24S (3A) p. 961-63.

Study was undertaken in seven selected districts of the Karnataka state for economic analysis of inland fisheries. The sampled farmers involved either used common property resources (CPRs), i.e. tanks or individually owned ponds. The farmers practiced extensive cultivation as the CPRs were multipurpose, open access resources and the risks were higher, while the later employed semi-intensive cultivation. Both of the groups cultivated carp species (common carp, Indian major carp). The fish yield from individually owned ponds (2800 kg/ha) was about 10 times more than that from CPRs. The mean cost of cultivation was Rs.2,193 and Rs.19,464/ha from CPRs and individually owned ponds respectively. The major items of costs were about Rs.7,600 and Rs.70,000/ha from CPRs and individually owned ponds respectively while the net returns were about Rs. 5,500 and Rs. 53,000/ha respectively.

52. Singh, P. K.; Gaur, S. R.; Chari, M. S. (Department of Fisheries, Indira Gandhi Agricultural University, Raipur, Chattisgarh – 492 006 (India)). **Development of supplementary fish feed from low cost indigenous materials.** Journal Inland Fisheries Society of India, (2006) v. 38(2) p. 26-30.

Four isocaloric pelleted feeds of 25, 30, 35 and 40% protein levels prepared from indigenous raw materials were fed to *Labeo rohita* fingerlings @ 4% of their body weight for a period of 49 days in glass aquaria. The growth of the fingerlings was recorded weekly. The lowest mortality was observed in fishes with 30% protein levels. Statistical analysis by Randomized Block Design also showed best growth with the feed containing 30% protein level.

53. Singh Pushpanjali; Singh, Siddhartha Shankar; Singh, Jagadish (R. P. G. College, Jamuhai, Jaunpur, U. P. (India)); Gupta, R. C (T. D. P. G. College, Jaunpur, U. P. (India)). **A new species of digenetic trematode of the genus masena from a catfish *Channa gachua* from Gomti River, Jaunpur.** Journal of Nature Conservation (India) (2006) v. 18(2) p. 417-420.

A new species of digenetic trematode Masena Pushpanjali is described obtained from intestine of a catfish *Channa gachua* from Gomti River, Jaunpur. It differs from other species of Masenia in having vittelavia follicles extending from oesphagus up to upper side of anterior testes.

54. Singh, Pushpanjali; Singh, Jagadish (R. P. G. College, Jamuhai, Jaunpur, U. P. (India)); Gupta, R. C. (T. D. P. G. College, Jaunpur, U. P. (India)). **Effect of parasite on hepatosomatic Index, glycogen and protein contents in liver of a catfish *Channa gachua***. Journal of Nature Conservation (India). (2006) v. 18(2) p. 435-437.

Bio-chemical changes due to parasitic infection in the liver of fresh water cat fish *Channa gachua* were investigated. Infection of fish reduced hepatic glycogen, protein and Hepatosomatic index (HIS). Marked depletion in liver glycogen and protein contents were recorded in *Channa gachua*. A considerable decrease is also observed in HSI.

55. Singh, S.; Chari, M. S. (Department of Fisheries, Indira Gandhi Agricultural University, Raipur (CG) 492 006 (India)). **Ichthyofauna of the river Kharun.** Environment & Ecology (India) (2006) v. 24(4) p. 844-849.

A total 59 species belonging to 38 genera, 19 families and 7 orders were recorded in the river Kharun, a major tributary of Mahanadi river system. It originates from Sanjari hills Balod tehsil, Durg district. The ichthofauna was collected form the bais of river Kharun from five sampling sites in the Raipur district. Out of 59 species, *Catla catla, Cirrhinus mrigala, Channa gachua* and *Mastacembalus*

armatus were found in most of the sampling sites. Family Cyprinidae with 23 species formed the largest single group in the ichthyofauna of Kharun basin forming 39% of the total fauna. The second largest family was Bagaridae with 12% of the total ichthyofauna.

56. Singh, Tun Tun; Prasad, Durga (Deputy Directors of Fisheries, Darbhanga Range, Darbhanga, Bihar (India)). Das, J. P. L.; Prasad, Sambh. (Department of Zoology L. N. Mithial University, Darbhanga, Bihar (India)). **Wetlands of North Bihar: a potential resource for wild collection of ornamental fish.** Fishing Chimes, (India) (2006) v. 26 (9) p. 53-54.

So far as India is concerned, ornamental fish culture is one of the most promising fisheries activity not only in Bihar but also throughout the country. Bihar has vast natural resources in the form of rivers, Chaurs, mauns, lakes, ponds and tanks in which many fishes of ornamental value inhabit. The wetlands of Bihar are thus potential wild resources for indigenous ornamental fishes. The present paper is based on study of a collection of ornamental fishes that occur in the wild in the State, their biology and rhewir management aspects in aquaria. The study was undertaken with the objective of contributing to efforts aimed at enhancing Indian ornamental fish trade in global market and for strengthening the economy of the State as well as the nation.

57. *Subathra, S.; Kurupswamy, R. (Department of Zoology, Annamalai University*, Annamalai Nagar – 608 002 (India)). **Sublethal effect of cadmium on the bimodal oxygen uptake in air-breathing fish *channa punctatus* (Bloch).** Environment & Ecology (India). (2006). v. 24S (3A) p. 934-938.

The effects of sublethal concentrations (29 mg/liter) of cadmium (Cd) on the rate of bimodal oxygen consumption of air breathing fish *Channa punctatus* after long term exposure period of 7, 15, and 30 days were studied the results indicated that the oxygen consumption rate of fish was significantly reduced in aerial, aquatic and total respiration at all exposure periods from day 30. The results showed that the maximum reduction of oxygen uptake by fish was observed after post exposure period of day 30 which may be due to damage of gill tissue and loss of muscular.

58. Suresh, N.; Ranganathan, L. S. (Department of Zoology, Annamalai University, Annamalainagar - 608 002, (India)). **Histogenesis of gut associated lymphoid tissues (GALT) in *Catla catla* (Hamilton).** Journal of Indian Fisheries (2006) v. 53(3) p. 363-366.

The present study focussed on the ontogeny of gut associated lymphoid tissues (GALT) in the Indian major carp, *Catla catla* at early developmental stages. Gut appeared as a small tube on third day of post hatch and there is no evidence of lymphoid cells at this stage. Few leucocytes were detected on fifth day of post hatch and thereafter the leucocytes were increased in subsequent stages. By

fifteen days of post hatch *C. catla* attains the adult component gut and there is no accumulation or aggregation of lymphoid cells along the entire length of the gut. The presence of isolated leucocytes in the gut epithelium and lamina propria indicates that GALT appeared to be of diffused nature.

59. Suseela, M. R.; Toppo, Kiran (Phycology laboratory, National Botanical Research Institute, Lucknow – 226 001 (India)). **Enumeration of freshwater algal flora of Gangtok, Sikkim, India.** Geobios, (India). (2006). v. 33(2) p. 225-232.

The present communication enumerates 68 algal taxa belonging to 45 Cynophyceae, 14 Chlorophyceae, one Xanthophyceae and 8 Bacillariophyceae. All these taxa are first reports from Gangtok the capital of Sikkim, India.

60. Teji, K.T.; Thomas, K. John (Animal Behaviour and Wetland Research Laboratory, Department of Zoology, Christ College, Irinjalakuda, Thrissur, Kerala, 680 125, (India)). **Observations on the morphological abnormalities in induced bred larvae of some freshwater fishes.** Journal of Indian Fisheries (2006) v. 53(3) p. 353-358.

Three different species of freshwater fishes, namely *Heteropneustes fossilis* (stinging catfish), *Anabas testudineus* (climbing perch), *Mystus vittattus* (striped dwarf catfish) were induced bred and morphological studies of the larvae were carried out. Morphological and behavioural abnormalities were noticed among larvae produced through induced breeding techniques in all the three species. Morphological abnormalities were seen in head, trunk and tail region of the larvae. Under-developed head, deformed trunk, enlarged yolk sac, underdeveloped barbel, curved tail and vertebral abnormalities were observed. Tunicate larvae (larvae with undetermined growth) were common in these species.

61. Thomas, Saly N. (Cental Institute of Fisheries Technology, Matsyapuri, P. O. Willington Island, Cochin – 682 022 (India)). Hridaynathan, C. (School of Industrial Fisheries, CUSAT, Cochin – 682 022 (India)). **Comparative technical efficiency of different gillnets fishing sectors in Kerala.** Indian Journal of Fisheries. (2006) v. 53(4) p. 417-423.

Based on the level of technology adopted and species targeted, four sub-sectors were identified within the gill net sector *viz*., non motorized small mesh, motorized large mesh and mechanized large mesh sectors. Technical and economic efficiency of operation of these four sub-sectors were analyzed. The technical efficiency with reference to fishing effort and productivity indicated that there is a direct relationship in terms of fishing effort with the level of technology but no such direct relationship was observed in terms of productivity.

AUTHOR INDEX

Every Author's name appearing in the original article are listed alphabetically. Reference is given in the serial number of the entries.

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Subject headings with their sub-headings are listed alphabetically. Reference is given to the serial number of the entry.

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TAXONOMIC INDEX

Taxonomic terms of the fishes, frogs, prawns and crabs occurring in the title, also in the body of the paper are included. The names of other groups appear as per their taxonomic status in the animal kingdom. Name of the authorities omitted.

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