The only abstracting journal
on Indian Fisheries

Vol. 41 No. 3-4, July - Dec. 2007 ISSN 0970-6879

INDIAN FISHERIES ABSTRACTS

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

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(The only abstracting service on Indian Fisheries)

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Published by
Prof. A. P. Sharma

Vol. 41 No. 3-4 **July-Dec., 2007**

A service of the Library & Informatics Section
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Barrackpore, Kolkata – 700 120 West Bengal

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1. Abraham, Joice; Manisseri, Mary. K. (Central Marine Fisheries Research Institute, Cochin – 682 018 (India)). **Biochemical composition of the ovary and partial characterisation of yolk protein vitellin in *Metapenaeus monoceros* (Fabricius, 1798).** Indian Journal of Fisheries (2007) v. 54(3) p. 299-304.

Yolk protein vitellin in 'speckled shrimp' *Metapenaeus monoceros* was partially characterised employing polyacrylamide gel electrophoresis (PAGE). There was an increase in the level of expression of vitellin in the ovary, with the advancement of maturation. The vitellin fraction was not expressed in immature and spent ovaries. Molecular weight of vitellin was 326 kDa. Confirmation of the vitellin band by selective staining showed that the yolk protein was a lipoglyco-carotenoprotein possessing a calcium moiety. A protein fraction with molecular weight 270 kDa, which was a lipoprotein, was expressed in ovaries of all maturity stages as well as in testis. The major biochemical constituents of mature yolk of *M. monoceros* on dry weight basis were protein (59.36 ± 1.18%), lipid (31.23 ± 2.98%) and carbohydrates (2.97±0.81 %). Carotenoids accounted for 0.70 ± 0.81 % wet weight of yolk.

2. Abraham, K. J.; Libini, C. L.; Basak, R.; Madhupal, P.; Kripa, V.; Velayudhan, T. S.; Mohamed, K. S.; Modayil, M. J. (Central Marine Fisheries Research Institute, PO Box. 1603, Cochin – 682 018. (India)). **Biometric relationships of the black-lip pearl oyster *Pinctada margaritifera* (Linnaeus, 1758) from the Andaman and Nicobar waters.** Indian Journal of Fisheries (2007) v. 54(4) p. 409-415.

The black-lip pearl oyster, *Pinctada margaritifera* is widely distributed in Indo-Pacific region and has prime importance in the production of black pearls. In India, its natural occurrence is confined to the Andaman and Nicobar Islands. The biometric relationships between (dorso-ventral measurement [DVM] and Hinge Length [HL]; Thickness [THK] and Total Weight [TWT]) were studied from 458 oysters collected from these islands which were grouped in to 5 length classes. In all size groups, there was increase in weight with increase in length. The highest coefficient (r^2 = 0.7828) was obtained for the animals with DVM ranging from 76 to 95 mm. The correlation coefficient 'r' was low for DVM-HL and slightly higher for DVM-THK. Comparisons of biometric relationships of the natural populations of the Indian pearl oysters with that of farmed oysters in other regions indicated xenomorphism in pearl oysters in Andaman and Nicobar Islands due to restricted space in natural habitats.

3. Abraham, T. Jawahar; Banerjee, Tirthankar (Department of Fishery Pathology and Microbiology, Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Panchasayar, P.O., Kolkata - 700 094, West Bengal, (India)). **Beneficial antagonistic bacteria from freshwater fishes and culture environment as probiotics in ornamental fish culture.** Indian Journal of Fisheries (2007) v. 54(3) p. 311-319.

A search for beneficial antagonistic bacteria from freshwater fishes and culture environment, and their use as probiotics in ornamental fish culture was attempted. In freshwater fishes, the antagonistic bacterial populations were found to be in the range of < 0.002 - 13.12% of the total population; while in ornamental fish culture environment, their populations were in the range of < 0.14 - 24.39%. Asporogenous Gram-positive rods (31.7%) and aerobic spore forming *Bacillus* spp. (30%) were the dominant antagonist groups followed by *Micrococcus* (18.3%), *Lactobacillus, Lactococcus* and *Streptococcus* in the fish gut. Eighteen opportunistic fish pathogenic bacteria belonging to the genera *Aeromonas, Bacillus, Citrobacter* and *Pseudomonas* were inhibited by the antagonistic bacterial strains *in vitro* at varying levels. The potential probiotic strains, *Bacillus* sp. P43 and *Lactobacillus* sp. P21 from fish gut were capable of adhering to different substrates and conferred protection to *Carassius auratus* and *Xiphophorus helleri. Bacillus* sp. P43 survived well both in pelleted feed and water while the *Lactobacillus* sp. P21 failed to do so. The dominance of Gram-positive antagonistic bacteria in freshwater fishes imply that these bacteria could be useful as probiotics and / or biocontrol agents in freshwater ornamental fish culture.

4. Agrahari, Raj Kumar; Saxena, Arti (Department of Zoology, Government Modal Science College, A. P. S. University, Rewa (M. P)); Varshney, P. K. (National Bureau of Fish Genetics Resources (ICAR), Centre - Chinhat, Lucknow - 227 105. (India)). **Zoo-benthic diversity in polluted zone of river Gomti at Daliganj, Lucknow.** Journal of Nature Conservation (India) (2007) v. 9(2) p. 279-285.

To assess the biodiversity of river Gomti in Lucknow the industrially dominated spot Daliganj (Near Mohan Mekin) was identified. The water quality in this region was poor with low pH and low dissolved oxygen (on many occasions 0.80 ppm) and higher levels of nutrients (NO_2, NO_3 & PO_4) and chemical oxygen demand. The substratum was clayey and black in colour. The mean population density (26,490 m^{-2}) and biomass (25.18 g^{-2}) were high. Seasonally mean maxima for density (48,452 m^{-2}) and biomass (41.31 g^{-2}) were observed during post-monsoon. Oligochaetes and chironomids (Diptera) dominated the fauna. The genera *Tubifex, Nais, Dero, Limnodrilus, Lumbricillus, Lumbriculus* and *Chaetogaster* pre-dominated among oligochaetes. Other groups occasionally present were Nematodes, Ephemeroptera, Coleoptera and Gastropoda. The benthic productivity is high with poor diversity in this zone compared to other river systems. The dominance of worms coupled with poor water quality due to anthropogenic effluent discharge the area is highly polluted. Though the productivity is high in this region it may not culminate in good production at higher tropic level. The study reveals that the area is highly polluted and reached at an alarming level.

5. Ali, P. H Anvar; Prasad, G. (Department of Zoology, University of Kerala, University Campus, Kariavattom, Thiruvananthapuram 695 581, Kerala, (India)). **Bionomics of a critically endangered and endemic catfish, *Horabagrus nigricoliaris* from its type locality in Kerala.** Journal of the Bombay Natural History Society (India) (2007) v. 104 (2) p. 165-169.

Data on some aspects of the bionomics of the Bagrid Catfish *Horabagrus nigricollaris* are presented. The Imperial White-collared Catfish is confined to the regime reaches of its type locality - the Chalakudy river, Kerala and is listed as critically endangered. The present sample consists of specimens with a total length ranging from 70 - 187 mm and total weight ranging from 3.7 - 66.95 g. The growth was found to be allometric and the

regression equation of combined sexes was log W= - 1.839 + 2.855 log 'L', *H. nigricollaris* is a benthophagic omnivore fish, feeding on insects, algae, and crustaceans. The absolute fecundity of a ripe specimen having a total length of 156 mm and weight 33.70 g was 1,320 eggs with a relative fecundity and GSI value of 413 eggs/g body weight and 9.5 respectively. The male : female sex ratio was 1:1.1, The information generated from this study is the first of its kind on the knowledge of the biology of this endemic catfish.

6. Ambasankar, K.; Ali, S. Ahamad; Dayal, J. Syama (Central Institute of Brackishwater Aquaculture, 75, Santhome Highroad, Chennai - 600 028, (India)). **Effect of dietary supplementation of phosphorus on growth and phosphorus excretion in Indian white shrimp, *Fenneropenaeus indicus* (Milne Edwards).** Indian Journal of Fisheries (2007) v. 54(3) p. 305-310.

An experiment was carried out to determine the effect of supplementary phosphorus on growth and faecal excretion in juveniles of *Fenneropenaeus indicus.* A practical feed was formulated using fish meal, squid, mantis shrimp, soyabean meal, wheat flour, fish oil and lecithin. To this feed, phosphorus was supplemented as mono sodium di-hydrogen orthophosphate at 0.0, 0.25, 0.5, 0.75 and 1.0%. Results of a 60 - day feeding trial in triplicate on the juveniles of *F. indicus* (initial average live weight 0.45 ± 0.008 g) showed that dietary supplementation of phosphorus was essential and the best performance (310 % increase in live weight and 1.40 FCR) was recorded by the feed having 7.50 g kg^{-1} supplementary phosphorus (total phosphorus in the diet 1.83%) which was significantly higher than the control feed fed groups having 1.03% dietary phosphorus (live weight increase 224% and FCR 1.60). Additional supplementary phosphorus (more than 0.75 g/100 g) had no beneficial effect. Shrimp fed with different feeds maintained the body phosphorus level in the range of 1.23 - 1.31 g/100 g irrespective of dietary phosphorus levels and the same trend was continued in Ca : P ratio in the body. There was no significant change in the proximate composition of the experimental shrimps on termination of the feeding trial. Phosphorus excretion in faeces increased with increase in dietary phosphorus.

7. Annappaswamy, T. S.; Reddy, H. R. V. (Department of Fisheries Resources and Management, College of Fisheries, Karnataka Veterinary, Animal and Fishery Sciences, Mangalore - 741 252, Karnataka); Nagesh, T. S. (Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, 5, Budherhat Road, Chakgaria, Kolkata - 700 094, West Bengal. (India)). **Age and growth of S*illago sihama* (Forskal, 1775) from estuaries of Dakshina Kannada along the south west coast of India.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p.16-22.

Length-weight relationship, condition, age and growth, and mortality of *Sillago sihama* from estuaries of Dakshina Kannada were studied between April 1998 and March 1999. Length-weight relationship showed significant difference between the sexes and the derived equations were $w = 0.0065L^{3.0593}$ for female and $w = 0.0113L^{2.8433}$ for male. Seasonal variation in condition factor showed higher values during May, September, October and December in both the sexes, while the mean values of Kn at different lengths showed higher condition at 230 mm. Age and growth studies revealed that females attain larger size than males and the Von-Bertalanffy growth equation was $Lt = 551.02\ [1- e^{-0.1482(t+1.1302)}]$ for females and $Lt = 500.94[1- e^{-0.1638(t+1.1398)}]$ for males. The estimated fishing mortality for males (0.9438) was higher than females (0.5105).

8. Arunkumar, L. (Department of Zoology, Mayai Lambi College, Yumnam Huidrom - 795 008, Manipur, (India)). ***Schistura paraprashadi,* a new species of nemacheiline fish (Cyprinifonnes: Balitoridae) from Manipur, India.** Aquacult (India) v. 8(2) p. 203-209.

A new freshwater nemacheiline fish *Schistrua paraprashadi* is described here based on 24 specimens collected from the Barak drainage of Manipur, India. The species is very similar to *S. prashadi* in its body colouration. However, it has shallower body, shorter predorsal length, shorter length of caudal peduncle, absence of a black spot at the base of dorsal fin, dissociated black bar at the base of caudal fin, less number of dorsal and caudal fin rays.

9. Atkore, M. Vidyadhar; Sivakumar, K.; Johnsingh, A. J. T. (Wildlife Institute of India, Post bag # 18, Chandrabani, Dehradun 248 001, Uttarakhand, (India)). **Length-weight relationship and relative condition factor of juvenile golden Mahseer *Tor putitora* (Hamilton 1822), in the tributaries of Ramganga river, Uttarakhand.** Journal of the Bombay Natural History Society, (India) (2007) v. 104 (2) p. 161-164.

The length-weight relationship and condition factor of juvenile Golden Mahseer *Tor putitora* was observed from samples collected between November 2004 and May 2005, in the Khoh, Kolhu and Mandal rivers, tributaries of the Ramganga river, in Uttarakhand. Golden Mahseer found were mostly less than one year old. There was no significant difference found between rivers in respect of length-weight relationship and condition factor of Golden Mahseer. The estimated condition factor for Golden Mahseer across rivers was low (Kn = 1.10), however, the condition factor of larger fish in the samples was good.

10. Bandyopadhyay, M. K.; Biswas, D. K. (Central Inland Fisheries Research Institute Barrackpore. Kolkata 700120. (India)). **Plankton Diversity and Soil-Water Relationship of a Typical Oxbow Lake in Dinajpur District, West Bengal, India.** Environment & Ecology (India) v. 25S (4A) p. 1413-1417.

A study was conducted on a typical oxbow lake (Churamon-Moranadi) in the Dinajpur district, West Bengal during 1996-1997. It was mainly concentrated on the plankton diversity and soil-water relationship of the ecosystem. A total of 22 species of phytoplankton and 13 species of zooplankton was recorded from the lake. The phytoplankton was dominated (93.39%) in the total plankton population. A rich biodiversity of both phytoplankton and zooplankton was ascertained based on Variety index (d) values. The Evenness index showed an even distribution pattern of phytoplankton and zooplankton species. Many positive relationships (r = 0.9143 to 0.9926) were recorded among the soil and water quality parameters of the lake. Less availability of the macro-nutrients (phosphate, nitrate-nitrogen) in the water phase has resulted in poor fish food production and fish yield (68.6 kg/ha per year) in the lake.

11. Bathusha, M. Ibrahim (Senior Lecturer, Department of Civil Engineering, PSG College of Technology, Coimbatore - 641 004, Tamil Nadu); Saseetharan, M. K. (Professor of Civil Engineering, Govt. College of Engineering, Salem - 636 001, Tamil Nadu (India)). **Assessment of surface water quality in eight major ponds of Coimbatore city and potential risk on ground water quality.** Journal of Environmental Science & Engineering (2007) v. 49(4) p. 297-308.

Water samples were collected from eight different water tanks located in the Coimbatore city during the study period of six months. Major surface water quality parameters such as turbidity, temperature, pH, electrical conductivity, total dissolved solids, chlorides, hardness, COD, BOD, DO, alkalinity, Calcium, Sodium, Sodium Absorption Ratio and Potassium were analysed. It was observed that the water quality gets deteriorated due to the continuous discharge / entry of domestic / industrial wastewater into these tanks. It was noted that the concentrations of all parameters follow a rising trend of variation with the time. Measures for the minimisation of organic load and suspended solids loading are to be made. It is evident that the discharges of domestic and industrial sewage into these ponds cause the deterioration in the water quality over the period.

12. Bhuvaneswari; K. Raviprasad, P. (Analytical Chemistry Division, Indian Institute of Chemical Technology, Hyderabad - 500 007 (India)); Sarma, P. N. (Deputy Director and Head, Bioengineering and Environmental Centre, Indian Institute of Chemical Technology, Hyderabad - 500 007. (India)). **Adsorption Studies on Wastewaters from Cypermethrin manufacturing process using activated coconut shell carbon.** Journal of Environmental Science & Engineering (2007) v. 49(4) p. 265-272.

Cypermethrin is a pyrethroid pesticide and is used in the control of a wide range of insects on crops like vegetables, cereals, maize etc. In the present study, the adsorption efficiency of coconut shell based activated carbon for the removal of color and organic matter from cypermethrin pesticide manufacturing industrial wastewater was investigated. Effect of carbon dosage, pH and contact time on the removal of COD was also studied. Equilibrium and kinetic studies were carried out and the data was fitted in Freundlich and Langmuir models. The study proved that activated coconut shell carbon (acc) is an efficient adsorbent for treatment of cypermethrin industrial wastewaters under study.

13. Bordoloi, Sabitry (Resource management and Environment Division, Institute of advanced study in Science and Technology, Paschim Boragaon, Guwahati - 781 035, Assam); Saha, Susmita. (Dalgoma Higher Secondary School, Dalgoma -783 125, Assam. (India)). **Record of C*lupisoma montana* (Hora) from Assam and comparative study with related species.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 23-31.

The present study report a thriving population of *C. montana* both from Amingaon, Kukurmara near Guwahati in Kamrup district and *beels* of Goalpara District, Assam and details a comparative account of morphometric characters of *C. Garua, C. Montana* and *Eutropiichthys vacha.* This is the first population report of *C. Montana* from Assam.

14. Borthakur, Sushanta (College of Fisheries, Assam Agricultural University, Raha-782 103, Assam, India); Goswami, Umesh C. (Department of Zoology, Aquaculture and Aquatic Resources Monitoring Centre, Gauhati University, Guwahati – 781 014, Assam, (India)). **Cage culture of magur *Clarias batrachus* (Linnaeus) with selected non-conventional diets in a floodplain wetland of Assam.** Indian Journal of Fisheries (2007) v. 54(4) p. 357-363.

A study was conducted to assess the efficacy of three test diets containing (i) blood meal (BOM), ii) blood meal mixed with papaya peels (BMP) and iii) blood meal mixed with pineapple tops and skin (BMA) in cage culture of *Clarias batrachus,* keeping fish meal based diet (ROF) as reference diet. The blood meal incorporated either with papaya peels or with pineapple tops and skins as exogenous enzyme sources resulted in better net weight gain, specific growth rate, food conversion and protein efficiency. Fish fed on blood meal alone (BOM) showed inferior growth when compared to the reference diet (ROF). The study suggests the usefulness of replacement of fish meal with exogenous enzymes incorporated into blood meal in the diet of *C. batrachus* and also indicates that the species can be successfully reared in cages installed in wetlands of Assam.

15. Chakrabarty N. M.; Chakrabarty P. P; Mondal, S. C. (Regional Research Centre, Central Institute of Freshwater Aquaculture, A-5 (Phase III), Santalpara, Kalyani 741 235. West Bengal (India)). **On breeding of Tangra (*Mystus vittatus*) and production of its post larvae/fry.** Fishing Chimes (July 2007) v. 27(4) p. 16-18.

Mystus vittatus, locally known as Tangra or Getteya tangra, is a minor lagrid cat fish that occurs in the East and North-east region of India. Allied species i.e., *Mystus tangra, M. cavacius* and *M. gulio* occur on swamps, canals and flooded paddy fields which dry up in summer months. All the above species together constitute a minor fishery. Among the cat fishes which form 33% of the total freshwater fish production in India, Tangra occupies a significant place. *Mystus vittatus* is a commercially important freshwater cat fish from Eastern India specially in West Bengal, Orissa and Assam having food value and a good market demand. Tangra is a fish in demand in East and North Eastern region of India owing to its taste. It fetches a price as high as Rs.150 - 180 per kg depending upon the size. Although in the early 1970s the species supported a strong fishery in West Bengal in 1980s and onwards sharp fall in catches was observed. The reason may be attributed to the decrease in the area of *beels, Bheris,* swamps and river mouth of estuarine areas. Therefore breeding grounds of the species suffered a major set back. Although bionomics and life history of allied species *Mystus Seenghala* (Saigal and Motwani 1961) *Mystus gulio* (Pantulu 1961: David 1963). *Mystus tangra* (Parameswaran *et al.* 1971), biology of *Mystus aor* (Saigal 1964) are known, information on the biology and breeding details of *M. vittatus* is meagre.

16. Chakrabarty, N. M.; Chakrabarty, P. P.; Mondal, S. C. (Regional Research Center. Central Institute of Freshwater Aquaculture, Kalyani 741 235. (India)). **Breeding and Early Development of Tangra *(Mystus vittatus)* in Captivity.** Environment & Ecology (India) v. 25S(3) p. 610-613.

Tangra, *Mystus vittatus* is a commercially important catfish available Swamp flooded paddy field, bheries in eastern Indian states of West Bengal, Orissa, Assam and Bihar. A sharp fall of this catfish has been noticed from the commercial catches. There is a need for propagation and conservation of the species of fish through artificial breeding. Attempts were made induced to breed *M. vittatus* in captivity through hormonal manipulation and the early larval and post larval developmental stages were studied.

17. Channa, Ashok; Mir, Hussain Imtiyaz (Post Graduate Department of Zoology, University of Kashmir, Srinagar – 190 006, Jammu & Kashmir. (India)). **Neutral and acid mucin in the intestinal tract and gills of *Schizothorax curvifrons* heckel.**

Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 32-34.

Histochemical localization of mucin and its functional significance in different portions of the intestinal tract and gills of *Schizothorax curvifrons* has been studied. Both neutral and acidic mucus secreting cells were observed in the entire intestinal tract and all along the gill epithelium. However, the reaction for acid mucin is observed to be more pronounced than the neutral mucin throughout the intestinal tract. Nevertheless, the gills exhibit uniformly intense reaction for both neutral and acidic mucin.

18. Chatterjee, S. K.; Ghosal, A.; Ghosh, S. (Life Science Laboratory, Institute of Science Education, University of Burdwan, Burdwan - 713 104. (India)). **Influence of Synthetic Pyrethroid on the Histosomatic Index and Hydration Level of Tissues of *Channa punctatus* (Bloch).** Environment & Ecology (India) v. 25S (4A) p. 1312-1314.

Effect of sub-lethal dose of cypermethrin, a synthetic pyrethroid was studied on the histo-somatic indices and tissue hydration level of liver and gill of the fish *Channa punctatus* for a maximum exposure period of 15 days. Periodical readings from both the experimental and control fishes were compared and statistically analyzed. Probable reasons of variations were discussed in the light of available literature.

19. Chembian, A. John (Cochin Base of Fishery Survey of India, Cochin - 682 005, India)). **New record of *Rhinochimaera atlantica* (Chimaeriformes: Rhinochimaeridae) spawning ground in the Gulf of Mannar along the south-east coast of India.** Indian Journal of Fisheries (2007) v. 54(4) p. 345-350.

The egg capsules and one embryo of *Rhinochimaera atlantica* were collected from the Gulf of Mannar while conducting fishery resource survey by bottom trawling. In total, 89 egg capsules were collected from the surveyed area (Latitude 08°51'N to 08°53"N and Longitude 78°47'E to 78°53'E) at a depth range of 281-301 m, which indicated that this area is the probable spawning ground of the species in the Gulf of Mannar. The egg capsule measured 257 mm in total length and weighed 28 g. It was ovoid in structure with a central longitudinal hollow core surrounded on both sides with a wing-like ribbed lateral web. Embryo was spindle shaped and perfectly placed in the tubular structure of the egg capsule. The ratio of the number of unhatched egg capsules to the empty capsules indicated that, March / April may be the terminal period of incubation. The embryo observed was in the advanced stage of release as the embryo nearly occupied the full length of central hollow core.

20. Das, Sirshendu; Sasmal, S. (Department of Fisheries, College of Agriculture, Indira Gandhi Agricultural University, Raipur, C. G. – 492 006 (India)). **Effect of Diurnal Variations on Physico-Chemical and Biological Parameters in a Freshwater Nursery Pond.** Aquacult (India) v. 8 (2) p. 179-183.

Diurnal variations in water chemistry and plankton in nursery pond were quite apparent. Large fluctuations were noted in dissolved oxygen, pH, carbonate and bicarbonate concentrations. The pond water was oversaturated with oxygen during day time (9.2 ppm) and oxygen was depleted at night (1.8 ppm); pH increased at daytime and decreased at night Phytoplankton did not show any apparent diurnal variation except *Microcystis* sp. Among zooplankton, *Daphnia* and *Cyclops* showed diurnal movement but *Cypris* and *Diaptomus* did not show any apparent diurnal movements.

21. Desai, V. R. (273, Saket Nagar, Indore – 452 018 (M.P.)); Srivastava, N. P. (Central Inland Fisheries Research Institute, Barrackpore – 700120, West Bengal); Kumar, D. (Riverine Fisheries Division of CIFRI, 24, Pannalal road, Allahabad (U.P) (India). **Constraints in reservoir fishery development – A case study of Ravishankar Sagar Reservoir.** Fishing Chimes (July 2007) v. 27(4) p. 19-22.

The task of raising fish crop from large and medium reservoirs is more challenging and difficult than small water bodies like ponds, tanks and small reservoirs. In this context, the experiences gained during the course of fishery development of Ravishankar Sagar Reservoir are focally discussed on this paper.

22. Goswami, M. M.; Hazarika, R; Saud, B. J. ((UGC-SAP (DRS) Project, Department of Zoology, Gauhati University, Guwahati – 781 014, Assam. (India)). **Induced spawning, embryonic and larval development of *Pangasius pangasius* (Hamilton - Buchanan).** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 1-9.

The present paper deals with the induced spawning of *Pangasius pangasius* in circular eco hatchery (CEH) and study of embryonic and larval development. Two induced breeding trials were conducted separately in altogether 18 fishes by administering synthetic ovatide hormone. Spawning response observed to a dose of 0.3-0.4 ml hormone per kg body weight (BW) in male and 0.6 - 0.7 ml per kg BW in female. The specially designed nest or egg collectors were used in the breeding pool. Hatching took place within 24-26 hours at 28-31°C water temperature. Only 22-28% hatching success was recorded due to outbreak of fungal infection in the fertilized eggs in egg collectors. Early embryonic development upto blastula stage was not distinct due to opaqueness of the egg. Formation of yolk plug was noticed at 8.2 hours. The hatchlings were light yellow in colour with a large yolk sac after 72 hours of fertilization. After 21 days of hatching the larvae developed structural configuration of the adult. The larvae survived till 21 days in flow-through system in plastic and earthen tubs.

23. Jagadis, I. (Tuticorin Research Centre of CMFRI, South Beach Road Extn, Tuticorin, 628 001); Rajagopal, S. (Centre of Advanced Study in Marine Biology, Parangipettai, (India)). **Age and growth of the venus clam *Gafrarium tumidum* (Roding) from south-east coast of India.** Indian Journal of Fisheries (2007) v. 54(4) p. 351-356.

Age and growth of the Venus clam *Gafrarium tumidum* was studied in detail employing four conventional methods and an electronic package ELEFAN - I. The growth rate obtained by all the methods was more or less similar and comparable with one another. The clam reached a length of 24.4, 31.9 and 37.7 mm at the end of 1st, 2nd and 3rd year of its life. Growth rates of male and female clams were similar and observed to be faster in the first year and then tended to slow down with age. The life span of *Gafrarium tumidum* was estimated to be 3 years.

24. Jain, Atul Kumar (Tropical Aquaculture and Farming Systems A-102. Galaxy Apartments. Old Fatehpura, Bedla Road, Udaipur - 313 001. Rajasthan, (India)). **Sustainable inland saline water aquaculture development.** Fishing Chimes (Oct. 2007) v. 27(7) p. 10-14.

The farming of commercially important aquatic species is considered a better option than agriculture for utilising vast inland surface and subsurface saline water resources, which are mainly distributed in semi-arid and arid regions of Rajasthan, Haryana, Punjab and Uttar Pradesh. As a follow up of this consideration the research and development efforts on inland saline water aquaculture began in the country in early 1980s. During the last two and half decades, success has been achieved in experimental farming of *Chanos chanos* (milkfish), *Mugil cephalus* (grey mullet), *Lates calcarifer* (sea bass), *Etroplus suratensis* (pearl spot) and *Peneaus monodon* (tiger prawn) in inland saline water. The suitability of inland saline water for larvae farming and grow-out of giant freshwater prawn *Macrobrachium rosenbergii* has also been ascertained. However, the inland saline water aquaculture is yet to be developed for large scale commercial utilisation in the country. There are several issues related to the subject that need attention of researchers, administrators and policy makers to harness the potential of inland saline water resources and also for sustainable growth of this sector.

25. Jayasankar, P.; Anoop, B.; Peter, Reynold; Afsal, V. V.; Rajagopalan, M. (Central Marine Fisheries Research Institute, Cochin - 682 018, India)). **Species of a whale and an unknown fish sample identified using molecular taxonomy.** Indian Journal of Fisheries (2007) v. 54(3) p. 339-343.

Molecular genetics provides a powerful tool for conservation of species protected by international regulations or threatened by overexploitation. The present communication is the first report from India on the application of molecular tools for the accurate identification of a stranded whale in putrefied condition as it was impossible to identify the species status using conventional taxonomy and the carcass of an unknown animal devoid of its head and tail, collected from a fish market. Partial sequences of mtDNA control region and cytochrome b gene of the whale were generated and tested with BLAST search and DNA *surveillance* for molecular identification. It was identified as Bryde's whale *(Balaenoptera edeni).* Partial sequence of mtDNA cytochrome b gene of the unknown fish from the market was generated, tested with BLAST search and was identified as sword fish *Xiphias gladius.*

26. Joseph, Imelda; Raj, R. Paul (Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P. O., Kochi-18, Kerala, (India)). **Efficacy of bacterial fermented oilcake mix as fishmeal substitute in the diet of tiger shrimp, *Penaeus monodon* (Fabricius) post larvae.** Indian Journal of Fisheries (2007) v. 54(4) p. 379-387.

Diets incorporated with varying levels (5, 15, 25 and 35%) of bacterial fermented oil cake mix, derived by solid-state fermentation (SSF) as fishmeal replacement, were evaluated in *Penaeus monodon* post larvae for growth, digestibility and body composition through a 42 days laboratory experiment. A diet containing 35% fishmeal and no fermented ingredient mix was used as the control. Pure culture of *Bacillus coagulans* MTCC-2449 was used for SSF and the 36 h fermented product was incorporated in the diets. Analysis of response data revealed that the shrimp fed diet containing 35% fermented ingredient mix (100% fishmeal substitution) had significantly higher ($P<0.05$) mean weight gain (0.63 ± 0.03 g), better feed conversion ratio (1.58), apparent protein utilization (25.65) and protein efficiency ratio (1.71) than all other diets as well as the control. The apparent protein digestibility (86.56%) and apparent fat digestibility (94.55%) were also found to be the highest for this diet. The

survival rate was 100% in all the treatments and the control.

27. Joshi, K. D. (National Research Centre on Cold Water Fisheries (ICAR), Champawat - 262 523, Uttarakhand, (India)). **Preliminary observations on rearing of the hill stream fish, *Naziritor chelynoides* (MeClelland) under pond environment.** Indian Journal of Fisheries (2007) v. 54(4) p. 423-425.

The present study was conducted to observe the general adaptability, growth and survival of a hill stream fish, *Naziritor chelynoides*, in the pond environment. The experimental fishes were caught from the rivulet Ladhiya in district Champawat (Uttaranchal), transported and reared in the experimental fish farm at Chhirapani, Champawat from April 1998 to March 1999. A total of 45 fishes with body length ranging between 170-185 mm and corresponding weight of 39.5-46.0 g (average weight 43.5 g) were stocked in 2 cement ponds at a stocking density of 1.5 fish m^{-2}. The stock was fed with a laboratory formulated wet diet @ 1-3% of body weight. On completion of the experiment, the fish attained 195-230 mm body length with corresponding weight between 71.0-89.5 g (77.66 g) with an overall growth rate of 0.09 g day^{-1}. The survival rate was 95.5%, in the ambient water temperature range between 4.5 - 24.3°C.

28. Kumar, A. Biju; Raffi, S. M. (CAS in Marine Biology, Annamalai University, Parangipettai - 608 502, Tamil Nadu, India); Kumar, M. Sushil, (Research Department of Zoology, N. S. S. College, Pandalam - 689 503, Kerala, India); Khan, S. Ajmal (Present Address: Department of Aquatic Biology and Fisheries, Trivandrum, Kerala, (India)). **Diversity of brachyuran crabs associated with trawl by-catch in Kerala coast, India.** Indian Journal of Fisheries (2007) v. 54(3) p. 283-290.

The by-catch landed by trawlers in Kerala coast was studied during April 2005 to May 2006 to estimate the diversity of brachyuran crabs. Forty three species of brachyuran crabs represented under 11 families and 22 genera were recorded from the trawl by-catch, including eight commercially exploited species. One species each was recorded under the crab families such as Dromidae, Dorippidae, Graspidae and Corystidae while Portunidae was represented by 16 species. The species diversity and abundance was more at Neendakara and results of cluster analysis showed that Neendakara and Munambam fishing harbours were similar in species composition. The species composition was also found to vary with seasons with more species diversity during the monsoon.

29. Kumar, Anand; Tripathi, Nalini; Tripathi, Madhu (Department of Zoology, University of Lucknow, Lucknow - 226 007 (India)), **Effect of Fluoride on Lipid Metabolism in Freshwater Catfish *Clarias batrachus* (Linn.).** Environment & Ecology (India) v. 25S (3) p. 683-686.

After exposure of *Clarias batrachus* to different concentrations of fluoride (35 and 70 mg/liter) for 30, 60 and 90 days, gradual depletion in lipid content in muscle, liver and testis was recorded. The significant depletion in muscle lipid and testis lipid was noticed in both lower and higher concentration exposed fish after 60 and 90 days. However, depletion of liver lipid was recorded to be highly significant in both lower and higher concentration exposed fish after 30, 60 and 90 days.

30. Kumari, Pramila. (Indian Council of Medical Research, New Delhi); Dhadse, Sharda; Chaudhari, P. R; Wate, S. R. (EIRA Division, National Environmental Engineering Research Institute, Nagpur – 440 020 (India)). **Bioindicators of pollution in lentic water bodies of Nagpur city.** Journal of Environmental Science & Engineering (2007) v. 49(4) p. 317-324.

The present study deals with assessment of water quality of four selected lakes in the Nagpur city using physicochemical and biological parameters especially phytoplankton and zooplankton community. Tropic level and pollution status of lakes were assessed on the basis of the Palmer's Pollution Index, Shannon Wiener Index and physico-chemical parameters. 57 genera belonging to 7 groups of phytoplankton and 10 genera belonging to 3 groups of zooplankton were identified from the lakes. Different patterns of dominance and sub-dominance of indicator plankton community and species along with physico-chemical quality observed confirm the pollution status of the lakes.

31. Mahapatra, B. K. (CIFE, Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata - 700 091, West Bengal); Vinod, K.; Mandal, B. K. (Division of Fisheries, ICAR Research Complex for NEH Region, Barapani -793 103, Meghalaya. (India)). **Potential ornamental fish biodiversity of Mizoram - Its prospects and constraints.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 10-15.

The state of Mizoram, India endowed with 22 rivers along with their tributaries, streams, creeks, lakes, reservoirs, paddy fields and ponds form an important fishery resource and possesses a rich wealth of indigenous ornamental Fishes. The present study recorded a total of 91 ornamental fish species, belonging to 49 genera under 22 families and 6 orders. Of the seven rivers surveyed in Mizoram, a majority of the species were found to be distributed in Karnafuli and Tuirial rivers (36.26% each), followed by Kolodyne (24.18%), Mat (16.48%), Tuirini (9.90%), Tlawng (7.70%) and Tuivai river (4.40%). The conservation status of the ornamental fish fauna of Mizoram were evaluated and it was found that 10% are endangered, 22% vulnerable, 29% lower risk near threatened, 5% lower risk least concerned 34% not evaluated. The highly priced native ornamental fish resources provide the state an ample scope for foreign exchange earning through long term planning, conservation and judicious use of the germplasm.

32. Mallia, V. Jyothi; Thomas, P. C. (Central Marine Fisheries Research Institute, Kochi - 682 018, India); Muthiah, P. (TRC of CMFRI, South Beach Road, Tuticorin - 628 001, (India)). **Induction and evaluation of triploidy in edible oyster, *Crassostrea madrasensis* (Preston) - an approach to enhance bivalve aquaculture.** Indian Journal of Fisheries (2007) v. 54(4) p. 417-421.

Induced triploidy can be used for enhancing production of commercially valuable bivalve species. Triploid individuals, having an extra set of chromosomes (3n) typically exhibit reduced gametogenic activity leading to better growth since the energy used for reproduction is reallocated for somatic growth. In India, research on genetic manipulation of the edible oyster, *Crassostrea madrasensis* by triploidy inducement and assessment of triploid performance as a strategy to increase production has been underway since 1998. This article outlines the potential of using triploidy in bivalve culture for better returns.

33. Manish, Nisha (Department of Zoology, S.D. (P.G.) College, Muzaffarnagar- 251 **001,** U.P., (India)). **Histo-morphology of the pituitary gland of the fresh water fish *Chela bacaila* (Hamilton).** Aquacult (India) v. 8 (2) p. 165-170.

Observations are made on the shape, size, location, enlargement of pituitary gland. Various cell types and their distribution have been studied on the basis of staining properties viz., acidophils, basophils, chromophobs and pituitcytes.

34. Manna, K. Ranjan; Aftabuddin, Md. (Northeastern Regional Centre, Central Inland Fisheries Research Institute (ICAR) Housefed Complex, Dispur, Guwahati - 781 006, Assam. (India)). **Impact of river connectivity on selected abiotic and biotic parameters of floodplain wetlands of Assam:** a **comparative study.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 35-42.

Floodplain wetlands *(beels)* are a major fishery resource of Assam, India. Loss of river connectivity is one of the main factors behind declining trend of fish productivity from these water bodies due to lack of auto-stocking. A study was undertaken in a closed ox-bow lake, Puthimari *beel* and a seasonally open ox-bow lake, Morakolong *beel* during 2005-06. The wetlands showed different behaviour in physical parameters like depth, flow and transparency. Seasonal changes in chemical parameters of water like specific conductivity, dissolved oxygen, free carbon-dioxide, total alkalinity, total hardness, nitrate, phosphate and silicate of both the *beels* were assessed in the light of river connectivity as major controlling factor. Soil organic carbon and soil sp. conductivity of both the *beels* are also discussed. Biological parameters like macrophytes, macrophyte-associated mollusc and fish fauna were found to be strongly controlled by river connectivity.

35. Manojkumar, P. P. (Calicut Research Centre of Central Marine Fisheries Research Institute West Hill, Calicut – 673 005 (India)). **Food and feeding habits of *Decapterus russelli* (Ruppell, 1830) along the Malabar Coast.** Indian Journal of Fisheries (2007) v. 54(4) p. 427-430.

Study on the food and feeding habits of *Decapterus russelli* showed that it is a carnivore, subsisting mainly on crustaceans, fishes, polychaetes, salps, molluscs and miscellaneous items. Crustaceans were the most dominant item in different size groups. The fish showed preference to other food fishes as they grew. The intensity of feeding was high during most of the months. Feeding intensity was high in juveniles followed by immature, maturing and spent fishes.

36. Mishra, Bibhudatta (Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar, Orissa, (India)). **On duckweed, the multi-use aquatic plant**. Fishing Chimes (Aug. 2007) v. 27(5) p. 11-13.

Duckweed belongs to the family Lemnaceae. a family of floating aquatic plants consisting of the genera viz. Lemna, Spirodela, Wolffia and Wolffiella. These grow well in natural organic-rich water bodies. The places where duckweed is not seen is in waterless desert and in the tundra. As a result of deviating aquatic habitats adopted to withstand adverse conditions, duckweed evolved as the smallest and the simplest floating plant at moderate climate zones of tropical and temperate regions in 7°C to 35^{o}C temperature range. Under low temperature conditions. Duckweed remains

dormant on the pond bottom until warmer conditions return.

37. Mishra, D. N.; Moza, Usha; Lakra, C.; Kumar, Sushil. (Karnal Research Centre of Central Inland Fisheries Research Institute, Karnal - 132 001, Haryana. (India)). **Time scale changes in fisheries of river Yamuna.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 48-52.

Assessment of fishery resources and its composition in the upper stretch of river Yamuna reveals that fish catch increased from 23.85 t $year^{-1}$ (1997-98) to 30.6 t $year^{-1}$ (2003-04) within 150 km stretch of upper Yamuna between Tajewallah to Panipat, But fishery composition exhibited deterioration of indigenous fishery. Indian Major Carp contribution declined from 5.4% (1997-98) to 2.45% (2003-04); big sized catfishes from 10.5 (1997-98) to 6.53% (2003-04); while common carp contribution increased from 1.8 (1997-98) to 16.8% (03-04). Mahseer showed stability. Middle stretch of Yamuna (50 km) along Faridabad recorded fish catch fluctuation between 20.129 to 30.124 t $year^{-1}$ within 3 year period and the presence of exotics like *Tilapia* sp. and *Clarias gariepinus.* The probable cause of invasion by exotic fishes into river Yamuna and decrease in IMC are being discussed in this communication.

38. Nair, P. Vineetha; Nair, J. Rajashekaran, and Mercy, T. V. Anna (Department of Fishery Biology, College of Fisheries, Panangad, Cochin - 682 651, (India)). **The individual and combined acute lethal toxicity of selected biocides on** the juveniles **of rohu *(Labeo rohita)* under tropical conditions.** Indian Journal of Fisheries (2007) v. 54(3) p. 267-274.

In the natural ecosystems, fishes are exposed to more than one contaminant at a given time. The present study is an attempt to understand the individual and combined acute lethal toxicity of the common biocides - malathion, methyl parathion, endosulfan and 2, 4-D on early juveniles of rohu under laboratory conditions. The 48 h LC50 values of the biocides were: malathion - 7.89 mgl^{-1} (7.28-8.61); methyl parathion - 7.34 $mg1^{-1}$ (7.25-7.43); endosulfan - 0.0036 $mg1^{-1}$ (0.0025-0.0047) and 2, 4-D - 962.43 $mg1^{-1}$ (954.02-970.81). The average "additive index" value and the average "magnification factor" for the different biocide pairs were: malathion -2, 4-D (0.218 and X 1.22); endosulfan -2, 4-D (-0.073 and X 0.93); malathion - methyl parathion (0.24 and X 1.24) and malathion-endosulfan (1.648 and X 2.65). It was found that 2, 4-D (chlorophenoxy herbicide) is "moderately toxic", malathion and methyl parathion (organophosphate insecticides) are "toxic" and endosulfan (organochlorine insecticide) is "very toxic" to rohu juveniles under static (with renewal) 48 h LC50 bioassay. The combined toxicity tests indicated the "strictly additive" nature of the insecticide-weedicide combinations and the "more than additive" nature of the insecticide-insecticide combinations. The simultaneous or even asynchronous application of these chemicals in the paddy fields and plantations thus greatly increase their potential to be toxic in freshwater and coastal ecosystems of the tropics.

39. Nath, D.; Ray, D. C. (Department of Ecology & Environmental Science, Assam University Silchar – 788 011, Assam (India)). **Evaluation of Plankton Diversity with their Interrelationship in four river bodies of Mizoram, NE India.** Environment & Ecology (India) v. 25S(4A) p. 1368-1371.

The evaluation of plankton diversity and their interrelationship was carried out during July 2004 to December 2004 under four river bodies of Mizoram. A diverse assemblage was recorded with a total of 413 identifiable taxa being recorded consisting of four phytoplankton and three zooplankton groups. All the river bodies mainly dominated by phytoplankton among which river Tlawang showed highest percentage of occurrence (31.96). Among zooplankton, river Karnaphuli was recorded to show the highest percentage occurrence (6.29) whereas lowest in river Tuirial (1.45). Population density and Simpson's diversity index were found to be maximum (2.20 and 0.51) in river Tlawang and minimum (1.11 and 0.05*)* in river Karnaphuli. Species richness was recorded more in river Karnaphuli (18.0) whereas minimum in Tuirial and Mat (13.0). Evenness was more (1.11) in river Karnaphuli and least in river Tlawang (0.12). Dominance index was found to be highest (0.16) in both the rivers viz. Tuirial and Tlawang and lowest (0.12) in Karnaphuli. Sorensen co-efficient of similarity was less to minimum (range 0.20 to 0.37) whereas dissimi arity was moderate to high (range 0.63 to 80) in all the rivers.

40. Pathani, S. S.; Joshi, Promod. (Department of Zoology, Kumaun University, S. S. J. Campus, Almora - 263 601, (India)). **Ichthyo-fauna and fishery in the Nanak Sagar reservoir of Uttrakhand State, India.** Aquacult (India) v. 8 (2) p. 191-197.

A total thirty nine (39) species of fish belonging to fourteen families were identified during 2003 to 2004 in the Nanak Sager reservoir of Udham Singh Nagar district of Uttrakhand state (India) in the present study. The fish species such as *Labeo calbasu, L. gonius, Puntius ticto, Cirrhinus reba, Mystus aor, M. seenghala, Wallago attu, Mastacembelus spp.* and *Gudusia chapra* were quantitatively the main components of the fishery in the reservoir. The total fish catch was recorded as 218.155 and 251.476 tones during 2003 and 2004, respectively in the reservoir. The fish catch is distributed into four categories viz. major carps, minor carps, cat and weed fishes in the study. In the first year total catch of major carps has ranged from 0.304 to 11.41 tones, the minor carps ranged from 0.125 to 4.052 tones, the catfish ranged from 1.130 to 10.490 tones and the weed fish ranged from 4.120 to 35.621 tones in the reservoir. In second year the major carps landing has ranged from 0.512 to 4.685 tones the minor carps from 0.061 to 4.449 tones, the catfish from 1.320 to 12.021 tones and the weed fishes 1.092 to 48.640 tones in Nanak Sagar reservoir. The percentage of different fish group mentioned above fluctuated monthly, seasonally and yearly in the water. Annual total fish landing ranged from 46.25 to 89.44 kg /hectare in the reservoir for last six years (2001 - 2006). The fishing in Nanak Sagar reservoir is carried out from November to July by using various gears/nets namely triangular net, drag net cast net and gill nets of different mesh size.

41. Paul, Abhijit; Das, S. K. (College of Fisheries, CAU, Lembucherra, Agartala-799 210, Tripura (West), India); Das, B. K. (Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Chakgaria, Kolkata - 700 094, (India)). **Interrelationship between primary productivity and environmental nutrients** of two **water bodies in Kalyani, West Bengal.** Indian Journal of Fisheries (2007) v. 54(3) p. 259-265.

A year long study (2002-2003) was conducted in the Kalyani fish farm (P_1) - a scientifically managed fish farm and Kalyani lake (P_2) - a weed infested natural water body, in the heart of Kalyani city, West Bengal, to draw an interrelationship between

the primary productivity and nutrients in water as well as soil at different temperature regimes. The study recorded high primary productivity in P_1 corresponding with the high nutrients in water (NO_3-N and PO_4-P) and soil (available nitrogen and available phosphorus). A moderate range of primary productivity was recorded in P_2 in accordance with the moderate ranges of nutrients in water and soil. No significant variation in temperature was recorded between the two water bodies. A strong influence of temperature was observed both on the primary productivity and availability of nutrients. A significant correlation ($P<0.05$) was recorded between the net primary productivity (NPP) and the available nitrogen and phosphorus of soil. However, no significant correlation ($P>0.05$) was observed between the NPP and the exchangeable potassium of soil in both the water bodies.

42. Ponnusamy, K. (Central Institute of Brackishwater Aquaculture, Chennai-600 028, Tamil Nadu, India); Gupta, Jancy (National Dairy Research Institute, Karnal-132 001, Haryana, (India)). **Fisheries based farming system for sustainable livelihood of coastal farmers.** Indian Journal of Fisheries (2007) v. 54(3) p. 327-331.

Fisheries is an important component in the coastal farming systems along with crop, dairy and poultry. In the present study, twelve farming systems in which fisheries is a component were studied by employing seven indicators of sustainable livelihood namely environmental conservation, permanent asset creation, food security, nutritional security, input recycling, employment generation and annual income in Tiruvallur and Thanjavur districts of Tamil Nadu. The results revealed that all the seven identified indicators were found to be higher in the fisheries based farming system. The farmers need to be educated and motivated to adopt fisheries as a component in farming system for attaining the much needed food and nutritional security as well as overall sustainability of the coastal farming systems. Institutional support coupled with development of rural infrastructure is suggested as strategies to promote this combination for the sustainability of agricultural systems in the coastal region.

43. Prabu, Ashok V.; Rajkumar, M. (Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai - 608 502 Tamil Nadu, (India)). **Biochemical Composition of Cultured Copepod, *Acartia spinicauda,* Giesbrecht.** Aquacult (India) v. 8(2) p. 219-224.

Nutritional quality of live feeds used in aquaculture is an important factor for survival and optimal growth of larvae of finfishes and shellfishes. Live feed is also essential for the growth of larval forms in hatcheries. Copepods are considered to be a valuable source of protein and an alternative ingredient to the more expensive *Artemia salina.* The adult organisms were harvested in the exponential phase of the culture cycle and dried for further biochemical analysis. Proximate composition and amino acid profiles were carried out using the standard methodologies. Higher protein (72.37%) and lipid (15.18%) content were observed in cultured *A. spinicauda.* Out of 10 amino acids observed Asparagine is the predominate one.

44. Pradhan, P. K. (College of Fisheries, Central Agricultural University, Lembucherra, Tripura – 799 210, India); Mohan, C. V. (Network of Aquaculture Centers in Asia-Pacific (NACA), P. O. Box 1040, Kasetsart Post Office, Bangkok, 10903, Thailand.); Shankar K. M. (Fish Pathology and Biotechnology Laboratory, Department of Aquaculture, College of Fisheries, Karnataka Veterinary, Animal and Fisheries Science

University Mangalore - 575 002, India); Kumar, B. Mohana (Gyeongsang National University, Republic of Korea, 660 701, Korea). **Sequential inflammatory response of fingerlings of Indian major carps to *Aphanomyces invadans.*** Indian Journal of Fisheries (2007) v. 54(4) p. 389-396.

The present paper describes the sequential inflammatory response of fingerlings of Indian major carps (IMC) to experimental infection of the fungal pathogen, *Aphanomyces invadans.* In all the three species of IMC, at one day of post injection (dpi), few fungal hyphae penetrating the muscle fibres were observed in the lesion area but no inflammatory response was found at the site. At 2 dpi, numbers of hyphae in the lesion increased and there was extensive infiltration of inflammatory cells. At 4 dpi, the mycotic lesion spread in the musculature at the site of injection and the lesion further extended even to the non-injected lateral side of the body. The fungal hyphae at the central part of the lesion were encapsulated by macrophages and/or epithelioid cells forming granulomata. At 6 dpi, both injected and non-injected sides and most of the internal organs revealed extensive mycotic lesions. There was extensive myonecrosis in large areas of myotome.

45. Pradhan, Prasenjit; Giri, Sunirmal; Chakraborty, Susanta Kumar. (Department of Zoology, Vidyasagar University, Midnapore - 721 102, West Bengal. (India)). **Zooplanktonic rotifers in river Kansai, West Bengal.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 43-47.

The species composition and abundance of rotiferan zooplankton of river Kansai was investigated between July 2001 to June 2003. Twenty six species belonging to seven families under the phylum rotifera were recorded from different sites of river Kansai in its 100 km stretch. Maximum number of species (11) belonged to the family brachionidae followed by Lecanidae (9), Filinidae (2), Asplanchnidae (1), Euchlanidae (1), Synchaetidae (1) and Testudinellidae (1).

46. Puvaneswari, S.; Karuppasamy, R. (Department of Zoology, Annamalai University, Annamalai Nagar - 608 002, Tamil Nadu, (India)). **Acute toxicity bioassays of cadmium chloride on Indian catfish, *Heteropneustes jossilis.*** Aquacult (India) v. 8(2) p. 155-163.

An attempt was made to assess the acute toxicity of cadmium on dIe mortality and behavioural responses of a freshwater Indian catfish *H. fossilis.* The static and renewable bioassay method was adopted to determine the lethal concentration (LC_{50}) through probit analysis. The LC_{50} values of 24hr, 48hr, 12hr and 96hr for Cd exposed fish were 141.90, 138.35, 134.12 and 131.82 mgCd L^{-1}. The results indicate that dose and dose-time dependant increases in the mortality response of test fish. Behavioural abnormalities such as erratic swimming, fast opercular beat, jerk and violent reaction, secretion of mucus on the body and loss of equilibrium were observed in fish during the toxicity test. The prominent feature of death was respiratory distress, paralysis and loss of equilibrium.

47. Ramana, T. Y.; Madhavan, N.; Ramalingaiah, D; Sudheer, K. V.; Veeranjaneyulu, K.; Ravindranath, K. (Department of Fishery Biology. College of Fishery Science. SVVU Muthukur 524 344. Andhra Pradesh. (India)). **Comparative Performance between Rohu and Jayanti Rohu.** Environment & Ecology (India) v. 25S (4A) p.1293-1296.

In this experiment comparative performance of Jayanti rohu over rohu was studied in agro-c1imatic zone of Nellore for one-year period. Temperature distribution showed a bimodal oscillation. Temperature and dissolved oxygen were inversely related. Plankton production showed a positive relation with fish growth. Monthly average growth trend revealed that Jayanti rohu achieved 78% higher growth over rohu under similar pond conditions. However survival was high in rohu (98%) and which is only 50% in Jayanti rohu. Feed conversion ratios recorded were 1.5 : 1 and 3 : 1 with respect to Jayanti rohu and rohu. Disease incidence was comparatively high in rohu. Data is also treated statistically.

48. Rani, Rekha; Gautam, R. K. (Department of Zoology, Faculty of Life Sciences, Khandari Campus, Dr. B.R. Ambedkar University, Agra - 282 002. (India)). **Effect of Nuvan on kidney lipids of fresh water fish L*abeo rohita.*** Journal of Nature Conservation (India) (2007) v. 19(2) p. 259-263.

Fish *Labeo rohita* were exposed to sublethal dose of Nuvan which was .0215 ml/L. Total lipids of kidney was studied after a period of 24, 48, 72 and 96 hours contents showed significant decline.

49. Saha, Suman; Bhaumik, Utpal (Central Inland Fisheries Research Institute, Barrackpore - 700 120, West Bengal); Das, P. (A8/4, Indrolok Estate, P.O. Paikpara, Kolkata-700 002. (India)). **Changing perspectives of carp and catfish availability in the open water systems of North 24 Parganas, West Bengal.** Journal of Inland Fisheries Society of India (2007) v. 39(2) p. 53-58.

Availability of fishes under the orders *Cypriniformes* and *Siluriformes* in the district of 24-parganas, West Bengal was examined. The study revealed that 45 species were available in the district comprising 8 families and 27 genera. The population of all the fishes declined in natural ecosystems of the district while comparing the same with the base line data for the year 1960. Amongst available fishes 7 species were critically endangered, 11 were endangered, 7 were vulnerable, 6 were near vulnerable and 2 were of lower risk. Causative factors for declining availability as perceived by the clientele were: natural habitat degradation, wanton destruction of seed and juveniles, pollution and over exploitation. Effective extension services are warranted for protecting the ichthyo-diversity of the district advocating responsible fishery.

50. Sahoo, S. K.; Giri**,** S. S.; Sara, A.; Chandra, S.; Sahu, A. K.; Sarangi, N. (Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar - 751 002, Orissa, (India)). **Embryonic development of the spiny eel, *Mastacembelus aculeatus* (Bloch, 1786).** Indian Journal of Fisheries (2007) v. 54(3) p. 333-337.

Induced spawning of the freshwater spiny eel, *Mastacembelus aculeatus* was undertaken to obtain fertilized eggs for studying the embryonic development. The fertilized eggs were sticky, demersal and green in colour. The perivitelline space of fertilized eggs was unequal. Several oil globules were visible on the yolk and sizes varied from 0.1-0.57 mm in diameter. First cleavage appeared at 50 min, producing two equal blastomeres. The size of blastomeres gets reduced as development proceeds. The fertilized egg took 4 h 10 min to reach morula stage. The hatching of egg started at 31 h 30 min and all the eggs hatched within 37-38 h at 28-29°C. The newly hatched yolksac

larvae were 4-5 mm in length.

51. Sahu, J. P.; Devi, G.; Kund, G. C.; Nanda, Saumyendra (P. G. Department of Aquaculture, College of Fisheries (OUAT), Rangeilunda, Berhampur-7 (India)). **Influence of dietary aquamos on growth and survival of Goldfish and Swordtail fry.** Aquacult (India) v. 8 (2), 171-178.

An attempt has been made to elucidate the effect of Aqua-Mos on growth performance and survival of two ornamental fish species viz., Gold fish and Swordtail at different levels of incorporation (2.5, 5.0 and 7.5%) through feed over an experimental period of 75 days. The basal feed was formulated by utilising the locally available ingredients viz., rice bran, soyabean oilcake, fish meal, com flour, vitamin and mineral premix at appropriate levels by employing least square method to arrive at a crude protein level of 35% in the diet. The treatment T_2 with 5.0% incorporation of Aqua-Mos in the basal diet exhibited the best growth in Goldfish and Swordtail fry followed by T_1 and T_3 containing 2.5 and 7.5% of Aqua-Mos respectively. Higher specific growth rate, higher food conversion efficiency and protein efficiency ratio of the test animals indicates that there was better utilisation of nutrients and protein for growth and metabolism under the treatments T_2 in comparison to others. The overall survival percentage of test animals ranges from 86.0 to 100%. The statistical analysis of the data reveals that the significant effect of Aqua-Mos incorporated diet at 5.0% level to basal feed on growth and survival of Goldfish and Swordtail fry.

52. Sahu, Prajyoti; Sethy, P. G. S.; Siddiqi, S. Z. (Zoological Survey of India, Estuarine Biological Station, Hill Top of main Road, Gopalpur-on-Sea-760 002, Barhampur, Ganjam, Orissa. (India.)). **Distribution and abundance of benthic macrofauna in Nalaban Island, Chilika, Orissa.** Indian Journal of Fisheries (2007) v. 54(3) p. 251-258.

The present study deals with the distribution and abundance of macrobenthic community in Nalaban Island, Chilika Lagoon. Five macro-invertebrate groups *viz.*, gastropods, pelecypods, isopods, amphipods and polychaetes were recorded. Gastropods (75.7%) comprised the most abundant group of macrobenthos followed by pelecypods (16.9%), isopods (4.9%), polychaetes (0.35%) and amphipods (0.07%). The species diversity index showed a wide range of higher $\bar{H}$ values indicating a stable benthic community with absence of environmental stress. Further, the community structure did not show any significant spatial variation in species composition. Interestingly, significant correlation was noticed between gastropods and isopods. Further, the statistical analysis confirmed that there exists significant variation within the molluscan species rather than variation within stations.

53. Saroha, R. P.; Garg, S. K. (Department of Zoology and Aquaculture, Laboratory of Aquaculture Management, CCS Haryana Agricultural University, Hisar - 125 004, (India)). **Growth performance of *Cirrhinus mrigala* (Ham.) fingerlings maintained on mixed feeding schedule of diets having different protein content.** Indian Journal of Fisheries (2007) v. 54(4) p. 371-378.

Seven different mixed feeding schedules were evaluated in *Cirrhinus mrigala* fingerlings having mean body weight (BW) of 2.84 g employing a low (L) protein

(20.29%) diet and a high (H) protein (40.12%) diet, feeding @ 3% Bwd^{-1} for 45 days. Regular feeding for 45 days on low protein (L) diet resulted in significantly ($P<0.05$) low growth and low protein efficiency ratio (PER), while feeding on 1L/3H feeding schedule resulted in good growth performance equivalent to the fish fed continuously on high protein diet. Gross protein retention (GPR), Gross energy retention (GER), Apparent nutrient digestibility (APD) and Feed conversion ratio (FCR) were similar in fingerlings fed either continuously on high protein diet or on a feeding schedule consisting of 1L/3H, while, PER values were significantly ($P<0.05$) high in fingerlings fed on 1L/3H diet in comparison with fish fed continuously on high protein diet. Based on total protein input, 12.36% protein can be saved without affecting growth by adopting the IL/3H feeding schedule as compared to feeding the fish daily on high protein diet.

54. Selvaraj, J. John; Biradar, R. S. (Central Institute of Fisheries Education (CIFE), Mumbai - 400 061, India); Somavanshi, V S. (Fishery Survey of India (FSI), Mumbai - 400 001, (India.)). **Spatial and temporal patterns of demersal fish distribution in the northwest coast of India: a study using Geographic Information System (GIS).** Indian Journal of Fisheries (2007) v. 54(3) p. 243-249.

This study illustrates a Geographic Information System (GIS) developed to analyze and visualize spatio-temporal patterns of demersal fish distribution in the northwest coast of India, extending between 17°45' and 23°00' N. Main functions of this GIS are catch and effort estimation and visualisation of their spatio-temporal variation. Catch per unit effort (CPUE) of threadfin breams *(Nemipterus* spp.), carangids *(Decapterus* spp.), lizardfish *(Saurida* spp.), catfish *(Tachysurus* spp.) and dhoma *(Johnius* spp. and *Otolithes* spp.) were mapped seasonally by pooling data from the year 1997 to 2000. Maps displaying CPUE distribution were produced for three seasons; pre-monsoon, monsoon and post-monsoon. Spatial maps indicated occurrence of these five species predominantly in deeper waters of the Gujarat coast. GIS is found to be useful in visualizing spatial and temporal distribution and abundance pattern of these key species.

55. Sharma, Parvati; Gahlawat, S. K. (2007). (Department of Zoology and Aquaculture, CCS Haryana Agricultural University Hisar - 125 004, India); Sihag, R. C.; Chauhan, Mamta (National Research Centre on Equines, Hisar (India)). **Induction of Mx gene expression in the Indian major carp, rohu *(Labeo rohita,* Linnaeus).** Indian Journal of Fisheries (2007) v. 54(3) p. 321-326.

Mx genes are inducible by type I interferon and involved in antiviral defenses in vertebrates. In the present investigation, the protocol for obtaining Mx gene expression was standardized by Poly I:C injection in *Labeo rohita.* A 786 bp cDNA was obtained on day 3 after poly I:C injection. PCR amplification of this cDNA using Mx specific primers also yielded 786 bp product. However, PBS injected fishes did not show any Mx expression.

56. Singh, N. Samarjit; Ch. Basudha. (Institute of Bioresources and Sustainable Development Takyelpat, Imphal - 795 001, Martipur (India)). **Induced spawning of *Osteobrama belangeri* (Val.), a critically endangered fish in India using carp pituitary and Ovaprim.** Aquacult (India) 8(2) p. 231-236.

An attempt was made to induce spawning of *Osteobrama belangeri* (Val.), a riverine spawner in nature. Carp pituitary gland extract and Ovaprim were used to induce spawning in the fishes in rectangular fibre-glass tanks. The experiments were conducted twice during the periods from June to August in the years 2005 and 2006. *O. belangeri* could breed successfully with both the pituitary extract and Ovaprim when the water temperature ranged from 24 to 26°C. A female of 350g could produce 80,000 eggs approximately in each spawning. Fertilization rate ranged 35.2-98.2% eggs. Hatching rate observed in different spawning ranged from 63% to 80.8%. Newly hatched larvae measured 4.5 mm long and 1.5 mg in weight. The yolk sac was fully absorbed on 4^{th} day of hatching. Statistical analysis was worked out to determine the relation between the hormone used and different breeding parameters like fertilization and hatching rate.

57. Subathra, S.; Karuppasamy, R.; Sivakumar, S. (Department of Zoology, Annamalai University, Annamalainagar 608 002, Tamil Nadu, (India)). **Acute toxicity bioassay of copper on juveniles and adults of the freshwater catfish, *Mystus vittatus* (Bloch.).** Indian Journal of Fisheries (2007) v. 54(4) p. 403-408.

An attempt was made to assess the acute toxicity of copper against juveniles and adults of the freshwater fish, *Mystus vittatus.* The static, renewable bioassay method was adopted to determine the lethal concentration (LC_{50}) through probit analysis. The values of 24, 48, 72 and 96 h LC_{50} for juveniles were 38.90, 28.84, 25.11 and 18.62 mg/l respectively and those of adult fish were 89.13, 69.18, 56.23 and 47.86 mg/l respectively. The LC_{50} values indicated that adult fish was more tolerant to copper than the juveniles. The pH level was slightly decreased with increasing concentration of copper solution. Changes in fish behaviour such as fast opercular beat, jerky movement, excessive secretion of mucus on body surface and loss of balance were observed in the experimental groups during the toxicity test.

58. Sukumaran, P. K. (Reservoir Fisheries Division, Central Inland Fisheries Research Institute Hesserghaua Lake Post, Bangalore 560 089, (India)). **Impact of thermal effluent on aquatic system with reference to biotic communities.** Environment & Ecology (India) v. 255 (3) p. 530-536.

Kayamkulam lake situated in the West Coast of India receiving some amount of thermal pollution was selected for the study between 2000 and 2002. The lake receives abstracted water from the thermal plant, which causes possible effects on the biology of receiving water. Thermal pollution was assessed on the basis of plankton diversity index. The lake has shown sign of pollution.

59. Sukumaran, Sandhya; Kasinathan, C. (Mandapam Regional Centre of Central Marine Fisheries Research Institute, Marine Fisheries PO., Mandapam Camp - 623 520, Tamil Nadu, India); George, Rani Mary. (Vizhinjam Research Centre of Central Marine Fisheries Research Institute, Vizhinjam - 695 521, Kerala, (India)). **Biodiversity and community structure of coral reefs around Krusadai Island, Gulf of Mannar, India.** Indian Journal of Fisheries (2007) v. 54(3) p. 275-282.

This paper gives the results of the surveys conducted in the Krusadai Reef for the assessment of the coral cover and biodiversity during March-May 2005, following the Line Intercept Transect Method. A total of 35 hard coral species were recorded in this

reef. The total live, dead and bleached coral cover for the reef as a whole was estimated as 54.9, 18.7 and 15.4% respectively and the remaining part was covered with soft corals, sponges, seagrasses, sand and rubble. Dead coral cover was dominated by porites. Further, relative abundance values were derived for each species and they were assigned the status dominant/ abundanti common/ uncommon/ rare. Although, no species was assigned "dominant" status, *Acropora formosa* belonged to the category "abundant" and all other species were either of "common" or "uncommon" status only. Fisher α and Shannon diversity indices were highest (3.68 and 2.14 respectively) in 8th site. Pielou's evenness was highest in 7th site. SIMPER analysis revealed that *Acropora formosa* (33.95%) along with *Acropora humilis* (15.85%), *Porites mannarensis* (12.97%) and *Montipora digitata* (12.07%) were responsible for dissimilarity among various sites in the island. The average similarity in species composition was 20.5%.

60. Sulochana; Gaur, S. R.; Chari, M. S. (Department of Fisheries, Indira Gandhi Agricultural University Raipur. Chhattisgarh 492 006. (India)). **Comparative efficiency of organic manures as producers of fish food organisms (Plankton).** Environment & Ecology (India) v. 25(3) p. 481-483.

Organic fish farming is a method of sustainable aquaculture based on long term ecologically and environmentally sound practice. Its general principle is based on protecting the environment by decreasing pollution and optimizing biological diversity and productivity. A experiment was conducted for hundred days in earthen ponds were treated with three manures i.e. cowdung, vermicompost and poultry manure. Qualitative and quantitative estimation of plankton showed maximum density in ponds treated with poultry manure and vermicompost. Average daily weight gain and specific growth of *Labeo rohita* fry was found to be maximum in ponds treated with poultry manure followed by vermicompost.

61. Tamang, Lakpa; Chaudhry, Shivaji (GB. Pant Institute of Himalayan Environment and Development, North East Unit, Vivek Vihar, Arunachal Pradesh 791 113, India); Choudhury, Dhrupad. (International Center for Integrated Mountain Development, G.PO. Box 3226, Kathmandu, Nepal). **Icthyofaunal contribution to the state and comparison of habitat contiguity on taxonomic diversity in Senkhi stream, Arunachal Pradesh, India.** Journal of the Bombay Natural History Society (India) (2007) v. 104 (2) p.170-177.

The Eastern Himalayan region has been identified as one of the 18 mega-biodiversity 'hotspot' areas of the world (Myers *et al.* 2000). Arunachal Pradesh constitutes 60.93% of the Eastern Himalayan region. Some documentation exists on the flora, but documentations on faunal aspects are still scanty, with scattered reports, mostly on birds and some large mammals. Although contributions to the fish fauna of the State have also been made, accounts of species compositions of many water bodies still remain undocumented awaiting explorations and studies of such aquatic systems. Descriptions of most faunal works have been added with special emphasis on fishes. The preliminary findings suggest 7 first reports for the district and 3 first reports for the State. Senkhi stream contributed 31.37% of the icthyofaunal families of the district and 29.52% of genera while the species representation was found to be 27.32%. The correlation matrix reveals an interesting fact that Dikrong and Pachin have more common species than Senkhi, which is a hill stream. The striking feature is the even distribution of species under family Badidae, Psilorhynchidae and Olyridae though

their contribution of each lotic (Senkhi, Pachin and Dikrong) water body is merely a single species and hence these species will be most vulnerable once a mega dam comes in-between, restricting the migration of already threatened population.

62. Vartak, V. R.; Bhatkar, V. R.; Bondreand, R. D.; Belsare, S. G. (Marine Biological Research Station, Peth Killa, Ratnagiri, Maharashtra - 415 612, (India)). **Effect of water hardness on growth and survival of fry of angelfish, *Pterophyllum sealare* (Lichtenstein, 1823).** Indian Journal of Fisheries (2007) v. 54(4) p. 397-402.

An experiment was conducted to study the effect of different levels of water hardness on survival and growth of two size groups (group A: 2.00 ± 0.20 cm and group B: 2.50 ± 0.20 cm) of fry of angelfish *(Pterophyllum scalare).* The gain in length was 1.9 ± 0.02 cm and 3.20 ± 0.04 cm in group A and B respectively in 100 mgl^{-1} $CaCO_3$ hardness, which was superior among all the treatments. Survival was 100% in all treatments, but specific growth rate differed significantly within both the groups. The specific growth rate was 1.87 ± 0,07 and 2.81 ± 0.33 in group A and B, respectively in 100 mgl^{-1} $CaCO_3$ hardness, which was significantly ($P<0.05$) higher than in other treatments. Growth rates at 50 and 100 mgl^{-1} $CaCO_3$ hardness levels were not significantly different ($P>0.05$) in both the size groups. Among treatments, the best growth results were obtained at 100 mgl^{-1} $CaCO_3$ hardness. Growth was significantly suppressed at 200 and 300 mgl^{-1} $CaCO_3$ hardness in both the size groups. The results indicated that 100 mgl^{-1} $CaCO_3$ is the optimum level for growth and survival of angelfish fry.

63. Ziauddin, Golam (District Fishery Officer, Dept of Fisheries, West Bengal Meen Bhavan Suri, Birbhum, West Bengal); Dutta, Chandraval; Goswami, Arunima. (Senior Research Fellows, Central Inland Fisheries Research Institute, Barrackpore - 700 120. (India)). **Ornamental fish trade and marketing in India.** Fishing Chimes (Dec. 2007) v. 27(9) p. 44-46.

India is gearing up for an 8-9% GDP growth in the economy, banking heavily on growth in agricultural production. In this endeavour, the contribution of fish output is also taken into account. The expected contribution from fisheries takes into account the upsurge in farmed fish production in the last and the present decade. In the Indian aqua products exports, the latest encouraging addition is the development of the lucrative trend in the export of ornamental fishes to cater to the expanding world-wide market.

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