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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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*(The only abstracting service on Indian Fisheries)*

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**CENTRAL INLAND FISHERIES RESEARCH INSTITUTE**

*(Indian Council of Agricultural Research)*

**Barrackpore, Kolkata – 700 120 West Bengal**

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## ENTRIES

1. Ankathi, Madhusudhan Rao; Piska, Ravi Shankar (University College of Science, Osmania University, Hyderabad – 500 007 (India). Department of Zoology). **Studies on zooplankton diversity in a Tilapia-dominated perennial tank, Julur, Nalgonda District.** Aquacult (India). (2009) v. 10(1) p.11-16.

The present paper deals with the zooplankton diversity in a Tilapia-dominated perennial tank situated at, Julur, Nalgoda District, Andhra Pradesh during 3 years from 2005-06 to 2007-08. The water spread area of the tank is 14.06 ha, is in eutrophic stage and dominated by Tilapia, *Oreochromis mossambicus* (61.04%). The zooplankton was represented by rotifera, cladocera, copepoda and ostracoda, out of which rotifera was dominated. The zooplankton was represented by 26 genera in the tank, out of which 8 genera of rotifera, 5 genera of copepoda, 12 genera of cladocera and one genus of ostracoda were found. The rotifer, *Brachionus* was dominated among zooplankton in the tank. Rotifers dominated with 74.21%, followed by copepoda (17.27%), cladocera (4.90%) and ostracoda (3.63%) during the study period.

2. Anon. **National consultation on strengthening sea farming and marine biodiversity research in CMFRI.** Fishing Chimes (India). (2009) v. 29(2) p. 47-50.

The research work in India on sea farming and marine Bio-diversity is now at an early stage. This is more so in respect of sea farming. At the captioned consultation held at Mandapam Research Centre of CMFRI, the subject was discussed by the experts who participated in it and in that light they made a set of recommendations of which one is the need to train the concerned scientists in national and international research organizations in sea farming and marine biodiversity and to upgrade the Mandapam Centre of CMFRI as Centre of Excellence in the disciplines.

3. Athithan, S.; Ramanathan, N.; Ramadhas, V. (Fisheries College and Research Institute. Thoothukudi – 628 008 Tamil Nadu (India)). **Chemical speciation of sedimentary nitrogen and phosphorous in integrated fish/pig farming system.** Indian Journal of Fisheries. (2009) v. 56(2) p. 107-114.

Experiments were carried out to investigate the temporal variations of different chemical species of sedimentary nitrogen and phosphorus in fish/pig integrated farming system particularly in a hard water seasonal pond. In sediments, exchangeable ammonia contributed to an average of 14.87 and 16.10% of total exchangeable inorganic nitrogen in treatment and control pond respectively. Highest percentage contribution of exchangeable nitrate (average contribution above 77.05%) to total exchangeable inorganic nitrogen could be recorded in these ponds. Availability of exchangeable nitrate in the sediments of these ponds confirmed the total absence of denitrification. The percentage contribution of different speciation of phosphorus such as an exchangeable phosphorus (E-P), apatite phosphorus (A-P), phosphorus bound to organic matter (O-P) and phosphorus bound to oxides of iron and manganese (O-Fe-Mn-P) to total

sedimentary phosphorus (TSP) observed in the present study ranged between 23.40 and 30.56%, 14.55 and 21.97%, 3.55 and 12.96% and 3.55 and 6.3% respectively.

4. Athithan, S.; Sanjeeviraj, G. (Krishi Vigyan Kendra, Veterinary College and Research Institute Campus. Tamil Nadu Veterinary and Animal Sciences University, Namakkal-637002, Tamil Nadu (India)). **Growth performance of carps in a hard water seasonal pond.** Indian Journal of Fisheries. (2009) v. 56(1) p. 69-71.

Experiments were carried out to assess the growth performance of carps under extensive composite culture in a hardwater seasonal pond, where water hardness ranged from 150 to 758 mg l<sup>-1</sup>. Carp seed (catla – *Catla catla*; rohu – *Labeo rohita*; mrigal – *Cirrhinus mrigala*; silver carp – *Hypophthalmichthys molitrix*; common carp – *Cyprinus carpio* and grass carp – *Ctenopharyngodon idella*) were stocked at the rate of 1537 no./ha. During the study period, the carp production recorded was 1846.14 kg/2.7 ha/300 days. The performance of carps on the basis of growth and survival under hardwater condition was encouraging.

5. Athithan, S.; Ramanathan, N.; Ramadhas, V. (Fisheries College and Research Institute. Thoothukudi – 628 008 (India)). **Biotransformation of nutritive elements in integrated fish/pig farming system.** Aquacult (India). (2009) v. 10(1) p. 105-111.

Experiments were carried out to investigate the bio-transformation efficiency of carbon, nitrogen and phosphorus into fish production in fish/pig integrated system particularly in hard water seasonal ponds. With respect to biotransformation efficiency (%) of three nutritive elements from organic manure and feed, the carbon (70.67%) and phosphorus (62.86%) contributed the highest percentage of biotransformation in control pond. However, nitrogen (28.95%) was observed to be more effectively bio-transformed in treatment pond.

6. Ayyappan, S.; Kalaimani, N.; Ponniah, A. G. (Indian Council of Agricultural Research, New Delhi, Central Institute of Brackishwater Aquaculture, Chennai (India)). **Disease status in Indian shrimp aquaculture and research efforts for better health management.** Fishing Chimes (India). (2009) v. 29(1) p. 13-21.

The present study revealed regarding losses in the shrimp aqua culture due to different diseases under the AP Cess funded project of ICAR conducted by CIBA. In this context the authors discussed about different diseases viz., WSSV, LSS etc. The authors also discussed about the role of DNA based technology and the pathogen detection, effort in improving diagnostic capacity in private sector. They also indicated about genome analysis, therapeutics etc. and highlighted nanotechnology and future thrust areas.

7. Bajpai, Sandeep; Tewari, Seema; Tripathi, Madhu (Aquatic Toxicology Research Laboratory, University of Lucknow, Lucknow – 226 007 U.P. (India). Department of Zoology). **Evaluation of acute toxicity and behavioural responses of *Heteropneustes fossilis* (Bloch) to sodium fluoride.** Aquacult (India). (2009) v. 10(1) p. 37-43.

In the present study, an attempt was made to assess the acute toxicity of fluoride and behavioural response of fresh water Indian catfish, *Heteropneustes fossilis*. The LC<sub>50</sub> values of 24, 48, 72 and 96 hours for fluoride exposed fish were 406.64, 402.45, 393.96 and 386.56 mgF/L. Dose and duration dependent increase in the mortality of ten fish was

recorded from lower to higher concentrations. Behavioural abnormalities such as fast opercular beating, loss of schooling, loss of balance, erratic swimming and secretion of copious amount of mucus on the body was observed in fish during the toxicity tests. The prominent feature of death was stretching of muscles and loss of equilibrium.

8. Bandyopadhyay, M. K.; Biswas, D. K.; Saha, Shuvra (Central Inland Fisheries Research Institute, Barrackpore, Kolkata –700120, West Bengal (India)). **Influence of dissolved inorganic calcium content on zooplankton production in some oxbow lakes of West Bengal**. Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 30-33.

The concentration of dissolved inorganic calcium ( $\text{Ca}^{2+}$ ) plays an important role in the aquatic productivity both at inorganic and organic level. It acts as a nutrient and controls the structural and functional integrity of plankton in freshwater. Seasonal samples were collected on calcium concentration of water and zooplankton from eight oxbow lakes of southern and northern parts of West Bengal during the year 1996 and 1997. The findings of the study have indicated that 72% ( $r^2 = 0.7230$ ) of zooplankton production in the investigated lakes are directly dependent on the calcium concentration of water. From the present investigation, it can be easily stated that to maintain zooplankton concentration at a level of  $760 \pm 201.15 \text{ unit l}^{-1}$  in the oxbow lakes of West Bengal, the dissolved inorganic calcium should be  $23.6 \pm 7.09 \text{ mg l}^{-1}$  equivalent of  $\text{CaCO}_3$ . The obtained regression equation for zooplankton and dissolved inorganic calcium content relationship of this study can be used as a management tool, for zooplankton population maintenance in the oxbow lakes of West Bengal towards development of a zooplankton feeder fishery.

9. Bansal, Deepika; Mittal, R. K.; Chandel, C.P. Singh (University of Rajasthan, Jaipur – 302 004 Rajasthan (India). Department of Chemistry). **Recycling of waste coloured water of textile printing industry at Sanganer (Jaipur)**. Aquacult (India). (2009) v.10(1) p. 85-89.

In this article, some simple and economical methods for decolourising waste water of local textile printing industry for recycling, in order to save water have been described. Dyes, which had been studied, are – Methylene blue, Malachite green, Black-B & Direct fast Blue BS. For methylene blue, the absorbent is charcoal while for malachite green, Black-B & Direct fast blue BS, absorbent is ash. Colour could be removed to the extent of 98-99% in one single operation. The main aim of this work is to develop a cost effective process because huge amount of water is required to be decolourised for recycling.

10. Chakrabarti, R. (Research Centre of Central Institute of Fisheries Technology, Visakhapatnam – 530 003, Andhra Pradesh (India)). Varma, P. R. G. (Central Institute of Fisheries Technology, Matsyapuri, P.O., Kochi - 682029 Kerala (India)). **Residual potassium sorbate level effective to control fungi in dried salted fish at tropical ambient temperature**. Indian Journal of Fisheries. (2009) v. 56(2) p. 129-134.

The use of sorbic acid and sorbate are permitted in all countries for preservation of fish and fishery products as effective inhibitors of fungi. The dipping in 0.2% potassium sorbate solution for 2 h was found to be sufficient for silver pomfret, goat fish and rainbow sardine to maintain residual sorbate level close to the accepted permissible limit of 1000 ppm in muscle (moisture level of 23%). Jew fish and thread fin trevally required slightly longer dipping time to retain the same sorbate level because of thick skin. During storage at ambient temperature ( $28 \pm 5^\circ\text{C}$ ) with RH  $80 \pm 15\%$ , the sorbate level in dried

rainbow sardine and trevally decreased rapidly to below 200 ppm in 6 months and visible fungal colonies appeared on these samples during the same period. Dried fish samples of jew fish with lowest residual sorbate level i.e. 420 ppm, could retain sorbate ion above 200 ppm and was free from visible fungal growth for 6 months. Residual sorbate level of above 200 ppm in the muscle of dried fish samples was found necessary to inhibit/delay the fungal growth during storage.

**11.** Chatterjee, S. K.; Ghoshal, A; Ghosh, S (Life Science Laboratory, Institute of Science Education, University of Burdwan, Burdwan – 713 104 (India)). **Influence of Mahua oil cake on the hepatic lipid content histosomatic index and hydration level of tissues of *Channa punctatus* (Bloch.)**. Environment & Ecology (India). (2009) v. 27(1A) p. 304-306.

Healthy lata fish, *Channa punctatus* of same size were exposed to three sub-lethal doses of mahua oil cake for a period of 10 days. After 5 and 10 days of exposure hepatic lipid content, histosomatic index and moisture content of liver and gill were measured from the exposed and control fishes using standard methods. A dose and time dependent impact of MOC on HSI and methods. Moisture hydration level of liver and gill was noticed. Moisture content of liver and hepatic lipid value showed inverse relation.

**12.** Choudhary, M.; Jha, M. M. (M.L.S.M. College, Darbhanga – 846 004 (India). Department of Zoology). **Acute toxicity and behavioural responses of nickel sulphate to the fish *Heteropneustes fossilis***. Aquacult (India). (2009) v. 10(1) p. 143-145.

Release of heavy metals into atmosphere contaminate the aquatic system. Such contamination deteriorates the water quality and results into large scale fish mortality. Further more the toxic potential of a particular chemical reduces the fitness of a population. It was thus, felt necessary to have an accurate method for finding out toxic calculation of a given chemical to a given animal in a specific time. Acute toxicity test in form of LC<sub>50</sub> are the most widely practiced and accepted methods for the determination of such toxic levels. The toxicity of Nickel sulphate to *H. fossilis* was evaluated by (Table 2) and (Table 3). The LC<sub>50</sub> values obtained by former method were 425.3 mg/l, 382.9 mg/l, 351.1 mg/l and 333.6 mg/l for 24, 48, 72 and 96 hrs. respectively. Surfacing, rapid uppercular movements, convulsions, profuse mucus secretions and its deposition over the gills. Gyrate swimming movements by moribund fish and loss of equilibrium before death were the prominent behavioural changes noticed during present study.(Table 1).

**13.** Choudhary, Swapna (S.K.M. College, Begusarai, Bihar (India). Department of Zoology). **Ultrastructure and distribution of taste buds in *Heteropneustes fossilis* (Bloch)**. Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 21-24.

The distribution and morphological features of taste buds in *Heteropneustes fossilis* (Bloch.) were investigated with scanning electron microscopy. The taste buds were distributed on external lips, skin surface barbell, within the oral cavity, including anterior part of oesophagus. Taste buds located on the external skin and barbel and within the oral cavity differ in appearance. Taste buds were of protrudes type and few were of sunken type, microvilli projected through the central pore of each taste buds. The number of taste buds varied in different body parts of the fish.

14. Das, Partha; Sarma, Debjit (Directorate of Coldwater Fisheries Research, Bhimtal, Nainital, Uttarakhand (India)). Dhar, Puspita (Central Institute of Fisheries Education, Kolkata Center, Sector-V, Saltlake, Kolkata (India)). Chatterjee, T. K. (Zoological Survey of India, Digha, West Bengal (India)). **Species diversity of polychaete fauna of Digha-Talsari region of West Bengal, India.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 16-20.

Polychaetes are one of the important natural foods of many economically important fishes, containing high calorific value and rich in protein. In the present investigation, taxonomic account, distribution pattern and habitat ecology of 24 species of polychaetes belonging to 14 genera in 12 families are studied. The analysis of the data shows that the majority of these species are restricted to areas located at the lower reaches, attributed to increased flow of sewage and wastes pouring into the sea. Many polychaetes are being used in aquaculture and agriculture sectors as live feed and biopesticide, respectively. The study has identified prospect of capturing and further culturing this group.

15. Dineshbabu, A. P. (Mangalore Research Centre of Central Marine Fisheries Research Institute, Mangalore – 575001, Karnataka, (India)). Manissery, Joseph K. (College of Fisheries, Mangalore –575002, Karnataka (India). Department of Aquaculture). **Food and feeding of the ridgeback shrimp, *Solenocera choprai* Nataraj, along Karnataka coast.** Indian Journal of Fisheries. (2009) v. 56(1) p. 21-26.

Though *Solenocera choprai* is an important shrimp resource from Karnataka coast, information on food and feeding of the species is lacking. ‘Index of preponderance’ method was used to study the food and feeding habit of the species. The food contents found were decapod crustaceans, unidentifiable mass, ‘fish remains’, molluscan shells, polychaete worms, sand, foraminiferans and small crustaceans (other than decapods) in the decreasing order of abundance. In adults, annual index of preponderance for decapod crustaceans, detritus and ‘fish remains’ were 43.82, 19.27 and 11.17 respectively. In females, the major component of the food was decapod crustaceans with indices above 40. Annual feeding intensity of adult *S. Choprai* was 28.88% with the highest value of 54% observed in February and lowest value from June to December. The change in monthly feeding intensity of the species is found to be influenced by the disturbances in the sea bottom caused by upwelling. Feeding intensity was the highest in immature females (40.71%) followed by spent females.

16. Dutta, C. (Faculty of Fishery Sciences, 5, Budherhat Road, P.O .- Panchasayar, Kolkata –700094, West Bengal (India). Department of Fish Processing Technology). **Storage characteristics of fish balls from rohu, *Labeo rohita* at –20<sup>0</sup>C.** Indian Journal of Fisheries. (2009) v. 56(1) p. 39-42.

The storage characteristics of fish balls prepared from minced rohu meat at –20<sup>0</sup>C upon treatment with cryoprotectants such as sorbitol (4%), sucrose (4%) and sodium tripolyphosphate (0.3%) were studied. The levels of different parameters like salt soluble nitrogen (SSN) total volatile base nitrogen (TVBN) and free fatty acid during storage period were observed to be within the acceptable limits. The product treated with cryoprotective agents had a better acceptability compared to control group.

17. Ghosh, Shubhadeep; Pillai, N. G. K.; Dhokia, H. K. (Vereval Regional Centre of Central Marine Fisheries Research Institute, Matsya Bhavan, Bhidiya, Veraval, Gujrat –

362 269 (India)). **Fishery and population dynamics of *Harpodon nehereus* (Ham.) off the Saurashtra coast.** Indian Journal of Fisheries. (2009) v. 56(1) p. 13 –19.

The fishery and population dynamics of Bombay duck (*Harpodon nehereus* Ham.) from Nawabunder, Rajpara and Jaffarbad were studied for the period from 2003 to 2006. The average annual landings of *Harpodon nehereus* was 25.079 t, which contributed 31.12% to the total dol net catches. The seasonal peak in catch was recorded during September – January and in May. The length –weight relationship showed that growth was isometric and there was no significant variation between the sexes. The overall sex ratio was 1:0.99 with gravid and ripe females encountered in most months with a peak during September – December. The length at first maturity of female was 20.2 cm. The growth parameters were estimated as  $L_{\infty} = 35.39$  cm and  $K = 0.86$  and the length attained at the end of 1, 2 and 3 years were 20.66 cm, 29.16 cm and 32.75 cm respectively. The length at first capture was 3.42 cm with recruitment occurring in most months of the year with a peak during February-June. The natural mortality, fishing mortality and total mortality were 1.52, 1.73 and 3.25 respectively and the exploitation ratio was 0.53. The maximum sustainable yield was 23,557 t, which was lower than the average annual catch indicating overexploitation of the species. The yield per recruit and biomass per recruit was 6.565 and 3.79 g and increase in relative yield by 111.45% would be obtained by decreasing the present level of fishing by 40%.

**18.** Guin, Sharmistha (Centre of Environmental Studies, Visva-Bharati, Santiniketan –731 235 (India)). Chattopadhyay, G.N.; Banerjee, Abira (Institute of Agriculture, Visva-Bharati, Sriniketan –731 236 (India)). **Use of vermicompost as an organic input for nutrient management in aquatic ecosystem.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 9-15.

The possibility of using vermicompost as a component of integrated nutrient management in aquatic ecosystem was assessed through a primary investigation. The microcosm study constituted ten treatments with different combinations of mineral fertilizers and two organic manures *viz* cow dung and vermicompost. Each of the treatments were replicated thrice and was incubated for 100 days under uniformly illuminated condition. Periodic observations on various water quality parameters showed vermicomposting to be significantly superior to cowdung in providing nutrition to primary producers and also in sustaining oxygen budget of the aquatic environment. When used in 50% lower doses than cowdung, vermicompost resulted in comparable primary production in association with recommended doses of fertilization. The study indicated that vermicomposting may be an effective proposition for greater resource utilization in aquaculture involving recycling of organic wastes and at the same time reduction of large scale uses of chemical fertilizers.

**19.** James, P.S.B.R. (NO. 832/27, 3<sup>rd</sup> B Main, 2<sup>nd</sup> cross, Prem Nivas Road, Kammananpalli, P.O. – St. Thomas Town, Bangalore - 560 084 (India)). **Water crisis : Some strategies for the sustainability of inland fisheries and aquaculture in India.** Fishing Chimes (India). (2009) v. 29(2) p. 15-18.

Taking an incisive look at the looming water crisis and the authors discussed remedial strategy of interlinking rivers to solve the problem and explained the demerits of such a step. He also discussed from the fisheries point of view, linking of rivers may bring in large scale physical, biological and hydrological changes that would affect the aquatic

ecosystems of the rivers and keeping in view fisheries development aspects. He suggested certain strategies in the place of linking of rivers, for the sustainability of inland fisheries and aquaculture.

20. Joshi, S. K.; Pathani, S. S. (S.S.J. Campus, K.U., Almora – 263 601, Uttarakhand, (India). Department of Zoology). **Spawning biology of a hill stream fish, *Botia almorhae* Day of Kumaun Himalaya, Uttarakhand.** Indian Journal of Fisheries. (2009) v. 56(2) p.151-155.

The Almora loach, *Botia almorhae* is a beautifully coloured hill stream fish which breeds once in a year. Spawning biology of *B. almorhae* from Kumaun Himalaya was studied. The breeding season extended from May to August in the river Suyal, Kumaun Himalaya and the fish preferred to spawn in small rivulets (Gadhera), where the water velocity is very slow. The fecundity ranged from 908-3616 (76-154 mm fish). The length-weight relationship was  $W = 6.728 + 2.216L$ . The correlation between fecundity and total length ( $F = 178 + 21.34x$ ) and body weight and fecundity ( $F = 109.2 + 431.7x$ ) was highly significant ( $r = 0.986682$  and  $0.96793$ , respectively). The K-values ranged from 0.52 (76-80 mm length group) to 0.63 (146-150 mm length group) in males, while in female fish, this value ranged from 0.53 (76-80 mm length group) to 0.65 (146-150 mm length group).

21. Kalita, Girindra (Guwahati College, Guwahati – 781 021, Assam (India). Department of Zoology). Sarmah, Sushil Kumar (Guwahati College, Guwahati – 781 021, Assam (India). Department of Zoology). **Studies on the wetlands and their usable resources of greater Guwahati.** Aquacult (India). (2009) v. 10(1) p.119-123.

Five lentic water wetlands of Guwahati, the capital city of Assam namely, Deepar beel, Barchola beel, Saruchola beel, Damal beel and Silsako beel are visited for the study of uses of wetland resources by the neighboring peoples. It is observed that out of the five studied area, only four have true wetland environment. Saruchola beel has totally transformed to an upland area. Moreover, Barchola beel has highly degraded environment and except some washing purpose, people do not use any other components from this wetland. However, neighbors of Deepar, Damal and Silsako beel are variously using wetland resources either for commercial purposes or for their own use. Four major components namely, soil, water, plants and animals are recorded as usable resources in these wetlands. There is also aesthetic and religious use of wetland components particularly in Deeper beel area.

22. Kizhakudan, Joe K. (Chennai Research Centre of Central Marine Fisheries Research Institute, Chennai – 600 028 (India)). Deshmukh, Vinay D. (Mumbai Research Centre of Central Marine Fisheries Research Institute, Mumbai – 400001 (India)) **Fishery and population dynamics of the spider prawn, *Nematopalaemon tenuipes* Henderson along the Saurashtra coast.** Indian Journal of Fisheries. (2009) v. 56(2) p. 81-86.

*Nematopalaemon tenuipes* Henderson forms about 20% of the non-peneaeid catch by dol nets operating along the Saurashtra coast. The length-weight relationships were obtained with,  $a=2.153 \times 10^{-5}$  and  $b=2.699$  for males and  $a=1.905 \times 10^{-5}$  and  $b=2.783$  for females. The von Bertalanffy growth equation was derived as  $L_t=73[1-e^{-1.38(t+0.02)}]$  for males and  $L_t=78.6[1-e^{-1.32(t+0.04)}]$  for females. The lengths attained at the end of 0.5 to 1.5 years/s were estimated as 37.3, 55.1 and 64 mm for males and 40, 59.2 and 69.5 mm for females. The mortality coefficients Z, M and F were 6.31, 3.23, 3.08 and 5.97, 3.08, 2.89 for males

and females respectively. The annual exploitation rate  $U$  was 0.49 for males and 0.48 for females. The MSY was estimated to be 1,678 t and 5,346 t for males and females respectively and 7,024 for the species in Saurashtra. With an average annual production of 5600 t, the resource does not appear to be under threat of over fishing at present.

**23.** Kolekar, Vijay (Northeastern Regional Center, Central Inland Fisheries Research Institute, 4<sup>th</sup> floor, Housefed Complex, Dispur, Guwahati – 781 006, Assam (India)). **An account of observations on fishing gear and crafts of Mandovi estuary of Goa.** Journal of the Indian Fisheries Society of India. (2009) v. 41(1) p. 41-46.

The present communications deals with the study of observations on fishing gear and crafts being used in Mandovi estuary of Goa. Seines and trawl nets contributing about 60% of the total catch perform major fishing in the estuary. A wide variety of non-mechanized gear comprising stake nets, gill nets, cast nets, bag nets, scoop nets etc. were discussed along with their mode of operation. Otter trawling and purse seines were significant gear among the mechanized category. Fishing crafts comprised conventional boats of Mandovi estuarine system. Maintenance of gear and crafts has also been discussed.

**24.** Kumar, A. Biju (University of Kerala, Kariavattom, Thiruvananthapuram – 695 581, Kerala (India). Department of Aquatic Biology and Fisheries). Abraham, Kurian Mathew (Postgraduate and Research, Mar Thoma College, Tiruvalla, Pathanamthitta – 689 103, Kerala (India). Department of Zoology). **Impact of peringottukurissi check dam on hydrography of Bharathapuzha river, Kerala.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 1-8.

Hydrographic changes in the upstream and downstream areas of Peringottukurissi check dam in Bharathapuzha river, Kerala State were studied. Seasonal variations in conductivity, hardness, alkalinity, sulphate and total suspended solids were significant in both upstream and downstream areas of the check dam. Phosphate, nitrate, silicate and total dissolved solids (TDS) exhibited significant seasonal variations in the upstream area of the check dam. Higher values of nutrients in the upstream area of the check dam could be due to the use of this area for washing and bathing coupled with leaching of nutrients from the nearby agricultural fields. Comparison of hydrographic features in the upstream and downstream areas revealed significant variations only in the case of phosphate and TDS.

**25.** Kumar, Adarsh; Qureshi, T. A. (Barkathullah University, Bhopal – 462 026 (India). Department of Applied Aquaculture). Patiyal, R. S.; Punia, Peyush; Lakra, W. S. (National Bureau of Fish Genetic Resources, Lucknow – 226 002 (India)). Mahanta, P.C. (National Research Centre for Coldwater Fisheries, Bhimtal, Uttarakhand - 263 136 (India)). **Food and feeding habits of *Tor putitora* (Ham.) under pond conditions.** Indian Journal of Fisheries. (2009) v. 56(1) p. 51-53.

The present investigation was undertaken to analyze the food and feeding habits of *Tor putitora* under pond conditions at the fish farm of National Bureau of Fish Genetic Resources (NBFGR), Lucknow. Gut analysis showed that animal matter formed the main component of the gut contents and constituted about 52.63% of the total food consumed, while plant matter constituted only 18.94%. The percentage of artificial feed (composed of rice bran and oil cake) was 18.42% and almost equal to the plant matter. Presence of

fish scales and sand particles in the gut along with other food materials indicated the bottom feeding tendency of the fish. However, the average relative gut length (RGL) of 2.7 and average gastro-somatic index (GSI) of 2.4, indicated their omnivorous tendency. The RGL values increased with increasing length of the fish, indicating suitability of the gut for omnivorous diet. Survival of *T. putitora* in pond conditions during the present study also showed that the fish has the capability to adapt to the new eco-biological conditions.

26. Kumar, Vijay M.; Joseph, Imelda; Raj, R. Paul (Central Marine Fisheries Research Institute, Post Box No. – 1603, Ernakulam North P.O., Kochi – 682 018, Kerala (India)). **Efficacy of a fungal fermented product as fishmeal replacement in the diet of *Penaeus monodon* Fabricius post-larvae.** Indian Journal of Fisheries. (2009) v. 56(2) p. 115-121.

The efficacy of diets, formulated by inclusion of an *Aspergillus niger* fermented product (AFP) as fish meal substitute, for *Penaeus monodon* post-larvae was determined. AFP was derived by solid state fermentation (SSF) of a mixture of soybean flour, wheat flour, groundnut oil cake and sesame oil cake in the ratio of 4:3:2:1 respectively for 96 h. The feeding trial was conducted in post-larvae stocked @ 10 animals in circular Perspex tanks containing 40l of water with five dietary treatments each with three replicates for 52 days. The diets containing graded levels of AFP substituting 0, 50, 150, 250 and 350g kg<sup>-1</sup> of fishmeal were fed to the post-larvae. Data on the growth performance and nutrient utilization efficiency were recorded from the feeding trials. Results showed that the post-larval shrimp fed diet containing 150 g kg<sup>-1</sup> AFP exhibited significantly better ( $p < 0.05$ ) growth rate (14.79 mg d<sup>-1</sup> post-larva<sup>-1</sup>), feed conversion ratio (1.62), protein efficiency ratio (1.64) and apparent protein utilization (25.39) than the other diets. The diet with 350 g kg<sup>-1</sup> AFP showed the best apparent protein digestibility (87.74%), apparent fat digestibility (97.95%) and apparent dry matter digestibility coefficient (77.09%) among the test diets. The results of the present study suggest that AFP can be used to improve the digestibility of nutrients and that partial replacement of fishmeal is possible in *P. monodon* post-larval diets under optimum rearing conditions.

27. Kund, G. C.; Sahoo, U. C.; Satapathy, D. (College of Fisheries, Orissa University of Agriculture and Technology, Rangailunda, Berhampur – 760 007, Ganjam, Orissa (India)). **Probability of capture of *P. monodon* in Chilika lagoon, east coast of India.** Aquacult (India). (2009) v. 10(1) p. 139 –141.

L25, L50 and L75 were estimated as 39.80 mm, 76.89 mm, 113.97 and 39.25 mm, 90.56 mm, 141.88 mm for the period 2005 and 2006 respectively. The probability of capture of prawn below 115 mm was between 65-77%. Considering the increment in growth and probability of capture of *P. monodon*, it is suggested not to catch the prawns below 115 mm, size from the Chilika lagoon.

28. Kurup, B. Madhusoodana (School of Industrial Fisheries, Cochin University of Science and Technology, Cochin – 682 016, Kerala, Govt. of Kerala (India)). **Biofloc in shrimp aquaculture, the futuristic technology for ecological and economic sustainability.** Fishing Chimes (India). (2009) v. 29(1) p. 23-29.

The author discussed about factor affecting operational sustainability at shrimp aquaculture, crisis of shrimp farming etc. He also discussed regarding bifloc technology

and its advantages. He mentioned about bifloc manipulation through C/N ratio optimization in shrimp aquaculture; its basic issue and concern. The author described with illustration about the development of biofloc technology for extensive shrimp aquaculture

**29.** Laskar, Boni Amin (National Research Centre on Coldwater Fisheries (ICAR) Project station, Government Fish Seed Farm, Lower Dibang Valley District, Roing –792 110, Arunachal Pradesh (India)). Das, D. N. (Rajiv Gandhi University, Rono Hills, Itanagar, Arunachal Pradesh, (India). Department of Zoology). Tyagi, B. C. (National Research Centre on Coldwater Fisheries (ICAR), Bhimtal, Nainital District, Uttaranchal –263136 (India)). **Growth performance of the chocolate mahseer *Neolissocheilus hexagonolepis* (Mc Clelland) in pond system in Arunachal Pradesh.** Indian Journal of Fisheries. (2009) v. 56(1) p. 55-59.

Growth performance of the chocolate mahseer *Neolissocheilus hexagonolepis* (Mc Clelland) cultured in an earthen pond was studied separately for adults and yearlings in terms of specific growth rate and net length gain during October 2003 – June 2004 and September 2004 – August 2005, respectively. Forty five adult fishes having an average length of 190.30 mm and average weight of 88.05 g were cultured in the pond at a stocking density of 1 no./ 13.4 m<sup>2</sup>. The gross increment in size of adult fishes after 278 days of culture was 82.87 mm (29.80% days) in length and 119.01 g in weight. Four hundred fifty numbers of yearlings of average length 127.39 mm and weight 19.58 g were cultured at a stocking density of 1 no./ 1.34 m<sup>2</sup> for 333 days. The yearlings gained a net length of 78.86 mm and net weight of 61.40 g.

**30.** Laxmilatha, P. (Calicut Research Centre of Central Marine Fisheries Research Institute, West Hill P.O., Calicut – 673 005, Kerala (India)). **Proximate composition of the surf clam *Mactra violacea* (Gmelin 1791).** Indian Journal of Fisheries. (2009) v. 56(2) p. 147-150

The surf clam *Mactra violacea* (Bivalvia: Mactridae) is a fairly large marine clam with high meat content. These clams are found in the surf zone of exposed sandy beaches. The proximate composition of *M. violacea* was studied. Moisture, crude protein, crude fat, acid insolubles and ash were estimated. The protein content of *M. violacea* was estimated as 11.9%, fat 1%, ash 3.2% and moisture 80%. The surf clam is a good source of protein and minerals and has low fat content. The nutritive value is high and comparable to other shellfishes.

**31.** Leena, K.; Deshmukh, V.D. (Mumbai Research Centre of Central Marine Fisheries Research Institute, 2<sup>nd</sup> Floor, CIFE (Old Campus), Fisheries University Road, Versove, Mumbai – 400 061, Maharashtra (India)). **Age and growth of Jhinga prawn *Metapenaeus affinis* Milne Edwards (Decapoda, Penaeidae) in Mumbai waters.** Indian Journal of Fisheries. (2009) v. 56(1) p. 1-5.

The result of the studies on age and growth of *Metapenaeus affinis*, one of the dominant species of penaeid shrimps in the coastal waters off Maharashtra are presented. From monthly size-frequency data, the growth parameters for males and females were estimated employing modal progression and computer based FiSAT software package using ELEFAN program, Bhattacharya method, Gulland-Holt plot, Faben's method, Appeldoorn's method and von Bertalanffy plot. The estimates obtained by Bhattacharya

analysis and Gulland Holt plot were  $L_{\alpha} = 162$  mm,  $K = 2.25$  for males and  $L_{\alpha} = 204$  mm,  $K = 1.91$  for females. Males and females were found to attain 145 mm and 174 mm at the end of one year and their life spans were 1.16 and 1.4 years respectively.

**32.** Mandal, P.; Dora, K.C. (Faculty of Fishery Science, WBUAFS, 5, Budherhat Road, P.O. - Panchasayar, Kolkata -700 094 (India). Department of Fish Processing Technology). Mishra, R. (KVK (OUAT), Katakpur, Dist. – Puri, Orissa (India)) **Quality changes of surimi prepared from common carp during frozen storage.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 25-29.

Common carp (*Cyprinus carpio*) has low consumer preference in Indian market and value added product like surimi can be prepared to enhance its acceptability. In the present study, the degutted whole fish, dewatered mince meat and surimi preparations from *C. Carpio* were frozen at  $-35^{\circ}\text{C}$  for upto 120 days and chemical quality monitored to examine the preservability of surimi over other preparations. The cryoprotectants namely sorbitol and sodium tripolyphosphate at a level of 4% and 0.3% respectively improved the stability of the common carp surimi significantly during frozen storage at  $-35^{\circ}\text{C}$ . An increase in total volatile base nitrogen and alpha amino nitrogen and decrease in salt soluble protein was observed during frozen storage period. Further, increase in peroxide value and thio-barbituric acid value indicated the deteriorative changes in lipid fraction. However, surimi was in acceptable condition for utilization even after a storage period of 4 months.

**33.** Mayank, Priyanka; Dwivedi, Amitabh Chandra; Singh, Krishna Raj (Central Inland Fisheries Research Institute, 24 Panna Lal Road, Allahabad – 211 002 U.P. (India)). Srivastava, Devendra (Iswar Saran Degree College, Allahabad, U.P. (India). Department of Zoology). **Assesment of sex ratio and sex structure of *Labeo calbasu* (Hamilton) from the Gomti river at Sultanpur.** Aquacult (India). (2009) v. 10(1) p. 113-117.

The samples were collected from the Gomati river at Sultanpur. Male proportion was higher than female in 1+ and 2+ age groups. Female proportion was higher than male in 3+, 4+, 5+ and 6+ age groups and chi-square values ranged from 0.04 to 2.82. Proportion of male and female was recorded equal in 7+ and 8+ age groups. In the stock sex structure of male and female proportion was higher than male (1:1.04). It did not differ significantly. In the stock sex structure of male and female was recorded (49.03%) and (59.97%), respectively. It is very close to equal proportions. The sex structure of male was maximum in 1+ age group (55.33%) and minimum in 4+ age group (37.20%). The sex structure of female was maximum in 4+ age group (62.79%) and minimum in 1+ age group (46.67%).

**34.** Michael, Babu; Immanuel, M.; Citarasu, G.; Punitha, T.; Dhas, M. J. Albin; Shankar, S.; Arul, C. V. R.; Selvaraj, T. (Centre for Marine Science and Technology, Manonmaniam Sudaranar University, Rajakkamangalam – 629 502, T.N. (India)). **Advances in microfilter depurator for defaecation and feeding of artemia in shrimp hatcheries.** Fishing Chimes (India). (2009) v. 29(2) p. 51-54.

Artemia being the chief food resource for larviculture of marine fish and shrimp, the latest way of producing these is under microfilter depuration system so as to ensure their growth in an environment free from the effects of the defaecated substances too. In this contribution, Michael Babu and his associates explain the advances in the adoption of

microfilter depurator system for treating defaecated material in the process of feeding of artemia in shrimp hatcheries.

35. Mishra, D. K. (Deogarh College, Deogarh –768119, Orissa (India). Department of Zoology). Bohidar, K. (Utkal University, Vani Vihar, Bhubaneswar – 751 002, Orissa (India). Department of Zoology). Pandey, A. K. (Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar – 751 002, Orissa (India)). **Response of hypothalamo-neurosecretory system of freshwater teleost, *Channa punctatus* (Bloch.) to sublethal exposure of carbaryl.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 51-56.

In order to record the effects of carbaryl on hypothalamo-neurosecretory system of *Channa punctatus*, fishes were exposed to sublethal concentration ( $5.20 \text{ mg l}^{-1}$ ; 30%  $\text{LC}_{50}$  for 96 h) of the pesticide for 96 h. Hypothalamo-neurosecretory complex of the murrel consisted mainly of nucleus preopticus (NPO), nucleus lateralis tuberis (NLT) and their axonal tracts. NPO was a paired structure situated on either side of the third ventricle antero-dorsal to the optic chiasma and morphologically divisible into a dorsal pars magnocellularis (PMC) consisting of large neurons and ventral pars parvocellularis (PPC) formed of smaller neurosecretory cells, NLT cells were distributed in the infundibular floor adjacent to the pituitary stalk. Sublethal treatment of carbaryl induced an initial hypertrophy of the neurosecretory cells of NPO and NLT followed by loss of staining affinity as well as varying degrees of cytoplasmic vacuolization and pyknosis. Herring bodies (HB) were also encountered in the neurohypophysis of the fishes exposed to the pesticide for 96 h.

36. Mohan, Madan; Bhanja, S. K.; Basade, Yasmeen (Directorate of Coldwater Fisheries Research, Bhimtal – 263 136, Nainital, Uttarakhand (India)). **Performance of chitin incorporated diet on the indigenous Kumaon Himalayan fishes: snow trout, *Schizothorax richardsonii* (Gray) and golden mahseer, *Tor putitora* (Hamilton).** Indian Journal of Fishes. (2009) v. 56(2) p. 135-137.

Golden mahseer, *Tor putitora* (Hamilton) and snow trout, *Schizothorax richardsonii* (Gray) were fed with diet containing chitin at 0 and 2% level for a period of eight weeks. The control diet (without chitin) and the experimental diet (with 2% chitin) were fed to triplicate groups of fishes having a mean initial body weight of 5.33-5.36 g for golden mahseer and 11.81-11.88 g for snow trout. In golden mahseer, net weight gain, specific growth rate (SGR), feed conversion ratio (FCR) and percentage survival were not significantly ( $p>0.05$ ) different in fish fed with control and chitin supplemented diets. However, in snow trout, net weight gain, SGR and FCR were significantly ( $p<0.05$ ) better in fish fed with chitin supplemented diet compared to those maintained on control diet. These results suggest that the dietary supplementation of chitin is advantageous for snow trout growth but has no significant impact on the growth of golden mahseer.

37. Naik, Manja; Benakappa, S.; Rajesh, K. M. (College of Fisheries, Mangalore - 575 002 (India). Department of Fisheries Resources and Management). Rajesh, Mridula (Krishi Vigyan Kendra, Mangalore – 575 002 (India)). **Seasonal abundance of commercially important shrimp seed in the Mulki Estuary, south-east coast of India.** Indian Journal of Fisheries. (2009) v. 56(1) p. 61-64.

Shrimp seed of five commercially important penaeid species viz. *Fenneropenaeus indicus*, *Fenneropenaeus merguensis*, *Peneus monodon*, *Metapenaeus monoceros* and *Metapenaeus dobsoni* were encountered in the Mulki Estuary during the present investigation. *F. indicus* was predominant in the samples in the early pre-monsoon period (25 to 28.3%) and late post-monsoon period (18.2 to 21.4%) at all the stations. *F. merguensis* seed showed distinct variations and was dominant during pre-monsoon months (30 to 89.3%), whereas *P. monodon* seed was predominant during early pre-monsoon season (22.1 to 26.6%) at all the stations. Both *M. dobsoni* and *M. monoceros* were dominant during the later part of post-monsoon season (22.1 to 26.6% ; 9.8 to 47.6% respectively). Among the hydrographical parameters tested salinity ( $r = 0.6954$ ) and temperature ( $r = 0.7307$ ) showed significant positive correlation with shrimp seed availability in the Mulki Estuary.

38. Nair, Mallika Sukumaran (N S S College for Women, Thiruvananthapuram – 695 581, Kerala (India). Department of Zoology). Aravindan, C.M. (Thiruvananthapuram - 695 581, Kerala (India). Department of Aquatic Biology and Fisheries). **Abundance, diversity and seasonal fluctuation of plankton in a tropical freshwater lake.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 34-40.

Composition and seasonal fluctuation of plankton in relation to physico-chemical parameters was studied in the Vellayani lake, a freshwater lake in Thiruvananthapuram district of Kerala, during the period June 1999-May 2000. Phytoplankton abundance showed two peaks, during post monsoon (September-October) and premonsoon (February-May). Cyanophyceae (50.2%) and Chlorophyceae (41.1%) were the co-dominant groups of phytoplankters with Bacillariophyceae contributing only 8.1% to the annual density. The peaks of zooplankton population coincided with the phytoplankton. Rotifera exhibited superiority over the zooplankton groups both in abundance and in the number of species. Changes in hydrobiological conditions of the lake water caused by monsoon were found to influence the plankton density in the lake.

39. Padmakumar, K.G.; Bindu, L.; Sreerekha, P.S.; Joseph, Nitta (Kerala Agricultural University, Regional Agricultural Research Station, Kumarakom – 686 566, Kerala (India)). **Food and feeding behaviour of the golden catfish, *Horabagrus brachysoma* (Gunther).** Indian Journal of Fisheries. (2009) v. 56(2) p. 139-142.

*Horabagrus brachysoma* (Gunther 1824) commonly known as golden catfish, is an endangered freshwater fish species endemic to the Western Ghats region of Peninsular India. The study was based on 246 fishes of total length ranging from 13 to 34 cm. Filamentous algae, detritus, fish offal, macro-vegetation, crustaceans and other miscellaneous items formed the food of *H. brachysoma*. Food intake was found to be reduced during pre-spawning months. The mean relative length of gut (RLG) recorded was 0.99.

40. Pal, Devonita; Joardar, Siddhartha N. (Faculty of Fishery Sciences, Mohanpur-741252 (India). Department of Fishery Pathology and Microbiology). Roy, Barun (Faculty of Veterinary and Animal Sciences, West Bengal University of Animal and Fishery Sciences, Belgachia, Kolkata – 700 037, West Bengal (India). Department of Animal Nutrition). **Yeast cell wall preparation from *Saccharomyces cerevisiae* enhances immune effector cells of Indian major carp. *Catla catla* (Hamilton).** Indian Journal of Fisheries. (2009) v. 56(1) p. 33-38.

The present study was designed to assess the effect of oral administration of yeast cell wall (YCW) preparation from *Saccharomyces cerevisiae* on non-specific immune responses of *Catla catla* (Ham.). Fish fed with experimental diet (for 15 days) were switched back to control diet and fed for a period of 30 days. Non-specific immune responses, viz. superoxide anion production, phagocytosis, nitrite production and proliferation of leukocytes along with haematological parameters were assessed at 10 days interval during post YCW feeding period. Although there was no significant difference in mean haematocrit values, dynamic changes of differential leucocyte count was observed in treated group as compared to control. Superoxide anion production, *in vitro* phagocytic activity and nitrite production of leucocytes increased significantly ( $p < 0.01$ ) and reached peak on 10<sup>th</sup> day post-treatment. *In vitro* lymphocyte proliferation also showed similar trend throughout the experimental period. The results showed that supplementation of YCW preparation in feed for 15 days had significant immunostimulatory effect on *C. catla*.

**41.** Patel, Alok; Das Paramananda; Barat Ashoktaru; Sarangi Niranjana (Central Institute of Freshwater Aquaculture, P.O. Kausalyaganga, Bhubaneswar – 751 002, Orissa (India). Fish Genetics and Biotechnology Division). **Estimation of genome size in Indian major carps *Labeo rohita* (Hamilton), *Catla catla* (Hamilton), *Cirrhinus mrigala* (Hamilton) and *Labeo calbasu* (Hamilton) by Feulgen microdensitometry method.** Indian Journal of Fisheries. (2009) v. 56(1) p. 65-67.

Genome size of Indian major carps viz. rohu, catla, mrigal and kalbasu has been reported here by estimating nuclear DNA content of Feulgen-stained blood smears in microdensitometer. The Nile tilapia (*Oreochromis niloticus*) genome size was taken as the internal reference standard. Although diploid chromosome number in all these species are same ( $2n = 50$ ), they show notable difference in their genome size viz. 1.044 pg (kalbasu), 1.047 pg (mrigal), 1.994 pg (rohu) and 2.447 pg (catla). These differences may be attributed to the content of junk DNA and degree of developmental complexity of the species. The study is first of its kind in Indian carps and the information would help in generating linkage maps for identification of trait associated genes.

**42.** Rahmatullah, M.; Das, Nanda K.; Rahman, M. Aminur; Sultana, Tahera; Jahan, Rownak (University of Development Alternative, Dhaka - 1205 (Bangladesh). Department of Biotechnology and Genetic Engineering). **A preliminary study on co-cultivation of Mozambique tilapia (*Oreochromis mossambicus*) with bronze featherback (*Notopterus notopterus*) in shallow homestead ponds.** Indian Journal of Fisheries (2009) v. 56(1) p. 43-45.

Mixed-sex population of Mozambique tilapia (*Oreochromis mossambicus*) and bronze featherback or chital (*Notopterus notopterus*) were co-cultivated in three 136 m<sup>2</sup> shallow ponds of 1 m depth at a ratio of 100:1 with a stocking density of 2 tilapia and 0.125 chital m<sup>-2</sup> for 308 days during 2003-2004. The ponds were manured with semidried cow dung alone during the culture at the rate of 3.5 kg week<sup>-1</sup>. The weight (mean  $\pm$  SD) of Mozambique tilapia at harvest was 39.3  $\pm$  12.4 g. Chital exhibited spectacular growth from an initial weight of about 0.8 g per fry to a final weight of 1073  $\pm$  246 g (mean  $\pm$  SD) at harvest. The survival rate of chital at the end of culture period was 47%. The extrapolated annual yield of tilapia and chital were 2.8 and 0.9 ha<sup>-1</sup> respectively. The results indicate that tilapia and chital can be co-cultivated in small shallow ponds.

**43.** Raje, Sadashiv Gopal (Mumbai Research Centre of Central Marine Fisheries Research Institute, Versova, Mumbai – 400 061 (India)). Zacharia, P.U. (Tuticorin Research Centre of Central Marine Fisheries Research Institute, South Beach Road, Tuticorin-628001, Tamil Nadu (India)) **Investigations on fishery and biology of nine species of rays in Mumbai waters.** Indian Journal of Fisheries. (2009) v. 56(2) p. 95-101.

Annual landings of rays by trawlers operating from New Ferry Wharf, Mumbai during 1990-2004 ranged from 205.7 t to 765.1 t with an average of 502.8 t constituting nearly 1% of trawl catches. The trawling effort increased from 0.95 million hours (mh) in 1990 to 1.73 mh in 2004, whereas the catch rate declined from 0.65 kg h<sup>-1</sup> in 1990 to 0.24 kg h<sup>-1</sup> in 2004. There were two peak periods of abundance, September-December and February-April. Fourteen species of rays constituted the fishery, of which *Himantura alcockii* (50.1%), *Himantura Bleekeri* (13.9%), *Amphotistius imbricatus* (8.5%) and *Himantura uarnak* (8.1%) formed the mainstay of the fishery. Information on biology of *H. alcockii*, *H. bleekeri*, *A. imbricatus*, *Pastinacus sephen*, *Dayyatis zugei*, *Gymnura japonica*, *G. poecilura* and *Mobula diabolus* is also presented. It appears that the resource of rays off Mumbai may not be able to withstand any further increase in fishing effort. Innate biological characteristics such as limited brood size, late maturation and capture of spawning stock are the causes of continuous decline. Conservation measures are required to protect this resource from further depletion.

**44.** Rao, A. Chandrasekhar; Krishnan, L. (Central Marine Fisheries Research Institute, P.O. Box. 1603, Cochin – 682 018, Kerala (India)). **Studied on the reproductive biology of the female spiny cheek grouper, *Epinephelus diacanthus* (Valenciennes, 1828).** Indian Journal of Fisheries. (2009) v. 56(2) p. 87-94.

Morphological and histological examination of gonads and detailed classification and description of maturity stages were carried out in the female *Epinephelus diacanthus*. Maximum ova diameter of 650 µm was observed in the ripe ovary. Oocyte size increased with the maturation of gonads. Gonado-somatic Index (GSI) values also increased with the maturation of gonads. Fecundity was in the range of 13.1 x 10<sup>3</sup> to 145.7 x 10<sup>3</sup>.

**45.** Rao, D.V. (Zoological Survey of India, Hilltop, Gopalpur-On-Sea (GM) Orissa – 761 002 (India)). **Checklist of fishes of Andaman and Nicobar Islands, Bay of Bengal.** Environment & Ecology (India). (2009) v. 27(1A) p. 334-353.

Fish constitutes one of the most important marine food resources of the Andaman and Nicobar Islands and authentic information on the diversity of this region is vital for planning sustainable utilization of suitable fish resources. Several significant taxonomic studies have been made on the fish fauna of the Andaman and Nicobar Islands during the last several decades. In recent times large number of new species and new records of fishes have been added to the list by many ichthyologists. In several cases one and the same species is found cited by various names in different publications. An analysis has been made and a comprehensive revised checklist containing 1,371 species under 586 genera belonging to 175 families so far recorded from Andaman and Nicobar Islands is presented here by compiling all the published records and materials studied by the author in this area.

46. Rao, G. Syda (Central Marine Fisheries Research Institute (CMFRI) Cochin – 682 018 (India). **Capture-based aquaculture: Mariculture initiatives – by CMFRI.** Fishing Chimes (India). (2009) v. 29(1) p. 32-36.

The author discussed about Indian scenario regarding capture based aquaculture; mariculture initiatives. In this context he mentioned about shrimp farming, lobster fattening/farming, oyster farming, marine fin fish culture and marine cage farming. He also discussed about seed resources of capture based aquaculture, environmental impacts, social and economic impacts and management of capture based aquaculture.

47. Rayaz, Khalid (Govt. P.G. College, Rajouri (J & K) – 185 212 (India). Department of Geography). **Assesment of anthropogenic activities and their impact on fish resources of Rajouri district, J & K, India.** Aquacult (India). (2009) v. 10(1) p. 27-32.

Anthropogenic activities are largely responsible for the deterioration of environmental quality and quantity to a large extent. The increase in human activities has not even left independent and innocent fishes in the area under scrutiny. Present investigation seeks to identify the human activities and their impact on fish resources. The study established the fact that the percentage of illegal fishing cases ranged between 12.9 percent dynamiting and electrocuting in Budhal to 25.5 percent silt creation in the same tehsil. Further, the numbers of illegal fishing cases has increased to 332.6 percent during the course of present assessment. Moreover, continuous increase in illegal fishing has badly affected the fish resources in the area which leads to extinction of important fishes like mahseers and trouts.

48. Roy, Sheela; Sarkar, Indrani (Vidyasagar College, Kolkata – 700 006, West Bengal (India)). **Territorial behavior in air-breathing catfishes.** Journal of the Inland Fisheries Society of India. (2009) v. 41(1) p. 47-50.

Territorial behavior of two air-breathing cat fishes namely *Heteropneustes fossilis* (Bloch) and *Clarius batrachus* (Linn) have been studied in laboratory pool. *Clarius batrachus* (Linn) maintains territory vigorously whereas *Heteropneustes fossilis* did not. Largest fish of *C. batrachus* both in weight and length occupied the largest area in laboratory pool. In breeding season, aggressiveness increased to maintain territory. On the other hand *H. fossilis* did not maintain territory, they liked to live together.

49. Sadawarte, R. K.; Sadawarte, V. R.; Naik, S. D.; Sawate, S. S.; Mulye, V. B.; Sharangdhar, M. T. (College of Fisheries, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Shirgaon, Ratnagiri – 415 629, Maharashtra (India)). **Studied on effect of ethynyl-extradiol on 30 days old Rosy barb, (*Puntius conchoni*).** Aquacult (India). (2009) v. 10(1) p. 57-61.

Studied on the effect of ethynylestradiol (2 mg/kg) on 30 days old Rosy Barb, *Puntius conchoni* was carried out for 120 days. The observations after 30 days of treatment showed significant difference ( $p < 0.05$ ) in growth among the treatment as compared to that of control. Observations after 60 days of treatment, it was found that both the body length and body weight showed significant difference ( $p < 0.05$ ) as compared to that of control. The observations after 90 days of treatment revealed significant increase in body length ( $p < 0.01$ ) but there was no significant differences in the weight as compared to that of control.

After 120 days of treatment, highly significant differences were recorded in body weight ( $p < 0.001$ ) and even the body length showed a significant difference ( $p < 0.001$ ) as compared to that of control. 100% gravid females were observed after 120 days of treatment. The control group showed a higher percentage of males (65%) and lower percentage of females (35%). The observations on percentage of females (100%) showed significantly higher proportion in 2 mg/kg ethynylestradiol as compared to that of control.

**50.** Sahoo, S. K.; Giri, S. S.; Chandra, S.; Sahu, A. K. (Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar – 751 002 (India)). **Larval rearing of the spiny eel, *Macrogathus aculeatus* (Lacepede) under different rearing conditions: a preliminary study.** Indian Journal of Fisheries. (2009) v. 56(1) p. 47-49.

A study was carried out to evaluate the role of rearing conditions on growth and survival of the spiny eel, *Macrogathus aculeatus* (Lacepede) larvae during a 30 days experimental period. The study was conducted with three treatment groups: the first group was reared in fibre-glass tanks with 6” deep water (Treatment-1), the second group in tanks provided with floating weed covering one fourth of the water surface (Treatment-2) and the third group was reared in tanks provided with soil bed and floating weed (Treatment-3). The tanks used for treatments 1 and 2 were not provided with soil bed. The growth and survival rate of the larvae, reared in the tanks with normal bottom and weed as well as in normal bottom without weed did not differ ( $p < 0.05$ ). However, the growth and survival rate were significantly reduced ( $p < 0.05$ ) when reared in tanks with soil base as well as floating weed. The results indicated that either providing soil at tank bottom or weed in rearing system did not help increase growth and survival of this species during the experimental rearing.

**51.** Sarojnalini, Ch; Suchitra, T. (Manipur University, Canchipur – 795 003, Manipur (India). Department of Life Science). **Microbial profile of starter culture fermented fish product ‘Ngari’ of Manipur.** Indian Journal of Fisheries. (2009) v. 56(2) p. 123-127.

Bacteria isolated from Ngari (a fermented fish product of Manipur), prepared in large-scale industrial products were identified. The starter culture isolated from ‘Ngari’, consisting of 3 species of *Bacillus* and 3 species of *Micrococcus* served as inoculum for the initiation of fermentation at 30°C in laboratory conditions. Proper fermentation was noticed in 40 days in starter culture inoculated fish whereas in naturally fermented fish, fermentation was noticed after 5 to 6 months. The results confirmed that bacteria are responsible in the ripening process of ‘Ngari’. Total plate count of bacteria reached up to  $10^8$  cfu g<sup>-1</sup>. Coliforms, *Escherichia coli* and *Salmonella* were not detected during the fermentation period. Sensory quality of the products so obtained were comparable with that of commercial ‘Ngari’. The spoilage indices such as thiobarbituric acid (TBA) number and total volatile base nitrogen (TVBN) were within the acceptable limit.

**52.** Shanmugavadivammal, P.; Sethuramalingam, T. A.; Rajakumari, K. (Center for Aqua Feed and Nutrition (CAFEN), St. Xavier’s College, (Autonomous) Palayamkottai – 627 002 (India). Research Department of Zoology). **Replacement of fishmeal with jack fruit (*Artocarpus integrifolia*) waste in the diets for *Labeo rohita* (Hamilton) fingerlings.** Environment & Ecology (India). (2009) v. 27(1) p. 42-45.

Jack fruit waste *Atocarpus integrifolia* (AIW) was substituted for fish meal at graded levels (10, 20, 30, 40 and 50) in the formulated diets for rohu fingerlings ( $3.64 \pm 0.06g$ ). A fish meal based diet was served as control and fed to fish for 41 days. The control diet fed fish exhibited a better growth response and nutrient utilization, where as 30% substituted AIW diet fed fingerlings showed higher specific growth rate (SGR), protein efficiency ratio (PER) and protein intake (PI) with low (best) food conversion ratio (FCR). Decreased growth rate, weight gain higher FCR and with low PI and PER of fish were noticeable above 30% inclusion levels of AIW diets. The result revealed that adequate supply of nutrients from feed was available to fish only at upto 30% inclusion level. A significant increase of body protein, lipid and carcass energy of fish fed with 30% inclusion of AIW meal which corresponds to the control diet fed fingerlings supported these results.

**53.** Singh, N. Okendro; Joshi, C.B. (Directorate of Coldwater Fisheries Research, Bhimtal – 263 136, Nainital, Uttarakhand (India)). Paul, A.K. (Indian Agricultural Statistics Research Institute, Library Avenue, Pusa Campus, New Delhi – 110 012 (India)). **Non-linear statistical models on estimation of maximum size of *Tor-putitora* (Hamilton) in different aquatic environments.** Indian Journal of Fisheries. (2009) v. 56(2) p. 103-106.

*Tor putitora* is one of the most important coldwater fish species. The population of this fish species has declined sharply in the recent past and is threatened with multifaceted dangers. As the size of fish plays an important role in fish stock assessment, in the present investigation, an attempt has been made to estimate the maximum size of *Tor putitora* in different aquatic environments by using nonlinear statistical models. We can expect a maximum length of approximately 3097 mm and 2994 mm for *Tor putitora* in the aquatic environments of Kumaun lakes and Gobindsagar reservoir respectively. It is seen that the estimated maximum size of *Tor putitora* in both environments are well acceptable in view of the reported maximum sizes in India and abroad.

**54.** Singh, P. N.; Singh, S. K.; Singh, P. K. (S.M.M. Town P.G. College, Ballia-277 001 (U.P.) (India). Department of Agriculture Chemistry and Social Science). Gupta, A. K. (S.M.M. Town, P.G. College, Ballia – 277 001 (U.P.) (India) Department of Zoology). **Paddy-fish farming in canal-irrigated areas of Ballia district, U.P.** Fishing Chimes (India). (2009) v. 29(2) p. 6-9.

The results of the captioned study (conducted by P.N. Singh and his associates), presented in this contribution, reflect the production and income benefits arising out of upgradation of paddy farming through its integration with fish farming. The results of the study are so convincing that it would be a wise strategy to encourage paddy farmers in canal irrigated areas to step up their efforts for producing fish along with paddy in their fields. The result of implementation of this line of action will be a significant contribution to fish production, without in any way affecting paddy yield. The authors discuss that in irrigated paddy fields the growth of major carps is remarkably good and as in fish ponds, and the Paddy – fish farming with the enhanced grain yield and marketable fish production even under the adverse conditions of flooding and water logging, adding that this will be promising for agri-entrepreneurship. They, however, caution that paddy based fish farming may be possible mainly in head portion of distributaries only, unless silt and infestation of wild grass and weeds in canals are cleared to meet irrigation target.

55. Singh, Soibam Khogen (Fisheries College and Research Institute, Thoothukudi – 628 008 (India)). Athithan, S. (Krishi Vigyan Kendra, VC&RI Campus, Namakkal – 637 002 (India)). Felix, N. (Associate Professor, Fisheries College and Research Institute, Thoothukundi-628008 (India)). Ratnakumar, K. (Fisheries College and Research Institute, Thoothukudi-628008 (India). Dept. of Fish Processing Technology). **Effect of partial replacement of marine fish oil with palm oil on the growth performance of *Catla catla* (Hamilton)**. Aquacult (India). (2009) v. 10(1) p. 1-9.

The present study was conducted for 60 days for substitution of marine fish oil (MFO) with palm oil (PO) in the diet of catla. Student's t-test confirmed that mean growth values of *Catla catla* showed significant difference between test diet T3 and control diet ( $p < 0.002$ ) and between test diet T4 and control diet ( $p < 0.002$ ). Two way ANOVA of the data collected affirmed that among the different test diets, the mean growth values showed no significant difference between the test diets except T1 & C ( $p < 0.03$ ). However, time bound variations showed significant difference. Different inclusion levels of palm oils in the test diets did not significantly affect the muscle proximate composition in terms of moisture, protein, lipid, ash and fibre when compared with the test groups and control. Thus, palm oil can be used to replace marine fish oil up to 25% in the diet without affecting the bio growth parameters and the cost of production per kg of diet will also be reduced than marine fish oil included diets.

56. Sivadas, M.; Bhaskaran M. M. (Calicut Research Centre of Central Marine Fisheries Research Institute, West Hill, Calicut – 673 005, Kerala (India)). **Stomach content analysis of the Indian mackerel *Rastrelliger kanagurta* (Cuvier) from Calicut, Kerala**. Indian Journal of Fisheries. (2009) v. 56(2) p. 143-146.

The food and feeding of the Indian mackerel *Rastrelliger kanagurta* was studied from Calicut based on 1,551 fishes ranging in size from 100 to 280 mm total length (TL) collected from both multi-day trawlers and ring net during the period January to December 2006. There was a preponderance of empty stomachs in all the months. The dominant food item was copepod. Sand and foraminiferans also formed part of the stomach content. The fish, *Bregmaceros* sp. was noticed for the first time in the adult mackerel.

57. Tiwari, Kunwer Ji (Prawn Research Center, University of Lucknow, Lucknow -226 007 (India). Department of Zoology). **Lead induced alterations in scaphognathite oscillations of fresh water prawn, *Macrobrachium dayanum* (Crustacea –Decapoda)**. Environment & Ecology (India). (2009) v. 27(1A) p. 330-333.

Fresh water prawn *Macrobrachium dayanum* were exposed to acute concentration, 116.46 mg/liter (96 h LC<sub>50</sub> value) and sub-acute concentration, 29.12 mg/liter (25% of 96 h LC<sub>50</sub> value) of lead nitrate to evaluate its effects on scaphognathite oscillations. Initially increase in scaphognathite oscillations were recorded while significant increase was noticed at final stage of experiments after both the exposures. Scaphognathite oscillations can be used as bio-marker to predict metal pollutions in water.

58. Ude, E. F. (Ebinyi State University, P.M.B. 053 Abakaliki (Nigeria) Department of Fisheries and Aquaculture). Oti, E. E. (Fisheries and Hydrobiology Unit, University of Nigeria, Nsukka (Nigeria) Department of Zoology). Mgbenka, B. O. (National Bureau of Fish Genetic Resources, Canal Ring Road, P.O. Dilkusha – 226 002 Lucknow, U.P.

(India). Nwani. C. D. (National Bureau of Fish Genetic Resources, Canal Ring Road, P.O. –Dilkusha, Lucknow-226002 (India)). **Evaluation of the cultivable and food fishes of Ebonyi river.** Aquacult (India). (2009) v. 10(1) p. 91-96.

Cultivable and food fishes of Ebonyi river was assessed by collecting fish species samples from four (4) stations of the river, using hooks and lines, cast nets, bag nets, gill nets and local traps from September 2006 to February 2008. Fish identification was done using taxonomic keys after they have been treated with 10% formalin. Results show the presence of 14 fish families and 39 species. Family Cichlidae has highest occurrence (24.2%), followed by Clariidae (20.3%) and the least is *Malapteruridae* (0.6%). The remaining 54.9% is made up of 11 families many of which are also of aquaculture importance. It is therefore concluded that the fish resource of the river has a potentially strong influence in the development of aquaculture, fisheries research and nutrition of the inhabitants of the State and its environs, if appropriate management strategies are put in place to conserve the fishery.

**59.** Vass, K. K. (Central Inland Fisheries Research Institute, Barrackpore, Kolkata, West Bengal (India)). **Central Inland Fisheries Research Institute (CIFRI) - major achievements.** Fishing Chimes (India). (2009) v. 29(1) p.22.

The author discussed about the major achievements of CIFRI. In this regard he indicated about contribution of river fisheries, reservoir fisheries, wetland fisheries, fishing environment and fishing resources.

**60.** Vass, K. K. (Central Inland Fisheries Research Institute (ICAR) Barrackpore, Kolkata, West Bengal (India)) **On enhancing fisheries of lakes and wetlands – in relation to their ecological attributes.** Fishing Chimes (India). (2009) v. 29(1) p. 37-44.

In this paper the author discussed about major categories of wetlands viz., Himalayan wetlands, Kashmir valley, Central Himalayan, Eastern Himalaya and Indo-Gangetic wetlands. He mentioned about ecological status. He also discussed about fish and fishery which includes trout, snow, mahseer and common carp fishery. He described with illustration regarding present yield, energy transfer and potential in relation to their ecological attribute.

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