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## **Effect of Dietary Protein and Feeding Time on Growth Performance and Feed Utilization of Post Larval Freshwater Prawn *Macrobrachium rosenbergii* (de Man 1879)**

M.A. Kabir Chowdhury, Ashraf M.A.S. Goda, Ehab R. El-Haroun, Mohamed A. Wafa and Shady A. Salah El-Din

A growth trial was conducted to investigate the effect of different dietary protein and feeding times on growth performance and feed utilization of freshwater prawn *Macrobrachium rosenbergii* Post-Larvae (PL). The experiment was conducted in outdoor concrete pens ( $6 \text{ m}^{-3}$ ) for 84 days. Post-larvae with an average weight of  $20.8 \pm 0.17 \text{ mg}$  were stocked at  $30 \text{ PL m}^{-3}$  in each pen. Two isocaloric ( $\sim 15.0 \text{ MJ DE kg}^{-1}$ ) test diets were formulated to contain two different dietary protein 35 and 40%. The daily feeding level was divided into equal two amounts and fed twice a day at three different feeding times (9:00; 12:00 h); (9:00; 15:00 h) and (9:00; 18:00 h). The highest survival rate, weight gain and specific growth rate ( $p \leq 0.05$ ) were observed for PL fed diet with 35% CP. The same trend was observed for PL fed with feeding time 9:00, 15:00 h. The PL fed diet containing 35% protein showed the highest ( $p \leq 0.05$ ) protein efficiency ratio, protein productive value, fat retention, energy retention and the better feed conversion ratio. Meanwhile, the PL fed at feeding time 9:00, 18:00 h recorded the better feed conversion ratio. No significant difference was shown for the effect of dietary protein on whole body moisture and protein contents. The highest whole body contents of crude fat and gross energy were observed for prawn fed the diet with 35% CP. However, PL fed at 9:00, 15:00 h had the highest whole body protein and lower fat contents ( $p \leq 0.05$ ). Irrespective of dietary proteins or feeding times, *M. rosenbergii* male recorded the better growth performance and feed utilization than female in all scenarios. The obtained findings revealed that *M. rosenbergii* PL fed the diet containing 35% CP at feeding time 9:00; 15:00 h is recommended to obtain optimum growth performance and feed utilization. (*Journal of Fisheries and Aquatic Science* 3 (1): 1-11, 2008; **Doi:** 10.3923/jfas.2008.1.11)

## **Phytoplankton Composition and Community Structure of Ariyankuppam Estuary and Verampattinam Coast of Pondicherry**

G. Ananthan, P. Sampathkumar, P. Soundarapandian and L. Kannan

Totally 156 species of marine phytoplankton were identified of which Diatoms formed the dominant group followed by Dinoflagellates, Blue Green and Greens.

Phytoplankton population density and species diversity were high during the summer season and were invariably sparse during the monsoon season at both the stations. Species richness and evenness of phytoplankton showed an inverse relationship with the dominance index. Distribution of chlorophyll a concentration closely followed the phytoplankton population density and gross primary productivity. Species composition, population density, primary productivity and chlorophyll a concentration was more in the coast due to higher number of autochthonous coastal marine species in addition to allochthonous species from the estuary. (*Journal of Fisheries and Aquatic Science* 3 (1): 12-21, 2008; **Doi:** 10.3923/jfas.2008.12.21)

### **Response of *Heterobranchus longifilis* Fingerlings to Supplemental Dietary Vitamin E**

M.O. Ibiyo Lenient, Job O. Atteh, James S. Omotosho and Chuka T. Madu

A study was conducted to determine the dietary vitamin E supplementation into a basal diet containing the common poultry premix as diet of *Heterobranchus longifilis* fingerlings. 0, 25, 50, 75, 100, 125, or 150 mg vitamin E kg<sup>-1</sup> diet as DL- $\alpha$ -tocopheryl acetate (Teva Pharmaceutical Industries, Petach Tikva) were fed to *H. longifilis* fingerlings initially averagely weighing 1.83 $\pm$ 0.06 for 12 week. Fish fed the basal diet were visually lighter in colour. Specific growth rate showed significant difference which was not significantly manifested in weight gain, feed consumed, feed efficiency and survival at the end of the trial as there was no significant difference in all levels with respect to these parameters. The Thiobarbituric Acid Reactive Substance (TBARS) of the liver, stored carcass and plasma however showed significant difference. Fish receiving the basal diet had significantly highest TBARS in both plasma and tissues. The haematological parameters also showed significant difference, while the Hb and PCV reflected the supplementation levels, the RBC and WBC showed no definite trend. Regression analysis of the liver TBARS data using the broken line model indicated a 112 mg vitamin E kg<sup>-1</sup> diet supplementation. It was concluded that for optimum performance of the liver and health of mud-fish fingerlings vitamin E supplementation is necessary whenever poultry premix is used in fish feed formulation. (*Journal of Fisheries and Aquatic Science* 3 (1): 22-30, 2008; **Doi:** 10.3923/jfas.2008.22.30)

## **Autoentrants and Fouling Problem on Growth, Survival and Production of Cage Reared White Shrimp *Penaeus indicus* (H. Milne Edwards) in Vellar Estuary**

P. Soundarapandian, P. Sivanadavel and T. Kannupandi

The present study was designed to find out the suitability of white shrimp, *Penaeus monodon* in the cages of Vellar estuary. In the previous experiments, the autoentrants and fouling were found to be disturbing the production and hence the present study deals with the controlling of this problem by changing the cages with fresh cages at regular intervals except control. Among the four uniform size rectangular cages (10×5×1.5 m) used, the first cage was treated as control, the second cage was changed at 15 days interval, the third cage was changed at 30 days interval and the fourth cage was changed at 60 days intervals. The culture was carried out for 120 days and the juveniles of size ranging from 3.3 to 4.0 g were stocked uniformly at the rate of 20 m<sup>-2</sup> for all the cages. In the cage changed at 15 days interval, the autoentrants and fouling species were found to be less. The maximum growth of 25.5 g, survival rate of 96% and production rate of 491.52 g m<sup>-2</sup> were recorded in the cage changed at the interval of 30 days. From the findings of the present study, it is suggested that the cage changed every 30 days regular interval is ideal for the higher production of *P. indicus*. (*Journal of Fisheries and Aquatic Science* 3 (1): 31-38, 2008; **Doi:** 10.3923/jfas.2008.31.38)

## **Use of Randomly Amplified Polymorphic DNA (RAPD) Analysis to Detect Genetic Variation in Sea Bass (*Dicentrarchus labrax*)**

Hesham Abdallah Hassanien

Genetic relatedness was estimated among five populations of the European sea bass (*Dicentrarchus labrax* L.) using 9 RAPD (Randomly Amplified Polymorphic DNA) primers. Samples were collected from Egyptian coast Mediterranean (Al Borge, Meadea and Rashid) and other two populations were from Manzalla lake and Bardawil lagoon. These primers produced 94 bands that could be scored with high confidence. On average, each primer gave rise to 6-16 bands and a majority of the bands was polymorphic. The percentage of polymorphic bands in Al-Borge (45%) and Meadea (44%) populations was low compared to Rashid (55%) and Manzalla (52%) populations. RAPD analysis showed that the Bardawil

population had higher genetic polymorphism (64%) than the other populations. The phylogenetic tree constructed by unweighted pair-group method of analysis (UPGMA) shows the Al-Borge and Manzalla populations and Meadea and Rashid populations, respectively, seems to be approximately as closely linked to each other from the dendrogram. The Bardawill population is more related to the Rashid and Manzalla populations. High levels of genetic variation and population differentiation indicated dynamic evolution in these populations as revealed by variation at RAPD loci. (*Journal of Fisheries and Aquatic Science* 3 (1): 39-46, 2008; **Doi:** 10.3923/jfas.2008.39.46)

### **Effect of Unilateral Eyestalk Ablation and Diets on the Growth of Freshwater Prawn Juveniles of *Macrobrachium malcolmsonii* (H. Milne Edwards)**

P. Soundarapandian

Effect of unilateral eyestalk ablation and diets on the growth of the juveniles of *Macrobrachium malcolmsonii* was studied. Weight gain of the eyestalk ablated juveniles fed with live foods, adult *Artemia* (8.41 g), earthworm (6.90 g) and oyster (6.54 g) was better than those fed with artificial feed I (5.18 g). Both in eyestalk ablated and intact control animals, adult *Artemia* induced higher weight gain; whereas the animals fed with artificial feed I showed the lowest weight gain. Feed consumption was higher when eyestalk ablated animals were fed with earthworm (13.92 g) and artificial feed II (13.73 g) than those feed with artificial feed I (11.63 g) and adult *Artemia* (12.12 g). However, feed consumption did not showed significant difference when eyestalk ablated animal fed with earthworm, feed II and oyster. The intact control animals consumed more earthworm (11.68 g) than oyster (10.51 g), adult *Artemia* (10.32 g) and artificial feed I (9.28 g). The eyestalk ablated prawns which were fed with adult *Artemia* showed the best FCR value (1.48) followed by oyster (2.02), earthworm (2.05) and artificial feeds I (2.38) and II (2.42). Similar pattern was evident in intact control prawns. The eyestalk-ablated animals fed with adult *Artemia* showed higher survival (75.6%) than those fed with earthworm (73.6%), oyster (72.8%), artificial feeds II (69.6%) and I (68.6%). Similar pattern was also observed in intact control juveniles. The present study clearly indicates that unilateral eyestalk ablation can be adapted in aquaculture practices of *M. malcolmsonii* juveniles as it yields high weight gain within a short period when compared to intact controls. (*Journal of Fisheries and Aquatic Science* 3 (1): 47-53, 2008; **Doi:** 10.3923/jfas.2008.47.53)

## **Duckweed (*Lemna minor*) as Supplementary Feed in Monoculture of Nile Tilapia, *Oreochromis niloticus***

M.M.R. Chowdhury, M. Shahjahan, M.S. Rahman and M. Sadiqul Islam

An experiment on duckweed (*Lemna minor*) as supplementary feed in monoculture of Nile tilapia (*Oreochromis niloticus*) was conducted for a period of 90 days. The experiment had two treatments each with three replications. In treatment-1 ponds were supplied with duckweed as supplementary fish feed and in treatment-2 ponds were kept as control (without supply of duckweed). Ponds were stocked at a stocking density of 80 fingerlings per decimal. The ponds were fertilized fortnightly with poultry dropping at the rate of 5 kg decimal<sup>-1</sup>, urea 60 g decimal<sup>-1</sup> and TSP 90 g decimal<sup>-1</sup>. Duckweeds were supplied to the ponds (treatment-1) at the rate of 60% of the total body weight (wet weight basis) of the fish. During the experimental period, the ranges of physico-chemical parameters viz., water temperature, transparency, dissolved oxygen, pH, total alkalinity, free CO<sub>2</sub>, PO<sub>4</sub>-P and NO<sub>3</sub>-N were within the productive limit and more or less similar in all the ponds under treatments 1 and 2. There were 27 genera of phytoplankton under five major groups and 11 genera of zooplankton under three major groups were found in the experimental ponds. Mean survival rates in treatments 1 and 2 were 94.37 and 93.75%, respectively. Specific growth rate (SGR, % per day) of the fish in treatments 1 and 2 were 1.16 and 0.80%, respectively. Calculated net production of the fish in treatment-1 was 16.28 kg decimal<sup>-1</sup> year<sup>-1</sup> and in treatment-2 was 8.92 kg decimal<sup>-1</sup> year<sup>-1</sup>. By t test it was found that the net production of fish in treatment-1 was significantly (p<0.05) higher than that of treatment-2. (*Journal of Fisheries and Aquatic Science* 3 (1): 54-59, 2008; *Doi*: 10.3923/jfas.2008.54.59)

## **Proximate Composition of the Eggs of Commercially Important Crab *Portunus sanguinolentus* (Herbst)**

P. Sounndarapandian and Shuvra Shankar Dey

The crab fishery in India is fast developing and there is a vast scope for crabmeat and also crab eggs due to their delicacy and nutritional richness. In the present investigation an attempt has been made to know the biochemical composition of matured eggs of *Portunus sanguinolentus*. The protein content was found to be 59.70% followed by lipid (21%) and carbohydrate (7.58%). The total values of saturated fatty acids in crab eggs were calculated as 34.65%. Among various saturated fatty acids recorded, the amount of palmitic acid (27.08%) was

maximum and capric acid was (0.09%) minimum. The total amount of monounsaturated fatty acids was found to be 1.36%. Higher amount of monounsaturated fatty acid was nervonic acid (0.52%) and less was myristoleic acid (0.13%). The total amount of polyunsaturated fatty acids was calculated as 17.97%. Maximum amount of polyunsaturated fatty acid was reported to be linolelaidic acid (9.65%) and minimum was eicosapentaenoic acid (0.12%). From the present study, it is confirmed that the percentage of protein is highest among the biochemical constituents and the percentage of saturated fatty acid is highest among all the fatty acids studied in the matured eggs of *P. sanguinolentus*. Further study is needed to know which biochemical constituents and fatty acids are fairly utilized during embryogenesis and larval development. For this investigation one should study the biochemical changes of different stages of embryogenesis and larval development. (*Journal of Fisheries and Aquatic Science* 3 (1): 60-65, 2008; **Doi:** 10.3923/jfas.2008.60.65)

### **Comparative Evaluation of Efficacy and Cost of Synthetic and Non-Synthetic Hormones for Artificial Breeding of African Catfish (*Clarias gariepinus* Burchell, 1822)**

O.T. Adebayo and O.M. Popoola

The efficacy and cost of utilization of the pituitary extract of African bull frog (*Rana adspersa*) (FPE) and *Clarias gariepinus* (CPE) and *Ovaprim* in the artificial breeding of the African catfish *Clarias gariepinus* was compared. The extraction and dosage are discussed along side the preliminary rearing of fries in the outdoor hatchery tanks. Three *C. gariepinus* were injected with 0.5 mL of *Ovaprim* in one dose while the remaining six were injected with the pituitary extract of frog (*Rana adspersa*) and *C. gariepinus* pituitary extract in one dose at the rate of 1 mL kg<sup>-1</sup> of the glands. *C. gariepinus* injected with *Ovaprim* had the highest percentage fertilization (84.5%) which was significantly different from other treatments. Percentage hatchability was high and ranged from 51.5-73.0% in the different hormones treatments. The percentage hatchability shows similar pattern to percentage fertilization and latency period was 12 h for all the treatments. The cost of production was highest in CPE followed by *Ovaprim* and least in FPE and were significantly different ( $p < 0.05$ ) from one another. The results show that the synthetic hormone (*Ovaprim*) is more effective than the Frog Pituitary Extract (FPE) and *Clarias* Pituitary Extract (CPE). (*Journal of Fisheries and Aquatic Science* 3 (1): 66-71, 2008; **Doi:** 10.3923/jfas.2008.66.71)

## **Change of Fish Fauna and Long-term Dynamics of the Harvest of Aquatic Product in a Large Shallow Lake (Lake Taihu, China)**

Yafen Chen and Songquan Zhu

A survey on fish fauna in Lake Taihu carried out from March 2002 to December 2003 revealed that an obviously succession of fish fauna has occurred over the past 50 years. There was only 48 fish species belonging to 15 families found in the survey. Most of large and medium-sized fish species and the carnivorous fish species were either extinct or on the verge of extinction, whereas small-sized fish species, such as lake anchovy *Coilia ectenes*, became dominant in the lake. The harvest of aquatic product in the lake increased from 4060.7 tons in 1952 to 30516.5 tons in 2002, which was highest annual yield up to now. The small-sized fish accounted for most of the yield. (*Journal of Fisheries and Aquatic Science* 3 (1): 72-76, 2008; **Doi:** 10.3923/jfas.2008.72.76)

## **Activity of Hyperglycemic Hormone in the Eyestalk of Commercially Important Crab *Portunus pelagicus* (Linnaeus)**

S. Velmurugan, P. Soundarapandian N. John Samuel and S. Rajagopal

The role of hyperglycemic hormones in the eyestalk ablated and intact control crabs of *Portunus pelagicus* were studied in relation to various external stimuli. The eyestalk ablated crabs showed lesser free and reducing sugar levels and also lesser haemolymph glucose levels than the intact control crabs. The ablated crabs showed considerably higher glucose levels than the normal crabs when injected with eyestalk extract (CHH). However, the ablated crabs showed lesser glucose levels than the intact control crabs when exposed to chloroform stress. The polyacrylamide gel electrophoresis bands of crude eyestalk extracts and purified extracts showed a much similar pattern of banding and protein nature. (*Journal of Fisheries and Aquatic Science* 3 (1): 77-81, 2008; **Doi:** 10.3923/jfas.2008.77.81)

## **Effect of Unilateral Eyestalk Ablation on the Biochemical Changes of Edible Portunid Crab *Charybdis lucifera* (Fabricius)**

R. Murugesan, P. Soundarapandian and K. Manivannan

In the present study was aimed to know the effect of eyestalk ablation on the biochemical composition of the crab, *Charybdis lucifera*. After 3 days of



experimental period, proximate composition was estimated both control and eyestalk ablated crabs. The protein content of unilaterally eyestalk ablated (68.97%) crabs was higher than that of control crabs (41.64%). Carbohydrate content of eyestalk-ablated crabs (1.45%) was relatively higher when compared to intact control crabs (1.42%). The lipid content of the present study was also higher in eyestalk-ablated crabs (1.85%) rather than intact control crabs (1.65%). In the present study the values of saturated fatty acids for eyestalk ablated and intact control crabs were 26.32 and 25.89%, respectively. The mono saturated fatty acids in eyestalk-ablated crabs were 0.76% and control crabs were 0.48%. However, the polyunsaturated fatty acids were 11.63% in eyestalk ablated and 5.8% in intact control crabs. From the present study, it could be confirmed that eyestalk ablation influenced protein, carbohydrate and lipid content of the crab, *C. lucifera*. It also effectively influenced saturated and unsaturated fatty acids as evidenced by higher values in eyestalk ablated crabs rather than control crabs. (*Journal of Fisheries and Aquatic Science* 3 (1): 82-86, 2008; **Doi:** 10.3923/jfas.2008.82.86)

### **Reoccurrence of *Salmo trutta macrostigma* (Duméril, 1858) in Lake Sapanca Basin (Sakarya, Turkey): Implications for Conservation**

Ali Serhan Tarkan, Özcan Gaygusuz, Müfit Özuluğ and Çiğdem Gürsoy Gaygusuz

*Salmo trutta macrostigma* is a freshwater fish species, which is very important in terms of biodiversity and economic utilization. The present study aims to study the reoccurrence and conservation of *S. t. macrostigma* in Lake Sapanca Basin (Sakarya, Turkey) during 2006. It has only once been reported from Lake Sapanca Basin in 1943. This fish species was not found until 2006, when a single specimen was found during routine and follow-up surveys. The mesural and meristic characters of the specimens were similar to those reported elsewhere for the species. Conservation needs and threats for the species are discussed. (*Journal of Fisheries and Aquatic Science* 3 (1): 87-91, 2008; **Doi:** 10.3923/jfas.2008.87.91)

### **Secondary Microbial Infection in *Ilisha melastoma* Due to Isopod Fish Parasites**

S. Ravichandran and T.T. Ajithkumar

Parasitation of isopod, *Joryma brachysoma* was observed in *Ilisha melastoma* collected from fish catches off Parangipettai coastal environment, southeast coast

of India. In parasitized fish skin lesions were observed in the gill and body surface due to the attachment of parasite. In the lesioned spots a heavy load of Total Heterotrophic Bacteria was observed. *Vibrio parahaemolyticus* and *V. anguillarum* were abundant at the site of parasitic lesion. The microbial load in the parasitized fish was significantly higher. Cenocytic fungal pathogens were also isolated from the lesioned sites. (*Journal of Fisheries and Aquatic Science* 3 (1): 92-96, 2008; **Doi:** 10.3923/jfas.2008.1.11)

### **Fattening of the Blue Swimming Crab *Portunus pelagicus* (Linnaeus)**

P. Soundarapandian and S. Dominic Arul Raja

In the present study, two types of experiments were conducted. First experiment was designed to know the optimum salinity and second experiment was to know the suitable live feeds for fattening. They were kept in different salinities (20, 25, 30 ppt). Weight gain of the crab's cultured in 30 ppt (58.3 g) was significantly higher than 20 (49.6 g) and 25 ppt (52.3 g) and also the shell hardens in shorter duration (11.6 days). Hence 30 ppt salinity was selected as optimum salinity for further experiment. After knowing the salinity 3 different live feeds viz., oyster, clam, trash fish were offered individually. Fourth feed was offered in combined manner. Proximate analysis was also performed for feeds used in the present study. Weight gain was higher when the water crabs were fed with mixed feed (59.00 g). The shell hardening duration (11.6 days) also shorter when compared to other feeds. From the present study 30 ppt salinity was optimum and mixed feed is suitable feed for fattening of *P. pelagicus* as evidenced by shorter duration and higher weight gain. (*Journal of Fisheries and Aquatic Science* 3 (1): 97-101, 2008; **Doi:** 10.3923/jfas.2008.97.101)

### **Seasonal Variations of Phytoplanktonic Community Structure and Production in Relation to Environmental Factors of the Southwest Coastal Waters of Bangladesh**

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The present study was carried out to monitor the plankton community structure and productivity, its diurnal and seasonal variations and the influence of physico-chemical factors in the Shibsha River of the southwest coast of

Bangladesh from July 2004 to June 2005. A total of 31 phytoplankton species were identified; 17 belong to Bacillariophyceae, seven to Cyanophyceae, five to Chlorophyceae and two to Dinophyceae. Bacillariophyceae appeared to be the dominant group in terms of total species and cell numbers during the period studied. The over all phytoplankton production was significantly ( $p < 0.05$ ) higher in June ( $175.8 \times 10^3$  cells  $L^{-1}$ ) and lower in September ( $12.0 \times 10^3$  cells  $L^{-1}$ ) attributed to low temperature. Phytoplankton diversity declined to the lowest level in winter and there was a positive correlation with water temperature. The number of phytoplankton species was high (26) in June and quite low (11) in December. Nutrient concentrations including nitrate and phosphate were significantly ( $p < 0.05$ ) higher in summer, while lower values recorded in winter. The lowest and highest concentration of Nitrate-Nitrogen ( $NO_3-N$ ) and Phosphate-Phosphorus (PO<sub>4</sub>-P) were 0.7, 0.3, 1.9 and 0.9  $mg^{-1}$ , respectively. (*Journal of Fisheries and Aquatic Science* 3 (2): 102-113, 2008; *Doi*: 10.3923/jfas.2008.102.113)

### **The Fishery and Bionomics of the Swimming Crab, *Callinectes amnicola* (DeRocheburne, 1883) from a Tropical Lagoon and its Adjacent Creek, Southwest, Nigeria**

Babatunde Eniola Emmanuel

The fishery and the bionomics of the swimming crab *Callinectes amnicola* from Lagos lagoon and its adjacent creek, south-west Nigeria was investigated from October 2003 to March 2004. The results indicate that the lift net was highly selective for the crab. The wire basket trap was more tedious to operate because of the fencing and gear fixing techniques that are needed for proper installation. The longevity of the wire trap was 3 to 3½ months. The Catch Per Unit Effort (CPUE) (number of crabs per traps) ranged between 2.5 and 15 crabs for lift nets; between 5.6 and 17 crabs for wire basket traps. *C. amnicola* were more abundant at depth 1.5 and 2.0 m in the lagoon. The maximum size of crab from the lagoon catch and creek was 16.6 cm with a weight of 348.5 g. The crab exhibited positive allometric growth. The condition factor was higher in males than females and increased in crab size. The fecundity ranged between 1,148 and 736,266 eggs, the average number of eggs per females was 141,290. Male: Female ratio was 1:0.39. A larger proportion of stomachs from the samples contained food (80.8%) with very few (19.2%) with empty stomach. The major food items were molluscs and crustaceans, apart from fishes and algal filaments which formed only between 0.4 and 4.0% of the food of *C. amnicola* from the lagoon and the creek. There was no variation in the feeding habits in relation to size. (*Journal of Fisheries and Aquatic Science* 3 (2): 114-125, 2008; *Doi*: 10.3923/jfas.2008.114.125)

## **Inhibition of Actinomycetes to Histamine Producing Bacteria Associated with Indian Mackerel Fish (*Rastrelliger kanagurta*, Cuvier, 1816)**

Milan Choudhury, Maloy Kumar Sahu, K. Sivakumar, T. Thangaradjou and L. Kannan

Actinomycetes and Histamine Producing Bacteria (HPB) were isolated and identified from the Indian mackerel fish, *Rastrelliger kanagurta* from three different parts viz., skin with muscle, gills and gut. Among the three parts, gill harboured the highest number of actinomycetes ( $2.9 \times 10^5$  cfu g<sup>-1</sup>) and HPB ( $2.47 \times 10^5$  cfu g<sup>-1</sup>) than the other parts. At the same time, the fish harboured more number of actinomycetes than HPB. During the present investigation, a total of 29 HPB strains were isolated and identified as *Bacillus* sp., *Pseudomonas* sp., *Vibrio* sp. and *Aeromonas* sp. Among them, *Pseudomonas* sp. contributed more (45%) followed by *Vibrio* sp. (22%), *Bacillus* sp. (20%) and *Aeromonas* sp. (13%) in all the three parts of fish. In the present investigation, 41 strains of actinomycetes also isolated and all belonged to the genus, *Streptomyces*. Out of these 41 strains, 32 strains showed inhibitory activity to one or more HPB at varying levels. Among them, 3 strains viz., ASP-2, ASP-11 and ASP-15 showed good inhibitory activity against all 4 HPB and these 3 actinomycete strains (ASP-2, ASP-11 and ASP-15) were tentatively identified as *S. aureofasciculus* (ASP-2), *S. chattanoogenesis* (ASP-11) and *S. hawaiiensis* (ASP-15). The study indicates that the actinomycetes could be used to control HPB. (*Journal of Fisheries and Aquatic Science* 3 (2): 126-136, 2008; **Doi:** 10.3923/jfas.2008.126.136)

## **South Indian Technology of Nursery Farming for Better Survival and Production of *Macrobrachium rosenbergii* (De Man)**

P. Soundarapandian and A. Kannan

In the present study, the nursery culture was practiced in 4 different farms (A, B, C and D). The salinity was ranging between 0-4 ppt and alkaline pH (7.0-8.3) was maintained by adding lime in all 4 ponds. The temperature fluctuations were not beyond the optimum (26-32°C) and the dissolved oxygen level was ranging between 3.5 to 6.5 ppm throughout the culture period in all four farms. Optimum

transparency (31-42 cm) was maintained throughout study period. The food conversion ratio of the present study ranges from 1:1.23 to 1:1.47. The survival rates of farms A, B, C and D were 78, 83, 80.32 and 81%, respectively. The maximum average body weight of 22.0 g in male population and 19.70 g in female population was reported in farm A, where the crop pattern is 5 seeds/m<sup>2</sup>/110 days. Whereas in farms B, C and D the crop pattern was 11 seeds/m<sup>2</sup>/70 days, 15 seeds/m<sup>2</sup>/70 days and 20 seeds/m<sup>2</sup>/70 days, respectively. The average body weight of females in the farms B, C and D are 4.16, 5.30 and 3.75, respectively. In farm A, all the female's population with the average body weight of 19.70 g was sold out in good price. The total (482 kg) production also high in farm A where as B, C and D farms it was 85, 277.38 and 280.62 kg, respectively. Extension of nursery culture up to 110 days, proper water quality and feeding management in nurseries and low stocking density are reported to get the maximum growth and total production in farm A. This is highly profitable business those who are maintaining their own ponds. The nursery culture period in farms B, C and D was 70 days. The male production in farms B, C and D were 7,400, 20,060 and 24,652 numbers, respectively. So, the culture period of 70 days and semi-intensive type of culture is found more profitable for male scampi seed selling farmers. (*Journal of Fisheries and Aquatic Science* 3 (2): 137-144, 2008; **Doi:** 10.3923/jfas.2008.137.144)

### **Distribution of Putative Virulence Genes in *Aeromonas hydrophila* and *Aeromonas salmonicida* Isolated from Marketed Fish Samples**

I. Seethalakshmi, R. Subashkumar and P. Saminathan

The study sought a prevalence of virulent *A. salmonicida* and *A. hydrophila* in marketed fish samples by the molecular methods. A significant score of incidences (31.25 and 15.6% of *A. salmonicida* and *A. hydrophila*, respectively) were recorded and more diversification among the isolates based on their availability. It is important threat to the people who are consuming contaminated fish and other seafoods. Existence of putative virulence genes *hlyA* and *aerA* provides evidence for multifactorial activities, which is encoded by the virulence factors like haemolysin and aerolysin and thus has the potential pathogenic. It was apparent that representatives of the four genotypes (*hlyA*<sup>+</sup> *aerA*<sup>+</sup>, *hlyA*<sup>-</sup> *aerA*<sup>+</sup>, *hlyA*<sup>-</sup> *aerA*<sup>-</sup> and *hlyA*<sup>+</sup> *aerA*<sup>-</sup>) were detected. The role in assessing *Aeromonas* influences on adverse public health is warranted. (*Journal of Fisheries and Aquatic Science* 3 (2): 145-151, 2008; **Doi:** 10.3923/jfas.2008.145.151)

## **Probiotic Performance on Fish Fry during Packing, Transportation Stress and Post-transportation Condition**

A. Jesu Arockia Raj, A. Victor Suresh, K. Marimuthu and S. Appelbaum

An experiment was conducted to determine whether the application of probiotic after transportation provides the same benefit of probiotic application prior to/during transportation in improving fry survival and growth. Fry of the Indian major carp *Catla catla* were stocked into 2 tanks (capacity: 2000 L) for conditioning. During this time one tank was treated with probiotic at the rate of 10 ppm for 2 h. The other tank was not treated with probiotic. The fry from both treatment and control tanks were packed in plastic bags at a packing density of 400 fry L<sup>-1</sup>. The fry that previously received probiotic treatment were packed in water containing probiotic whereas the fry from the control tank was packed in water without probiotic. The bags were transported to the laboratory and unpacked after 13 h. Treatment with probiotic resulted in higher survival (98.4%) whereas fry not treated with probiotic had a mean survival of 92.5%. Post-transportation, the fry in each bag were stocked in individual, shallow, plastic tanks at a density of 25 fry L<sup>-1</sup> and reared for five days. The fry that were administered probiotic during transportation were either treated with probiotic or not treated during this period. Similarly, the fry that were not administered probiotic during transportation, were either treated with probiotic or not treated. Wherever applicable, probiotic was added at the rate of 10 ppm per day after water exchange, but before first feeding. They were fed *ad libitum* three times per day. Fry that were treated with probiotic throughout the trial gave the highest survival (95.2%) and growth (mean final weight = 1060 mg). (*Journal of Fisheries and Aquatic Science* 3 (2): 152-157, 2008; **Doi:** 10.3923/jfas.2008.152.157)

## **Population Genetic Structure of Stellate Sturgeon (*Acipenser stellatus* Pallas, 1771) in the South Caspian Sea Using Microsatellite Markers**

M. Norouzi, M. Pourkazemi, A. Keyvan, S.M.R. Fatemi and B. Kazemi

In this study, 197 samples of adult stellate sturgeon from four fishery regions were collected. DNA was extracted using 15 pairs of microsatellite primers, Polymerase Chain Reaction (PCR) was conducted. DNA bands were analyzed using Biocapt and GenAlex software package. Out of 15 microsatellite primers, 11 loci were produced, in which 10 of them were polymorphic and 1 monomorph. Analyses revealed that average of 13 alleles per locus (range 8 to 18 alleles per locus).

Average observed and expected heterozygosity were 0.650 and 0.855 and significant genetic differences between 4 regions were observed ( $p \leq 0.01$ ). Deviations from Hardy-Weinberg equilibrium were in most cases. Maximum genetic difference were observed between regions 2 and 4 ( $F_{ST} = 0.063$ ,  $N_m = 3.728$ ). These results indicate that at least, 3 populations of stellate sturgeon exist in the South Caspian Sea. Population of stellate sturgeon in region 2 where Sefidrud drainage is located was consider as independent population, therefore management of this unique stocks for restocking and conservation of gene pools is highly recommended. (*Journal of Fisheries and Aquatic Science* 3 (3): 158-166, 2008; **Doi:** 10.3923/jfas.2008.158.166)

## **A Checklist of Phytoplankton Species of the Iyagbe Lagoon, Lagos**

I.C. Onyema

The phytoplankton diversity of the Iyagbe lagoon, Lagos was investigated from October, 2004 to September, 2006. Seven main algal groups were recorded namely: Bacillariophyta, Cyanophyta, Chlorophyta, Euglenophyta, Pyrrophyta, Chrysophyta and Rhodophyta. A total of 129 species belonging to 64 genera were observed. Diatoms formed the most abundant group making up 90 species from 39 genera. This was followed by the cyanobacteria with 19 species from nine genera, the green algae with 10 species from eight genera, the euglenoids with four species from three genera, the dinoflagellates with three species from two genera, the chrysophytes with two species from two genera and the red algae represented by one species. Comparatively, a higher number of species was recorded in the dry than in the wet season. 18 species of diatoms, nine species of cyanobacteria, four species of euglenoids and green algae each, one species of dinoflagellates, red algae and chrysophytes each, are first reports for south-western Nigeria with regard to existing checklists in the region. (*Journal of Fisheries and Aquatic Science* 3 (3): 167-175, 2008; **Doi:** 10.3923/jfas.2008.167.175)

## **Comparison Studies on Water Quality and Plankton Production Between Perennial and Non-Perennial Ponds in Bangladesh**

Md. Yeamin Hossain, Mohammad Mustafizur Rahman, Saleha Jasmine, Abu Hanif Md. Ibrahim, Zoarder Faruque Ahmed, Jun Ohtomi, Mohamed A.H. El-Kady and Bernerd Fulanda

The present study was conducted to compare the water quality and plankton availability between perennial and non-perennial ponds in Bangladesh for a period

of six months during October 2004 to March 2005. All water quality parameters in perennial ponds were statistically different ( $p < 0.05$ ) than that of non-perennial ponds except temperature. Free  $\text{CO}_2$ , total alkalinity, pH and transparency were greater in the perennial ponds than that of non-perennial ponds, whereas an opposite result was observed in case of DO concentration. In general, water quality in the perennial ponds was more suitable for aquaculture than that of non-perennial ponds. Total phytoplankton and zooplankton availability were also greater in perennial ponds than that of non-perennial ponds. Absence or presence of aquatic macrophytes was the main cause of the water quality and plankton availability variation between perennial and non-perennial ponds. The present study suggests that non-perennial ponds will be suitable for aquaculture if aquatic macrophytes are removed. (*Journal of Fisheries and Aquatic Science* 3 (3): 176-183, 2008; **Doi:** 10.3923/jfas.2008.176.183)

### **Aspects of the Ecology and Fishes of Badagry Creek (Nigeria)**

Julius I. Agboola, Martins A. Anetekhai and Abiodun A.B. Denloye

To ascertain the ecological state of Badagry creek, Lagos, Nigeria, some physico-chemical parameters, heavy metals concentration in water and bottom sediments were analyzed and its fish composition determined. Monthly values of temperature, pH, acidity, turbidity, salinity, TDS, COD,  $\text{NH}_3$  and  $\text{NO}_3$  were significantly different over a period of six months ( $p < 0.05$ ). There were no significant variations in colour, alkalinity, BOD, DO and  $\text{PO}_4$  values with the sampling periods. However, colour, temperature, alkalinity, BOD and COD values were significantly different across the sampling stations. Higher values obtained for BOD and COD at Station D (Ajido) than other stations suggests anthropogenic organic loadings on this axis of the creek. Salinity values showed highly significant correlation with TDS, BOD and COD and equally revealed Badagry creek as an estuary. N:P ratio was not statistically significant across the stations and sampling periods. Heavy metals (Hg, Ni, Cr, Cd, Ar and Se) concentrations were Not Detected (ND) in water. With the exception of Cu, there were no significant variations in other heavy metals concentration with the sampling stations, however, within the sampling periods, only Cu and Mn showed no significant variation in concentration. Bottom sediments concentrations of heavy metals (Fe, Cu, Cr, Pb, Mn and Ni) and (Cd, Pb, Fe and Ni) were statistically significant with the sampling periods and sampling stations respectively. Mercury (Hg) was not detected. Biological survey of fish species yielded 1614 samples of the fish population comprising 28 families, 34 genera and 37 species. Percentage relative abundance of species was highest for *Chrysichthys nigrodigitatus* (15.74%), *Ethmalosa fimbriata* (15.55%) and *Tilapia zilli* (8.55%). (*Journal of Fisheries and Aquatic Science* 3 (3): 184-194, 2008; **Doi:** 10.3923/jfas.2008.184.194)



## **The Contributions of Environmental and Haematological Factors to the Distributions and Estimations of *Eustrongylides africanus* Larvae Densities in *Clarias gariepinus* and *Clarias anguillaris* from Bida Floodplain of Nigeria**

T.I.I. Ibiwoye, R.A. Ogunsusi, A.M. Balogun and J.J. Agbontale

The contributions of environmental and haematological factors to the distributions and estimations of *Eustrongylides africanus* larvae densities in *Clarias gariepinus* and *C. anguillaris* from Bida floodplain of Nigeria were investigated. The environmental factors making the most important contributions to the distributions of *E. africanus* larvae infection in *Clarias* species are rainfall, soil pH, water conductivity, sunshine and silt-clay; in descending order of magnitude; having the manifestation for the months of January, March and June by the year being closely related. The haematological factors making the most important contributions to the distributions of *E. africanus* larvae infections in the two species are Mean Corpuscular Haemoglobin Concentration (MCHC), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Volume (MCV) and neutrophils count, in descending order of magnitude; having the manifestations for the months of January, March, September and December of the year being closely related. Six and five environmental (sand, silt-clay, soil pH, water turbidity, dissolved oxygen and total phosphate content) and haematological (neutrophils, lymphocytes and eosinophils counts; MCH and MCV) factors, respectively, having positive or negative correlation coefficient ( $r$ ) between 0.50 and 0.85 contributed to the estimations of *E. africanus* larvae densities in the wild population of *Clarias* species in Bida floodplain. The relevance of these results in quick estimations of the distribution and density of parasites in fish is discussed. (*Journal of Fisheries and Aquatic Science* 3 (3): 195-205, 2008; *Doi*: 10.3923/jfas.2008.195.205)

## **Economic Performance of Fish Based Farming Systems in Bangladesh**

Shuraya Tasnoova, Khan M. Iqbal, Izumi IWAMOTO and M. Mahfuzul Haque

Bangladesh has 10.4 million hectare of rice field which can be used for fish culture either in con-current or alternate with paddy production and such system of paddy and fish improves productivity and profitability. The present study was carried out to investigate the economic performance of fish based farming systems such as:

Alternate-Rice-Fish (A-R-F), Rice-Cum-Fish (R-C-F) and Only-Rice-Farming (O-R-F). A total of 90 farmers were selected randomly where 30 from each of the farming systems for this study. Total return was highest for A-R-F farming than R-C-F and O-R-F which was calculated Tk.123,300, Tk.62,000 and Tk.31,725, respectively and the total cost also higher for A-R-F farming (Tk.42,599) than R-C-F (Tk.28,525) and O-R-F (Tk.19,569). Net return was also higher for A-R-F farming (Tk.80,701) than R-C-F (Tk.33,475) and O-R-F (Tk.12,156). To compare the net return of A-R-F farming was more than two times higher than the R-C-F farming and more than six times higher than the O-R-F and the net return for R-C-F farming was more than two times higher than the O-R-F farmers. It means that the net return ratio for A-R-F farming is quite high compared to R-C-F and O-R-F farmers and the R-C-F farming is more profitable than the O-R-F. The high profitability of A-R-F and R-C-F farming shown the good performance of fish based farming systems. (*Journal of Fisheries and Aquatic Science* 3 (3): 206-212, 2008; *Doi*: 10.3923/jfas.2008.206.212)

### **The Spatial Distribution of Fish Species Catches in Relation to Catchment and Habitat Features in the Floodplain Lot Fisheries of Tonle Sap Lake, Cambodia**

Nguyen T. Hai Yen, Kengo Sunada, Satoru Oishi, Yasusi Sakamoto, Kou Ikejima and Tomaya Iwata

The Tonle Sap Lake area in the lower part of the Mekong River basin is the largest wetland in Southeast Asia. It contributes about 60% of the total inland fish catch of Cambodia. The floodplain fish production is an important contributor to the total catch, about 10-12 thousand tons annually from 344,308 hectares on 31 fishing lots during 1995-1999, with an average productivity of 30 kg ha<sup>-1</sup>. Mapping the spatial distributions of some dominant species including *Channa micropeltes* (19%), *Channa marulius* (10%), *Trichogaster microlepis* (8%), *Pangasius hypophthalmus* sp. (7%), *Cyclocheilichthys enoplos* (5%) would support the Cambodian fisheries managers to locate the proper protected area for each specific species. The positive correlations ( $p < 0.05$ ) between *Channa micropeltes*, *Pangasius hypophthalmus*, *Cyclocheilichthys enoplos* and *Channa marulius* and the permanent water area, the inundated shrub and/or grass lands indicated the habitat preference of these species. The positive or negative correlations ( $p < 0.05$ ) between species *Channa micropeltes*, *Channa marulius*, *Pangasius hypophthalmus* sp. and *Hynicorhynchus* sp. with inundated forest, grassland, agricultural land, population, cambisol, gleysol and/or fluvisol among 29 catchment parameters indicated that these species were sensitive in responses

to those catchments parameters and would significantly support the catchment management strategy. (*Journal of Fisheries and Aquatic Science* 3 (4): 213-227, 2008; **Doi:** 10.3923/jfas.2008.213.227)

### **True Electrotaxis and Threshold Voltages in the American Crayfish *Procambarus clarkii***

Ahmadi, Gunzo Kawamura, Miguel Vazquez Archdale and Kazuhiko Anraku

Experiments were conducted to obtain detailed information on the behavioral responses of American crayfish, *Procambarus clarkii* to DC electric stimuli in the form of voltage gradients. Four different arrangements of electrodes producing different electric fields were tested in both indoor and outdoor tanks. The electrical intensity used was varied from 0.02 to 0.46 V cm<sup>-1</sup>. We determined two threshold voltages: threshold voltage I, which induced parallel orientation of the animal to the electric field and forward crawling toward the anode (0.04-0.10 V cm<sup>-1</sup>) and threshold voltage II, which induced flicking of the tail and backward swimming toward the anode (0.12-0.16 V cm<sup>-1</sup>). The crayfish that displayed true electrotaxis moved to the anode when stimulated within the space enclosed by the electrodes. However, when the electrodes were elevated 5 or 10 cm off the bottom of the tank, the crayfish moved to the anode, crawled through the gap beyond it and out of the electric field. This movement beyond the anode cannot be explained by positive electrotaxis, but it can be interpreted as repulsion from the cathode. Anodal movement was most effective at 0.24-0.30 V cm<sup>-1</sup> in the indoor tank and from 0.16-0.24 V cm<sup>-1</sup> in the outdoor tank. The crayfish suffered electronarcosis when stimulated at 0.32-0.46 V cm<sup>-1</sup> in the indoor tank and at 0.28-0.46 V cm<sup>-1</sup> in the outdoor tank. They recovered from narcosis several minutes after the electric current was switched off. Thus, crayfish can be herded into a trap or net when stimulated by direct current of 0.24-0.30 V cm<sup>-1</sup>, taking care not to induce electronarcosis. (*Journal of Fisheries and Aquatic Science* 3 (4): 228-239, 2008; **Doi:** 10.3923/jfas.2008.228.239)

### **Seasonal Diet Shift of the Most Important Fish Species in a Sahelo-Soudanian Reservoir (Burkina Faso)**

Adama Ouéda, Wendengoudi Guenda, Allassane Ouattara, Germain Gourène, Bernard Huguény and Gustave B. Kabré

Fish diet, feeding patterns and trophic interactions were studied according to season in a Sahelo-Soudanian man-made lake (Loumbila, Burkina Faso). Some

food resources (zooplankton and benthic fauna) were also sampled. An examination of 425 non-empty stomachs belonging to 6 species showed that *Auchenoglanis occidentalis*, *Clarias anguillaris* and *Schilbe intermedius* varied their diets and feeding strategies from one season to another. These species adapt their feeding strategies to the seasonal food availability. The three other species (*Brycinus nurse*, *Oreochromis niloticus* and *Tilapia zillii*) showed constant specialisation in the same prey items. Diets overlaps were low during the wet season and Resource Breadths more or less higher. Thus diminution in food availability in the dry season appears to induce shortage of resources used by individuals and by whole populations, leading to an increased likelihood of competition between species. The changes in fishes feeding patterns within the year are an adaptive response to change in food availability and allow fish communities to make better use of available resources. (*Journal of Fisheries and Aquatic Science* 3 (4): 240-251, 2008; **Doi:** 10.3923/jfas.2008.240.251)

### **Age, Growth, Mortality and Yield per Recruit of the Filefish *Stephanolepis diaspros* (Fraser-Brunner, 1940) (Pisces: Monacanthidae), in the Gulf of Suez, Egypt**

Azza A. EL-Ganainy and Manal M.M. Sabra

The filefishes Monacanthids have a relatively high occurrence in the trawl landings of the Gulf of Suez, representing about 7% of the total trawl catch. The leasarjaket filefish *Stephanolepis diaspros* is the most abundant filefish in the area. In the present work the population structure of *S. diaspros* was studied. Samples were collected from the commercial trawl catches during the period from November 2004 till March 2007. The anterior dorsal spine was used for age determination. Validation of the ageing method was carried out by analyzing the monthly length frequency distributions. The life span was found to be four years. The estimated von Bertalanffy growth parameters from the dorsal spine age reading were  $L_{\infty} = 27.83$  cm,  $K = 0.350$  year<sup>-1</sup> and  $t_0 = -0.499$ . The values of natural mortality (M), total mortality (Z) and fishing mortality rates were 0.702, 1.88 and 1.18 year<sup>-1</sup>, respectively. Results of the exploitation rate (E = 0.628) and relative yield per recruit showed that the filefish resource in the Gulf of Suez is overexploited and that juvenile individuals are the target of the fishery. Some implications for the fishery management were proposed. (*Journal of Fisheries and Aquatic Science* 3 (4): 252-260, 2008; **Doi:** 10.3923/jfas.2008.252.260)

## **Growth Performance and Postprandial Metabolic Responses of Southern Catfish (*Silurus meridionalis* Chen) Fed Formulated Feed and Loach Flesh**

Shi-Jian Fu, Zhen-Dong Cao and Jiang-Lan Peng

Growth and postprandial metabolic responses of juvenile Southern catfish, *Silurus meridionalis* Chen fed either formulated feed or loach flesh were investigated at 27.5°C. The feeding rate of loach flesh was significantly lower ( $p < 0.05$ ) but the specific growth rate was significantly higher than that of formulated feed. Both feed efficiency and protein efficiency ratio of loach fresh were significantly higher than those of formulated feed. The specific dynamic action duration and coefficient of loach flesh were significantly smaller than those of formulated feed. The results suggested that Southern catfish was more adaptive to loach flesh. The postprandial metabolic response might partly explain the observed differences in nutrient utilization between the two foods. (*Journal of Fisheries and Aquatic Science* 3 (4): 261-267, 2008; **Doi:** 10.3923/jfas.2008.261.267)

## **Antimicrobial Activity of Polysaccharide Isolated from the Cuttlebone of *Sepia aculeata* (Orbigny, 1848) and *Sepia brevimana* (Steenstrup, 1875): An Approach to Selected Antimicrobial Activity for Human Pathogenic Microorganisms**

A. Shanmugam, T.S. Mahalakshmi and A. Barwin Vino

Polysaccharide isolated from the cuttlebone of *Sepia aculeata* and *Sepia brevimana* using 10 mM EDTA were studied for their antibacterial and antifungal activity against nine bacterial (*Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Vibrio cholerae*, *Vibrio parahaemolyticus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella typhi* and *Shigella* sp.) and four fungal (*Candida* sp., *Rhizopus* sp., *Aspergillus flavus* and *Aspergillus fumigatus*) pathogens at different concentrations such as 25, 50, 75 and 100% against control. The activities were found to be increasing with the increasing concentration of the extracts. No antibacterial activity was recorded against *V. cholerae* in all concentrations of *S. brevimana*. In *S. aculeata*, maximum (8 mm inhibition zone in 100%) and minimum (2 mm inhibition zone in 25%) activity was recorded against *E. coli*, but in *S. brevimana* the highest and lowest activity was recorded as 17 mm (100%) and 2 mm (25%) (inhibition zone) against *P. aeruginosa* and *E. coli*, respectively. In the antifungal activity study, the highest

and lowest inhibition zones of 12 mm (100%) and 3 mm (25%) were noted against *A. flavus*, *Candida* sp. and *A. fumigatus* and *Rhizopus* sp. respectively, but in *S. brevimana*, maximum and minimum activity of 9 mm (100%) and 2 mm (25%) (inhibition zone) were observed against *A. flavus* and *A. fumigatus*, respectively. In both species the cuttlebone polysaccharide showed no activity against *Candida* sp. (*Journal of Fisheries and Aquatic Science* 3 (5): 268-274, 2008; **Doi:** 10.3923/jfas.2008.268.274)

## **Environmental Impact of Nutrient Discharged by Aquaculture Waste Water on the Haraz River**

A. Keramat Amirkolaie

The aim of this study is to assess the effect of aquaculture waste water on water quality of the receiving ecosystem. Vana rainbow trout farm was selected as a site of the study. There were four sampling stations around the fish farm along the Haraze river (200 m before and 200 m after farm, inlet and outlet of the farm) for water quality measurements. Waste excreted by fish did not increase nitrate and nitrite concentration at the releasing point but surprisingly a reduced phosphorous content was observed for the outlet water in comparison to station 1. Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) were consistently higher for station 3 where waste water was released. However, the organic matter discharged was reduced in fall compared to winter. In conclusion fish farm effluent contains pollutant that can affect river water quality. However the pollutants magnitudes are too low to put a significant impact on the river ecosystem. (*Journal of Fisheries and Aquatic Science* 3 (5): 275-279, 2008; **Doi:** 10.3923/jfas.2008.275.279)

## **Synergistic Evaluation of Oil-Dispersant and Oil-Detergent Mixtures Using African Catfish, *Clarias gariepinus* Fry**

O.B. Samuel, O.Q. Suleiman and W.O. Odiete

The single action toxicities of Spent Lubrication Oil (SLO), dispersant (SAF Power), detergent (Sodium Dodecyl Sulphate, SDS) and the joint action toxicities with the synergistic interactions of their mixtures (SLO-dispersant, 9:1 and SLO-detergent, 9:1) were evaluated against *Clarias gariepinus* fry in laboratory bioassays. The synergistic interaction of the tested mixtures was evaluated using the concentration-addition (relative toxic units, RTU), synergistic ratio, SR and isobolograms (pictorial isobole) models. The dispersant (96 h  $LC_{50}$  = 0.008 ml L<sup>-1</sup>) and the detergent (96 h  $LC_{50}$  = 1.00 ml L<sup>-1</sup>) was about 150 times

and 1.2 times more toxic than SLO (96 h  $LC_{50} = 1.20 \text{ ml L}^{-1}$ ), respectively when acting singly against *C. gariepinus*. Based on the joint action toxicity, the SLO-dispersant mixture (96 h  $LC_{50} = 0.008 \text{ ml L}^{-1}$ ) was 1318 times more toxic than SLO-detergent mixture (96 h  $LC_{50} = 10.54 \text{ ml L}^{-1}$ ). Synergistic evaluation of the test mixtures based on RTU and SR models (with reference to SLO) revealed that the SLO dispersant mixture and SLO-detergent mixture conformed to the model of synergism (RTU = 135.10, SR = 150.00) and model of antagonism (RTU = 0.11, SR = 0.11), respectively. The resultant pictorial isobole using isobologram model was in agreement with RTU and SR models. The environmental implication of the synergistic interactions of the tested mixtures was discussed. (*Journal of Fisheries and Aquatic Science* 3 (5): 280-290, 2008; *Doi*: 10.3923/jfas.2008.280.290)

### **The Histopathological Effects of Copper Sulphate on Rainbow Trout Liver (*Oncorhynchus mykiss*)**

Muhammed Atamanalp, Turgay Sisman, Fatime Geyikoglu and Ahmet Topal

Fish were exposed to sublethal dose of copper sulphate ( $\text{CuSO}_4$ ) in order to determine the histopathological alterations in the liver of rainbow trout (*Oncorhynchus mykiss*). After 28 days treatment; non-homogenous regions and congestion of central vein, dark-stained hepatocytes, increasing the number of Kupffer cells, vascular degeneration and sinusoidal degenerations were observed. (*Journal of Fisheries and Aquatic Science* 3 (5): 291-297, 2008; *Doi*: 10.3923/jfas.2008.291.297)

### **Heat Shock Protein70 mRNA Expression as a Biomarker for Stress Evaluation in Blue Green Damsel fish *Chromis viridis***

Eri Iwata, Kyohei Mikami, Natsumi Hiyakawa, Hideaki Sasaki, Terukazu Arai, Akihiro Itoh and Takeshi Matsuoka

cDNA partial sequence of heat shock protein 70 (HSP70) were isolated from blue green damselfish *Chromis viridis*, with highly homologous to other teleost HSP70 genes. To evaluate the stress response of HSP70 gene in damselfish, RT-PCR was conducted after 90 days of daily exposure to excess level of water stream. Increased expression of HSP70 mRNA was found in the brains and the gills of experimental fish compared to control fish. This result suggests that HSP70 mRNA may provide a useful biomarker for the evaluation of stress levels in small ornamental fish with difficulty of blood sampling. (*Journal of Fisheries and Aquatic Science* 3 (5): 298-301, 2008; *Doi*: 10.3923/jfas.2008.298.301)

## **Diversity of Lactic Acid Bacteria in the Gastrointestinal Tracts of Reared Beluga (*Huso huso*) and Persian Sturgeon (*Acipenser persicus*): A Comparative Study**

F. Askarian, A. Matinfar, A. Kousha, M. Bahmani, K. Khorshidi, A. Shenavar and E. Ringo

The composition of lactic acid bacteria (LAB) in intestine of two species of sturgeon, beluga (*Huso huso*) and Persian sturgeon (*Acipenser persicus*), was analyzed. LAB in the gastrointestinal (GI) tract of the two sturgeon species was not similar as LAB population levels in beluga was significantly higher than Persian sturgeon. Six strains of lactic acid bacteria isolated from the GI tract of beluga and Persian sturgeon were characterised by 16S rDNA. Two species of LAB including *Enterococcus seriolicida* and *Leuconostoc mesenteroides* were isolated from GI tract of Persian sturgeon and the predominant species was *L. mesenteroide*. Furthermore, *Lactobacillus curvatus*, *Lactococcus raffinolactis*, *Lactococcus lactis* and *Streptococcus* sp. were isolated from the GI tract of beluga and the counts of *L. curvatus* was significantly higher in the GI tract of beluga than other species. (*Journal of Fisheries and Aquatic Science* 3 (5): 302-311, 2008; **Doi:** 10.3923/jfas.2008.302.311)

## **Comparative Utilization of Biodegraded Rice Husk in the Diets of *Clarias gariepinus***

Aderolu Ademola Zaid and Oyedokun Ganiyat Taiwo

Possible improvement in the nutritional composition of Rice Husk (RH) was attempted through Solid State Fermentation with the use of fungus, *Trichoderma viridii*. A randomised complete block design experiment was set up to compare the utilization of the fermented RH (FRH), raw RH and a control diet, using parameters like performance and nutrient utilization alongside some economic indicators to arrive at conclusion. Seven isonitrogenous diets were produced using graded levels of RH (5.0, 7.5 and 10%) of both raw and the fermented which were compared to a control diet. The process of fermentation resulted in improvement in the crude protein value of RH by 97% and reduction in the crude fibre composition by 45%. Probably as a result of the fermentation process, fishes fed FRH had better FCR (0.98-1.51), PER (1.84-2.78) and SGR (1.84-1.94) than their counterparts fed raw RH but these values are significantly lower than the control diet. The Feed Intake (FI), Feed Conversion Ratio (FCR) and Protein Intake (PI) increased as level of inclusion of the RH increases. The same



observation is equally true for the Profit Index, Benefit Cost Ratio and the Incidence Cost. (*Journal of Fisheries and Aquatic Science* 3 (5): 312-319, 2008; **Doi:** 10.3923/jfas.2008.312.319)

### **Fecundity Studies of *Gerres abbreviatus* (Bleeker, 1850) From the Jaffna Lagoon, Sri Lanka**

K. Sivashanthini, G.A. Charles and S. Shutharshan

The present study on fecundity of *Gerres abbreviatus*, Bleeker, 1850 (Pisces: Gerreidae) occurring in Jaffna lagoon, Sri Lanka covers annual fecundity, batch fecundity, spawning frequency and relationship between fecundity and various lengths of *G. abbreviatus*. The composite histograms based on the diameters of all oocytes at successive stages of maturation showed three modes in ovaries at stages 4, 5 and 6 in *G. abbreviatus*. Fecundity varied from 167610 to 3162280 ova for an animal with a total length of 149 to 280 mm. Annual Fecundity (AF) varied significantly between various size groups and showed perfect positive correlation with total length (TL, mm) and total weight (W, g). The relationships between length or weight and fecundity were statistically significant and best described with the simple linear regressions:  $AF = 19.678 TL^{3.563}$  and  $AF = 218.2 TW^{1.226}$ . Linear regressions for logarithmic transformed data of annual fecundity and batch fecundity versus total length were computed. Comparison of these two regressions confirmed that *G. abbreviatus* spawn around three batches of eggs during a season. (*Journal of Fisheries and Aquatic Science* 3 (5): 320-327, 2008; **Doi:** 10.3923/jfas.2008.320.327)

### **Diatom Diversity in Hypersaline Environment**

A. Nagasathya and N. Thajuddin

The present study is the first detailed investigation of the diversity and distribution of diatoms in relation to the hydrography in the Saltpans of Southern coasts of India starting from Vedharanyam to Mandapam. Totally 52 taxa, both centric and pinnate diatoms were identified in the present investigation. When compared to Palk Strait and Palk Bay regions less diversity of diatoms was observed in the Bay of Bengal region. Highest diversity of diatoms was observed in the 50 ppt. But only 4 taxa namely *Achnanthes hauckiana*, *Cyclotella striata*, *Pseudonitzschia seriata* and *Thalassionema eccentrica* were observed at higher salinity (150 ppt). (*Journal of Fisheries and Aquatic Science* 3 (5): 328-333, 2008; **Doi:** 10.3923/jfas.2008.328.333)

## **First Record of Three Species of Gerreids (Pisces: Perciformes) from the Jaffna Lagoon, Sri Lanka**

S. Shutharsan and K. Sivashanthini

The present investigation is an attempt to record three species of gerreids for the first time from the Jaffna lagoon, Sri Lanka. Gerreids are economically important fish found along the coastal regions of Sri Lanka. Seven species namely *Gerres abbreviatus*, *Gerres acinaces*, *Gerres filamentosus*, *Gerres lucidus*, *Gerres oblongus*, *Gerres oyena* and *Pentaprion longimanus* have been recorded in Sri Lankan waters. However, only two species of gerreids, *Gerres abbreviatus* and *Gerres oblongus* have been recorded from the Jaffna lagoon, so far. During the present investigation samples were collected from Pasaiyoor, Kurunagar, Kakkaitteevu and Ponnalai coastal areas from commercial catches by siragu valai, hand nets, hook and line and bottom trawling. The morphometric characters were observed, measured and examined and three new species of gerreids were recorded. Those are *Gerres filamentosus*, *Gerres acinaces* and *Gerres lucidus*. The distinctive features to identify those species and a key for identification discussed in detail in the present study. The record of these species is an important contribution to ichthyofauna of Northern Sri Lanka. The occurrence of these species in the Jaffna lagoon can be explained that they may have migrated due to the environmental changes from the Indian ocean. (*Journal of Fisheries and Aquatic Science* 3 (5): 334-339, 2008; **Doi:** 10.3923/jfas.2008.334.339)

## **Mechanisms of Phototaxis in American Crayfish, *Procambarus clarkii* (Girard, 1852) Following Different Methods of Trapping**

Ahmadi, Gunzo Kawamura and Miguel Vazquez Archdale

The phototactic behavior of the American crayfish *Procambarus clarkii* was investigated in aquaria and a large tank to determine their sensitivity thresholds to light and possible harvesting applications. Adult and juvenile crayfish were found to be positively phototactic and their attraction to light was highest at an intensity of 1,290 lx. Conversely, post-embryonic crayfish were negatively phototactic and moved away from the light source at intensities higher than 111 lx. Fishing trials using traps with four open funnel entrances under lighted and dimmed lamps, fish baited and non-baited treatments tested the application of trapping with lamps as an alternative harvesting method. Results showed that traps with lighted and dimmed lamps captured similar numbers of crayfish, that in some cases they catch significantly more crayfish than non-baited traps, but that their catching performance was lower than fish baited traps. Possible applications of this novel

luring method are further discussed, as well as its implications in eradication programs and harvest from aquaculture ponds. (*Journal of Fisheries and Aquatic Science* 3 (6): 340-352, 2008; **Doi:** 10.3923/jfas.2008.340.352)

### **Diversity of Benthic Invertebrates Fauna and Secondary Production in Southern Caspian Sea Basin, Case Study on Tajan River Estuary**

A. Javanshir, M. Shapoori and S. Jamili

Macro benthic invertebrate assemblages were investigated monthly, from March 2006 to March 2007, at six stations in Tajan river estuary, a south eastern Caspian Sea coastal estuary, in order to estimate secondary production consumable for extensive finger fish releasing and to investigate the factors affecting this production. Benthic assemblages comprised 9 taxa, of which *Ballanus* sp., *Chironomus plumosus* and *Cerastoderma lamarki* were the main contributors to both overall biomass and secondary production. Annual secondary production varied from 4.55 g AFDW m<sup>-2</sup> year<sup>-1</sup> (Ash Free Dry Weight), in the upper Tajan estuary, to 78.06 g AFDW m<sup>-2</sup> year<sup>-1</sup> (Ash Free Dry Weight) in the center of the estuary area. Multivariate correlations between environmental variables and the Macro benthic assemblage biomass highlighted the role of the water level, temperature, sediment organic carbon content and dissolved oxygen in the differentiation of the communities in the estuary. Composition, biomass and secondary annual production of Macro benthic communities were dramatically affected by changes in water residence time and summer drought crises. The isolation of this habitat limits the recovery of other invertebrate benthic assemblages during drought periods. Only populations of two species, *Balanus* sp. and *C. plumosus*, seemed to be able to recover quickly after the drought crises, which, in turn, could compromise the overall secondary production, with negative effects on the released fish survival. During summer water renewal, when agricultural activity is intense and nutrient inputs should be regulated in this estuary to reduce the risk of benthic mass mortality and to ensure a sustainability of this environment. (*Journal of Fisheries and Aquatic Science* 3 (6): 353-365, 2008; **Doi:** 10.3923/jfas.2008.353.365)

### **The Influence of Feeding Ration on the Acute Stress Response of Beluga (*Huso huso*)**

F. Askarian and A. Kousha

In this study, the effect of 90 days maintenance-feeding period on the acute stress response of 45 one year old beluga, *Huso huso*, to handling and confinement were

determined. The fishes were divided to three treatments including Control, High food ration (H>L) and low food ration (L>H). Fishes were raised on an optimal feeding level of 4% of body weight per day during the experiment. The fishes in High treatment (H>L) was fed 4% of body weight per day for 60 days and food ration was reduced to 1% of body weight per days in the last month of experiment. The fishes in Low treatment (L>H) was fed 1% of body weight per day for 60 days and food ration was suddenly increased to 4% of body weight per days in the last month of experiment. All fishes were sampled at the end of experiment one time before exposure to stress and 3 times including half an hour, 1 and 3 h after stress. The results revealed that food ration had significant effects on the growth rate and food conversion values because fishes fed the high ration performing better than those on a lower level. Prior to the application of the stressor, only plasma levels of triglycerides were lower in fish fed a low food ration at the last month of experiment (H>L). Feeding history Influenced the onset of the stress response with stressor-induced elevations of plasma cortisol, glucose and free fatty acids being higher in fish fed a high ration compared with those fed a low ration prior to sampling (H>L). These results suggest that feeding history through modification of the energy reserves can influence the onset of the acute stress response. (*Journal of Fisheries and Aquatic Science* 3 (6): 366-374, 2008; *Doi*: 10.3923/jfas.2008.366.374)

### **Seasonal Variation in the Distribution and Fish Species Diversity of a Tropical Lagoon in South-West Nigeria**

Soyinka Olufemi Olukolajo and Kassem Adedoyin Oluwaseun

Twenty five fish species representing 16 families were recorded in the Ologe Lagoon, South-West Nigeria. Adult stages of 12 of them were freshwater (48%), 4 were estuarine (16%) and 9 were near-shore marine species (36%). The slight seasonal variation in the catch composition of the fish fauna of the lagoon was attributed to the slight seasonal fluctuation in salinity marked with higher rainfall volumes in the rainy season than in the dry. Availability of food organisms was also noted for the seasonal distribution of some of the fish species. Temperature and pH varied slightly, while DO was higher in the dry season but lower in the rainy season. Distance from salt water influence and much river influx with the associated reduced salinity appear to be the major meteorological forcing operating in the lagoon. The lagoon is very low brackish water. The highest species richness was observed in September with 13 species, while the lowest with least abundance was observed in August (when there was a break in rains) with 7 species. The most abundant species during their occurrence were *T. mariae* (10.1%), *C. senegalensis* (9.84%) and *M. electricus* (7.51%). Species richness and total abundance were found to increase slightly during the

rainy season than the dry season. Availability of much juvenile forms indicated that the lagoon forms a good nursery ground for many fish species. (*Journal of Fisheries and Aquatic Science* 3 (6): 375-383, 2008; *Doi*: 10.3923/jfas.2008.375.383)

### **Inbreeding Depression by Family Matching in Rainbow Trout (*Oncorhynchus mykiss*)**

M. Yousefian and A. Nejati

In this study, inbreeding depression and abnormality effects on the basis of differences between inbred and outbred half-sib family groups of rainbow trout, *Oncorhynchus mykiss* are investigated. One generation of brother-sister mating, inbreeding depression in rainbow trout was calculated for three production traits, percentage egg hatchability, percentage survival of fry at active nutrition stage and weights at 150, 225 and 300 days. The inbreeding depression obtained for half-sib mating was 1.25 for percentage hatchability, 2.9 for percentage fry survival and up to 28.1, 35.2 and 35.6 for percent weight at 150, 225 and 300 days, respectively. Egg hatchability, fry survival and weight at early growth stage were not significant while a highly significant inbreeding depression was found for weight at 300 day ( $p < 0$ ). The difference between inbreeding depression for male and female half-sib group was non significant ( $p \geq 0.05$ ). Although the inbreeding embryo had a noticeable though not significant negative effect on survival larval stage, it had a strong and significantly negative effect of growth rate at later stages of development. In the second series of experiments, the three traits showed the same pattern as the first one. Following one generation of full-sib mating, the calculated effect of inbreeding on the number of live fish and total weight of fish at 150 days of age showed a reduction of 5.83 to 8.49 weight percent in 2 groups. About 23% of larvae at hatching showed abnormal shapes of bighead, curved body, shortened tail and big abdomen, etc. There was frequently a type of axial deformations that were related to notochord alternations during embryogenesis. About 19% of abnormal larvae survived only upto feeding stage but 4% survived and reached juvenile and adults stage. (*Journal of Fisheries and Aquatic Science* 3 (6): 384-391, 2008; *Doi*: 10.3923/jfas.2008.384.391)

### **Effect of Temperature on the Produced Aflatoxins in the Rainbow Trout Feed in West Azerbaijan Province**

A.A. Motalebi, K. Ardalani and S. Jamili

In the executed research on aquaculture diet in West Azerbaijan Province coldwater fish propagation and culture farms, which was accomplished by the kind

cooperation and coordination of West Azerbaijan Province aquaculture department, samples of feed were evaluated during 2 phases, one phase between spring and summer and another phase between fall and winter, based on aflatoxin amount by HPLC technique. The feed samples used in this research were from different factories and of various kinds (SFT-FFT-GFT-BFT) and sizes. After the fulfilling of high performance liquid chromatography (HPLC) and evaluation of the test results in accordance with laboratory standards (the concentration was between 2-4 ppb). Result of samples of the second stage, fall and winter were negative, but of the samples of the first stage, spring and summer there were 5 positive samples. The total concentration of toxin ( $B_1$ ,  $B_2$ ,  $G_1$ ,  $G_2$ ) was between 1.21 to 6.62 ppb. The sample has been concentration of 6.62 ppb highly exceeded the allowed level. During these examinations, it was revealed that, the farms which had executed the hygienic principals of stocking, showed lower levels of toxin in the diet and vice versa. The toxin levels detected between spring and summer are higher than those of fall and winter due to the high heat and humidity of the warehouse. (*Journal of Fisheries and Aquatic Science* 3 (6): 392-397, 2008; *Doi*: 10.3923/jfas.2008.392.397)

### **Study on Growth Performance, Survival Rate, Hematological Parameters in Rainbow Trout (*Oncorhynchos mykiss*) in Mazandaran Province of Iran**

T. Faghani, A. Kousha, G.H. Azari Takami and S. Faghani

The aim of this study was the evaluation of the immunostimulatory effects of alginic acid and anti-streptococcus vaccine on the Growth Rate (GR), Specific Growth Rate (SGR), Feed Conversion Ratio (FCR), Condition Factor (KF) and Survival Rate (SR%). The weight range of fish were 5-8 g and the trials were divided to 4 treatments with triplicate groups including control, vaccine, vaccine+alginic acid and alginic acid and each treatment included 3000 fishes. The period of this study was 4 month and biometry was done 6 times (every 20 days intervals) at the end of experimental period the blood samples were taken from all treatments and hematological parameters were evaluated. The results showed that GR had a significant increase in vaccine+alginic acid treatment when compared with the control group ( $p < 0.05$ ). SR% showed a significant increase in vaccine+alginic acid and alginic acid treatment in compared with control group ( $p < 0.05$ ). Significant elevation in the percentage of lymphocyte observed in vaccine, vaccine+alginic acid and alginic acid treatment when compared with control group have observed. According to the results, it seems that prescription of vaccine and alginic acid were stimulated lymphocyte proliferation in all treated groups and therefore fish resistance increase to environmental stress and pathogen. (*Journal of Fisheries and Aquatic Science* 3 (6): 398-403, 2008; *Doi*: 10.3923/jfas.2008.398.403)

## **Effect of Frozen Storage Time on the Lipid Deterioration and Protein Denaturation During Caspian Sea White Fish (*Rutilus frisi kutum*)**

A. Keyvan, S. Moini, N. Ghaemi, A.A. Haghdooost, S. Jalili and M. Pourkabir

The study was designed to investigate the effect of duration of frozen storage on chemical analysis, lipid damage and extractability of Myofibrillar proteins of Kutum (*Rutilus frisi kutum*). The fish were collected from Anzaly landings in north of Iran and were subjected to 12 months of frozen storage and analyzed at intervals of three month. Protein content ranges from  $21.8 \pm 0.01$  to  $19.9 \pm 0.01$ . Protein decrease with increasing duration of frozen storage; fish samples that were for frozen thirty days; having highest protein content  $21.8 \pm 0.01$  while the least  $19.9 \pm 0.01$  was recorded for fish samples that were frozen for 12 months. Similar results obtained for the fat content where the highest fat content  $3.21 \pm 0.01$  was recorded for the fish samples that were for frozen 30 days and the least value was recorded for those stored for 12 months. The least moisture content was observed for fish samples the was stored for 12 months but, the highest Ash content was observed for fish samples the was stored for 12 month. Lipid damage were measured on the basis of Free Fatty Acids (FFA), Peroxide Value (PV), Thiobarbituric acid index (TBA-i). PV, TBARS and FFA concentration of frozen Caspian Sea white fish stored at  $-18^{\circ}\text{C}$ ; the temporal variation of these three variables were statistically significant ( $p < 0.001$ ). SDS-PAGE patterns showed that myosin heavy chain was much more susceptible to hydrolysis than actin. (*Journal of Fisheries and Aquatic Science* 3 (6): 404-409, 2008; **Doi:** 10.3923/jfas.2008.404.409)

## **Consequences of Frozen Storage for Amino Acids and Unsaturated Fatty Acids of Tuna (*Thunnus tonggol*) Roe**

H. Ziaeeian, S. Moini and S. Jamili

Amino acid and Unsaturated Fatty Acid (UFA) contents of long tail tuna (*Thunnus tonggol*) roe and their changes were investigated during 9 months of frozen storage at  $-18^{\circ}\text{C}$ . These analyses were performed immediately after the freezing, then after 3rd, 6th and 9th months of cold storage at  $-18^{\circ}\text{C}$ . Numbers 10 poly unsaturated fatty acids (PUFAs) and 8 monounsaturated fatty acids (MUFAs) were identified. After 9 months of cold storage, these compounds

reduced from 34.55 and 27.78% to 24.62 and 25.62%, respectively. The most abundant UFAs in the fresh and frozen roes were C16:1, C18:1, C20:5 (n-3), C22:5 (n-3) and C22:6 (n-3). The results showed that n-3 and n-6 fatty acids in fresh roe were 32.75 and 1.61%, respectively, which decreased to 23.41 and 1.09%, respectively, after 9 months of cold storage. The most abundant amino acids in long tail tuna roe were lysine, histidine, aspartic acid and leucine. According to the results, the amounts of Essential Amino Acids (EAA) and nonessential amino acids (NE) were 104.78 and 75.61 mg g<sup>-1</sup>, respectively that reduced to 78.25 and 61.40 mg g<sup>-1</sup> at the end of storage period. Moreover, the amino acid compositions for fresh roe showed a relatively higher ratio of EAA/NE in comparison to frozen samples after 9 months of cold storage. These ratios were 1.38 and 1.27, respectively. These findings are showing that *Thunnus tonggol* can be a rich source of n-3 fatty acids and Essential Amino Acids (EAA) for human health. (*Journal of Fisheries and Aquatic Science* 3 (6): 410-415, 2008; **Doi:** 10.3923/jfas.2008.410.415)

### **Reproductive Biology and Histological Studies in Abu Mullet, *Liza abu* in the Water of the Khuzestan Province**

M. Chelemal, S. Jamili and I. Sharifpour

To study the reproductive biology of *Liza abu*, 360 samples of this species were collected during the period from February 2007 to January 2008. Reproductive characteristics of *Liza abu* showed that sex ratio is 1: 2.7 male to female, respectively. This means that females predominate males. Monthly variation in GSI of both sexes were quiet apparent. Maximum values were recorded in March (10.26 and 11.51% for males and females, respectively) and reached to the minimum levels in August (0.42 and 1.15% for males and females, respectively). These cyclic changes in GSI indices are considered as a proof that maturation season is started from January and spawning occurs in April. The maturity stages of male and female *Liza abu* are separated to 6 different successive stages. These stages in female are immature, resting, developing, developed, spawning (ripe) and post spawning. The testes maturation classified to virgin (immature), maturing virgin, maturing virgin, developing, developed, ripe and spent. The ova diameter ranged from 16.02 to 470.3 μ. It can be classified into transparent eggs ranging from 16.02 to 106.97 μ in diameter and yolked egg ranging from 126.82 to 470.3 μ in diameter. (*Journal of Fisheries and Aquatic Science* 4 (1): 1-11, 2009; **Doi:** 10.3923/jfas.2009.1.11)



## **Distribution of Fish Assemblages in Two Floodplain Lakes of North 24-Parganas in West Bengal, India**

D.K. Mondal and A. Kaviraj

Assemblage of fish and their seasonal variation in two floodplain lakes in the Bongaon subdivision of the north 24-parganas district of West Bengal in India was investigated during the period 2004 to 2006. These lakes are locally called as baur. Forty nine species belonging to 23 families were recorded from these two bours. Cyprinidae was the most dominant family with eleven species. Overall species composition of the two bours almost resembled each other. But average number of species in a month significantly varied between the bours. Species richness and the total number of individuals caught per each sampling varied significantly between seasons. *Amblypharyngodon mola* (Cyprinidae) and *Gudusia chapra* (Clupeidae) were the most abundant among the eighteen frequently available species from these two bours. But more than fifty percent of the species were sparsely available. (*Journal of Fisheries and Aquatic Science* 4 (1): 12-21, 2009; **Doi:** 10.3923/jfas.2009.12.21)

## **Increasing in Growth of *Rutilus frisii kutum* Larvae with Using Slurry (Fermented Organic Manure) in Yosefpoor Propagation and Rearing Center (Iran)**

M. Fallahi Kapoorchali, S.M. Reza Fatemi, G. Vosoghy, M. Matinfar and M. Sharifian

The main objective of this study is to investigate the effect of slurry on larval growth in comparison with common methods; thus, cow manure was fermented under anaerobic conditions for 40 days. Then the following two treatments were examined: concentrated food as common method and slurry as the new method. To study, the two treatments and each with three replications, 6 ponds were selected, each measuring 1.7 ha with depth of 1.7 m. The larvae population density was 1.7 m ha<sup>-1</sup>. The results showed that the mean weight and length, in slurry treatments were 77.16±25.3664 mg and 22.03±2.31 mm and in control treatment were 63.13±17.8552 mg and 19.6±2.296 mm, respectively. Condition factor was found to be 0.9 for slurry and 0.8 for control treatment. During culture period some other factors such as DWG (Daily Weight Gain), DLG (Daily Length Gain), CF (Condition Factor) and SGR (Specific Growth factor Rate) were measured. In comparison with control group, all parameters had higher values in slurry treatment. The statistical analysis indicated that there is a significant difference (p<0.001) for parameters of length and weight for both treatments in the first week

of culture and also there was a significant difference ( $p < 0.05$ ) for the items in the 2nd week too. The obtained results showed that the slurry, due to high concentration of nutrients, had more effect on growth and increased the abundance of zooplanktons, which are the main food of larvae in early stages of life cycle. (*Journal of Fisheries and Aquatic Science* 4 (1): 22-31, 2009; **Doi:** 10.3923/jfas.2009.22.31)

### **Patterns of Reproduction and Spawning of the *Scomberomorus commerson* in the Coastal Waters of Iran**

M.S. Sadeghi, F. Kaymaram, S. Jamili, M.R. Fatemi and M.S. Mortazavi

Patterns of reproduction and spawning were studied for the king fish (*Scomberomorus commerson*) in the Persian Gulf (Hormozgan province). During one year of sampling, 599 fish were collected from different landing sites along the Persian Gulf. Analysis of the reproductive stages and gonadosomatic index revealed a single yearly reproductive cycle beginning in March and ending with a single spawning period in August-September. The mean length at first maturity (Lm 50%) for females was 75 cm. The sex ratio was M/F = 0.97 in the samples. (*Journal of Fisheries and Aquatic Science* 4 (1): 32-40, 2009; **Doi:** 10.3923/jfas.2009.32.40)

### **The Influence of Photoperiod in Farming Beluga Sturgeon (*Huso huso*): Evaluation by Growth and Health Parameters in Serum**

F. Askarian and A. Kousha

Data on the concentrations of some blood constituents of reared Beluga sturgeon, *Huso huso*, including Serum cortisol, glucose, triglyceride, cholesterol, osmolality,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ , ALP that reared under different light regimes were measured. The light regimes were consist of natural photoperiod (NP), continuous dark (0L:24D), continuous light (24L:0D) and long day regime (16L:8D) and tested on 4 group of 30 one year old reared Beluga for 6 month which sampled four times during the experiment. No significant difference in serum cortisol and ALP levels was found between treatments ( $p > 0.05$ ). Elevations of serum cortisol, glucose, cholestrol and triglyceride concentrations were reported in continues dark regime. Increase of serum osmolality,  $\text{Na}^+$ ,  $\text{K}^+$  and decrease of  $\text{Ca}^{2+}$  were also associated with increase of cortisol levels. Results are compared with the few data available in condroestean fish and with those on teleosts. (*Journal of Fisheries and Aquatic Science* 4 (1): 41-49, 2009; **Doi:** 10.3923/jfas.2009.41.49)

## **Preservative Effect of Quaternary Water to Reduce Lead Acetate Toxicity (LC<sub>50</sub>, 96 h) on *Capoeta fusca***

Arash Omid, Sohrab Mazloomi and Homayoon Farhangfar

This study was conducted to determine the acute toxicity of lead acetate on *Capoeta fusca*. A total of 580 fishes with mean length of 12.28±0.14 cm and mean weight of 16.64±0.52 g. were divided into 15 control and treatment groups of fish. The fish were kept in 20 L aquariums and the procedure designed in static condition according to the Organization Economic Cooperation and Development (OECD) method. Mortality rate was recorded in 96 h and lead acetate LC<sub>50</sub> was calculated by standard statistical method. LC<sub>50</sub> of 10.992, 10.594, 9.338 and 7.575 mg L<sup>-1</sup> were determined at 24, 48, 72 and 96 h post exposing respectively. In addition, minimum and maximum lethal concentrations of lead were determined as 4 and 12.5 mg L<sup>-1</sup> and MAC was 0.7575 mg L<sup>-1</sup>. Lead acetate in soft water (Hardness 10 mg L<sup>-1</sup>) was highly toxic for fish but in hard water (Hardness: 310 mg L<sup>-1</sup>) had a little toxicity. High trend of lead for interaction with minerals such as calcium and carbonates is the major reason of this phenomenon. Lead toxicity is decreased with increase of water hardness and this is the cause of fish tolerance against some heavy metals pollution in natural environment. Lead intoxicated fish showed abnormal behaviors, restless and rapid circling. (*Journal of Fisheries and Aquatic Science* 4 (1): 50-56, 2009; *Doi*: 10.3923/jfas.2009.50.56)

## **Feeding and Spawning of *Sphyraena jello* in the North-West of Persian Gulf**

S.A. Hosseini, S. Jamili, T. Valinassab, G. Vosoghi and S.M.R. Fatemi

This study, being conducted in 2006-2007, attempts to investigate its biological habit and characteristics in Iran's water of the Persian Gulf. For the sampling purpose, three major landings namely Bushehr, Deylam and Genaveh were selected to obtain samples from commercial catches. The sampling is composed of 655 males and 515 females during a twelve month period. By studying the feeding through the counting method, it is revealed that, *Liza subviridis* characterized by 42.8% and *Sepia pharaonis* by 8.4% made the highest and lowest stomach content, respectively. The findings showed that male fish in smaller size will mature sooner than females specimen but this sex ratio or proportion was not significantly different except during October and September. Such a difference between male and female in different months could be originated from longer

residing of female group in spawning ground compared to male group. The earlier spawning lasted during September-October and there was a peak of spawning in feeding in August. The lowest fat proportion for both male and female genders was reported 0.10 and 0.11, respectively in October; but the highest level of condition factor was reported to be 0.59 and 0.63 during November and June. (*Journal of Fisheries and Aquatic Science* 4 (1): 57-62, 2009; **Doi:** 10.3923/jfas.2009.56.62)

### **Detection of Genetic Variation in the Wild Populations of Indian Major Carps Using Random Amplified Polymorphic DNA Fingerprinting**

Sameer R. Phale, Shivkumar Chauhan, Yogesh V. Bhute and Vidya V. Baile

Genetic variations in wild populations of Indian Major Carps (IMCs) from six geographically isolated locations of Central India Rivers were examined using Randomly Amplified Polymorphic DNA (RAPD). Thirty six specimens of each species from each location were collected. Genomic DNA was isolated from the liver tissues. Out of twenty RAPD primers used, thirteen were found to be scorable on agarose gel, of which 83.33% were polymorphic for *Labeo rohita*, 80.0% for *Cirrhinus mrigala* and 75.0% for *Catla catla*. A total of 576 RAPD bands were amplified. Dendrogram generated for species-specific genetic evaluation revealed that *C. catla* was genetically dissimilar from *L. rohita* and *C. mrigala*. The present investigation is the first report on wild varieties of IMCs while the available data on farmed varieties suggest that *C. catla* and *C. mrigala* are more genetically similar to each other than to *L. rohita*. This study also revealed high intra-specific genetic variation in the wild populations of IMCs. To conclude, the present study suggest high levels of genetic variation and population differentiation required for dynamic evolution and RAPD assay therefore may have potential use for establishing genetic relationship, genome specificity and phylogeny among wild species of IMCs. (*Journal of Fisheries and Aquatic Science* 4 (1): 63-70, 2009; **Doi:** 10.3923/jfas.2009.63.70)

### **Influence of 17-Alpha Methyl Testosterone on Masculinization and Growth in Tilapia (*Oreochromis mossambicus*)**

M. Marjani, S. Jamili, P.G. Mostafavi, M. Ramin and A. Mashinchian

In the present study, effect of different dose rates of synthetic androgen 17-alpha Methyl Testosterone (MT) i.e., 50, 75 and 100 mg of hormone in per kg of feed,

on sex reversal and growth performance of Mozambique tilapia was evaluated. MT was administrated orally by using pellet dry starter and Ethanol Alcohol, diet to tilapia fry for 21 days in glass aquaria. The fry were also kept for 2 weeks after feeding to monitor its growth performance. At the end of the experiment the sex ratio was determined by examining the gonads after dissecting the fish. Growth performance was monitored by recording the morphometric characteristics. Wet body weight and total length of fish on start of feeding end of feeding and two weeks after feeding were measured. The results of the present study showed that all MT receiving treatment showed a significantly higher male proportion than the control experiment. Dose rate of 75 mg kg<sup>-1</sup> MT of feed resulted in maximum male population (98.09%) with 1.91% sterilized fish. The dose rate of 75 mg kg<sup>-1</sup> MT gave the maximum gain in body weight i.e., 11.8 g, which is 1.2 times greater than the control. (*Journal of Fisheries and Aquatic Science 4 (1): 71-74, 2009; Doi: 10.3923/jfas.2009.71.74*)

### **Trophic Seasonal Behavior of the Ichthyofauna of Camaronera Lagoon, Veracruz**

Carbajal-Fajardo Zuleica Shareet, Franco-López Jonathan, Héctor Barrera Escorcía, Luis Gerardo Abarca Arenas, Carlos Bedia Sánchez, Ángel Moran Silva and Horacio Vázquez-López

The objective of this study was to analyze the seasonal behavior of the ichthyofauna, considering the trophic relationships between the species that live in Camaronera Lagoon, their food composition, diversity and trophic amplitude, as of the captures obtained in Camaronera Lagoon inlet during February-June, 2000. We realized seasonal tables of the fish species and items of identified foods. The data were grouped in diurnal and nocturnal samplings in order to know the abundance, specific richness, evenness and McNaughton's community dominance index. The amplitude of the niche was calculated as of Levin's standardized index. Costello's graphic method was used to evaluate the preference and feeding behavior of any given type. The families with more species were *Cichlidae*, *Eleotridae* and *Gobiidae*. The most representative species regarding biomass and abundance were *Gambusia affinis*, *Petenia splendida*, *Cathorops melanopus*, *Diapterus auratus* and *Bathygobius soporator*. (*Journal of Fisheries and Aquatic Science 4 (2): 75-89, 2009; Doi: 10.3923/jfas.2009.75.89*)

## **Using Reefcheck Monitoring Database to Develop the Coral Reef Index of Biological Integrity**

Hai Yen T Nguyen, Ole Pedersen, Kou Ikejima, Kengo Sunada and Satoru Oishi

The coral reef indices of biological integrity was constituted based on the reef check monitoring data. Seventy six minimally disturbed sites and 72 maximally disturbed sites in shallow water and 39 minimally disturbed sites and 37 maximally disturbed sites in deep water were classified based on the high-end and low-end percentages and ratios of hard coral, dead coral and fleshy algae. A total of 52 candidate metrics was identified and compiled. Eight and four metrics were finally selected to constitute the shallow and deep water coral reef indices respectively. The rating curve was applied for each metric to identify two lower  $a_i$  and upper  $b_i$  threshold values. A set of scores 1, 3 and 5 was used to score and narrate individual metric values. Each metric value at a site presented a poor, moderated or good condition of reefs. The index was calculated by averaging all selected metric scores. The overall site classification efficiencies were of 65.97 and 66.13% for shallow and deep waters, respectively. Importantly, the strong negative correlation between indices and dynamite fishing  $-0.286$  ( $p < 0.01$ ) and number of yacht within 1 km  $-0.185$  ( $p < 0.05$ ) in shallow water and with poison fishing  $-0.279$  ( $p < 0.05$ ) and coral damaged by other factors  $-0.283$  ( $p < 0.05$ ) in deep water indicated that coral reef indices were sensitive responses to stressors and can be capable to use as the coral reef biological monitoring tool. (*Journal of Fisheries and Aquatic Science* 4 (2): 90-102, 2009; **Doi:** 10.3923/jfas.2009.90.102)

## **Evaluation of Antifungal Activity of New Combined Essential Oils in Comparison with Malachite Green on Hatching Rate in Rainbow Trout (*Oncorhynchus mykiss*) Eggs**

S.M. Mousavi, S.S. Mirzargar, H. Ebrahim Zadeh Mousavi, R. Omid Baigi, A. Khosravi, A. Bahonar and M.R. Ahmadi

The aim of this study was introducing a new herbal constitution for malachite green in hatcheries. In this study, antifungal activities of a new Combination of Essential Oils (CEO) from the herbs; *Thymus vulgaris*, *Salvia officinalis*, *Eucalyptus globulus* and *Mentha piperita* in *Oncorhynchus mykiss* eggs and its effects on hatching rate in comparison with malachite green (a specific treatment for the

control of saprolegniasis) were studied. After fertilization, eggs were transferred to incubators and then treated with five concentration of the combined essential oils with concentrations: 10, 50, 100, 150 and 200 ppm, respectively and malachite green (1 ppm) using constant flow treatment method for incubation period. One incubator was as control without any treatment. The water quality factors were controlled over the study period. In the end of hatching rate, the mold infection and hatching rate were calculated. The hatching percentage in five treatment groups of CEO were 69.99% at 10 ppm, 63.61% at 50 ppm, 62.1% at 100 ppm, 60.53% at 150 ppm, 54.63% at 200 ppm, 60%. 83 at 1 ppm of malachite green group and 53.48% in control group, respectively. The results revealed significant antifungal effects of the combined essential oils in comparison with malachite green on fish eggs so that it could decrease mold infection and increase hatching rate on concentration 10 ppm ( $p < 0.05$ ). This indicated that this combination of essential oils may be a promising antifungal agent in aquaculture. (*Journal of Fisheries and Aquatic Science* 4 (2): 103-110, 2009; **Doi:** 10.3923/jfas.2009.103.110)

### **Length-Weight Relationship of *Sphyraena obtusata* Cuvier, 1829 (Pisces: Perciformes) from the Jaffna Lagoon, Sri Lanka**

K. Sivashanthini, G. Gayathri and K. Gajapathy

The present study was carried out to gain some knowledge on length-weight relationship parameters, growth pattern and difference between the growth parameters of male and female *Sphyraena obtusata*. The knowledge of length-weight relationship has numerous practical applications in fishery biology. Such a mathematical equation enables conversion of one parameter in to another as is often required during monitoring field measurements. Length-weight regression equations were derived for male and female *Sphyraena obtusata* collected from the Jaffna lagoon, Sri Lanka. Regression coefficients were estimated by using the logarithms of the total lengths and the corresponding weights. The curvilinear relationships of length-weight relationships for male and female were  $W = 0.0117 * L^{2.898}$  and  $W = 0.0138 * L^{2.843}$ , respectively. Covariance analysis for length-weight relationships of males and females revealed that there is no significant difference ( $p > 0.05$ ) between male and female and hence a common formulae of  $W = 0.0133 * TL^{2.857}$  was derived for *S. obtusata*. The 'b' values 2.898 and 2.843 obtained for male and female, respectively indicate that the fish follows the cube law and its growth is negative allometry. (*Journal of Fisheries and Aquatic Science* 4 (2): 111-116, 2009; **Doi:** 10.3923/jfas.2009.111.116)

## **Effect of Rearing Systems (Mono- and Poly-Culture) on the Performance of Freshwater Prawn (*M. rosenbergii*) Juveniles**

M.S. El-Sherif and A.M. Ali Mervat

This study was carried out to investigate the effect of mono and polyculture of freshwater prawn with Nile tilapia fry on growth performance and survival rate. Freshwater prawn-juveniles, (*M. rosenbergii*) averaging ( $0.30 \pm 0.02$  g) in weight [Trial 1 (monoculture)] were cultured for 90 days, with different stocking densities (50, 100, 150 and 200 prawn  $m^{-2}$ ) using 12 circular fiberglass tanks (0.36 m and 0.6 m in water depth). Prawns were fed manufactured diet contained 35% protein. Water exchange occurred daily with 20% of water size. Growth measurements of prawn were recorded at 15 days intervals. The results showed that growth performance was significantly ( $p \leq 0.05$ ) decreased with increasing the stocking density. Survival rate was inversely related to stocking density, since there were significant differences among the four densities, while the difference between stocking density of 50 and 100 prawn  $m^{-2}$  was not significant. The food conversion ratio FCR increased with increasing the stocking densities, since the fourth density (200 prawn  $m^{-2}$ ) was significantly higher than that achieved in the first one (50 prawn  $m^{-2}$ ). Prawn juveniles, of average weight  $0.30 \pm 0.02$  g [Trial 2 (Poly culture)] were stocked (as declared in Trial 1) in poly culture with Nile tilapia fry (average weight  $0.3 \pm 0.03$  g) at stocking density 12 fish per  $m^2$  for each treatment, for 90 days. Growth measurements of prawns and fish were recorded at 15 days intervals. Results showed that growth performance for fish and prawn were significantly ( $p \leq 0.05$ ) decreased with increasing of the stocking density of prawn. Survival rate was inversely related to stocking densities, since, there were significant differences among the four treatments. Also, the food conversion ratio FCR for fish and prawn increased with increasing stocking density, since, the differences were significant among the four stocking densities. Therefore, polyculture system is more suitable at stocking density of 100% prawn  $m^{-2}$  for optimum growth and survival rate than of monoculture. (*Journal of Fisheries and Aquatic Science* 4 (3): 117-128, 2009; **Doi:** 10.3923/jfas.2009.117.128)

## **Causes and Mitigations on Trap Ghost Fishing in Oman: Scientific Approach to Local Fishers' Perception**

Hussein S. Al-Masroori, H. Al-Oufi and Paul McShane

This study aims to investigate the ghost fishing problem in Sultanate of Oman. The questionnaire survey on trap ghost fishing in Oman provided information on rates



of trap loss, the financial cost to fishers, the cause of trap loss and the circumstances leading to non recovery of fish traps. Each trap fisher in the Omani fishery owned and fished on average 20.4 traps per fishing day and each trap had a mean useful lifetime of 5.7 months. The study revealed that a total of 15,390 traps or 18 traps per fisher are lost every year in the study area. Once lost, these traps remain functional and on average continue to ghost fish for a period of 3.1 months per year. The three main causes of trap loss were gear interference, theft and/or vandalism, and collisions with boats and ships. Economic losses resulting from ghost fishing by traps was estimated to be 1,011,594 O.R. (US\$ 2.63 million), equivalent to 2.1% of the total landing value of the Omani fishery in 2006. To reduce ghost fishing it is recommended that traps be better marked, that they be equipped with timed-release or degradable sections or panels, and that openings be included in the traps for the release of sub legal size fish. Conflicts with other fishing vessels and other types of gear could be reduced by implementing a zonation policy. (*Journal of Fisheries and Aquatic Science* 4 (3): 129-135, 2009; *Doi*: 10.3923/jfas.2009.129.135)

### **The Fluctuation of Coralline Fish Larvae of Khark and Kharko (Persian Gulf)**

G.H. Vosoghi, M.R. Fatemi, S. Jamili, A.R. Nikoyan and M. Rabbaniha

This study was undertaken due to identification, abundance and diversity, temporal and spatial fluctuation of coralline fish larvae in Khark and Kharko Islands water. Khark and Kharko Islands are the last Northern point for fringing coral reefs in Iranian side of the Persian Gulf. These Coralline habitats are the Protected Area and Wildlife Refugees with the total area of 2400 ha which located in the territory of Bushehr Province. This research carried out during 2006-2007 with monthly sampling from 9 stations, which selected around Islands inshore waters with maximum depth of 20 m. Sampling was conducted using by Bongo-Net plankton sampler with 500  $\mu$  of mesh size. Totally 494 specimens from: 22 coralline fish larva families were identified in studied area, such as pelagic and demersal fishes. The results was shown that coral reef diversity in coral reefs (Khark and Kharko Islands) is more than other habitats such as estuary and river mouth, creeks, mangrove forest sites and off shore water of the Persian Gulf and Oman Sea Iranian side. The pick of fish larvae abundance family were estimated in spring. (*Journal of Fisheries and Aquatic Science* 4 (3): 136-142, 2009; *Doi*: 10.3923/jfas.2009.136.142)

## **Reproductive Biology of the Japanese Threadfin Bream, *Nemipterus japonicus*, in the Northern of Persian Gulf**

M. Kerdegari, T. Valinassab, S. Jamili, M.R. Fatemi and F. Kaymaram

Since the *N. japonicus* comprises the most abundant commercial fish in the Persian Gulf, an evaluation of the stock status of this species is needed. Reproductive biology of *Nemipterus japonicus* in the northern part of Persian Gulf is described, based on 595 specimens collected between November 2006 and October 2007. Length range of females was 11.0-26.3 cm FL and their weight range was 21.7-325.65 g. Males ranged from 9.4-27.3 cm FL and 14.04-351.89 g in weight. The relationship between Body Weight (BW) and Fork Length (FL) for all individuals was estimated as  $BW = 0.0181 \times FL^{3.0001}$  ( $r^2 = 0.9797$ ,  $n = 503$ ). The overall sex ratio was estimated as M: F = 1.0: 2.6. The length at 50% maturity was estimated to be 19.1 cm for females and 19.6 cm for males. The smallest size at first maturity was 9.4 cm for males and 11.0 cm for females. The spawning behavior was investigated based on macroscopic observations of gonads and determination of gonadosomatic index. The maximum GSI values were recorded in April (2.70%) and September (0.45%) for females and males, respectively. Spawning occurs in spring and autumn seasons. (*Journal of Fisheries and Aquatic Science* 4 (3): 143-149, 2009; **Doi:** 10.3923/jfas.2009.143.149)

## **Effects of Pollutants on Some Aquatic Organisms in Tamsah Lake in Egypt**

M.S. El-Sherif, M.T. Ahmed, M.A. El-Danasoury and Nagwa H.K. El-Nwishy

Tamsah lake is considered one of the wild life features in Egypt in general and in the Suez Canal region in particular. Through field experiment, concentrations of some pesticides which are used around the area, were monitored in the tissues of some birds of prey (wild birds), some species of algae, fish and crustaceans. The results obtained revealed: (1) The presence of some Organochlorines (OC) in the tissues of many of the tested birds represented in (DDE, Heptachlore, HCH, Dicofole). (2) The presence of high residues of Organophosphorus (OP) pesticides represented in malathion and diazinon in most of the tested birds. But they were not detected with high levels in any of fish, crustaceans or algae. (3) The presence of high concentrations of (OC) compounds in the tissues of algae, crab, mullet and some birds (moorhen-cormorant and gulls). Meanwhile, none of those compounds was detected in the water samples. (4) The presence of high levels of all detected pesticides in the tissues of crab makes it the very acceptable

bioindicator to mirror the pollution of the lake, then followed by algae. (5) Pollutants can be transferred through the food chain which causes biomagnification of them in the bodies of the higher organisms in the food chain. It could be concluded that implementation of the environmental management practices in Lake Temsah is still needed to protect these ecosystems from more pollutions which could affect human health and environment. (*Journal of Fisheries and Aquatic Science*, 4 (3): 150-160, 2009; **Doi**: 10.3923/jfas.2009.150.160)

### **Population Genetic Structure of Pikeperch (*Sander lucioperca* Linnaeus, 1758) in the Southwest Caspian Sea Using Microsatellite Markers**

M. Gharibkhani, M. Pourkazemi, M. Soltani, S. Rezvani and L. Azizzadeh

The aims of this study were to analysis the population genetic structure and genetic diversity among and between populations of *Sander lucioperca* based on microsatellite markers. For this purpose, 149 samples of adult pikeperch from three regions of Southwest Caspian Sea (Talesh Coasts, Anzali Wetland and Chaboksar Coasts) were collected. DNA was extracted and using 13 pairs of microsatellite primers, Polymerase Chain Reaction (PCR) was conducted. DNA bands were analysed using Biocapt and GenAlex software package. Out of 13 microsatellite primers, 11 loci were produced, in which 6 of them were polymorphic and 5 monomorphic. Analysis revealed that the average number of alleles per locus and observed heterozygosities were not statistically significant ( $p > 0.05$ ) for all 3 populations. The  $F_{ST}$  value between populations was low but significant ( $p < 0.01$ ), suggesting that the 3 populations are genetically differentiated. Deviation from Hardy-Weinberg equilibrium was obvious in most cases, mostly due to the deficiency of heterozygosities. The highest genetic distance was between Anzali Wetland and Chaboksar Coast populations. The data generated in this study provide useful information on the genetic variation and differentiation in populations of Southwest Caspian Sea pikeperch. (*Journal of Fisheries and Aquatic Science*, 4 (3) 161- 168, 2009; **Doi**: 10.3923/jfas.2009.161.168)

### **Evaluation of Diazinon Toxicity on Nile Tilapia Fish (*O. niloticus*)**

M.S. El-Sherif, M.T. Ahmed, M.A. El-Danasoury and Nagwa H.K. El-Nwishy

Diazinon was used in the laboratorial study to investigate its biochemical effect on tilapia as it is the most popular fish in Egypt. Two hundred and twenty appeared

40±2 g adult male Nile tilapia were reared in glass aquaria of 60 L capacity, provided with a good air supply and dechlorinated tap water, Fish were maintained under suitable condition for the fish growth. Results of the study are summarized as follow: (1) The bioassay test revealed that the LC<sub>50</sub> for tilapia after 96 h of exposure was 2.8 ppm, (2) Fish was very excited after being exposed to lethal concentrations of diazinon (5, 10, 200 ppm) for 96 h. Meanwhile, fish exposed to sublethal concentrations of diazinon for 30 days didn't cause mortality to fish and (3) Exposing fish to 0.28 and 1.87 ppm for 30 days caused the following changes: (A) A reduction in total protein content in muscles up to 13.69 and 21.5% for 0.28 and 1.87 ppm, respectively, (B) A reduction in total protein content in blood serum up to 22.23 and 24.32% for 0.28 and 1.87 ppm, respectively and (c) 52, 27 and 6.8 kDa proteins were not scanned in the treated or the recovered samples in both treatments, a slight reduction in the 33.55, 31.72, 24.31 and 20.8 kDa proteins in both treatments, (4) Exposing the treated fish to 7 days of recovery in un poisoned water caused the following changes: (A) A recovery in total protein content in muscles up to 95.59 and 90.58% for 0.28 and 1.87 ppm, respectively, (B) A recovery in total protein content in blood serum up to 89.36 and 95.14% for 0.28 and 1.87 ppm, respectively and (C) 52.27 and 6.8 kDa proteins were still not scanned after recovery of both treatments. A slight increase in the rest of affected proteins after recovery of both treatments was recorded. Therefore, it can be emphasized for good environmental administration of the water bodies to save human health and environment from the dangerous pesticides. (*Journal of Fisheries and Aquatic Science* 4 (4): 169-177, 2009; *Doi: 10.3923/jfas.2009.169.177*)

### **Protective Effect of Antioxidant Medicinal Herbs, Rosemary and Parsley, on Subacute Aflatoxicosis in *Oreochromis niloticus***

Manal Ibrahim El-Barbary and Ahmed Ismail Mehrim

The object of this study was to conduct the ability of two medicinal herbs, namely rosemary and parsley, for amelioration of aflatoxicosis in *Oreochromis niloticus*. Two herbs' extracts at three concentrations of either (0, 2 and 4 g kg<sup>-1</sup> b.wt. divided into 2 doses at the start and the 6<sup>th</sup> day of the experiment) and three concentrations of aflatoxin B<sub>1</sub>, (AFB<sub>1</sub> 0, 9 and 18 mg kg<sup>-1</sup> b.wt. as a single intraperitoneal administration) were tested either individually or in combination. The herbs and AFB<sub>1</sub> were dissolved in Dimethylsulphoxide (DMSO 25%) and injected to fish groups. Sixteen groups of fish were investigated in this study, where A group (control) was injected with saline 0.89%, group B injected with DMSO

(control solvent), groups F<sub>1</sub> and F<sub>2</sub> were injected with AFB<sub>1</sub> alone (9 and 18 mg kg<sup>-1</sup> b. wt., respectively), R<sub>1</sub> and R<sub>2</sub> groups were injected with rosemary alone (2 and 4 g kg<sup>-1</sup> b. wt., respectively), groups F<sub>1</sub>R<sub>1</sub>, F<sub>1</sub>R<sub>2</sub>, F<sub>2</sub>R<sub>1</sub> and F<sub>2</sub>R<sub>2</sub> were injected with AFB<sub>1</sub> + rosemary, while groups P<sub>1</sub> and P<sub>2</sub> were injected with parsley alone (2 and 4 g kg<sup>-1</sup> b. wt., respectively); however, F<sub>1</sub>P<sub>1</sub>, F<sub>1</sub>P<sub>2</sub>, F<sub>2</sub>P<sub>1</sub> and F<sub>2</sub>P<sub>2</sub> groups were injected with AFB<sub>1</sub> + parsley. At the 12<sup>th</sup> day of the experiment, blood and liver samples were taken from each group. The results indicated that the AFB<sub>1</sub> injected groups revealed a significant increase in mortality rate (MR%) compared with AFB<sub>1</sub>-not injected, group F<sub>2</sub> was the highest while F<sub>1</sub>R<sub>1</sub> and F<sub>1</sub>P<sub>1</sub> were the lowest in MR% among all AFB<sub>1</sub> injected fish groups. Also, AFB<sub>1</sub> led to reduction of haemoglobin (Hb), total protein (TP) and globulin (GL) concentrations and increase in activity of aspartate aminotransferase (AST) and alanine aminotransferase (ALT). These alterations were significantly ameliorated when fish were injected with herbs' extracts. AFB<sub>1</sub> residues showed that the herbs level of 2 g kg<sup>-1</sup> b.wt. have higher potency of reducing the AFB<sub>1</sub> residues than the level of 4 g kg<sup>-1</sup> b.wt. in case of AFB<sub>1</sub> level 9 mg kg<sup>-1</sup> b.wt. While, in case of AFB<sub>1</sub> level 18 mg kg<sup>-1</sup> b.wt., the groups F<sub>2</sub> and F<sub>2</sub>P<sub>1</sub> showed absence of AFB<sub>1</sub> residues. Microscopically, AFB<sub>1</sub> presented histopathological changes in hepatopancrease which increased in severity with increasing AFB<sub>1</sub> level. These lesions may become less severer in all fish groups injected with AFB<sub>1</sub> combined with herbs' extracts especially with the lowest levels of herbs' extracts and AFB<sub>1</sub>. So, this study concluded that either of rosemary or parsley was found to be safe and successful in protection from aflatoxicosis, particularly at the low level. (*Journal of Fisheries and Aquatic Science* 4 (4): 178-190, 2009; *Doi*: 10.3923/jfas.2009.178.190)

### **Accumulation of Lipofuscin and Preliminary Estimation of Age-Structure in Wild Mud Crab (*Scylla paramamosain*) Population in Tropical Mangrove Swamps, Thailand**

Md. Sherazul Islam and Hisashi Kurokura

The age structure of wild mud crab (*Scylla paramamosain*) was explored using autofluorescent age pigment, lipofuscin. Samples were collected from the mangrove swamp area in Pak Phanang mangrove swamps, Thailand. The carapace width-frequency distribution did not show any distinct modes of the sample population, whereas lipofuscin concentration showed positive correlation with carapace width. Lipofuscin concentration in the Olfactory Lobe Cell Mass (OLCM) of the brain was measured using image analysis of fluorescent

micrographs. The lipofuscin concentration (% of area fraction) ranged from 0.06 to 0.26 with the formation of three regularly-spaced modes developed by modal analysis that could be regarded as distinct age classes. Strong correlation was found between lipofuscin concentration and modes observed in the lipofuscin concentration histogram ( $R^2 = 0.99$ ) and the lipofuscin accumulation rate was almost constant (0.08% of area fraction) in each year. Although, existence of wide size ranged population in a lipofuscin concentration mode, the analysis suggested that *S. paramamosain* live in the mangrove ecosystem at best of 2<sup>+</sup> year class. (*Journal of Fisheries and Aquatic Science* 4 (4): 191-202, 2009; **Doi:** 10.3923/jfas.2009.191.202)

### **Effects of Different Protein and Energy Levels on Growth Performance of Caspian Brown Trout, *Salmo trutta caspius* (Kessler, 1877)**

Hamid Ramezani

The objective of this study is to assess the effects of protein and energy levels of diet on fish performance and growth efficiency of Caspian brown trout in order to develop optimum protein and energy level during the preparation of diet for this species. Fish were fed with six experimental diets containing three protein levels (45, 50 and 55%) and two energy levels (3.5 and 4 kcal g<sup>-1</sup>) according to a 3×2 factorial design. The diet was assigned to 18 tanks with 50 fish each, with three replicates for each diet. The experiment was conducted for 8 weeks with Caspian brown trout with an initial body weight of around 7 g. Protein content of diet influenced feed conversion ratio ( $p < 0.05$ ) and specific growth rate statistically ( $p = 0.052$ ). Caspian brown trout demonstrated a better feed conversion ratio and a larger specific growth rate at lower protein levels (45 and 50%) in comparison to high protein level (55%). Protein efficiency ratio improved by a decrease in protein content of the diet ( $p < 0.05$ ), but energy content of diets does not affect any growth related parameter such as feed conversion ratio, specific growth rate and protein efficiency ratio. There was also no interaction between protein and energy levels in the growth related parameters, suggesting the effect of protein on the growth parameters in Caspian brown trout did not depend on energy levels of diet. In conclusion diet containing 50% protein can support the maximum growth and protein sparing by the use of high-energy diet did not occurred in this study. (*Journal of Fisheries and Aquatic Science*, 4 (4): 203-209, 2009; **Doi:** 10.3923/jfas.2009.203.209)

## **First Remarks on Abalone Biology (*Haliotis pustulata*) on the Northern Coast of Aden Gulf, Yemen**

A.M. Ali, A.A. Basmidi, M.Sh. Aideed and Al-Quffail A. Saeed

Abalone has been exploited by humans around the ocean coasts of the world. On contrary, it is still neglected in the Gulf of Aden. This study is a first attempt to explore the biological and ecological status of the absolutely unexploited abalone *Haliotis pustulata* in the Aden Gulf, Yemen. Between Jan 2004 and June 2006, about 700 abalones were collected and analyzed from Intertidal and sublittoral zones along 6 sites of Hadhramout coast. It is revealed that the studied species is relatively small, measuring up to 62 mm, with a slow growth rate of 4-10 mm year<sup>-1</sup> and has moderate fertility compared with many other species in other localities. The highest GSI as well as the highest proportion of mature Sufaylah were prevailed from March to May. Morphological traits, spread, age-size structure and reproduction behavior are discussed in the light of the absence of local similitude studies and well documented world wide haliotids. Results call for necessity of more detailed studies. (*Journal of Fisheries and Aquatic Science* 4 (5): 210-227, 2009; *Doi*: 10.3923/jfas.2009.210.227)

## **Calcium Pre-Exposure Reducing Histopathological Alteration in Nile Tilapia (*Oreochromis niloticus*) After Lead Exposure**

P. Singhadach, W. Jiraungkoorskul, T. Tansatit, P. Kosai and C. Ariyasrijit

This study was evaluated the influence of calcium to reduce the toxicity of sub-lethal lead concentration in Nile tilapia with emphasis on histopathological analysis. The values of 24, 48, 72 and 96 h LC<sub>50</sub> of lead to tilapia were 247.51, 197.47, 183.74 and 182.38 mg L<sup>-1</sup>, respectively. Fish were pre-exposed to vary dosages of calcium carbonate: 0 (G1 and G2); 20 (G3 and G4) and 60 (G5 and G6) mg L<sup>-1</sup> for 4 days. After that, fish were post-exposed to 45 mg L<sup>-1</sup> lead, which correspond to 25% of the 96 h LC<sub>50</sub> (G2, G4 and G6) for 96 h. Histopathological changes were especially most evident in the group (G2) exposed to lead without calcium pre-exposure. The gills were observed edema, lamellar cell hyperplasia, epithelial lifting, lamellar fusion and aneurysm. There were blood congestion in sinusoids, vacuolation of hepatocytes and necrosis. Glomerulus's atrophy, tubular swelling and also necrosis were seen. However, the only observable lesion in the muscle was the infiltration of inflammatory cells and there were no histopathological changes observed in the brain and intestine of the lead treated fish. Fish with pre-exposed calcium (G4 and G6) showed slightly alteration

when compare the only lead treatment groups. The results suggested that calcium pre-exposure may play an important role in the reduction of lead toxicity in fish. (*Journal of Fisheries and Aquatic Science* 4 (5): 228-237, 2009; **Doi:** 10.3923/jfas.2009.228.237)

### **Response to Increased Sediment Load by Three Coral Species from the Gulf of Suez (Red Sea)**

M.L. Ebeid, M.H. Hassan and Y.A. Geneid

This study examines the hypothesis that sedimentation, as a result of anthropogenic activities, has a measurable effect on the growth rate (in terms of linear extension) of branching corals of a subtropical site in the northern Gulf of Suez. Three of the dominant branching coral species; *Stylophora pistillata* (Esper) 1792, *Acropora pharaonis* (Milne Edwards and Haime) 1860 and *A. hemprichi* (Ehrenberg) 1834 were chosen for monitoring their growth rate after the cessation of construction works. At the beginning of the study, the three study species had very low rates of growth in response to increased sediment load. Over time sedimentation rates decreased significantly while linear extension rate per branch of the three study species showed a significant gradual increase. The study reaches the conclusion that coral growth is negatively related to sedimentation. (*Journal of Fisheries and Aquatic Science* 4 (5): 238-245, 2009; **Doi:** 10.3923/jfas.2009.238.245)

### **Hematological Parameters and Erythrocyte Osmotic Fragility in Rainbow Trout, *Oncorhynchus mykiss*, Experimentally Infected with *Pseudomonas putida***

S. Bektas and O. Ayik

In the present study, selected hematological and osmotic fragility values in rainbow trout, following experimental *Pseudomonas putida* infection have been described. Blood samples were collected at day, 1, 3, 7, 14 and 21 post inoculation and examined for the above parameters. Erythrocyte values were significantly decreased at all days. Hematocrit values at day 14 was significantly higher than other days. Hemoglobin values revealed significant decrease from day first onwards. Among red blood cell indices, MCV were found significantly higher from day 1 to 21. Significant decrease in MCHC were also reported. MCH remain unchanged in all days examined. Leukocyte values at day 21 were significantly higher than at day 7. In addition, thrombocytes values at day 21 were significantly



higher than at day 7 and 14 . On the other hand, erythrocyte osmotic fragility values were significantly increased at day 14 and 21 post infection. Interpreted hematological data in the present study, can be used to assess an abnormality or disease process in pseudomonas infected rainbow trout. (*Journal of Fisheries and Aquatic Science* 4 (5): 246-253, 2009; **Doi:** 10.3923/jfas.2009.246.253)

### **Effects of Pre-Drying on Quality of Fried Breaded Black Pomfret (*Parastromateus niger*) Fillet**

Y. Moradi, J. Baker, Y. Che Man and S. kharidah

The objective of this study was to investigate the effects of pre-drying process on quality of fried breaded fish fillets. For this study, breaded black pomfret (*Parastromateus niger*) fillets were pre-dried in conventional oven at 180°C for 0, 30, 60, 90 and 120 sec. The pre-dried fillets were pre-fried in sunflower oil and stored at -20°C for 1 week. They were then finally cooked in the combination oven. Fat, moisture, texture and color of the cooked fillets were evaluated. Results indicated that moisture loss and the fat uptake of cooked fillets decreased with increasing pre-drying time. Instrumental texture analysis showed that hardness of the pre-dried samples increased as compared to the control. Results from color evaluation showed that the b\* (yellowness) values of the samples increased, while L\* (whiteness) and a\* (redness) values did not change significantly (p<0.05). The best quality product was prepared when 90 sec pre-drying time was applied. (*Journal of Fisheries and Aquatic Science* 4 (5): 254-260, 2009; **Doi:** 10.3923/jfas.2009.254.260)

### **Effect of Dietary Supplementation of Biogen® (Commercial Probiotic) on Mono-Sex Nile tilapia *Oreochromis niloticus* under Different Stocking Densities**

A.I. Mehrim

The present study was carried out to evaluate the effects of dietary supplementation of a commercial probiotic Biogen® on growth performance, carcass composition, blood hematological and biochemical parameters, histometric characteristics of fish dorsal muscles and economic efficiency of mono-sex Nile tilapia *Oreochromis niloticus* under different stocking densities. Therefore, fish with similar body weight (12.71±0.17 g) were distributed randomly into seven treatments at different stocking densities, being 10 fish m<sup>-3</sup> which fed a basal diet without Biogen® (T<sub>1</sub>), 10 fish m<sup>-3</sup> (T<sub>2</sub>), 20 fish m<sup>-3</sup> (T<sub>3</sub>), 30 fish m<sup>-3</sup> (T<sub>4</sub>), 40 fish

$m^{-3}$  ( $T_5$ ), 50 fish  $m^{-3}$  ( $T_6$ ) and 60 fish  $m^{-3}$  ( $T_7$ ), which were fed the basal diet but supplemented with 3 g Biogen®  $kg^{-1}$  diet for 14 weeks. The obtained results indicated that  $T_4$  was the best treatment which realized significantly ( $p \leq 0.05$ ) increases of all growth performance parameters (final weight, AWG, ADG and SGR), hematological parameters (hemoglobin, RBCs count, PCV, blood platelets and WBCs count), plasma proteins (total protein, albumin, globulin and albumin/globulin ratio), improved FCR, blood indices (MCV, MCH and MCHC), differentiation of leukocytes, carcass composition, histometric characteristics of fish dorsal muscles and best economic efficiency. There were no adverse effects on water quality criteria among all experimental treatments. Consequently, from the obtained results, it could be concluded that the inclusion of the commercial probiotic Biogen® at a level of 3 g  $kg^{-1}$  diet at stocking density rate of 30 fish  $m^{-3}$  of mono-sex Nile tilapia *O. niloticus* is useful to get the best fish performance with friendly effects on the environment. (*Journal of Fisheries and Aquatic Science* 4 (6): 261-273, 2009; **Doi:** 10.3923/jfas.2009.261.273)

### **The Use of Stable Isotopes and Stomach Contents to Identify Dietary Components of the Spotted Rose Snapper, *Lutjanus guttatus* (Steindachner, 1869), off the Eastern Coast of the Southern Gulf of California**

Arturo Tripp-Valdez and Francisco Arreguín-Sánchez

The food habits of the spotted rose snapper, *Lutjanus guttatus* (Steindachner, 1869), living off of the Eastern coast of the Southern Gulf of California (off the coast of Nayarit) are described based on their stomach contents and isotopic analysis. Fish were collected from the bycatch of shrimp trawling during the 2005-2007 shrimp fishing seasons. Twenty-six taxa were identified in the stomach contents and the geometric importance index suggested xanthid crabs and engraulidae fish are the most important species in the *L. guttatus* diet. Isotopic analysis and mixing models also led to the identification of crustaceans as important species in diets, but fish were considered only as secondary prey in these models. Notably, the diet and trophic level of the spotted rose snapper tend to change as it matures; young fish mainly feed on crustaceans, while larger *L. guttatus* can incorporate fish into their diets. Furthermore, Morisita-Horn index suggests that there are significant differences between the diets of juvenile and adult fish. The estimates of the trophic level for *L. guttatus* from stomach contents ( $TL_{sc} = 3.7$ ) and isotopic analysis ( $TL_{iso} = 3.5$ ) are very similar. (*Journal of Fisheries and Aquatic Science* 4 (6): 274-284, 2009; **Doi:** 10.3923/jfas.2009.274.284)

## **Median Lethal Concentration (LC<sub>50</sub>) for Suspended Sediments in Two Sturgeon Species, *Acipenser persicus* and *Acipenser stellatus* Fingerlings**

M.Y. Garakouei, Z. Pajand, M. Tatina and H. Khara

Median lethal concentration (LC<sub>50</sub>) of suspended sediments in the Sepidrud River on two sturgeon species *Acipenser persicus* and *Acipenser stellatus* were determined to provide reliable criteria and guidelines for the protection of aquatic resources. Static bioassays were performed for 24 and 96 h periods on *A. persicus* and *A. stellatus* one control was used for *A. persicus*. Three replicates were used for each trial. Ten fish were stocked in each aquarium (35×30×35 cm<sup>2</sup>) containing 30 L of water. pH, dissolved oxygen concentration and water temperature was measured and recorded throughout the experimental period. The LC<sub>50</sub> for 24 and 96 h for median lethal concentration were determined following Probit analysis. The LC<sub>50</sub> for 24 and 96 h for suspended sediments was 46294 and 8539 mg L<sup>-1</sup> in *A. stellatus* fingerlings, respectively. However, *A. persicus* fingerlings showed higher tolerance and median lethal concentration for suspended sediments but this species LC<sub>50</sub> was 15367 mg L<sup>-1</sup> for 96 h and 60802 mg L<sup>-1</sup> for 24 h. (*Journal of Fisheries and Aquatic Science* 4 (6): 285-295, 2009; **Doi:** 10.3923/jfas.2009.285.295)

## **Stability of Effective *Edwardsiella tarda* Vaccine Developed for Japanese Eel (*Anguilla japonica*)**

Md. Mer Mosharraf Hossain and Kenji Kawai

This study aimed to design to evaluate the immunogenicity as well as the stability of inactivated bacterins in storage conditions to prevent edwardsiellosis in fish species. Three vaccine formulations, formalin (0.4%, FKC), pressure (600 kgf cm<sup>-2</sup> for 5 min, PKC) and electric current (100 mA at 12v DC for 5 sec, ECKC) killed bacterin and a routes of administration with intraperitoneal injection (i.p.) was tested. The effectiveness of the immunization strategies was evaluated in terms of Relative Percent Survival (RPS) and antibody levels. On the basis of the results pressure inactivated vaccine via i.p. which confers RPS values over 85% at least 6 months post-vaccination. In the search for a more stable bacterin, inactivated *E. tarda* antigen was subjected to different storage temperatures. Storage at 4°C did not significantly affect the titer of PKC and antigenic potency remained stable for

6 month. However, with the bacterins FKC and ECKC there is a considerable loss of potency during stored at 4°C. Bacterins were discarded if exposed to temperature of 0°C or below, because the precise freezing point is not established. Bacterins loosed significant potency after 1 month when stored at 25°C. (*Journal of Fisheries and Aquatic Science* 4 (6): 296-305, 2009; **Doi:** 10.3923/jfas.2009.296.305)

### **The Relation Between Egg Viability, Selected Aspects of Egg and Ovarian Fluid Composition and Time of Stripping in Endangered Caspian Brown Trout (*Salmo trutta caspius*)**

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The effects of egg retention time in the abdominal cavity after ovulation on egg viability were studied in Caspian brown trout (*Salmo trutta caspius*). Eggs were retained in the parental abdominal cavity for 40 days post ovulation. Partial volumes of eggs stripped from 10 individually identified females and fertilized with fresh semen obtained from 8 males at 10 days intervals for 4 stages. The biochemistry of the eggs and ovarian fluid were studied to investigate possible links with post-ovulatory oocyte aging. The eyeing and hatching rate of the eggs declined with over-ripening time: that is, the expected amounts (90.60±6.28% for eyeing and 86.33±6.82% for hatching) in newly ovulated eggs (0-10 days post ovulation) decreased to 0.67±1.34% and 0.49±0.98%, respectively, in over-ripened eggs (30-40 days post ovulation). However, larval abnormalities remained constant for 30 days after ovulation. Over the course of post-ovulation oocyte aging, the pH of the ovarian fluid significantly decreased and the concentration of glucose, protein, calcium, iron and aspartate aminotransferase activity significantly increased. Moreover, the concentration of protein, triglycerides and aspartate aminotransferase activity in the eggs also changed. The present study demonstrated that the best time to take Caspian brown trout eggs after ovulation at 7±0.6°C was up to 10 days post ovulation. Also, egg viability was related to both ovarian fluid parameters (e.g., pH, protein, aspartate aminotransferase, glucose, cholesterol, triglycerides, iron, calcium) and egg parameters (e.g., cholesterol, triglycerides, iron, aspartate aminotransferase) which can be used to detect egg quality defects associated with oocyte post-ovulatory aging. (*Journal of Fisheries and Aquatic Science* 4 (6): 306-315, 2009; **Doi:** 10.3923/jfas.2009.306.315)

## **Population Genetic Study of *Rutilus frisii kutum* (Kamansky 1901) from the Caspian Sea; Iran and Azerbaijan Regions, using Microsatellite Markers**

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The genetic diversity and population structure of *Rutilus frisii kutum* from three regions in the Iranian coastline and one region from Azerbaijan were investigated using microsatellite DNA markers. Genomic DNA from 140 specimens was extracted and using PCR approach nine loci with reasonable polymorphism were amplified. The results showed that the lowest mean number of alleles per locus (5.22) was observed in Tonekabon River and the highest (5.77) in Azerbaijan population. The observed heterozygosity in the Tonekabon River (0.625) population was higher than those of the other two populations in Iran and Azerbaijan population (0.473). Significant deviations from HWE were found at more loci in the Iranian populations than Azeri population. In spite of geographical distance, both the highest and lowest population differentiation ( $F_{st}$ ) value was between Iranian populations not among the Iranian and Azerbaijan populations. The highest and significant was between Khoshkrud and Tonekabon (0.098) and the lowest and significant was between Khoshkrud and Gorganrud (0.062). The genetic distance was the lowest (0.27) between the Khoshkrud and Gorganrud populations, whereas the highest distance (0.493) was between Khoshkrud and Tonekabon River. The AMOVA analysis with consideration of 2 sampling regions (Iran and Azerbaijan) and 4 sampling locations (Iran: Khoshkrud, Tonekabon, Gorganrud and Azerbaijan: the Kura mouth) revealed that almost all of the variance in data namely 86% ( $p = 0.01$ ) was within locations, genetic variances among locations was 12% ( $p = 0.01$ ) and among regions was 2% ( $p = 0.01$ ). The reported results could be of interest for management and conservation programmes of this species in the Caspian Sea. (*Journal of Fisheries and Aquatic Science* 4 (6): 316-322, 2009; **Doi:** 10.3923/jfas.2009.316.322)

## **Effect of Pb and Cd on the Iron Solute in Blood (*Chalcalburnus chalcoides*)**

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This study was carried out within inland Aquaculture Research Center Bandar Anzali (Guilan Province) through Southwestern part of the Caspian Sea; to examine the effect of two heavy metals (lead, cadmium) on (Fe) amount in blood

of *Chalcalburnus chalcoides*. This fish is widespread and lives through Southern and Western part of the Caspian. The sampling was randomly done in two stages. The size of fish was 15-16 cm. After transferring fish to the pool, in order to adaptation, has been provided 12 aquariums in which 9 fish were released to each one. Regarding to the lowest capacity (LC50) for these fish, chose the selective densities to pollute aquariums' environs. In such a way that for each aquarium cell with a constant density, we account 0.05, 0.15 and 0.03 ppm for lead and 0.15, 0.25 and 0.75 ppm for cadmium, respectively; while a stereotype aquarium was considered as a non- polluted environ. In each stage, we left 3 fish out of them to take blood from their heart and tail-stem, then we transferred the frozen samples to the lab. This experiment was repeated for the second metal as the same. Acid nitric digested the blood to provide a transparent and colorless solution for the atomic absorption device. With respect to the obtained absorptions by Pb, Cd and Fe in lab, the variance analysis (ANOVA) was carried out in (SPSS) and (Excel) systems. Based on statistical results, cadmium with ratio  $p < 0.05$  replaced with ferritin (Fe) over the time, but metal (Pb) couldn't so. The results indicated that by increase in lead density within various times, this metal was absorbed by other fish's tissues. (*Journal of Fisheries and Aquatic Science* 4 (6): 323-329, 2009; *Doi*: 10.3923/jfas.2009.323.329)

### **Isolation and Characterization of Saprolegniaceae from Rainbow Trout (*Oncorhynchus mykiss*) Eggs in Iran**

H.A.E. Mousavi, M. Soltani, A. Khosravi, S.M. Mood and M. Hosseinfard

The goal of the this study was to identify Saprolegniaceae fungi isolated from affected rainbow trout eggs in six hatcheries in Mazandaran Province (Northern Iran) from December 2006 to February 2007. The isolated oomycetes were classified according to their morphological characteristics on hemp seed media at 18-24°C. Seven fungal species belonging to three genera of *Saprolegnia*, *Achlya* and *Brevilegnia* were identified. The fungal species were morphologically characterized as *S. parasitica*, *S. mixta*, *S. monilifera*, *Saprolegnia* sp., *A. oblongata*, *Achlya* sp. and *Brevilegnia* sp. This is the first recorded oomycetes infection in rainbow trout hatcheries in Iran. (*Journal of Fisheries and Aquatic Science* 4 (6): 330-333, 2009; *Doi*: 10.3923/jfas.2009.330.333)