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## The Impact of Fish Meal Replacement with Rice Bran Protein Concentrate on Survival, Growth and Amino Acid Composition of Rainbow Trout, *Oncorhynchus Mykiss*, Fry

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### ABSTRACT

Animal protein sources in fish feeds are expected to be greatly decreased as a consequence of increasing economic, environmental and safety issues. Research for fish nutrition has recently focused on the development of practical diets with minimal levels of fish meal and alternative lower-cost protein sources. At the present study, primarily, rice bran protein concentrate (RBPC) was produced with alkalinity method and, then, were used in rainbow trout diets at three levels (10, 25 and 35%) as a fish meal replacement. One diet was taken as control without replacing. Alvine fed these diets for 30 days after the start of feeding. The survival was significantly ( $P<0.05$ ) higher in control but there was no significant difference among others ( $P>0.05$ ). High final weight and weight gain and SGR were observed at the end of trial for RBPC-10 diet ( $P<0.05$ ). The highest and lowest of PER and LER was observed in control and RBPC-35 groups, respectively. But these factors had no significant difference between RBPC-25 and RBPC-10 ( $P>0.05$ ). Based on a proximate analysis, the groups fed RBPC-35 showed lower protein and higher lipid in body composition ( $P<0.05$ ). Results of amino acid profile of fishes fed plant protein showed that the amount of Glycine increased at 25 and 35% of RBPC. Also, histidine decreased at all diets compared to the control. The lowest amount of lysine was found at RBPC-35. In conclusion, fish meal can be substituted with up to 25% RBPC in larval stage of rainbow trout without any growth reduction.

**Keywords:** body composition, *Oncorhynchus mykiss*, protein concentrate, replacement, Rice Bran.

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## **A study on the effect of temperature and pH on the lipase activity purified from the foregut of Rainbow trout (*Oncorhynchus mykiss*)**

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### **ABSTRACT**

Lipases are one of the most important digestive enzymes that have considerable physiological significance and industrial potential. Aquatics are one of the important resources for enzymes purification such as lipase. In this study, effect of temperature and pH on the lipase activity purified from the foregut of Rainbow trout, was assessed. For the purification, ammonium sulphate for the precipitation and ultrafiltration for concentration of sample was used. Enzyme activity was assessed by Nitrophenyl palmitate as substrate in different temperatures and pH to determination the best of temperature and pH for enzyme activity. The results showed that the optimum temperature and pH for rainbow trout lipase were 40°C and 8, respectively. Thermal and pH stability were also 4-40°C and 6-8 for rainbow trout lipase activity.

**Keywords:** enzyme activity, lipase, rainbow trout, thermal stability.

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## Effects of diazinon of hematological parameters of *Capoeta damascina*

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### ABSTRACT

Diazinon is a highly-consumed organophosphate pesticide. This poison can reach to the aquatic ecosystems and has negative effects of aquatics and finally humans. At the present study, effects of 0.5, 1 and 1.5 ppm diazinon on hematological parameters (Hb, HCT, RBC, WBC, MCV, MCH, MCHC, lymphocyte, monocyte, neutrophil and eosinophil count) of the *C. damascina* were examined. The blood samples were collected at 1, 5 and 9 days after exposure to the poison. HB, HCT, RBC, WBC, lymphocyte counts of the fished exposed to the poison decreased compared to those received no poison. In contrast, diazinon increased the neutrophil count. There was no significant difference in MCV, MCH and MCHC between fishes received poison and the control group. In conclusion, hematological parameters of *C. damascina* are suitable indicators of diazinon.

**Keywords:** Blood, *Capoeta damascian*, Diazinon, Hematological parameters, Pesticide.

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## Study of Morphology and Density of Acartidae species (Copepoda: Calanoida) in Hendijan Harbor (NW Persian Gulf)

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### ABSTRACT

The present investigation is based on separation and identification of Planktonic Acartidae in Hendijan Harbor during 2010-2011. Zooplankton samples collected by plankton net (100 $\mu$ m) from six stations in July, August, October of 2010 and December, February, April of 2011. In this study family of Acartidae was represented by 5 species: *Acartia ohtsukai*, *A. erythraea*, *A. danae*, *A. fossae* and *Acartiella faoensis*. Abundance of each species was measured in sampling stations and studying months. The highest density of Acartidae copepods were recorded in August and August 2010 (12037 $\pm$ 1200 Ind./m<sup>3</sup>) and any species of this family did not observed in December and February 2010. Family Acartidae formed 28% of all planktonic copepods during studying period. *A. faoensis* with relative frequency of 19% was dominant species among all Copepods. There was Positive significant correlation coefficient between density of Acartidae and water temperature ( $P < 0.05$ ) that shows effect of temperature on density of Acartidae species.

**Keywords:** Acartidae, copepods, Hendijan Harbor, morphology, Persian Gulf.

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## Ontogenetic changes of pancreatic enzymes and fatty acids in egg and larvae of grass carp (*Ctenopharyngodon idella*)

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### ABSTRACT

Ontogenetic changes of digestive enzymes (pancreatic) and fatty acids profile in fertilized grass carp (*Ctenopharyngodon idella*) eggs and eleuthero-embryo were examined at the beginning of exogenous feeding. The fertilized egg, newly hatched larvae, one-day-old larvae, larvae in 2/3 yolk-sac absorption stage and complete yolk-sac absorption stage were sampled. Then, the digestive enzymes including trypsin, chymotrypsin, lipase and amylase which related to the digestion of protein, lipid and carbohydrate were measured in egg, at hatching stage and onset of exogenous feeding. High specific activity of trypsin and chymotrypsin in egg and newly hatched larvae revealed their importance during embryogenesis and hatching ( $P<0.05$ ). The results showed the increasing trend in the specific activity of lipase and amylase ( $P<0.05$ ). The results also showed that the increase in saturated fatty acids (SFA) coincide with a decrease in monounsaturated fatty acids (MUFA), indicating the role of monounsaturated fatty acids for energy provision during embryogenesis and larval development.

**Keywords:** *Ctenopharyngodon idella*, fatty acid, grass carp, larval development, ontogeny, pancreatic enzymes.

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## Performance evaluation of combined probiotic *Bacillus* and yeast *Saccharomyces cerevisiae* isolated from the digestive tract of *Huso huso* on growth factors and biochemical body extracts improvement and increased resistance of Silver Carp (*Hypophthalmichthys molitrix*) larvae in the face of stressors

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### ABSTRACT

The aim of this study is determine the combined effects of probiotic: *B. licheniformis* and *B. subtilis* and a yeast species that called *Saccharomyces cerevisiae* that isolated from gut Beluga (*Huso huso*) on growth factor, biochemical factors in the body extract, and the amount resistance of silver carp larvae (*Hypophthalmichthys molitrix*) (The mean weight  $200 \pm 15$  mg) against environmental stressors. Control fish were fed with basal diet and other experimental groups of fish were fed with supplement diet in three concentration  $1.5 \times 10^6$  (T1),  $3 \times 10^6$  (T2) and  $4.5 \times 10^6$  (T3). Results showed that after 30 days of feeding the probiotic treatments, growth parameters significantly was increased ( $P < 0.05$ ). T2 and T3 treatments have significantly better growth with less Feed conversion ratio (FCR) than the control group and specific growth rate (SGR) in this treatment had the best performance. Results showed that lipase levels in all four groups was not significantly change ( $P > 0.05$ ). Amylase levels in T2 and T3 respectively and sugar in T3 showed the highest value. Cortisol levels in the control treatment were significantly greater than the groups that fed whit probiotic supplement ( $P < 0.05$ ). Larvae fed diets containing the probiotic showed more resistance against unfavorable environmental conditions compared with the control group ( $P < 0.05$ ). The results of this experiment showed that the probiotic mixture in a food supplement, on growth factors, biochemical factors in the body extract and resistance of Silver carp larvae in most cases will affect.

**Keywords:** biochemical factors, growth factor, probiotic, resistance, Silver Carp larvae

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## The Effects of Temperature on Survival, Growth, Life Span and Reproduction Characteristics of *Phallocryptus spinosa* Milne Edwards, 1980 (Crustacea; Anostraca)

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### ABSTRACT

The survival, growth, reproductive and life span characteristics of *Phallocryptus spinosa* were studied at different temperatures in the laboratory. Three replicates of 200 newly hatched nauplii were transferred to culture containers at 15, 20, 25 and 30°C. The larvae were fed with unicellular algae *Dunaliella tertiolecta* and chemically treated yeast known as Lansy PZ. Survival and growth rate of fairy shrimps were calculated on days 3, 6, 9, 12, 15 and 18. After attaining the adulthood twenty pairs of adult Anostraca were transferred from all culture vessels into separate containers filled with 300 ml of brackish water (5ppt) with similar temperatures to compare their reproductive and life span characteristics. Maximum growth at shortest period ( $13.2 \pm 2.0$  mm on day 12) was observed at 30°C, but all died before day 15. Maximum survival (86%) was observed at 15°C; however, minimum growth also was obtained at this temperature with none of the shrimps reaching sexual adulthood. The fairy shrimps reached sexual adulthood only at 20 and 25°C with significantly better results in most of the reproductive parameters especially in total cyst production per female (174 cyst) at 20°C. It was concluded that 20 °C is suitable temperature for culture if this species.

**Keywords:** Anostraca, growth, life span and reproductive, *Phallocryptus spinosa*, survival.

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## Culture of freshwater copepod *Eucyclops serrulatus* using algal and non-algal diets under laboratory conditions

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### ABSTRACT

Copepods as crustacean zooplankton are suitable preys for feeding of fish larvae. In the present research, effect of five different diets consist of green algae *Scenedesmus quadricauda*, cereal plant meal (rice+white+canola+barley), fish food meal, mixed manure powder (chicken manure+cattle manure), and baker's yeast (*Saccharomyces cerevisiae*) were investigated on production, growth, and body length in freshwater copepod *Eucyclops serrulatus*. Results showed that mean nauplii production of  $48.8 \pm 4.7$  ( $\pm$ SE),  $28.4 \pm 2.35$ ,  $17.7 \pm 2.10$ ,  $15.9 \pm 1.80$ , and  $2.6 \pm 1.80$  ind./female and mean copepodit production of  $37.3 \pm 4.9$ ,  $29.3 \pm 1.80$ ,  $18.6 \pm 3.20$ ,  $7.1 \pm 1.00$ , and  $5.3 \pm 1.80$  ind./female were obtained fed on fish food meal, baker's yeast, cereal plant meal, algae *Scenedesmus* and mixed manure powder, respectively. Fish food meal was most suitable diet for copepod *E. serrulatus* culture because had highest total copepod production (nauplii+copepodits+adults) ( $101.3 \pm 3.7$  ind./female or  $2533.0 \pm 94.2$  ind./L), specific growth rate (0.15 /day), shortest doubling time of population (4.6 days), and highest body size ( $691.8 \mu\text{m}$  in length and  $298.2 \mu\text{m}$  in width). Overall, results of present study based on production, growth, and body length illustrated that *E. serrulatus* has suitable potential culture on algal and non-algal diets, but the better performance obtain on non-algal diets.

**Keywords:** algal and non-algal diets, copepods, eucyclops serrulatus, growth, production.

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## Determination of growth parameters, Age structure and sex ratio of Pike (*Esox lucius* Linnaeus, 1758) from Anzali wetland

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### ABSTRACT

The aim of this study was to record growth parameters, age structure and sex ratio of Pike (*Esox lucius*) from Anzali wetland. 337 specimens were caught by fixed gill net (32-84 mm stretched mesh size) and fyke net (48-64 mm stretched mesh size) during November 2010 to Jun 2011. The age rang was 2<sup>+</sup> to 6<sup>+</sup> years for male and 3<sup>+</sup> to 7<sup>+</sup> years for female. 81.59% of age composition was belonging to year classes of 3<sup>+</sup> and 4<sup>+</sup>. Male to female sex ratio was obtained 1.12:1 that was not differed significantly ( $P>0.05$ ). Total length (TL) and weight (W) ranged from 28.4 to 62.8 cm and 100 to 1900 g respectively. The *b* value of the length-weight relationship for male ranged 2.945 that showed isometric growth ( $P>0.05$ ) and for female ranged 3.144 that showed positive allometric growth ( $P<0.05$ ). Mean of Relative weight ( $W_r$ ) was calculated  $0.923\pm 0.009$  and  $0.996\pm 0.011$  for male and female respectively that was differed significantly ( $P<0.05$ ). Instantaneous growth coefficient (*G*) was obtained 0.44 and 0.52 for male and female respectively. Growth performance index ( $\phi$ ) was calculated 3.10 and 3.04 for male and female respectively. The estimated von Bertalanffy growth parameter values were ( $L_\infty= 77.34$  cm,  $K= 0.21$  yr<sup>-1</sup> and  $t_0= -0.27$  yr;  $L_\infty= 91.95$  cm,  $K= 0.13$  yr<sup>-1</sup> and  $t_0= -0.82$  yr) for male and female respectively. Also infinity weight ( $W_\infty$ ) was estimated 2610.03 g and 4102.68 g for male and female respectively. These results showed that environmental condition are not suitable for pike (*E. lucius*) in Anzali wetland.

**keywords:** age, Anzali wetland, *Esox lucius*, growth, Pike.

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## The effects of Diazinon (organophosphate pesticide) on motility indices and morphological parameters of Caspian Lamprey (*Caspiomyzon wagneri*) sperm

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### ABSTRACT

The Caspian Lamprey (*Caspiomyzon wagneri*) is native to the Caspian Sea that migrates into its rivers for spawning, while is encountered with many threats including the organophosphate pesticides pollution. This study conducted to investigate the effects of an organophosphate pesticide *i.e.* Diazinon, on motility indicators and morphology of sperm in Caspian Lamprey. Hence, sperm were exposed to Diazinon in concentrations of 0.01, 0.05, 0.1, 0.5, 1 and 5mg/l until the end of its motility. The results showed that increasing concentrations of Diazinon significantly reduce sperm motility ( $P<0.05$ ). Increasing length, width and area of head, destruction and amputation of flagellum were significantly raised among sperm in three minutes of Diazinon exposure ( $P<0.05$ ). The results also displayed that percentage of damaged sperm significantly increased according to Diazinon concentration ( $P<0.05$ ) with a maximum effect at concentration of 5m/l in which the amputation of flagellum, twisting and shortening of flagellum, head deformity and destruction of sperm was recorded 4.4%, 26.6%, 15.3% and 31% respectively. Finally, this study can suggest that Diazinon effects on reproduction process of Caspian Lamprey decreasing sperm quality indicators *i.e.* motility and its morphological parameters. This can probably reduce the rate of fertilization in this species threatening its survival.

**Keywords:** Caspian Lamprey, Diazinon, motility, sperm morphology.

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## Hydrodynamic and salinity modeling in Gorgan Gulf for the retrieval of the confidence interval between aquaculture fields under instantaneous pollution loading

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### ABSTRACT

One of the important issues in aquaculture is the confidence interval between the aquaculture fields under the different pollution loading conditions. One of these conditions is the instantaneous pollution loading. It is necessary to determine a confidence interval between aquaculture fields that the instantaneous pollution in one field doesn't influence another field. Gorgan Gulf is one of the most important water resources and supplier of fishing in Iran. The goal of this study is the determination of confidence interval between aquaculture fields. In this study, 2-D hydrodynamic and salinity modeling of Gorgan Gulf using MIKE21 is performed. Salinity concentration was measured in 19 different stations during 5 months of 1390 and the hydrodynamic and salinity models were calibrated and verified using these data. The optimum values for Manning and dispersion coefficients were determined 0.025 m/s and 50 m<sup>2</sup>/s, respectively. Then, 6 different conservative instantaneous pollution point sources were exerted in the gulf and the salinity model was implemented. The peak of pollutant concentration in various distances from point sources was determined and compared with the initial concentration of pollutant in the point sources. The results demonstrated that 99.9% of pollutants is diluted until to 100m from point sources. Hence, the confidence interval of Gorgan Gulf was determined about 100m.

**Keywords:** Aquaculture fields, Confidence interval, Gorgan Gulf, hydrodynamic modeling, instantaneous pollution loading, salinity modeling.

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## Survey of compensatory growth of Tinfoil Barb (*Barbonymus schwanenfeldii*) following periods of starvation and refeeding

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### ABSTRACT

To investigate the compensatory growth of tinfoil barb (*Barbonymus schwanenfeldii*) a 7 week study was performed. Tinfoil Barb with an average weight of  $10.7 \pm 0.1$ g were starved for 0 (control), 1 (T1) or 2 (T2) weeks and then re-fed to satiation for 5 weeks. At the end of the experiment, fish deprived for 1 week had similar body weight to the control indicating that complete compensatory growth occurred. However, fish deprived for 2 week had significantly lower body weight and specific growth rate than the control. Daily feed intake was significantly higher in fish deprived for 1 week than that in the control whereas fish deprived for 2 week had significantly lower daily feed intake than the controls. No significant differences were found in feed conversion ratio and condition factor between the deprived and control fish at the end of the experiment. Our results indicate that compensatory growth occurred in tinfoil barb and the magnitude and duration of compensatory growth depended on the length of food deprivation.

**Keywords:** *Barbonymus schwanenfeldii*, compensatory growth, food deprivation, growth performance, Tinfoil barb.