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## Effect of bambara groundnut (*Voandzeia subterranean*) protein isolate as protease inhibitor on autolysis and gel properties of surimi from lizard fish (*Saurida tumbil*)

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### ABSTRACT

Impact of bambara groundnut protein isolate (BGPI) on autolysis and gel properties of surimi from lizard fish was investigated. As the levels of BGPI increased (0-3%), breaking force, deformation and retention/ stability of myosin heavy chain (MHC) of modori gel markedly increased ( $P < 0.05$ ). Nevertheless, only 0.25% BGPI increased above parameters in kamaboko gel. A decreasing trend in whiteness and expressible moisture content of kamaboko gel was observed when the BGPI levels increased. Because of suitability of 0.25% BGPI in kamaboko gel, this level was selected for determination of microstructure and sensory analysis. Microstructure of kamaboko gel added with 0.25 %BGPI had a more compact structure than that without BGPI addition. Regarding sensorial properties, elasticity, texture and general acceptance of kamaboko gel added with 0.25% BGPI was significantly higher than control ( $P < 0.05$ ). Therefore, BGPI at an appropriate level could be a protease inhibitor to improve gel properties of kamaboko.

**Keywords:** bambara groundnut, gel inhibitor, lizard fish, saurida tumbil, sensory analysis, surimi.

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## Heavy metal content in muscles of the Indian white shrimp (*Fennerpenaeus indicus*)

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### ABSTRACT

Heavy metal (HMs) pollution of aquatic environment has become a great concern in recent years. Commercial aquatic animals, such as shrimp, are highly consumed by human being and may accumulate large amounts of metals from the water, therefore, it is important to determine the concentration of HMs in them. This study was conducted to determine the distribution of several types of heavy metals (Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb and Zn) in the muscle of Indian white shrimp (*Fennerpenaeus indicus*) caught in Bandar-e Mahshahr which is located in the north western Persian Gulf Coast of Iran. The mean concentrations of Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb and Zn were 0.405, 0.694, 18.9, 17.1, 0.413, 0.748, 0.663, 3.71 and 33.2  $\mu\text{g g}^{-1}$  respectively. Our results indicated that all analyzed HMs in Indian white shrimp were lower than the threshold values described in literature (i.e., WHO).

**Keywords:** heavy metals, Indian White Shrimp (*Fennerpenaeus indicus*), permissible amounts, Persian Gulf, pollution.

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## Molecular and pathological identification of *Lactococcus garvieae* isolated from cultured rainbow trout in Ilam

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### ABSTRACT

In the present study, 60 diseased rainbow trout with clinical signs such as lethargy, erratic swimming and exophthalmia were collected from rainbow trout farms in Ilam in January 2010. For detection the agent of disease, samples were collected from liver, kidney and spleen of fish and cultured on blood agar and incubated at 22 °C for 24h. Isolates were confirmed using a m-PCR targeting 16S rRNA, *lctO*-gene and 16S-23S rRNA that detect *Lactococcus garvieae*, *Streptococcus iniae* and *S. dysgalactiae*, respectively. In the present study a single band of 1100 bp for *L. garvieae* for most of isolates. It concluded that the main agent of septicemia was *L. garvieae*. Edema of the secondary lamellae and epithelial lifting, lamellar capillary aneurysms, hypertrophy and hyperplasia of epithelial cells in gill and thickening of the glomerular basement membrane of glomerulus capsule, tubular cell necrosis, increase of melanomacrophage centers, blood congestion and hemorrhage in the kidney were the most histopathological changes observed in the diseased fish. In conclusion, it seems that Multiplex PCR is a definite method for rapid detection of bacteria in mixed infection.

**Keywords:** *Lactococcus garvieae*, multiplex PCR, pathology, Rainbow trout, *Streptococcus iniae*.

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## The comparison of growth performance and survival rate of sterlett (*Acipenser ruthenus*) and Siberian sturgeon (*Acipenser baerii*) from larvae to fingerling

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### ABSTRACT

This study was carried out on the growth and survival rates of *Acipenser ruthenus* and from larvae to fingerling stages. A total of 4000 larvae from each species were provided and stocked in 2 fiberglass tanks (2000 larvae in each tank with volume 3.2 m<sup>3</sup>). Food Conversion Ratio (FCR) for both species was  $3.07 \pm 0.3$  in this period, which showed no significant difference statistically significantly ( $P > 0.05$ ). Based on these results, the mean weight of *Acipenser ruthenus* larvae was  $21.8 \pm 0.82$  mg at the start phase of activated feeding and reached to  $3 \pm 0.35$  g in fingerlings at the end after 76 days. The mean weight of Siberian sturgeon larvae was  $23.7 \pm 2.06$  mg at the beginning of the study and reached to  $2.8 \pm 0.19$  g at the end. Specific growth rate (SGR) in *Acipenser ruthenus* and *Acipenser baerii* was  $2.77 \pm 0.02\%$  and  $2.72 \pm 0.02$  percent, respectively that showed no significant difference. Survival rate in *Acipenser ruthenus* and *Acipenser baerii* were  $45.5 \pm 0.016$  and  $32.5 \pm 0.15$  that showed significant difference ( $P > 0.05$ ). Therefore, survival rate indices in *Acipenser ruthenus* were better than *Acipenser baerii* stocked in fiberglass tanks.

**Keywords:** *Acipenser ruthenus*, *A. baerii*, larvae, activated feeding, fiberglass, growth parameters

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## Estimation of density of trout in fish farm using image-processing technique

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### ABSTRACT

Fish is one of the major sources of animal protein that has an important role as a healthy food for people. To supply this useful food source, fish farming in ponds has been considered and developed. Since about 57% of the total cost of fish farms is spent on fish feeds, fish farmers would like to determine the mass of live fishes accurately within period of the rearing. So far, the weight and mass density of live fishes is estimated by statistical methods with an error of about 15 to 25 percent. Therefore, a new method for estimation of the live mass density of fishes was proposed using image-processing technique. A metal frame for installation of a digital still camera was designed and installed on the pool, and at six stages of growth season, several images were taken for different fish densities. An accurate scale was used to measure the actual weight of fishes. Images were then analyzed using MATLAB software. Results showed that at each growth stage, the area of live fishes (in pixel) and actual weight of fishes followed a linear relationship with coefficients of determination ( $R^2$ ) of 0.937, 0.962, 0.790, 0.988, 0.991 and 0.942 from the beginning of growth to final stage of fish harvest. Model was validated with new set of data, and results revealed no significant difference between actual and estimated densities at 5% level of significance.

**Keywords:** fish bulk density, fish farming, machine vision, mathematical model, trout.

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## Investigation of the genetic variability in *Litopenaeus vannamei* shrimp, using SSR markers, in Jask port of Hormozgan province

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### ABSTRACT

Due to the lack of specified lineage and parentage information from exotic broodstocks of *Litopenaeus vannamei* shrimp, in Iran, the status of genetic structure and genetic variability of this species isn't clear. In order to estimate the current status of genetic pool and investigate the genetic variability indices, total of 30 samples from Amiri and Gorgeaj farms in Jask port of Hormozgan province were detected with four microsatellite markers Pvan1758, TUDGLv1-3.224, TUDGLv5-7.33 & TUDGLv7-9.17. The number of alleles in every marker was 5-10; the mean number of alleles ( $N_a$ ) by populations ranged from 7.5 to 7.75 and their effective number of alleles ( $N_e$ ) from 4.834 to 5.148. The mean value of observed heterozygosity ( $H_o$ ) by populations ranged from 0.458 to 0.479, which was lower than the expected one (0.791-0.794). Observed heterozygosity values ( $H_o$ ) were lower than expected heterozygosity values ( $H_e$ ), except for TUDGLv1-3.224, in Gorgeaj population that indicating a general deficit of heterozygous types for the under studied markers. Mean polymorphism information content (PIC) in two populations based on markers (0.88), indicating the high polymorphism of studied markers. Amiri's farm population in TUDGLv5-7.33 and Pvan1758 ( $P < 0.001$ ) markers; Gorgeaj's farm population in TUDGLv5-7.33 ( $P < 0.01$ ), TUDGLv7-9.17 and Pvan1758 ( $P < 0.001$ ) markers; departed from Hardy-Weinberg equilibrium (HWE). The mean coefficient of inbreeding ( $F_{IS}$ ), 41%, and the coefficient of genetic differentiation among populations ( $F_{ST}$ ) was 0.100. Using analysis of molecular variance (AMOVA), the molecular variability among (15%) and within (85%) populations were obtained. Also, values of  $\Phi_{PT}$  and  $N_m$ , 0.149 and 1.432 respectively, showed that there is moderate genetic differentiation and adequate gene flow among two studied populations. The high  $F_{IS}$  and moderate  $F_{ST}$  highlight the importance of continuous evaluation of genetic variability in Hormozgan cultured *Litopenaeus vannamei* shrimp populations.

**Keywords:** genetic variability, Hormozgan, *Litopenaeus vannamei*, marker microsatellite.

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## Spatial distribution of macrobenthic communities in relation to environmental conditions on the intertidal and subtidal of Bushehr coasts

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### ABSTRACT

The spatial distribution of the macrobenthos community was studied along the Iranian coasts of Persian Gulf of Bushehr province. Samples were collected with van Veen grab from intertidal (0 m) and subtidal (depths 5 m and 10 m) zones at 16 stations determined in 6 transects, including 4 harbors (Genaveh, Bandargah, Rostami and Asaluyeh) and 2 creeks (Farakeh and Shif). A total of 17 groups (taxa) of macrobenthos were identified during research so that the most dominant assemblages belonged to Mollusca, Annelida, Arthropoda and miscellaneous groups, respectively. The average density (abundance) of macrofauna in depth\*station ranged from 450 to 4380 ind/m<sup>2</sup> and the average biomass (wet) ranged from 9 to 165 g/m<sup>2</sup>, also. Highest value of density and biomass were observed at 10 m and intertidal depths, respectively. Generally, the environmental parameters such as water depth, transect, sediments texture and organic matter found to influence the biological indices (density and biomass), ecological indices (diversity and richness) and structure distribution pattern of macroinvertebrates. In conclusion with increase depth and soft sediment was showed high density and decrease biomass. Also, density and biomass varied significantly ( $P < 0.05$  and  $P < 0.01$ ) which could be correlated with combination of different factors such as depth, transect, sediment characteristics, hydrodynamic conditions and marine pollution.

**Keywords:** Bushehr, intertidal, macrobenthic communities, spatial distribution, subtidal.

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## Use of an Otoscope to Sex Identification of Cultured Great Sturgeon *Huso huso*

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### ABSTRACT

In the present study, an otoscope was used to sex identification of 3-year old great sturgeon *Huso huso* in a weight range of 2.5-5.5 kg. For direct observation of gonads and identify sexes, 2350 fish were considered for this procedure with a small incision of 0.6-0.8 cm through the abdomen with insert of otoscope into the body cavity. The results showed that 99.2% of fish could be sexed via the otoscope and the sex ratio was classified as 1:0.98. Result revealed that otoscopy is a high accurate and efficient technique for sex identification of great sturgeon in 3-year old fish.

**Keywords:** gender, gonad, otoscope, sturgeon, weight.

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## Determination of the age structure, growth models from sand goby (*Neogobius pallasii* Berg, 1916) in the Kaboodval, Zaringol and Shirabad streams.

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### ABSTRACT

The purpose of this study was to determine the age structure, growth models and its variation from sand goby *Neogobius pallasii*, in Kaboodval, Zaringol and Shirabad Streams. For this purpose, 104, 30 and 62 specimens were studied in three streams, respectively, in summer 2008. Both male and female comprised five age groups ( $0^+$  -  $4^+$ ). The maximum lengths were 137.55, 114.1 and 137.97 mm (TL) respectively. The most frequent age was  $1^+$ . There were only significant differences in sex ratio of specimens in the Shirabad Stream ( $P < 0.05$ ). Growth model were positive allometric for specimens of the Kaboodval and Zaringol Streams ( $b > 3$ ) but in the Shirabad Stream was isometric ( $b = 3$ ). Based on the von Bertalanffy growth model,  $L_{\infty}$  and  $K$  in the Kaboodval, Zaringol and Shirabad Streams were ( $L_{\infty} = 143.7$   $K = 0.774$ ,  $L_{\infty} = 122.1$   $K = 0.777$  and  $L_{\infty} = 147.3$   $K = 0.66$ ) and also the growth performance Index ( $\phi$ ), were 4.20, 4.06 and 4.15 respectively. The highest values of condition factor were observed in the Kaboodval and Shirabad Streams ( $1^+$ ), in the Zaringol stream ( $3^+$ ) and its minimum was for age group ( $0^+$ ) in three streams. After  $2^+$  year age, significantly decrease in growth rate was observed. The stressful ecological conditions of Rivers in comparison with Sea ecosystems including of rapid changes in flow rate and human manipulation in environmental factors of River, may have some influences on the reducing longevity or eliminating the elder samples in population.

**Keywords:** age structure, growth model, Kaboodval stream, sand goby, Shirabad stream, Zaringol stream.

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## A comparative study on the effect of trypsin treatment and clay method on jelly coat removal of the Persian sturgeon (*Acipenser persicus*) Ova

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### ABSTRACT

The present study investigated the effects of different concentrations of trypsin to eliminate egg stickiness of the Persian sturgeon (*Acipenser persicus*). Embryo survival rate and adhesiveness removal time were the criteria used to compare our method with the common methodology using clay. Also, thickness of corion was measured during the experiment using histological assay. The eggs were exposed to four different enzyme concentrations (1, 3, 6 and 12 IU/ml) for 30 minutes after fertilization of eggs and washing with water. In addition, one group was exposed to clay and considered as control. All five groups (each with three replicates with 150 eggs in each replicate) were sampled at the beginning of experiment at time 0 (when egg activation was done and jelly coat was formed) and another three times each with 10-minute interval. Sampled eggs were fixed in Bouin solution. In each treatment, adhesiveness removal time was recorded. To determine embryo survival rate, sampling was done 60 hours after the fertilization. The highest survival rate with  $86.9 \pm 2/19\%$  was found in 6 IU/ml treatment., which was significantly higher ( $P < 0.05$ ) than the those of the other groups ( $75.2 \pm 0.88\%$ ,  $77.1 \pm 2.1\%$ ,  $77.3 \pm 2.26\%$  and  $77 \pm 2.75\%$  in 1 IU/ml, 3 IU/ml, 12 IU/ml and control, respectively). The shortest adhesiveness time was six minutes for 12 IU/ml treatment. The adhesiveness time for 1, 3, 6 IU/ml and control groups were 19, 15, 11 and 23 minutes, respectively. Histological studies revealed no physical damage in the control and all treated groups. The results of this study showed that jelly coat thickness was correlated negatively with time in different treatments. In conclusion, trypsin is more reliable method for de-adhesion of Persian sturgeon egg compare to the common method. The suggestive concentration of trypsin is 6 IU/ml that removes the adhesiveness within 11 minutes.

**Keywords:** jelly coat, deadhesiveness of eggs, Persian sturgeon, trypsin.

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## Feeding behavior and taste preferences of *Rutilus frisii kutum* to free amino acids

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### ABSTRACT

Free amino acids have a stimulatory effect on the taste system. Taste preferences of Mahi sefid (*Rutilus Frissi Kutum*) 1.5±0.5g to granules containing different amounts of amino acids were established. The granules containing different concentrations amino acids, and control (lacking amino acids) preparation, and behavioral responses to each granule were recorded. Highest palatability index, percentage of consumption and consumption/grasp, were observed at concentrations of 0.01M of Glutamic acid. Least palatability index, percentage of consumption and consumption/grasp were observed at different concentrations of cysteine. No significant difference at repeat the grasp in the several of amino acids ( $P \geq 0.05$ ), but in high concentrations of substances decreased. High correlation was between in duration of storage granules in the mouth and palatability index. Proline and Glutamic acid were highly attractive and methionine and cysteine were neutral or deterrent. Different behavioral responses in varied fish species to same amino acids, ascribed to highly species-specific in fish taste preferences.

**Keywords:** amino acid, behavior of feeding, gustatory system, palatability index, rutilus frissi kutum.

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## A comparative study of healthy and lost larvae of Beluga (*Huso huso*) body shape using geometric morphometric method

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### ABSTRACT

High mortality of Beluga larvae (*Huso huso*) is occurred with beginning of their exogenous feeding in hatcheries and this appears to be linked to various types of body shape deformities. This study was conducted to compare the body shape of healthy and lost beluga larvae (15DPH) and to find the patterns of body shape deformities among lost larvae using geometric morphometric method. This method was applied to extract shape data as landmark's coordinates. Specimens were photographed using digital camera and the landmarks put on two-dimensional images using TpsDig2. Landmark data after GPA (Generalized Procrustes Analysis) analyzed using PCA and DFA and the patterns of body shape deformities were illustrated in deformation grids. Results displayed significant differences between healthy and lost larvae body shape ( $P < 0.0001$ ). In addition, various pattern of deformities found in the head area (snout and operculum) and anterior portion of tail. These deformities probably effect on swimming function and food obtaining of larvae.

**Keywords:** beluga, deformity, geometric morphometrics, *Huso*, larvae.

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