
A REVIEW OF FEEDING PRACTICES AND NUTRITIONAL REQUIREMENTS OF POSTLARVAL GROUPERS

Kevin C. Williams-2009

Aquaculture 292(3-4): 141-152

Abstract:

Groupers (Family: Serranidae) are a very diverse family of predatory fish that are widely distributed throughout the tropical and subtropical seas of the world and notably those of the Indo-Pacific region. Species from this family are probably the most sought-after fish in the live reef fish trade and command high prices. Increased fishery effort has led to a significant decline in the wild catch of groupers and consequently, a heightened need for aquaculture product to supply the market. Improved hatchery technology and a more reliable supply of hatchery-produced fry in the past decade have resulted in a rapid increase in grouper aquaculture production world-wide but especially in the Asia-Pacific region. This expansion has seen an increasing need for more sustainable and environmentally responsible culture practices and especially for the development of manufactured feeds that better meet the nutritional requirements of the fish. This review provides an account of feeding practices used to rear juvenile groupers and advances that have taken place in the development of nutritionally adequate manufactured feeds for post-larval grouper.

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USE OF MICROALGAE BIOENCAPSULATED IN ARTEMIA DURING THE WEANING OF SENEGALESE SOLE (SOLEA SENEGALENSIS KAUP)

Pavlos Makridis, Cristiana Moreira, Rita Alves Costa, Pedro Rodrigues and Maria Teresa Dinis-2009

Aquaculture 292(3-4): 153-157

Abstract:

The microalgae species *Chlorella minutissima* and *Tetraselmis chuii* were bioencapsulated in *Artemia metanauplii* and used during the weaning of Senegalese sole, *Solea senegalensis* post-larvae. We evaluated the effect of microalgae on: (i) survival and growth of the Senegalese sole post-larvae and juveniles, (ii) expression of genes related to the non-specific immune system, and (iii) the microbial load of sole juveniles.

The survival of sole juveniles at the end of the experiment was significantly higher in the treatments added microalgae in their diet compared with the control treatment ($P < 0.05$), while there was no effect on the final weight of sole juveniles. The total numbers of bacteria as determined by the counts on Zobell's medium were significantly lower in both treatments added microalgae compared with the control treatment ($P < 0.05$), whereas no significant differences were shown among the different treatments in the numbers of presumptive *Vibrio* as determined by counts on TCBS. Four partial nucleotide sequences of genes related to the immune system were isolated from lymphoid tissues of *S. senegalensis*: natural resistance associated macrophage protein 1 (Nramp1), complement C3, transforming growth factor β 1 (TGF- β 1), and transferrin. The expression of these four genes was calculated at the end of the experiment in relation to the expression of β -actin, a housekeeping gene. No significant differences ($P > 0.05$) were determined among the three treatments in relation to the expression of the four genes in homogenates of fish.

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EFFECTS OF COMMONLY USED DISINFECTANTS AND TEMPERATURE ON SWIM BLADDER NON-INFLATION IN FRESHWATER ANGELFISH, PTEROPHYLLUM SCALARE (LICHTENSTEIN)

C. Sanabria, A. Diamant, D. Zilberg-2009

Aquaculture 292(3-4) : 158-165

Abstract:

Swim bladder non-inflation is common in hatchery-reared fish and was also reported in angelfish, *Pterophyllum scalare* L. Fish eggs are routinely treated with disinfectants and exposed to a variety of physical conditions. We studied the effect of these factors on the prevalence of swim bladder non-inflation in angelfish. Hatching and rearing at 26 °C resulted in 8% swim bladder non-inflation, compared to no swim bladder non-inflation at 28 °C. Eggs hatched in the presence of 1, 2 and 5 ppm methylene blue exhibited significant increases in swim bladder non-inflation (11, 9 and 33%, respectively; none in controls). Time of exposure to methylene blue was a key factor. Exposure for up to 1 day post-hatch did not affect swim bladder non-inflation, but exposure from 2 days onwards significantly increased swim bladder non-inflation. Hydrogen peroxide at 250 ppm significantly increased swim bladder non-inflation (65% comparing to 27% in the control). Higher concentrations resulted in 100% mortality. Exposure to acriflavin at 2.25 ppm, but not 1.25 ppm, significantly increased swim bladder non-inflation (75 and 52% respectively; 20% in controls). Chloramine-T did not significantly affect swim bladder non-inflation. Treatment with methylene blue and acriflavin, but not chloramine-T, produced significantly different frequencies of swim bladder non-inflation morphologies compared to control fish. In conclusion, several chemical treatments commonly used in aquaculture and sub-optimal water temperature increase the prevalence of swim bladder non-inflation in angelfish.

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EFFECT OF TEMPERATURE ON SURVIVAL AND DEVELOPMENTAL PERIOD OF COCONUT CRAB (*BIRGUS LATRO*) LARVAE REARED IN THE LABORATORY

Katsuyuki Hamasaki, Mio Sugizaki, Shigeki Dan, Shuichi Kitada-2009

Aquaculture 292(3-4): 259-263

Abstract:

Populations of the coconut crab, *Birgus latro*, have been severely depleted on most inhabited islands throughout Indo-Pacific regions because of overharvesting and environmental degradation. To assist in the development of artificial propagation technologies for restocking/stock enhancement of this species, this study was designed to elucidate the effect of rearing temperature on survival and developmental period of zoeae through a laboratory experiment testing six constant temperatures levels (18.9, 21.3, 24.6, 27.0, 29.8, and 32.4 °C). Mortality of all first stage zoeae occurred at 18.9 °C. In contrast, the survival rate to the megalopal stage was significantly higher (85.6 and 82.2%) at 27.0 and 29.8 °C, respectively, than all other treatments. Temperature also had marked effects on larval developmental periods. The number of days from hatching required to reach each larval stage (D) significantly decreased with increasing temperature (T). The mean duration from hatching to the megalopal stage ranged between ~ 19 and 23 days at appropriate temperatures for larval survival (27.0 and 29.8 °C).

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EFFECT OF GERM-FREE REARING ENVIRONMENT ON GUT DEVELOPMENT OF LARVAL SEA BASS (*DICENTRARCHUS LABRAX* L.)

A. Rekecki, K. Dierckens, S. Laureau, N. Boon, P. Bossier, W. Van den Broeck-2009

Aquaculture 293(1-2): 8-15

Abstract:

A gnotobiotic feed chain (*Artemia*-European sea bass) has been developed recently. To investigate the extremely complex and poorly understood modes of action of putative probiotics and pathogens *in vivo*, we quantified the effect of a germ-free controlled culture on survival and gastrointestinal tract development from day after hatching (DAH) 0 till DAH15. The larvae were kept in a germ-free static and rotating set-up, next to the conventional static group. They were sampled on DAH1, DAH6, DAH9 and DAH14. The survival of sea bass larvae on DAH14 from both germ-free treatments was

not significantly higher ($93 \pm 3\%$ and $82 \pm 5\%$) compared to the conventional ($51 \pm 19\%$) group ($p = 0.058$). Morphometric data revealed a significant growth on DAH14 in germ-free static larvae (4.84 ± 0.07 mm) compared to that of conventional (4.55 ± 0.06 mm) and germ-free rotating larvae (4.54 ± 0.08 mm) ($p = 0.002$). However, histological analysis showed minor variations in regional morphology of epithelial cell types observed in the gut in individual larvae between and within treatment groups. These presented techniques combined with the germ-free sea bass model can be used as a standardised model system to study in vivo the mode of action of probiotics.

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MICROSATELLITE-CENTROMERE MAPPING IN ZHIKONG SCALLOP (*CHLAMYS FARRERI*) THROUGH HALF-TETRAD ANALYSIS IN D-SHAPED LARVAE OF GYNOGENETIC DIPLOID FAMILIES

Qi Li, Hongtao Nie, Lingfeng Kong-2009

Aquaculture 293(1-2): 29-34

Abstract:

Inheritance of 27 informative microsatellite loci was examined in 40-h D-shaped larvae of three induced meiogynogenetic diploid families of zhihong scallop (*Chlamys farreri*) for centromere mapping using half-tetrad analysis. Mendelian inheritance was confirmed for the loci by examining the genotypic segregation in three control crosses. Nine of the 27 microsatellite loci showed the existence of null alleles in control crosses. All gynogenetic offspring only possessed the alleles of the mother, indicating 100% success level for the three families. The second division segregation frequency (y) of the microsatellite loci ranged from 0.05 to 0.78 with a mean of 0.41, suggesting the existence of positive interference after a single chiasma formation in some chromosomes in the scallop. Microsatellite-centromere (M-C) distances ranged from 3 cM to 39 cM under the assumption of complete interference. Information on the positions of centromeres in relation to the microsatellite loci will represent a contribution towards assembly of genetic maps in the commercially important scallop species.

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ENRICHMENT POTENTIAL OF HUFA-RICH THRAUSTOCHYTRID SCHIZOCHYTRIUM MANGROVEI FOR THE ROTIFER BRACHIONUS PLICATILIS

Chona Estudillo-del Castillo, Rolando S. Gapasin, Eduardo M. Leaño-2009

Aquaculture 293(1-2): 57-61

Abstract:

An enrichment experiment was performed to evaluate the changes in lipid and essential fatty acid contents of the rotifer *Brachionus plicatilis* fed with freeze-dried cells of tropical thraustochytrid *Schizochytrium mangrovei* (Isolate IAo-1). Rotifers starved for 24 h were fed with *S. mangrovei* cells at 200, 300, 400, 500, 600 and 700 mg L⁻¹. Enrichment was carried out at two periods (Short-term = 5 h; Long-term = 10 h) to determine the optimum time needed for the maximum enrichment of the rotifers. There was an overall significant increase in the total lipid, arachidonic acid (AA) and docosahexaenoic acid (DHA) contents of rotifers after feeding with freeze-dried *S. mangrovei* indicating the successful uptake of these nutrients in the rotifer's biochemical composition. On the other hand, docosapentaenoic acid (DPA) did not change significantly in enriched rotifers. Results of the present study indicate that both factors, feeding concentrations and enrichment periods, significantly affected the lipid, AA and DHA contents of rotifers. Uptakes of lipid, AA and DHA significantly increased with increasing feeding concentrations except for those fed the highest feeding concentration of 700 mg L⁻¹ for 10 h. Moreover, lipid and AA contents of enriched rotifers were significantly higher during the short-term enrichment period while DHA contents were significantly higher during the long-term enrichment period. Therefore, it is concluded that the feeding concentration of 700 mg L⁻¹ at an enrichment period of 5 h is optimum in the AA and DHA enrichment of rotifers. The strategic scheme of combining the proper amount of enrichment product

and the duration of enrichment in boosting the DHA contents of rotifers will effectively ensure a reliable production of nutritionally superior rotifers at a minimal cost. This will ultimately contribute to the success of rearing marine fish larvae in the hatchery.

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THE MINUTE MONOGONONT ROTIFER PROALES SIMILIS DE BEAUCHAMP: CULTURE AND FEEDING TO SMALL MOUTH MARINE FISH LARVAE

Stenly Wullur, Yoshitaka Sakakura, Atsushi Hagiwara-2009

Aquaculture 293(1-2): 62-67

Abstract :

The body length and width of *Proales similis* (mean \pm SD; $83 \pm 11 \mu\text{m}$ and $40 \pm 6 \mu\text{m}$, respectively) is 38.1% smaller and 60.3% narrower than that of *Brachionus rotundiformis*. Due to its small size, *P. similis* has potential for rearing marine fish larvae which require first food smaller than *B. rotundiformis*. We examined the feasibility of using *P. similis* as live food by analyzing its life history, population growth and feeding incidence by fish larvae. *P. similis* produced first offspring on 2.5–2.8 days after hatch. Females produced 4.3–7.8 offspring during their 2.9–3.4 day reproductive period. *P. similis* grew well at temperatures 25 to 35 °C (density = 250 to 1030 ind./ml; $r = 0.68$ to 0.81 day^{-1}) and at salinities 2 to 15 ppt (density = 360 to 500 ind./ml; $r = 0.73$ to 0.78 day^{-1}). Population density of *P. similis* was higher than *B. rotundiformis* after 8 days of culture period with either *N. oculata* and *C. vulgaris* as food. In mass culture, population density of *P. similis* increased from 25 to 2400 ind./ml ($r = 0.42 \text{ day}^{-1}$) after 11 days. Results from feeding experiments confirm that *P. similis* is consumed by seven-band grouper (*Epinephelus septemfasciatus*) larvae. The larvae demonstrated the highest feeding rate at 20 ind./ml of *P. similis*.

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EFFECTS OF DIET, STOCKING DENSITY, AND SUBSTRATE ON SURVIVAL AND GROWTH OF HATCHERY-CULTURED RED KING CRAB (*PARALITHODES CAMTSCHATICUS*) JUVENILES IN ALASKA, USA

Benjamin Daly, James S. Swingle, Ginny L. Eckert-2009

Aquaculture 293(1-2): 68-73

Abstract:

Juvenile red king crab (*Paralithodes camtschaticus*) mass rearing was conducted in Seward, Alaska, USA in a king crab stock enhancement feasibility study. Hatchery-raised juveniles were cultured from larvae of 12 ovigerous females collected from Bristol Bay, Alaska, USA. Juvenile instars were cultured in nursery grow-out containers in two phases: (1) C1–C3 juveniles and (2) C3–C6 juveniles. Experiments lasted for 42 and 44 days, respectively, and tested the suitability of various diets, stocking densities and substrates in terms of survival rate and growth. The first experiment (C1–C3) compared fully-factorial treatments of three diets (Cyclop-eeze®, enriched *Artemia* nauplii, or Zeigler™ shrimp feed), three stocking densities (500 m^{-2} , 1000 m^{-2} , or 2000 m^{-2}), and two substrates (none or a combination of artificial seaweed, gillnet, and mechanical biofilter medium). The second experiment (C3–C6) used a mixed diet and compared fully-factorial treatments of two stocking densities of 800 m^{-2} and 1600 m^{-2} and two substrates (as above). No one food produced the highest survival and growth to C3. Cyclop-eeze® yielded highest survival (62.7%) with low growth (wet weight 8.63 mg and CW 2.04 mm). Crabs on shrimp nursery feed had the highest wet weight (10.0 mg) and CW (2.14 mm) but with low survival (44.5%). The highest stocking density resulted in a decrease in survival in both experiments. Lower stocking densities of 500 m^{-2} and 800 m^{-2} had relatively high survival of 58.7% and 48.7%, respectively, while the 1600 m^{-2} and 2000 m^{-2} densities had survival of 30.5% and 44.7%, respectively. Growth appeared to be inhibited at the highest density (2000 m^{-2}) in the C1 to C3 stages, as crabs at this density were smaller and weighed less than at the 500 m^{-2} or 1000 m^{-2} density. Complex artificial substrate increased survival and reduced growth in both experiments, likely due to reduced cannibalism and increased time spent

foraging. Among substrate treatments, highest abundances of crabs were observed on artificial seaweed, which may more closely resemble preferred natural substrate. These results suggest that culturing red king crab juveniles at low to intermediate stocking densities with a mixed diet in the presence of artificial substrate provides good survival. Intermediate densities may provide for greater production without great loss in survival.

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INFLUENCE OF SALINITY ON MORPHOLOGICAL DEFORMITIES IN CULTURED LARVAE OF JAPANESE EEL, *ANGUILLA JAPONICA*, AT COMPLETION OF YOLK RESORPTION

Takuma Okamoto, Tadahide Kurokawa, Koichiro Gen, Koji Murashita, Kazuharu Nomura, Shin-Kwon Kim, Hajime Matsubara, Hiromi Ohta, Hideki Tanaka-2009

Aquaculture 293(1-2): 113-118

Abstract:

The occurrence of morphological deformities under different incubation salinities (24, 30, 33, 36 and 42 practical salinity units [psu]) was examined in Japanese eel larvae. Fertilized eggs hatched at all salinity treatments. The survival rate until yolk resorption decreased at higher than 36 psu. The proportions of deformed larvae reared at 36 psu were significantly lower than at other treatments. Pericardial edema and abnormal lower jaw increased at lower than 33 psu and spinal curvature occurred at high salinity (42 psu). In contrast, the incubation salinity did not significantly affect the relative frequency of abnormal neurocranium. These results imply that the optimal salinities for rearing Japanese eel eggs and embryos are 34–35 psu from the viewpoints of survival and deformity. Taken together with previous study [Kurokawa, T., Okamoto, T., Gen, K., Uji, S., Murashita, K., Unuma, T., Nomura, K., Matsubara, H., Kim, H.S., Ohta, H., Tanaka, H., in press. Influence of Water Temperature on Morphological Deformities in Cultured Larvae of Japanese Eel, *Anguilla japonica*, at Completion of Yolk Resorption. *J. World Aqua. Soc.*], the rearing of eel eggs and embryos at 25 °C and 34–35 psu probably decreases the mortality and deformity rate of eel larvae at yolk resorption stage.

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THE CHANGES IN DIGESTIVE ENZYMES AND HORMONES OF GILTHEAD SEABREAM LARVAE (*SPARUS AURATA*, L 1758) FED ON ARTEMIA NAUPLII ENRICHED WITH FREE METHIONINE

Mehmet Naz, Mustafa Türkmen-2009

Aquaculture International 17(3): 243-256

Abstract:

Variations in digestive enzymes and hormones during the larval development of gilthead seabream (*Sparus aurata*) fed on live prey (*Artemia nauplii*) enriched with free methionine were investigated for 16 days (from day 24 to day 40). Prior to initiation of the experiment, newly hatched larvae were transferred from incubators to fiber glass tanks (300 l) with black walls and fed with same diets until day 24. Each experiment was performed in triplicate. In the experimental group, the content of the free methionine in the *Artemia nauplii* was increased by adding a 5.3 mM free methionine solution to the culture water during a 16-h enrichment period. The larvae of both the control and enriched-methionine groups were sampled four times, with 4-day intervals between samplings, during a 16-day period. The larvae in the control group had a significantly lower growth than those of the methionine group at the end of the study ($P < 0.05$). The highest trypsin activity and leucine aminopeptidase N/leucine-alanine peptidase ratios were observed in the control group. A significant difference between bombesin activities in the treatment groups was not found at 5th minute after the initiation of feeding ($P > 0.05$), but they were significant at 15th minute post-initiation of feeding ($P < 0.05$). A significant difference between the cholecystokinin levels of the treatment groups was found ($P < 0.05$).

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EFFECT OF GEOGRAPHIC ORIGIN, TEMPERATURE AND TIMING OF BROODSTOCK COLLECTION ON CONDITIONING, SPAWNING SUCCESS AND LARVAL VIABILITY OF RUDITAPES DECUSSATUS (LINNÉ, 1758)

Domitília Matias, Sandra Joaquim, Alexandra Leitão, Clara Massapina-2009

Journal Aquaculture International 17(3): 257-271

Abstract:

Culture of *Ruditapes decussatus* is clearly limited by the availability of seed, as this production proceeds almost exclusively from natural recruitment. Artificial spawning and larval rearing programs could provide an alternative source of spat. This study was designed to evaluate the effect of different conditioning temperatures on the broodstock maturation, spawning success and larval viability of two geographically (north and south of the Iberian Peninsula) distinct populations of European clam (*R. decussatus*) collected at different periods of the year in order to create “optimal” artificial spawning and larval rearing programs. Two batches of clams from each population were collected in October and February, and conditioned at $18 \pm 1^\circ\text{C}$, $20 \pm 1^\circ\text{C}$ and $22 \pm 1^\circ\text{C}$. Of the three variables analysed the timing of broodstock collection was the most determining factor for gametogenic development, spawning and larval rearing. Geographic origin and conditioning temperature also greatly affected the spawning. The results also showed that the February conditioning was more effective than October and that the best conditioning temperatures were $20 \pm 1^\circ\text{C}$ and $22 \pm 1^\circ\text{C}$ for the northern and southern populations, respectively. These results suggest that the efficient conditioning temperature for each population of the same species is related to the seasonal temperature regime from their geographic origin. Larval viability and growth performance seemed to be independent of the broodstock conditioning.

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ENVIRONMENTAL BEST MANAGEMENT PRACTICES FOR AQUACULTURE

C.S. Tucker, J.A. Hargreaves (eds):

Wiley-Blackwell, Oxford, 2008, Hardback, XIV + 592 pp, £84.99, ISBN-10: 0-8138-2027-8

Journal Aquaculture International 17(3): 301-302

BOOK REVIEW

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REVIEW ARTICLE

INFLUENCE OF DIETARY PHOSPHOLIPIDS ON EARLY ONTOGENESIS OF FISH

Chantal L Cahu, Enric Gisbert, Laure A N Villeneuve, Sofia Morais, Neila Hamza, Per-Avid Wold, Jose L Zambonino Infante-2009

Aquaculture Research 40(9): 989 – 999

Abstract:

The aim of this paper is to provide explanations of how dietary phospholipid (PL) globally improves fish larval development, including growth and survival, digestive functions and skeletal development, and to propose optimal PL levels and sources in fish larval diets. Dietary incorporation of 8–12% PL related to dry matter (d.m.) promotes growth and enhanced survival in various species. Marine source PL, incorporating highly unsaturated fatty acids, was most efficient than soybean lecithin. This beneficial effect was explained by an enhancement in digestive functions, assessed by digestive enzyme activities and histomorphology. Nevertheless, 1.5–2.5% highly unsaturated fatty acids related to diet d.m. supplied by PL improved growth, survival and skeletal development, while 5% induced different skeletal deformities. The high incidence of deformities was associated with the down-

regulation of genes involved in development, such as RXR α , RAR α , RAR β and BMP-4, observed in the early stages in larvae fed a high highly unsaturated fatty acids level.

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OPTIMUM HISTIDINE REQUIREMENT OF FRY AFRICAN CATFISH, CLARIAS GARIEPINUS (BURCHELL)

Mukhtar A Khan, Shabi Fatma Abidi-2009

Aquaculture Research 40(9): 1000 – 1010

Abstract:

Dietary histidine requirement of fry African catfish, *Clarias gariepinus* (2.57 ± 0.02 cm; 0.22 ± 0.03 g) was quantified by feeding casein–gelatin-based isonitrogenous (40% crude protein) and isocaloric (17.90 kJ g⁻¹ gross energy) amino acid test diets with graded levels of histidine (0.25%, 0.30%, 0.35%, 0.40%, 0.45% and 0.50% dry diet) in eighteen 80 L indoor circular aqua-coloured troughs provided with the flow-through system for 12 weeks. Maximum absolute weight gain (2.66), best feed conversion ratio (1.29), highest protein efficiency ratio (1.94), protein retention efficiency (34%) and energy retention efficiency (70.4%) were achieved at 0.40% dietary histidine. Broken-line and non-linear regression models were adopted to assess dietary histidine requirement for *C. gariepinus*. When analysed using broken-line regression model these parameters were also best at 0.40% dietary histidine corresponding to 1.0% protein, respectively, whereas using second-degree polynomial regression analysis, histidine requirement was obtained at 0.42%, 0.41%, 0.40%, 0.41% and 0.41% of dry diet, corresponding to 1.05%, 1.02%, 1.0%, 1.02% and 1.02% protein respectively. Based on the broken-line and second-degree polynomial regression analyses of the growth and nutrient retention data, optimum histidine requirement of fry *C. gariepinus* was found to be in the range of 0.40–0.42% dry diet, corresponding to 1.0–1.05% of dietary protein.

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TWO HIGHLY DIVERGED NEW WORLD ARTEMIA SPECIES, A. FRANCISCANA AND A. PERSIMILIS, FROM CONTRASTING HYPERSALINE HABITATS EXPRESS A CONSERVED STRESS PROTEIN COMPLEMENT

James S. Clegg, Gonzalo Gajardo-2009

Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology 153(4): 451-456

Abstract:

The brine shrimp *Artemia* is a well known animal extremophile adapted to survive in very harsh hypersaline environments. We compared the small stress proteins artemin and p26, and the chaperone hsc70 in encysted embryos (cysts) of the New World species, *A. franciscana* and *A. persimilis*. Cysts of the former, from San Francisco Bay, USA (SFB), were used essentially as a reference for these proteins, while both species were from locations in Chile where they occur in habitats at latitudinal extremes, the Atacama desert and Patagonia. These two species are phylogenetically distant, *A. persimilis* being closer to the Old World species, whilst *A. franciscana* is considered younger and undergoing evolutionary expansion. Using western blotting we found all three stress proteins in cysts from these five populations in substantial although variable amounts. The protein profiles revealed by Coomassie staining after electrophoresis (SDS-PAGE) were similar qualitatively, in spite of marked differences in the habitats from which these populations originated, and the long time since they diverged. We interpret these findings as further evidence for the adaptive importance of these three conserved proteins in coping with the variable, but severe stresses these encysted embryos endure.

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VIRULENCE OF METALLOPROTEASES PRODUCED BY VIBRIO SPECIES ON PACIFIC OYSTER CRASSOSTREA GIGAS LARVAE

Hiroaki Hasegawa, Dima N. Gharaibeh, Erin J. Lind, Claudia C. Häse-2009

Diseases of Aquatic Organisms 85(2): 123-131

Abstract:

Vibrio tubiashii, a pathogen of shellfish larvae and juveniles, produces several extracellular products. Here, we document that culture supernatants of several marine *Vibrio* species showed toxicity to oyster larvae. Treatment of these supernatants with EDTA not only severely diminished proteolytic activities, but also dramatically reduced toxicity to the larvae. Culture supernatants of metalloprotease-deficient mutants of *V. tubiashii*, *V. cholerae*, and *V. splendidus* were impaired in their ability to cause larval death compared to the wild type strains. Culture supernatants of *Pseudomonas aeruginosa*, known to contain several secreted proteases, showed virtually no toxicity to oyster larvae. Purified *V. tubiashii* protease A (VtpA), but not the prototype metalloprotease, thermolysin from *Bacillus thermoproteolyticus*, was highly toxic to the larvae. In addition, toxicity of purified VtpA was much greater for 6 d old oyster larvae than for 16 d old larvae. Together, these results indicated that culture supernatants of a variety of *Vibrio* species are highly toxic to oyster larvae and that the production of a metalloprotease is required for this effect. We propose that there are, as yet uncharacterized, specific substrates contained in larval tissue that are degraded by VtpA as well as certain homologous metalloproteases produced by other marine *Vibrio* species which, in turn, may contribute to vibriosis.

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TRANSITION FROM ENDOGENOUS TO EXOGENOUS FEEDING, STARVATION TOLERANCE, AND EFFECT OF STARVATION ON SWIMMING PERFORMANCE IN HATCHERY-REARED LARVAE OF THE JAPANESE SANDFISH ARCTOSCOPIUS JAPONICUS

Taizo Morioka, Yoshitomo Nagakura, Naoto Murakami, Takashi Ichikawa, Norio Shirafuji, Kyohei Fukunaga, Seiichi Watanabe-2009

Nippon Suisan Gakkaishi 75(3): 376-382

Abstract:

The transition from endogenous to exogenous feeding, starvation tolerance, and effect of starvation on growth and swimming performance were examined in hatchery-reared larvae of the Japanese sandfish *Arctoscopus japonicus*. Most newly hatched larvae (12.3 mm in standard length and 2.47 mg in dry weight) commenced feeding at 2 days after hatching (DAH) and completed yolk sac absorption at about 25 DAH. However, no differences in the larval size and swimming speed between feeding and non-feeding groups were observed at 8 DAH (dry weight), 10 DAH (standard length) and about 10 DAH (cruising speed). The 50% lethal time (Ltime50) of 0 DAH larvae under starvation conditions was 23-25 days. Ltime50 was shortest (4 days) when starvation conditions were initiated at 25 DAH and after that the tolerance gradually increased. This suggests that the larvae have a long overlap of endogenous nutrition and exogenous feeding period (2-25 DAH) and mainly depend on endogenous nutrition until 8 DAH. The completion period of yolk absorption is also a critical time for starvation. Although endogenous nutrition is important for growth and survival, exogenous feeding may be required at least before 8 DAH because the influence of starvation on growth appeared after 8 DAH. (Hokkaido National Fisheries Research Institute, FRA, Akkeshi, Hokkaido 088-1108)

CONTRIBUTIONS OF DIFFERENT SPAWNING SEASONS TO THE STOCK OF PACIFIC BLUEFIN TUNA THUNNUS ORIENTALIS ESTIMATED FROM OTOLITH DAILY INCREMENTS AND CATCH-AT-LENGTH DATA OF AGE-0 FISH

Tomoyuki Itoh-2009

Nippon Suisan Gakkaishi 75(3) : 412-418

Abstract:

Contributions of different spawning seasons to the fishery stock of age-0 Pacific bluefin tuna *Thunnus orientalis* were estimated. Spawning season estimated from otolith daily increments of 477 individuals from 17 to 93 cm in fork length ranged from March to October at the earliest which is longer than previously reported. Age-0 fish caught in Japanese fisheries in 1993-1997 were divided into two sub-cohorts by comparing monthly length data with the growth curves derived from otolith age data. Fish of one sub-cohort which were fertilized up to early July, probably in the area around Taiwan to the Nansei Islands, accounted for most (76%) of the age-0 catch. Fish of the second sub-cohort were fertilized after mid July, probably mainly in the Sea of Japan, and accounted for on average 24% of the age-0 catch, and as much as 40% in 1994.

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