

ADULT ARTEMIA ENRICHMENT

From: Tony Charles tcharles@mcs.net.au

To: shrimp@yahoogroups.com

Date: 3 May 2007

QUESTION:

I am looking for information on ongrown Artemia enrichment (juveniles and adults). I have researched the web, but haven't found much information. In particular, I am unsure as to what densities adult artemia can be enriched in, and if this varies depending on enrichment media. Does 5000 / litre sound like a reasonable starting point? Or can I go higher for a 1-2 hour enrichment?

I also am keen to hear ideas on disinfecting enriched artemia. I currently disinfect hatched Artemia nauplii with hydrogen peroxide, which works well. Not sure whether or not it's appropriate for older Artemia. Lastly, can anyone provide a general feed guideline for juvenile and/or adult Artemia compared to nauplii? I know this is dependent on the size and weight of the Artemia. Nevertheless, I'd appreciate any information so I can start substituting some of the late PL feeds with confidence.

COMMENTS 1:

The best product I found to grow up Artemia is spirulina. I have a source of good quality spirulina from Brazil at approx. 15 USD/kg. I have no problem of water pollution but I am growing up Artemia up to 72 hours only. I also use H2O2 for the disinfection.

Olivier Mueller omueller@fastnet.ch

COMMENTS 2:

I run a tiger prawn hatchery, so have plenty of Chaetoceros to grow the Artemia on. It's the final enriching that I am a bit unsure of. For now, I will use a commercial enrichment formula (DHA Selco or AlgaMac) until I gain more experience and then may start to make my own.

Tony Charles tcharles@mcs.net.au

COMMENTS 3:

For the final enrichment I use Algamac 3050 and ARA (a mix to match the fatty acids profile I need for my fish). I tried selco many time but I always have problem of low oxygen and had to use pure oxygen...

Olivier Mueller omueller@fastnet.ch

COMMENTS 4:

Many of INVE's clients have used the PROLON enrichment product (a powder) and/or the larval shrimp diet LANSY-Shrimp ZM for ongrowing Artemia to adults and for enrichment. Summary information on Prolon can be found on the website <http://www.inve.com/fish/index.asp?id=156>

You may also want to look at the FAO 'Manual on the Production and Use of Live Food for Aquaculture', specifically at the section on adult Artemia
<http://www.fao.org/DOCREP/003/W3732E/w3732e0p.htm#b8-4.4.2.4.%20Feeding>

Roeland Wouters, INVE Technologies N.V.

THE EFFECT OF UNILATERAL EYESTALK ABLATION AND DIET ON THE REPRODUCTIVE PERFORMANCE OF WILD-CAUGHT FARFANTEPENAEUS AZTECUS (IVES, 1891) USING A CLOSED RECIRCULATING MATURATION SYSTEM

Ryan L. Gandy, Tzachi M. Samocha, Michael P. Masser, Joe M. Fox, Abdul-Mehdi S. Ali, Delbert M. Gatlin III, Michael Speed-2007

Aquaculture Research 38(6): 580–587

Abstract:

Two studies were conducted to evaluate the effects of unilateral eyestalk ablation and diet on the reproductive performance of wild populations of *Farfantepenaeus aztecus*. In both studies, females in two treatments were unilaterally ablated while those in the control treatment were not. Shrimp in the non-ablated treatment and one of the unilaterally ablated treatments received frozen bloodworms (8% BW day⁻¹) and frozen squid (12% BW day⁻¹). The bloodworm component of the diet of the third unilateral ablation treatment was replaced with frozen adult enriched *Artemia* sp. Ablated female population spawning per night, in both studies, was higher than non-ablated spawning (8.5 and 8.9 vs. 2.6%; 7.4 and 7.5 vs. 2.7% respectively; $P < 0.05$). Replacement of bloodworms with adult enriched *Artemia* sp. had no negative effect on the number of eggs spawned per ablated female (124 000 vs. 115 000 eggs spawn⁻¹; 144 000 vs. 151 000 eggs spawn⁻¹ respectively; $P > 0.05$). The life span of ablated females fed adult enriched *Artemia* sp. was 8 and 40 days longer than ablated females fed bloodworms for the first and second studies respectively. Replacement of bloodworms with adult enriched *Artemia* sp. resulted in higher hatch and larval survival rates (Nauplius 1 to Zoea 1) (55.0% vs. 46.9% and 44.8% vs. 37.2%), respectively, $P < 0.05$.

(Texas Agricultural Experiment Station – Shrimp Mariculture Research Facility, Corpus Christi, TX, USA; email of R.L. Gandy: ryanlgandy@hotmail.com)

SURFACE DISINFECTION OF PACIFIC THREADFIN, POLYDACTYLUS SEXFILIS, AND AMBERJACK, SERIOLA RIVOLIANA, EGGS

David W. Verner-Jeffreys, Izumi Nakamura, Robin J Shields-2007

Aquaculture Research 38(6): 605–612

Abstract:

The effects of exposing the eggs of Pacific threadfin and amberjack eggs (AEs) to different concentrations of hydrogen peroxide for 5 min on hatch rate and survival were assessed in a series of experiments using a petri dish model rearing system. Despite significant inter-batch variation in hatch rate, it was shown that eggs of both species could be safely exposed to up to 11 340 mg L⁻¹ H₂O₂ for 5 min. Exposure to 34 230 mg L⁻¹ H₂O₂ for 5 min was shown to be lethal to AEs at a late stage of development. In two further experiments, it was demonstrated that Pacific threadfin eggs were resistant to all tested concentrations of a range of polyvinylpyrrolidone iodine (PVP-I) concentrations and contact times (up to 1000 mg L⁻¹ PVP-I for 10 min). The level of bacteria adhering to the eggs of both species was highly variable. Where eggs were heavily colonized (>10⁴ cfu egg⁻¹), hydrogen peroxide concentrations of at least 11 340 mg L⁻¹, or PVP-I concentrations higher than 500 mg L⁻¹ for 10 min, were required for effective sterilization. In less colonized batches, rinsing in sterile seawater or exposure to lower (550 mg L⁻¹) concentrations of H₂O₂ was sufficient to result in high apparent levels of surface sterility (<1 cfu egg⁻¹).

(Center for Applied Aquaculture and Marine Biotechnology, The Oceanic Institute, Waimanalo, HI, USA; email of David W. Verner-Jeffreys: david.verner-jeffreys@cefas.co.uk)

FISH ANTIBIOTHERAPY: BIOENCAPSULATION OF FLUMEQUINE USING ADULT BRINE SHRIMP (ARTEMIA SALINA) Aquaculture Research

João Gomes, Cristina Lobo Vilela, Ricardo Bexiga, Gonçalo D. Nunes, Nuno Pereira, Lina M. Cavaco-2007

Aquaculture Research 38(6): 613–617

Abstract:

Optimization of antibiotic delivery strategies to aquatic environment and to the specific characteristics of the target species is essential for the improvement of bacterial infection control measures. This work aimed at standardizing the use of *Artemia salina* to deliver flumequine to fish as antimicrobial treatment. Adult *Artemia* were used to bioencapsulate flumequine. A flumequine concentration of 358 µg mL⁻¹ was found adequate to perform bioencapsulation during 24 h without causing mortality. Antibiotic concentration in *Artemia*, quantified by means of a microbiological assay based on MIC determination, using *Escherichia coli* ATCC 25922 as control strain was 256.55 mg g⁻¹ (±71.22). The therapeutic doses of 10 mg kg⁻¹ BW, calculated on the basis of a consumption of about 4% BW/day, would then be delivered by the consumption of 7.8 *Artemia* g⁻¹ of fish.

(CIISA/Faculdade de Medicina Veterinária, Pólo Universitário do Alto da Ajuda, Av. da Universidade Técnica, Lisboa, Portugal; email of Cristina Lobo Vilela: clvilela@fmv.utl.pt)

COMPARATIVE EFFICACY OF PYCEZE® (BRONOPOL) IN CONTROLLING MORTALITY OF BROWN TROUT SALMO TRUTTA EGGS

José Miguel Aller-Gancedo, Juan Manuel Fregeneda-Grandes-2007

Aquaculture Research 38(6): 618–624.

Abstract:

The efficacy of Pyceze® (Novartis Animal Vaccines) and Proxitane® 0510 (Solvay Interrox) in controlling the mortality of eggs was studied in brown trout *Salmo trutta* eggs under the usual incubation conditions in a hatchery affected by saprolegniosis. Eggs from eight spawnings and from two lines of brown trout were used. The cumulative mortality of eggs at the start of the eyed stage (M1) and at hatching (M2) was measured, as was the percentage of eggs with fungal infection at weekly intervals during the green stage. Mortality at M2 with Pyceze® ranged between 2.38% and 12.61% depending on the batch, with a mean of 6.10%. Mortality at M2 with Proxitane® varied between 5.83% and 43.86%, with a mean of 22.36%. Fungal colonization at the start of the eyed stage ranged between 0% and 0.15% when Pyceze® was used and between 0.82% and 12.50% with Proxitane®. Mortality rates were higher among those eggs left untreated. The results indicate that Pyceze® (bronopol) is efficacious in controlling mortality caused by *Saprolegnia* spp. and other biological factors in fertilized brown trout eggs, as has been demonstrated previously in other salmonid species.

(Departamento de Sanidad Animal, Facultad de Veterinaria, Universidad de León, 24071 León, Spain; email of José Miguel Aller-Gancedo: jmallg@unileon.es)

LOGIT MODELS FOR EVALUATING SPAWNING PERFORMANCE OF CHANNEL CATFISH, ICTALURUS PUNCTATUS (RAFINESQUE)

Herbert E. Quintero, Asheber Abebe, Donald Allen Davis-2007

Aquaculture Research 38(6): 635–643

Abstract:

Broodstock evaluations are often measured by variables such as spawning success, fecundity, fertilization and hatching rates, usually expressed as percentage values. Outcomes are generally analysed as continuous random variables, assuming that they follow a normal distribution. Ordinary linear regression models (e.g. analysis of variance) as well as χ^2 analysis are typically applied. However, these models may not be the most appropriate as a number of test criteria may not be met. For example, spawning success outcomes are inherently discrete and non-negative data and hence their distribution is not likely to be normal. As these models may not be the most appropriate, a case study using logit analysis as an alternative method for the evaluation of this type of data is presented by considering the response as binary data (spawned versus did not spawn). An exact version of logit analysis was performed due to the sparseness of the data. The results demonstrate that appropriate statistical models provide better insight into the cause–effect relationships that exist between control variables and the dependent variable (likelihood of spawning in this case). As would be expected,

each strain of fish responded somewhat differently to the test variables. Changing the protein level of the diet from 32% to 42% or increasing the feeding frequency from three to six times per week either did not influence spawning or negatively affected spawning respectively. Additionally, older fish performed better than younger fish and the early spawning period was better than the later spawning period, regardless of strain. These responses, however, were only detected using logit analysis, which is a more sensitive test and would thus be recommended for this type of data.

(Department of Fisheries and Allied Aquacultures, Auburn University, 203 Swingle Hall, Auburn, AL 36849-5419, USA; email of Donald Allen Davis: davisda@auburn.edu)

PANAGRELLUS REDIVIVUS (LINNÉ) AS A LIVE FOOD ORGANISM IN THE EARLY REARING OF THE CATFISH SYNODONTIS PETRICOLA (MATTHES)

Jürgen Sautter, Horst Kaiser, Ulfert Focken, Klaus Becker-2007

Aquaculture Research 38(6): 653–659

Abstract:

The nematode *Panagrellus redivivus* (Linné) has been suggested as a source of live food in the rearing of larval fish and shrimp species. This study tested the use of *P. redivivus* in the early rearing of the bottom-feeding catfish *Synodontis petricola* (Matthes). A comparison of feeding rates of 5000–10 000 nematodes larval day⁻¹ showed that fish receiving 5000 nematodes larval day⁻¹ grew faster than those fed a dry diet, but slower than treatments fed 200 and 600 *Artemia* larval day⁻¹. Enrichment of nematodes with SuperSelco® improved fish growth relative to a non-enriched control treatment, with both treatments receiving 5000 nematodes larval day⁻¹. In the first two trials, feeding commenced 2 days after hatching. In the third study, fish were fed nematodes 6 days after hatching and there was no difference in growth between *Artemia*-fed fish (600 *Artemia* larval day⁻¹) and fish fed 5000 nematodes larval day⁻¹. Thus, it is suggested to feed *S. petricola* at a nematode density of at least 10 000 nematodes larval day⁻¹ in order to achieve growth comparable to that of fish fed *Artemia*, or, alternatively, to feed 5000 nematodes larval day⁻¹ to improve growth relative to that achieved with a dry diet. Furthermore, nematodes may be enriched with essential fatty acids to improve the growth of *S. petricola* larvae.

(Department of Ichthyology and Fisheries Science, P.O. Box 94, Rhodes University, Grahamstown 6140, South Africa; email of H. Kaiser: h.kaiser@ru.ac.za)

CHARACTERIZATION BY WHOLE-CELL HYBRIDIZATION OF BACTERIAL POPULATIONS ASSOCIATED WITH SHRIMP HATCHERY BIOFILMS

Marco Antonio López-Torres, Marcial Leonardo Lizárraga-Partida-2007

Aquaculture Research 38(7): 671–680

Abstract:

The impact of shrimp larvae development, as well as water and food inputs upon the increase of bacterial populations within the bacterial community of hatchery tank biofilms, was studied. For this study, a total of 68 biofilm samples were collected from concrete tanks at three larvae production times in a commercial shrimp hatchery. Seventeen samples were taken at each larval development stage (Zoea I, Mysis I, postlarvae 1 and postlarvae 16), as well as 37 samples from water, shrimp nauplii and food, introduced into the shrimp hatchery tanks. Culturable and direct bacterial counts were performed and 16S-rRNA-targeted oligonucleotide probes were used to quantify the presence of specific bacterial groups. An average of 27–70% of DAPI total cell counts were detected with the EUB338 probe, while the GAM42a probe signal ranged from 1% to 11%. *Vibrio*-like bacteria (VLB) counts in TCBS agar ranged from <10 to 101 VLB/cm², with a tendency to increase at the last postlarvae stage. The most significant external source of bacteria registered with GAM42a probe and TCBS agar were found in live *Artemia* nauplii, used as food; nevertheless, biofilms remain with low counts of these groups.

(Unidad Experimental Peñasco, DICTUS-Universidad de Sonora, Sonora, Mexico; email of Marcial Leonardo Lizárraga-Partida: lizarra@cicese.mx)

IMPROVING WEANING STRATEGIES FOR SENEGALESE SOLE: EFFECTS OF BODY WEIGHT AND DIGESTIVE CAPACITY

Sofia Engrola, Luís E. C. Conceição, Lurdes Dias, Ricardo Pereira, Laura Ribeiro, Maria Teresa Dinis-2007

Aquaculture Research 38(7): 696–707

Abstract:

To optimize Senegalese sole-weaning strategies, three experiments were performed. The first trial tested four weaning strategies with a 10 mg sole. Artemia-fed sole grew threefold less than fish fed an inert diet. Sudden weaning (abrupt change from Artemia to inert diet) and weaning with co-feeding produced larger sole than did a late weaning treatment; delayed weaning negatively affected fish growth. In the second experiment, the digestive capacity of early-weaned 1, 2 and 4 mg sole was investigated. The highest growth was observed in sole weaned at 4 mg. Digestive enzyme profiles suggest that sole have an adaptation period to inert diets, with reduced feed intake. This adaptation period is inversely proportional to post-larvae weight. The third experiment examined weaning with co-feeding at different weights (2, 5 and 11 mg). These studies demonstrate that sole of 5–10 mg can be weaned, with high survival rates. On the basis of the digestive enzyme profiles, the early introduction of inert diets in co-feeding with Artemia seems to affect intestinal processes in smaller postlarvae. This study also suggests that trypsin and alkaline phosphatase may be used as indicators of nutritional status in sole of <5 mg.

(CCMAR – Centro de Ciências do Mar, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal; email of S. Engrola: sengrola@ualg.pt)

EFFICIENT ANALYSIS OF GROWTH TRIAL DATA

Edward Nigel Ling-2007

Aquaculture Research 38(7): 728–732

Abstract:

A three-factor hierarchical analysis of variance is applied to growth trial data. A formula for statistical power of this analysis is derived and used to compare the power of a two-factor analysis on the data collected at a single date with the complete set. Power is substantially higher for the latter. Applying a three-factor analysis allows growth trials to be performed more economically. Figures supplied by the Marine Institute in Ireland suggest that cost savings of 37% are achievable.

(Faculty of Computing, Information Systems and Mathematics, Kingston University, Kingston-upon-Thames, KT1 2EE UK; e.ling@kingston.ac.uk)

EFFECTS OF ADULT STOCKING DENSITY ON EGG PRODUCTION AND VIABILITY IN CULTURES OF THE CALANOID COPEPOD ACARTIA TONSA (DANA)

Per M. Jepsen, Nikolaj Andersen, Thue Holm, Anders T. Jørgensen, Jonas K. Højgaard, Benni W. Hansen-2007

Aquaculture Research 38(7): 764–772

Abstract:

The effect of stocking density of the calanoid copepod *Acartia tonsa* was evaluated in a 96 h rearing experiment. Possible density-dependent egg production and egg viability were analysed at stocking densities of 100, 200, 300, 400 and 600 adults L⁻¹. Temperature, oxygen saturation and algal concentration were kept optimal. A non-density-dependent mortality rate of 15–19% day⁻¹ was documented. A non-significant density-dependent egg production was observed between 100 and 600 adults L⁻¹. The average egg production was 22.5±8.8 egg female⁻¹ day⁻¹ in all densities. The average egg hatching success was 84.7±4.8% and was never observed below 76.1%, with no significant differences across the stocking densities. Conclusively, as a practical recommendation for the aquaculture industry, copepod cultures with densities ranging from 100 to 600 adults L⁻¹ and presumably even more dense cultures are possible with the studied species obtaining a steady egg production and still high egg viability.

THE PROBLEM OF MEETING DIETARY PROTEIN REQUIREMENTS IN INTENSIVE AQUACULTURE OF MARINE FISH LARVAE, WITH EMPHASIS ON ATLANTIC HALIBUT (*HIPPOGLOSSUS HIPPOGLOSSUS* L.)

A. Kvale, A. Nordgreen, S.K. Tonheim, K. Hamre-2007

Aquaculture Nutrition 13(3): 170–185

Abstract:

Atlantic halibut (*Hippoglossus hippoglossus*) achieve a mature gastrointestinal tract approximately 2 months after first feeding (12 °C). The immature digestion may be the reason that compound diets fail to sustain growth and survival in first feeding halibut larvae and in larvae of other marine fish species. On the other hand, larvae fed with live feeds are capable of extraction of sufficient quantities of nutrients to sustain high growth rates. A lower availability of the protein in formulated diets compared with live prey is considered to be an important reason for the low performance of formulated diets. One approach to increase dietary protein availability is supplementation of pre-digested proteins. Experiments using tube fed individual larvae show that halibut larvae are able to utilize hydrolysed protein more efficiently than intact protein. However, Atlantic halibut in culture did not respond well to dietary supplementation of hydrolysed protein, in contrast to some other species. One reason may be extensive leaching of pre-hydrolysed proteins from the microparticulate feed. Atlantic halibut are slow feeders and may thus suffer more from nutrient leaching than species eating more rapidly. Feed formulation techniques affect dietary protein leaching, and in this paper, different techniques and their impact on feed properties are described. Microbound diets are most widely used in larval rearing, but show high rates of nutrient leaching. Lipid-based capsules seem to have the best potential to prevent leaching, however, they are not able to deliver a complete diet. The high need for improvements in larval feed formulation techniques are clearly stated, and some suggestions are given. Among these are production of complex particles, where small lipid-based capsules or liposomes containing the low molecular weight water-soluble nutrients are embedded. In such feed particles the water-soluble molecules are protected from leaching. Techniques for delivery of water-soluble nutrients that are needed in large quantities, i.e. free amino acids or hydrolysed and water-soluble protein, remain to be developed.

(National Institute of Nutrition and Seafood Research (NIFES), Nordnes, Bergen, Norway; email of K. Hamre: kristin.hamre@nifes.no)

EFFECTS OF DIETARY LIPID SOURCES ON GROWTH AND FATTY ACID COMPOSITION OF JUVENILE SHRIMP, *LITOPENAEUS VANNAMEI*

Q.-C. Zhou, C.-C. Li, C.-W. Liu, S.-Y. Chi, Q.-H. Yang-2007

Aquaculture Nutrition 13(3): 22–229

Abstract:

This experiment was conducted to evaluate the effects of dietary lipid sources on the growth performance and fatty acid (FA) composition of juvenile shrimp, *Litopenaeus vannamei*. Six isoenergetic and isonitrogenous semi-purified diets containing casein, solvent-extracted soybean meal and gelatin as protein sources, were supplemented with 60 g kg⁻¹ of lipid sources. The lipid sources included: pollack fish oil (PO), pork lard (PL), soy oil (SO), peanut oil (PN), rapeseed oil (RO) and a mixture of pollack fish oil and soy oil (POSO 1 : 1 w/w). Each diet was fed to juvenile shrimp (0.10 g average weight) four times daily in triplicate tanks to apparent satiation (feeding ratio was about 8%) for 8 weeks. At the end of the experiment, weight gain, specific growth rate and protein efficiency ratio were significantly higher for shrimp fed the diet containing PO and the POSO mixture oil than the other lipid sources. The nutritional values of SO, RO, PN and PL were similar. Shrimp fed on PO, mixture oil of POSO and SO had better survival rates than the other lipid sources, and shrimp fed the PL had the lowest survival rate. There were significant differences in lipid contents of whole body and hepatopancreas amongst the dietary treatments; however, lipid contents of tail muscle were not

significantly affected by the dietary lipid sources. Shrimps fed POSO diet had higher protein content in whole body than those fed the other lipid sources, and shrimp fed PO diet had highest crude protein content of the tail muscle. A high correlation was found between dietary FA composition and FA composition of whole shrimp. FA composition of the whole body was generally affected by dietary lipid sources, especially dietary unsaturated FA.

(Laboratory of Aquatic Economic Animal Nutrition and Feed, College of Fisheries, Guangdong Ocean University, Zhanjiang 524025, People's Republic of China; email of Q.C. Zhou: qicunzhou@tom.com)

INFLUENCE OF DIFFERENT YEAST CELL-WALL MUTANTS ON PERFORMANCE AND PROTECTION AGAINST PATHOGENIC BACTERIA (VIBRIO CAMPBELLII) IN GNOTOBIOTICALLY-GROWN ARTEMIA

Siyavash Soltanian, Jean Dhont, Patrick Sorgeloos, Peter Bossier-2007

Fish & Shellfish Immunology 23(1): 141-153

Abstract:

A selection of isogenic yeast strains (with deletion for genes involved in cell-wall synthesis) was used to evaluate their nutritional and immunostimulatory characteristics for gnotobiotically-grown Artemia. In the first set of experiments the nutritional value of isogenic yeast strains (effected in mannoproteins, glucan, chitin and cell-wall bound protein synthesis) for gnotobiotically-grown Artemia was studied. Yeast cell-wall mutants were always better feed for Artemia than the isogenic wild type mainly because they supported a higher survival but not a stronger individual growth. The difference in Artemia performance between WT and mutants feeding was reduced when stationary-phase grown cells were used. These results suggest that any mutation affecting the yeast cell-wall make-up is sufficient to improve the digestibility in Artemia. The second set of experiments, investigates the use of a small amount of yeast cells in gnotobiotic Artemia to overcome pathogenicity of *Vibrio campbellii* (VC). Among all yeast cell strains used in this study, only mnn9 yeast (less cell-wall bound mannoproteins and more glucan and chitin) seems to completely protect Artemia against the pathogen. Incomplete protection against the pathogen was obtained by the gas1 and chs3 mutants, which are lacking the gene for a particular cell-wall protein and chitin synthesis, respectively, resulting in more glucan. The result with the chs3 mutant is of particular interest, as its nutritional value for Artemia is comparable to the wild type. Hence, only with the chs3 strain, in contrast to the gas1 or mnn9 strains, the temporary protection to VC is not concomitant with a better growth performance under non-challenged conditions, suggesting non-interference of general nutritional effects.

(Laboratory of Aquaculture & Artemia Reference Center, Faculty of Bioscience Engineering, Ghent University, Rozier 44, 9000 Gent, Belgium; email of S. Soltanian: soltanian.siyavash@ugent.be)

EFFECTS OF LEAD NITRATE ON THE ACTIVITY OF METABOLIC ENZYMES DURING EARLY DEVELOPMENTAL STAGES OF THE AFRICAN CATFISH, CLARIAS GARIEPINUS (BURCHELL, 1822)

Alaa G. M. Osman, Imam A. Mekkawy, Johan Verreth, Frank Kirschbaum-2007

Journal Fish Physiology and Biochemistry 33(1)

Abstract:

Glucose-6-phosphate dehydrogenase (G6PDH), lactate dehydrogenase (LDH) and pyruvate kinase (PK) are key metabolic enzymes. G6PDH has been used as a biomarker of pollution-induced carcinogenesis in fish. LDH has been used as marker of lesions in toxicology and clinical chemistry, and PK catalyses the conversion of phosphoenol pyruvate to pyruvate, with regeneration of ATP. The effect of different concentrations of lead nitrate on the activity of these enzymes in two different early ontogenetic stages (embryonic and free embryonic stage) of the African catfish *Clarias gariepinus* was investigated. Embryo homogenates were used for measurements of G6PDH, LDH and PK activity spectrophotometrically at 340 nm and 25°C. The ontogenetic variations of the three enzymes during early ontogeny, from the 30 h to the 168 h post-fertilisation stage (PFS) (beginning of exogenous

feeding), were studied. There was a significant decrease in activities of all three enzymes from 30 h-PFS to 96 h-PFS, followed by a significant increase in G6PDH and LDH. PK showed insignificant fluctuations in activity. Different patterns of enzyme activities were recorded due to exposure to different lead nitrate concentrations (100 µg/l, 300 µg/l and 500 µg/l). In the pre-hatching stage (30 h-PFS) the activity of the three enzymes increased at exposure to 100 µg/l lead nitrate and then decreased with increasing dose. In the post-hatching stages (48 h-PFS–168 h-PFS) G6PDH activity increased and LDH activity decreased with increasing lead concentrations. Unlike G6PDH and LDH, the PK enzyme fluctuated during the post-hatching stages and did not reveal a specific trend of response (increase or decrease) with increasing lead concentrations. Therefore, the measurement of G6PDH and LDH activities, but not PK activity, could be useful biomarkers of intoxication to reveal the embryotoxic potential of lead nitrate in fish embryos. The post-hatching stages of the African catfish are more sensitive than the pre-hatching stage (30 h-PFS) is, probably due to the protective capacity provided by the hardened chorion. The interaction and the main effects of age and lead doses were found to be highly significant, referring to the great impact of lead on these enzyme systems with increasing early development.

(Department of Biology and Ecology of Fishes, Leibniz Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany; email of Alaa G. M. Osman: osman@igb-berlin.de)

EFFECTS OF WEANING AGE AND DIETS ON ONTOGENY OF DIGESTIVE ACTIVITIES AND STRUCTURES OF PIKEPERCH (SANDER LUCIOPERCA) LARVAE

Neila Hamza, Mohamed Mhetli, Patrick Kestemont-2007

Journal Fish Physiology and Biochemistry 33(2)

Abstract:

Growth and ontogeny of digestive function were studied in pikeperch (*Sander lucioperca*) larvae weaned on artificial food at different ages. Three weaning treatments initiated respectively on day 9 (W9), day 15 (W15) or day 21 (W21) post-hatching (p.h.) were compared with a control group, fed *Artemia nauplii* from first feeding until the end of the rearing trial on day 36 p.h. The digestive enzyme activities and the ontogeny of digestive structures were investigated using enzymatic assays and histological methods. Growth of pikeperch larvae was significantly affected by precocious weaning. Pancreatic (trypsin and amylase) and intestinal (leucine-alanine peptidase, leucine aminopeptidase N and alkaline phosphatase) enzyme activities were detected from hatching onwards, increased at the moment of first feeding and then decreased. Pepsin secretion occurred at day 29 p. h. only, concurrently with the stomach development and differentiation of gastric glands. In the early weaning group (W9) the maturation process of intestinal enterocytes seems to be impaired and/or delayed and several signs of malnutrition were recorded. Except for alkaline phosphatase activity, no differences in enzyme activities and development of digestive structures were observed among the control, W21, and W15 groups. Moreover, at the end of the experiment, no differences in proteolytic activities were observed among larvae from the different treatments, indicating that, in surviving individuals, the digestive structures were properly developed and the larvae had acquired an adult mode of digestion. Based on the artificial diet used, our results suggested that pikeperch larvae can be weaned from day 15 p.h. without significant adverse effect on digestive capacities (except for alkaline phosphatase) or development of digestive tract, while earlier weaning impaired the onset of the maturation processes of the digestive system, both in terms of morphological structures and enzymatic activities.

(Institut National des Sciences et Technologies de la Mer, 28, avenue 2 Mars 1934, 2025 Salamambo, Tunisia ; email of P. Kestemont: patrick.kestemont@fundp.ac.be)

CHANGES IN LIPID AND FATTY ACID COMPOSITION OF WILD FRESHWATER ZOOPLANKTON DURING ENRICHMENT AND SUBSEQUENT STARVATION

S. E. Lochmann, K. J. Goodwin, C. L. Racey-2007

North American Journal of Aquaculture 69: 99–105

Abstract:

Concentrated wild zooplankton harvested from freshwater ponds have been used to feed the larvae of hybrid striped bass (female white bass *Morone chrysops* × male striped bass *M. saxatilis*) in tanks. However, larval growth and survival have been superior when cultured rotifers and brine shrimp *Artemia* spp. nauplii have been offered as first feeds. We hypothesized that enrichment with highly unsaturated fatty acids (HUFAs), which is common for cultured zooplankton, would enhance the nutritional value of wild freshwater zooplankton. Wild zooplankton were enriched for 24 h with Super Selco, a formula rich in HUFAs. Lipid and fatty acid composition changes in wild freshwater zooplankton were monitored during the enrichment period and the subsequent 72 h. Total lipids in wild zooplankton increased from a preenrichment level of 38 mg/g dry weight (DW) to 72 mg/g DW after enrichment. Although wild zooplankton were initially deficient in HUFAs, the HUFA level after enrichment was 10.41 mg/g DW, which was above the recommended level for good growth and survival of hybrid striped bass larvae. The nutritional state of wild zooplankton returned to the preenrichment level 24 h after enrichment was terminated. Therefore, enriching wild zooplankton from culture ponds for 24 h after harvesting and concentration offers producers another nutritional option for hybrid striped bass larvae during the early life history stages.

(Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, 1200 North University Drive, Mail Slot 4912, Pine Bluff, Arkansas 71601, USA)

VOLUME AND LIPID, FATTY ACID, AND AMINO ACID COMPOSITION OF GOLDEN SHINER EGGS DURING A SPAWNING SEASON

S. E. Lochmann, K. J. Goodwin, R. T. Lochmann, N. M. Stone, T. Clemment-2007

North American Journal of Aquaculture 69: 116–126

Abstract:

The Arkansas baitfish industry leads the nation in production of golden shiners *Notemigonus crysoleucas*. To determine nutritional requirements for golden shiner broodstock diets, we examined the volume and lipid, fatty acid, and amino acid composition of the eggs produced by a group of captive broodstock over a spawning season. Egg volume was 0.67 ± 0.117 mm³ (mean \pm SD); egg volume declined during the spawning season. Total lipid was 15.67 ± 2.99 μ g/egg, and triacylglyceride (TAG) concentration was 6.82 ± 1.81 μ g/egg. Based on the stability of egg total lipid, the percent neutral lipid, the consistent contribution of TAG to neutral lipid, the consistent TAG concentration, and the stable fatty acid and amino acid profiles, we conclude that the lipid and amino acids in eggs from the experimental group were stable. The eggs should be equally sufficient for embryological development throughout the spawning season, but specific indices of egg and fry quality must be measured to confirm the links among egg size, biochemical composition, and egg and fry quality.

(Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff, 1200 North University Drive, Mail Slot 4912, Pine Bluff, Arkansas 71601, USA)

SEASONAL VARIATION OF SPERM QUALITY AND THE RELATIONSHIP BETWEEN SPERMATOCRIT AND SPERM CONCENTRATION IN YAMÚ BRYCON AMAZONICUS

Pablo E. Cruz-Casallas, Víctor M. Medina-Robles, Yohana M. Velasco-Santamaría-2007

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Abstract:

Osmolality, the concentrations of glucose, total cholesterol, and triglyceride, and the concentrations of ions such as Na⁺, Cl⁻, K⁺, and Mg²⁺ in the seminal plasma of yamú *Brycon amazonicus* were evaluated during one reproductive season. Semen quality and the relationship between spermatocrit and sperm concentration were examined over two reproductive seasons. Activation time, spermatocrit, and sperm concentration were significantly higher in 2003 than in 2004. Spermatocrit and sperm concentration showed a significant positive relationship ($r^2 = 0.79$). During the 2004 reproductive season, a significant variation was observed for spermatocrit and sperm concentration

between the initial period (February 15th to March 14th) and the middle and final periods (March 15th to April 14th and April 15th to May 14th, respectively). Neither the ion concentrations nor the glucose and cholesterol concentrations varied between any periods of the reproductive season. Osmolality and triglyceride concentrations showed significant variations between periods during the reproductive season.

(Instituto de Acuicultura, Universidad de los Llanos, Villavicencio, AA 110, Meta, Colombia)

ENRICHED ARTEMIA AND PROBIOTIC DIETS IMPROVE SURVIVAL OF COLORADO RIVER CUTTHROAT TROUT LARVAE AND FRY

Ronney E. Arndt, Eric J. Wagner-2007

North American Journal of Aquaculture 69: 190–196

Abstract:

In a sequence of two tests, probiotics were tested for their ability to enhance the survival of larvae and fry of the Colorado River cutthroat trout *Oncorhynchus clarkii pleuriticus*. For the first test (12 d), first-feeding fish were fed *Artemia franciscana* that had been enriched with *Lactobacillus* bacteria, a commercial probiotic formula, or Selco (an emulsion containing omega-3 fatty acids and essential fatty acids combined with phytoplankton). Two control treatments—an *Artemia* control group fed nauplii that had not been enriched and a commercial feed control group that was fed a commercial swim-up feed formulation—were also included. There were no significant differences between treatments with respect to survival, although the swim-up feed controls had 82% survival over 12 d, compared with an average of 93% for the other treatments. Swim-up control fish grew significantly better than fish in the *Lactobacillus*-fed treatment. As a continuation of the study (second test), growth and survival between the swim-up control fish and the *Lactobacillus*-fed treatment were compared over 71 d. The swim-up control fish were fed a commercial diet for the duration, the particle size increasing with fish growth. The *Lactobacillus*-fed fish were offered the same-sized diet as the control except that it was top-dressed with lactobacilli. Survival was improved for fry fed the *Lactobacillus* diet compared with fish fed the unmodified commercial formulation. Feed conversion ratios were also significantly better for fry fed the *Lactobacillus* diet. *Artemia* and probiotics appear to be useful methods for improving the survival of Colorado River cutthroat trout larvae and fry.

(Utah Division of Wildlife Resources, Fisheries Experiment Station, 1465 West 200 North, Logan, Utah 84321, USA)
