INFORMATION OF INTEREST

- Controlled reproduction and domestication in aquaculture – the current state of the art: review article by M. Bilio published in 4 parts in Aquaculture Europe (2007-2008)
- Several video clips with Professor Crawford discussing the vital role that seafood played in human evolution, the importance of seafood to human health, and the range of health problems, including an increase in brain disorders, caused by the decline in seafood consumption.
- EU Aquatic Products Marketing Report 2008
- Past issues of the @Magazine "Aquaculture Health International" can be downloaded from the AHI website
- EU project CONSENSUS has put up a channel on YouTube regarding sustainable aquaculture
- International training programmes at Central Institute of Fisheries Education, Mumbai, India
- 2nd Newsletter Aquamax: 'Health benefits of fish consumption for pregant woman and her child'
- The Asian Fisheries Science E-journal volume 21 number 2 is now available. The AFS website: www.asianfisheriessociety.org
- The importance of dietary EPA & DHA omega-3 fatty acids in the health of both animals and humans – IFFO datasheet
- Wageningen IMARES newsletter e-MARES
- International Catfish Symposium at Can Tho University (Vietnam) on 5-7 December 2008: see website
- *Macrobrachium: the culture of freshwater prawns.* New book by Michael New, C.M. Nair, M.N. Kutty, K.R. Salin and M.C. Nandeesha, published by Macmillan India Ltd in 2008: see press release
- Sustainable Aquaculture Research Networks in Sub Saharan Africa : A new era for strengthening African Aquaculture - website
- Asian Fisheries Society - eNewsletter issue June 2008
- BioFlocTechnology working group: new website with conference presentations
- Important Concepts in Fish Nutrition and Their Relevance to Fish Feed Formulation: pdf presentations from the Fish Nutrition Research Laboratory at the University of Guelph, Canada
- eNewsletter (in Spanish) "Industria Acuicola" : free subscription
- Reports of the ICES Working Group on Application of Genetics in Fisheries and Mariculture
- Special issue of Aquatic Botany on Mangrove Ecology – Applications in Forestry and Costal Zone Management
- *Saline Systems* is an on-line journal publishing articles on all aspects of basic and applied research on halophilic organisms and saline environments
- "Shellfish News" magazine, a regular publication produced and edited by CEFAS on behalf of the UK Department for Environment, Food and Rural Affairs, as a service to the British shellfish farming and harvesting industry, is available online.
- Mitigating impact from aquaculture in the Philippines: EU project report aiming to reduce the impact of aquaculture on the environment and help the central and local government plan, manage, monitor and control aquaculture development.
- ICES MARICULTURE COMMITTEE - Report of the Working Group on Pathology and Diseases of Marine Organisms, Galway-Ireland, 4–8 March 2008
- MSc in Aquaculture Internships offered in Asia via new EU Asia Link Program
- Book of Abstracts World Aquaculture 2008, Busan-Korea May 2008
- Interesting publications of the ESF Marine Board

- Snapperfarm – Open Ocean Aquaculture: interesting website with video about cobia farming

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ONTOGENY OF THE DIGESTIVE TRACT OF LARVAL PERCULA CLOWNFISH, AMPHIPRION PERCULA (LACÉPÈDE 1802): A HISTOLOGICAL PERSPECTIVE
Umur Önal, Chris Langdon, İhsan Çelik-2008
Aquaculture Research 39(10): 1077-1086
Abstract:
An understanding of the development of the digestive system of marine fish larvae is of critical importance in determining optimal feeding regimes for their culture. The present study provides information on the histomorphological development of the digestive system of clown fish, Amphiprion percula, larvae during the first month of life. Before hatching, clownfish larvae possess an alimentary tract, liver and pancreas with absorptive and digestive capabilities. The yolk sac is completely consumed within 5–7 days at 25 °C. Clownfish larvae readily accept rotifers after hatching and a complete dietary shift from rotifer to Artemia can be accomplished at 10 days after hatch (DAH). Gastric glands in the stomach first develop 11 DAH and proliferate by 15 DAH. Both non-staining vacuoles (NSV) and supranuclear inclusion vesicles (SIV) appear at 11 DAH in the midgut and hindgut respectively. Pinocytosis and extracellular digestion coexist for about 2 weeks after hatching. While SIV disappeared completely at 25 DAH, NSV continued to be a prominent feature of the midgut during the first month.
(Department of Aquaculture, Fisheries Faculty, Çanakkale Onsekiz Mart University, Terzioğlu Campus, 17100, Çanakkale, Turkey; email of Umur Önal: umuronal@yahoo.com)

SHORT COMMUNICATION
LARGE-SCALE BATCH ALGAE CULTIVATION: COMPARISON OF TWO SEAWATER STERILIZATION TECHNIQUES
Melanie A Rhodes, Chris Sedlacek, Nancy H Marcus-2008
Aquaculture Research 39(10): 1128-1130
(Department of Oceanography, Florida State University, Westcott 408, Tallahassee, FL 32306 USA; email of N. H. Marcus: nmarcus@fsu.edu)

GENETIC CHARACTERIZATION OF ARGENTINEAN ARTEMIA SPECIES WITH DIFFERENT FATTY ACID PROFILES
Olga Ruiz, Francisco Amat, Carlos Saavedra, Alba Papeschi, Rosa G. Cohen, Athanasios D. Baxevanis, Ilias Kappas, Theodore J. Abatzopoulos, Juan C. Navarro-2008
Hydrobiologia 610(1): 223-234
Abstract:
The Anostracan genus Artemia is composed by several sibling species reproductively isolated, but identical or very similar in outward appearance. The genus shows also an underlying striking variability from the biochemical point of view, regarding especially the fatty acid profile of the cysts and nauplii. In Argentina, Artemia is represented by two bisexual species: A. franciscana and A. persimilis. Former studies have shown that A. franciscana is present in northern of 36º and that A. persimilis is constrained southwards of 37° S. In general, there is good agreement between morphological and cytogenetic comparisons of Argentinean populations with respect to species discrimination. However, new Argentinean Artemia populations are being analyzed morphologically and it becomes necessary to further investigate if the genetic adscription of these populations is

congruent with the results obtained from the current morphological analyses. Restriction fragment length polymorphism (RFLP) analysis of a fragment of the 16S rRNA mitochondrial gene was used to investigate the genetic diversity and population structure of 10 new Artemia populations from Argentina. The mitochondrial DNA (mtDNA) results showed a similar pattern to that of previous cytogenetic and morphological analyses with the two Argentinean species appearing as highly divergent. The presence of A. persimilis in southern Argentina and the southernmost Chilean population was confirmed unveiling a novel picture of species distribution in the country. A. franciscana showed a unique haplotype. Populations of A. persimilis appeared highly structured, although their clustering did not follow a clear geographic pattern. The different Argentinean Artemia populations analyzed were characterized by high variability in their fatty acids, showing both marine- and freshwater-type profiles. For the first time, the investigation of the relatedness between the fatty acid composition in Artemia and genetic markers was attempted. The study aimed at the putative association of molecular markers with marine versus freshwater-type populations. A lack of correlation between RFLP patterns at mtDNA and the fatty acid (FA) profiles was found in the A. persimilis populations which was discussed from the point of view of two main genetic hypotheses and/or phenotypic plasticity.
(Instituto de Acuicultura de Torre de la Sal (CSIC), 12595 Ribera de Cabanes, Castellon, Spain; email of Olga Ruiz: olga@iats.csic.es)

INSTANTANEOUS SALINITY REDUCTIONS AFFECT THE SURVIVAL AND FEEDING RATES OF THE CO-OCCURRING COPEPODS ACARTIA TONSA DANA AND A. CLAUSI GIESBRECHT DIFFERENTLY

Danilo Calliari, Marc C. Andersen Borg, Peter Thor, Elena Gorokhova, Peter Tiselius-2008
Journal of Experimental Marine Biology and Ecology 362,(1): 18-25

Abstract:
Salinity variability at short time scales constitutes a severe restriction to marine life in coastal and estuarine ecosystems. In these environments zooplankters may experience rapid salinity variations due to diverse processes, yet lethal or sub-lethal responses to such changes have been scarcely studied. We assessed short-term (12 h) survival and time-integrated clearance (F; mL ind− 1 h− 1) and ingestion rates (I, µgC ind− 1 h− 1) after 1, 2, 4, 8 and 12 h of two widespread and abundant coastal copepods, Acartia tonsa and A. clausi, subjected to instant salinity changes from 32 PSU to 26, 20, 14, 8 and 4 PSU (A. tonsa) and from 32 to 26, 20 and 14 PSU (A. clausi). We expected that A. tonsa, which occur naturally in environments where sharp salinity gradients are common would tolerate wider salinity changes than A. clausi, which less frequently encounter sharp gradients in nature. For A. tonsa mortality for the extreme haline shock (change from 32 to 4 PSU) was 31%, whereas A. clausi reached 22% mortality already at a change from 32 to 14 PSU; in comparison, mortality for A. tonsa at the 32/14 PSU treatment was only 3%. F and I decreased significantly at extreme treatments, and the total clearance in experimental bottles with salinity shocked animals (Ftot, mL h− 1) was only 5% of rates measured in non-shocked control bottles for A. tonsa (32/4 PSU change) and 20% for A. clausi (32/14 PSU change); corresponding total ingestion (Itot, µgC h− 1) represented 9.5% of that in control bottles for A. tonsa and 24% for A. clausi. In comparison, the 32/14 PSU treatment did not affect either clearance or ingestion rates in A. tonsa. Results suggest that in the field A. tonsa is not likely to suffer significant mortalities due to sudden salinity reductions in the surrounding medium — except under extreme circumstances— while A. clausi cannot tolerate changes > 18 PSU. However, in both species feeding activity could be severely compromised by salinity reductions. The decreased feeding rate may have direct implications for processes ranging from energy acquisition at individual level to organic matter transfers at ecosystem level and thus deserves more attention in experimental studies and population modelling.
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FLUIDIZED SAND BIOFILTERS USED TO REMOVE AMMONIA, BIOCHEMICAL OXYGEN DEMAND, TOTAL COLIFORM BACTERIA, AND SUSPENDED SOLIDS FROM AN INTENSIVE AQUACULTURE EFFLUENT

John Davidson, Neil Helwig, Steven T. Summerfelt-2008

Aquacultural Engineering 39(1): 6-15

Abstract:

Effluents from aquaculture facilities must be effectively managed to remove dissolved wastes and suspended solids that can pollute receiving bodies of water. High volume, dilute flows leaving settling or filtration units can appear pristine, but still contain dissolved wastes. Effective technologies are needed to treat high volume effluents from intensive fish farms. The objective of this study was to evaluate fluidized sand biofilters as a treatment option for removing carbonaceous biochemical oxygen demand (cBOD5), total-ammonia-nitrogen (TAN), total phosphorous, total suspended solids (TSS), and total coliform bacteria from high volume intensive aquaculture effluents. Treatment across three full-scale CycloBio® fluidized sand biofilters was evaluated using two sand sizes, i.e., an effective size (D10) of 0.11-mm and 0.19-mm sand that were each expanded approximately 60% at a superficial velocity of 0.31 cm/s and 0.64 cm/s, respectively. Two bed management techniques were also evaluated: (1) siphoning from the top portion of the bed and (2) a biofilm shearing method in which a submersible pump was used to strip and release excess biofilm as it accumulated at the top of the expanded bed. Greater removal of cBOD5, TAN, and nitrite, and greater dissolved oxygen consumption across the biofilter correlated with the 0.11-mm sand. Additionally, improvements in removal of cBOD5, TAN, and nitrite, and greater dissolved oxygen consumption across the biofilter were measured when the biofilm shearing method was used to manage bed growth compared to siphoning. The biofilm shearing method was also more effective in controlling bed growth, resulted in less sand loss, and required substantially less labor than siphoning which was a large contrast from the labor required using the bed siphoning and sand replacement technique. The fluidized-sand biofilters removed 66–82% of the cBOD5 each pass and 86–88% of the TAN when bed growth was controlled using biofilm shearing. Outlet cBOD5 and TAN concentrations were reduced to 1.7 ± 0.4 mg/L and 0.11 ± 0.04 mg/L, respectively and outlet nitrite was 0.10 ± 0.02 mg/L when using biofilm shearing. Total phosphorous removal efficiency was 15–41% across the biofilters, and TSS removal was inconsistent but was achieved at inlet concentrations above 10 mg/L for both bed management techniques. Results indicate that full-scale fluidized sand biofilters can effectively treat high volume, dilute aquaculture effluents.

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PARTICLE SIEVE ANALYSIS FOR DETERMINING SOLIDS REMOVAL EFFICIENCY OF WATER TREATMENT COMPONENTS IN A RECIRCULATING AQUACULTURE SYSTEM

Timothy J. Pfeiffer,Andrew Osborn, Megan Davis-2008

Aquacultural Engineering 39(1): 24-29

Abstract:

Recirculating aquaculture systems offer potential finfish production units for small-scale entities as well as large-scale operations. However, the water treatment components of such systems require efficient and proper operation to assure successful production. This study evaluated the solids removal ability of three water treatment components in a two-tank recirculating aquaculture system (28 m3) utilized for the warmwater production of tilapia. The components include a swirl separator, a floating plastic bead bioclarifier, and a fluidized sand filter. Sampling was conducted at five different points in the system with each sample volume being serially fractionated through sieves in size ranging from 23 to 500 μm. Total suspended solids analysis was completed on each sample set to determine the particle size distribution of the influent and effluent water and removal efficiency of each component. The removal efficiency of the swirl separator was over 90% for particles larger than 250 μm and the propeller-wash bead filter had removal efficiencies greater than 85% for particles larger than 55 μm. The fluidized sand filter had the best removal for the smaller size particles with over 65% removal efficiency for particles between 23 and 55 μm. The overall reduction in total suspended solids for the

treatment loop of the three components of this small-scale experimental unit was over 85% and adequately removed the suspended solids from the recirculating water for tilapia growout production.
(USDA Agricultural Research Service, Sustainable Marine Aquaculture Systems, 5600 U.S. Highway 1 North, Fort Pierce, FL 34946, USA; email of T. Pfeiffer: timothy.pfeiffer@ars.usda.gov)

FOAM FRACTIONATION EFFICIENCY IN PARTICULATE MATTER AND HETEROTROPHIC BACTERIA REMOVAL FROM A RECIRCULATING SEABASS (DICENTRARCHUS LABRAX) SYSTEM

Fabio Brambilla, Micaela Antonini, Pietro Ceccuzzi, Genciana Terova, Marco Saroglia-2008
Aquacultural Engineering 39(1): 37-42
Abstract:
In recirculating aquaculture systems (RAS), particulate matter and bacterial communities management are required to maintain water quality. Foam fractionation is a water treatment technology that can be easily applied to water reuse systems to remove bacteria and suspended solids. This study investigated the efficiency of foam fractionation in removing particulate matter and heterotrophic bacteria in a closed recirculating seabass (Dicentrarchus. labrax) system. This system consisted of 10 rearing tanks, a skimmer acting as the foam separation system (SKIM®), a biofilter unit, and an UV unit. The efficiency of SKIM was analyzed for different foam fractionation operation times (5′on/5′off, 15′on/15′off and 30′on/30′off) and for different sizes of particulate matter (>60 μm, 60–8 μm, 8–1.2 μm, and 1.2–0.22 μm). The removal of particulate matter was influenced by different particle sizes with higher removal percentages for the >60 μm and 1.2–0.22 μm categories of 96.8 and 100%, respectively. Nevertheless, these categories represented the lower percentage of total solid compositions in the RAS water studied (>60 μm = 7.14 ± 2.78%, and 1.2–0.22 μm = 18.27 ± 2.50%). The removal of heterotrophic bacteria did not correlate with the operation time or particle size and SKIM removal percentages ranged between 32 and 88%.
(Department of Biotechnology and Molecular Sciences, University of Insubria, Via H.J. Dunant 3, 21100 Varese, Italy; email of F. Brambilla: fabio.brambilla@uninsubria.it)

PIPES SIZE SELECTION OF WATER DISTRIBUTION SYSTEMS OF FISHFARMS

Inmaculada Pulido-Calvo, Juan Carlos Gutiérrez-Estrada, José María Corbacho-2008
Aquacultural Engineering 39(1): 43-52
Abstract:
The problem of selecting the best combination of pipe diameters of water distribution networks of fishfarms is analysed in this paper. With this goal, an optimisation algorithm with a rule of thumb to limit the range of flow velocities was developed. The available range of flow velocities was selected according to hydraulics constraints and fouling potential impacts (fishfarms are flowing systems with adequate conditions for development of unwanted deposits). This way, the designs to select must be determined as trade-offs between costs, hydraulic reliability and risk of impaired water quality based in the flow velocity effect on fouling growth. The optimisation equations were implemented in a computer program that is constituted as a specific software for fishfarms which can be utilised as a tool to determine efficient low-cost solutions for a set of design conditions. The model was applied based on data from an eel fishfarm in southern Spain. The findings of this study provide insight into the advantages and disadvantages of some design alternatives and indicate that the appropriate sizing of pipe network is cost effective.
(Dpto. Ciencias Agroforestales, Universidad de Huelva, EPS, Campus Universitario de La Rábida, 21819 Palos de la Frontera, Huelva, Spain, email of I. Pulido: ipulido@uhu.es)

LETTER TO THE EDITORS

CONFIRMATION OF THE RIGHT TO REFUSE REVISION IN THE GENUS PENAEUS

Aquaculture 280(1-4) : 1-4
T.W. Flegel

(Centex Shrimp, Faculty of Science, Mahidol University, Thailand; sctwf@mucc.mahidol.ac.th)

IDENTIFICATION OF DIFFERENTIAL BROODSTOCK CONTRIBUTION AFFECTING GENETIC VARIABILITY IN HATCHERY STOCKS OF ATLANTIC SALMON (SALMO SALAR)

Jose L. Horreo, Gonzalo Machado-Schiaffino, Andrew Griffiths, Dylan Bright, Jamie Stevens, Eva Garcia-Vazquez-2008

Aquaculture 280(1-4): 89-93

Abstract:

Supportive breeding of Atlantic salmon (Salmo salar) is commonly employed to maintain numbers of fish where the species has become locally endangered. Increasingly, one of the main aims of population management is the preservation of natural genetic diversity. If the stocks employed in supportive breeding exhibit reduced variation they can alter the natural pattern of genetic variation observed in wild populations. In northern Spain, wild adult salmon are caught every year from local rivers and artificially crossed in order to create supportive stocks. The offspring are hatchery reared until the juvenile stage, then released into the same river where their parents were caught. In the current study, our findings demonstrate that although adult broodstock exhibit a pattern of variation similar to the wild populations, variability at microsatellite loci was drastically reduced in the juveniles released into one of three rivers analyzed. The contribution of broodstock to this juvenile stock was examined by pedigree analysis. A restricted number of females contributing to the hatchery stock was identified as the main cause of loss in genetic variation, possibly due to overmaturity of some multi-sea-winter females. We suggest that better monitoring and control of parental contribution will help in solving the problem of loss of genetic diversity in hatchery populations.

(Departamento Biologia Funcional, Universidad de Oviedo. C/ Julian Claveria s/n. 33006-Oviedo, Spain; email of Eva Garcia-Vazquez: egv@uniovi.es)

STRAIN-SPECIFIC VITAL RATES IN FOUR ACARTIA TONSA CULTURES, I: STRAIN ORIGIN, GENETIC DIFFERENTIATION AND EGG SURVIVORSHIP

Guillaume Drillet, Erica Goetze, Per M. Jepsen, Jonas K. Højgaard, Benni W. Hansen-2008

Aquaculture 280(1-4): 109-116

Abstract:

Successful development of planktonic copepods for use as live feed in marine aquaculture relies on optimization of environmental conditions for population growth and egg storage. This study examined strain-specific differences in egg survivorship during cold-storage-induced quiescence in four cultures of the widespread marine calanoid Acartia tonsa Dana, 1849. Experimental cultures were obtained from Øresund, Denmark (DIFRES), Kiel, Germany (KIEL), Turkey Point, Florida, USA (FL), and Mobile Bay, Alabama, USA (AL), and were shown to derive from three highly distinct mitochondrial clades. Eggs from Gulf of Mexico strains had low tolerance for cold storage, and showed very low hatching success after 10 days. In contrast, Baltic Sea strains produced eggs able to tolerate up to 150 days of cold storage, with the DIFRES strain showing the highest egg survivorship during the experiment. Eggs from the Kiel strain showed an increase in hatching over time, indicating the presence of dormant eggs. Parental rearing temperature was also found to affect egg survivorship during quiescence in the DIFRES strain, with lower hatching success observed among eggs produced at 25 °C than at 17 °C. The DIFRES strain is recommended as the optimal strain for use in aquaculture, and conditions for cold storage of eggs are discussed.

(Technical University of Denmark, Danish Institute for Fisheries Research, Department of Marine Ecology and Aquaculture, Kavalergården 6, 2920 Charlottenlund, Denmark; email of Guillaume Drillet: gdr@difres.dk)

LACTOBACILLUS SPP. BACTERIA AS PROBIOTICS IN GILTHEAD SEA BREAM (SPARUS AURATA, L.) LARVAE: EFFECTS ON GROWTH PERFORMANCE AND DIGESTIVE ENZYME ACTIVITIES

Cüneyt Suzer, Deniz Çoban, H. Okan Kamaci, Şahin Saka, Kürşat Firat, Özge Otgucuoğlu, Hakan Küçüksari
Aquaculture 280(1-4): 140-145
Abstract:
In this study, the influence of commercial probiotic, Lactobacillus spp., supplementation was investigated on growth parameters and digestive enzyme activities in gilthead sea bream, Sparus aurata, during larval development. All experiments were triplicated and designed in three different administrations of probiotic from 3 days after hatching (DAH) concurrently with starting of exogenous feeding. In the first group, probiotic was added to live food (rotifer and Artemia). In the second group, probiotic was supplemented directly to both live food and water. In the third group, probiotic was added directly to water. Also, no probiotic treatment was maintained in control group. Total bacterial counts among probiotic probiotic-supplemented groups were significantly different from total bacterial counts in controls in water and digestive tract of larvae ($p < 0.05$). The mean of total bacterial counts in control was approximately 4 × 104-fold increased from the experimental groups in the sea water ($p < 0.05$). Besides, mean digestive enzyme activities of all probiotics treatment groups were significantly different ($p < 0.05$) with that of the control. Except probiotic water supplementation group, in all treatments, the specific activities of pancreatic and intestinal enzymes were significantly higher ($p < 0.05$) in larvae to which probiotic had been supplemented by live food and live food with water. Also, S. aurata larvae that had probiotic administered by live food with water demonstrated significant ($p < 0.05$) increases in both survival (13–105% higher) and specific growth rate (2–9% higher) as compared to controls. As a result, supplementation of probiotic to directly tank water could not significantly increase growth parameters and digestive enzyme activities and therefore, administration of probiotics by this method would not be effective in terms of husbandry parameters and nutritional condition.
(Ege University, Faculty of Fisheries, Aquaculture Department, 35100 Bornova, Izmir, Turkey; email of C. Suzer: cuneyt.suzer@ege.edu.tr)

REARING PERFORMANCE OF CLARIAS BATRACHUS LARVAE: EFFECT OF AGE AT STOCKING ON GROWTH AND SURVIVAL DURING FINGERLING PRODUCTION
S.K. Sahoo, S.S. Giri, S. Chandra-2008
Aquaculture 280(1-4): 158-160
Abstract:
An experiment was conducted to evaluate the rearing performance of different larval stages for optimum growth and survival during fingerling production of Clarias batrachus with an aim to reduce the rearing time of the catfish larvae in a hatchery system. The larvae were reared for 5, 10 and 15 days before stocking them in the nursery tanks. No significant ($P < 0.05$) difference could be found in length increment at the end of first week of rearing. But the total length was reduced during rest three weeks in five days old larvae compared to that of other two higher age groups. In 5 days old larvae the reduced weight ($P < 0.05$) was observed during the entire rearing period. However, the specific growth rate (SGR) did not vary among the groups. The survival rate as well as total biomass was decreased while stocking five days old larvae for rearing, compared to that of other two age groups.
(Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751 002, India; email of S.K. Sahoo: sksahoo100@rediffmail.com)

EFFECTS OF DIETARY PROTEIN AND ENERGY LEVELS ON SPAWNING PERFORMANCE OF NILE TILAPIA (OREOCHROMIS NILOTICUS) BROODSTOCK IN A RECYCLING SYSTEM
Abdel-Fattah M. El-Sayed, Mamdouh Kawanna-2008
Aquaculture 280(1-4): 179-184
Abstract:
The effects of dietary protein and energy level on spawning performance of Nile tilapia broodstock and hatchability of their eggs were studied. Nine diets containing three protein (30, 35 and 40%) and three energy (14.6, 16.7 and 18.8 MJ GE/kg) levels were prepared. The diets were fed to duplicate

groups of broodfish (average weight of 60.5 ± 4.6 g for males and 39.4 ± 3.1 g for females) at 2–3% of their body weight, twice a day, for 150 days. At low protein level (30%), time to first spawning was significantly longer than at 35 and 40% protein levels, and increased with increasing dietary energy (decreasing protein-to-energy (P/E) ratio). At 35 and 40% protein levels, time to first spawning was not affected by dietary energy. Inter-spawning intervals (ISI) showed irregular patterns in relation to dietary protein and energy, however, at 40% protein the females tended to spawn at shorter intervals, regardless of dietary energy. Spawning performances, including total number of spawnings per tank, number of spawnings per female, absolute fecundity and average number of eggs per spawn, were all significantly lower ($P < 0.05$) at 30% CP than at higher protein levels. At all protein levels, increasing dietary energy from 14.6 to 18.8 MJ GE/kg (and decreasing P:E ratio) resulted in a significant decrease in fish fecundity. Egg size was not significantly affected by dietary protein and energy. At all energy levels, egg hatchability increased with increasing dietary protein levels ($P < 0.05$). Eggs produced from broodstock fed 30 and 35% CP, exhibited significantly lower hatchability ($P < 0.05$) and needed less time for hatching and yolk-sac absorption, and resulted in lower larval length than those fed a 40% protein diet. However, increasing energy level at each dietary protein level did not significantly affect these parameters. These results revealed that the best spawning performance of Nile tilapia broodstock reared in a recycling system was achieved at 40% dietary protein and 16.7 MJ GE/kg, with a P/E ratio of 23.6 g/MJ.
(Oceanography Department, Faculty of Science, Alexandria University, Alexandria, Egyp; email of Abdel-Fattah M. El-Sayed: a_elsayed50@yahoo.com)

EVALUATION OF COMMERCIAL LIVE BAKERS' YEAST, SACCHAROMYCES CEREVISIAE AS A GROWTH AND IMMUNITY PROMOTER FOR FRY NILE TILAPIA, OREOCHROMIS NILOTICUS (L.) CHALLENGED IN SITU WITH AEROMONAS HYDROPHILA

Mohsen Abdel-Tawwab, Azza M. Abdel-Rahman, Nahla E.M. Ismael-2008
Aquaculture 280(1-4): 185-189

Abstract:
This study was carried out to evaluate the use of commercial live bakers' yeast, Saccharomyces cerevisiae as a growth and immunity promoter for Nile tilapia, Oreochromis niloticus (L.). Fish (0.33 g) were randomly distributed at 25 fish per 140-L aquarium and fed a diet containing 0.0, 0.25, 0.50, 1.0, 2.0, or 5.0 g yeast/kg diet for 12 weeks. After the 12-week experimental period, fish of each treatment were challenged by pathogenic Aeromonas hydrophila, which was given by interperitoneal (IP) injection and kept under observation for 10 days to record clinical signs and the daily mortality rate. The growth-promoting influences of bakers' yeast were observed with fish and the optimum growth, feed utilization, and protein turn-over were obtained with 1.0–5.0 g yeast/kg diet. Also, yeast supplementation increased protein deposition in fish body. Biochemical parameters were improved in fish fed yeast up to 1.0 g/kg diet. Total fish mortality 10-days after IP injection with A. hydrophila and its count after incubation with fish serum decreased with the increase of yeast level in fish diets. However, the lowest fish mortality and bacterial counts were obtained in fish fed 5.0 g yeast/kg. These results indicate that bakers' yeast supplement is promising as an alternative method to antibiotics for disease prevention in tilapia aquaculture, and the optimum level of live bakers' yeast is about 1.0 g per kg diet.
(Fish Ecology Department, Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharqia, Egypt; email of Mohsen Abdel-Tawwab: mohsentawwab@yahoo.com)

NATURAL CARBON STABLE ISOTOPE RATIOS AS INDICATORS OF THE RELATIVE CONTRIBUTION OF LIVE AND INERT DIETS TO GROWTH IN LARVAL SENEGALESE SOLE (SOLEA SENEGALENSIS)

Julián Gamboa-Delgado, José Pedro Cañavate, Ricardo Zerolo, Lewis Le Vay-2008
Aquaculture 280(1-4): 190-197

Abstract:

The relative contributions of live Artemia metanauplii and an inert diet for growth of Senegalese sole larvae and postlarvae were assessed through the analysis of carbon stable isotopes ratios (δ13C) in both diets and whole larval tissue. Larvae were reared on four dietary regimes: 100% live prey (rotifers and Artemia), 100% inert formulated diet and two co-feeding regimes of 70:30 and 30:70 ratios of Artemia and inert diet, respectively. Larvae from the live food regime and both co-feeding regimes showed a steep increase in δ13C from 10 days after hatching (DAH) as a result of the onset and continuation of Artemia consumption. From 12 DAH fish larvae from all the regimes showed significant isotopic differences as their δ13C increased to final asymptotic values of − 15.1, − 15.6 and − 16.3‰ in the live food, 70:30 and 30:70 regimes, respectively. Carbon turnover rates in larvae from both live food and co-feeding regimes were relatively high (0.071 to 0.116 d− 1) but more than 90% of the observed change in fish tissue isotopic values was accounted for by the retention of carbon in new tissue growth. A two-source, one-isotope mixing model was applied to estimate the nutritional contribution of Artemia and inert diet to postlarvae growth in the co-feeding regimes. At 23 DAH, the relative contribution of live and inert diets to tissue growth in larvae was respectively, 88 and 12% for the 70:30 co-feeding regime and 73 and 27% for the 30:70 co-feeding regime. At 17 DAH, the estimated proportion of tissue carbon derived from the inert diet was higher at 23 and 38% for the 70:30 and 30:70 regimes, respectively. The results suggest that co-feeding regimes in Solea senegalensis larvae may be adjusted to meet ontogenetic changes in the capacity for larvae to utilise inert diets. The contrasting levels of carbon isotope discrimination between diet and tissue in larvae reared on either 100% live feed or 100% inert diet indicate relatively poor utilization of nutrients from the inert diet. The use of isotopic discrimination factors as potential indicators of the digestive physiological performance of a consuming organism in regards to its diet is discussed.
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EFFECTS OF PHOTOPERIOD ON EGG PRODUCTION AND HATCHING SUCCESS, NAUPLIAR AND COPEPODITE DEVELOPMENT, ADULT SEX RATIO AND LIFE EXPECTANCY OF THE TROPICAL CALANOID COPEPOD ACARTIA SINJIENSIS

Thomas Camus, Chaoshu Zeng-2008

Aquaculture 280(1-4): 220-226

Abstract:
The tropical calanoid copepod Acartia sinjiensis has good potential for mass culture as live feed for reef fish larvae. The present study was conducted to evaluate the effects of photoperiod on various parameters related to A. sinjiensis productivity in culture.
Five photoperiods of Light:Dark = 0:24; 6:18; 12:12; 18:6 and 24:0h were setup. Daily egg production of individual females under each photoperiod was monitored for 8 consecutive days. The females were randomly selected daily from stock cultures kept under respective photoperiods and discarded after experiment. The results showed a clear trend of increasing egg production with longer illumination period. Under constant darkness, acclimatization was evident as egg output increased steadily over the 8 day period. Statistics showed that photoperiod significantly ($p < 0.005$) affected mean daily egg production, with the highest egg output recorded at 18L:6D and 24L:0D (17.6 ± 1.7 and 17.6 ± 1.8 eggs/female/day respectively), which were significantly higher than all other treatments. Photoperiod also significantly affected 48 h egg hatching success ($p < 0.005$), a trend of increased hatching success with longer light phase was demonstrated. The highest hatching rate (87.2 ± 1.4%) was recorded at 24L:0D, which was significantly higher than the 0L:24D and 6L:18D treatments but not significantly different from the second highest (85.3 ± 2.6%) hatching rate of 18L:6D treatment.
Photoperiod was further confirmed to significantly ($p < 0.005$) affected naupliar and copepodite development with accelerated development observed with increased illumination period of photoperiods. Mean development time from egg to adult was the shortest at 6.00 ± 0.33 days under constant light (24L:0D), followed by 6.24 ± 0.24 days at 18L:6D, both were significantly shorter than that of 0L:24D and 6L:18D treatments although no significantly difference was detected between themselves. Adult life expectancy was also found significantly ($p < 0.005$) affected by photoperiod with the shortest adult life span recorded under constant light (24L:0D) (9.4 ± 0.4 days), which was

significantly shorter than all other photoperiods tested. Adult sex ratio was the only parameter tested that was not significantly affected by photoperiod, a skewed sex ratio in favor of female was found across all photoperiod treatments.
Based on results of current study, it is recommended that a photoperiod of 18L:6D being adopted for A. sinjiensis culture to maximize its productivity for aquaculture hatcheries.
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METHYL FARNESOATE INHIBITION OF LATE STAGE OVARIAN DEVELOPMENT AND FECUNDITY REDUCTION IN THE BLACK TIGER PRAWN, PENAEUS MONODON
Gay Marsden, David Hewitt, Eric Boglio, Peter Mather, Neil Richardson-2008
Aquaculture 280(1-4): 242-246
Abstract:
There is mounting evidence that the terpenoid hormone methyl farnesoate (MF) plays important roles in regulating reproductive processes in crustaceans. To gain further information on its roles and possible modes of action, MF was orally administered to ablated Penaeus monodon at a concentration of 5.5 μg per gram of diet, and a range of reproductive performance criteria measured. Results confirmed that MF plays a role in the reproductive process of this species. Specifically, under the conditions of this study, MF inhibited late stage ovary development and reduced fecundity in ablated prawns. The impact of the artificial diet (without additional MF) relative to a squid–mussel diet, was also assessed in this study and although it increased the quality of larvae produced, it also increased inhibition of late stage ovary development. Thus while the current study has increased our knowledge of MF by isolating an ovary developmental stage at which MF regulates reproduction in P. monodon, factors that determine the extent of its effect and whether it has a stimulatory or inhibitory effect, remain unknown. Until these factors are identified, the application of MF as a means of predictably manipulating egg production in captive prawns remains problematic.
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EVALUATION OF HEMATO-IMMUNOLOGICAL PARAMETERS DURING THE REPRODUCTIVE CYCLE OF THE SCALLOP NODIPECTEN NODOSUS IN ASSOCIATION WITH A CAROTENOID-ENRICHED DIET
Delano D. Schleder, Mirian Kayser, Simone Sühnel, Jaime F. Ferreira, Guilherme S. Rupp, Margherita A. Barracco-2008
Aquaculture 280(1-4): 256-263
Abstract:
The cultivation of scallops Nodipecten nodosus is a promising activity emerging in Brazil. The purpose of this study was to characterize the immune system of N. nodosus and evaluate the modulation of some hemato-immunological parameters during the reproductive cycle, in association with an astaxanthin-enriched diet. It was hypothesized that a supplementation on astaxanthin could enhance scallop immune system and minimize stress of reproduction. Scallops were separated in different groups: juveniles (J), adults (A), sexually mature (M), and recently spawned (S) animals. The last two groups were fed standard (M and S) or astaxanthin-enriched (Ma and Sa) diets. Scallop hemolymph contained two hemocyte populations: hyaline (HH) and granular hemocytes (GH). Antimicrobial peptides, similar to mussel defensins and mytilins, were found by immunodetection within the GH granules, even though the scallop hemolymph did not exhibit significant antimicrobial activity against different bacteria, including marine vibrios. Scallop hemocytes were able to phagocytose zymosan and produce reactive oxygen intermediates (ROI–NBT reduction). The number of circulating hemocytes (Neubauer chamber) varied from 12 to 26.106 cells mL− 1, and the GH was always the predominant cell type (67–99%). The plasma of N. nodosus contained lectins, specific to galactose and sialoconjugates, and their agglutinating activity was partially calcium-dependent. A phenoloxidase (PO) activity (146–446 U min− 1 mg− 1) was observed in the scallop hemolymph.

However, this activity was not induced by trypsin or components of microorganism surface, and was strongly enhanced by alkaline pH (≥ 8.5). The total protein concentration of the plasma varied from 240 to 660 μg mL− 1. In general terms, all examined hemato-immunological parameters (hemograms, superoxide anion production, PO activity, lectin titers and total protein concentration) had a similar profile during all the scallop reproductive cycle. Their levels increased significantly from juveniles to adults (except PO activity), and declined markedly (immune depletion) in the sexually mature scallops. After spawning, the animals had a tendency to recover the standard levels of their immune parameters. Apparently, the astaxanthin-enriched diet had no effect on the tested immune parameters except for a slight influence on the scallop immune-oxidative reactions (ROI production). The results obtained in this study suggested the occurrence of a general immune depletion in the sexually mature scallops, confirming that the reproductive stage is a critical period in scallop life.

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