

INFORMATION OF INTEREST

- The taxonomy of algae strains having a potential use as biofuels raw materials: deliverable of the EU FP7 project “AquaFUELS”
- Major international stakeholders relevant to the biofuels production from algae: deliverable of the EU FP7 project “AquaFUELS”
- The latest issue of Journal of the World Aquaculture Society is on-line Volume 41, Issue 6 Page 841 - 941
- Two new aquaculture performance indices: “Global Aquaculture Performance Index GAPI ” and “Ethical Aquatic Food Index EAFI”.
- Have a look at this website: be critical when negative publicity is made for aquaculture products, in this case salmon

VLIZ Library Acquisitions no

- 486 November 19, 2010
- 487 November 26, 2010

488 November 18, 2010

CRYOPRESERVATION OF SPERM FROM NATURAL AND SEX-REVERSED ORANGE-SPOTTED GROUPER (*EPINEPHELUS COIOIDES*)

Taweessin Peatpisut, Amrit N. Bart-2010

Aquaculture Research 42(1): 22–30

Abstract:

The shortage of males and/or sperm has been an impediment to the aquaculture of orange-spotted grouper (*Epinephelus coioides*). This study reversed orange-spotted grouper females into males using hormone implants. A cryopreservation protocol for sperm was developed using normal males, and then using similar procedures the cryopreservation of sperm from sex-reversed males was compared. Immature, young and mature female fish were injected with 4 mg kg⁻¹ BW 17 methyltestosterone as implants and the gonad development stage was monitored over a 120-day period. All treated females converted into functional males within 120 days of the experimental period. Younger females (2Y) were all males within 30 days, although not all were capable of fertilizing fresh ova until day 60. The time after injection to sex reversal in immature fish was 50% shorter than in older females. Postthaw fertilization (81%, 82%) and hatching (45%, 47%) of cryopreserved sperm from natural males were the highest in trehalose (15–20%) with 150 mmol NaCl treatment; however, it was less than the control (89% fertilization and 69% hatch). There was no difference in the postthaw fertilization and the hatch percentages between sex-reversed male sperm (64% and 46% respectively) compared with natural male sperm (59% and 49%). The findings of this study suggest the potential use of sex-reversed males and cryopreserved sperm for commercial production of orange-spotted grouper seed for aquaculture.

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EVALUATION OF DIFFERENT CONCENTRATIONS OF ADULT LIVE ARTEMIA (*ARTEMIA FRANCISCANA*, KELLOGS 1906) AS NATURAL EXOGENOUS FEED ON THE WATER QUALITY AND PRODUCTION PARAMETERS OF *LITOPENAEUS VANNAMEI* (BOONE 1931) PRE-GROWN INTENSIVELY

Alfredo Campaña-Torres, Luis R Martínez-Córdova, Humberto Villarreal-Colmenares, Edilmar Cortés-Jacinto-2010

Aquaculture Research 42(1): 40–46

Abstract:

A 7-week experimental study was performed to evaluate the effect of five concentrations of adult live *Artemia* (0, 1, 2, 3 and 4 L⁻¹) as exogenous natural feed on the water quality and production parameters of juvenile (0.2 ± 0.01 g) shrimp (*Litopenaeus vannamei*) pre-grown intensively (125 organism m⁻²) under laboratory conditions (80 L plastic tanks). No significant differences were observed in the environmental variables among treatments. Total ammonium nitrogen, nitrates and phosphates recorded higher concentrations in all the treatments using *artemia*, as compared with the treatment without *Artemia*. In all the cases, the levels remained within or close to the ranges considered necessary for the farming of the species. The highest weight gain and biomass were obtained in the treatments with 3 and 4 *Artemia* L⁻¹. The best feed conversion ratio were recorded using 2 *Artemia* L⁻¹ and the highest with 0 *Artemia* L⁻¹. No differences in survival were detected among treatments. The greatest concentrations of nitrogenous metabolites achieved at the highest densities of *Artemia* were lower than the LC50 for penaeid shrimp and no negative effect was observed on the survival of the shrimp. These results clearly indicate that the use of adult live *Artemia* as exogenous natural feed significantly increased the production parameters of the Pacific white shrimp. (Centro de Investigaciones Biologicas del Noroeste S, La Paz, BCS, Mexico ; email of L. R. Martinez-Cordova: lmtz@guaymas.uson.mx)

GELATIN-WALLED MICROENCAPSULATED DIET FOR LARVAL SHRIMP (*PENAEUS JAPONICUS* BATE) MANUFACTURED USING THE FLUIDIZED BED COATING PROCESS

Zhongguo Xie, Furong Wang, Haiying Liu, Shidong Guo, Aixia Zhu, Huaxin Niu-2010

Aquaculture Research 42(1): 65–73

Abstract:

The gelatin-walled microencapsulated feed for larval shrimp (*Penaeus japonicus*) was produced using the fluidized bed coating process. The microencapsulated diet showed no significant agglomeration in the coating process and the diameters of the microdiet were in a normal distribution. Scanning electron microscopy microphotographs showed the appearance of a microencapsulated diet with a uniform surface and a continuous film around the core. The retention efficiency of vitamin C was 88.2% in the coating process. The inclusion efficiency, lipid encapsulation efficiency and nitrogen retention efficiency of the microdiet were 92.2 ± 1.6%, 76.8 ± 4.1% and 60.6 ± 5.2% respectively. The mysis of *P. japonicus* were reared for 20 days to the later larval stage. The wet weight of larval shrimp increased 300.0% in the microdiet from 10 up to 30 day after hatching. The wet weight and the total length of larvae were greater in co-feeding compared with the control ($P < 0.05$), but there was no significant difference in larval survival between co-feeding and control ($P > 0.05$). There were significant differences ($P < 0.05$) in the wet weight, total length and survival in the microdiet compared with the control. The results indicated a huge potential for the use of the gelatin-walled microencapsulated diet for the partial and total replacement of live food for larval shrimp.

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EFFECTS OF SALINITY AND TEMPERATURE ON SURVIVAL AND DEVELOPMENT OF LARVAE AND JUVENILES OF THE MUD CRAB, *SCYLLA SERRATA* (CRUSTACEA: DECAPODA: PORTUNIDAE)

Juliana C. Baylon-2010

Journal of the World Aquaculture Society 41(6): 858–873

Abstract:

An investigation was conducted to determine salinity and temperature effects on the survival and development of larvae and juveniles of the mud crab, *Scylla serrata*. Zoea, megalopae, and juveniles were reared at various salinity and temperature combinations: 15, 25, 35, and 45 ppt for zoea; 5, 15, 25, 35, and 45 ppt for megalopae; and 0, 5, 15, 25, 35, and 45 ppt for juveniles, at 20, 26, and 32 C. Salinity and temperature affected the survival of the zoea larvae, and there was an interaction between salinity and temperature. Salinity and temperature also affected the survival of megalopa and juveniles, but there was no interaction between salinity and temperature. There was high survival and metamorphosis

on zoea reared at 25–35 ppt at 26 and 32 C. Megalopae developed to juveniles at 15–45 ppt at 20, 26, and 32 C. Juveniles survived and developed at 5–45 ppt at 20, 26, and 32 C. Salinity and temperature also affected the development and molt duration. Development was rapid at 25 and 35 ppt, at 32 C, but delayed at 15 and 45 ppt, at 20 and 26 C. Zoea benefited gradual transfer to 15 and 45 ppt but megalopa and juveniles did not. As the larvae grew, there was tolerance to wider salinity and low temperature. (Division of Biological Sciences, College of Arts and Sciences, University of the Philippines in the Visayas, 5023 Miagao, Iloilo, the Philippines)

EFFECT OF NUTRITIONAL ENRICHMENT METHOD ON FATTY ACID CONTENTS OF ROTIFER BRACHIONUS PLICATILIS

Tomonari Kotani, Teruhisa Genka, Mari Tanabe, Aki Miyashima, Hiroshi Fushimi, Masahiro Hayashi-2010

Journal of the World Aquaculture Society 41(6): 884–892

Abstract:

Nutritional enrichment for rotifer is necessary for the stable production in larviculture. Although manufacturers recommend feeding amount for enrichment diets, the effects of these recommended amounts on nutritional enrichment of rotifer are unknown. We assessed the effects of normal and overdose amount of enrichment diets on nutritional enrichment of rotifer using batch and continuous culture methods. Rotifer populations in two culture systems were enriched using four enrichment conditions, matched two diet levels, and two enrichment durations: 0.25 g/L for 8 h (normal enrichment) 0.25 g/L for 24 h (longer enrichment), 0.75 g/L for 8 h (overdose enrichment), and 0.75 g/L for 24 h (overdose + longer enrichment). When the batch-cultured rotifer populations were enriched, longer and overdose enrichments could not make the fatty acid contents differ from the normal one. Overdose enrichment was most effective of all enrichment conditions when continuous-cultured rotifer populations were used. In both culture methods, the docosahexaenoic acid (DHA) content under overdose + longer enrichment conditions was two to three times as high as normal enrichment conditions and it resulted in two- to threefold increase in DHA/eicosapentaenoic acid ratio by overdose + longer enrichment. Accordingly, it is possible to alter the fatty acid composition of rotifer by changing the enrichment method.

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EFFECTS OF ENVIRONMENTAL FACTORS ON LARVAL SETTLEMENT OF SEA CUCUMBER, APOSTICHOPUS JAPONICUS (SELENKA)

Li Li, Qi Li, Lingfeng Kong-2010

Journal of the World Aquaculture Society 41(6): 936–941

Abstract:

In this study, a series of experiments were conducted to evaluate the influence of environmental factors on larval settlement of sea cucumber, *Apostichopus japonicus* (Selenka). These experiments examined the following factors: temperature (18, 21, 24, and 27 C), salinity (20, 25, 30, and 35 ppt), and diet supply (micro-algae, macro-algae, sea mud, and a mixture of macro-algae and sea mud). Results indicated that larval settlements were significantly different among different temperatures, salinities, and diet supplies ($P < 0.001$). Lower temperature between 18 and 21 C and a salinity of 30 ppt were the optimum for larval settlement of *A. japonicus*. The sediments (macro-algae and sea mud) replaced micro-algae as a food source for the newly settled juveniles with an increase in metamorphosis and early settlement.

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SWIMBLADDER INFLATION AND ITS IMPLICATION TO THE CULTURE OF MARINE FINFISH LARVAE

Lindsey D. Woolley, Jian G. Qin-2010

Reviews in Aquaculture 2(4): 181–190

Abstract:

This review examines the initial swimbladder inflation in cultured finfish larvae and the mechanisms controlling body buoyancy and the distribution of larvae during the critical early development stages. The literature suggests that the body buoyancy of larvae affects their distribution in the tank and fish with low buoyancy are likely to sink to the bottom leading to mortality. Initial swimbladder inflation occurs in a finite period of the postlarval stage and a number of biotic and abiotic factors have been associated with preventing inflation during the 'window' period. In recent times larval rearing techniques have been advanced, but it is still a challenge to increase the initial swimbladder inflation rates and maintain larval positioning in the water column to reduce mortality. This review shows that various nutritional and abiotic factors can be manipulated in the culture of many finfish species to achieve high rates of swimbladder inflation and reduce deformations and mortality during early larval rearing.

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COMPARATIVE PERFORMANCE OF CO₂ MEASURING METHODS: MARINE AQUACULTURE RECIRCULATION SYSTEM APPLICATION

Timothy J. Pfeiffer, Steven T. Summerfelt, Barnaby J. Watten-2011

Aquacultural Engineering 44(1): 1-9

Abstract:

Many methods are available for the measurement of dissolved carbon dioxide in an aqueous environment. Standard titration is the typical field method for measuring dissolved CO₂ in aquaculture systems. However, titrimetric determination of dissolved CO₂ in marine water aquaculture systems is unsuitable because of the high dissolved solids, silicates, and other dissolved minerals that interfere with the determination. Other methods used to measure dissolved carbon dioxide in an aquaculture water included use of a wetted CO₂ probe analyzer, standard nomographic methods, and calculation by direct measurements of the water's pH, temperature, and alkalinity. The determination of dissolved CO₂ in saltwater based on partial pressure measurements and non-dispersive infra-red (NDIR) techniques with a CO₂ gas analyzer are widely employed for oceanic surveys of surface ocean CO₂ flux and are similar to the techniques employed with the head space unit (HSU) in this study. Dissolved carbon dioxide (DC) determination with the HSU using an infra-red gas analyzer (IRGA) was compared with titrimetric, nomographic, calculated, and probe measurements of CO₂ in freshwater and in saltwater with a salinity ranging from 5.0 to 30 ppt, and a CO₂ range from 8 to 50 mg/L. Differences in CO₂ measurements between duplicate HSUs (0.1–0.2 mg/L) were not statistically significant different. The coefficient of variation for the HSU readings averaged 1.85% which was better than the CO₂ probe (4.09%) and that for the titrimetric method (5.84%). In all low, medium and high salinity level trials HSU precision was good, averaging 3.39%. Differences existed between comparison testing of the CO₂ probe and HSU measurements with the CO₂ probe readings, on average, providing DC estimates that were higher than HSU estimates. Differences between HSU and titration based estimates of DC increased with salinity and reached a maximum at 32.2 ppt. These differences were statistically significant ($P < 0.05$) at all salinity levels greater than 0.3 ppt. Results indicated reliable replicated results from the head space unit with varying salinity and dissolved carbon dioxide concentrations.

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EVALUATING THE EFFECTS OF ORGANIC CARBON ON BIOLOGICAL FILTRATION PERFORMANCE IN A LARGE SCALE RECIRCULATING AQUACULTURE SYSTEM

Todd C. Guerdat, Thomas M. Losordo, John J. Classen, Jason A. Osborne, Dennis DeLong-2011

Aquacultural Engineering 44(1): 10-18

Abstract:

Studies evaluating the impact of organic carbon on biological filters at the large scale for aquaculture production are lacking. Understanding the performance characteristics of different biofilters under actual production conditions will be the only means by which recirculating system designers may

properly select and size biological filters for commercial production use. Previous studies have determined the impact of organic carbon on biofilter performance at the small lab scale often using artificial waste nutrients in the evaluation. Evaluations under actual production conditions using real wastewater produce vastly different results than previous lab scale studies using artificial nutrients. As such, this study is a preliminary step in evaluating the impact of organic carbon on three different commercially available biological filters at the large scale under actual recirculating aquaculture production conditions. The study was conducted at the North Carolina State University Fish Barn—a commercial scale research and demonstration recirculating aquaculture facility operated by the Biological and Agricultural Engineering department. The study was based on a 60 m³ Tilapia system with average daily feed rates of 45 kg using a 40% protein feed and an average biomass of 6750 kg. The system was dosed with sucrose (C₁₂H₂₂O₁₁) to increase the concentration of biodegradable organic carbon in the system. The effect of elevated organic carbon concentrations on total ammoniacal nitrogen (TAN) removal rates was evaluated and determined based on biofilter media volume. Variability increased substantially in the volumetric TAN removal rate (VTR) for all three filters. VTR for all three filter types was reduced by approximately 50% as compared to normal production conditions. The results demonstrate the importance of controlling the concentration of biologically available organic carbon in a recirculating aquaculture system.

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EFFECTS OF TWO DIFFERENT OZONE DOSES ON SEAWATER RECIRCULATING SYSTEMS FOR BLACK SEA BREAM ACANTHOPAGRUS SCHLEGELI (BLEEKER): REMOVAL OF SOLIDS AND BACTERIA BY FOAM FRACTIONATION

Jeonghwan Park, Youhee Kim, Pyong-Kih Kim, Harry V. Daniels-2011

Aquacultural Engineering 44(1): 19-24

Abstract:

Foam fractionators, with and without additional ozonation, were evaluated for their effect on solids removal (suspended solids, SS; volatile suspended solids, VSS; dissolved organic carbon, DOC), particle size distribution of the foam in seawater recirculating systems during a 44-day experimental period. The effect of ozone on heterotrophic bacteria was also quantified in the entire system. Three separate but identical recirculating systems (4.5 m³ system volume) with foam fractionators (300 mm in diameter, 3 m in height) were used in this study. One system (Control: CS) did not receive ozone, while the other two systems were ozonated at a rate of either 20 g ozone/day (T 20) or 40 g ozone/day (T 40) per kg of feed applied, respectively. A total of 107 kg of black sea bream *Acanthopagrus schlegeli* (Bleeker) with an average weight of 334.5 g was stocked into each system. Daily feeding rate was 1% of total body weight. The solids enrichment factor (EF = C_c/C_i, where C_c = concentration in foam condensate, C_i = concentration in inlet water) in T 40 was 10 times more dilute than the factors in CS and T 20. However, due to the higher volume of the foam (>10 times) in T 40, the removal rates of SS, VSS and DOC were the highest in T 40, but were not significantly different from T 20 (P > 0.05). The mean particle sizes at the 90% cumulative removal point decreased with ozonation, 71.2 ± 15.9, 57.9 ± 10.2 and 48.0 ± 10.2 μm in CS, T 20 and T 40, respectively. The overall mean particle diameter of solids in the foam decreased as ozonation increased, with values of 29.4 ± 4.4, 23.9 ± 3.8 and 20.5 ± 3.7 μm in CS, T 20 and T 40. Numbers of heterotrophic bacteria in the inlet were 6.21 ± 4.93 × 10⁵ CFU/mL, 0.29 ± 0.19 × 10⁵ CFU/mL and 0.30 ± 0.29 × 10⁵ CFU/mL in CS, T 20 and T 40, declining sharply with the addition of ozonation. As the number of the bacteria in the inlet decreased, the bacteria in the foam and the removal rate greatly decreased with increasing ozonation. However, EFs in T 20 (76.4) and T 40 (14.5) were higher than that in CS (12.2), and the T 20 showed significantly higher EF (P < 0.05). Therefore, based on the EF, ozonation improved the removal efficiency of heterotrophic bacteria, even at the lowest concentration.

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EFFECTS OF DIETARY PROTEIN AND LIPID LEVELS AND PROTEIN TO ENERGY RATIOS ON GROWTH PERFORMANCE AND FEED UTILIZATION OF HATCHERY-REARED JUVENILE SPOTTED BABYLON (BABYLONIA AREOLATA)

Nilnaj Chaitanawisuti, Sirusa Kritsanapuntu, Wannanee Santaweek-2011

Aquaculture International 19(1): 13-21

Abstract:

A 120-day feeding trial was designed to determine the effects of different dietary protein and lipid levels and protein to energy ratio (P:E) on growth performance and feed utilization of hatchery-reared juvenile spotted babylon, *Babylonia areolata*, cultured under a flow-through seawater system. Six diets were formulated to contain three protein levels (18, 28, and 36%) and two lipid levels (10 and 15%) in a 3×2 factorial design with three replicates to provide six different dietary P:E ratios (50.17, 49.09, 68.50, 65.85, 88.66, and 85.36 mg protein/kcal). Each replicate was stocked with 50 snails (0.12 ± 0.01 g, initial weight) and fed to satiation once daily. The results showed that survival was above 96% at the end of the feeding trial in all groups and was not affected by either dietary protein level or dietary lipid level. The highest significant ($P < 0.05$) growth and feed utilization were observed for juveniles fed diet with a P:E ratio of 88.66 kcal g⁻¹ diet. With respect to dietary protein and lipid levels, the highest ($P < 0.05$) values for growth and feed efficiency were observed for snails fed a diet containing 36% protein level and the same trend was observed for snails fed a diet with 10% lipid level. This results indicated that the diet containing 36% protein and 10% lipid level with a dietary P:E ratio of 88.66 mg protein/kcal would be suitable for optimum growth and feed utilization of *B. areolata* juveniles.

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DIFFERENCES IN FATTY ACID COMPOSITION OF EGG CAPSULES FROM BROODSTOCK SPOTTED BABYLON, BABYLONIA AREOLATA, FED A LOCAL TRASH FISH AND FORMULATED DIET UNDER HATCHERY CONDITIONS

N. Chaitanawisuti, S. Sangsawangchote, S. Piyatiratitivorakul-2010

Aquaculture International 19(1): 23-31

Abstract :

This study is the first attempt to condition broodstock *Babylonia areolata* using formulated diets under hatchery conditions. Samples of spotted babylon egg capsules from broodstock fed either a formulated diet or a local trash fish, carangid fish (*Seleroides leptolepis*) for 120 days were analyzed for proximate composition and fatty acid composition. The formulated diet contained significantly higher levels of arachidonic acid (20:4n - 6; ARA), eicosapentaenoic acid (20:5n - 3; EPA) and docosahexaenoic acid (22:6n - 3; DHA) than those of the local trash fish. The formulated diet also had significantly higher ratios of DHA/EPA and (n - 3)/(n - 6) PUFA than those of local trash fish but not for the ARA/EPA ratio. The compositions of egg capsules produced from broodstock fed formulated diet contained significantly more ARA, EPA and DHA compared to broodstock fed the local trash fish. The ARA/EPA and DHA/EPA ratios in egg capsules were significantly higher in the trash fish—fed group compared to those fed the formulated diet. However, (n - 3)/(n - 6) PUFA ratios in egg capsules produced from broodstock fed the formulated diet did not differ significantly compared to those from broodstock fed the local trash fish. The relatively low DHA/EPA, ARA/EPA and (n - 3)/(n - 6) ratios in the egg capsules produced from the formulated diet—fed broodstock *B. areolata* suggested that this diet is inferior, when compared to the traditional food of trash fish.

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EFFECTS OF EARLY WEANING STRATEGIES ON GROWTH, SURVIVAL AND DIGESTIVE ENZYME ACTIVITIES IN COBIA (*RACHYCENTRON CANADUM* L.) LARVAE

Huy Quang Nguyen, Helge Reinertsen, Per-Arvid Wold, Thien Mai Tran, Elin Kjørsvik-2010

Aquaculture International 19(1): 63-78

Abstract:

The effects of weaning strategies of cobia (*Rachycentron canadum* L.) larvae to commercial microdiets, either from rotifers or from *Artemia*, on growth, survival and enzymatic digestive capacity, were investigated. In the first experiment, cobia larvae were weaned from rotifers by co-feeding with a microdiet (Otohime) from 8, 13 or 20 days post-hatching (dph). The larvae in the control treatment were fed rotifers (2–12 dph), *Artemia* nauplii from 7 dph, and co-fed with the microdiet from 20 dph. In the second experiment, the larvae were weaned from *Artemia*, which was fed to the larvae from 7 dph, by co-feeding with a microdiet (NRD) from 8, 13 or 18 dph. The larvae in control treatment were fed rotifers, then *Artemia* to the end of the experiment (28 dph). Weaning of cobia larvae onto a microdiet directly from rotifers significantly reduced growth, survival and digestive capacity of the larvae and did not lead to larval acceptance of the microdiet, compared to those weaned from *Artemia* in the first experiment. Early weaning of cobia larvae onto NRD microdiet (on 8 or 13 dph) from *Artemia* in the second experiment also reduced growth, survival rate and gut maturation index, compared to those fed live feed. With available microdiets, weaning of cobia larvae could start from *Artemia* at around 18 dph in order to obtain comparable growth, survival and gut maturation to larvae fed live feed. (Department of Biology, Center of Fisheries and Aquaculture, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway; email of Huy Quang Nguyen: huy.nguyen@bio.ntnu.no)

EFFECTS OF DIETARY LIPID LEVELS ON GROWTH PERFORMANCE, FEED UTILIZATION AND FATTY ACID COMPOSITION OF JUVENILE JAPANESE SEABASS (*LATEOLABRAX JAPONICUS*) REARED IN SEAWATER

Jian-He Xu, Jie Qin, 2, Bin-Lun Yan, Ming Zhu, Gang Luo-2010

Aquaculture International 19(1): 79-89

Abstract:

Triplicate groups of 40 Japanese seabass *Lateolabrax japonicus* (initial weight, 11.3 ± 0.4 g) reared in seawater (salinity, 30.0–33.0 g L⁻¹) were fed with five isonitrogenous ($41.3 \pm 0.2\%$ crude protein) and isoenergetic (18.5 ± 0.3 MJ kg⁻¹) experimental diets formulated with increasing lipid levels (4.3, 8.4, 12.2, 15.8 and 20.1% lipid) for 10 weeks. Survival throughout the feeding experiment ranged from 87.5 to 100%, but the survival of fingerlings fed with the 4.3% lipid diet was significantly lower than the rest of the diets. At the end of the feeding experiment, fish fed with 12.2% lipid diet showed optimal growth performance ($P < 0.05$). Lipid contents of whole body, liver and muscle increased in parallel with the increase in dietary lipid levels. Viscerosomatic index (VSI), hepatosomatic index (HSI) and muscle lipid content were higher in 20.1% lipid group than those in the rest of the lipid level groups indicating that viscera and muscle tissues played important contributions to body lipid deposition. High proportions of 18:1n-9, eicosapentaenoic acid (20:5n-3; EPA) and docosahexaenoic acid (22:6n-3; DHA), and low concentrations of n-6 polyunsaturated fatty acids (PUFAs) occurring in liver and muscle, to some extent, reflected fatty acid (FAs) composition in the experimental diets.

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ANTIBACTERIAL EFFECT OF MEDIUM-CHAIN FATTY ACID: CAPRYLIC ACID ON GNOTOBIOTIC ARTEMIA FRANCISCANA NAUPLII AGAINST SHRIMP PATHOGENS VIBRIO HARVEYI AND V. PARAHAEMOLYTICUS

G. Immanuel, M. Sivagnanavelmurugan, A. Palavesam-2010

Aquaculture International 19(1): 91-101

Abstract:

The present study was carried out to determine the antibacterial effect of caprylic acid in the culture system of *Artemia franciscana* nauplii inoculated with shrimp pathogens *Vibrio harveyi* and *V. parahaemolyticus*. To begin with, the antibacterial effect of different concentrations (1, 10 and 100 mM) of caprylic acid against *V. harveyi* and *V. parahaemolyticus* was assessed through bacterial growth study. This indicated that at 100 mM concentration, the growth of the pathogens was completely inhibited within 5 h, whereas, in 1.0 and 10 mM concentrations, effective inhibition was observed with the extension of time. Subsequently, the influence of pH variation on the growth inhibitory effect of 10

mM caprylic acid against *V. harveyi* and *V. parahaemolyticus* at different pH (5–7) was also made through bacterial growth study. At pH 5, the pathogen growth was very less, compared with pH 6 and 7. The *Artemia nauplii* (instar II) reared in 10 mM caprylic acid supplemented medium were challenged with *V. harveyi* and *V. parahaemolyticus*, and the mortality was recorded at an interval of 6 h up to 60 h. In this study, the mortality of *Artemia nauplii* reduced to 20.61 and 16.30% in *V. parahaemolyticus* and *V. harveyi* challenged groups, respectively. The present results provide evidence for the potential antibacterial activity of caprylic acid in aquaculture against luminescent vibrios.

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GROWTH AND SURVIVAL OF GROUPER EPINEPHELUS COIODES (HAMILTON) LARVAE FED FREE-LIVING NEMATODE PANAGRELLUS REDIVIVUS AT FIRST FEEDING

Ofelia S. Reyes, Marietta N. Duray, Corazon B. Santiago, Manuele Ricci-2010

Aquaculture International 19(1): 155-164

Abstract:

The free-living nematode, *Panagrellus redivivus*, was tested as live food for grouper *Epinephelus coioides* larvae during the first feeding stage. A series of experiments were conducted to determine the acceptability of the free-living nematodes in grouper larvae at first feeding, the optimum nematode density and the response of the larvae to nutritionally enriched nematode. All experiments were conducted in 200-L conical tanks filled with 150-L filtered seawater and stocked at 15 larvae L⁻¹. Duration of feeding experiments was up to day 21 (experiment 1) and 14 days (experiment 2 and 3). *Brachionus plicatilis* and *Artemia* (experiment 1) and *Brachionus plicatilis* alone (experiment 2 & 3) was used as the control treatment. Observations indicated that the grouper larvae readily fed on free-living nematodes as early as 3 days posthatching, the start of exogenous feeding. Optimum feeding density for the larvae was 75 nematodes ml⁻¹. The enrichment of cod liver oil or sunflower oil influenced the total lipids and n-3 highly unsaturated fatty acids of *P. redivivus*, which in turn influenced those of the grouper larvae, however, growth and survival of the larvae were not affected ($P > 0.05$). The results from this investigation showed that the nematode, *P. redivivus*, can be used as first live food for grouper larvae from the onset of exogenous feeding until they could feed on *Artemia nauplii*.

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COMPARISON OF SPAWNING INDUCTION TECHNIQUES ON PARACENTROTUS LIVIDUS (ECHINODERMATA: ECHINOIDEA) BROODSTOCK

João Gago, Orlando J. Luís-2010

Aquaculture International 19(1): 181-191

Abstract:

The performance of different and expedite spawning induction methods was compared on samples of both mature wild and captive *Paracentrotus lividus* sea urchin populations. Thermal, saline and mechanical shocks, emersion during different periods of time, addition of con-specific gametes and different KCl concentrations were tested. Percentage of spawned sea urchins, mean number of released eggs, percentage of males that released more than 200 million spermatozoa, and survival after 5 days were the variables analysed. Results indicate that both thermal and saline shocks were ineffective methods to trigger spawning. Mechanical shock and addition of con-specific gametes were able to promote spawning but with a reduced number of released gametes. Emersion for a period of 3 h induced spawning with 100% broodstock survival but longer periods up to 12 h, although increasing the number of spawners can cause significant broodstock mortality. An injection of 1-mL intra-peristomial KCl was an expedite method to obtain *P. lividus* gametes, but high mortalities were always recorded and was related with excessive KCl concentrations. When there is need for a small number of gametes, the mechanical shock technique can be considered since led to 100% survival. When large spawnings are

required, the emersion procedure can be a viable method, but further investigation must be carried out to assess the best time period to obtain broodstock full survival.

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TOLERANCE RESPONSE TO AMMONIA AND NITRITE IN HATCHLINGS PARALARVAE OF OCTOPUS VULGARIS AND ITS TOXIC EFFECTS ON PREY CONSUMPTION RATE AND CHROMATOPHORES ACTIVITY

Paloma Feyjoo, Rodrigo Riera, Beatriz C. Felipe, Alí Skalli, Eduardo Almansa-2010

Aquaculture International 19(1): 193-204

Abstract:

Ammonia and nitrite are among the most important water quality parameters. The aim of this study was to determine the acute toxicity of unionized ammonia and nitrite on newly hatched *Octopus vulgaris* paralarvae. Concretely, survival, feeding and chromatophore activity were examined under different NH_3 and NO_2^- concentrations. The median lethal concentration (LC 50) determined for 24 h was 10.7 ppm for NH_3 and 19.9 ppm for NO_2^- . Based on these results, a concentration range was chosen to test the effect of this environmental contaminants in feeding and chromatophore activity (range between 2.5 and 20 ppm for feeding and 10 and 30 ppm for chromatophore activity), resulting in modifications in both parameters. In fact, a significant decrease ($P < 0.05$) in *Artemia nauplii* consumption by the paralarvae was observed with an increase in NH_3 and NO_2^- . Similarly, the chromatophore activity was also affected by concentration of these contaminants, with decreasing response ($P < 0.05$) when submitted to stressful situations, as the ammonia and nitrite concentration was increased.

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SPERM CAPACITATION OF THE SHRIMP LITOPENAEUS VANNAMEI

Sirinda Aungsuchawan, Craig L Browdy, Boonsirm Withyachumnarnkul-2011

Aquaculture Research 42(2): 188–195

Abstract:

Litopenaeus vannamei is one of the most important species of farmed shrimp. The females have an 'open' thelycum. Mating is accomplished by attaching the male spermatophore onto the surface of the thelycum 4–6 h before spawning. During this period, sperm may have to undergo morphological changes associated with a capacitation process that has been described for other shrimp species. The objective of this research was to extend research on sperm capacitation in *L. vannamei* by ultrastructural and biochemical means. The sperm of *L. vannamei* were divided into those freshly prepared from the spermatophore (S-sperm), extracted from the male gonopores, and those extracted from the female thelycum (T-sperm). Under transmission electron microscopy, ultrastructural differences were detected between the S- and the T-sperm in the nuclear material, the filamentous meshwork and the cytoplasmic particles. Under scanning electron microscopy, the difference was observed in the cap and spike regions. Immunofluorescence using confocal microscopy to detect tyrosine phosphorylated proteins revealed different distribution patterns between S- and T-sperm. The location of phosphorylation activity changed from the spike in S-sperm, to the filamentous meshwork in the T-sperm. These morphological and biochemical changes confirm that capacitation of *L. vannamei* sperm takes place following mating.

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INTERACTIONS BETWEEN TEMPERATURE AND SIZE ON THE GROWTH, SIZE HETEROGENEITY, MORTALITY AND CANNIBALISM IN CULTURED LARVAE AND JUVENILES OF THE ASIAN CATFISH, PANGASIANODON HYPOPHTHALMUS (SAUVAGE)

Etienne Baras, Thomas Raynaud, Jacques Slembrouck, Domenico Caruso, Christophe Cochet, Marc Legendre-2011

Aquaculture Research 42(2): 260–276

Abstract:

Temperature effects vary throughout the ontogeny, but are proportionally more variable during the early life stages than in older fish. The larvae of a few species have been studied but contrasting trajectories were observed, thereby making it difficult to predict how temperature impacts on the growth, survival and size heterogeneity in a particular species. This study examined these interactions in young [0.9 mg–1 g wet mass (WM)] Pangasianodon hypophthalmus, one of the most extensively cultured tropical fish. Fish were raised at five temperatures from 23 to 33 °C in a recirculated water system, fed in excess with a high-energy feed (Artemia then a formulated feed, >50% protein), and examined at 1-day (first feeding days) or 4-day intervals (older fish). The temperature that produced the fastest growth (T^{opt}) was 31 °C at the start of exogenous feeding (0.9 mg); it increased to 32.7 °C at 8 mg then decreased by 0.7 °C for each 10-fold increase of WM. Size heterogeneity was lower and survival was higher (70–85% from 0.9 mg to 1 g) when the temperature was close to T^{opt} . Comparisons with other species suggest that the slope of the relationship between T^{opt} and fish size has a strong latitudinal component, and may also reflect the fish sensitivity to oxygen.

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LIMITATIONS FOR PROLONGED CHILLED STORAGE OF ZEBRAFISH (DANIO RERIO) EMBRYOS

Franz Lahnsteiner-2011

Aquaculture Research 42(2): 288–295

Abstract:

Chilled storage of zebrafish embryos is possible for up to 33 h at 8 °C without a loss in viability. In the present study, higher chilling temperatures in the range of 10–16 °C were tested to extend the storage periods to 65 h. It was also investigated whether prevention of microbiological growth with antibiotics and iodine, and stabilization of the quality of the storage solution by regular changes and constant aeration had an effect on the embryo and larvae viability. At incubation temperatures of 10 and 12 °C, the embryo development was completely arrested; at 14 and 16 °C, it proceeded slowly. At 10 °C, the percentage of embryos developing to the long-pec stage was significantly lower than those at 12, 14 and 16 °C and in the control. At 10 and 12 °C, the percentage of embryos developing to the long-pec stage decreased with increasing chilling period, while it remained constant at 14 and 16 °C. All chilling treatments resulted in low hatching rates <25% and many larvae showed malformations. Supplementation of storage solutions with antibiotics and iodine had no effect on the embryo and larvae viability, similar to regular solution changes and constant aeration.

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GROWTH AND KINETICS OF LIPIDS AND FATTY ACIDS OF THE CLAM VENERUPIS PULLASTRA DURING LARVAL DEVELOPMENT AND POSTLARVAE

M.J. Fernández-Reiriz, A. Pérez-Camacho, L.G. Peteiro, U. Labarta-2010

Aquaculture Nutrition 17(1): 13-23

Abstract:

This study examines the larval development, metamorphosis and postlarval stage of Venerupis pullastra in relation to growth, lipids content and fatty acid composition, specifically those believed to be essential for most bivalves (i.e. 20:5n-3 and 22:6n-3). Clam larvae were fed with two species of microalgae supplied individually or mixed –Isochrysis galbana and Tetraselmis suecica–species normally used in bivalve hatcheries. Larvae fed with T. suecica showed a progressive accumulation of lipids and fatty acids but did not survive to metamorphosis. Contrarily, larvae fed with I. galbana or mixed diet showed a progressive decline in lipids and essential fatty acids (20:5n-3 and 22:6n-3) from the pediveliger stage onwards, and a survival rate of 95% until the start of metamorphosis. The lower

content in n-6 and the absence of 22:6n-3 in T. suecica diet might contribute to the massive mortality observed for larvae fed with this diet. That diet seems to fail in the supply of some particular nutrient that allows energetic transformation of reserves for growth and metamorphosis. Nevertheless, larvae fed on mixture diet showed higher weight growth values at postlarval stage than those larvae fed on I. galbana diet.

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EFFECTS OF IN VIVO TREATMENT WITH THE DOPAMINE ANTAGONIST PIMOZIDE AND GONADOTROPIN-RELEASING HORMONE AGONIST (GNRHA) ON THE REPRODUCTIVE AXIS OF SENEGALESE SOLE (SOLEA SENEGALENSIS)

José M. Guzmán, Rosa Cal, Ángel García-López, Olvido Chereguini, Katherine Kight, Mercedes Olmedo, Carmen Sarasquete, Constantinos C. Mylonas, José B. Peleteiro, Yonathan Zohar, Evaristo L. Mañanós-2011

Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology 158(2): 235-245

Abstract:

The Senegalese sole (*Solea senegalensis*) is a flatfish that exhibits severe reproductive dysfunctions in captivity. This study aimed at investigating the existence of a dopamine (DA) inhibitory tone on the reproductive axis of this species. Four groups of Senegalese sole breeders were treated with, saline (controls, CNT), the DA antagonist pimoziide (PIM, 5 mg kg⁻¹), gonadotropin-releasing hormone agonist (GnRH_a, 40 µg kg⁻¹) or a combination of PIM + GnRH_a (COMB). Effects were evaluated on pituitary GnRH levels (ELISA), pituitary gonadotropin subunit transcript levels (qPCR), plasma levels of sex steroids and vitellogenin (ELISA), gonad development (histology), spermiation and egg production. The GnRH_a treatment induced egg release and stimulated testis maturation. In males, PIM did not affect pituitary GnRH content, but enhanced GnRH_a-induced pituitary GP α transcripts and modified plasma androgen levels; moreover, PIM stimulated spermatogenesis and milt production, both alone and combined with GnRH_a. In females, PIM did not affect pituitary and plasma endocrine parameters and did not affect egg production and fertilization success of the broodstock, either alone or in the combined treatment. In conclusion, data indicated the existence of a DA inhibition in mature males, which would be absent or weakly expressed in females.

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NEW RT-QPCR ASSAY FOR VIRAL NERVOUS NECROSIS VIRUS DETECTION IN SEA BASS, *DICENTRARCHUS LABRAX* (L.): APPLICATION AND LIMITS FOR HATCHERIES SANITARY CONTROL

L. Mazelet, J. Dietrich, J.L. Rolland-2011

Fish & Shellfish Immunology 30(1): 27-32

Abstract:

A sensitive and quantitative one step RT-qPCR method was developed to study Viral Nervous Necrosis (VNN) virus loads in sea bass *Dicentrarchus labrax* (L.) in hatcheries. After determining the limits of this new method, fin tissues were identified as an interesting new simple non-invasive sample source, which might be useful for screening *D. labrax* (L.) in hatcheries. We observed VNN virus strain V26 associated to *D. labrax* (L.) eggs and its release in tank water during spawning suggesting both vertical transmission to the eggs and the possibility of horizontal transmission by contamination of tank water. VNN is widespread in water bodies and has the ability to infect a large number of fish species, with this in mind, this PCR technique may be used for the surveillance of various fish farms.

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ANTIVIRAL FUNCTION OF TILAPIA HEPICIDIN 1-5 AND ITS MODULATION OF IMMUNE-RELATED GENE EXPRESSIONS AGAINST INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV) IN CHINOOK SALMON EMBRYO (CHSE)-214 CELLS

Venugopal Rajanbabu, Jyh-Yih Chen-2011

Fish & Shellfish Immunology 30(1): 39-44

Abstract:

Antimicrobial peptides, small cysteine-rich molecules, play vital roles in host defense mechanisms against pathogen infection. Recently, tilapia hepcidin (TH)1-5, was characterized, and its antimicrobial functions against several pathogens were reported. Herein, we investigated the antiviral functions of TH1-5 against infectious pancreatic necrosis virus (IPNV) in Chinook salmon embryo (CHSE)-214 cells. The presence of TH1-5 enhanced the survival of CHSE-214 cells infected with IPNV. Additionally, the number of plaques formed by the cytopathic effect of IPNV in CHSE-214 cells decreased when IPNV was preincubated with TH1-5. This observation demonstrates the antiviral function of TH1-5. Real-time PCR studies showed the modulation of interleukin, annexin, and other viral-responsive gene expressions by TH1-5. When TH1-5 and IPNV were used to co-treat CHSE-214 cells, then cells were re-challenged with IPNV at 24 h, the cells did not survive the IPNV infection. This shows that in the absence of TH1-5, viral re-challenge killed CHSE-214 cells. In conclusion TH1-5 protected CHSE-214 cells against IPNV by direct antimicrobial and immunomodulatory functions.

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CAN SOLAR POWERED CIRCULATION CONTROL PRYMNESIUM PARVUM BLOOMS AND TOXICITY IN FISH HATCHERY PONDS?

Aaron Barkoh, Drew C. Begley, Dennis G. Smith, Gerald L. Kurten, Loraine L. Fries, J. Warren Schlechte-2011

Harmful Algae 10(2): 173-180

Abstract:

The harmful alga *Prymnesium parvum* can be controlled with chemicals that also can kill non-target organisms including fish. Currently, there is no ecologically safe and sustainable method for controlling this alga. Therefore, we evaluated SolarBee® solar powered water circulation (SPC) for efficacy in controlling *P. parvum* blooms and ichthyotoxicity. We hypothesized that SPC can alter the ecological niche that promotes *P. parvum* blooms and toxicity, and thereby control this alga. Ecological niche variables considered were inorganic phosphorus (P) and nitrogen (N), conductivity, pH, temperature, and cations. The effects of SPC on total algal biomass and community structure and zooplankton were also investigated. The study was conducted in six 0.4 ha plastic-lined fish hatchery ponds from September 2007 to March 2008. Three ponds received SPC and another three without SPC served as control. Variables tested were *P. parvum* cell density and ichthyotoxicity, total algal density, algal population diversity, chlorophyll a, P, N, pH, water temperature, dissolved oxygen, conductivity, calcium, magnesium, potassium, and sodium. The algal community consisted of 69 taxa (genera and species) from eight divisions, including Haptophyta and Chlorophyta, and two unidentified algae. The SPC suppressed the chlorophytes population and otherwise had no effect on any of the tested variables. The SPC was unable to alter water quality and nutrient levels in hatchery ponds and thus failed to control *P. parvum*.

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EXPRESSION OF VIRULENCE GENES IN LUMINESCENT AND NONLUMINESCENT ISOGENIC VIBRIOS AND VIRULENCE TOWARDS GNOTOBIOTIC BRINE SHRIMP (ARTEMIA FRANCISCANA)

H.A.D. Ruwandeepika, T. Defoirdt, P.P. Bhowmick, I. Karunasagar, P. Bossier-2011

Journal of Applied Microbiology 110(2): 399-406

Abstract:

Aims: This study aimed to evaluate the expression levels of virulence gene regulators (luxR and toxR) and virulence factors (serine protease, metalloprotease and haemolysin) in luminescent and nonluminescent isogenic *Vibrio harveyi* and *Vibrio campbellii*.

Method and Results: Nonluminescent variants have been reported before to become dominant in cultures of luminescent vibrios when grown under static conditions in the dark. Wild-type *V. harveyi* BB120, *V. campbellii* LMG 21363, quorum sensing mutants of *V. harveyi* BB120 and their previously reported nonluminescent isogenic counterparts were used in this study. The expression level of the virulence genes *srp* serine protease, *vhp* metalloprotease and *vhh* haemolysin, the quorum sensing master regulator gene *luxR* and the virulence regulator gene *toxR* in isogenic luminescent and nonluminescent strains were quantified using reverse transcriptase real-time PCR. These experiments revealed that the nonluminescent strains produced lower levels of the quorum sensing master regulator gene *luxR* and the *vhp* metalloprotease gene (which is known to be regulated by quorum sensing). Finally, challenge tests with gnotobiotic brine shrimp (*Artemia franciscana*) larvae revealed that the nonluminescent strains are less virulent than their luminescent isogenic counterparts.

Conclusion: Nonluminescent variants of *V. harveyi* and *V. campbellii* strains produce lower levels of the quorum sensing master regulator gene *luxR* and the *vhp* metalloprotease gene and are less virulent to brine shrimp than their isogenic luminescent counterparts.

Significance and Impact of the study: These results indicate that adaptation of luminescent vibrios to specific growth conditions that result in a dominant nonluminescent phenotype is accompanied by a decreased adaptation to a host environment because of altered virulence gene regulation.

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