

INFORMATION OF INTEREST

- Interesting article on bioremediation strategy in a marine fish cage culture area in China: see pdf

VLIZ Library Acquisitions no

- 475 July 2, 2010
-

DEGRADATION AND EFFECT OF HYDROGEN PEROXIDE IN SMALL-SCALE RECIRCULATION AQUACULTURE SYSTEM BIOFILTERS

Martin Sune Møller, Erik Arvin, Lars-Flemming Pedersen-2010

Aquaculture Research 41(8): 1113–1122

Abstract:

From an environmental point of view, hydrogen peroxide (HP) has beneficial attributes compared with other disinfectants in terms of its ready degradation and neutral by-products. The rapid degradation of HP can, however, cause difficulties with regard to safe and efficient water treatment when applied in different systems. In this study, we investigated the degradation kinetics of HP in biofilters from water recirculating aquaculture systems (RAS). The potential effect of HP on the nitrification process in the biofilters was also examined. Biofilter elements from two different pilot-scale RAS were exposed to various HP treatments in batch experiments, and the HP concentration was found to follow an exponential decay. The biofilter ammonia and nitrite oxidation processes showed quick recuperation after exposure to a single dose of HP up to 30 mg L⁻¹. An average HP concentration of 10–13 mg L⁻¹ maintained over 3 h had a moderate inhibitory effect on the biofilter elements from one of the RAS with relatively high organic loading, while the nitrification was severely inhibited in the pilot-scale biofilters from the other RAS with a relatively low organic loading. A pilot-scale RAS, equipped with two biofilter units, both a moving-bed (Biomedica) and a fixed-bed (BIO-BLOK®) biofilter, was subjected to an average HP concentration of ~12 mg L⁻¹ for 3 h. The ammonium- and nitrite-degrading efficiencies of both the Biomedica and the BIO-BLOK® filters were drastically reduced. The filters had not reverted to pre-HP exposure efficiency after 24 h, suggesting a possible long-term impact on the biofilters.

(Department of Environmental Engineering, Technical University of Denmark, Lyngby, Denmark; email of L-F Pedersen: lfp@aqua.dtu.dk)

PROTEIN REQUIREMENTS OF NILE TILAPIA (OREOCHROMIS NILOTICUS) FRY CULTURED AT DIFFERENT SALINITIES

Edvino Larumbe-Morán, Martha P Hernández-Vergara, Miguel A Olvera-Novoa, Carlos I Pérez Rostro-2010

Aquaculture Research 41(8): 1150–1157

Abstract:

Effect of isolipidic (62.7 ± 5.0 g kg⁻¹) diets with protein levels of 204.6 (T20), 302.3 (T30), 424.6 (T40) or 511.0 g kg⁻¹ (T50) on growth and survival in Nile tilapia (*Oreochromis niloticus* Linnaeus 1758) fry cultured for 70 days at one of four salinities (0, 15, 20 and 25 g L⁻¹) was evaluated. A bifactorial (4 × 4) design was used with 16 treatments run in triplicate and 20 fry (0.25 ± 0.04 g) per replicate under semi-controlled conditions. Four independent, recirculating systems (one per salinity level) were used, each one with 12 circular tanks (70 L capacity), filters and constant aeration. The different salinities had no significant effect on growth. Weight gain improved significantly as dietary protein content increased, although organisms fed the T50 diet had a lower growth rate. Survival was highest (98.33%) in the T50/15 (protein/salinity levels) treatment and lowest (71.0%) in the T20/20 treatment, with no pattern caused by the variables. The T40/25, T40/20 and T50/0 treatments produced the most efficient growth and feed utilization values while the T20 treatments at all the salinities

resulted with the lowest performance. With the exception of the T50 treatments, a non-significant tendency to increased weight gain was observed as water salinity increased, suggesting that the salinity of the culture environment does not influence dietary protein requirements in Nile tilapia *O. niloticus* fry.

(Centro de Estudios Tecnológicos del Mar, Michoacán, México; email of M/ P. Hernández-Vergara: mphv1@yahoo.com.mx)

THE ECOLOGICAL SIGNIFICANCE OF LIPID/FATTY ACID SYNTHESIS IN DEVELOPING EGGS AND NEWLY HATCHED LARVAE OF PACIFIC COD (*GADUS MACROCEPHALUS*)

Benjamin J. Laurel, Louise A. Copeman, Thomas P. Hurst, Christopher C. Parrish-2010

Marine Biology 157(8): 1713-1724

Abstract:

The lipid/fatty acid composition of marine fish eggs and larvae is linked with buoyancy regulation, but our understanding of such processes is largely restricted to species with pelagic eggs. In this study, we examined developmental changes in the lipid/fatty acids of eggs and embryos of Pacific cod (*Gadus macrocephalus*), a species that spawns demersal eggs along coastal shelf edges, but as larvae must make a rapid transition to the upper reaches of the water column. Adult Pacific cod were collected in the Gulf of Alaska during the spawning season and eggs of two females were artificially fertilized with sperm from three males for each female. The eggs were subsequently reared in the laboratory to determine (1) how lipids/fatty acids were catabolized during egg and larval development, and (2) whether lipid/fatty acid catabolism had measurable effects on egg/embryo density. Eggs incubated at 4°C began hatching after 3-weeks and continued to hatch over a 10-day period, during which there was a distinct shift in lipid classes (phospholipids (PL), triacylglycerols (TAG), and sterols (ST)) and essential fatty acids (EFAs: 22:6n-3 (DHA), 20:5n-3 (EPA), and 20:4n-6 (AA)). In the egg stage, total lipid content steadily decreased during the first 60% of development, but just prior to hatch we observed an unexpected 2–3-fold lipid increase (~6–9 µg individual⁻¹) and a significant drop in egg density. The increase in lipids was largely driven by PL, with evidence of long-chained fatty acid synthesis. Late-hatching larvae had progressively decreasing lipid and fatty acid reserves, suggesting a shift from lipogenesis to lipid catabolism with continued larval development. Egg density measures suggest that lipid/fatty acid composition is linked to buoyancy regulation as larvae shift from a demersal to a pelagic existence following hatch. The biochemical pathway by which Pacific cod are apparently able to synthesize EFAs is unknown, therefore representing a remarkable finding meriting further investigation.

(Fisheries Behavioral Ecology Program, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, Hatfield Marine Science Center, OR, Newport, USA)

PHYSIOLOGICAL AND BIOCHEMICAL EFFECTS OF CONJUGATED LINOLEIC ACID AND ITS USE IN AQUACULTURE

Rui Rosa, Ana M. Andrade, Narcisa M. Bandarra, Maria L. Nunes-2010

Reviews in Aquaculture 2(2): 59–72

Abstract:

In the past few decades, the major compelling force in the study of marine lipids has been the need of the developing aquaculture industry to understand the lipid nutritional requirements of farmed fish so as to optimize production. At present, there is also increased interest to include health-promoting nutrients (nutraceuticals) in farmed foods, such as conjugated linoleic acid (CLA). Conjugated linoleic acid, a group of positional and stereoisomers of linoleic acid (18:2), acts as a growth factor to promote a repartitioning of fat to lean, lower blood lipids, and shows anticarcinogenic, hypocholesterolaemic and anti-atherogenic properties. In the present paper, we discuss current knowledge of the role of CLA in animal physiology and health and review advances in its application in fish aquaculture.

(Laboratório Marítimo da Guia, Centro de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Av. Nossa Senhora do Cabo, 939, 2750-374 Cascais, Portugal; email of Rui Rosa: rrosa@fc.ul.pt)

ANAEROBIC DIGESTION OF SLUDGE FROM INTENSIVE RECIRCULATING AQUACULTURE SYSTEMS: REVIEW

Natella Mirzoyan, Yossi Tal, Amit Gross-2010

Aquaculture 306 (1-4) : 1-6

Abstract:

Intensive recirculating aquaculture systems (RAS) produce high volumes of biosolid waste which is a potential source of pollution if not properly treated. A reduction in sludge-mass would therefore minimize the potential environmental hazard and economic burden stemming from its disposal. Recently, anaerobic digestion was suggested as an alternative to aquaculture sludge digestion and stabilization in RAS. This practice results not only in sludge-mass reduction, but also in water and energy savings, as well as in biogas production in certain practices, which can serve as an alternative energy source and partially cover the RAS's energy demands. In the current review, we summarize the reports on anaerobic digestion of sludge produced in RAS and compare the efficiencies of various methods.

(Department of Environmental Hydrology and Microbiology, Zuckerberg Institute for Water Research, Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Midreshet Ben Gurion 84990, Israel; email of Amit Gross: amgross@bgu.ac.il)

EFFECTS OF LOCATION AND TIME OF *PINCTADA MARGARITIFERA* SPAT TRANSFER FROM HATCHERY, ON ITS GROWTH AND MORTALITY IN THE SEA

Fariborz Ehteshami, Annie Christianus, Hossein Rameshi-2010

Aquaculture 306(1-4) : 85-91

Abstract:

This study reports on the effects of different locations and hatchery transfer time on the growth and mortality of *P. margaritifera* spat. In the first experiment spat of *P. margaritifera* were transferred to the sea farms in Hendurabi and Lavan Islands at 25, 50, and 65 days post settlement and a Control was kept in the hatchery. Retaining spat in the hatchery more than 25 days after settlement did not improve the growth and mortality of juveniles. Spat grown in Hendurabi were significantly greater in size compared to those grown in hatchery and Lavan at the end of experiment ($P < 0.05$). Growth curve both in hatchery and sea farms best conformed to cubic model. In the second experiment, 55 days old spat from two propagation trials at a size circa 0.5 mm were deployed to the Hendurabi on 5th September and 7th October 2008 and were reared for five months accordingly. Spat of first deployment were significantly greater in size than second deployment at the end of experiment ($P < 0.05$). Maximum (0.34 mm d^{-1}) and minimum (0.11 mm d^{-1}) daily growth rate (DGR) were observed in September and October 2008 respectively. Mean DGR in fall was more than double in winter. There was positive correlation between water temperature and DGR, whereas food abundance, as expressed by concentration of chlorophyll-a, had a negligible effect.

(Department of Aquaculture, Faculty of Agriculture, University Putra Malaysia (UPM), 43400 Serdang, Selangor, Malaysia; email of Annie Christianus: anniechr@yahoo.com)

SEED PRODUCTION PRACTICES OF STRIPED CATFISH, *PANGASIANODON HYPOPHTHALMUS* IN THE MEKONG DELTA REGION, VIETNAM

Tam M. Bui, Lam T. Phan, Brett A. Ingram, Thuy T.T. Nguyen, Geoff J. Gooley, Hao V. Nguyen, Phuong T. Nguyen, Sena S. De Silva-201

Aquaculture 306(1-4): 92-100

Abstract:

Hatchlings to fry, and fry to fingerling rearing of the striped catfish (*Pangasianodon hypophthalmus*) sectors of the Mekong Delta ($8^{\circ}33' - 10^{\circ}55'N$; $104^{\circ}30' - 106^{\circ}50'E$), Vietnam, a practice that has witnessed an explosive growth (1,094,879 tonnes, in 2008), in an area of approximately 7,000 ha, and the produce exported to over 100 countries, is presented. The findings are based on a survey of 45 hatcheries and 47 nursery farms located in three provinces (Dong Thap, An Giang and Can Tho) where these activities are predominant. Hatchery and nursery farm size ranged from 0.2-15 ha (2.5 ± 0.5 ha), with 0.05-10 ha (1.59 ± 0.3 ha), and from 0.09-11 ha (mean 1.9 ± 0.4 ha), with 0.01-8 ha (1.36 ± 0.28

ha) under water, respectively. Hatcheries maintained 350 to 29,200 ($8,042 \pm 805$) fish, of which 240-11,300 ($4,100 \pm 454$) are considered as broodstock, the rest being potential broodstock. The mean weight of male and female broodstock ranged from 0.5-8 kg and 0.5-12 kg, respectively, maintained at a ratio of 0.05-1.0 (mean 0.34 ± 0.03). Fish spawned were at least 1.75 kg (female) and 1.5 kg (males), and induced spawned by injection with HCG. Females received four or five doses at a time (averages 542, 597, 893 and 3,442 IU/kg or 500, 500, 500, 1500 and 3000 IU/kg; injected at 0, 23, 46, 56 and 66 hrs). Ovulation occurred 5-11 hours after the last injection (at 28-29 °C). The relationship of relative fecundity and larvae per kg to body weight are:

Eggs/ kg (mil.) = $0.151 - 0.015 \times \text{female wt (kg)}$ ($P = 0.006$, Adj. $R^2 = 0.179$)

Larvae/ kg (mil.) = $0.108 - 0.012 \times \text{female wt (kg)}$ ($P = 0.006$, Adj. $R^2 = 0.182$)

(College of Aquaculture and Fisheries, Can Tho University, Can Tho, Vietnam; email of Sena S. De Silva: sena.desilva@enaca.org)

EFFECT OF DAILY THERMO- AND PHOTO-CYCLES OF DIFFERENT LIGHT SPECTRUM ON THE DEVELOPMENT OF SENEGAL SOLE (*SOLEA SENEGALENSIS*) LARVAE

B. Blanco-Vives, N. Villamizar, J. Ramos, M.J. Bayarri, O. Chereguini, F.J. Sánchez-Vázquez-2010
Aquaculture 306(1-4): 137-145

Abstract:

This paper investigates the impact of different thermo- and photo-cycles of distinct wavelengths on *Solea senegalensis* larvae from day 1 to 30 post-hatching. In experiment 1, larvae were exposed to 12 h light:12 h dark (12 L:12D) cycle and (A) constant temperature (20.7 °C), (B) thermocycle of 12 h thermophase: 12 h cryophase, 22.1 °C day: 19.0 °C night (referred to as TC) or (C) 12 h cryophase: 12 h thermophase, 19.2 °C day: 22.0 °C night (referred to as CT). In experiment 2, larvae were kept under constant temperature (20.8 °C) and exposed to (A) continuous light (LL), (B) continuous darkness (DD), and LD 12 L:12D cycles of (C) white light (LDW), (D) blue light (LDB) or (E) red light (LDR). The sole larvae achieved the best performance, and showed fastest development and lowest degree of deformity under natural thermocycle conditions (TC) with a deformity percentage of 31.1% and LDB cycles with 27.7% of malformation, conditions which were nearest their natural aquatic environment. Larvae reared under TC started eye migration at 9 day post-hatching (DPH), while larvae exposed to CT started eye migration at 11 DPH. In larvae under the LDB treatment the migration of the eye started earlier than in the other treatments (9 DPH), while larvae reared under LL and DD photoperiods died before metamorphosis. These findings highlight the importance of light and temperature cycles during the early development of *S. senegalensis* larvae, which should be taken into consideration in experimental or rearing protocols.

(Department of Physiology, Faculty of Biology, University of Murcia Espinardo Campus, 30100, Murcia, Spain; email: borja@um.es)

EFFICACY OF FLUMEQUINE ADMINISTERED BY BATH OR THROUGH MEDICATED NAUPLII OF ARTEMIA FRANSISCANA (L.) IN THE TREATMENT OF VIBRIOSIS IN SEA BASS LARVAE

Maria Touraki, Ioannis Niopas, Emmanuel Ladoukakis, Vassilis Karagiannis-2010
Aquaculture 306(1-4) : 146-152

Abstract:

The uptake of flumequine by *Artemia* nauplii was studied as a function of its concentration in the enrichment medium and of the duration of the enrichment period. An emulsion containing 20, 30, 40 or 50% (w/w) flumequine was administered to nauplii for 4, 8, 12, 24 or 32 h. Increased uptake of flumequine ($450.4 \pm 15.8 \mu\text{g/g}$ dry weight) and good survival rates of the nauplii were observed with the 40% emulsion and 24 h enrichment. The concentration data of flumequine in nauplii were best fit to a two phase exponential elimination model with the first phase elimination half-life ($t_{1/2\alpha}$) and the terminal phase elimination half-life ($t_{1/2\beta}$) to be 1 and 19.5 h, respectively. In the efficacy trial 1000 sea bass larvae were challenged by bath with *Listonella anguillarum* strain 332A, 2.5×10^7 CFU/ml for 1 h.

Fish either received no treatment or oral treatment with flumequine bioencapsulated in nauplii or bath treatments with flumequine. Medication commenced two days following challenge, for bath treatments performed on day 2, 4 and 6 post challenge at a dosage of 20 mg/l for 2 h. Medication for oral treatments, commenced two days post challenge and two doses each of 700 nauplii per fish daily for five consecutive days. Cumulative mortality reached 96% for the unmedicated challenged group, 43% in the group receiving bath treatments and 29% in the group receiving medicated nauplii. Pharmacokinetic parameters of flumequine were calculated in sea bass larvae, after bath treatment with flumequine and oral treatment with flumequine bioencapsulated in nauplii. Steady state concentrations of flumequine (80.7 µg/g) in sea bass larvae were achieved after a 5-day oral treatment with medicated nauplii and the elimination half-life was found to be 19.5 h.

(Laboratory of General Biology, Department of Genetics, Development and Molecular Biology, School of Biology, Faculty of Sciences, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece; email of Maria Touraki: touraki@bio.auth.gr)

BIODIVERSITY OF N-CYCLE BACTERIA IN NITROGEN REMOVING MOVING BED BIOFILTERS FOR FRESHWATER RECIRCULATING AQUACULTURE SYSTEMS

Maartje A.H.J. van Kessel, Harry R. Harhangi, Katinka van de Pas-Schoonen, Jack van de Vossenberg, Gert Flik, Mike S.M. Jetten, Peter H.M. Klaren, Huub J.M. Op den Camp-2010

Aquaculture 306(1-4) : 177-184

Abstract:

Maintenance of optimal water quality and removal of nitrogen compounds pose challenges to aquaculture worldwide. Presence and activity of different bacteria involved in nitrogen cycling in the biofilm of a moving bed biofilm reactor (MBBR) connected to a Koi carp tank were investigated experimentally. For this MBBR system, a nitrogen removing rate of 3.5 g nitrogen per day was found in activity assays, whereas the predicted nitrogen removal rate was calculated to be 58 g nitrogen per day. The presence of ammonium-oxidizing and nitrite-oxidizing bacteria in the biofilm was demonstrated by situ hybridization (FISH) analysis. A large number of planctomycetes were shown to be present in the biofilm of the reactor, but they did not hybridize to oligonucleotide probes of known genera of anammox bacteria. Molecular 16S rRNA gene analysis of the MBBR biofilm revealed a novel group of planctomycete cells was present in this biofilter, which may explain the difference in experimentally found and calculated nitrogen removal of the system. The novel 16S rRNA gene sequences showed a low similarity to described anammox bacteria. This and other studies may implicate that the anammox reaction can be incorporated in biofilter systems for aquacultural freshwater systems, which makes it possible to remove nitrogen compounds from these systems in a relatively inexpensive and sustainable manner.

(Department of Microbiology, IWW, Radboud University Nijmegen, Heyendaalseweg 135, NL-6525 AJ Nijmegen, the Netherlands; email of Huub J.M. Op den Camp: h.opdencamp@science.ru.nl)

REPRODUCTIVE CYCLE AND OVARIAN DEVELOPMENT OF THE MARINE ORNAMENTAL SHRIMP STENOPUS HISPIDUS IN CAPTIVITY

Rafael A. Gregati, Vivian Fransozo, Laura S. López-Greco, Maria Lucia Negreiros-Fransozo-2010

Aquaculture 306(1-4): 185-190

Abstract:

The reproductive cycle and ovarian development of the marine ornamental shrimp *Stenopus hispidus* were described starting from adult mating pairs under laboratorial conditions. The pairs were individually kept in aquaria under constant conditions of salinity (35‰), temperature (26 ± 0.5 °C) and photoperiod (12L:12D). Molting, mating, spawning and hatching were recorded during three consecutive reproductive cycles. Females at different stages of ovarian development were anesthetized and their ovaries were removed, photographed, fixed and processed for histological examination. Mating occurred after female molting. Mean incubation time was 22.8 ± 2.1 days and mean intermolt periods were 25.5 ± 2.3 days for females and 26 ± 4.1 days for males. The ovaries varied in size and color during each reproductive cycle, which could be clearly seen through the transparent carapace. Spent ovary (translucent), lasted for 3 days after egg spawning; developing ovary (white), lasted 7 days;

developed ovary (light green), between 5 and 8 days and advanced ovary (dark green) lasts 10 to 13 days. Microscopically, the ovarian stages differed in proportion of follicular cells, oocytes and oogonia. Follicular cells were abundant and mature oocytes were absent at the spent stage, while the number and size of secondary oocytes increased gradually thereafter. The present study indicates that *S. hispidus* can undergo multiple reproductive cycles under culture conditions. The changes in the macroscopic appearance of the ovary are strongly associated with the reproductive cycle.

(Group of Studies on Crustacean Biology, Ecology and Culture (NEBECC), Department of Zoology, Institute of Biosciences, Universidade Estadual Paulista UNESP, 18618-000, Botucatu, SP, Brazil; email of Rafael A. Gregati: gregati@ibb.unesp.br)

INCREASING THE LEVEL OF SELENIUM IN ROTIFERS (*BRACHIONUS PLICATILIS* 'CAYMAN') ENHANCES THE MRNA EXPRESSION AND ACTIVITY OF GLUTATHIONE PEROXIDASE IN COD (*GADUS MORHUA* L.) LARVAE

S. Penglase, A. Nordgreen, I. T. van der Meer, P.A. Olsvik, Ø. Sæle, J.W. Sweetman, G. Baeverfjord, S. Helland, K. Hamre-2010

Aquaculture 306(1-4): 259-269

Abstract:

Commercially produced Atlantic cod (*Gadus morhua* L.) larvae are fed rotifers, while in the wild cod larvae feed on copepods. Rotifers contain up to 30-fold less selenium (Se) than copepods, and may contain insufficient Se to meet cod larvae requirements. In this study, rotifers were fed Se-enriched yeast (Se + rotifers) to obtain copepod levels of Se (3 mg kg⁻¹ dry weight (DW)), and the effects of feeding the Se + rotifers to cod larvae was investigated and compared to cod larvae fed control rotifers containing 0.7 mg Se kg⁻¹ DW. No differences were observed in growth or survival between groups at the end of the rotifer-feeding period (29 days post hatch (dph)), or in the rate of skeletal deformities at 120 dph. Cod larvae fed Se + rotifers had increased whole-body levels of Se, and expression and activity of Se-dependent glutathione peroxidases during the rotifer-feeding period (3 to 29 dph) compared to controls. Meanwhile no effect of the treatment was seen in the activity or mRNA expression of the deiodinases. There was no difference in thyroid hormone levels at 29 dph, but the T3/T4 ratio was increased in the Se + larvae. Thyroid follicles of Se + larvae had increased total volume, colloid volume and ratios of epithelium to colloid compared to controls. The results demonstrate that Se-dependent enzyme mRNA expression and activities in cod are retained according to a selenoprotein hierarchy as found in other vertebrates, and suggest that rotifers need extra supplementation of Se to meet cod larvae requirements.

(National Institute of Nutrition and Seafood Research (NIFES), PO Box 2029, NO-5817 Bergen, Norway; email of S. Penglase: spe@nifes.no)

OPTIMISING THE DELIVERY OF THE KEY DIETARY DIATOM *CHAETOCEROS* CALCITRANS TO INTENSIVELY CULTURED GREENSHELL™ MUSSEL LARVAE, *PERNA CANALICULUS*

Norman L.C. Ragg, Nick King, Ellie Watts, Jonathan Morrish-2010

Aquaculture 306(1-4): 270-280

Abstract:

The diatom *Chaetoceros calcitrans* forma *pumilum* is an important dietary component for cultured Greenshell™ mussel larvae, *Perna canaliculus*. However concerns surrounding potentially deleterious side effects have motivated a series of experimental trials to optimise the safe usage of this alga. Bioassays involved raising veliger larvae in the purpose-built Cawthron Ultra-Density Larval rearing (CUDL) system; an array of 2.5-L tanks were stocked with 2-day-old veligers (200 larvae mL⁻¹) supplied with inflowing water dosed with sufficient microalgae to maintain a fixed concentration of cells, after compensating for ingestion. The nutritional role of *C. calcitrans* was examined by adjusting its cellular fraction in the feed environment. Diets of 0, 5, 66, 95 and 100% *C. calcitrans* were each offered to six replicate rearing tanks, using *Isochrysis* aff. *galbana* (T-Iso clone) to maintain a total of 40 cells μL⁻¹ in the larval cultures. The 66% *C. calcitrans* diet was also offered at 3, 20, 60 and 120 cells μL⁻¹ (n = 6). Higher *C. calcitrans* fractions sustained faster growth, with 95% and 100% treatments

producing 23-day-old pediveligers of $240 \pm 15 \mu\text{m}$ and $228 \pm 5 \mu\text{m}$ mean shell length, respectively; compared to $212 \pm 7 \mu\text{m}$ in the 66% treatment (40 cells μL^{-1}). However, high C. 'calcitrans' treatments were more volatile, had higher mortality and greater predisposition towards population crashes. Similarly, reduced survival was observed in the high feed treatment of 120 cells μL^{-1} , reflected in a final pediveliger yield of $29 \pm 6\%$, compared to $47 \pm 3\%$ at 60 cells μL^{-1} and $36 \pm 7\%$ at 40 cells μL^{-1} . The 5% C. 'calcitrans' and 20 cells μL^{-1} treatments showed signs of nutrient limitation, while larvae fed 0% C. 'calcitrans' or a total of 3 cells μL^{-1} starved, failing to reach metamorphosis. A standard diet consisting of 66% C. 'calcitrans' and 34% I. aff. galbana maintained at 40 cells μL^{-1} was used to test the hypothesis that culture age increased deleterious side effects associated with feeding C. 'calcitrans'. The final stage of batch culture, using 20-L nylon carboys inoculated with 1010 C. 'calcitrans' cells was allowed to age for 2, 3, 4, 5 or 6 days before being fed to larvae. After 21 days eating 2-day-old C. 'calcitrans' larvae reached a mean shell length of 236 μm , were eating 35,000 cells larva $^{-1}$ day $^{-1}$, and had a survival rate of $59 \pm 3\%$; in contrast, larvae eating 6-day-old cells only reached 214 μm , eating 17,000 cells larva $^{-1}$ day $^{-1}$, with an overall survival of $46 \pm 7\%$. While C. 'calcitrans' is valuable in the larval culture of P. canaliculus and many other bivalves, appropriate feeding protocols are needed when using this diatom.

(Cawthron Institute, Private Bag 2, Nelson 7042, New Zealand; email of Norman L.C. Ragg: Norman.ragg@cawthron.org.nz)

NUTRITIONAL EVALUATION OF MYSIDS MESOPODOPSIS ORIENTALIS (CRUSTACEA:MYSIDA) AS LIVE FOOD FOR GROUPEP EPINEPHELUS FUSCOGUTTATUS LARVAE

P.S. Eusebio, R.M. Coloso, R.S.J. Gapasin-2010

Aquaculture 306(1-4): 289-294

Abstract:

The potential of mysids *Mesopodopsis orientalis* as live food source for grouper *Epinephelus fuscoguttatus* larvae was investigated. In comparison with *Artemia* biomass, a common live food source in larviculture, mysids contained significantly higher levels of protein, total lipid, eicosapentaenoic acid (EPA, C_{20:5n-3}), and docosahexaenoic acid (DHA, C_{22:6n-3}). DHA was not detected in *Artemia* biomass. Grouper larvae fed mysids from 35 to 55 days after hatching (DAH) had 2-fold and 3-fold higher specific growth rates and survival, respectively, than those fed *Artemia* biomass. DHA levels increased 6-fold while EPA levels remained constant in mysid-fed grouper larvae. In contrast, DHA and EPA significantly decreased in *Artemia* biomass-fed grouper larvae. Furthermore, the specific activities of amylase, lipase and protease generally significantly increased ($P < 0.05$) in both mysid-fed and *Artemia* biomass-fed grouper larvae from 35 to 55DAH. A marked increase in the specific activity of amylase was seen in mysid-fed than in *Artemia* biomass-fed grouper larvae. Results of the nutritional evaluation suggest that mysids are superior live food organisms than *Artemia* biomass for grouper larvae and could significantly improve production of grouper juveniles in the nursery phase.

(Aquaculture Department, Southeast Asian Fisheries Development Center, 5021 Tigbauan, Iloilo, Philippines; email of P.S. Eusebio: pseusebio@seafdec.org.ph)

LARVAL SETTLEMENT AND METAMORPHOSIS OF THE PEARL OYSTER PINCTADA FUCATA IN RESPONSE TO BIOFILMS

Xiujuan Yu, Weihong He, Hengxiang Li, Yan Yan, Chuanxu Lin-2010

Aquaculture 306(1-4): 334-337

Abstract:

Biofilms is an important mediator of larval settlement and metamorphosis for the pearl oyster *Pinctada fucata*, which is an important aquaculture species in South China. However, the role of biofilms in larval settlement and metamorphosis in this species remains unclear. This paper presents the first laboratory study investigating larval settlement and metamorphosis of *P. fucata* in response to natural biofilms of different ages and biofilm-conditioned seawater. Natural biofilms from 1 to 9 day-old except 6-day-old significantly induced larval settlement, while there was no obvious positive correlation between microbial abundance of the biofilms and percentages of larval settlement and metamorphosis.

These results indicate that the inductive effect may be closely associated with biofilms community structure and extracellular products in the biofilms rather than microbial abundance. No inductive effects were observed when larvae were exposed to biofilm-conditioned seawater. Thus, the inductive cues from the natural biofilms seem to result from its surface-associated characteristic rather than waterborne. In addition, this study also provides valuable information for studies of mechanism of larval settlement and metamorphosis in this species, which is useful information for the hatchery industry of this pearl oyster.

(South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou 510301, China; email of Yan Yan: yany@scsio.ac.cn)

DEVELOPMENT OF SPERM CRYOPRESERVATION TECHNIQUES IN PEJERREY ODONTESTHES BONARIENSIS

Gabriel Lichtenstein, Mariano Elisio, Leandro A. Miranda-2010

Aquaculture 306(1-4): 357-361

Abstract:

The pejerrey, *Odontesthes bonariensis*, is being considered for aquaculture due to its high demand and market price. Reproduction and larviculture studies have demonstrated the feasibility of massive fingerling production, and techniques that prolong life and increase gamete viability can assist in the culture development of this species. In this regard, the main objective of this study was to develop freezing protocols for pejerrey sperm. For this purpose, two extenders: Ex1, a modified Mounib solution (127 mM NaHCO₃, 159 mM sucrose, 0.025 g/ml reduced glutathione; pH: 8; osmolality 400 mOsm/kg) and Ex2, a saline based solution (250 mM NaHCO₃, 100 mM trehalose; pH: 8; osmolality 450 mOsm/kg) were developed. Dimethyl sulfoxide (DMSO) and ethylene glycol, (EG) were added at 10% as cryoprotectants and two types of containers were used: cryovials (1 ml of volume) and French straws (0.250 ml). Cryopreservation was made without equilibration time using dry ice or liquid nitrogen. The results obtained by freezing pejerrey semen with dry ice showed that all the combinations tested were suitable because high motility indexes (among 4 or 5) and good fertility percentages (between 46% and 56%) were obtained after thawing. However, the fertilization percentage obtained with control semen was significantly higher (80%). No significant statistical differences were observed on the fertilization percentages between experimental combinations or the containers used. In the case of liquid nitrogen as freezing method, it was possible to obtain for all the combinations motility indexes among 3 or 4 after thawing. In the case of fertilization trials, similar percentages (around 80%) were found for control semen and for the majority of cryopreserved samples. However, statistically lower results (among 44%–60%) were found for Ex1DMSO (cryotubes) samples and for Ex1EG samples in both containers. In summary, the feasibility to cryopreserve pejerrey sperm was demonstrated for the first time using simple and practical protocols.

(Laboratorio de Ictiofisiología y Acuicultura, Instituto de Investigaciones Biotecnológicas-Instituto Tecnológico de Chascomús (IIB-INTECH) (CONICET-UNSAM), Camino de Circunvalación Laguna Km. 6 (B7130IWA) Chascomús, Buenos Aires, Argenti; email of Leandro A. Miranda: lmiranda@intech.gov.ar)

SHORT COMMUNICATION

SELECTION OF BROODERS FROM EARLY MATURING FRESHWATER PRAWNS (*MACROBRACHIUM ROSENBERGII*) RESULTS IN FASTER GROWTH RATES OF OFFSPRING THAN IN THOSE SELECTED FROM LATE MATURING PRAWNS

Nissara Kitcharoen, Skorn Koonawootrittiron, Uthairat Na-Nakorn-2010

Aquaculture 306(1-4): 362-364

Abstract:

In the giant freshwater prawn (GFP), unintentional negative selection may have occurred when farmers recruited brooders from late maturing females instead of from those that matured first (Doyle et al., 1983). In this study, we provided empirical evidence that selection made from early maturing female freshwater prawns yielded offspring that grew faster than did those from females selected from the later maturing batches. Sixteen full sibling families were produced and separately reared. When they reached

maturation, gravid females were removed and separately divided into four batches according to time to maturity. Within family selection, with a 10% selection proportion was then performed within each batch. The females were simultaneously mated with males from different families within a batch. Growth comparison of offspring between batches showed that the offspring of the females selected from the first batch were larger in carapace length (CL) and body weight (BW) than those from later batches.

(Department of Aquaculture, Graduate School, Kasetsart University, Bangkok, Thailand 10900; email: ffisurn@ku.ac.th)

SHORT COMMUNICATION
POLYCHAETE-ASSISTED SAND FILTERS

Paul J. Palmer-2010

Aquaculture 306(1-4) : 369-377

Abstract:

The objective of this study was to investigate the productivity and functionality of sand filters stocked with marine worms for wastewater treatment at mariculture facilities. Medium bedding sand which is commonly available in coastal sedimentary deposits and nereidid polychaetes (*Perinereis nuntia* and *P. helleri*) from Moreton Bay in southeast Queensland were combined and studied in down-flow sand filtration beds. This combination appears to provide a new option for brackish wastewater treatment whereby the activities of the worms help to prevent sand filters from blocking with organic debris and their biomass offers a valuable by-product. Phytoplankton-rich pond waters percolating through sand-worm beds were reliably treated in several useful ways: suspended solids and chlorophyll a levels were consistently reduced by > 50% by the process, and nutrients were converted into bio-available dissolved forms. Dissolved oxygen, redox and pH levels were also lowered significantly by the process. Water treatment rates of approx 1500 L m⁻² d⁻¹ were routinely achieved. *P. nuntia* appeared more suitable than *P. helleri* for stocking directly into sand filtration beds as nectochaetes, but generally exhibited slower growth. Survival and growth were influenced by stocking density. Sand-filter beds stocked with juvenile worms and fed only with eutrophic pond water demonstrated polychaete production capacities in the order of 300–400 g m⁻² (eg. *P. helleri*: 328 g m⁻² in 16 weeks). These results show how nereidid polychaetes can be reliably produced within simple, low-maintenance sand filters, and provide data necessary for the functional integration of this novel wastewater treatment system into contemporary seafood farming systems.

(Bribie Island Research Centre, PO Box 2066 Woorim, Queensland, 4507 Australia; email: paul.palmer@deedi.qld.gov.au)

SHORT COMMUNICATION
CAN DISSOLVED AQUATIC HUMIC SUBSTANCES REDUCE THE TOXICITY OF AMMONIA AND NITRITE IN RECIRCULATING AQUACULTURE SYSTEMS?

Thomas Meinelt, Hana Kroupova, Angelika Stüber, Bernhard Rennert, Andreas Wienke, Christian E.W. Steinberg-2010

Aquaculture 306(1-4): 378-383

Abstract:

In recirculating rearing systems of aquatic food organisms, humic substances (HSs) accumulate along with toxic nitrogen species (nitrite, unionized ammonia). The aim of the present study was to find out whether or not HSs have the capability to modify the acute toxicity of nitrite and unionized ammonia; and whether different HS qualities cause similar effects in fish. 144-h-Embryo-Larval-Test (ELT) was used for these purposes. Two commercial HS isolates with high reactivity and one natural lake isolate with relatively low reactivity have been tested for their detoxification potential. Results revealed that the HSs of different qualities reduced toxicity of both nitrogen species to different degrees with the lake isolate being least effective. Ion exchange may be one prevalent mechanism with unionized ammonia. For nitrite, equivalent information is not available. Beside the ion exchange mechanisms, the weak pH-buffer capacity of HSs may stabilize the pH and, hence, prevent the formation of the toxic species. Further potential mechanism are discussed, namely the acquisition of multiple stress resistance of HS-

exposed embryos. As a practical consequence, the addition of low-cost commercial HS preparation of high reactivity to recirculating aquaculture systems (RASs) is recommended.
(Leibniz Institute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 301, 12587 Berlin, Germany; email of Thomas Meinelt: meinelt@igb-berlin.de)

SHORT COMMUNICATION

THE ROLE OF BACTERIAL BIOFILMS AND EXUDATES ON THE SETTLEMENT OF MUSSEL (*PERNA CANALICULUS*) LARVAE

Annapoorna Maitrayee Ganesan, Andrea C. Alfaro, John D. Brooks, Colleen M. Higgins-2010

Aquaculture 306(1-4) : 388-392

Abstract:

The ability of bacterial biofilms and biofilm exudates to induce mussel (*Perna canaliculus*) larvae to settle was investigated. Marine bacteria were isolated from marine seaweeds, seawater and mussels, and cultured in marine agar plates. Three main bacterial strains were selected, identified based on biochemical and 16 S rRNA techniques, and used for mussel settlement assays. Bacterial biofilms and biofilm exudates from *Pseudoalteromonas* sp. AMGP1 did not induce larval settlement in treatments, whereas biofilms and their exudates resulted in extremely high larval mortality. Thus, *Pseudoalteromonas* sp. AMGP1 biofilms may produce toxins deadly for *P. canaliculus*. Conversely, both *Macrocooccus* sp. AMGM1 and *Bacillus* sp. AMGB1 significantly increased larval settlement (over 60%) compared with controls. These results suggest that settlement cues for *P. canaliculus* may be produced by the biofilm cells (and are present in the biofilm exudates), possibly as quorum sensing signals.

(School of Applied Sciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Private Bag 92006, Auckland 1142, New Zealand; email of Andrea C. Alfaro: andrea.alfaro@aut.ac.nz)

SHORT COMMUNICATION

CONTROLLED REPRODUCTION OF ASP, *ASPIUS ASPIUS* (L.) USING LUTEINIZING HORMONE RELEASING HORMONE (LHRH) ANALOGUES WITH DOPAMINE INHIBITORS

Katarzyna Targońska, Dariusz Kucharczyk, Roman Kujawa, Andrzej Mamcarz, Daniel Źarski-2010

Aquaculture 306(1-4) : 407-410

Abstract:

Artificial reproduction of asp under controlled conditions was investigated using two different spawning agents based on luteinizing hormone releasing hormone (LHRH) analogues and dopamine antagonists (Ovopel and Ovaprim), during two successive spawning seasons. Fish in the Ovopel and Ovaprim treatment groups were treated with a dose equivalent to 2 pellets and 0.5 mL per kg of body weight respectively. Out-of-season spawning and reproduction after a sudden increase in water temperature were also examined. No control fish ovulated although in both years, fish treated with Ovaprim showed a higher percentage of ovulation (75–88%) and embryo survival to the eyed-egg-stage (69–78%) than those treated with Ovopel (ovulation 25–38%; embryo survival 36–47%). The latency time was shorter in the groups where Ovopel was applied (40–42 h) than in Ovaprim groups (42–48 h). Similar results were obtained in out-off-season spawning. After a sudden increase in water temperature, females treated with Ovopel did not ovulate. This indicates that Ovaprim might be successfully used for artificial reproduction of asp by applying the induction protocol and the conditions reported in the present study.

(Department of Lake and River Fisheries, University of Warmia and Mazury in Olsztyn, Poland; email of Katarzyna Targońska: targonska.k@uwm.edu.pl)
