

INFORMATION OF INTEREST

- Introduction for Fisheries and Aquatic Biology. Hisashi Kurokura and Neelam Ramaiah (Eds), TERRAPUB, 2011: see contents or selected chapters (1 2 3 4 5)
- Analysis of the Asian Consumer Market: Seafood Purchase Behaviors and Preferences for Southern Mainland China & Hong Kong
- FAO Technical Guidelines on Aquaculture Certification - version adopted by the 29th Session of Committee on Fisheries (COFI) held in Rome, Italy from 31 January to 04 February 2011
- Interesting presentations about impending seafood shortage at the March 2011 International Boston Seafood Show
- Report about Asia Pacific Aquaculture 2011 conference in Kochi, India
- EU project “AquaFUELS” – proceedings of the October 2010 roundtable fostering critical thinking on the state of the art and future perspectives for algae biofuels
- International Symposium on Aquaculture and Fisheries Education (ISAFE), Bangkok November 27-29, 2009: summary report
- The sustainable development of China’s ocean and coasts: ecological issues and policy recommendations, October 2010 – briefing document

VLIZ Library Acquisitions no

- 499 March 18, 2011
 - 500 March 25, 2011
 - 501 April 1, 2011
-

DEVELOPMENTAL CHANGES OF DIGESTIVE ENZYMES IN PERSIAN STURGEON (ACIPENSER PERSICUS) DURING LARVAL ONTOGENY

Seyedeh Sedigheh Babaei, Abdolmohammad Abedian Kenari, Rajabmohammad Nazari, Enric Gisbert
Aquaculture 318(1-2): 138-144

Abstract:

The development of digestive enzymes from the stomach (pepsin), pancreas (trypsin, chymotrypsin, α -amylase and lipase) and intestine (alkaline phosphatase) was studied in Persian sturgeon (*Acipenser persicus*) from hatching to the juvenile stage at 40 days post hatching (dph). Larvae were obtained from artificial propagation of one male and one female and transferred to larval culture tanks where, after yolk sac absorption (9 dph at 17–18 °C), they were fed with *Artemia urmiana* and *Daphnia* sp. The assessment of the activity of digestive enzymes showed that at the onset of exogenous feeding, gastric glands were already functional as indicated by the increase in pepsin specific activity. In contrast, alkaline proteases like trypsin and chymotrypsin decreased their specific activity after the onset of exogenous feeding, indicating the importance of these types of enzymes in the cleavage of yolk proteins during the endogenous feeding phase and the replacement of the larval alkaline-type digestion by a juvenile-type acid digestion. After the first feeding, amylase and lipase specific activities increased. Such increments in the activity of amylase might be genetically programmed to better digest carbohydrates in diets with the goal of sparing proteins during the larval stage, whereas the increase in lipase was related to changes in the lipid content of live prey and the progressive maturation of the pancreatic function during larval development. Changes in enzyme activities from the stomach and pancreas were coupled with that in the intestine (brush border membrane), where the specific activity of alkaline phosphatase progressively increased until 19–24 dph and remained constant thereafter, indicated the maturation of the intestine and the achievement of a juvenile-like mode of digestion. Considering these data on the digestive enzymes from the pancreas, stomach and intestine, Persian sturgeon larvae might be weaned around 19–24 dph, as larvae have achieved the complete maturation of their digestive functions by this date. This developmental process, and particularly for the digestive functions, can be considered as a reference to evaluate the effect of a formulated micro diets feeding on larvae.

(Fisheries Department, Tarbiat Modares University, Noor, P.O. Box 64414-356, Noor, Mazandaran, Iran; email of Seyedeh Sedigheh Babaei: Sedigheh.babaei@yahoo.com)

ONTOGENY OF THE DIGESTIVE TRACT AND ENZYMATIC ACTIVITY IN WHITE SEABASS, *TRACTOSCION NOBILIS*, LARVAE

Mario A. Galaviz, Alejandra García-Gasca, Mark Drawbridge, Carlos Alfonso Álvarez-González, Lus M. López-2011

Aquaculture 318(1-2): 162-168

Abstract:

The development of the digestive system and digestive enzyme activity in white seabass larvae, *Atractoscion nobilis*, were analyzed from hatching until 40 days post hatch (dph) using histological and biochemical approaches. The development of the digestive system in *A. nobilis* larvae was similar to that reported for other marine fish species. Larvae at 3 dph (0.55 ± 0.001 mg wet weight and 3.6 ± 0.02 mm total length), cultured at 18 °C in seawater, presented all the structures (i.e. differentiation of the alimentary canal into the buccopharynx, esophagus, anterior and posterior intestines, pancreas with zymogen granules, liver, gall bladder and open mouth) necessary for the digestion and absorption of nutrients such as proteins and lipids (primarily). At this time, the larvae had fully-developed digestive systems that allowed them to digest inert feed and to absorb nutrients throughout the intestine walls. On the other hand, most digestive enzyme activities were detected at the moment of hatching. Trypsin activity was 0.80 ± 0.16 mU/mg protein at 1 dph (0.51 ± 0.001 mg wet weight larvae), and increased gradually during the following days, but most notably after the initial exogenous feeding at 4 dph. The specific activity of chymotrypsin was 7.21 ± 1.29 mU $\times 10^{-4}$ /mg protein at 1 dph and reached peak level (15.9 ± 1.02 mU $\times 10^{-4}$ /mg protein) at 18 dph (6.6 ± 0.003 mg wet weight larvae). The specific activity of leucine aminopeptidase increased continuously from 1.31 ± 0.05 mU $\times 10^{-3}$ /mg protein at 1 dph to 15.91 ± 0.40 mU $\times 10^{-3}$ /mg protein at 18 dph. The activity of α -amylase at 1 dph was 1.35 ± 0.09 U/mg protein, increasing to 8.07 ± 0.98 U/mg protein at 16 dph. The activity of pepsin was detected at a very low level (0.71 ± 0.53 U/mg protein) at 10 dph, and a stepwise increase in activity was observed between 16 and 20 dph, reaching maximum level (13.92 ± 0.09 U/mg protein) at 40 dph. These results indicate that the digestive tract develops rapidly in this species and that the stomach becomes functional between 16 and 18 dph. It should, therefore, be possible to start weaning the fish at this young age.

(Programa de Maestría y Doctorado en Oceanografía Costera, Facultad de Ciencias Marinas, Universidad Autónoma de Baja California (UABC), PO Box 76, Ensenada B.C., 22860, Mexico; email of Lus M. López: llopez@uabc.edu.mx)

A METHOD FOR REDUCING THE THICKNESS OF THE OUTER EGG MEMBRANE OF THE JAPANESE MITTEN CRAB *ERIOCHEIR JAPONICA* TO IMPROVE THE NORMAL ZOEAL LARVAE HATCHING RATE OF *IN VITRO* ARTIFICIAL FERTILIZED EGGS

Tai Hung Lee-2011

Aquaculture 318(1-2): 176-179

Abstract:

This study was an attempt to prove that the thickness of the outer egg membrane is the key factor that contributes to the normal zoeal larvae hatching rate of the *in vitro* artificially fertilized eggs of the Japanese mitten crab *Eriocheir japonica* by artificially stretching and thinning the outer egg membrane with the help of water surface tension. The results showed that the artificially thinned outer egg membrane became six times thinner. In addition, the normal zoeal larvae hatching rate of the *in vitro* artificially fertilized eggs rose from 10% to over 66% after the thinning treatment. Discussion focuses on the mechanism of this thinning phenomenon, the role the thinned outer egg membrane plays in the increase of the normal zoeal larvae hatching rate of the *in vitro* artificially fertilized eggs and the utilization of this particular outer egg membrane thinning method.

(Laboratory of Aquaculture Genetics and Genomics, Faculty of Fisheries Sciences, Hokkaido University, 3-1-1 Minato-cho, Hakodate, Hokkaido, 041-8611, Japan; email : thlee@fish.hokudai.ac.jp)

SPERM CRYOPRESERVATION OF THE ENDANGERED RED SPOTTED GROUPER, *EPINEPHELUS AKAARA*, WITH A SPECIAL EMPHASIS ON MEMBRANE LIPIDS

Qiutao He, Gang Lu, Kai Che, Enhui Zhao, Qiongsan Fang, Hansheng Wang, Jing Liu, Changjiang Huang, Qiaoxiang Dong-2011

Aquaculture 318(1-2): 185-190

Abstract:

The red spotted grouper, *Epinephelus akaara*, is an economically important aquaculture species in Southeast Asia. It is also classified as endangered in the Red List of Threatened Species. It is a protogynous hermaphrodite marine species, and the asynchronization of gamete production from both sexes has restricted mass seed production in artificial propagation. Cryopreservation can resolve these problems by storing sperm when they are abundant and to be used later for fertilization without any time constraint, yet sperm cryopreservation has not been explored in red spotted groupers. This study was intended to develop an optimal sperm cryopreservation protocol for this species. Specifically, we compared various activation solutions and found that maximum activation in red spotted grouper sperm can be achieved with glucose at 1100 mOsm/kg. Previous protocols used for the dusky grouper with 10% dimethyl sulfoxide (DMSO) plus 10 mg/ml bovine serum albumin (BSA) also yielded high post-thaw motility ($70 \pm 4\%$) for red spotted grouper in this study. Further optimization of cooling rate suggested a more rapid cooling of $61\text{ }^{\circ}\text{C}/\text{min}$ or higher to be optimal for red spotted grouper. Addition of cholesterol in combination with 10% DMSO not only yielded high post-thaw motility ($77 \pm 5\%$) comparable to fresh sperm ($87 \pm 1\%$), but also prolonged motility duration to twice that of cryopreserved with the dusky grouper protocol (21 vs. 9 min). Sperm lipid measurement of fresh and thawed samples revealed a high retention of sphingomyelin (SM) content in samples that had high post-thaw motility. Future studies are necessary to further explore the role of SM in sperm cryopreservation. (Zhejiang Provincial Key Lab for Technology and Application of Model Organisms, Institute of Watershed Science and Environmental Ecology, Wenzhou Medical College, Wenzhou 325035, China; email of Qiaoxiang Dong: dqxdong@163.com)

SEAWATER OZONATION AND FORMALIN DISINFECTION FOR THE LARVAL CULTURE OF EASTERN ROCK LOBSTER, *JASUS (SAGMARIASUS) VERREAUXI*, PHYLLOSOMA

Mark A. Jensen, Arthur J. Ritar, Chris Burke, Louise R. Ward-2011

Aquaculture 318(1-2): 213-222

Abstract:

The effects of seawater disinfection with continuous ozonation or with daily formalin treatment during flow-through culture, on the survival, growth, bacteriology and histology of eastern rock lobster, *Jasus (Sagmariasus) verreauxi*, phyllosoma were determined. Survival from hatch to Instar II was highest and bacterial abundance was least in low ozonated seawater (containing 5 ppb ionised bromine, Br). By contrast, at high ozonation (45 ppb Br) and medium ozonation (15 ppb Br), 77% and 69% of larvae, respectively, suffered deformities at the moult to Instar II and starved to death. Histological examination of phyllosoma showed no differences in cuticular epithelium thickness but the digestive gland tissue of moribund deformed phyllosoma had significantly thinner tubule epithelium, the lumen was dilated, B-cells were more abundant and there was greater separation between the cuticular epithelium and distal tip of digestive gland tubules. In unozonated (Control) water, 66% of larvae died during Instar II probably resulting from a possible *Vibrio* infection. In a second experiment, survival to Instar III was highest at low ozonation or no ozonation without addition of formalin (0 ppm). Bacterial numbers were lowest in low ozonation with 0 ppm formalin treatments, compared to daily treatment with formalin at 10 ppm or above. A concentration of 250 ppm formalin killed all larvae by Instar III. In a final experiment, larval survival between Instar III to VI in low ozonated seawater was approximately 80% at formalin levels of 0 to 80 ppm, whereas all larvae treated with 160 ppm formalin died shortly after Instar V. Disinfection improved survival by minimising bacterial disease for the culture of phyllosoma to Instar VI without interrupting growth and development. The present study established that the optimum treatment for the culture of phyllosoma to Instar VI appeared to be low ozonation (5 ppb Br) with 10 ppm formalin.

(Marine Research Laboratories, Tasmanian Aquaculture and Fisheries Institute, University of Tasmania, Nubeena Crescent, Taroona, Tasmania 7053, Australia; email of Mark A. Jensen: Mark.Jensen@utas.edu.au)

SHORT COMMUNICATION

MINIMIZATION OF GENETIC DIVERSITY LOSS OF ENDANGERED FISH SPECIES CAPTIVE BROODSTOCKS BY MEANS OF MINIMAL KINSHIP SELECTIVE CROSSBREEDING

Maria del Mar Ortega-Villaizan, Daiki Noguchi, Nobuhiko Taniguchi-2011

Aquaculture 318(1-2): 239-243

Abstract:

The loss of genetic variability in artificially bred seed populations increases the potential risk of reducing the fitness of the hatchery stock as well as that of the wild population when releasing such seed fish to the natural water. With the aid of computer simulation and the minimal kinship (*MK*) selective crossbreeding model, we have examined how to minimize the loss of genetic variability in future generations, using real data of barfin flounder broodstock management, a rare fish species on the verge of becoming endangered. Two types of selective breeding scenarios were applied: i) selection of parental pairs based on *MK* by means of mean P_s (proportion of shared alleles) as a similarity measure; and ii) random selection of parental pairs. Gene diversity (expected heterozygosity, H_e) and allelic diversity (number of alleles, N_a) were used as measures of genetic variability. Results showed that the *MK* selective breeding scenario resulted advantageous in the retention of both gene and allelic diversities.

(Institute of Molecular and Cell Biology, Miguel Hernandez University, 03202 Elche, Spain; email of Maria del Mar Ortega-Villaizan: mortega-villaizan@umh.es)

SHORT COMMUNICATION

BREEDING OF THE FORKTAIL BLENNY *MEIACANTHUS ATRODORSALIS*: BROODSTOCK MANAGEMENT AND LARVAL REARING

Jonathan A. Moorhead, Chaoshu Zeng-2011

Aquaculture 318(1-2): 248-252

Abstract:

The present study describes the reproductive behavior of the forktail blenny, *Meiacanthus atrodorsalis*, and investigates the survival and growth of larvae under various feeding regimes. Two harems of six *M. atrodorsalis* began spawning about 3 months after acquisition, with egg clutches discovered regularly throughout the study period. Observations of courting behavior suggested that the female initiated courtship with spawning commencing after a series of male displays and courtship encounters. Adult *M. atrodorsalis* displayed a preference for shelters of single entrance 50-mm PVC pipe, with a 25-mm reduced entrance, for egg laying, while the male took full responsibility for egg care. Larvae measuring 3.11 ± 0.15 mm standard length (SL) and 0.63 ± 0.03 mm body depth (BD) hatched approximately 181 h post fertilization at 28 °C, with a mouth gape height and width of 307.3 ± 11.0 and 263.8 ± 5.5 μ m, respectively. Using a feeding protocol consisting of firstly feeding rotifers, and then switching to *Artemia* nauplii with enriched *Artemia* meta-nauplii added later on, larvae were observed to reach settlement approximately 35 days post hatching (DPH), measuring 13.54 ± 0.38 mm SL and 3.91 ± 0.27 mm BD. The first feeding trial tested the effect of rotifer density on survival and growth of newly hatched larvae. The results showed no significant difference in either larval survival or growth when fed rotifers at 2, 5, 10 and 20 rotifers mL^{-1} . The second trial investigated the appropriate time to shift from feeding larvae with rotifers (10 mL^{-1}) to *Artemia* nauplii (3 mL^{-1}). These feeding trials suggest that to optimize survival and growth, newly hatched larvae of *M. atrodorsalis* should be fed rotifers at a density of between 2 and 20 rotifers mL^{-1} , and that the majority of larvae appeared to display the ability to ingest *Artemia* nauplii between 6 to 10 DPH.

jonathan.moorhead@jcu.edu.au

EFFECTS OF DIFFERENT DIETARY LIPID CONTENTS ON GROWTH AND LIPASE ACTIVITY OF ERIOCHEIR SINENSIS LARVAE

Debin Zheng, Luqing Pan, Bo Fang-2011

Journal of Ocean University of China (English Edition) 10(1): 55-60,

Abstract:

The effects of different dietary lipid content on the growth and lipase activity of *Eriocheir sinensis* larvae were studied in the paper. The results showed that the survival, metamorphic rate and weight gain of *E. sinensis* larvae at different stages of growth all varied significantly with lipid content ($P < 0.05$). Further, the survival and metamorphosis rates were the highest during the larval phases Z3 to Z4, and the weight gain was the highest during the larval phases Z5 to M. During the first 20 h after metamorphosis of every larval stage, the lipase activity increased over time at Z1, Z2, Z3 and M and declined at Z4 and Z5, and was influenced significantly by lipid content ($P < 0.05$). In addition, lipase activity at each larval stage began to respond to dietary lipid contents 4 h after the larvae were fed, and tended to be stable after 12 h. The diets with higher lipase activity and lower lipid content were selected to give the suitable recipe of lipid requirements at each larval stage. It was concluded that the suitable lipid requirements at Z1, Z2, Z3, Z4, Z5 and M were 6%, 4%, 6%, 8%, 8% and 10%, respectively.

(The Key Laboratory of Mariculture, Ministry of Education, Ocean University of China, Qingdao 266003, P. R. China; email of Luqing Pan: panlq@ouc.edu.cn)

ADVANCES IN BREEDING AND REARING MARINE ORNAMENTALS

Ike Olivotto, Miquel Planas, Nuno Simões, G. Joan Holt, Matteo Alessandro Avella, Ricardo Calado-2011

Journal of the World Aquaculture Society 42(2): 135–166

This work addresses the most relevant advances in the breeding and rearing of marine ornamental species. The main breakthroughs in marine ornamental fish culture are discussed, with seahorses deserving a section of their own as a result of their conservation status and unique biology. Details on spawning, embryo development, larval rearing, plankton culturing, and tank design are presented. In addition, with the increase in popularity of ornamental invertebrates in reef aquariums, details on the culturing techniques of some of the most traded invertebrate groups (e.g., live rocks, corals, anemones, polychaetes, mollusks, decapod crustaceans and echinoderms) are also discussed. Finally, the last part of this work highlights the concerns toward the establishment of sustainable collection, production, and trading practices for marine ornamentals as well as the urgent need to develop reliable traceability protocols to distinguish sustainably caught and/or cultured specimens from wild ones. This work represents not only an exhaustive and updated bibliographical source but also a starting point for all those who want to contribute to the development of this fascinating research field.

(Department of Marine Sciences, Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy)

SURVIVAL AND Na^+/K^+ ATPASE SPECIFIC ACTIVITY IN RESPONSE TO ACUTE SALINITY CHANGE IN NEWLY HATCHED OBSCURE PUFFER, TAKIFUGU OBSCURUS, LARVAE

Jia-Jia Li, Ying Liu, Wei Wang, Zhou Yang, Ya-Fen Chen-2011

Journal of the World Aquaculture Society 42(2): 275–280

(Jiangsu Key Laboratory for Biodiversity and Biotechnology, School of Biological Sciences, Nanjing Normal University, 1 Wenyuan Road, Nanjing 210046, China)

THE RELATIVE IMPORTANCE OF SLOPPY FEEDING, EXCRETION, AND FECAL PELLET LEACHING IN THE RELEASE OF DISSOLVED CARBON AND NITROGEN BY *ACARTIA TONSA* COPEPODS

Grace K. Saba, Deborah K. Steinberg, Deborah A. Bronk-2011

Journal of Experimental Marine Biology and Ecology 404(1-2): 47-56

Abstract:

Crustacean zooplankton produce dissolved organic matter (DOM) and inorganic nutrients via sloppy feeding, excretion, and fecal pellet leaching. These different mechanisms of the release of metabolic products, however, have never been individually isolated. Our study was designed to determine the relative importance of these different modes on release of dissolved organic carbon (DOC), ammonium (NH_4^+), and urea from *Acartia tonsa* calanoid copepods feeding on the diatom *Thalassiosira weissflogii*. Excretion and sloppy feeding were the dominant modes of DOC production (80 and 20% of total DOC release, respectively) and NH_4^+ release (93 and 7% of total NH_4^+ release, respectively). Urea, however, was predominately produced via sloppy feeding and fecal pellet leaching (25% and 62% of total urea release, respectively). Urea contributed 20% of total measured nitrogen (TMN; NH_4^+ + urea) released from copepods, and constituted 100% of TMN released via fecal pellet leaching, 47% of TMN released via sloppy feeding, and only 3.5% of TMN released via excretion. TMN release was $> 100\%$ of copepod body N d^{-1} , resulting in low DOC:TMN release ratios (4.1 for sloppy feeding, 2.1 for cumulative release of sloppy feeding, excretion, and fecal pellet leaching). Our results suggest that the mechanism of release plays an important role in the amount of different forms of DOM, NH_4^+ , and urea available to bacteria and phytoplankton.

(Virginia Institute of Marine Science, College of William & Mary, P.O. Box 1346, Gloucester Point, VA 23062, USA; email of Grace K. Saba: saba@marine.rutgers.edu)

TEMPERATURE AND DISSOLVED OXYGEN REQUIREMENTS FOR SURVIVAL OF YELLOWFIN TUNA, *THUNNUS ALBACARES*, LARVAE

Jeanne B. Wexler, Daniel Margulies, Vernon P. Scholey-2011

Journal of Experimental Marine Biology and Ecology 404(1-2): 63-72

Abstract:

We determined the optimal water temperature and oxygen ranges for survival, development, and growth of yellowfin tuna (*Thunnus albacares*) eggs and yolk-sac and first-feeding larvae by conducting a series of experiments between 2004 and 2006 at the Achotines Laboratory on the Pacific coast of the Republic of Panama.

Based on the results of our experiments, yolk sac and first-feeding yellowfin larvae exhibited lethal limits for their survival at temperatures less than 21 °C and greater than 33 °C. Embryos hatched alive at all temperatures tested except 36 °C; however, larvae were malformed after hatching at temperatures < 20 °C and ≥ 34 °C. Egg and larval development were significantly slower at mean incubation temperatures < 23 °C. Mean egg diameters were significantly greater at mean incubation temperatures < 26 °C compared with those incubated at temperatures > 27 °C. Within the temperature range for survival and normal development, mean specific growth rates in weight for larvae after 2 days of feeding maintained at mean temperatures of 21.3 °C, 26.6 °C, 27.5 °C, and 31.5 °C were 1.8%, 20.9%, 27.2%, and 45.0%, respectively. The optimal range of temperatures for rapid growth and moderate to high survival in first-feeding larvae was from about 26° to 31 °C.

Lethal conditions (100% mortality) for larvae after hatching and shortly after the onset of first feeding occurred at dissolved oxygen concentrations of < 2.2 mg O_2 L^{-1} ($< 34\%$ oxygen saturation) at temperatures between 26° and 29 °C. Significantly lower survival first occurred for first-feeding larvae when the larvae were exposed to dissolved oxygen concentrations of 2.65 mg O_2 L^{-1} (40.4% oxygen saturation).

Based on our experimental results, critical depths for survival of yolk-sac and first-feeding yellowfin larvae within the Panama Bight of the Pacific Ocean would occur at depths less than 30 m during the upwelling season and at depths less than 50 m during the reduced upwelling season, based on temperature alone. Limiting oxygen levels may occur at depths greater than 30 m during the upwelling season and greater than 50 m during the reduced upwelling season.

(Inter-American Tropical Tuna Commission, 8604 La Jolla Shores Drive, La Jolla, California 92037–1508, USA; email of Jeanne B. Wexler: jwexler@iattc.org)

FIRST MOLECULAR EVIDENCE OF DIATOM EFFECTS IN THE COPEPOD *CALANUS HELGOLANDICUS*

Chiara Lauritano, Marco Borra, Ylenia Carotenuto, Elio Biffali, Antonio Miralto, Gabriele Procaccini
Adrianna Ianora-2011

Journal of Experimental Marine Biology and Ecology 404(1-2): 79-86

Abstract:

In this study we develop gene expression tools in *Calanus helgolandicus* to study the effects of toxic diatom diets on copepod fitness and survival. We demonstrate that when adult females are fed on the control dinoflagellate *Prorocentrum minimum* and the flagellate *Rhodomonas baltica*, which are not known to produce toxic oxylipins, there are no significant changes in alpha- and beta-tubulin (microtubule subunits) gene expression levels. By contrast, the oxylipin-producing diatom *Skeletonema marinoi* influences tubulin expression levels which were markedly down-regulated. We scored a panel of putative reference genes (ACT, EFA, GAPDH, 18S, S7, S20, ATPs, UBI and IST) and found that two (S20 and S7) were highly stable in the tested conditions and can be used for further experiments. To normalize reverse transcription-quantitative real time polymerase chain reaction (RT-qPCR) data we also used the third best reference gene, GAPDH, considering the possibility that the two ribosomal proteins could be co-regulated. This pilot study will pave the way for further investigations on which genes are affected by diatom diets and clarify when and if a stress response or a detoxification mechanism becomes visible in *C. helgolandicus*. Moreover, the RT-qPCR analysis presented here may also be useful to study the effects of other diets and/or environmental factors such as salinity, temperature, pollution and other toxic compounds, on gene expression levels in this copepod species.

(Stazione Zoologica Anton Dohrn, Villa Comunale I, 80121 Napoli, Ital ; email of Chiara Lauritano: chiara.lauritano@szn.it)

PRIMING THE PROPHENOLOXIDASE SYSTEM OF *ARTEMIA FRANCISCANA* BY HEAT SHOCK PROTEINS PROTECTS AGAINST *VIBRIO CAMPBELLII* CHALLENGE

Kartik Baruah, Jayant Ranjan, Patrick Sorgeloos, Thomas H. MacRae, Peter Bossier-2011

Fish & Shellfish Immunology 31(1): 134-141

Abstract:

Like other invertebrates, the brine shrimp *Artemia franciscana* relies solely on innate immunity, which by definition lacks adaptive characteristics, to combat against invading pathogens. One of the innate mechanisms is melanisation of bacteria mediated by the activation of the prophenoloxidase (proPO) system. The 70 kDa heat shock proteins (Hsp70) derived from either prokaryote (*Escherichia coli*) or eukaryote (*Artemia*), well conserved and immune-dominant molecules, protect *Artemia* against *Vibrio campbellii*. However, the molecular mechanisms by which these proteins protect *Artemia* against *Vibrio campbellii* infection are unknown. Here we demonstrated that feeding gnotobiotically grown *Artemia* with either *Artemia* Hsp70 or the *E. coli* Hsp70 equivalent DnaK, each overproduced in *E. coli*, followed by *V. campbellii* challenge enhanced the proPO system, at both mRNA and protein activity levels. Additionally, the *Artemia* fed with these proteins survived well in a *Vibrio* challenge assay. These results indicated that Hsp70s derived from either prokaryotic or eukaryotic sources generate protective immunity in the crustacean *Artemia* against *V. campbellii* infection by priming the proPO system. This is apparently the first *in vivo* report on priming activity of Hsp70 in an invertebrate.

(Faculty of Bioscience Engineering, Laboratory of Aquaculture & Artemia Reference Center, Ghent University, Rozier 44, Gent 9000, Belgium; email of Peter Bossier: peter.bossier@ugent.be)

TOTAL LIPID AND FATTY ACID COMPOSITION OF BRILL EGGS *SCOPHTHALMUS RHOMBUS* L. RELATIONSHIP BETWEEN LIPID COMPOSITION AND EGG QUALITY

Ismael Hachero Cruzado, Marcelino Herrera, Daniel Quintana, Ana Rodiles, José I. Navas, Antonio Lorenzo, Eduardo Almansa-2011

Aquaculture Research 42(7): 1011–1025

Abstract:

The present study examines the total lipid (TL) and fatty acid (FA) composition in eggs of brill *Scophthalmus rhombus* L. and the possible relationships with their quality parameters. Wild broodstocks were caught and maintained in captivity until eggs were collected. A lipid characterization of each egg batch was conducted in TL, lipid classes (LC) and FA of TL. The TL content was lower

than the values reported for other flatfish species, showing high levels of sterol esters (SE). High viability rates were related to higher lipid reserves. Higher cholesterol (CHO) was linked to higher egg viability, whereas SE could have an opposite effect. Comparison of female quality showed that lipid composition was more related to egg batches than to individual females. However, multivariate analysis did not show a clear correlation between lipid composition and brill egg quality, neither as individual components nor as a whole profile of LC or FA. Our results suggest that some lipid components (phosphatidylcholine, CHO, SE, monounsaturated, eicosapentaenoic acid) could be related to differences in spawning quality, although these were not the only factors involved in these differences. Thus, these lipid components could be considered to be descriptors of the differences found in the rates of brill quality.

(Instituto de Investigacion y Formacion Agraria y Pesquera de Andalucia (IFAPA), Centro Agua del Pino, Huelva, Spain ; email of Ismael Hachero Cruzado: ismael.hachero.ext@juntadeandalucia.es)

EFFECTS OF DIETARY LEVELS AND RATIO OF PHOSPHATIDYLCHOLINE AND PHOSPHATIDYLINOSITOL ON THE GROWTH, SURVIVAL AND DEFORMITY LEVELS OF ATLANTIC COD LARVAE AND EARLY JUVENILES

Øyvind J. Hansen, Velmurugu Puvanendran, Jens Petter Jøstensen, Christian Ous-2011

Aquaculture Research 42(7):1026–1033

Abstract:

Effects of two weaning diets that differed in phospholipid (PL) classes on growth, survival and deformities of cod larvae and early juveniles were evaluated. Cod larvae were fed rotifers until 21 days post hatch (dph) and then weaning onto dry diet started. One group of larvae were fed a control diet with low levels of phosphatidylcholine (PC), PE and phosphatidylinositol (PI) and the other group of larvae were fed with an experimental diet containing higher levels of PC, PE and PI. Larvae fed with the control diet were significantly smaller than larvae fed with the experimental diet at the end of the experiment. Swim bladder abnormalities were significantly higher in larvae fed with control diet at 35 dph than the larvae fed with experimental diet; however, no significant difference was evident at 42 dph. Vertebral deformities were significantly higher in larvae fed with control diet and scoliosis was significantly different between the treatments. Survival was also significantly higher in the experimental group. Our results indicate that dietary levels of PL, PC and PI may affect the cod larval growth, survival and deformities. More detail studies are needed to find out the optimal levels of these important PL classes in larval cod diets.

(Nofima marine, Tromsø, Norway; email of Øyvind J. Hansen: oyvind.j.hansen@noçma.no)

SHORT COMMUNICATION

EFFECTS OF MECHANICAL PERTURBATION AT VARIOUS TIMES DURING INCUBATION ON EGG SURVIVAL, HATCHING AND MALFORMATION RATES IN THE RAINBOW TROUT *ONCORHYNCHUS MYKISS*, AND THE INFLUENCE OF POST-OVULATORY OOCYTE AGEING

Sylvain Milla, Elisabeth Sambroni, Patrick Kestemont, Bernard Jalabert-2011

Aquaculture Research 42(7): 1061–1065

(The University of Namur (FUNDP), Unite de Recherche en Biologie des Organismes (URBO), Namur, Belgium; email of Sylvain Milla: sylvain.milla@fundp.ac.be)

SEDIMENT CORES FROM LAKE URMIA (IRAN) SUGGEST THE INHABITATION BY PARTHENOGENETIC ARTEMIA AROUND 5,000 YEARS AGO

R. Manaffar, S. Zare, N. Agh, A. Siyabgods, S. Soltanian, F. Mees, P. Sorgeloos, P. Bossier, G. Van Stappen-2011

Hydrobiologia 671(1): 65-74

Abstract :

In Lake Urmia area, northwestern Iran, parthenogenetic Artemia and the bisexual Artemia urmiana Günther 1890 are found to occupy different ecological niches determined by salinity. Given the

fluctuations of the lake over geological times, we thus hypothesized that species identification of *Artemia* cysts, buried in the sediments, can provide information on lake conditions in the past. Therefore, encysted embryos of *Artemia* were recovered from lake sediments by augering at a site near the present shoreline. Cysts and associated plant remains from two studied levels yielded radiocarbon ages in the range 5,000–6,700 YBP. For determination of the type of *Artemia*, the constant synonym mutation in exon-7 of the Na/K ATPase gene was verified, and the diameter of the recovered cysts was compared with that of modern cysts from the Lake Urmia region. The results show that the cysts represent a parthenogenetic type of *Artemia*, whose cyst diameter is somewhat different from that of present-day local parthenogenetic *Artemia*. The present study firstly confirms the stability of DNA in ancient *Artemia* cysts for molecular analysis. Moreover, it suggests variation in Lake Urmia's conditions over time, and based on comparison with salinity preferences of contemporary *Artemia* populations, it more specifically suggests that Lake Urmia was a brackish lake dominated by a parthenogenetic *Artemia* population in the geological period sampled. It finally illustrates how, like in the study of freshwater propagule banks, paleogenetic analysis of *Artemia* DNA recovered from sediment cores can be used as a tool in the paleoecological study of generally highly fluctuating saline habitats.

(*Artemia* and Aquatic Animals Research Institute, Urmia University, PO Box 165, Urmia, Iran; email of Gilbert Van Stappen: gilbert.vanstappen@ugent.be)
