
INFORMATION OF INTEREST

VLIZ Library Acquisitions no

- [470 May 28, 2010](#)
 - [471 June 04, 2010](#)
 - [473 June 18, 2010](#)
 - [474 June 25, 2010](#)
 - [477 July 16, 2010](#)
-

SENEGALESE SOLE LARVAE GROWTH AND PROTEIN UTILIZATION IS DEPRESSED WHEN CO-FED HIGH LEVELS OF INERT DIET AND ARTEMIA SINCE FIRST FEEDING

S. Engrola, M.T. Dinis, L.E.C. Conceição-2010

Aquaculture Nutrition 16(5) : 457–465

Abstract:

A large effort has been dedicated in the past years to the development of nutritional balanced inert diets for marine fish larvae in order to suppress the nutritional deficiencies of live feed. In this study growth performance, Artemia intake, protein digestibility and protein retention were measured for Senegalese sole (*Solea senegalensis* Kaup), in order to provide insight into how protein utilization affects growth performance. Three feeding regimes were tested: ST – standard live feed; ArtRL – live feed and 20% Artemia replacement with inert diet (dry matter basis) from mouth opening; ArtRH – live feed and 58% Artemia replacement with inert diet from mouth opening. Artemia intake and protein metabolism were determined at 6, 15 and 21 days after hatching using ¹⁴C-labelled Artemia protein and subsequent incubation in metabolic chambers. At the end of the experiment, sole fed exclusively with live feed were significantly larger than sole from Artemia replacement treatments. Protein digestibility decreased during sole ontogeny, and more sharply in ArtRH sole. Concomitantly retention efficiency increased during ontogeny but with a slight delay in ArtRH sole. Senegalese sole larvae growth and protein utilization is depressed when co-fed high levels of inert diet and Artemia, mostly during metamorphosis climax.

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

INTERACTIVE EFFECTS OF DIETARY VITAMIN C AND PHOSPHOLIPID IN MICRO-BOUND DIET FOR GROWTH, SURVIVAL, AND STRESS RESISTANCE OF LARVAL RED SEA BREAM, PAGRUS MAJOR

T. Ren, S. Koshio, Zh.-Q. Jiang, S. Yokoyama, C.F. Komilus, J. Gao, M. Ishikawa-2010

Aquaculture Nutrition 16(5) : 475–482

Abstract:

This study was conducted to examine the effects of dietary ascorbic acid (AsA) and phospholipid (PL) and their interaction on growth, survival, and stress resistance in red sea bream larvae. Twenty-six days old red sea bream were fed nine micro-bound diets supplemented three levels of AsA (0, 800 and 1600 mg kg⁻¹ diet) and PL (0, 20 and 40 g kg⁻¹ diet) for 15 days. Dietary AsA and PL were both significant factors on survival rates. There was also an interaction between dietary AsA and PL on survival rate ($P < 0.05$). The larvae fed 800 or 1600 mg kg⁻¹ AsA with 40 g kg⁻¹ PL diets showed the highest survival rate, with values similar to those of the live-food supplemented group. Stress resistance against low salinity exposure significantly increased with increased dietary level of AsA and PL. However, significant interaction of AsA and PL was not detected. The larvae fed 1600 mg kg⁻¹ AsA with 40 g kg⁻¹ PL diet showed the highest stress resistance among all diets, but it was not significantly different than that of larvae fed 800 mg kg⁻¹ AsA with 40 g kg⁻¹ PL diet. This study clearly demonstrated that combined use of AsA and PL can improve survival of 26–40 days posthatching red sea bream larvae.

Moreover, the present study suggested that 800 mg kg⁻¹ AsA with 40 g kg⁻¹ PL in diet was needed for producing high quality seedling under the stressful conditions.

(Key Laboratory of Mariculture and Biotechnology, Ministry of Agriculture, Dalian Fisheries University, 52 Heishijiao Street, Dalian 116023, China; email of T. Ren: sea_bream@hotmail.com)

EFFECTS OF DIETARY DOCOSAHEXAENOIC ACID (22:6N-3) AND ARACHIDONIC ACID (20:4N-6) ON THE GROWTH, SURVIVAL, STRESS RESISTANCE AND FATTY ACID COMPOSITION IN BLACK SEA BASS CENTROPRISTIS STRIATA (LINNAEUS 1758) LARVAE
Troy C. Rezek, Wade O. Watanabe, Moti Harel, Pamela J. Seaton-2010

Aquaculture Research 41(9): 1302–1314

Abstract:

The objectives of this study were to determine the effects of the dietary docosahexaenoic acid (DHA) to arachidonic acid (ARA) ratio on the survival, growth, hypersaline stress resistance and tissue composition of black sea bass larvae raised from first feeding to metamorphic stages. Larvae were fed enriched rotifers *Brachionus rotundiformis* and *Artemia nauplii* containing two levels of DHA (0% and 10% total fatty acids=TFA) in conjunction with three levels of ARA (0%, 3% and 6% TFA). On d24ph, larvae fed the 10:6 (DHA:ARA) treatment showed significantly ($P<0.05$) higher survival (62.3%) than larvae fed 0:0 (DHA:ARA) (27.4%). Notochord length and dry weight were also significantly ($P<0.05$) greater in the 10:6 (DHA:ARA) treatment (8.65 mm, 2.14 mg) than in the 0:0 (DHA:ARA) (7.7 mm, 1.65 mg) treatment. During hypersaline (65 g L⁻¹) challenge, no significant differences ($P>0.05$) were observed in the median survival time (ST50) between larvae fed 10% DHA (ST50=25.6 min) and larvae fed 0% DHA (ST50=18.2 min). The results suggested that black sea bass larvae fed prey containing 10% DHA with increasing ARA within the range of 0–6% showed improved growth and survival from first feeding through metamorphic stages.

(Center for Marine Science, University North Carolina Wilmington, 601 South College Road, Wilmington, NC 284035927, USA; email of T. C. Rezek: rezekt@uncw.edu)

REVIEW ARTICLE: LIVE PREY FIRST FEEDING REGIMES FOR SHORT-SNOURED SEAHORSE HIPPOCAMPUS HIPPOCAMPUS (LINNAEUS, 1758) JUVENILES

Francisco Otero-Ferrer, Lucía Molina, Juan Socorro, Rogelio Herrera, Hipólito Fernández-Palacios, María Soledad Izquierdo-2010

Aquaculture Research 41: e8-e19

Abstract:

As with many species of seahorses, *Hippocampus hippocampus* wild populations are being subjected to uncontrolled exploitation in their natural environment. Thus, aquaculture could contribute to satisfy the commercial demand for animals while promoting the recovery of wild stocks. The present study was conducted to compare the effect of the substituting *Artemia nauplii* with rotifers for first feeding seahorse juveniles. Survival, growth and biochemical composition of prey organisms and fish were studied during the feeding trial. In addition, to help the biometric study, an anaesthetic test was also carried out using clove oil. The results showed excellent survival (average 60%) in juveniles exclusively fed with *Artemia*, with better values than those reported previously obtained by other authors for this species. By comparison, high mortality and poor growth were observed during first feeding with seahorses fed on rotifers. This could have been related to the lower energy intake and poorer nutritional value of the rotifers. Furthermore, clove oil concentrations of 25 ppm were found to work well as an anaesthetic for seahorse juveniles. Overall, first feeding *Artemia* alone was found to be an efficient and simplified method for feeding young *H. hippocampus* fry, building the principles for their culture for ornamental or re-stocking purposes.

(Grupo de Investigacion en Acuicultura, Universidad de las Palmas de Gran Canaria & Instituto Canario de Ciencias Marinas, PO Box 56,35200 Telde, Las Palmas Canary Islands, Spain ; email of Francisco Otero-Ferrer: francesco_25@hotmail.com)

DIETARY N-3/N-6 RATIO AFFECTS THE BIOCHEMICAL COMPOSITION OF EURASIAN PERCH (*PERCA FLUVIATILIS*) SEMEN BUT NOT INDICATORS OF SPERM QUALITY

Emilie Henrotte, Vojtech Kaspar, Marek Rodina, Martin Psenicka, Otomar Linhart, Patrick Kestemont-2010

Aquaculture Research 41: e31-e38

Abstract:

In general, the effects of dietary fatty acids (FA) on sperm quality have received less attention than egg quality, and were never studied in perch. This study investigated the effects of dietary FAs on the quality and chemical composition of sperm in Eurasian perch (*Perca fluviatilis*). Two experimental diets containing 16% lipids and 45% proteins were compared. The n-3/n-6 ratios tested were 0.2 for diet 1 (D1) and 7.0 for diet 2 (D2). No significant effects of the n-3/n-6 ratio were observed on the sperm characteristics, either in terms of the sperm volume (around 1.2mL) and density, spermatozoa motility (94%) and velocity, or the sperm osmolality. All these parameters corresponded to semen of good quality in Eurasian perch. Interestingly, both the FA composition and the lipid class profile of the semen were correlated to the tested diet. However, basal levels of certain highly unsaturated FAs such as eicosapentaenoic acid, 20:5 n-3 and docosahexaenoic acid, 22:6 n-3, were maintained in the sperm irrespective of the diet tested. Perch semen was characterized by high levels of cholesterol, phosphatidylethanolamine and phosphatidylcholine. In conclusion, the dietary n-3/n-6 ratio affects the lipid composition of perch semen but not the indicators of sperm quality.

(Unit of Research in Organismal Biology, University of Namur, 61 rue de Bruxelles, B-5000 Namur, Belgium; email of E Henrotte: emilie.henrotte@fundp.ac.be)

SPAWNING BEHAVIOUR, EARLY DEVELOPMENT AND FIRST FEEDING OF THE BLUESTRIPED ANGELFISH [*CHAETODONTOPLUS SEPTENTRIONALIS* (TEMMINCK & SCHLEGEL, 1844)] IN CAPTIVITY

Ming-Yih Leu, Pei-Jie Meng, Chao-Sheng Huang, Kwee Siong Tew, Jimmy Kuo, Chyng-Hwa Liou-2010

Aquaculture Research 41: e39-e52

Abstract:

Successful natural spawning of *Chaetodontoplus septentrionalis* in captivity from 19 March to 11 May, 2008 is described for the first time. A single male dominates a harem of two females, spawning with each at dusk, from 10 min before to 20 min after sunset. Each female laid an average 119-103 eggs during the spawning period. Fertilized eggs were spherical, buoyant and had a diameter of 0.83±0.02 mm (mean±SD). Embryonic development lasted 15-18 h at 28.1 °C. Newly hatched larvae were 1.60±0.07mm in total length (TL) with 27 myomeres. Larvae completed yolk absorption within 3 days post hatching (ph) at 3.01±0.08mm TL. Ten days ph, the larvae had attained 3.95±0.12mm TL. Larvae were fed either 100% s-type rotifers (*Brachionus rotundiformis*), 100% copepods (*Microsetella* sp.), a combination of the two (50%:50%) or without live feed (starved control) to determine the effect of live feed on the survival rate. The survival was significantly ($P<0.001$) higher in larvae fed a combination of diet than the others. These results indicate that *C. septentrionalis* is a potential species for captive breeding programs and the use of a combination of diet (s-type rotifers and copepods) may be a suitable first food for the larvae.

(Department of Aquaculture, National Taiwan Ocean University, Keelung 202, Taiwan; email of M.-Y. Leu: myl@nmma.gov.tw)

EGG AND LARVAL QUALITY, AND EGG FATTY ACID COMPOSITION OF EURASIAN PERCH BREEDERS (*PERCA FLUVIATILIS*) FED DIFFERENT DIETARY DHA/EPA/AA RATIOS

Emilie Henrotte, Robert S N M Mandiki, Agbohessi T Prudencio, Michael Vandecan, Charles Mélard, Patrick Kestemont-2010

Aquaculture Research 41: e53-e61

Abstract:

In Eurasian perch (*Perca fluviatilis*), the variability in spawning quality is a major limiting factor for successful production, especially when breeders are fed with an artificial diet. The influence of the

dietary DHA/EPA/AA ratio on the egg and larval quality and on the fatty acid and lipid class composition of eggs has been investigated in perch broodstock. Two experimental diets (16% lipids) with two different DHA/EPA/AA ratios, D1 (3/2/2) and D2 (23/9/1), were compared with a natural diet consisting of cultured carp juveniles, CC (10/10/1) and with a commercial diet for salmonids, CDS (14/16/1). Percentages of fertilization and hatching were comparable between fish fed D1, D2 and CC, with the highest hatching rate observed for D1 (63.5 +/-3.8%). These diets supported better values than the CDS. Larval survival and TL50 observed after osmotic stress were higher for the D1 group, followed by larvae produced by fish fed D2 and CC. Larvae from fish fed D1, D2 and CC were significantly more robust than larvae from the CDS group. Differences were observed regarding the fatty acid (FA) profile in the eggs, which was related to the dietary FA composition. The results indicate that a ratio of 3/2/2 seemed to be effective for obtaining eggs and larvae of good quality.

(University of Namur, Unit of Research in Organismal Biology, 61 rue de Bruxelles, B-5000 Namur, Belgium; email of Emilie Henrotte: emilie.henrotte@fundp.ac.be)

EFFECT OF STORAGE TIME AND CRYOPROTECTANT CONCENTRATIONS ON THE FERTILIZATION RATE AND HATCHING RATE OF CRYOPRESERVED SPERM IN RED SEABREAM (*PAGRUS MAJOR* TEMMINCK & SCHLEGEL, 1843)

Qing Hua Liu, Ya Kun Chen, Zhi Zhong Xiao, Jun Li, Shi Hong Xu, Xue Hui Shi-2010

Aquaculture Research 41: e89-e95

Abstract:

This study examined the effects of storage time and cryoprotectant concentrations on the post-thaw sperm of red seabream, *Pagrus major*. Sperm treated with 12%, 15%, 18% and 21% DMSO were cryopreserved for 10, 30, 60 and 360 days, and fertilization and hatching rates were analysed. For all groups, there were no differences in the fertilization rates and hatching rates between sperm cryopreserved for 60 days and fresh sperm (98.8 +/- 0.8%, 96.4 +/- 1.3%). However, for sperm cryopreserved for 360 days, both fertilization rates (88.6 +/- 3.0% to 7.0 +/- 1.9%) and hatching rates (79.4 +/- 7.2% to 3.3 +/- 0.8%) decreased drastically. Furthermore, the cryoprotectant concentrations affected sperm quality significantly ($P < 0.05$). When cryopreserved for 360 days, sperm treated with 15% DMSO obtained the best results compared with other concentrations. We suggest that 15% DMSO may be an effective cryoprotectant for long-term sperm cryopreservation of red seabream.

(Center of Biotechnology R&D, Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, China; email of J Li: junli@ms.qdio.ac.cn)

SURVIVAL AND GROWTH OF SELECTED MARINE FISH LARVAE FIRST FED WITH EGGS AND ENDOTROPHIC LARVAE OF THE SEA URCHIN *PARACENTROTUS LIVIDUS*

Joao Gago, Tiago Martins, Orlando J Luis, Pedro Pousao-Ferreira-2010

Aquaculture Research 41: e96-e108

Abstract:

Two sets of experiments were carried out to evaluate the potential of eggs and endotrophic larvae of captive *Paracentrotus lividus* as alternative live prey for marine fish larvae first feeding. The first consisted in rearing sparids, *Diplodus sargus* and *Sparus aurata*, larvae until 15 days after hatching in a recirculation system. Compared with the commonly used live prey rotifer *Brachionus* spp. general lower values of survival and growth were obtained when fish larvae were fed with the alternative live prey. Among these, eggs showed to be the preferred feeding. Broodstock feed showed to play a fundamental role on prey quality and consequent fish larvae survival. In the second set of experiments, the 24-h ingestions of the first feeding larvae in static water were determined for five currently cultured fish larvae species. Except for larger and more predatory *Dicentrarchus labrax* larvae, there was a trend for higher *P. lividus* egg ingestion, followed by pre-plutei and prisms. Prey size, colour and movement affected food selection by fish larvae. It is concluded that, in spite of the alternative live prey being readily consumed by all tested fish larvae, they cannot however presently compete with rotifers in marine fish larvae first feeding.

(Laboratório Marítimo da Guia, Centro de Oceanografia, Faculdade de Ciências, Avenida Nossa Senhora do Cabo 939, 2750-354 Cascais, Portugal; email of J.Gago: joaolontra@hotmail.com)

EFFECT OF EPA/DHA RATIOS ON THE GROWTH AND SURVIVAL OF GALAXIAS MACULATUS (JENYNS, 1842) LARVAE REARED UNDER DIFFERENT SALINITY REGIMES

Patricio Dantagnan, Aliro Bórquez, Adrián Hernández, Marisol Izquierdo-2010

Aquaculture Research 41(9): e239–e244

Abstract:

Despite the importance of certain highly unsaturated fatty acids in osmotic regulation, few studies have been addressed to determine the essential fatty acid requirements for a given species cultured under different salinities. As *Galaxias maculatus* is a diadromic species, the present study aimed to determine the effect of salinity on the optimum dietary EPA/docosahexaenoic (DHA) ratio for survival and growth during the larval stages. Larvae were fed for 20 days with rotifers containing two different EPA/DHA ratios (low: 0.64 and high: 2.18) at three different salinities (0, 10 and 15 g⁻¹). The results of this study showed a marked effect of water salinity on larval dietary lipid utilization in *G. maculatus* larvae. These results suggested that *G. maculatus* larvae reared at higher salinities may have a higher dietary requirement for DHA, whereas larvae reared at 0‰ showed higher requirements for EPA. The overall results of the present study indicate that even small changes in salinity can determine the optimum dietary EPA/DHA ratio and the quantitative essential fatty requirements of fish. This may have important repercussions and affect the rearing performance of *G. maculatus* cultured under different salinities.

(Escuela de Acuicultura, Facultad de Recursos Naturales, Universidad Católica de Temuco, PO Box 15-D, Temuco, Chile; email of A Hernández: ajhernandez@uct.cl)

DIETARY SUPPLEMENTATION OF MANNAN OLIGOSACCHARIDE ON WHITE SEA BREAM (DIPLODUS SARGUS L.) LARVAE: EFFECTS ON DEVELOPMENT, GUT MORPHOLOGY AND SALINITY TOLERANCE

Arkadios Dimitroglou, Simon J Davies, John Sweetman, Pascal Divanach, Stavros Chatzifotis-2010

Aquaculture Research 41(9): e245–e251

Abstract:

The influence of dietary mannan oligosaccharide (MOS) on the development, gut integrity and quality (in respect of stamina and survivability) of white sea bream *Diplodus sargus* L. larvae was investigated. White sea bream larvae were held under appropriate rearing conditions and fed *Artemia*, enriched by A1 DHA Selco™ with the addition or absence of MOS (Bio-Mos®). The results indicated that larval growth performance and survivability were not affected by the MOS supplementation. Light microscopy revealed that MOS supplementation significantly improved the intestinal morphology by increasing the villi surface area by over 12%. Transmission electron microscopy revealed that MOS supplementation increased the microvilli length by 26% compared with the control. Salinity challenge experiments showed that MOS significantly increased larval stamina and survival in both 0 and 60 mg L⁻¹ salinity water by 13% and 22.9% respectively. These improvements in the larval quality at the early stages of fish development are important for the efficiency of intensive hatchery production.

Arkadios Dimitroglou¹, Simon J Davies¹, John Sweetman², Pascal Divanach³ & Stavros Chatzifotis³
(Department of Biological Sciences, University of Plymouth, Plymouth, PL4 8AA, UK; email of A. Dimitroglou: arkadios.dimitroglou@gmail.com)

EFFECT OF PARTIAL HARVESTING STRATEGIES ON ARTEMIA BIOMASS PRODUCTION IN VIETNAMESE SALT WORKS

Nguyen Thi Ngoc Anh, Nguyen Van Hoa, Gilbert Van Stappen, Patrick Sorgeloos-2010

Aquaculture Research 41(9): e289–e298

Abstract:

The effect of partial harvest strategies on the production of *Artemia* biomass was evaluated for 12 weeks under Vietnamese salt farm conditions. The initial stocking density was 100 nauplii L⁻¹. After 3 weeks of inoculation, *Artemia* adults were partially harvested at intervals of 1, 3, 6 and 9 days starting with an initial quantity of 30 kg ha⁻¹ day⁻¹ at first harvest, and then the quantity of harvestable

biomass was adjusted according to the standing stock present in the culture pond, combined with the time needed to harvest these quantities and with the weight of biomass harvested in each pond. The results showed that in most cases, the total densities were not significantly different among harvesting frequencies ($P>0.05$). However, a relatively higher *Artemia* adult density and its standing stock were better maintained in the 3-day than in the 1-day interval, and were significantly higher compared with the other two harvesting frequencies. The total biomass yields were the highest (1587 kg ha⁻¹) in the 3-day harvesting interval, followed by 1-, 6- and 9-day harvesting interludes, corresponding to 1323, 1091 and 975 kg ha⁻¹ respectively. However, no statistical difference was observed between the 1- and the 3-day interval as well as between the 6- and the 9-day harvest schemes ($P>0.05$). The results of this study suggest that partial harvest of *Artemia* biomass performed every 3 days appears to be an appropriate strategy to enhance biomass productivity.

(Laboratory of Aquaculture & *Artemia* Reference Center, Faculty of Bioscience Engineering, Ghent University, Ghent, Belgium; email of N T N Anh: ntnanh@ctu.edu.vn)

FEEDING STRATEGIES FOR STRIPED BLENNY MEIACANTHUS GRAMMISTES LARVAE

Ike Olivotto, Chiara Carla Piccinetti, Matteo Alessandro Avella, Carles Molina Rubio, Oliana Carnevali-2010

Aquaculture Research 41(9): e307–e315

Abstract:

Rotifers and *Artemia salina* nauplii are the most widely used live prey for newly hatched larvae, but they do not always promote optimal survival and growth. Alternative food sources such as copepods, which bypass these inadequacies and promote adequate growth, are needed and they are viewed with considerable interest by the scientific community. The aim of the present study was to test two different diets [rotifers and *A. salina* nauplii (group A) and a mixture (group B) of rotifers/*Tisbe* spp. copepods and *A. salina* nauplii/copepods] during the larval rearing of the striped blenny *Meiacanthus grammistes*. The analysis of the survival rate, size (total length and wet weight) and metamorphosis time during the larval phase of this species showed that *Tisbe* spp. administration can significantly improve larval survival and growth and also reduce the metamorphosis time. The results obtained are related to the fatty acid content of the live prey used and are essential in order to improve the captive production of *M. grammistes* through a closed system and, in turn, to preserve natural stocks.

(Dipartimento di Scienze del Mare, Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy; email of I. Olivotto: i.olivotto@univpm.it)

SHORT COMMUNICATION: THE EFFECTS OF INULIN ON GROWTH FACTORS AND SURVIVAL OF THE INDIAN WHITE SHRIMP LARVAE AND POSTLARVAE

Seyed Hossein Hoseinifar, Parviz Zare, Daniel Lee Merrifield-2010

Aquaculture Research 41(9): e348–e352

(Islamic Azad University, Young Researcher Club Pishva-Varamin Branch, Iran; email of S. H. Hoseinifar: hoseinifar@ut.ac.ir)

SHORT COMMUNICATION: EFFECTS OF SALINITY ON GROWTH AND SURVIVAL OF COMMON SNOOK CENTROPOMUS UNDECIMALIS (BLOCH, 1792) LARVAE

Nicole R. Rhody, Nadir Abi Nassif, Kevan L. Main-2010

Aquaculture Research 41: e357–e360

(Mote Marine Laboratory, Center for Aquaculture and Development, 1600 Ken Thompson Parkway, Sarasota, FL, USA; email of N. R. Rhody: nicole@mote.org)

AQUACULTURE SYSTEM DIVERSITY AND SUSTAINABLE DEVELOPMENT: FISH FARMS AND THEIR REPRESENTATION

Jérôme Lazard, Aurèle Baruthio, Syndhia Mathé, Hélène Rey-Valette, Eduardo Chia, Olivier Clément, Joël Aubin, Pierre Morissens, Olivier Mikolasek, Marc Legendre, Patrice Levang, Jean-Paul Blancheton, François René-2010

Aquatic Living Resources 23: 187–198

Abstract:

Initiatives for the sustainable development of aquaculture have so far focused on the production of codes of conduct, of best management practices, of standards etc., most of which have been developed by international organisations, the industrial sector and non governmental organisations. They were, to a large extent, produced using a “top down” process and inspired by models from intensive industrial shrimp and sea fish farming (mainly salmon). However, most of global aquaculture production comes from small- and medium-sized farms, essentially in Asia which contributes 92% of the total world aquaculture production volume. The objective of this article is to define the contours of systemic typologies that are able to express the sustainability conditions of aquaculture systems. The proposed approach builds on surveys of aquaculture systems which differ in terms of their biogeographical nature (temperate/tropical and north/south countries) or their farming techniques and their governance systems. This work is a prerequisite to any attempt at an individualised and comparative evaluation of specific aquaculture systems from either global or territorial viewpoints. In order to go beyond the cleavage of a typology based on the differentiation between developed and developing countries, three typologies were produced. These typologies allow for discriminatory variables to be identified such as for example the marketing methods or the pace of innovation: a structural typology, a functional typology and a systemic typology. Finally, the representations of aquaculture activity and of its sustainability that producers have of the 4 different types that emerge from the systemic typology were recorded and analyzed.

(CIRAD, UR Aquaculture et gestion des ressources aquatiques, TA B-20/01, avenue Agropolis, 34398 Montpellier Cedex 5, France; email of Jérôme Lazard : jerome.lazard@cirad.fr)

A STANDARD ECOTOXICOLOGICAL BIOASSAY USING EARLY LIFE STAGES OF THE MARINE FISH PSETTA MAXIMA

Lazhar Mhadhbi, Moncef Boumaiza, Ricardo Beiras-2010

Aquatic Living Resources 23: 209–216

Abstract:

Fish tests must be developed for both regulatory and conservation reasons, as such testing forms an indispensable component of integrated toxicity testing strategy for the marine environment. To standardise a fish embryo test, the acute toxicity of metals and polycyclic aromatic hydrocarbons (PAHs) to early life stages (ELS) of turbot (*Psetta maxima*) was studied. Embryos were exposed to dilutions of copper, cadmium, mercury, fluoranthene, phenanthrene, pyrene and naphthalene in darkness and under visible light. Hatching success, yolk sac alterations, pericardial edema, skeletal deformities and mortality were observed. The effective concentrations (EC50, EC10,) no observed effect concentration (NOEC) and the lowest observed effect concentration (LOEC) were determined at the end of the bioassays. Exposure to metals and PAHs in ecologically relevant concentrations, either in darkness or under artificial light, caused significant lethal and sublethal effects in turbot, such as alterations in yolk sac, pericardial edema and skeletal abnormalities. According to the 96 h EC50, the ranking of acute toxicity for metals was respectively: 47.4 (46.8–59.2) $\mu\text{g L}^{-1}$ Cu; 51.5 (20.9–91.7) $\mu\text{g L}^{-1}$ Cd, and 83.2 (62.3–125) $\mu\text{g L}^{-1}$ Hg. For PAHs, acute toxicities were 5.2 (4.3–6) $\mu\text{g L}^{-1}$ pyrene, 12.3 (6.4–12.7) $\mu\text{g L}^{-1}$ fluoranthene, 52.2 (30.4–82.7) $\mu\text{g L}^{-1}$ phenanthrene, and 142 (55–228) $\mu\text{g L}^{-1}$ naphthalene. Pyrene was consistently the most toxic PAH. In addition, light exposures were performed and photo-enhanced toxicity was found only for fluoranthene and pyrene. Turbot embryos were found to be more tolerant to metals and PAHs than were hatched larvae. These results suggest that, considering the short duration of the ELS turbot test and its high sensitivity, it is suitable for use as a standard test for marine fish.

(Universidad de Vigo, Toralla Marine Science Station, ECIMAT, 36331 Vigo, Spain; email of Lazhar Mhadhbi: lazhar@uvigo.es)

COMPARATIVE STUDY ON SEED PRODUCTION IN TWO STRAINS OF THE NILE TILAPIA OREOCHROMIS NILOTICUS L.

Mohammad T. Ridha-2010

Asian Fisheries Science 23(1): 1-8

Abstract:

This experiment was conducted to compare the spawning performance of the non-improved Nile tilapia *Oreochromis niloticus* (Chiclidae) strain (NS) with the Genetically Improved Strain of the Nile tilapia (GIFT) for 120 days. Three 0.43-m³ breeding tanks in a recycling water system were assigned for each strain and fish were stocked at 4-breeders/tank with a male to female ratio of 1:3. Water temperature was maintained at 29.0 ± 1.0 °C and seeds were harvested biweekly. Results showed no significant difference between the NS and GIFT strains in the total seed production tank-1 (3705 and 3030 seeds, respectively), relative fecundity (31.3 and 27.5 seeds kg female-1 day-1, and 10.1 and 8.0 seeds female-1 day-1, respectively), and system productivity (30.9 and 24.0 seeds m-2 day-1, respectively). No significant difference was observed in the spawning rate, inter-spawning intervals, spawning periodicity, seed composition and spawning synchrony between the two strains. Results indicated that under these experimental conditions, the spawning performance of the GIFT strain was not significantly affected by selective breeding for growth and only a slight decrease in fecundity would be expected in this improved strain.

EFFECT OF REARING CONTAINER'S COLOUR ON METAMORPHOSIS AND SURVIVAL OF LARVAE OF MACROBRACHIUM ROSENBERGII (DE MAN, 1879)

S. T. Shelke, S.S. Belsare, S.T. Indulkar-2010

Asian Fisheries Science 23(1):25-34

Abstract:

Macrobrachium rosenbergii larvae (IV stage) were reared in tubs having different colours viz, white, red, blue, dark-violet, grey and green. The time required for the appearance of first post-larvae was observed to be 37.3, 32.0, 29.5, 27.5, 34.0 and 35.8 days and the total amount of time required for obtaining post-larvae was 41.8, 36.3, 33.0, 31.5, 39.0 and 40.0 days in white (T1), red (T2), blue (T3), dark-violet (T4), grey (T5) and green (T6) colours respectively. Significantly less time was required for the metamorphosis of larvae to post-larvae in dark-violet tub as compared to other colours. However, there was no significant difference in grey and green colour treatments. Significantly higher survival (61.38%) was observed in dark-violet colored treatment, followed by 57.88% in blue, 51.63% in red, 43.38% in grey, 35.75% in green and 27.25% in white coloured tubs. The water parameters such as salinity, temperature, pH and dissolved oxygen were observed during the experimental period and were found to be within tolerance limit of *M. rosenbergii* zoeal larvae. Light-intensity in water varied in the range of 33.00 to 94.75 lux, 25.75 to 80.50 lux and 20.00 to 68.00 lux at 11:00, 15:00 and 18:00 hrs respectively in dark-violet, blue, red, grey, green and white colours. A significant difference ($P < 0.05$) in light-intensity was observed in various treatments. Significantly maximum light-intensity was recorded in white tub and minimum in dark-violet tub. Darker internal colour of rearing tubs significantly reduces the metamorphosis period and increases survival rate of larvae of *M. rosenbergii*.

NATURAL PRODUCTION OF ARTEMIA IN THE EVAPORATION PONDS OF A WATER TREATMENT PLANT IN SAUDI ARABIA

A.H. Al-Harbi, M. Dimaano-2010

Asian Fisheries Science 23(1): 35-43

Abstract:

Live food such as *Artemia* is considered to be an essential part of many crustacean and finfish hatcheries. The natural occurrence of the brine shrimp *Artemia* is reported for the first time in highly saline evaporation ponds of the water treatment plant at Al-Qassim Research Station of King Abdulaziz City for Science and Technology (KACST) in Saudi Arabia. The evaporation pond produced, during a 3-month period, more than 37 kg of *Artemia* cysts /3600 m² (wet weight). The highest biomass production (over 19 and 7 kg of wet and dry cysts/3600 m², respectively) was collected on March. The

hatching percentage decreased gradually throughout the trials and ranged from 73.4%-87.3%. The water quality of the ponds is also discussed in relation to the occurrence of *Artemia*.

INDUCED SPAWNING OF NATIVE THREATENED SPOTTED SNAKEHEAD FISH *CHANNA PUNCTATUS* WITH OVAPRIM

K. Marimuthu, M.A. Haniffa-2010

Asian Fisheries Science 23(1): 60-70

Abstract:

The spotted snakehead, *Channa punctatus*, is one of the native threatened fish species in India. In the present study the efficacy of Ovaprim in stimulating ovulation and spawning performance of this candidate fish was examined under captive condition. A total of 9 matured female and 18 male fishes with weights ranging from 63 to 80g, were randomly selected for three hormone dosages. Both male and female fishes in each hormone dosage were administered a dose of 0.2, 0.4, and 0.6 mL of Ovaprim/kg body weight (BW) respectively. Each breeding set consisted of two males and one female. The hormone-administered fishes were then placed into the concrete cement tanks for spawning. The breeding performance was assessed based on the number of eggs spawned, spawning response, percentage fertilization and percentage hatching. Partial spawning was observed with a dose of 0.2 ml Ovaprim/kg BW, while complete spawning was noticed in the medium dose (0.4 ml of Ovaprim/kg BW) and higher dose (0.6 ml of Ovaprim /kg BW) administered fishes. The highest number of eggs spawned ($p < 0.05$) was recorded when the females were injected with 0.4 ml of Ovaprim/kg body weight than those injected with other doses. The latency period and number of spawned eggs ranged from 24 -31 hrs and 2,164- 6,538 respectively. The highest fertilization (97.6%) and hatching rates (96.3%) were also observed at the medium dose ($P < 0.05$). With regard to hatching rates, no significant difference was noticed between the medium and low doses of Ovaprim administered groups. From the present study, it is evidenced that the synthetic gonadotropin-releasing hormone with a dopamine antagonist at a dose of 0.4 ml /kg BW could be used as an appropriate spawning agent for successful breeding and seed production of *C. punctatus* under captive conditions.

LABORATORY REARING OF THE PHARAOH'S CUTTLEFISH, *SEPIA PHARAONIS* (ERHENBERG, 1831) THROUGH MULTIPLE GENERATIONS IN A 'SEMI-CLOSED' WATER SYSTEM

Ditty Chacko, Jamila Patterson-2010

Asian Fisheries Science 23(2): 240-253

Abstract:

The pharaoh's cuttlefish, *Sepia pharaonis* were cultured in a 'semi-closed' water system through multiple generations. Eggs of *S. pharaonis* landed in overnight crab nets, gill nets and shrimp nets were collected and brought to the laboratory, incubated and the hatchlings were maintained throughout their life cycle. The hatchlings from the eggs collected from the wild were called G1 generation. Subsequent generations were named as G2 and G3 generations. Incubation period for the eggs were 21 ± 3 days, 21 ± 2 days and 21 ± 1 days, respectively for G1, G2 and G3 generations. The hatchling behaviour, as well as feeding and reproductive behaviours were recorded. Brine shrimp and post larvae of *Acetes indicus* were given during the initial days of culture, but switched to dead fish after 40 days. Daily growth rate was noted to be 0.72 mm in G1, 0.52 mm in G2 and 0.2 mm in G3 generations, respectively. Using simple and inexpensive filtration system *Sepia pharaonis* can be reared to marketable sizes in fishermen's backyards and serve as an additional source of income. This technique could also be employed in sea-ranching projects of *S. pharaonis*.

REPRODUCTIVE BIOLOGY OF SNAPPER (*PAGRUS AURATUS*) IN SUBTROPICAL AREAS OF ITS RANGE AND MANAGEMENT IMPLICATIONS OF REPRODUCTIVE DIFFERENCES WITH TEMPERATE POPULATIONS

Wayne D. Sumpton, Stuart Jackson-2010

Asian Fisheries Science 23(2): 194-207

Abstract:

Snapper (*Pagrus auratus*) (Bloch and Schneider) sampled from the waters of the Queensland east coast (20° to 28°S) spawned from June to October, at least three months earlier than the New Zealand snapper (36° to 44°S) and snapper from other temperate latitudes. The size at which snapper reached sexual maturity (26 to 30 cm FL) was broadly similar to other more temperate areas. However, the apparent faster growth rate of tropical snapper enabled them to reach sexual maturity at less than 2 years of age, more than a year earlier than in more temperate latitudes. This suggests that the attainment of sexual maturity in snapper is more likely to be based on size than age. There were also fish as old as 5 years that had not yet matured. No specific snapper spawning grounds were sampled and snapper with ripe gonads were found throughout the species distribution in Queensland. Snapper mainly spawned in the evening and early morning. The timing of the spawning season relative to the timing of the winter growth check formation may be partially responsible for the difficulty in interpreting snapper otoliths in subtropical areas.

OPTIMUM FOOD TYPE, FEEDING SCHEDULE AND PREY DENSITY FOR THE ZOEAL LARVAE OF THE CRUCIFIX CRAB, *CHARYBIS FERIATUS* (CRUSTACEA:DECAPODA:PORTUNIDAE)

Juliana C. Baylon-2010

Asian Fisheries Science 23(2): 159-173

Abstract:

Feeding experiments were carried out on the zoea larvae of the crucifix crab, *Charybdis feriatius*. The 1st experiment aimed to find out which among the rotifer *Brachionus* sp., brine shrimp *Artemia* sp. nauplii, and combination of both, would be a better diet to support survival, development of the zoeal larval stages (Z1-Z5) and metamorphosis to megalopa. In this experiment, the timing of introduction and cessation of rotifers, and co-feeding with brine shrimp nauplii was also determined. The 2nd experiment determined the density of *Artemia* nauplii that can support up to postmolt and the possibility of reducing prey density as zoeal stage progresses. Results showed high survival of Z1-Z2 larvae when fed purely with *Brachionus* but none of the larvae reached Z4 stage. When fed purely with *Artemia* nauplii, all the larvae died at Z3. Highest survival, fastest development and successful metamorphosis to megalopa was obtained on larvae fed with rotifers alone in Z1 and combination of rotifers and brine shrimp nauplii from Z2 onwards. Survival dropped when rotifers were removed from the diet in the later zoeal stages and when density of *Artemia* nauplii was gradually lowered from 2.0 nauplii ml⁻¹ at Z1 to 0.5 nauplii ml⁻¹ at Z5. Larvae fed with *Artemia* at a constant density of 2.0 nauplii ml⁻¹ in all zoeal stages (Z1-Z5) resulted to highest number of megalopa produced. These results advance the development of hatchery techniques for the crucifix crab, *C. feriatius*.

A DICER-1 GENE FROM WHITE SHRIMP *LITOPENAEUS VANNAMEI*: EXPRESSION PATTERN IN THE PROCESSES OF IMMUNE RESPONSE AND LARVAL DEVELOPMENT

Xuemei Yao, Lingling Wang, Linsheng Song, Huan Zhang, Chaohua Dong, Ying Zhang, Limei Qiu, Yaohua Shi, Jianmin Zhao, Yongkun Bi-2010

Fish & Shellfish Immunology 29(5): 565-570

Abstract:

Dicer is a member of the RNAase III family which catalyzes the cleavage of double-stranded RNA to small interfering RNAs and micro RNAs, and then directs sequence-specific gene silencing. In this paper, the full-length cDNA of Dicer-1 was cloned from white shrimp *Litopenaeus vannamei* (designated as LvDcr1). It was of 7636 bp, including a poly A tail, a 5'UTR of 136 bp, a 3' UTR of 78 bp, and an open reading frame (ORF) of 7422 bp encoding a putative protein of 2473 amino acids. The predicted amino acid sequence comprised all recognized functional domains found in other Dicer-1 homologues and showed the highest (97.7%) similarity to the Dicer-1 from tiger shrimp *Penaeus mondon*. Quantitative real-time PCR was employed to investigate the tissue distribution of LvDcr1 mRNA, and its expression in shrimps under virus challenge and larvae at different developmental stages. The LvDcr1 mRNA could be detected in all examined tissues with the highest expression level in hemocyte, and was up-regulated in hemocytes and gills after virus injection. These results indicated

that LvDcr1 was involved in antiviral defense in adult shrimp. During the developmental stages from fertilized egg to postlarva VII, LvDcr1 was constitutively expressed at all examined development stages, but the expression level varied significantly. The highest expression level was observed in fertilized eggs and followed a decrease from fertilized egg to nauplius I stage. Then, the higher levels of expression were detected at nauplius V and postlarva stages. LvDcr1 expression regularly increased at the upper phase of nauplius, zoea and mysis stages than their prophase. The different expression of LvDcr1 in the larval stages could provide clues for understanding the early innate immunity in the process of shrimp larval development.

(Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, Chin; email of Lingling Wang: wanglingling@ms.ac.cn)

EFFICACY OF HETEROLOGOUS AND HOMOLOGOUS HEAT SHOCK PROTEIN 70S AS PROTECTIVE AGENTS TO *ARTEMIA FRANCISCANA* CHALLENGED WITH *VIBRIO CAMPBELLII*

Kartik Baruah, Jayant Ranjan, Patrick Sorgeloos, Peter Bossier-2010

Fish & Shellfish Immunology 29(5): 733-739

Abstract:

The Hsp70 class of heat shock proteins (Hsps) has been implicated at multiple points in the immune response of both vertebrates and invertebrates. This class of chaperones is highly conserved in both sequence and structure, from prokaryotes to higher eukaryotes. In view of their high degree of homology, it was assumed that these Hsp70 proteins derived either from the prokaryotes or eukaryotes would have similar functions, especially in relation to their protective ability in a challenge assay. To verify this, we compared two evolutionary diverse Hsp70s, *Artemia* Hsp70 and *Escherichia coli* Hsp70 equivalent DnaK (each overproduced in *E.coli*), for their ability to protect *Artemia* against *Vibrio* challenge. Results showed that *Artemia* fed with *E. coli* producing *Artemia* Hsp70 or DnaK proteins, as assessed by immune-probing in western blots, survived better in a *Vibrio* challenge assay. The observed effects could be due to enhancement of the *Artemia* immune system as phenoloxidase activity was found to be increased by these proteins. These two Hsp70 proteins exhibit a high degree of homology, particularly in the peptide-binding domain (the putative innate immunity-activating portion) with 59.6% identity, indicating that the observed protective capacity of homologous or heterologous Hsp70 proteins might reside within this peptide-binding domain.

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

QUORUM QUENCHING BACTERIA PROTECT MACROBRACHIUM ROSENBERGII LARVAE FROM VIBRIO HARVEYI INFECTION

D.T. Nhan, D.T.V. Cam, M. Wille, T. Defoirdt, P. Bossier, P. Sorgeloos-2010

Journal of Applied Microbiology 109(3): 1007–1016

Abstract:

Aims: In this study, we investigated the effect of N-acyl homoserine lactone-degrading bacterial enrichment cultures (ECs) on larviculture of the giant freshwater prawn *Macrobrachium rosenbergii*.

Methods and Results: The larval performance in terms of larval growth, larval survival, larval quality, duration of the larval rearing process and microflora levels in the rearing water as well as inside the prawn gut was investigated. The application of the EC bacteria was performed in two ways: by adding them directly into the larval rearing water and via enriched *Artemia* nauplii used for larval feeding. The results of the study demonstrated that both ECs that were tested had a similar positive effect on larval survival and larval quality, whereas they did not affect larval growth or the duration of the larval rearing process.

Conclusions: Under normal hatchery conditions, the optimal EC densities were found to be 106 CFU ml⁻¹ for adding into the rearing water and 5 × 10⁸ CFU ml⁻¹ for enrichment of *Artemia* nauplii used for feeding of the larvae. In the hatchery, the ECs can be grown on waste streams of *Artemia* hatching.

Significance and Impact of the Study: Application of this kind of ECs could lead to a more sustainable aquaculture production, by replacing the use of antibiotics to control diseases.

(Laboratory of Aquaculture & Artemia Reference Center, Ghent University, Ghent, Belgium; email of Patrick Sorgeloos: Patrick.Sorgeloos@UGent.be)

THE INFLUENCE OF FIRST-FEEDING DIET ON THE ATLANTIC COD GADUS MORHUA PHENOTYPE: SURVIVAL, DEVELOPMENT AND LONG-TERM CONSEQUENCES FOR GROWTH

R. M. Koedijk, A. Folkvord, A. Foss, K. Pittman, S. O. Stefansson, S. Handeland, A. K. Imsland-2010
Journal of Fish Biology 77: 1–19

Abstract:

Atlantic cod *Gadus morhua* larvae reached four-fold (at low larval density) to 11 fold higher body mass (high larval density) at 50 days post hatch (dph) when fed zooplankton rather than enriched rotifers. A short period (22–36 dph) of dietary change affected larval growth positively if changed from enriched rotifers to natural zooplankton and negatively if prey type changed vice versa. Overall survival did not differ between the two larval groups at low larval density, but at high density the rotifer group had a higher overall survival (10.8% v. 8.9%). Long-term growth was affected significantly by larval diet in favour of the zooplankton diet; juveniles reached a 23% higher mass in a 12 week growth period. No difference in growth performance was found between juveniles fed natural zooplankton during the larval period for 36, 22 or 14 days, but all these juveniles performed significantly better compared with the rotifer-fed group. These findings suggest that optimal diet during a short period in the larval period can result in improved growth in both the larval and juvenile period. Improved rotifer quality may, therefore, hold a large potential for growth improvement in this species.

(Department of Biology, University of Bergen, High Technology Centre, P.O. Box 7803, 5020 Bergen, Norway, email of R.M. Koedijk: roland.koedijk@bio.uib.no)

DIRECT AND INDIRECT EFFECTS OF SIMULATED CALCAREOUS DREDGE MATERIAL ON EGGS AND LARVAE OF PINK SNAPPER PAGRUS AURATUS

G. J. Partridge, R. J. Michael-2010
Journal of Fish Biology 77: 227–240

Abstract:

The direct and indirect effects of a simulated, calcarenite-based dredge material on eggs and larvae of pink snapper *Pagrus auratus* were assessed. Direct effects were assessed by measuring hatch rate or survival of eggs and pre-feeding larvae, respectively, over a range of concentrations and exposure durations. Exposure of eggs to suspended solid concentrations up to 10 000 mg/l for 24 h did not affect egg buoyancy or hatch rate, despite sediment adherence occurring at the two highest concentrations tested. Newly hatched larvae, whose mouths were still closed, were relatively tolerant of suspended solids, with a 12 h lethal concentration resulting in 50% mortality, LC50, of 2020 mg/l and a first observable effect concentration of 150 mg/l. Once the larvae's mouths opened, tolerance was significantly reduced, with a 12 h LC50 of 157 mg/l and a first observable effect concentration of 4 mg/l. Tolerance of larvae to suspended solids was negatively correlated with suspended solids concentration and exposure time, with exposure durations of ≤6 h being significantly less detrimental than those of 9 h or more. Indirect effects to larvae were assessed by measuring ingestion of copepod nauplii by 10 and 15 days post-hatch (dph) larvae at sediment concentrations from 0 to 200 mg/l in 50 mg/l increments over 4 h. Ingestion was not significantly affected by sediment for 10 dph larvae, but by 15 dph, sediment had a far greater impact on ingestion, with larvae in all sediment treatments eating significantly fewer copepods than those in the control.

(Aquaculture Development Unit, Challenger Institute of Technology, Fleet Street, Fremantle, Western Australia 6160, Australia; email of G.J. Partridge: gavin.partridge@challenger.wa.edu.au)

COMPARISON OF EARLY LIFE-STAGE STRATEGIES IN TEMPERATE FRESHWATER FISH SPECIES: TRADE-OFFS ARE DIRECTED TOWARDS FIRST FEEDING OF LARVAE IN SPRING AND EARLY SUMMER

F. Teletchea, P. Fontaine-2010

Journal of Fish Biology 77(1): 257–278

Abstract:

Based on the analysis of 12 egg and larval variables and temperature of 65 temperate freshwater fish species, the possible relationships between oocyte diameter, larval size at hatch, time and temperature were reassessed and the main early life-stage strategies were described and compared. Time and degree-days required to reach hatching and mixed feeding were weakly related to oocyte diameter and strongly to temperature. These results are chiefly because oocyte diameter and yolk reserves are weakly related and temperature strongly increases tissue differentiation rate, activity of hatching glands and embryo motility. Strong positive relationships were found between larval size and oocyte diameter and degree-days for incubation. No relationship was found between larval size and degree-days from hatching to mixed feeding and between degree-days for incubation and degree-days from hatching to mixed feeding. These last two results are chiefly because the developmental stages at hatching and at the onset of exogenous feeding are not fixed in ontogeny and are not directly related to either larval size or degree-days for incubation, but more probably are species specific. Whatever the spawning season, which can occur almost all year long, the different trade-offs at the early life-stages ensure that most larvae are first feeding during spring, when food size and abundance are the most appropriate.

(URAFPA, Nancy-Université INRA, 54000 Nancy, France; email of F. Teletchea: fabrice.teletchea@lsa-man.uhp-nancy.fr)

VALIDATION AND EFFICACY OF TRANSGENERATIONAL MASS MARKING OF OTOLITHS IN VIVIPAROUS FISH LARVAE

M. Kuroki, R. M. Buckley, L. L. LeClair, L. Hauser-2010

Journal of Fish Biology 77(1): 292-298

Transgenerational mass marking of viviparous fish larvae in vivo was validated by intra-muscular injection of elemental strontium chloride (SrCl₂) in gestating females and detection of the Sr in the otoliths of developing larvae. All otoliths of brown rockfish *Sebastes auriculatus* larvae produced from SrCl₂-injected females showed enriched Sr:Ca ratios near the otolith edges, and the signatures did not appear to be affected by the anterior, centre and posterior positions of larvae within the ovary. Results from the present study indicate that transgenerational marking is a highly reliable technique for marking large numbers of extremely small viviparous fish larvae.

(School of Aquatic and Fishery Sciences, University of Washington, 1122 NE Boat Street, Box 355020, Seattle, WA 98105-5020, U.S.A.; email of M. Kuroki: mari@um.u-tokyo.ac.jp)
