

FATTY ACID COMPOSITION AND BIOMETRY OF FIVE GREEK ARTEMIA POPULATIONS SUITABLE FOR AQUACULTURE PURPOSES

Maria Moraiti-Ioannidou, Jeanne Castritsi-Catharios, Hellen Miliou, Yannis P. Kotzamanis-2007

Aquaculture Research 38(15): 1664-1672

Abstract:

Evaluation of a new-to-science *Artemia* population and comparison with four other existing populations were carried out. Five parthenogenetic *Artemia* populations from the following Greek saltworks were studied: Alyki (a new population), Kalloni, Milos, Polychnitos and Messolongi. The diameters of non-decapsulated and decapsulated cysts as well as the lengths of nauplii instar stages I, II and III were measured. In addition, the fatty acid composition of decapsulated cysts was estimated. The cyst size of the Alyki population was the smallest, with the largest chorion found in Greece so far. The Messolongi population had the largest cysts, with the smallest chorion of all five populations. The diameter of the non-decapsulated cysts was highly related ($P < 0.01$) to the length of the nauplii instar I, II and III. The diameter of decapsulated cysts was found to be the most stable and reliable biometric characteristic. The study of their fatty acids profiles revealed that the Polychnitos and Messolongi populations are suitable as live food for freshwater species, while the Alyki, Milos and Kalloni populations are suitable for marine species, having high levels (8.9%, 11.2% and 12.5% respectively) of eicosapentaenoic acid and detectable amounts (0.3%, 0.1% and 0.2% respectively) of docosahexaenoic acid.

(Department of Biology, Sector of Zoology – Marine Biology, National and Kapodistrian University of Athens, University Campus, Athens 15784, Greece; email of Jeanne Castritsi-Catharios: cathario@biol.uoa.gr)

WILD SHRIMP LARVAE HARVESTING IN THE COASTAL ZONE OF BANGLADESH: SOCIO-ECONOMIC PERSPECTIVES

A.K. Azad, C.K. Lin, K.R. Jensen-2007

Asian Fisheries Science 20(4): 339-357

Abstract:

About 0.42 million people are involved in shrimp post larvae collection along the estuaries and coastline of the Bay of Bengal in Bangladesh. Shrimp fry collection from wild sources has assumed a notorious image for being ecologically destructive. In 2000, the Government of Bangladesh imposed regulation to stop shrimp seed collection to protect the fisheries resources. But thousands of people involved in post larvae collection are defying the ban. There is an apprehension that strict implementation of the banning ordinance may displace the people who depend upon the income from catching the larvae. To get the socio-economic patterns of fry collection, 72-85 collectors were interviewed weekly from three harvesting sites. This paper analyzes the larvae collection and distribution efficiency, livelihood strategy of fry collectors, user options for fisheries management and role of various stakeholders empirically. Results show that poverty, migration, credit systems and lack of coordination of service-providing agencies all have important influence on shrimp fry collection in the coastal zone. With an ever-increasing demand for sustainable use of coastal fisheries resources there is a need for consensus among the stakeholders. We propose alternative employment opportunities for fry collectors, community participation and integrated coastal zone management approach for the development of fisheries resources.

ENHANCED DISEASE RESISTANCE IN ARTEMIA BY APPLICATION OF COMMERCIAL B-GLUCANS SOURCES AND CHITIN IN A GNOTOBIOTIC ARTEMIA CHALLENGE TEST

Siyavash Soltanian, Jean-Marie François, Jean Dhont, Sven Arnouts, Patrick Sorgeloos, Peter Bossier-2007

Fish & Shellfish Immunology 23(6): 1304-1314

Abstract:

The anti-infectious potential of a selection of putative immunostimulants including six commercial β -glucans (all extracted from baker's yeast *Saccharomyces cerevisiae* except for Laminarin) and chitin particles were verified in *Artemia nauplii* by challenging them under gnotobiotic conditions with the pathogen *Vibrio campbellii*. Under the described experimental conditions, no differential macroscopic nutritional effect (e.g. growth) was observed among the products. Significant increased survival was observed with β -glucan (Sigma) and Zymosan and to a lesser extent with MacroGard in challenged nauplii. A poor correlation was found between survival values of the challenged *Artemia* and the product compositions (such as chitin, mannose and β -glucan content) indicating that the quality of β -glucans (e.g. the ratio of β -1,3 and β -1,6 glucan, the molecular weight, the dimensional structure, type and frequency of branches), eventually in combination with other unidentified compounds, is more important than the amount of product offered. This small-scale testing under gnotobiotic conditions using freshly hatched *Artemia nauplii* allows for a rapid and simultaneous screening of anti-infectious and/or putative immunostimulatory polymers, and should be combined with studies on cellular and humoral immune responses in order to gain more quantitative insight into their functional properties.

(Laboratory of Aquaculture & Artemia Reference Center, Faculty of Bioscience Engineering, Ghent University, Belgium; email of S. Soltanian: siyavash1385@yahoo.com)

REPRODUCTIVE PERFORMANCE OF CARP, CATLA CATLA (HAM.), REARED ON A FORMULATED DIET WITH PUFA SUPPLEMENTATION

S. Nandi, P. Routray, S. D. Gupta, S. C. Rath, S. Dasgupta, P. K. Meher, P. K. Mukhopadhyay -2007

Journal of Applied Ichthyology 23(6): 684-691

Abstract:

Effect of dietary supplementation of n-3 and n-6 polyunsaturated fatty acids (PUFA) on reproductive performances in both sexes of an Indian major carp, *Catla catla* (Ham.), were investigated in terms of sperm quality, spawning response, fecundity and spawn recovery over a consecutive 2-year period. Sperm count and spermatocrit value were in the range of $3.2\text{--}3.8 \times 10^7 \text{ ml}^{-1}$ and 80–82%, respectively, in fish fed the PUFA-enriched test diet, and significantly higher ($P < 0.01$) than in fish fed control diet ($2.3\text{--}2.5 \times 10^7 \text{ ml}^{-1}$ and 64–70%). Spawning response in the test diet group was quite high (96%) compared to 76% in the control. Egg and larval quality were superior in the test diet group as evidenced by the significantly higher fertilization rate and larval survival in the range of 91–92% and 93.3%, respectively. Fatty acid profile of fertilized eggs and larvae showed that the quantities of 18:3 (n-3), 20:5 (n-3) and 22:6 (n-3) were significantly ($P < 0.01$) increased in the test group while 18:1, 18:2 (n-6) and 20:4 (n-6) remained at higher levels in control. The results indicated that enrichment of n-3 PUFA in the broodfish diet not only improved the quality of eggs and larvae in terms of recovery, but also enhanced the physiological response of broodfish to induced spawning. Oil enrichment in the broodfish diet should therefore be mandatory to ensure the optimum n-3 PUFA content for warmwater carp for quality seed production.

(Central Institute of Freshwater Aquaculture, ICAR, Kausalyaganga, Bhubaneswar 751 002, Orissa, India; email of P. Routray: routray30@yahoo.co.in)

ECOTOXICOLOGICAL EVALUATIONS OF COMMON HATCHERY SUBSTANCES AND PROCEDURES USED IN THE PRODUCTION OF SYDNEY ROCK OYSTERS *SACCOSTREA GLOMERATA* (GOULD 1850)

Michael C. Dove, Wayne O'Connor R

Journal of Shellfish Research 26(2): 501–508

Abstract:

Progress in the Sydney rock oyster *Saccostrea glomerata* industry, through the adoption of oyster spat selected for faster growth and disease resistance, has been hampered by long-term variability in commercial hatchery spat supply. As part of a broader study to evaluate spat production impediments, the chronic toxicity of substances commonly used in bivalve hatcheries and the effects of handling procedures during early ontogeny (embryo to D-veliger) were evaluated. Among the substances tested, chlorine, Virkon S and Virkon S for Aquaculture (virucidal disinfectants, Antec International Limited, Suffolk, UK), bore water and stored rainwater were found to significantly affect larval development at practically/commercially-relevant concentrations. Toxicity was determined by quantifying embryo-larval development after 48 h exposure and three tests were performed for each substance or procedure. Concentrations of 0.83–1.66 mg L⁻¹ of chlorine in seawater and 0.05–0.5 mg L⁻¹ of Virkon S in seawater significantly decreased the normal development of embryos after 48 h exposure. An EC50 value of 0.76–1.18 mg L⁻¹ for chlorine in seawater and 0.47–1.01 mg L⁻¹ for Virkon S in seawater was derived. The EC50 value for Virkon S for Aquaculture was 0.99–1.12 mg L⁻¹ and this substance caused significant development problems for larvae at a concentration of 0.5 mg L⁻¹ in seawater. Tests that added stored rainwater to seawater had a significant decrease in the percentage of embryos developing to the D-veliger stage at concentrations greater than 1%, whilst no effect was detected at 0.1%. The EC50 value for rainwater was 0.67% to 2.29%. Similarly, bore water added to seawater caused a significant decrease in the percentage of embryos to develop to the D-veliger stage at a concentration of 10% and no effect was observed at 1%. The EC50 value for bore water ranged between 2.3 and 3.7%. Handling procedures for screening fertilized eggs did not significantly decrease development percentage after 48 h incubation time. Likewise, tests conducted with de-ionized water at concentrations up to 10% added to seawater did not significantly reduce the percentage of embryos to develop to the D-veliger stage after 48 h exposure. This study highlights the sensitivity of *S. glomerata* larvae to surfactants and disinfectants and identified contaminated water sources.

(NSW Department of Primary Industries, Port Stephens Fisheries Centre, Taylors Beach, NSW 2316, Australia; email of Michael Dove: michael.dove@dpi.nsw.gov.au)

COMPARISONS OF REARING SYSTEMS BASED ON ALGAE OR FORMULATED FEED FOR JUVENILE GREENLIP ABALONE (*HALIOTIS LAEVIGATA*)

Sabine Daume, Mark Davidson, Stephen Ryan, Fiona Parker-2007

Journal of Shellfish Research 26(3): 729–735

Abstract:

In most commercial abalone nurseries worldwide, algal biomass grown on vertical plates becomes inadequate once juvenile abalone reach about 5 mm in shell length. At that stage animals need to be moved into a different tank system and weaned onto a formulated feed or alternative algal diets consisting of diatoms or macroalgae that can provide more biomass for the growing juveniles. Two trials were conducted to compare the growth and survival of juvenile greenlip abalone (5.9 ± 0.6 and 7.1 ± 0.1 mm in initial shell length) in two rearing systems: (1) shallower tanks with or without horizontal shelter, feeding a commercial formulated feed on horizontal surfaces; (2) deeper tanks with plate system feeding algal diets. The second experiment included two algal diets and two abalone stocking densities for one of the algal diets. The first experiment revealed that the algal diet consisting of *Ulvella lens* produced the best growth rates during the first 4 wk of the experiment, when juveniles reached about 9 mm in shell length and seawater temperatures averaged 20.1°C. Growth rates on the *Ulvella* diet declined rapidly thereafter, whereas growth rates on formulated feeds

increased, coinciding with a decrease in seawater temperature to 15.2°C at the end of the experiment. The formulated feed produced high growth rates (over 75 $\mu\text{m day}^{-1}$) once juveniles reached 7 mm in shell length. In the second experiment, the algal diet that included germlings of the green alga *Ulva* sp. produced the highest growth rates (105 $\mu\text{m day}^{-1}$), indicating that *Ulva* sp. germlings are a suitable additional food source for juvenile greenlip abalone. Growth rates were particularly high towards the end of the experiment when seawater temperatures were above 19°C. Juveniles stocked at higher density (80 juveniles per plate) feeding on one of the algal diets showed reduced growth rates and overall lower average weight gain per individual compared with the juveniles stocked at low density and juveniles in the tank system feeding on formulated diet. In both experiments the survival was higher on the algal diets (77% to 82%) than on the formulated feed (62% to 65%). Culturing and maintaining algae for larger juveniles in the nursery system involved more labor, compared with the tank systems feeding formulated feed, suggesting that in higher labor cost countries, juveniles should be weaned onto a formulated feed as early as possible. We recommend moving animals into a tank system to feed formulated feed once they reach 7 mm in shell length. The weaning process can be delayed (e.g., to 17 mm shell length) by supplementing with macroalgal germlings if the seawater temperature is high and high mortality is expected when weaning onto formulated diets. The algal diet including *Ulva* sp. germlings produced particularly high growth rates when seawater temperature was above 19°C.

(Department of Fisheries, Research Division, P.O. Box 20, North Beach, WA 6920, Australia; email of Sabine Daume: sabine.daume@fish.wa.gov.au)

EFFECT OF WATER VELOCITY AND BENTHIC DIATOM MORPHOLOGY ON THE WATER CHEMISTRY EXPERIENCED BY POSTLARVAL ABALONE

Rodney D. Roberts, Niels Peter Revsbech, Lars Riis Damgaard

Journal of Shellfish Research 26(3): 745–750

Abstract:

The water bathing postlarval abalone often lies within the diffusive boundary layer (DBL) so its chemistry is greatly influenced by the metabolism of the biofilm on which the abalone feed. This study used microelectrodes to investigate the influence of water velocity and diatom morphology on dissolved oxygen and pH in the DBL. Decreasing water velocity increased the thickness of the DBL, thereby increasing the amplitude of changes in oxygen concentration. Over a film of the prostrate diatom *Nitzschia ovalis* Arnot, DBL thickness averaged 71, 139, 177, and 406 μm at water velocities of 78, 15, 7, and 1 mm s^{-1} respectively. Corresponding oxygen concentrations at the biofilm surface under moderate light (75 $\mu\text{E m}^{-2} \text{s}^{-1}$) and temperature (15°C) averaged 111%, 120%, 125%, and 151% of air saturation respectively, at the four velocities. The presence of a 1-mm tall diatom canopy (*Achnanthes longipes* Agardh) over a *Nitzschia ovalis* film thickened the DBL by 3-fold at 1 mm s^{-1} and 6-fold at 80 mm s^{-1} . The thickened DBL and higher diatom biomass generated extreme conditions at the biofilm surface. Dissolved oxygen concentrations as high as 440% of air saturation, and pH as high as 9.8 were recorded beneath the canopy in moderate light (105 $\mu\text{E m}^{-2} \text{s}^{-1}$) and temperature (15°C) at a water velocity of 1 mm s^{-1} . Changes during darkness were less extreme, with 53% oxygen saturation and pH 7.7 the minima recorded. These measurements demonstrate the extreme water chemistry that can develop in the microhabitat of postlarval abalone. The changes will be amplified by the presence of filamentous diatoms, by increased light intensity, and by lack of water movement. Standard aeration will greatly reduce the extremes experienced by postlarvae by generating water movement sufficient to thin the DBL.

(Cawthron Institute, Private Bag 2, Nelson, New Zealand; email of Rodney Roberts: rodney.roberts@oceanzblue.co.nz)

EVALUATION OF THREE METHODS FOR TRANSPORTING LARVAE OF THE RED ABALONE HALIOTIS RUFESCENS SWAINSON FOR USE IN REMOTE SETTLEMENT

Luis Pereira, José Lagos, Fernando Araya

Journal of Shellfish Research 26(3): 777–781

Abstract:

Three closed systems were evaluated for the transport of abalone larvae for use in remote settlement associated with mass culture activities. The first of these systems maintained the larvae in seawater, the second in seawater with oxygen added, and the third in wet condition without seawater but with oxygen added. Survival of the larvae was determined within each system over periods of 10, 16, and 36 h. In a separate experiment, larval settlement in aquaria was determined after holding the larvae in the three different transport systems for 10 h. The results showed the best survival was obtained for the larvae in water alone, with survival rates ranging from 97% at 10 h to 63% at 36 h. In the system without water these rates were 88–50% respectively. The use of oxygen in the transport systems only produced a positive effect at 36 h. Larval settlement after 10 h showed no significant differences in relation to transport system, from 60% settlement of larvae transported in water to 54% settlement of larvae in the wet condition, not suspended water.

(Universidad Católica del Norte, Faculty of Marine Science, Aquaculture Department, Casilla 117. Coquimbo, Chile; email of Luis Pereira: lpereira@ucn.cl)

METAMORPHOSIS AND POSTLARVAL GROWTH OF ABALONE HALIOTIS RUFESCENS IN A MEXICAN COMMERCIAL HATCHERY

Ricardo Searcy-Bernal, Esteban Pérez Sánchez, Casandra Anguiano-Beltrán, Roberto Flores-Aguilar-2007

Journal of Shellfish Research 26(3): 783–787

Abstract:

Metamorphosis induction and postlarval growth of the red abalone (*Haliotis rufescens*) were evaluated in a commercial farm of Baja California, México. This hatchery settles larvae with gamma-aminobutyric acid (GABA, 1- μ M final concentration) and culture postlarvae in 250-L tanks placed in a four-story structure inside a building with artificial illumination. Eight tanks (four at the top and four at the bottom of a culture structure) were sampled during four months after settlement. Upper tanks received more light than the lower tanks (means of 727 and 217 lux, respectively) and had a higher mean water temperature (14.9°C and 14.4°C, respectively). Estimates of metamorphosis induction were highly variable (37% to 99%) and mean values were higher in lower (76%) than in higher (54%) tanks. Potential causes of this unexpected variability are discussed. There was a significant positive linear relationship between metamorphosis induction and early (7-day) postlarval survival. Average postlarval growth rates were also highly variable among tanks (37–63 μ m/day) and slightly higher in upper than in lower tanks (60 and 52 μ m/day, respectively). During the sampling period, growth variability was positively associated with water temperature changes, especially after the formation of the first respiratory pore when growth increased abruptly.

(Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Ensenada, Baja California, México; email of R. Searcy-Bernal: rsearcy@gmail.com)

EFFECT OF DARKNESS AND WATER FLOW RATE ON SURVIVAL, GRAZING AND GROWTH RATES OF ABALONE HALIOTIS RUFESCENS POSTLARVAE

Ricardo Searcy-Bernal, Eréndira Gorrostieta-Hurtado

Journal of Shellfish Research 26(3): 789–794

Abstract:

The effect of two light conditions (light at 10–13- μmol quanta/ m^2/s and darkness) in three water flow rates (0, 200, and 600 mL/min) on the survival, grazing, and growth rates of 6-day-old *Haliotis rufescens* postlarvae (pl) was evaluated. A factorial experiment with three replicates per treatment in blocks was conducted for 44 days in 2-L plastic containers with ca. 100 postlarvae each, inoculated every week with the cultured diatom *Navicula incerta*. Survival was highest (80%) in the treatment without water flow and with light, whereas the lowest (52%) corresponded to the 600-mL/min flow rate under darkness, but these differences were not significant. Initial grazing rate was significantly higher in darkness than in light (37 cell/pl/hr, SE = 1.6, and 27 cell/pl/hr, SE = 2.8, respectively). Growth rate was not significantly affected by the light treatments. However, in static conditions growth was higher in darkness (38- $\mu\text{m}/\text{day}$, SE = 2.0) than in light (34- $\mu\text{m}/\text{day}$, SE = 1.0). Growth rates of postlarvae were significantly affected by flow conditions, with means of 36 (SE = 1.3), 33 (SE = 0.7) and 31 (SE = 0.7) $\mu\text{m}/\text{day}$ in flows of 0, 200, and 600 mL/min, respectively). These results suggest that the benefits of dark conditions on the growth rate of abalone postlarvae shown in previous experiments might not occur under flow conditions. However, the flow rates tested here were apparently too high to allow an optimal postlarval growth and slower flows should be tested in future experiments. On the other hand, flow allowed the development of high diatom densities under the light condition, which were difficult to maintain in darkness.

(Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Ensenada, Baja California, México; email of R. Searcy-Bernal): rsearcy@uabc.mx)

EFFECTS OF ANTIBIOTICS ON THE CONCENTRATION OF BACTERIA IN BIOFILMS AND ON THE GROWTH OF HALIOTIS RUFESCENS POSTLARVAE

Casandra Anguiano-Beltrán, Ricardo Searcy-Bernal-2007

Journal of Shellfish Research 26(3): 795–799

Abstract:

The effects of chloramphenicol and streptomycin/penicillin on the concentration of heterotrophic bacteria in biofilms associated with abalone postlarval culture and on the growth and survival of *Haliotis rufescens* postlarvae (3–5 days old) were studied under laboratory conditions. Two experiments were carried out in 12-well polystyrene tissue culture plates with 5 mL of 1- μm -filtered autoclaved seawater. Water was changed every other day and antibiotics were added during the water change. Experimental units were previously inoculated with the benthic diatom *Navicula incerta*. In the first experiment chloramphenicol at 0, 5, 10, and 20 mg L⁻¹ was used and a mixture of streptomycin and penicillin at 0/0, 50/50, 100/100, and 150/150 mg L⁻¹ was tested in the second experiment (in both cases with three replicates). Bacterial counts (Zobell plates) were performed for a period of 4 and 5 wk (experiments 1 and 2, respectively). Bacterial densities decreased 90% in 20 mg L⁻¹ of chloramphenicol during the first 48 h; however, bacterial counts increased in all treatments thereafter and differences were not significant at the end of the experiment. The growth of abalone postlarvae was not significantly different among treatments. In the experiment with antibiotic mixtures, bacterial abundance was reduced 99% at the highest concentration (150/150) in the first 48 h, and remained significantly lower than the control for 2–3 wk. During this period, postlarval growth in this antibiotic treatment was also slower, as well as final survival, suggesting an important role of bacteria in the nutrition and/or digestion of abalone postlarvae. Results of this study also suggest that bacterial resistance to these antibiotics develops fast, discouraging their long-term use in abalone culture.

(Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Apartado Postal 453, Ensenada, B.C. 22860, México; email of Casandra Anguiano-Beltrán: casandra@uabc.mx)

SELECTIVE BREEDING GREENLIP ABALONE (*HALIOTIS LAEVIGATA*):
PRELIMINARY RESULTS AND ISSUES

P. D. Kube, S.A. Appleyard, N.G. Elliott-2007

Journal of Shellfish Research 26(3): 821–824

Abstract:

Greenlip abalone (*Haliotis laevigata*) (Donovan 1808) is a preferred aquaculture species in temperate Australia and selective breeding programs are being developed for this species. This study presents the results of a genetic parameter study for a small population grown on a farm in Tasmania, Australia. A total of 21 families were produced from 14 parents, with all parents except one being used in at least two families. Length and total weight were measured at four periods during the grow-out (10, 21, 27, and 38 mo after spawning) and at the final assessment meat and shell weights were also assessed. Because of issues with tag durability, only 17 of the original 21 families were recovered at final assessment. Genetic variation was low and, at best, the age 3 y heritabilities for total weight, meat weight, and length were 0.10, 0.10, and 0.04 respectively. Despite this low genetic variation, economically important gains appear possible in this small population, with a 5% gain in total weight being predicted. Prior to age 2.5 y, the genetic variation for length and weight appeared to be masked by maternal, larval, and settlement effects. The main factors limiting genetic gains in this study were difficulties in raising large numbers of pedigreed families in separate larval and settlement tanks, the effects of variability in the stages up to and including settlement and difficulties in tagging animals. DNA pedigree assignment is seen as a way to overcome these limitations.

(CSIRO Food Futures Flagship, CSIRO Marine and Atmospheric Research, GPO Box 1538, Hobart, Tasmania, Australia, 7001; email of Peter Kube: e-mail: peter.kube@csiro.au)

EMBRYONIC AND LARVAL DEVELOPMENT OF *HALIOTIS TUBERCULATA*
COCCINEA REEVE: AN INDEXED MICRO-PHOTOGRAPHIC SEQUENCE

G. Courtois De Viçoise, M. P. Viera, A. Bilbao, M. S. Izquierdo-2007

Journal of Shellfish Research 26(3): 847–854

Abstract:

First description of the complete embryo and larval development of the Canarian abalone (*Haliotis tuberculata coccinea* Reeve.) was conducted along 39 stages from fertilization to the appearance of the third tubule on the cephalic tentacles and illustrated in a microphotographic sequence. Eggs obtained by induced spawning with hydrogen peroxide from the GIA captive broodstock were stocked at a density of 10 eggs/mL and kept at $23 \pm 0.5^\circ\text{C}$ for 62 h until the formation of the third tubule. Live eggs and larvae were continuously observed on a 24 h basis at a $\times 400$ magnification under transmitted light. At each stages, specific morphological features, illustrated by microscopic photographs, were described, as well as the time required for their apparition. Fertilized eggs diameter was $205 \pm 8 \mu\text{m}$ (mean \pm SD), whereas length and width of larvae ready to undergo metamorphosis were $216.6 \pm 5.3 \mu\text{m}$ and $172 \pm 8.8 \mu\text{m}$, respectively. Knowledge on the larval morphological development acquired through this study will contribute to the improvement of larval rearing techniques for this abalone species.

(Grupo de Investigación en Acuicultura (GIA) ICCM & ULPGC P.O. Box 56. 35200 Telde, Las Palmas, Islas Canarias, España; email of G. Courtois De Viçoise: gtricolor@hotmail.com)
