

INFORMATION OF INTEREST

[7th International Symposium on Fish Immunology](#), June 18-22, 2007 - Stirling, Scotland

[Manual](#) for Sandfish (sea cucumber) Hatchery Techniques ACIAR/SPC/WDC 2006

Algaebase: a web-enabled world [database of algae](#) (terrestrial, freshwater and marine protists including seaweeds)

121564 species and infraspecific names, 5495 images, 37020 bibliographic items, 134362 distributional records

[SeaweedAfrica](#) – a database of seaweed information for the African continent

Shrimp News International: [free news reports](#)

Expert Workshop on Guidelines for Aquaculture Certification, Bangkok-Thailand March 27-30, 2007: [report](#) at NACA website

The [Report](#) of the 4th Regional Grouper Hatchery Production Training Course 2006

Thierry Chopin new president of the International Seaweed Association: [brief intro to the ISA](#)

[Invitation](#) to join New Global Aquatic Veterinary Association

Seaweed: source of medicine: interesting [article](#) in Algo Rhythm 2006

[Omega-3 Centre](#): the leading Australian and New Zealand authority on long-chain Omega-3s and their benefits for nutritional health

FAO/NACA/DOF Thailand Expert Workshop on Guidelines for Aquaculture Certification (Bangkok, Thailand; 27-30 March 2007): [presentations](#).

Tilapia farming [update 2007](#)

DELIVERY OF HUFA, PROBIOTICS AND BIOMEDICINE THROUGH BIOENCAPSULATED ARTEMIA AS A MEANS TO ENHANCE THE GROWTH AND SURVIVAL AND REDUCE THE PATHOGENESITY IN SHRIMP PENAEUS MONODON POSTLARVAE

G. Immanuel, T. Citarasu, V. Sivaram, M. Michael Babu, A. Palavesam-2007

Aquaculture International 15(2): 137-152

Abstract :

One of the major problems in the shrimp culture industry is the difficulty in producing high-quality shrimp larvae. In larviculture, quality feeds containing a high content of highly unsaturated fatty acids (HUFA) and ingredients that stimulate stress and disease resistance are essential to produce healthy shrimp larvae. In the present study, *Penaeus monodon* postlarvae (PL15) were fed for 25 days on an unenriched Artemia diet (control; A) or on a diet of Artemia enriched with either HUFA-rich liver oil of the trash fish *Odonus niger* (B), probiotics [*Lactobacillus acidophilus* (C1) or yeast-*Saccharomyces cerevisiae* (C2)] or biomedicinal herbal products (D) that have anti-stress, growth-promoting and anti-microbial characteristics. *P. monodon* postlarvae fed unenriched Artemia exhibited the lowest weight gain (227.9 ± 8.30 mg) and specific growth rate ($9.95 \pm 0.05\%$), while those fed the HUFA-enriched Artemia (B) exhibited the highest weight gain and specific growth rate (362.34 ± 12.56 mg and 11.77

± 0.08%, respectively). At the end of the 25-day rearing experiment, the shrimp postlarvae (PL40) were subjected to a salinity stress study. At both low and high (0 and 50‰) salinities, the group fed the control diet (A) experienced the highest cumulative mortality indices (CMI) 935.7 ± 2.1 and 1270.7 ± 3.1 , respectively. Those fed diet D showed the lowest stress-induced mortality, and CMI were reduced by 31.1 and 32.3% under conditions of low and high salinity stress, respectively. A 10-day disease challenge test was conducted with the *P. monodon* postlarvae (PL40–PL50) by inoculating the shrimp with the pathogen *Vibrio harveyi* at the rate of 105–107 CFU/ml in all rearing tanks. *P. monodon* postlarvae fed probiont-encapsulated Artemia diets (C1 and C2) exhibited the highest survival (94.3 and 82.3%, respectively) and lowest pathogen load (*V. harveyi*) in hepatopancreas ($5.2 \times 10^2 \pm 9.0 \times 10$ and $4.6 \times 10^2 \pm 9.0 \times 10$ CFU g⁻¹, respectively) and muscle ($2.0 \times 10^2 \pm 6 \times 10$ and $1.7 \times 10^2 \pm 8.6 \times 10$ CFU g⁻¹, respectively) tissues. The shrimp that were fed the unenriched Artemia (Control; A) showed the lowest survival (26.33%) and highest bacterial load in the hepatopancreas ($1.0 \times 10^5 \pm 5 \times 10^3$ CFU g⁻¹) and muscle ($3.6 \times 10^4 \pm 6 \times 10^2$ CFU g⁻¹). The shrimp fed the herbal product (D)-enriched Artemia also exhibited enhanced survival and reduced *V. harveyi* load in the tissues tested compared to the control diet (A) group. The results are discussed in terms of developing a quality larval feed to produce healthy shrimp larvae. (Marine Biotechnology Laboratory, Centre for Marine Science and Technology, Manonmaniam Sundaranar University, Rajakkamangalam, Kanyakumari District, Tamil Nadu, 629502, India; email of G. Immanuel: g_immas@yahoo.com)

CONTROLLED REPRODUCTION OF AN IMPORTANT INDIGENOUS FISH SPECIES, SPINIBARBUS DENTICULATUS (OSHIMA, 1926), IN SOUTHEAST ASIA

Dinh Van Trung, Amrit Bart -2007

Aquaculture Research 38(5): 441–451

Abstract:

Aquaculture of *Spinibarbus denticulatus* (Oshima, 1926), a fish species indigenous to North Vietnam and Eastern China, is constrained by lack of fingerlings for stocking ponds and cages. As these fish do not naturally breed in captivity, carp pituitary extract (CPE), luteinizing hormone-releasing hormone analogue (LHRHa) with domperidone (DOM) and human chorionic gonadotropin (HCG) were administered at various doses to induce ovulation. A first set of experiments evaluated the response to LHRHa (30, 40 and 50 µg kg⁻¹) with or without DOM (10 mg kg⁻¹), CPE (20, 30 and 40 mg kg⁻¹) and HCG (3000, 4000 and 5000 IU kg⁻¹). A second set of experiments evaluated the dose response to LHRHa (30, 35, 40 and 50 µg kg⁻¹) primed with 6 mg kg⁻¹ of CPE, and HCG (3000, 3500, 4000, 5000 IU kg⁻¹) primed with 6 mg kg⁻¹ of CPE. The treatment groups were compared with each other and the control (injected with 0.9% saline solution). Only 25% and 50% ovulation resulted when treated with LHRHa at 40 and 50 µg kg⁻¹, whereas 100% ovulation was achieved with an addition of DOM to LHRHa. Both 30 and 40 mg kg⁻¹ CPE induced 100% ovulation. However, HCG (4000 and 5000 IU kg⁻¹) induced ovulation in only 33% of females. When primed with CPE, the minimum dose of LHRHa required was 35 µg kg⁻¹ to achieve 70% ovulation. Priming HCG with CPE also resulted in 100% ovulation, and the minimum effective dose of HCG to induce ovulation was 3500 IU kg⁻¹ with 60% ovulation. Fertilization and hatch rates observed in this study with different hormonal stimulation were high (80–93%). The results indicate that while the use of combined hormone strategy has no apparent advantage over a single hormone strategy, LHRHa+DOM (40 µg kg⁻¹+10.0 mg kg⁻¹) and CPE (30 mg kg⁻¹) are most effective in consistently inducing ovulation and thus can be used for commercial hatchery production of *S. denticulatus* larvae.

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IMPROVING COLD STORAGE OF SUBITANEOUS EGGS OF THE COPEPOD ACARTIA TONSA DANA FROM THE GULF OF MEXICO (FLORIDA - USA)

Guillaume Drillet, Laban C. Lindley, Alan Michels, Jeffrey Wilcox, Nancy H. Marcus-2007

Abstract:

Developing methods to store copepod eggs is necessary to increase the availability of copepods as a live food for the aquaculture industry and aquarium trade, and also to allow the exchange of copepods between researchers. The present study, evaluated the effect of glucose and two antibiotics (kanamycin sulphate and oxytetracycline HCl) on extending the shelf life of cold-stored subitaneous *Acartia tonsa* eggs. Also, egg development effects on the survival of the eggs were tested. Glucose did not have any significant effects on the survival of the eggs. However, the addition of antibiotics to the storage vials resulted in an increase of the survival of the eggs. In the best case, the shelf life of the eggs was almost doubled. After 7 days, the kanamycin+glucose treatment led to a hatching success of $86\pm 1\%$ of the hatchable eggs, while the untreated eggs presented a hatching success of $47\pm 6\%$. However, long exposure to high concentrations of antibiotics was lethal to the copepod eggs. After more than 30 days of exposure to 100 mg L⁻¹ of oxytetracycline, the survival of the eggs was lower than in the untreated samples. After 45 days, oxytetracycline-treated eggs (100 mg L⁻¹) presented a hatching success of 4–5% while the non-stored eggs still had a hatching success of 9%, and the eggs treated with a lower concentration of antibiotics (10 mg L⁻¹) showed a hatching success up to 21–23%. The size of the nauplii in all trials tended to decrease as the period of cold storage at 1°C increased. We consider that the use of antibiotics at the right dosage to be a means to increase the storage capacity of the Gulf of Mexico strain of *A. tonsa* eggs, which do not show any capacity to be stored for long periods of time, compared with some other strains. In addition eggs that were between 5 and 7 h old survived longer when stored in the cold than eggs, which were freshly spawned or closer to hatching.

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EARLY OUT-OF-SEASON INDUCED SPAWNING OF CHANNEL CATFISH *ICTALURUS PUNCTATUS* (RAFINESQUE) CONDITIONED IN HEATED EARTHEN PONDS

R. Paul Lang, Terrence R. Tiersch-2007

Aquaculture Research 38 (5), 498–507

Abstract:

This study documents early out-of-season induced spawning of channel catfish *Ictalurus punctatus*. During the early spring (February–April) of 1999, 2000 and 2001, ponds containing (1) male and female channel catfish (mixed-sex ponds) or (2) male channel and blue catfish *I. furcatus* only, or female channel catfish only (single-sex ponds) were heated to 24–30°C to encourage gonadal maturation and spawning. Unheated ponds were stocked with males and females and were monitored during the duration of heating. When natural spawning occurred in the heated ponds, the fish were captured by seining and unspawned females were injected with 100 µg kg⁻¹ of synthetic leutenizing hormone-releasing hormone. Injected females were either paired with males or held in communal all-female groups, and monitored for ovulation. Eggs were collected and fertilized with sperm of channel catfish or blue catfish. Females paired with males were induced to spawn 44 days (mixed-sex ponds) and 50 days (single-sex ponds) before natural spawning occurred in unheated ponds. Spawning latency (the time between injection and ovulation) and the percentage of neurulated embryos from eggs fertilized using channel catfish sperm was not different between spawning before the natural season ($P=0.68$) and during the natural season in fish from mixed-sex ponds ($P=0.57$). Females held in all-female groups produced eggs 34 days before the onset of spawning in unheated ponds. Spawning latency was not different between spawns before and during the natural season ($P=0.16$), and the percentages of neurulated embryos from eggs fertilized with channel catfish sperm ($P=0.76$) or blue catfish sperm ($P=0.77$) before or during the natural season were not different. This study demonstrates the feasibility of conditioning of channel catfish females for early out-of-season induced spawning in the laboratory.

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EFFECT OF PROBIOTIC ON REPRODUCTIVE PERFORMANCE IN FEMALE LIVEBEARING ORNAMENTAL FISH

Shubhadeep Ghosh, Archana Sinha, Chittaranjan Sahu-2007

Aquaculture Research 38 (5): 518–526

Abstract:

A probiotic bacterial strain, *Bacillus subtilis*, isolated from the intestine of *Cirrhinus mrigala* (Hamilton), was incorporated in fish feed at four different concentrations (5×10^8 cells g⁻², 5×10^7 cells g⁻², 5×10^6 cells g⁻¹ and 5×10^5 cells g⁻¹) and fed to four species of livebearing ornamental fish, *Poecilia reticulata* (Peters), *Poecilia sphenops* (Valenciennes), *Xiphophorus helleri* (Heckel) and *Xiphophorus maculatus* (Gunther) for one year duration to observe the effect of dietary probiotic supplementation on their reproductive performance. Sixty virgin females of each species were stocked separately in circular FRP tanks (350 L) and fed diets with varying levels of probiotic cells and control feed. Broodstock performance was evaluated based on gonadosomatic index (GSI), fecundity and fry production of female broodstock. The results showed that supplementation of feed with probiotics increased significantly ($P < 0.05$) the GSI, fecundity and fry production of spawning females and length and weight of fry in all the four species of fish. The number of dead and deformed fry were also significantly lower ($P < 0.05$) in fish fed with the probiotic feeds. The use of higher concentration of the probiont in diet did not always lead to significantly improved reproductive performance of the spawners. Collectively, this study showed that female livebearers benefit from inclusion of probiotics in diet during their reproductive stages.

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COMPARISON OF IODINE AND GLUTARALDEHYDE AS SURFACE DISINFECTANTS FOR RED PORGY (*PAGRUS PAGRUS*) AND WHITE SEA BREAM (*DIPLODUS SARGUS SARGUS*) EGGS

Pantelis Katharios, Aggelos Agathaggelou, Stavros Paraskevopoulos, Constantinos C Mylonas-2007

Aquaculture Research 38 (5): 527–536

Abstract:

The efficacy of iodine and glutaraldehyde as fish egg surface disinfectants were assessed in red porgy (*Pagrus pagrus*) and white sea bream (*Diplodus sargus sargus*) eggs, two species of interest for Mediterranean aquaculture. Iodine was effective in reducing the bacterial load of the 1-day-old eggs when applied at 50 mg L⁻¹ for 5 min. The same concentration did not cause any significant change in hatching success or survival of the larvae for the first 5 days. Glutaraldehyde failed to reduce the bacterial load of the fish eggs at concentrations that were safe for the eggs (100 mg L⁻¹ for 5 min), as it had a significant effect in preventing hatching of the developed embryo. Disinfecting 0-day-old eggs with iodine resulted in a significant reduction of hatching percentage, while larval survival thereafter was unaffected. The results of the present study suggest that iodine may be an appropriate egg disinfectant for both red porgy and white sea bream.

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EFFECTS OF DIFFERENT DIETARY LEVELS OF FISH PROTEIN HYDROLYSATES ON GROWTH, DIGESTIVE ENZYMES, GUT MICROBIOTA, AND RESISTANCE TO *VIBRIO ANGUILLARUM* IN EUROPEAN SEA BASS (*DICENTRARCHUS LABRAX*) LARVAE

Y.P. Kotzamanis, E. Gisbert, F.J. Gatesoupe, J. Zambonino Infante, C. Cahu-2007

Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology: 147(1): 205-214

Abstract:

Two fish protein hydrolysates (FPH) were incorporated into four diets prepared for start-feeding sea bass larvae, at two different levels (10% and 19% of total ingredients): a commercial FPH, CPSP, in

which the molecular mass of the main fraction of soluble peptides (51%) was between 500–2500 Da, and an experimental FPH obtained by acidic silage of sardine offal, SH, with a main portion of soluble peptides (54%) ranging from 200 to 500 Da. The diet with 10% of the commercial FPH gave the best results in terms of growth, survival and intestinal development, as evaluated by the early activity of digestive enzymes in the brush border membrane (alkaline phosphatase and aminopeptidase N). This was related to the low level of *Vibrio* spp. counted in the larvae of group C10. The high dose of FPH, especially in the experimental preparation rich in short peptides, seemed to favour the dominance of *Vibrio* sp. TYH3, which behaved opportunistically. The effect of the experimental FPH was ambiguous, since early larvae challenged with *Vibrio anguillarum* were more resistant to the pathogen, especially at high FPH dose (group S19). This might be due either to direct antagonism between *V. anguillarum* and *Vibrio* sp. TYH3, or to the stimulation of the immune response in the larvae. These results indicate that different molecular weight fractions and concentrations of feed-soluble peptides may affect the growth performance and immunological status of sea bass larvae. Consequently, a low dose of commercial FPH seems advisable, both for larval development and for the bacterial environment, although further research is required to determine and characterize peptide fractions that may have a beneficial effect on growth and immune response, and to determine their optimal inclusion levels in diets for sea bass larvae.

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HEMOLYMPH PATTERNS OF FREE AMINO ACIDS IN THE BRINE SHRIMP ARTEMIA FRANCISCANA AFTER THREE DAYS STARVATION AT DIFFERENT SALINITIES

Kaworu Nakamura, Koichi Iwaizumi, Shoji Yamada-2007

Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology 147(1): 254-259

Abstract:

The hemolymph pattern of free amino acids was examined in the brine shrimp, *Artemia franciscana* (Great Salt Lake origin). After one-month acclimation to 35 or 60 ppt salinity at 27 °C, the animals were transferred to 10, 35 or 60 ppt salinities to continue acclimation for 3 days without feeding at 27 °C. The osmolarity of one of the new media was raised by glycerol addition. In the hemolymph, 8 amino acids such as taurine, alanine, threonine, serine, lysine, glycine, arginine and leucine, comprised approximately 70% of the total content of free amino acids. This pattern suggested internal proteolysis due to starvation at high temperature. The total content of free amino acids significantly increased at 10 and 60 ppt salinities in comparison to 35 ppt. The hemolymph patterns from the 10 ppt and glycerol-added media showed a singularly high peak of taurine or alanine.

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IDENTIFICATION OF A NOVEL DNA METHYLTRANSFERASE 2 FROM THE BRINE SHRIMP, ARTEMIA FRANCISCANA

Chen-Zhuo Feng, Xiao-Jing Zhu, Zhong-Min Dai, Feng-Qi Liu, Jian-Hai Xiang, Wei-Jun Yang-2007

Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology 147(2): 191-198

Abstract:

DNA methyltransferase 2 (Dnmt2) is a dual-specificity DNA methyltransferase, which contains a weak DNA methyltransferase and novel tRNA methyltransferase activity. However, its biological function is still enigmatic. To elucidate the expression profiles of Dnmt2 in *Artemia franciscana*, we isolated the gene encoding a Dnmt2 from *A. franciscana* and named it as AfDnmt2. The cDNA of AfDnmt2 contained a 1140-bp open reading frame that encoded a putative Dnmt2 protein of 379 amino acids exhibiting 32%–39% identities with other known Dnmt2 homologs. This is the first report of a DNA methyltransferase gene in Crustacean. By using semi-quantitative RT-PCR, AfDnmt2 was found to be expressed through all developmental stages and its expression increased during

resumption of diapause cysts development. Southern blot analysis indicated the presence of multiple copies of *AfDnmt2* genes in *A. franciscana*.
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MATERNAL AND GENETIC EFFECTS ON INDIVIDUAL VARIATION DURING EARLY DEVELOPMENT IN JAPANESE FLOUNDER *PARALICHTHYS OLIVACEUS*

Yukinori Shimada, Takahito Shikano, Naoto Murakami, Tatsuo Tsuzaki, Tadahisa Seikai-2007
Fisheries Science 73(2): 244–249

Abstract:

To investigate the changes in maternal effects during early development in Japanese flounder *Paralichthys olivaceus*, four-by-four factorial mating by artificial fertilization was performed to produce 16 families. Larvae and juveniles of each family were reared under common environmental conditions until completion of metamorphosis. The magnitude of maternal effects was estimated as the differences between sire and dam variance. Maternal effects were highest at hatching, and then disappeared at 30 days after hatching. During early development, larval size at hatching was largely affected by egg size, but this effect decreased as larvae grew. Estimated mean heritability during early development was nearly constant (0.14 ± 0.06 for total length and 0.10 ± 0.05 for body depth). Therefore, it is suggested that early development in Japanese flounder is affected by both maternal effect and genetic factors.

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DIETARY VALUE OF BENTHIC DIATOMS FOR POST-LARVAL ABALONE *HALIOTIS DIVERSICOLOR* ASSOCIATED WITH FEEDING TRANSITIONS

Toshihiro Onitsuka, Tomohiko Kawamura, Satoshi Ohashi, Toyomitsu Horii, Yoshiro Watanabe-2007

Abstract:

The feeding behavior and growth of post-larval *Haliotis diversicolor* with initial shell lengths (SL) of approximately 500 μm (Exp. 1-1 and 1-2), 800 μm (Exp. 2), and 1200 μm (Exp. 3) were studied in a laboratory setting while they fed on four species of benthic diatom *Achnanthes longipes*, *Cocconeis sublittoralis*, *Cylindrotheca closterium*, and *Navicula ramosissima*. Exp. 1-1 and 1-2 revealed no marked differences in post-larval growth rates (mean 24–39 μm SL/day) among the diatom species. However, marked differences in growth rates among the species were revealed in Exp. 2 and 3. Three species, *A. longipes*, *Co. sublittoralis*, and *Cy. closterium*, produced faster growth (Exp. 2 mean 29–51 μm /day, Exp. 3 mean 36–44 μm /day) than *N. ramosissima* (Exp. 2 mean 18 μm /day, Exp. 3 mean 23 μm /day). Post-larvae fed *N. ramosissima* had lower digestion efficiency (42.8%) than those fed other diatom species (90.7–100%). Diatom extracellular substances appeared to be principally used from post-settlement to 800 μm SL, and diatom cell contents were required to produce rapid growth of larger post-larvae (>800 μm SL). It is likely that the availability of each diatom for post-larvae was affected by diatom morphology, attachment strength, frustule strength, and post-larval size.

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ONTOGENETIC CHANGES IN RNA, DNA AND PROTEIN CONTENTS OF LABORATORY-REARED PACIFIC BLUEFIN TUNA *THUNNUS ORIENTALIS*

Yosuke Tanaka, Woo-Seok Gwak, Masaru Tanaka, Yoshifumi Sawada, Tokihiko Okada, Shigeru Miyashita, Hidemi Kumai-2007

Fisheries Science 73(2): 378–384

Abstract:

The ontogenetic changes in the growth potential of larval and juvenile laboratory-reared Pacific bluefin tuna were examined based on RNA–DNA and protein–DNA ratios. Experimental fish were reared at the Ohshima Experiment Station of Kinki University Fisheries Laboratory in August 2002. Samples were taken from 13 to 35 days after hatching (DAH). Metamorphosis from larva to the juvenile stage was observed around 23 DAH. Somatic growth of Pacific bluefin tuna was accelerated after metamorphosis. The value of the RNA–DNA ratio from 13 to 19 DAH increased slightly from 3.77 ± 0.58 (mean \pm SD) to 7.28 ± 2.23 . After that, the ratio markedly increased from 13.89 ± 3.71 on 21 DAH to 19.11 ± 4.27 on 23 DAH, which was the end of the metamorphic period. After 25 DAH, the ratio remained at a high level of 15–20. The protein–DNA ratio showed a similar tendency to the RNA–DNA ratio. These results suggest that the rapid increase in the RNA–DNA ratio in the metamorphic period supports the consequent rapid somatic growth in the juvenile stage. The high ratio after the metamorphic period could be because of the species-specific traits large prey exhibit for their survival and because of the tuna's fast -growth after the juvenile stage.

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ONTOGENY OF THE GASTROINTESTINAL TRACT AND SELECTED DIGESTIVE ENZYMES IN COBIA RACHYCENTRON CANADUM (L.)

C. K. Faulk, A. D. Benninghoff, G. J. Holt-2007

Journal of Fish Biology 70 (2): 567–583

Abstract:

The ontogeny of the digestive system of cobia *Rachycentron canadum* from hatching to 22 days post-hatch (dph) (20.1 mm standard length) was examined with light microscopy. The activities of selected pancreatic enzymes were also determined during this period in order to optimize current rearing methods for this species. At hatching (3.6 mm), the digestive tract consisted of a relatively undifferentiated, straight tube positioned dorsally to the yolk sac. The major morphological changes in the digestive tract primarily occurred over the first 1–4 dph (3.6–4.4 mm). During this time, larvae began exogenous feeding (3 dph) and the digestive tract differentiated into five histologically distinct regions: buccopharynx, oesophagus, stomach anlage, anterior intestine and posterior intestine. Yolk reserves were exhausted by 5 dph (4.5 mm) and the oil globule began rapidly decreasing in size disappearing entirely by 9–10 dph (6.3–6.8 mm). Gastric glands differentiated at this time, and by 12 dph (8.1 mm) surface mucous cells of the stomach anlage stained positive for neutral mucosubstances. By 16 dph (11.6 mm), the blind sac (fundic region) of the stomach formed as did the pyloric caecae which initially appeared as a single protrusion of the anterior intestine just ventral to the pyloric sphincter. Generally, enzyme activities (U larva⁻¹) for amylase (0.0–1.8), chymotrypsin (0.0–7902.4), trypsin (0.2–16.6) and lipase (9.3–1319.0) were measurable at or soon after hatching and increased steadily from c. 8–22 dph (5.7–20.1 mm). The results of this study are discussed in terms of current and future weaning practices of this species.

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EARLY DEVELOPMENT AND GROWTH OF THE LABORATORY REARED NORTH-EAST ATLANTIC MACKEREL SCOMBER SCOMBRUS L.

D. Mendiola, P. Alvarez, U. Cotano, A. Martínez de Murguía-2007

Journal of Fish Biology 70 (3): 911–933

Abstract:

The early development, growth and morphological changes of mackerel *Scomber scombrus* were investigated at different incubation temperatures (8, 10, 13, 15 and 18° C). Details on the early life history are illustrated with special reference to morphological transformations. Culture techniques to rear larval mackerel stages are described using laboratory cultured foods. Artificially fertilized eggs were hatched after 80.6 h at 18.4° C and 256.8 h at 8.7° C. The standard length (LS) of the individuals at first feeding was 4.71 ± 0.18 mm. Four mortality critical periods and cannibalistic behaviour were

identified. A maximum average larval size of 37.5 ± 4.41 mm LS was attained 30 days post-hatch (dph) at 18.4° C. Development and growth were affected significantly by temperature during both endogenous and exogenous feeding periods. Larvae grew more rapidly at high, than at low temperatures. Daily specific growth rate (in mass) ranged from 2.4% at 10.6° C to 16.9% at 18.4° C. Likewise, average growth rate (in length) ranged from 0.05 mm day⁻¹ at 8.4° C to 0.37 mm day⁻¹ at 18.4° C. The allometric relationship of LS, with several body measurements was not affected by temperature. Comparison with larvae collected in the Bay of Biscay did not show any significant difference in the dry mass and LS relationship; conversely, the growth rate in length differed significantly between both laboratory and field conditions. The trends observed in the laboratory are described in relation to some aspects of the year-class strength regulation.

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STOCK AND PARENTAL EFFECTS ON EMBRYONIC AND EARLY LARVAL DEVELOPMENT OF WINTER FLOUNDER PSEUDOPLEURONECTES AMERICANUS (WALBAUM)

I. A. E. Butts, M. K. Litvak-2007)

Journal of Fish Biology 70 (4): 1070–1087

Abstract:

A hierarchical breeding design was used to determine if winter flounder *Pseudopleuronectes americanus* embryos and yolk-sac larvae sired by Georges Bank males developed and grew larger than fish sired by Passamaquoddy Bay males, and to examine parental contributions to variations in fertilization success, time to 50% hatch, hatch success and larval morphological development. Significant stock effects were detected for time to hatch and larval development. Eggs fertilized by Passamaquoddy Bay males reached 50% hatch significantly earlier than eggs fertilized by Georges Bank males. Larvae sired by Georges Bank males were significantly larger during larval development for four of the six traits measured at 12 days post-hatch: head depth, jaw length, myotome height and body area. Embryo and larval development were strongly influenced by maternal contributions; there were significant maternal variance components for the majority of the variables measured. Paternal variance components were significant for fertilization success, time to hatch, larval jaw length and larval head depth, however, they acted principally through parental interactions. This information has important implications for the long-term sustainable development of winter flounder for aquaculture purposes as well as for understanding winter flounder genetic variation in the wild.

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A COMPARISON OF SURVIVAL RATES UNTIL RECRUITMENT FOR HATCHERY-RELEASED JAPANESE SPANISH MACKEREL SCOMBEROMORUS NIPHONIUS WITH DIFFERENT SIZES AT RELEASE

Yasuhiro Obata, Hideki Yamazaki, Hiromasa Takemori, Akio Iwamoto, Shigenobu Okumura, Hiroshi Fujimoto, Yoshihisa Yamamoto, Shuichi Kitada-2007

Nippon Suisan Gakkaishi 73 (1): 55- 61

Abstract:

Efficiency of recruitment of hatchery-reared juvenile Japanese Spanish mackerel *Scomberomorus niphonius* was evaluated based on estimates of the survival rate after release. Experiments of juvenile release were carried out in 2002 and 2003 to compare the survival rates of 40 mm juveniles released directly from the production tank with those releases after rearing in net cages in the sea up to 100 mm in total length. The ratio of survival rates of the 2 groups was estimated at 4.10 for 2002 and 3.13 for 2003. Recruitment to the wild population was more efficient in the 100 mm juvenile release than in the 40 mm juvenile release in terms of the production costs and survival after release.

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