EFFECTS OF MICROALGAL DIETS ON THE GROWTH AND SURVIVAL OF LARVAE AND POST-LARVAE OF THE BASKET COCKLE, CLINOCARDIUM NUTTALLII

W. Liu, C.M. Pearce, A.O. Alabi, H. Gurney-Smith-2009

Aquaculture 293(3-4) : 248-254

Abstract:
The nutritional value of four microalgal species: Chaetoceros muelleri, Pavlova lutheri, Tahitian strain of Isochrysis sp. (TISO), and Thalassiosira pseudonana in single- and bi-species diets was evaluated for larvae and post-larvae of the basket cockle, Clinocardium nuttallii. Larval shell growth and metamorphic rate were found to be the greatest with both single- and mixed-species diets comprising TISO. For the post-larvae, however, optimal shell growth was observed in both single- and mixed-species diets containing Chaetoceros muelleri. In another feeding experiment, the microalga Tetraselmis suecica was tested singly and in combination with TISO. Results showed that the food value of Tetraselmis suecica alone was poor for both larvae and post-larvae. In contrast, the mixed-species diet of Tetraselmis suecica and TISO resulted in significantly improved larval and post-larval growth, similar to the respective best (control) diets as identified in the first experiment. It is concluded that, for the hatchery production of Clinocardium nuttallii seed, a single-species diet of TISO is the best for the larvae and a single-species diet of Chaetoceros muelleri is the best for the post-larvae. A nutritional transition period during which both the microalgal species may be required, is also suggested for the hatchery production of basket cockle seed.

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LOCALIZATION, ABUNDANCE AND COMMUNITY STRUCTURE OF BACTERIA ASSOCIATED WITH ARTEMIA: EFFECTS OF NAUPLII ENRICHMENT AND ANTIMICROBIAL TREATMENT

Lone Høj, David G. Bourne, Michael R. Hall-2009

Aquaculture 293(3-4): 278-285

Abstract:
The use of live feeds presents a biosecurity risk for aquaculture due to the potential for inadvertent introduction of bacterial pathogens. Reared Artemia nauplii constitute the most commonly used live feed for larval aquaculture species including fish, crustaceans, and molluscs. We therefore analyzed the localization, abundance and community structure of bacteria associated with Artemia nauplii using a combination of culture-based, microscopy-based and molecular methods. Most bacteria were localized in the nauplii gut, with external surfaces having limited bacterial colonization. The bacterial community of newly hatched nauplii was dominated by populations related to uncultured members of Gammaproteobacteria and Planctomycetales. Enrichment of Artemia nauplii for 24 h with lipid concentrates or a mixture of microalgae generally increased their bacterial load relative to newly hatched nauplii, and in one case the enrichment process shifted the bacterial community towards Vibrio spp. Antimicrobial treatment using a combination of formalin, Virkon® S and a mixture of antibiotics reduced the load of culturable bacteria as expected, but strains of the genera Vibrio, Pseudomonas, Micrococcus, Brevundimonas, Sphingomonas, and Rhizobium were isolated from treated nauplii. Surprisingly, the molecular methods revealed that the antimicrobial treatment caused a relative enrichment of DNA from Vibrio spp. in the bacterial DNA pool. This demonstrated that Vibrio spp. were relatively more resistant to the treatment than other members of the bacterial community, a fact that was not revealed by the culture-based approach. While it is unknown whether the detected DNA originated in viable cells, a low-abundant but Vibrio-dominated bacterial community would represent a substantial biosecurity risk for any hatchery. The results from this study therefore support the use of disinfected Artemia nauplii in combination with probiotics to ensure that beneficial rather than potentially pathogenic bacteria dominate the bacterial community added to rearing tanks of target larvae.

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SPAWNING INDUCTION IN THE CARP: PAST EXPERIENCE AND FUTURE PROSPECTS - A REVIEW

Z. Yaron, A. Bogomolnaya, S. Drori, I. Biton, J. Aizen, Z. Kulikovsky, B. Levavi-Sivan-2009

The Israeli Journal of Aquaculture – Bamidgeh 61(1): 5-26

Abstract:

Most fish in aquaculture either fail to breed in captivity or their spawning occurs sporadically and late in the season. This is mainly due to the lack of natural cues in captivity, which leads to dysfunction of the endocrine axis regulating oocyte maturation and ovulation. Hypophysation as a remedy for this situation in fish has been employed in aquaculture since the 1930s and is still widely practiced. However, using crude pituitary homogenates in local hatcheries has frequently ended in failures that were attributed to the inconsistent potency of the injected material and the unknown ovarian stage of the recipient fish. Since the mid 1980s, hypophysation has improved through the introduction of a standardized dry carp pituitary extract in which the luteinizing hormone (LH) content and activity have been calibrated (calibrated carp pituitary extract = CCPE). Induction of spawning, however, is successful mainly in female cohorts in which 65% or more of the oocytes in an ovarian biopsy have migrating germinal vesicles. Further, due to decreasing quantities of industry-processed common carp and the expansion of ornamental carp production (koi and goldfish), the growing demand for CCPE could not be met, and an alternative had to be found. A hypothalamic approach, introduced into Israeli aquaculture in 1993 (called Dagin), combines a superactive analog of sGnRH (10 □g/kg), with the water-soluble dopamine (D2) receptor antagonist, metoclopramide (20 mg/kg). The progress of oocyte maturation in ovarian biopsies has been studied in parallel with changes in levels of LH, estradiol, and the maturation-inducing steroid (MIS; 17□, 20□, dihydroxy-4-pregnene-3-one). The hormone profile indicated that the gradual increases in LH and MIS following a single administration of Dagin were similar to those in fish treated with priming and resolving doses of CCPE. This would explain why Dagin is effective even when only a single injection is given, saving labor and reducing handling stress. CCPE and Dagin were tested in parallel on common
carp in a commercial hatchery. The spawning ratio and embryo viability were similar, although the latency between injection and ovulation was considerably longer and more variable in Dagin-treated than in CCPE-treated carp. It is recommended to use CCPE at the beginning and end of the spawning season when the LH content in the pituitary is low, and Dagin in mid-season and in field spawning. Future prospects raise the possibility that by employing molecular tools, a recombinant carp LH will be produced that will have the regular and expected potency of the hypophyseal approach without the risk of spreading pathogens from donor fish to broodstock. Work along this line is currently in progress.

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EFFECTS OF LIVE FOOD ORGANISMS AND FORMULATED DIETS ON GROWTH, SURVIVAL, AND BODY PROTEIN OF ASIAN SEA BASS FRY *(LATES CALCARIFER,* BLOCH)

Vivek Rohidas Vartak, Ravendra Kumar Singh-2009

The Israeli Journal of Aquaculture – Bamidgeh 61(1): 63-67

Abstract:

The effects of the live feeds, *Artemia, Moina, and Tubifex*, and a formulated diet on the survival, growth, and body composition of fry (0.05±0.001 g) of the Asian sea bass, *Lates calcarifer* (also called barramundi), were evaluated. The formulated diet was supplemented with dry Bombay duck fishmeal(10%) as an attractant. The experiment was conducted for 30 days in 40-l glass aquaria containing 30 l fresh water. The fry fed Artemia had the best survival (70%) and growth rate (6.48±0.10%). Fry fed *Moina* and formulated diet had 60% survival, not significantly different from fry fed Artemia. Survival was poor (30%) in fry fed *Tubifex*. Body protein and lipid contents differed significantly among treatments. The present study suggests that *Artemia* nauplii is the better feed for

Asian sea bass fry but formulated diet can be used as a substitute since growth and survival were similar.
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EMBRYONIC DEVELOPMENT OF BARBEL *(BARBUS BARBUS)*
Katarzyna Lugowska-2009
The Israeli Journal of Aquaculture – Bamidgeh 61(1): 68-72
Abstract:
Barbel (Barbus barbus L.) is rarely bred and reared in hatcheries, and data on the early development of this species are scarce. Thus, the aim of the study was to describe its embryonic development in detail. Eggs and sperm were obtained from artificially stimulated spawning. Fertilized eggs were incubated in ten 2000-ml aquaria filled with aerated dechlorinated tap water and maintained at a constant 18°C, the optimal temperature for embryonic development of barbel. The eggs swelled to a maximum of 18% during the first hour after fertilization.There were eight distinct tages of embryonic development: two blastomeres, eight blastomeres, small-celled blastula, embryo body formation, body segmentation, formation of brain and eye germs, change of yolk sac shape, and first movement of the embryo. Survival during development was over 81% and during hatching 74%. Of the newly hatched larvae, 88% were normal, 7% were dead, and only 5% had morphological abnormalities, the most common of which were yolk sac malformations, spinal cord curvatures, and heart edema.
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LARVAE DEVELOPMENT STAGES OF THE EUROPEAN FLAT OYSTER (*OSTREA EDULIS*)
Sefa Acarli, Aynur Lok-2009
The Israeli Journal of Aquaculture – Bamidgeh 61(2): 114-120.
Abstract:
This paper reports on the larvae development of the flat oyster, *Ostrea edulis* (Linnaeus, 1758), from veliger to pediveliger stage. Adult oysters were induced to spawn by thermal stimulation and large amounts of veliger larvae were obtained for study. Veliger larvae were cultured in 180-l bins at a density
of 3 larvae/ml. Larvae, reared at 20±2°C and fed 8-200 x 103 cells/ml of *Isochrysis galbana*, reached pediveliger larvae in 17 days. Shell length and width at the beginning of the pediveliger stage were 254 and 233 □m, respectively. Survival rate from veliger to viable pediveliger stage was 15.5%.
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IMPROVED INDUCED-SPAWNING PROTOCOL FOR THE SPOTTED ROSE SNAPPER (*LUTJANUS GUTTATUS)*
L. Ibarra-Castro, L. Alvarez-Lajonchere-2009
The Israeli Journal of Aquaculture – Bamidgeh 61(2): 121-133
Abstract:
An improved protocol for hormonal induction of spawning in spotted rose snapper *(Lutjanus guttatus)* resulted in increased spawning efficiency in newly-caught wild breeders and wild-caught adults maintained in captivity for more than a year. A controlled-release delivery system (implant) based on an ethylene-vinyl acetate copolymer (EVAc) matrix was loaded with gonadotropin-releasing hormone agonist (GnRHa). The required GnRHa dose was established in two stages. The first stage included meta-analysis of our earlier experiments with wild spawners; the second stage included new experiments with wild and captive breeders. A nomograph was developed to calculate the required GnRHa implant dose, taking into account the
origin of the female (wild vs. captive), the initial mean oocyte diameter, and body weight. The effective GnRHa dose was greater in wild than captive females and, in both cases, inversely related to

mean oocyte diameter. Using this nomograph, over half the wild females with a mean oocyte diameter of ≥425 □m and over half the captive females with a mean oocyte diameter of ≥350 □m responded to GnRHa implant treatment (producing multiple spawning events in captives), with mean total relative fecundity ranging 80-278 x 103 eggs/kg body weight and 51-85% fertilization success. The nomograph can be used to calculate the GnRHa implant dose required to induce spawning in this species under commercial aquaculture conditions.
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FATTY ACID PROFILE OF *SPIRULINA PLATENSIS* USED AS A FOOD SUPPLEMENT
Harun Diraman, Edis Koru, Hamdi Dibeklioglu-2009
The Israeli Journal of Aquaculture – Bamidgeh 61(2): 134-142
Abstract:
The commercially produced multicellular microalga, Spirulina platensis, is widely consumed by humans in the Aegean area of Turkey as a food additive or a whole food. The fatty acid profiles of six commercial tablets produced from S. platensis in Turkey and one from China were determined. The samples contained 33.68-66.75% saturated fatty acids (SFA) and 28.20-47.78% polyunsaturated fatty acids (n-3 and n-6 PUFA). Spirulina platensis is a rich source of gamma linolenic acid (GLA), which accounted for 4.07-22.51% of the fatty acids. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) were found in only two samples where they accounted for 1.79 and 7.70%, and 2.28 and 2.88%, respectively. There was a significant ($p<0.05$) variation among samples in total SFA, monosaturated fatty acids (MUFA), PUFA, GLA, total unsaturated fatty acids (UFA), and ratio of n-3 to n-6 PUFA. The S. platensis samples from Turkey were classified by fatty acid profile using two multivariate statistical methods, Principal Component Analysis and Hierarchical Cluster Analysis. Clustering produced defined groups according to production site.
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EFFECTS OF STARTER DIETS ON PANCREATIC ENZYME ACTIVITY IN JUVENILE STERLET (ACIPENSER RUTHENUS)
Lukasz Napora-Rutkowski, Maciej Kamaszewski, Wieslaw Bielawski, Teresa Ostaszewska, Arleta Wegner-2009
The Israeli Journal of Aquaculture – Bamidgeh 61(2): 143-150
Abstract:
Nine-day-old sterlet (Acipenser ruthenus) larvae were reared for 21 days on one of three commercial diets with different protein and fat contents: Bio Kyowa, Aglo Norse, or Perla Larva Proactive. At the end of the experiment, the sterlet juveniles were sampled for histological analysis of the pancreas and evaluation of lipase, trypsin, and amylase activity. Fish fed the Bio Kyowa and Aglo Norse diets were the largest. Survival was highest in the Aglo Norse group. There were no differences between groups in histological analysis of the pancreas, and no histological anomalies. The highest lipase activity was observed in fish fed the diet with the highest lipid content (21%) - the Aglo Norse diet. Trypsin activity was higher in fish fed Bio Kyowa with a protein content of 55% than in fish fed Aglo Norse with a protein content of 59%.
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SUBLETHAL STRESS: IMPACT OF SOLAR UV RADIATION ON PROTEIN SYNTHESIS IN THE COPEPOD ACARTIA TONSA
Barbara Tartarotti, Joseph J. Torres-2009
Journal of Experimental Marine Biology and Ecology 375(1-2): 106-113

Abstract:
Aquatic organisms respond to environmental challenges such as thermal stress with the rapid induction of highly conserved polypeptides known as stress proteins or heat shock proteins (Hsps). Solar ultraviolet radiation (UVR, 280–400 nm) is an important environmental stressor in marine ecosystems. Here, we present results of experiments conducted with the marine copepod Acartia tonsa to follow the de novo protein synthesis and measure the level of constitutive and inducible isoforms of the Hsp70 gene family of stress proteins after UV exposure. Animals were collected from Tampa Bay, Florida (USA), and exposed to solar radiation (full spectrum), UV-A (320–400 nm) and PAR (400–700 nm), or PAR only, for periods of 0.5–4 h. Controls were kept in the dark. Protein synthesis was robust under all treatments when the copepods were exposed to low solar radiation intensities. Conversely, high solar radiation intensities (both UV-B and UV-A) caused an overall suppression in the protein synthesis of the copepods with no detectable induction of stress-inducible isoforms of Hsps. Immunochemical assays (western blotting) showed that UVR increased levels (3.5–4-fold increase compared to the dark control) of the constitutively expressed 70 kDa heat-shock (Hsc70) protein in A. tonsa, without indication of inducible isoform upregulation.
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