



Managing the Microbial Community of Marine Fish Larvae: A Holistic Perspective for Larviculture

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The availability of high-quality juveniles is a bottleneck in the farming of many marine fish species. Detrimental larvae-microbe interactions are a main reason for poor viability and quality in larval rearing. In this review, we explore the microbial community of fish larvae from an ecological and eco-physiological perspective, with the aim to develop the knowledge basis for microbial management. The larvae are exposed to a huge number of microbes from external and internal sources in intensive aquaculture, but their relative importance depend on the rearing technology used (especially flow-through vs. recirculating systems) and the retention time of the water in the fish tanks. Generally, focus has been on microbes entering the system, but microbes from growth within the system is normally a substantial part of the microbes encountered by larvae. Culture independent methods have revealed an unexpected high richness of bacterial species associated with larvae, with 100–250 operational taxonomic units associated with one individual. The microbiota of larvae changes rapidly until metamorphosis, most likely due to changes in the selection pressure in the digestive tract caused by changes in host-microbe and microbe-microbe interactions. Even though the microbiota of larvae is distinctly different from the microbiota of the water and the live food, the microbiota of the water strongly affects the microbiota of the larvae. We are in the early phase of understanding larvae-microbe interactions *in vivo*, but some studies with other animals than fish emphasize that we so far have underestimated the complexity of these interactions. We present examples demonstrating the diversity of these interactions. A large variety of microbial management methods exist, focusing on non-selective reduction of microbes, selective enhancement of microbes, and on improvement of the resistance of larvae against microbes. However, relatively few methods have been studied extensively. We believe that there is a lot to gain by increasing the diversity of approaches

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web la cellule végétale objectif la plupart des plantes aériennes ont un port dressé pourtant elles n ont pas de squelette
comparable à celui des vertébrés mais chacune de leurs cellules est munie d une paroi la cellule végétale est organisée
comme n importe quelle cellule du monde vivant comme les autres cellules elle se

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web le groupe des angiosperme ainsi qu'un rappel sur les particularités de la cellule végétale chapitre 2 les différents types des tissus végétaux ce chapitre commence par l'origine des tissus les méristèmes ainsi que les tissus primaires et secondaires