Hellenic Center For Marine Research HCMR



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OPTIMIZATION OF LARVAE REARING PROTOCOLS ACCORDING TO THE DEVELOPMENT OF THE VISION AND DIGESTIVE SYSTEM



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Introduction

Larval rearing success is the main bottleneck for the industrial-scale farming of any species.



The development of the digestive and visual systems is essential for the survival of larvae and both systems are directly related to the employed rearing protocol.

INTRODUCTION DIGESTIVE AND VISION SYSTEM

The digestive system and the visual system constitute two of the most important systems for the survival of fish

With the digestive system, the organism is provided with the necessary nutrients that allow it to survive and subsequently to grow and to reproduce

Feeding protocols (qualitative – quantitative composition)

✤ With the eye fish detect food for capture

Photic conditions

The aim of the study

The study will focus on the:

- a) Ontogeny of the digestive system and the eye and the correlation with feeding protocol
- b) Feeding preferences during larval rearing.
- c) The detection of problematic periods for larvae during the rearing procedure (malnutrition periods).
- ➤ The final aim of the study will be to evaluate the rearing protocol that will be performed, based on the above information.
- > Optimization of the rearing protocol.

The basic information, in order to understand and identify the problems encountered during the rearing procedure, will be extracted from the **larvae - fish.**

Questions – Answers – Information

Question: Did the larvae suffer from any nutritional stress during the rearing process and when?

Answer: Lipids analysis in the liver.

Information: Identification of malnutrition periods

Question: Were the larvae well equipped in order to use the feeding protocol at the specific time of rearing?

Answer: Ontogenetic status of digestive system and eye.

Information: Ontogeny of digestive system and eye in relation with feeding protocol

Question: Which was the larvae feeding preference from the food items that were included in the feeding protocol during the rearing process?

Answer: Stomach content analysis in relation with the feeding protocol. Information: Changes on the feeding protocol according to the feeding preferences

Question: Were the optical conditions optimum in the rearing tank for the larvae in order to identify the food items ?

Answer: The development of eye and visual acuity.

Information: Light conditions, size and density of food items in the rearing tank

Materials & methods

Parameters

Growth performance

Ontogeny of digestive system and eye

Feeding preferences

Estimation of malnutrition periods

Estimation of visual acuity (visual distance)



Digestive system ontogeny HCMR



glands Buccopharynx Esophagus Stomach Intestine Liver folds Goblet cells Goblet cells Pancreas Taste buds lleo-rectal valve Mouth opening Gastric glands Pharyngeal teeth Cardiac sphincter Pyloric caeca Supranuclear bodies HG Longitudinal



Lipids analysis in the liver

Evolution of lipid deposition



> Two periods of problematic utilization of the Protocol

(I) Live food

(II) Live and artificial food

Optimization of rearing protocol



Increase





ONTOGENY OF THE EYE



The light from the sun to.... the retina



Materials and methods





Results Eye ontogeny



Differentiation of retina layers

Cone cells appearance (day vision)

Rod cells appearance (night and vision under low light intensities)

Results Eye ontogeny



Differentiation of retina layers

Cone cells appearance (day vision)

Rod cells appearance (night and vision under low light intensities)

Results Eye ontogeny



Differentiation of retina layers

Cone cells appearance (day vision)

Nucleus of rod cells appearance (night and vision under low light intensities)

Results

Estimation of the histological visual acuity

Visual acuity is defined as the minimum angle, which two parallel objects can project at the eye and still be resolved as separate.

Data from Histological analysis like number of cones dimeter of lens estimated the visual acuity of larvae.

Minimum Separable Angle (MSA) = \mathbf{a} ,



Results Visual acuity – Visual distance











Results Visual acuity – Visual distance



dah

Visual acuity (visual distance) increases during development



Results Visual distance



Deliverables

Specific project deliverables

- 1. Description of the development of digestive and vision systems in relation to the employed rearing protocols.
- 2. Assessment of visual ability (distance and light intensity) in different developmental stages and correlation with the size and density of feeding items that were used in the tank.
- 3. Variation of lipid deposition in the liver in correlation with the feeding protocol, pointing to periods of nutritional deficiencies and inappropriate feeding.
- 4. Correlation between preferences of larvae and the items provided by the feeding protocol, providing information for the optimization of feeding strategy.
- 5. Identification of critical phases (malnutrition periods) during the rearing procedure, in order to improve the rearing conditions (eg feeding protocol and light conditions) with the aim to avoid those malnutrition periods.

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Thank you for your attention

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