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Growth and development of dusky grouper, *Epinephelus marginatus*, larvae in mesocosm of semi-intensive technology

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Dusky grouper *Epinephelus marginatus* (Lowe, 1834) is a threatened high market value species. Research on its cultivation for stock enhancement has been intensified but rates of mortality during larval stages remain high. The present work describe a successful rearing experiments with *E. marginatus* larvae in mesocosm systems of semi-intensive technology and present the minimum feeding requirement per day for larvae from the opening of the mouth until the beginning of metamorphosis.

Rearing conditions:

- Natural filtered (500 µm mesh) seawater from Ria Formosa coastal lagoon
- 3 m³ circular fibreglass tank
- Sun shaded natural light
- Stagnant water with 6 days of maturation
- Natural photoperiod (July-August 2008)
- Low larval density (1.5 larvae L^{-1})
- Slow increasing flow
- Feeding schedule (Fig. 1)

Calculations of individual weights of the main zooplankters:

Weight/Length relationships in van der Meeren (1991) and in Uye (1982)

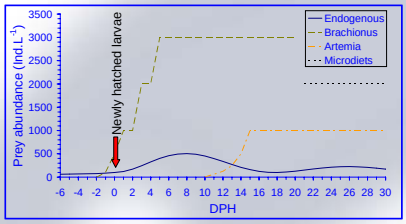

Fig. 1 – Feeding schedule, showing endogenous production and additional live feed delivered

Calculations of larval minimum food requirement (Yoshinaga et al., 1994):

Ingestion = Routine Metabolism x 2 x 1.6 x 0.8 x 0.4

Larval Respiration = 3.75 x Dry Weight x exp(0.92)

Active:Routine during day time (14.5 hours)

20% x Wet Weight

Respiration quotient for carnivorous fish

Carbon:Dry weights

-2.115 x Larval Standard Lenght x exp(3.156)

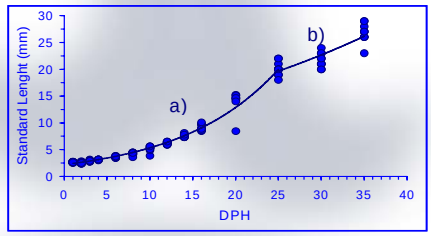

Fig. 2 – Larval growth curves

Results: Dusky grouper larvae growth at two different rates (Fig. 2): a) first feeding to beginning of metamorphosis and b) transformation. Before metamorphosis the percentage of daily growth was 9%. During transformation, the growth rate declined significantly, and was 3% per day. Metamorphosis occurred at 25 dph and 20 ±1.2 mm in standard length and settlement started to occur at 22 ± 1.3 mm (30 dph).
Information on mean length, body weight, metabolism and minimum daily food requirements (in terms of carbon) at the different larval stages are as follows:

	Larval stage	Routine metabolism	Ingestion		Prey required
 2 dph	**Mouth opening** SL=2.7 mm W=14.8 µg C	µg C day^{-1} =1.9 % body C day^{-1}=12.6	µg C day^{-1} =6.0 % body C day^{-1}=40.3	=	Length range (µm)=100>160 Mean weight (µg C day^{-1})=0.06 Minimum number (ind. day^{-1})= 94
 5 dph	**Oil globule exhaustion** SL=3.5 mm W=31.9 µg C	µg C day^{-1} =3.8 % body C day^{-1}=11.8	µg C day^{-1} =12.1 % body C day^{-1}=37.9	=	Length range (µm)=100>275 Mean weight (µg C day^{-1})=0.24 Minimum number (ind. day^{-1})= 51
 15 dph	**Beginning of notochord flexion** SL=7.9 mm W=411.9 µg C	µg C day^{-1} =39.8 % body C day^{-1}=9.7	µg C day^{-1} =127.2 % body C day^{-1}=30.9	=	Length range (µm)=275>860 Mean weight (µg C day^{-1})=1.9 Minimum number (ind. day^{-1})= 67
 25 dph	**Beginning of metamorphosis** SL=17.7 mm W=5 311.7 µg C	µg C day^{-1} =417.9 % body C day^{-1}=7.9	µg C day^{-1} =1 337.2 % body C day^{-1}=25.2	=	Length range (µm)=610>860 Mean weight (µg C day^{-1})=2.6 Minimum number (ind. day^{-1})= 513

Conclusions: Larvae of dusky grouper can be successfully reared in mesocosms of semi-intensive technology, using the natural bloom method with addition of rotifers and *Artemia* in later developing stages. In the mesocosm, grouper larvae had available a large variety of prey of different sizes from ciliates to different larval stages of copepods to meet their basic nutritional needs. Pre-metamorphic specific growth rates are high (9%.day^{-1}) and at 10 dph the larvae attained an average size at which *Brachionus* spp. can easily be ingested.

References: Uye, S. 1982. Length-weight relationships of important zooplankton from the inland Sea of Japan. J. Oceanographi. Soc. Japan 38:149-158.
van der Meeren, T. 1991. Selective feeding and prediction of food consumption in turbot larvae (*Scophthalmus maximus* L.) reared on the rotifer *Brachionus plicatilis* and natural zooplankton. Aquaculture 93:35-55.
Yoshinaga, K., J. Hiromi, and S. Kadota. 1994. Respiration and food requirement by larvae and juveniles of red sea bream, *Pagrus major*. Bull. Coll. Agr. Vet. Med., Nihon University 51:174-181.

Acknowledgments: This study benefited from funding by project ECOAQUA ecoaqua (programme POCTEP)