UNIVERSIDAD JUÁREZ AUTÓNOMA DE TABASCO
DIVISIÓN ACADÉMICA DE CIENCIAS BIOLÓGICAS
Laboratorio de Acuicultura Tropical

DEVELOPMENT OF DIGESTIVE ENZYMES IN COMMON SNOOK
Centropomus undecimalis

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Introduction
The common snook (*Centropomus undecimalis*) is a species with important value in Mexico (commercial) and the United States (recreational); however, fry production is still a bottleneck due to the need of live foods, which are neither necessary nor adequate. To understand the digestive physiology of fish during early ontogeny, our objective was to evaluate the changes of digestive enzymes using biochemical and electrophoretic techniques during the larviculture of *C. undecimalis*.

Results
Trypsin, chymotrypsin, Leucine-aminopeptidase, carboxypeptidase A, lipase, amylase, and phosphatases were detected from yolk absorption (2 days after hatching, dah) onwards, increasing their activities between 12 and 25 dah. Pepsin was first detected from 25 dah, and increase rapidly from 34 onwards (Figs. 1-2). The alkaline protease zymogram showed two bands, the first (26.1-26.4 kDa) at 25 dah onwards, and the second (51.6 kDa) at 36 dah. The acid protease zymogram showed two bands (0.32 and 0.51 rf´s) at 34 dah. This species has the classic digestive enzymatic development as other carnivorous fishes and the weaning period should be started after 34 dah (Fig. 3).

Materials and method
Embryos were obtained from an induced spawning of broodstock maintained in 13-m3 circular tanks. Larvae were fed using the microalgae *Nannochloropsis sp* and S-type rotifers *Brachionus rotundiformis* (R) from mouth opening until 10dah. Rotifers were mixed with newly hatched *Artemia* nauplii (AN) until day 25 after hatching. Finally, from day 25 to 36dah lipid-enriched (SELCO) Artemia meta-nauplii (EAMN) were supplied to the larvae. Several numbers of larvae were collected at 0, 1, 3, 5, 7, 12, 25, 34, and 36dah. Enzyme activities measured were the total alkaline proteases, acid proteases, chymotrypsin, trypsin, leucine aminopeptidase, carboxypeptidase A, α-amylase, lipase, acid and alkaline phosphatases. Alkaline protease isoforms were revealed using SDS-PAGE and acid protease isoforms were revealed using PAGE. Each isoform MW were calculated with Quality One V. 4.6.5 software. A Kruskal-Wallis test was used to compare the enzyme activity between ages for each activity. A nonparametric Nemenyi test was used when significant differences were detected.

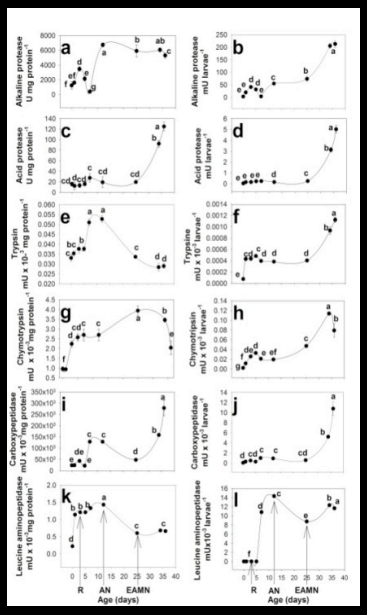

Figure 1. Digestive proteases activities during common snook larviculture (mean ± SD, n = 3 pooled larvae). R: rotifers, AN: Artemia nauplii, EAMN: enriched Artemia meta-nauplii. Mean values with different letters show significant differences ($p < 0.05$) .

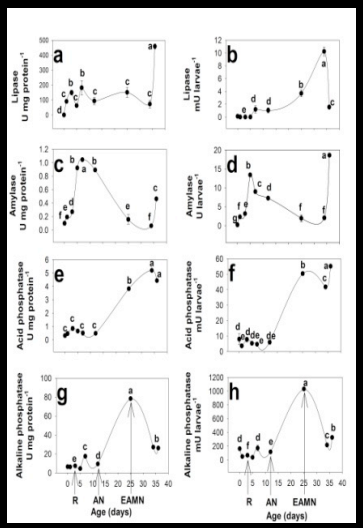

Figure 2. Digestive lipase, amylase, and phosphatase activities during common snook larviculture (mean ± SD, n = 3 pooled larvae). R: rotifers, AN: Artemia nauplii, EAMN: enriched Artemia meta-nauplii. Mean values with different letters show significant differences ($p < 0.05$) .

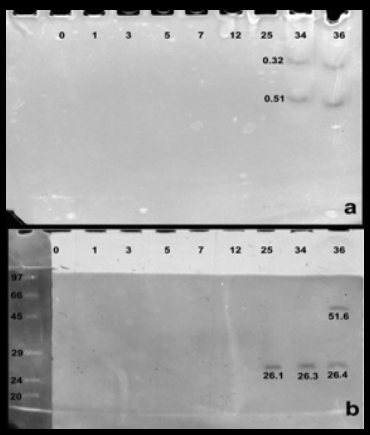

Figure 3. Zymograms of a) acid and b) alkaline protease digestive activities during the development of Common snook larvae.

Discussion and conclusions
Our results agree with those obtained for other species where the changes in activities are related with morphophysiological changes in the larvae gut; when this organ differentiates to hind, mid and fore-gut, the maturation of microvilli in the enterocytes, as well as in live or artificial food changes during larval growth (Moyano et al., 1996; Zambonino-Infante and Cahu, 2007). *C. undecimalis* larvae have the classic digestive enzyme development as other marine fish. We propose the weaning for this species from 34dah onwards.

References
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Acknowledgements
The project was funded under SEP-CONACyT (CB-2006-1-58931). We thank Claudia Durruty Lagunes and Jaime Suárez Bautista for their technical assistance.