

STUDIES ON THE ONTOGENY OF THE DIGESTIVE SYSTEM
AND SELECTED ENZYME ACTIVITY DURING EARLY LIFE
STAGES OF HUMPBACK GROUPEE
(*Cromileptes altivelis*) (Valenciennes , 1828)

WAWAN ANDRIYANTO

MASTER OF SCIENCE
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Studies on the ontogeny of the digestive system and selected enzyme activity during early life stages of humpback grouper (Cromileptes altivelis) (Valenciennes, 1828) / Wawan Andriyanto

PERPUSTAKAAN SULTANAH NUR ZAHIRAH
UNIVERSITI MALAYSIA TERENGGANU (UMT)
21030 KUALA TERENGGANU

1100084287

Lihat sebelah

HAK MILIK
PERPUSTAKAAN SULTANAH NUR ZAHIRAH UMT

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STAGES OF HUMPBACK GROUPER
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1828)**

WAWAN ANDRIYANTO

**Thesis Submitted in Fulfillment of the
Requirement for the Degree of Master of
Science in the Institute of Tropical Aquaculture
Universiti Malaysia Terengganu**

JULY 2011

DEDICATION

This thesis is dedicated to :

- 1. My mother, Maryati; my late father, Sukarmin Sumardi Hartono, my wife Daniar Kusumawati and my lovely sisters, Yuni Wulandari, Dewi Trimurwani and my lovely young brother, Anggit Catur Nugroho. For their support everything in entire of my life.*
- 2. My supervisor Assoc. Prof. Dr. Abol Munafi Ambok Bolong and all his family for their support and happiness during my study in Malaysia.*
- 3. Also for my respected committee member Prof. Dr. Mohd Effendy Abd. Wahid for his support to my degree of Master of Science on Aquaculture.*

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science.

**STUDIES ON ONTOGENY OF DIGESTIVE SYSTEM AND
SELECTED ENZYME ACTIVITY DURING EARLY LIFE STAGES
OF HUMPBACK GROUPER (*Cromileptes altivelis*) (Valenciennes,
1828)**

WAWAN ANDRIYANTO

July, 2011

Chairperson : Assoc. Prof. Dr. Abol Munafi Ambok Bolong

Member : Prof. Dr. Mohd Effendy Abd. Wahid

Institute : Institute of Tropical Aquaculture

A study on the development of the digestive system and selected enzymes activity of humpback grouper (*Cromileptes altivelis*) larvae was conducted from hatching until 40 days after hatching (DAH) by morphological, histological and enzyme assay technique. In addition, the behavior of fish larvae has been studied, by knowing the relationship between the development of morphology and behavior of fish, and finally the best technique on how to reduce the risk of the failure in seed production was understood.

The growth rate value from 1 DAH until 40 DAH was 0.43 mm day^{-1} . The pigmentation patterns were developed at 3 DAH such as melanophores on the dorsal part of the abdomen. The spines that characterized of groupers, such as dorsal and pelvic fin spines were firstly detected on 7 DAH and were developed on 8 DAH. On 1 DAH, the digestive tract was a simple tube with the mouth and anus were closed. The mouth had

opened on 3 DAH and the epithelium of the intestine and rectum were started to fold. The liver and pancreas were appeared and situated between the yolk sac and primordial stomach. Yolk sac was fully adsorbed at 3 DAH and the mucous cells were observed at esophagus. On 4 DAH, numerous acidophilic supranuclear vacuoles appeared indicating the start of protein digestion and absorption in the gut and the squamous cell on esophagus became rapidly increased. Goblet cells, pharyngeal teeth, taste buds and the tongue were appeared on buccopharyngeal cavity at 8 DAH. The stomach was divided into cardiac and fundic regions on 16 DAH. Gastric glands were firstly detected on 25 DAH at fundic stomach region and continue to develop. Two days after the formation of gastric glands which is at 28 DAH, formation of pyloric caeca and blind sac were detected. On 31 DAH fundic stomach was became enlarged and gastric glands were distributed around the fundic stomach wall. The formation of fundic stomach indicated the starting point of weaning which was the most important stage on ontogeny.

The earlier research describe that trypsin and chymotrypsin play an essential role in the early development in all Serranidae. The activities of these proteases play a key role in yolk formation and degradation during embryogenesis of marine fish. The highest activity of both enzymes were reach maximum on yolk sac stage and on the formation of gut at 7–10 DAH and the activity declined until 40 DAH. This result showed that trypsin and chymotrypsin had an important role in the first larvae stage.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Master Sains

**KAJIAN KE ATAS PERKEMBANGAN SISTEM PENCERNAAN
DAN ENZIM TERPILIH PADA PERINGKAT AWAL KEHIDUPAN
IKAN KERAPU TIKUS (*Cromileptes altivelis*) (Valenciennes, 1828)**

WAWAN ANDRIYANTO

Julai 2011

Pengerusi : Profesor Madya Dr. Abol Munafi Ambok Bolong

Ahli : Prof. Dr. Mohd Effendy Abd. Wahid

Institut : Institut Akuakultur Tropika

Satu kajian ke atas perkembangan sistem pencernaan dan aktiviti enzim-enzim terpilih larva ikan kerapu tikus (*Cromileptes altivelis*) telah dijalankan dari hari pertama hingga 40 hari setelah penetasan (HSM) dengan menggunakan teknik-teknik morfologi, histologi dan ujian enzim. Selain itu tingkah laku larva ikan juga telah dikaji, dengan mengetahui hubungan antara perkembangan morfologi dan tingkah laku larva ikan, teknik terbaik tentang bagaimana mengurangkan risiko kegagalan dalam penghasilan benih dapat difahami.

Kadar pertumbuhan dari 1 HSM hingga 40 HSM adalah $0.43 \text{ mm.hari}^{-1}$. Corak-corak pigmentasi telah berkembang pada 3 HSM seperti melanofor pada bahagian dorsal abdomen. Spina-spina yang mencirikan kerapu, seperti spina sirip dorsal dan pelvis, mula dikesan pada 7 HSM dan berkembang lebih kurang 8 HSM. Pada 1 HSM saluran pencernaan kelihatan seperti salur lurus dimana mulut dan anus masih tertutup. Mulut telah terbuka pada 3 HSM dan epitelium usus

dan dubur telah mula berlipat. Hati dan pankreas muncul dan terletak antara kuning telur dan perut primordial. Kuning telur diserap sepenuhnya pada 3 HSM dan sel-sel mukus telah mula muncul pada esofagus. Pada 4 HSM, banyak vakul supranukleus asidofilik muncul menunjukkan permulaan pencernaan dan penyerapan protein dalam perut dan sel skuamus pada esofagus menjadi bertambah dengan pesat. Sel-sel goblet, gigi faring, tunas rasa dan lidah muncul pada ruang bucofaring pada 8 HSM. Perut terbahagi kepada bahagian kardiak dan fundik pada 16 HSM. Kelenjar gastrik mula dikesan pada 25 HSM di bahagian perut fundik dan terus berkembang mengikut masa. Dua hari selepas pembentukan kelenjar gastrik iaitu pada 28 HSM, pembentukan sikum pilorik dan kantong kosong telah dikesan. Pada 31 HSM perut fundik menjadi lebih besar dan kelenjar gastrik bertaburan sekitar dinding perut fundik. Pembentukan perut fundik menunjukkan titik permulaan bagi pertukaran makanan dan merupakan peringkat paling penting dalam ontogeni. Kajian terdahulu menerangkan bahawa tripsin dan kimotripsin memainkan peranan penting dalam perkembangan awal semua Serranidae. Aktiviti enzim protease ini memainkan peranan utama dalam pembentukan yolka dan degradasi semasa embriogenesis ikan air masin. Kadar aktiviti kedua-dua enzim ini mencapai maksimum pada peringkat kuning telur dan pembentukan usus pada umur 7 - 10 HSM dan menurun hingga 40 HSM. Keputusan ini menunjukkan bahawa enzim tripsin dan kimotripsin mempunyai peranan penting dalam pada fasa awal perkembangan larva ikan.