海鱸仔稚魚攝餌生態之研究
Study on feeding ecology of Cobia
Rachycentron canadum larvae and juveniles

研究生：蔡昆祐
Student: Tasi Kun You
指導教授：曾建璋 博士
Advisor: Ph. D. Chien-Chang Tseng

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摘要

海鱒（Rachycentron canadum，Cobia），肉質鮮美、成長快速，經濟價值高，廣受養殖業者青睞，在大力投入養殖情況下，對種苗需求量逐年增加，現已成為台灣水產種苗產業之重要魚種之一。目前台灣水產種苗產業面臨之問題中，以初期減耗造成的魚體損失最大，由於種苗前期發育過程中各部位器官快速發育，所需營養迫切需要，開口後短時間內必須攝取飼料以維持生存，若無法順利攝飼或對飼料之不適應將會因飢餓而導致死亡，因此，對於種苗前期發育中攝飼機能之變化是值得深入探討的。又多數海鱒養殖業者在進行中間育成時，為了節省空間，多以高密度放養，因需大量投餌飼料，所以產生過多殘餌，不但影響海鱒成長、增加養殖業者的飼料成本，同時也造成生態環境的污染。有鑑於此，本研究依照可行進行中間育成之週期，將海鱒分為初期種苗（孵化後~10 cm）及後期種苗（10 cm~23 cm），針對初期種苗攝飼及游泳相關形態之形態發育、機能轉變及對輪鱗體型大小之選擇性進行研究；後期種苗則在不同投飼方式及放養密度下，探討對攝食及成長之影響，以了解其攝飼生態之變化，並可直接應用於養殖現場，加以改變投飼技術，解決海鱒種苗培育時之高死亡率、高殘餌及環境污染等問題。

依研究結果提出初期及後期種苗兩階段飼育改進方式：1.孵化後第 2~8 日初期種苗，投餌 100~200μm 之輪鱗體型，可使種苗順利攝飼，降低因飢餓所導致的死亡；孵化後第 8 日開始，對飼料量的需求已高於對體型的選擇，投餌方式應增加投飼次數，使種苗能隨時獲得充足的飼料量；孵化後第 23 日開始之攝飼及游泳相關機能漸趨完備，期間已可攝食人工配合飼料，對營養需求增加，因此必須更加注意飼餌量是否充足及其營養價值，並以少量多次方式進行投餌，如此才可避免因飼料不足及缺乏營養而影響種苗品質。2.後期種苗在飼育過程中拉長投飼間隔，可增加整體攝飼量，又利用種苗晝 下午攝飼量高的特性，若能加以調整投餌方式及時間，更能提升種苗攝食效率；篩選體型相近的種苗進行飼育，當發現殘
餌時立即準備停止投餌，是降低高殘餌率的有效措施；在不同飼育密度及體型大小的飼育環境中，種苗會有不同的成長特性，利用符合所需之飼育目的來規劃養殖流程、進行中間育成，將能增加養殖整體效益，使常為人詫病的餌料浪費以及殘餌造成的水質污染問題得以解決，並達到海鱺種苗生產精緻化及產業永續經營之目的。

Key word:海鱺、攝餌機能、攝餌生態、選擇性、殘餌率
Abstract

*Rachycentron canadum* known as Cobia with great meat quality, rapid growth rate, and high economic value was a popular aquaculture species. The need for Cobia seeds expanded annually due to the increasing investment on Cobia aquaculture. Cobia had become a main species for cage culture in Taiwan. At present, the loss caused by critical period was the most serious among the difficulties the aquaculture seeds industry in Taiwan encountered. Due to the reason that the organs developed rapidly at the early stage, larvae had to ingest feed within short time right after the mouth opening in order to survive. If the feeding had not succeeded or larvae had not adapted themselves to feeds, they would have died of starvation. For that reason, it was necessary to discuss that the changes of feeding function at the early development of seeds. Most Cobia cage aquaculturists cultured at high stocking density during the grow-out stage. Great amount of feeds were applied, and it resulted in the problem of residue which not only effects the growth of Cobia and increased the cost of feeds but also polluted the environment. Therefore, in this study, seeds whose size was suitable for grow-out stage were classified into early-stage seeds (newly-hatched to 10 cm) and later-stage seeds (10 cm to 23 cm). For early-stage seeds, the study was focused on the development of feeding related characters, changes of function, and the selectivity toward the size of rotifer. For later-stage seeds, it aimed to find out the effects of different feeding method and stocking density on feeding and growth. The knowledge of change of feeding ecology could be the reference to adjust the feeding technique and apply on the aquaculture farm. It would solve the problem of high morality, residue and environment pollution.

According the result of experiment, the possible improvements of rearing
early-stage seeds and later-stage seeds were as following. Firstly, feeding 2\textsuperscript{nd} to 8\textsuperscript{th} days after hatching seeds with 100~200\textmu m rotifers made them ingest successfully and reduced the morality caused by starvation. From the 8\textsuperscript{th} day after hatching, the needs for amount had the priority to size. Therefore, the feeding frequency had to be increased to provide sufficient amount of feed for seeds. From the 23\textsuperscript{rd} day after hatching, the feeding related function became completed. The seeds were able to eat artificial feeds and needed more nutrition. Both amount and nutritional value were important at this time. The amount for each feeding should be less, while the feeding frequency was increasing. It helped to maintain the quality of seeds. Secondly, to extend the feeding intervals helped to increase the feed consumption. Furthermore, if the feeding method and feeding times could be adjusted according to the factor that the seeds ate more at the afternoons, the efficiency of feed consuming would boost. Besides, it was a solution to lessen the rate of residue that to grade seeds and stop feeding as soon as the residue occurred. Under the environment with different stocking density and seeds of various sizes, seeds had distinct growing features. Planning the culture procedure and grow-out stage according to purpose of rearing could profit whole benefit of aquaculture. It not only solved the problem of feed waste and water pollution, but also refined the Cobia seed propagation and reach the goal of sustainable management.

Key word: *Rachycentron canadum*, Cobia, feeding function, feeding ecology, selectivity, rate of residue