SHORT COMMUNICATION

The culture of sand goby, *Oxyeleotris marmoratus* I: Feed and feeding scheme of larvae and juveniles

Thumronk Amornsakun[1] Wasan Sriwatana[2] and Uraiwan Chamnanwech[2]

Abstract

Amornsakun, T.[1] Sriwatana, W.[2] and Chamnanwech, U.[2]
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Songklanakarin J. Sci. Technol., 2003, 25(3) : 367-371

Natural spawning of sand goby was carried out in earthen ponds and eggs were then collected. Fertilized eggs were incubated in a glass aquaria for hatching. The feed and feeding scheme experiments were done in the 500 liters (water volume 300 liters) rearing tanks containing 1,000-1,500 of two-day old larvae (stage at first feeding). It was found that the larvae 3-18 days old (average total length 0.31-0.41 cm) preferably fed only on rotifer while the 21-27 day-old larvae (average total length 0.44-0.65 cm) fed on rotifer and *Artemia*, and the 30-45 day- old larvae (average total length 0.69-2.15 cm) fed only on *Moina.*

Key words : feeding scheme; larviculture; sand goby, *Oxyeleotris marmoratus*

[1]Ph.D. (Aquaculture), Asst. Prof., Department of Technology and Industries, Faculty of Science and Technology, Prince of Songkla University, Pattani Campus, Pattani 94000 [2]B.Sc. (Fisheries), Pattani Inland Fisheries Development Center, Amphoe Yarang, Pattani 94160 Thailand.
Corresponding e-mail: thumronk@bunga.pn.psu.ac.th
Received, 20 November 2002 Accepted, 27 March 2003

บทคัดย่อ

ธำรงค์ อมรสกุล[1] วสันต์ ศรีวัฒนา[2] และ อุไรวรรณ ชำนาญเวช[2]

การเลี้ยงปลาบู่ทราย 1: อาหารและชนิดของอาหารสำหรับลูกปลาระยะวัยอ่อน

ว. สงขลานครินทร์ วทท. 2546 25(3) : 367-371

พ่อแม่พันธุ์ปลาบู่ทรายวางไข่โดยอาศัยการเลียนแบบธรรมชาติในบ่อดิน แล้วรวบรวมไข่นำไปฟัก ไข่ที่ได้รับการผสมพันธุ์นำมาฟักในตู้กระจก ศึกษาประเภทของอาหารในแต่ละระยะของการเจริญเติบโตโดยใช้ถังไฟเบอร์กลาสขนาดปริมาตร 500 ลิตร (ปริมาตรน้ำ 300 ลิตร) ใส่ลูกปลาอายุ 2 วันหลังจากที่ฟักออกเป็นตัว (เริ่มกินอาหาร) จำนวนถังละ 1,000-1,500 ตัว พบว่าลูกปลาบู่อายุ 3-18 วัน (ความยาวลำตัวเฉลี่ย 0.31-0.41 ซม.) กินโรติเฟอร์เป็นอาหารเพียงอย่างเดียว ขณะที่ลูกปลาอายุ 21-27 วัน (ความยาวลำตัวเฉลี่ย 0.44-0.65 ซม.) กินทั้งโรติเฟอร์และอาร์ทีเมีย และเมื่อลูกปลาอายุ 30-45 วัน (ความยาวลำตัวเฉลี่ย 0.69-2.15 ซม.) กินไรแดงเป็นอาหารเพียงอย่างเดียว

[1]ภาควิชาเทคโนโลยีและการอุตสาหกรรม คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตปัตตานี อำเภอเมือง จังหวัดปัตตานี 94000 [2]ศูนย์พัฒนาประมงน้ำจืดปัตตานี อำเภอยะรัง จังหวัดปัตตานี 94160

Oxyeleotris marmoratus, commonly known as sand goby, which is considered a first grade fish in Thailand and Malaysia as well as in other parts of Southeast Asia, is a commercially important species for inland fisheries. It is a very popular and highly demanded fish in the market because of its taste, non-bony flesh and high protein value.

The growth and survival rate of larval and juvenile fish are determined by various environmental factors, food supply etc. Mass mortality of larval and juvenile fish might occur if the food supply is inadequate (Houde, 1978). The food supply during larval stage is an important factor to achieve high growth and survival rates. In different species, the sequential food in early stages differs. In the early larval stage, the freshwater fish are generally given rotifer, *Artemia* or *Moina* as an initial diet. At the later stage the larvae or juveniles are fed minced fish, shellfish and shrimp or an artificial pellet. It is obvious that fish of different species require different feeding techniques. The feed and feeding scheme in the larval and juvenile sand goby have not been established.

The purpose of this study was to investigate feed and feeding scheme in the culture of larval and juvenile sand goby in sequential stages.

Materials and Methods

The experiments of feed and feeding scheme in culture of larvae and juvenile were carried out at the facilities of the Fisheries Technology Programme, Faculty of Science and Technology, Prince of Songkla University, Pattani campus, Thailand, from October 1, 2001 to September 30, 2002. Sand goby larvae were produced by controlled natural spawning. The sexually mature fish were cultured in earthen ponds with stocking density of 2 fish/m^2 and fed fresh fish at 1% of body weight every other day. Concrete plates as fish nesting were prepared for spawning activities. Egg observation at the plates was made once a day at 0800 hr. The water depth in the spawning pond was 1.5 meter and 10 % water replacement was carried out daily. Fertilized eggs were transferred to an aquarium hatching tank.

The experiments were conducted in the 500 liters rearing tanks (water volume 300 liters) containing 1000-1500 of 2-day old larvae. Rotifers were given to 2 to 27-day old larvae, *Artemia* were given to 16 to 30-day old larvae (rotifer and *Artemia* were given to 16 to 27-day old larvae) *Moina* were given to 27 to 45-day old larvae (*Artemia* and *Moina*

were given to 27 to 30-day old larvae) twice a day at the density of 5-10 ind/ml (Tarnchalanukit *et al*., 1982; Kungvankij *et al*.,1986; Eda *et al*., 1993). Samples of 20 larvae were randomly collected every day about 1 hour after previous feeding, then preserved in 5% buffered formalin solution. Stomach content of preserved larval sand goby was later determined. Observations of the size of mouth opening were measured at each stage.

Results

It was found that the larvae of age 3-18 days (average total length 0.31-0.41 cm) with 489.59-1,376.88 μm mouth height consumed only rotifer. The average rotifer densities in larvae digestive tract per day of 3, 6, 9, 12, 15 and 18 days old were 58.8, 95.4, 64.0, 88.8, 134.0 and 147.4 ind/larva, respectively. The 21-27 days old (average total length 0.44-0.65 cm) with 1,558.93-2,200.53 μm mouth height consumed both rotifer and *Artemia*. The average rotifer densities in digestive tract per day of 21, 24 and 27 days old were 126.8, 42.8 and 43.4 ind/larva, respectively while the average *Artemia* densities in digestive tract per day of 21, 24 and 27 days old were 54.8, 142.8 and 197.6 ind/larva, respectively. Larvae of the 30 days old and more (average total length 0.69-2.15 cm) with 2,442.68-2,850.20 μm mouth height consumed only *Moina*. The average *Moina* densities in digestive tract per day of 30, 33, 36, 39, 42 and 45 days old were 177.4, 179.4, 214.8, 249.6, 362.8 and 366.2 ind/larva, respectively (Table 1 and Figure 1).

Discussion

Larval sand goby 3-18 days old (average total length 0.31-0.41 cm) consumed only rotifer. The 21-27 days old (average total length 0.44-0.65 cm) consumed rotifer and *Artemia*. And the 30-45 days old (average total length 0.69-2.15 cm) consumed only *Moina*. The food supply during larval stage is potentially important factor to achieve high survival and growth rates. Mass mortality of larval and juvenile fish might occur if the food supply was inadequate (Houde, 1978). Different species require different sequential food during the early life stages. Watanabe *et al*. (1983) described the food regimes used most extensively in the larvae of various fish production in Japan. In newly

Table 1. Amount of food uptake in a day of sand goby in each stage

Larval age (days)	Number of food/larva/day (days)		
	Rotifer	***Artemia***	***Moina***
3	58.8		
6	95.4		
9	64.0		
12	88.8		
15	134.0		
18	147.4		
21	126.8	54.8	
24	42.8	142.8	
27	43.4	197.6	
30			177.4
33			179.4
36			214.8
39			249.6
42			362.8
45			366.2

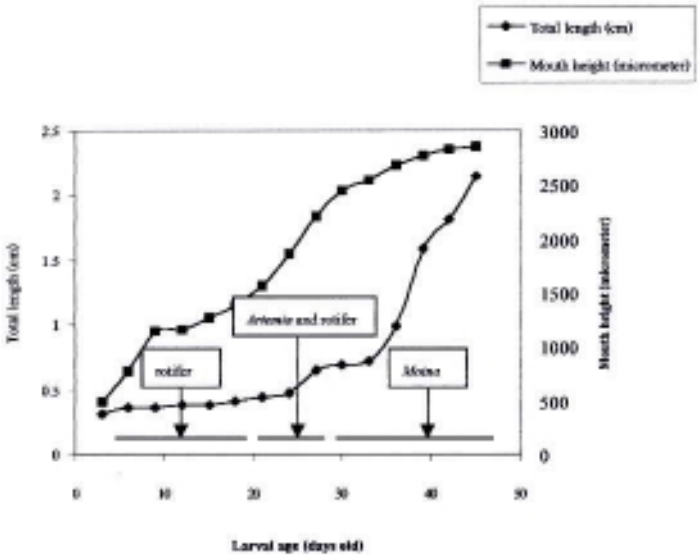

Figure 1. Mean total length of larval sand goby according to age and feeding scheme

hatched fish greater than 2.3 mm of body length, rotifers were exclusively given as an initial feed, when fish reached 7 mm or more, marine copepods such as *Tigriopus, Acartia, Oithona* and *Paracalanus* were given. Brine shrimp, *Artemia salina*, were frequently used for the larvae of many species during shortages of marine copepods. Larvae larger than 10 to 11 mm were fed minced fish, shellfish and shrimp or an artificial diet. Tsukashima and Kitajima (1981) reported the rearing of larval and juvenile filefish, *Stephanolepis cirrhifer*, up to the stage of young fish. They were fed rotifer, *Tigriopus japonicus, Artemia* and subsequently fish meat. The sand goby of 3-27 days old (larval stage with mouth height of 489-2,200 µm) were fed zooplankton such as rotifer and *Artemia* at the start of feeding. Sand goby of age 30-45 days old (mouth height of 2,442-2,850 µm) consumed only *Moina*. At this age the young sand goby is classified as juvenile, while its food particle size and character are in transformation. The juvenile stage of sand goby developed to consume *Moina* and slowly than did green catfish. Larval green catfish of age 2-10 days old were fed with *Moina* only and the feed completely changed to commercial pellet when they were 16 days old (Amornsakun *et al*., 1998).

The mouth height of larval sand goby (489 µm) at the start of feeding on rotifer was similar in size to that of green catfish and red-tail catfish, but type of living food organism at the start of feeding was different. Green catfish and red-tail catfish started to feed on *Moina* when the mouth heights were 553 µm at 52 hr after hatching and 534 µm at 64 hr after hatching, respectively (Amornsakun *et al*., 1997 and Amornsakun, 1999). The mouth height of larval sand goby at the start of feeding was larger than those of rabbitfish and grouper. Juario *et al*. (1985) reported that the mouth of the larval rabbitfish, *Siganus guttatus* (Bloch), was about 125 µm wide when feeding started 2 days after hatching on rotifers. Maneewong *et al*. (1986) reported the mouth size of the larval grouper, *Epinephelus malabaricus* (Bloch and Schneider), was 169.7±16.1µm to consume rotifers 91-100 µm in width. The larval sand goby's mouth size is considered large compared to others. However, its first feeding appeared to be on small living organisms.

Acknowledgments

I am grateful to the National Research Council of Thailand (TEC 45076) for financial support of the field work. I also thank Miss Wilawan Panrungsri for assistance in research.

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