



## Inshore migration of tropical glass eels (*Anguilla* spp.) in Lambeso River, Aceh Jaya District, Aceh Province, Indonesia

Zainal Abidin Muchlisin<sup>1\*</sup>, Maulidin Maulidin<sup>2</sup>, Abdullah A. Muhammadar<sup>1</sup>,  
Dedi F. Putra<sup>1</sup>

<sup>1</sup>Department of Aquaculture, Faculty of Marine and Fisheries, Syiah Kuala University, Banda Aceh, Indonesia; <sup>2</sup>Department of Marine Science, Faculty of Marine and Fisheries, Syiah Kuala University, Banda Aceh, Indonesia. \*Corresponding author, email: muchlisinza@unsyiah.ac.id

### ABSTRACT

The objective of the present study was to evaluate the migration time of glass eels (*Anguilla* spp.) in the estuary of Lambeso River, Aceh Jaya District, Indonesia. The survey was done in March and June 2015. The sampling location was determined based on an initial survey during February 2015 by considering the river condition. Based on initial survey there are no glass eels were recorded during noon time, and therefore the sampling was focused at night. The sampling was done four times a month (weekly basis) for three months (12 times in total) using trap nets based on Hijri Calendar. The trap was settled up to opposite direction of tide (seaward) from 18.00 PM to 06.00 AM and the catches glass eels were monitoring one-hour interval. A total of 131 glass eels were sampled during the study, where the samples were only caught on first (new month) and fourth week (old month) base on Hijri Calendar during spring tide and no glass eels were sampled during second and third weeks. It was concluded that the migration time of the glass eels (*Anguilla* spp.) in Lambeso Rivers is during the dark moon at the new and old month of Hijri Calendar.

**Keywords:** Hijri Calendar, Dark moon, Flood tide, Elvers

### INTRODUCTION

Tropical freshwater eels (*Anguilla* spp.) or locally known ileah is one of the high economic value fish, this species occurs in some areas of Aceh Province. According to Muchlisin (2013) eels have potency as a fish target for the aquaculture industry. Presently the market demand for eels is increasing over the years, for example, in 1995 the production of eels was 20,5000 tons or equivalent to 3.1 billion USD, this is mostly from culture (Rovara *et al.*, 2007), but the fish larvae (glass eels) were collected from wild. However, the glass eels supply was declined over the years. According to Aoyama *et al.* (2015) that the less supply of the glass eels for aquaculture have significantly impacted the eel industries in East Asia and have triggered in increasing economic interest in eels species.

There are 19 species of eels recognized worldwide (Miller and Tsukamoto 2004), while at least 7 species were occurred in Indonesia waters (Sugeha *et al.*, 2006) and two species have been recorded in Aceh waters namely *Anguilla bicolor* (shortfin eel) and *A. marmorata* (giant mottled eel) (Muchlisin and Siti-Azizah, 2009). Eels are the catadromous fish, the brood fish migrate from freshwater to the ocean for spawning activities (Denoncourt and Stauffer, 1992; Chino and Arai 2010) and the leptocephalus, the early stage of eel larvae migrate diurnally to surface waters and at glass eel stage they migrate turn back to freshwater for growing (Arai *et al.*, 1999). According to Sugeha and Genisa (2015), the differences in environmental conditions and duration of glass eel migration differ between one species to another led to the difference in size when they arrived in the estuary area.

The Aceh Province has a big potency of glass eels because many rivers in this region are still natural and free of pollution, one of this river is Lambeso situated in Lambeso village, Aceh Jaya district, Indonesia. The headwaters of Lambeso River are in Leuser Rainforest Mountain and disembugue into the Indian

Ocean. According to local fishermen in Lambeso River, at certain times, the glass eels are often caught by fishermen. However, the migration time from ocean to the river was still unknown. It was speculated that the glass eels migration are affected by the tides associated with lunar phases. Hence, the objective of the present study was to determine the peak of migration time of glass eels in Lambeso River, Aceh Jaya District, Aceh Province, Indonesia.

## MATERIALS AND METHODS

The study was conducted in the mouth of Lambeso River, Aceh Jaya District, Aceh Province, Indonesia from March to June 2015 (Figure 1). The glass eels were caught using trap nets (Figure 2). The initial sampling was done in February 2015. The objective of the initial sampling was to determine the migration time in general, whether they migrate during the day or night, for this purposes sampling was done for 24 hours and the trap was monitored at one-hour interval. The initial samplings were done for two

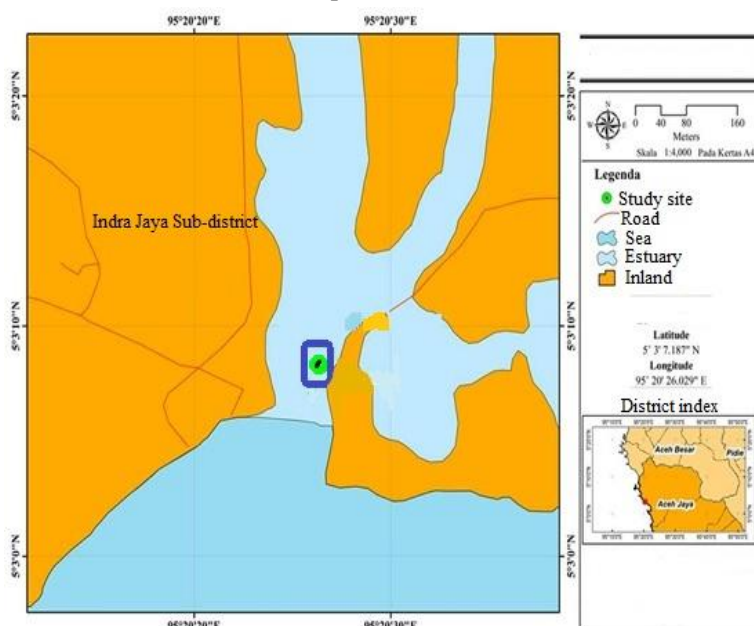


Figure 1. The map of Lambeso River mouth, Aceh Jaya District. The sampling location indicated with blue square

days. According to the initial sampling, the glass eels were only caught at night. Therefore, the intensive samplings were conducted at night from 6 PM to 6 AM for four times a month with one-week interval during March and June 2016 (in total 12 times sampling). The sampling was based on Hijri Calendar (Islamic Calendar) from Jumadil Akhir to Syakban 1436 H or from March to June 2015.

The trap was set up at the one-meter depth where the mouth of the trap is facing the sea and the trap was monitored at one-hour interval. The sampled glass eels were counted according to trapped time and then preserved in 10% formalin. The salinity, water temperature, dissolved oxygen, and tides level were also recorded during the sampling.

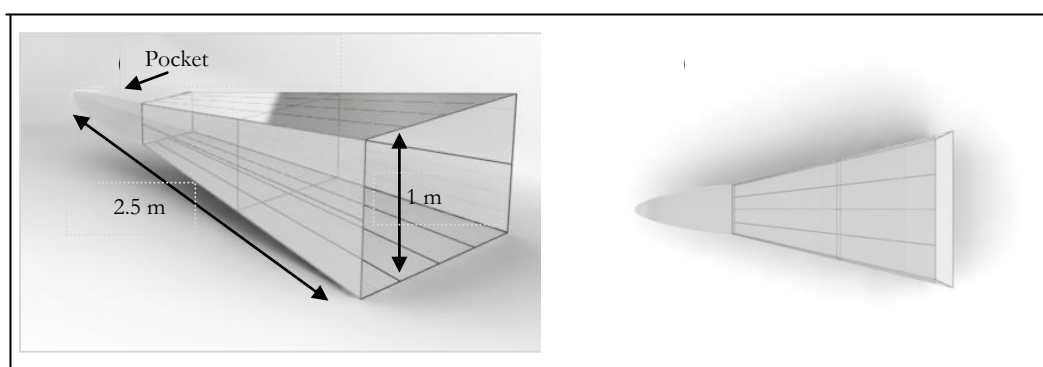


Figure 2. The trap net using to caught the glass eels (a) front view and (b) side view

## RESULTS AND DISCUSSION

A total of 129 glass eels were caught during the sampling where the higher samples were recorded at the fourth week of Syakban (33 glass eels). The study showed that the total numbers of glass eels were higher at the first and fourth week of the month of the Hijri Calendar when the night is dark and the tides level is higher (Table 1) and no glass eels were caught at low tides at every night of sampling. The sampled glass eels ranged between 4.0 cm to 6.0 cm where the small glass eels were mostly caught at the fourth week of respective months (Table 2). The waters temperature ranged from 24°C - 28°C, pH ranged from 7.21 to 7.98, dissolved oxygen ranged 4.86 ppm to 6.99 ppm and the salinity ranged from 4 ppt to 8 ppt.

Table 1. Total number of sampled glass eels according to week of month of the Hijri Calendar

Time (GMT)	Week of Jumadil Akhir (First Month)				Week of Rajab (Second Months)				Week of Syakban (Third Month)				Total
	I	II	III	IV	I	II	III	IV	I	II	III	IV	
18.00	-	-	-	-	-	-	-	-	-	-	-	-	-
19.00	3	-	-	6	3	-	-	5	2	-	-	8	27
20.00	6	-	-	11	5	-	-	9	4	-	-	12	47
21.00	2	-	-	4	1	-	-	4	1	-	-	6	18
22.00	2	-	-	2	2	-	-	4	2	-	-	3	15
23.00	0	-	-	3	1	-	-	2	-	-	-	2	8
00.00	1	-	-	2	2	-	-	-	2	-	-	2	9
01.00	1	-	-	-	1	-	-	2	1	-	-	-	5
02.00	-	-	-	-	-	-	-	-	-	-	-	-	-
03.00	-	-	-	-	-	-	-	-	-	-	-	-	-
04.00	-	-	-	-	-	-	-	-	-	-	-	-	-
05.00	-	-	-	-	-	-	-	-	-	-	-	-	-
06.00	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>15</b>	<b>-</b>	<b>-</b>	<b>28</b>	<b>15</b>	<b>-</b>	<b>-</b>	<b>26</b>	<b>12</b>	<b>-</b>	<b>-</b>	<b>33</b>	<b>129</b>

Note: I= first week, II= second week III= Third week IV= fourth week

Table 2. Total number of glass eels samples according to length frequency based on Hijri calendar

Length (cm)	Week of Jumadil Akhir (First Month)				Week of Rajab (Second Months)				Week of Sya'ban (Third Month)			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
4.0-4.5	3	-	-	1	2	-	-	3	1	-	-	-
4.6-5.0	1	-	-	3	2	-	-	2	1	-	-	3
5.1-5.5	6	-	-	14	7	-	-	12	7	-	-	18
5.6-6.0	5	-	-	10	4	-	-	9	3	-	-	12
<b>Total</b>	<b>15</b>	<b>-</b>	<b>-</b>	<b>28</b>	<b>15</b>	<b>-</b>	<b>-</b>	<b>26</b>	<b>12</b>	<b>-</b>	<b>-</b>	<b>33</b>

Note: I= first week, II= second-week III= third week IV= fourth week

The study indicates that the recruitment of eels in Lambeso Rivers occur at dark night, they utilize the tidal currents at night to migrate inshore. According to Sriati (2003), the abundance of glass eels in Cimandiri River mouth is strongly influenced by salinity and turbidity as recorded in this study. In addition, Deelder (1984) stated that glass eels have the ability to detect the direction of freshwater and swim toward the source of that freshwater. The leptocephalus drifts toward the coast as glass eels. Changes in water flow

due to tides and salinity triggers glass eels swim toward the river mouth and continue upstream for growing. This study is in agreement to Taufik *et al.* (2005) who mentioned that presence of glass eels in the estuary area is affected by several factors such as dark month period, salinity, pH and water temperature.

The study showed that the glass eels is a nocturnal and the negative phototaxis fish where the fish is actively at night and avoid the light. This is the reason why there were no glass eels caught at the second and third weeks of each month when the night is bright due to a full moon. A similar phenomenon was also reported by Fukuda *et al.* (2016) who reported that the abundances of glass eels (*A. japonica*) in Hamana Lake, Japan showed a diel rhythm and a tidal rhythm with eels appearing only at night and catches volume was higher during flood tide. The lunar migration was also recorded in depik (*Rasbora tawarensis*) the cyprinids group fish in the Lake Laut Tawar, Indonesia (Muchlisin *et al.*, 2011).

We speculated that the schools of glass eels migrate in multi-species. However, we have not recognized the species composition of glass eel migrated in the river Lambeso. Therefore, further study on DNA barcoding is being undertaken to evaluate the species composition of glass eels in several river mouths of Aceh Province including in Lambeso River. This information is crucial in relation to plan a better conservation strategy of tropical eels in Aceh waters, Indonesia.

## CONCLUSIONS

It is concluded that the eels were caught only at night and the peak of migration time of glass eels in Lambeso River was occurred during first and fourth weeks of Hijri calendar when the night is dark (new and old moons) and the tides are higher.

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