

FOOD AND REPRODUCTION OF THE BLENNY  
*HALMABLENNIUS LINEATUS*  
(VALENCIENNES) \*

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Received for publication, April 9, 1977

ABSTRACT

Sin-Che Lee and Kun-Hsiung Chang (1977). *Food and reproduction of the blenny Halmablennius lineatus* (Valenciennes). Bull. Inst. Zool., Academia Sinica, 16(1): 1-7. *H. lineatus* inhabits higher part of rocky tide pools with shallow water. It feeds mainly on diatoms and filamentous green algae growing on the surface of rocks. Crenulated upper lip, fine comb-like teeth and long, coiled intestine are adaptive features of the fish as a herbivore. Spawning extends from March to November and each female may spawn several times during the breeding season. Absolute fecundity varies from 1,475 to 1,0705 (mean 3,918) and depends on fish size, according to the equation  $F=0.109 L^{2.855}$  ( $r=0.867$ , significant at 0.1%)

*Halmablennius lineatus* is characterized by having black lines along the body sides and tiny short filaments on the edges of the simple supraorbital cirrus. This blenny is widely distributed along the coasts of the warmer waters of Indo-Pacific zone including Hawaii, Queensland, Melanesia, Micronesia, Ryukyu Is., Taiwan, Philippines, Indoesia, Indian Ocean and East African coast (Fowler, 1968<sup>(1)</sup>; Matsubara, 1955<sup>(2)</sup>; Smith, 1959<sup>(3)</sup>; Schultz *et al.*, 1960<sup>(4)</sup>). *H. lineatus* live in the algae covered tide pools with shallow water near high tide level, often hiding in holes and crevices of the rocks and usually darting away when threatened. The commonest blennies occurring in the same pools with *H. lineatus* were *Praealticus tanegasimae* and *Istiblennius endnotulus* together with occasional individuals of *H. dussumieris*, *I. andamensis* and

*Entomacrodus striatus*.

This report is based on monthly collections made for the purpose of ecological studies on intertidal fishes from Maopitou at the southernmost tip of Taiwan. Because age determination was not possible by otoliths (since all materials were preserved in formalin), the present paper can only provide a brief description of the food and reproduction of this blenny.

MATERIALS AND METHODS

179 specimens were collected from tide pools at Maopitou from January 1975 to January 1976. They were preserved in 10% formalin immediately and were measured, weighed and sexed after the removal of guts and gonads. Gut contents were examined under the microscope and the food items were when expressed

\* Paper No. 175 of the Journal series of the Institute of Zoology, Academia Sinica.

by Points Method of Hyne's (1950<sup>(5)</sup>). Of which 20 points were given when the guts were full of food. Gonads were weighed after drying on filter paper. Diameter of 10 oocytes of the largest egg class from each ovary were measured along their long axes. Fecundity were based on 14 ripe or late ripening ovaries and the total number of oocytes were estimated from counts in a known weight of ovarian tissue.

## RESULTS

### 1. Body size:

There is a very good fit between total length and standard length in both sexes (Fig. 1). The total length of this blenny could be expressed by the equation;  $Tl=0.1237+1.1725$  Sl ( $r=0.9995$ ), where Sl is the standard length of fish.

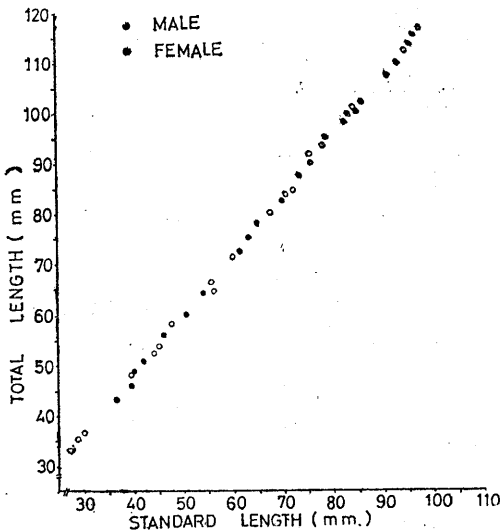


Fig. 1. Relationship between total length and standard length of *H. lineatus*.  $Tl=0.1237+1.1725$  Sl ( $r=0.9995$ )

Among the sample, the smallest female obtained was 19 mm in standard length and the largest was a male of 120 mm. The male of this species is usually longer than the female,

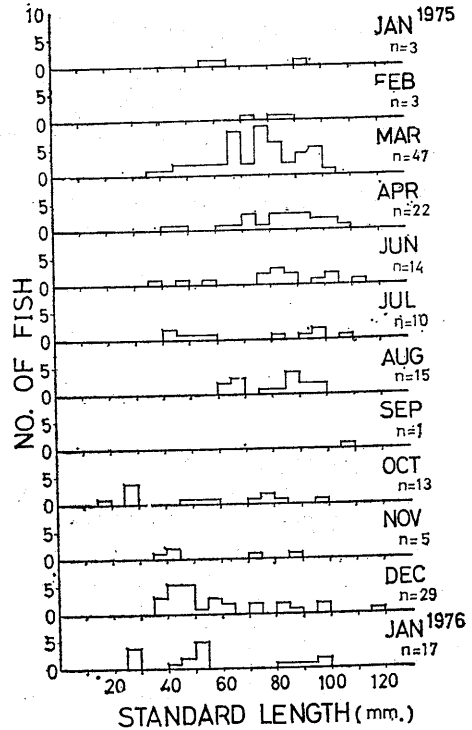


Fig. 2. Length-frequency histograms for each monthly sample of *H. lineatus*.

being 76.31 mm and 66.48 mm in average respectively. The length-frequency distribution for the whole sample is given in Fig. 2 which suggests that there are different age groups and that even different broods of the same age group might occur together in the same pool, but the precise age of this fish is unknown. Since ages could not be determined by the formalin preserved otoliths and Petersen's method is of no value for fish with a long breeding season, growth and longevity of this scaleless blenny were not to be easily interpreted.

### 1. Food:

Among the 174 fish examined 93.68% of them obtained food in their guts. The results of gut analysis were shown in Table 1 which reveals that the fish feed mainly on the filamentous green algae and diatoms. The latter include *Coscinodiscus*, *Stephanopyxis*, *Nitzschia*,

*Pleurosigma*, *Rhabdonema*, *Triceratium* and *Gyrosigma* etc. Although they were found frequently in the gut contents, however, the quantity were small in bulk. Other minor food items such as foraminiferans, nematodes, juvenile gastropods, harpacticoid copepods and insect larvae were taken incidentally while grazing on the fine algae growing on the surface of rocks and the

sides of the pools. Sand also accounted for a large amount of the gut contents as the result of the particular feeding habits of this fish. There was no significant difference of food composition between sexes according the Chi-square test (Table 1). Besides, there was also no indication of food preference between juveniles and adults.

TABLE 1

List of food organisms contained in the guts of *H. lineatus*, expressed in points  
(% total points in parentheses)

Food items	Male	Female	$\chi^2$
Diatoms inc. <i>Coscinodiscus</i> , <i>Stephanopyxis</i> , <i>Nitzschia</i> , <i>Synedra</i> , <i>Pleurosigma</i> , <i>Rhabdonema</i> , <i>Triceratium</i> , <i>Gyrosigma</i> ect.	78.5 (7.71)	85 (8.11)	0.2584
Algae mostly filamentous	587.5 (57.71)	542.5 (51.77)	1.7920
Foraminiferans	—	2 (0.19)	
Nematodes	—	1 (0.1)	
Juv. gastropods	1 (0.1)	—	
Harpacticoid copepods	2.5 (0.25)	7 (0.67)	2.1316
Insect larvae	1 (0.1)	—	
Sands	347.5 (34.14)	410.5 (39.17)	
No. fish examined	84	79	
No. fish without food	7	4	

This blenny has crenulae on the upper lip and there are numerous fine, flexible comb-like teeth on both jaws as well as a rather long intestine which is 1.83–3.39 (mean 2.55) times as long as standard length or 1.55–2.86 (2.4) as the total body length. These are adaptive feature for a herbivorous mode of feeding.

### 3. Reproduction:

Sexes of this species may be distinguished externally by well developed supraorbital crest and higher anal fin in male.

a). **Sex ratio:** Of 179 fish examined, 89 were females and 90 were males, so that the sex ratio of female to male was nearly 1:1.

b). **Maturation:** To know the process of gonad maturation, the following criteria for gonad maturity stages were adopted and judged mainly from changes in gonad width and oocyte diameter. Therefore, ovaries with the highest average egg diameter are the ripest.

#### Female:

Stage I (Immature): Ovaries very small, thread-

like or cylindrical in form, translucent, width less than 1.5 mm. Ovarian wall thick, oocytes less than 0.1 mm in diameter (Fig. 3-A).

**Stage II (Developing):** Ovaries slightly swollen, width about 1.5-3mm, most oocytes transparent, 0.1-0.25 mm in diameter (Fig. 3-B).

**Stage III (Ripening)** includes IIIa (Early ripening) and IIIb (Late ripening). For stage IIIa, width of ovaries 3-4 mm, oocytes containing yolk and appearing opaque when preserved, diameter 0.25-0.45 mm (Fig. 3-C). For IIIb, ovary 4-6 mm in width, oocyte diameter 0.45-0.65 mm (Fig. 3-D).

**Stage IV (Ripe):** Width of ovary over 6 mm the largest being 9 mm, and oocyte diameter over 0.65 mm (Fig. 3-E).

**Stage V (Spent):** Ovary flattened, somewhat in its original width when freshly spent but gradually its width reduced afterward, ovarian wall once again thicker and tougher. Oocyte diameter about the same as in stage II or IIIa (Fig. 3-F).

#### Male:

**Stage I:** Testis thread-like, semitransparent, not wider than 0.5 mm.

**Stage II & III:** Testis 0.5-2 mm in width.

**Stage IV:** Testis creamy white, thick and wider than 2 mm.

**Stage V:** Testis thinner than that shown in stage IV, semitransparent.

Although it is difficult to classify all the fish into exact valid gonad stages, this arbitrary classification may still provide a convenient way to interpret the progress of gonad maturation. During the period of observation, ripe females were found between March and December (Table 2) while ripe males were found between March and September (Table 3). It is presumed that the breeding season of this species may extend at least from March to November or even later. A ripe female of 55.5 mm standard length (66.5 mm total length) was collected in March. This 55.5 mm standard length might be regarded as the biological minimal size of the blenny.

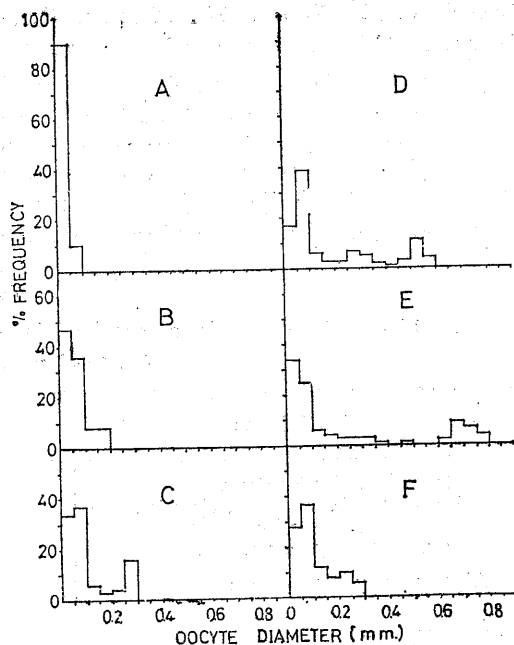


Fig. 3. Percentage size-frequency distribution of oocytes in different gonad maturity stages of *H. lineatus*. A, Stage I (Immature), 48 mm, Dec. 1975; B, Stage II (Developing) 84.5 mm, Mar. 1975; C, Stage IIIa (Early ripening), 60 mm, Jun. 1975; D, Stage IIIb (Late ripening), 90.5 mm, Mar. 1975; E, Stage IV (Ripe), 85.5 mm, Apr. 1975; F, Stage V (Spent), 97 mm, Jan. 1976.

c). **Fecundity:** Fecundity of the blenny was estimated from the ovaries of 14 females ranging from 55.5 to 99.5 mm in standard length. Oocytes of over 0.6 mm in size were counted when they were in late ripening or ripe conditions. Total number of oocytes in ovaries were obtained from count of a weighed portion. The results show that average number of eggs varied from 1,475 to 10,705 with a mean of 3,918. The smallest fish of 55.5 mm had only 1,475 late ripening eggs while the greatest number of oocytes was in a fish of 99.5 mm. Fig. 4 shows the plots of egg number against fish length. There were great variation in fecundity at any given fish length recorded in sand gobies (Healey,

TABLE 2  
 Number of females per maturity stages in *H. lineatus*, with size range  
 (standard lengths in mm) in parentheses.

	I	II	IIIa	IIIb	IV	V	Total
1975 Jan.	—	—	—	1 (56)	—	—	1
Feb.	—	1 (72)	—	—	—	—	1
Mar.	1 (39.5)	12 (44-84.5)	4 (77.5-94.3)	3 (70.2-94.3)	2 (55.5-97.5)	3 (78-99)	25
Apr.	1 (45)	—	1 (76.5)	1 (67.5)	2 (75-85.5)	—	5
Jun.	—	—	1 (60)	3 (77.5-87.5)	—	—	4
Jul.	—	2 (47.5-59.5)	—	2 (83-97.5)	—	1 (96.5)	5
Aug.	—	—	1 (66.5)	7 (62.5-89.5)	3 (88-98)	—	11
Oct.	5 (19-28.5)	2 (45.5-51.5)	1 (56)	4 (72-99.5)	1 (84)	—	13
Nov.	1 (41.5)	—	—	1 (74.5)	1 (89.5)	—	3
Dec.	9 (40.5-59.5)	3 (48-90)	1 (95.5)	—	1 (81.5)	1 (73)	15
1976 Jan.	5 (26-42)	—	—	—	—	1 (97)	6
Total	22	20	9	22	10	6	86

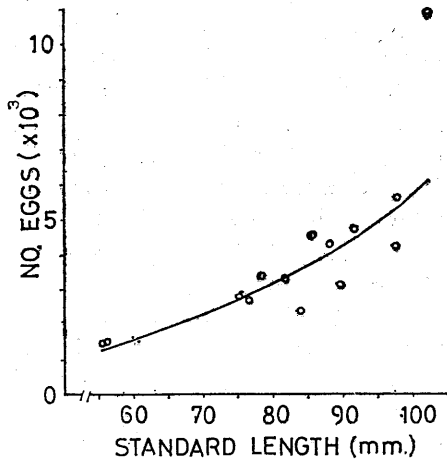


Fig. 4. Absolute fecundity and standard lengths of 14 *H. lineatus*.  $F=0.109$   
 $L^{2.355}$  ( $r=0.867$ , significant at 0.1%).

TABLE 3  
 Number of males per maturity stages in *H. lineatus*, with size range  
 (standard length in mm) in parentheses.

	I	II & III	IV	V	Total
1975 Jan.	—	2 (61.5-91)	—	—	2
Feb.	—	2 (85-86)	—	—	2
Mar.	3 (46-54)	16 (65-96.5)	3 (94.5-105)	—	22
Apr.	1 (48.5)	3 (82-89)	12 (63-109)	1 (91.5)	17
Jun.	2 (40-46.5)	1 (86.5)	6 (85-113)	1 (79)	10
Jul.	3 (42-51.5)	—	1 (106)	1 (91.5)	5
Aug.	—	1 (66.5)	3 (65-98.5)	—	4
Sept.	—	—	1 (107.5)	—	1
Nov.	2 (39.5-40.5)	—	—	—	2
Dec.	6 (36.5-44.5)	3 (48.5-60.5)	—	5 (63.5-120)	14
1976 Jan.	4 (48.5-55)	3 (53.5-55)	—	4 (84-99)	11
Total	21	31	26	12	90

1970)<sup>(6)</sup>, but the present species shows an approximately curvilinear relationship between absolute fecundity and fish length, with a highly significant correlation coefficient of 0.867 (significant at 0.1%) in the equation  $F=0.109 L^{2.355}$ . In order to compare the spawning potential of this species with other intertidal species, the above absolute fecundity were then converted to relative fecundity of 298 to 824 (mean 503) per gram of fish weight.

## DISCUSSION

Since the blenny lives under somewhat variable physical conditions in rocky tide pools, the fish has developed a certain range of adaptation to ensure survival of the species. *H.*

*lineatus* lives only in the rocky pools with shallow water and within that ecosystem, the blenny plays a role as a primary consumer taking mainly filamentous algae and diatoms. On the other hand, the blenny itself may be preyed upon by larger predatory fishes, such as moray eels from the same pool or elsewhere by cardinal fishes (eg. *Apogon semilineatus*) recorded as predators on other members of Blenniidae (Yokota, 1961)<sup>(7)</sup>.

The morphological adaptiveness of the blenny may be considered in relation to its role as a permanent resident of the rocky tide pool. The small body size and moderately compressed, elongated body shape enable the species to inhabit holes and crevices of rocks and may furthermore promote streamlining for rapid escape movement. Consequently, relative to this mode

of life, scales of the blenny living in such a habitat are absent.

The blenny is a poor swimmer, but the forward hop is mainly achieved by bending its tail. Finger-like pelvic fins are close to the pectorals and both are used to resist water movement and as supports during resting on the surface of the substratum. Eyes are set close together and protrude dorsolaterally; this kind of adaptive feature is useful for detecting approaching enemies while hiding among algae. The crenulated lip and comb-like teeth on jaws are adapted for feeding on unlimited sources of algal growths on the surface of rocks; together with a long, coiled intestine, the blenny might be entitled as a typical herbivore feeding solely on plants.

The female blenny lays eggs in crevices and these are guarded by the larger male parent to protect from other animals. This is a common adaptive feature of littoral fishes to increase the survival rate of eggs. Eggs of this species lacks adhesive threads, but adhere to one another by a lipoidal secretion from the testis of the male parent as suggested by Champy & Gley (Gibson, 1969)<sup>(9)</sup>. Good protection of the eggs of the blenny may be linked with its low fecundity (3,918 absolute fecundity) but the fish may spawn several successive batches during a long period of breeding season between March and November due to warm water temperature throughout the year.

**Acknowledgements:** The authors would like

to thank the colleagues of the Laboratory of Fisheries Biology, for their assistance in collecting specimens. We also acknowledge Dr. P.J. Miller of the Department of Zoology, University of Bristol, for reading the manuscript.

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## 線鱚 (*Halmablennius lineatus*) 之食性與生殖

李信徹 張崑雄

線鱚爲一種棲息於近高潮線之淺水岩質潮池魚類，以岩石表面之矽藻及絲狀綠藻類爲生。因上唇具有微細之缺刻，牙齒爲細長之櫛狀，復具特長之消化管道以利其適應草食性魚類生活。生殖季節大約自3月至11月，每尾雌魚在此間可能產卵數次。絕對抱卵數爲 1,475~10,705 (平均 3,918) 視體之大小而異，兩者之關係式爲  $F = 0.109L^{2.355}$  ( $r = 0.876$ )。