

Asian Journal of
Biological
Sciences

Interrelationship among Reproductive Traits in Indian Seahorse, *Hippocampus kuda*

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ABSTRACT

Seahorse populations are declining year by year not only in India but also throughout the world, because of over-fishing and increasing demand in Chinese market. The yellow seahorse, *Hippocampus kuda* is one of the dominant species and distributed all along the Indian coast. To increase its population in the wild, captive breeding and sea ranging is the alternative option. To breed this fish, it is very essential to know about its reproductive behavior. During this one year study, the clutch size of *Hippocampus kuda* varied from 61-325 depending on the maternal body mass. Size and weight of individual egg were also dependent on maternal body mass. However, there was no significant correlation noted between paternal body mass and brood size suggesting dominant role of females in determining brood size only. But the long and healthy babies were produced by larger males.

Key words: Seahorse, conservation, clutch size, brood size, *Hippocampus kuda*

INTRODUCTION

Reproduction is a crucial event in the propagation of living organism. The body size, age, clutch/egg size, weight and young one body weight, length are the basic components of life-history characteristics. In fishes, females influence more on offspring survival by altering egg size and clutch size (Blaxter, 1969) and they also determine the size and number of their young ones (Beacham *et al.*, 1985). The unique parental care offered by male seahorse is useful in assessing the influence on the size and quality of their progeny. The females produce larger eggs with large males but ultimately the paternal size determines the reproductive output in the paternal mouth brooding fish, *Pterapogon kauderni* (Kolm, 2001, 2002). However, the males play a major role in determining survival and reproductive success in seahorse as they provide a lengthy protection, aeration, osmoregulation and nourishment of developing embryos, depending on egg size in the pouch (Vincent, 1990). As a female transfers the entire clutch to one male, it indirectly controls the size of brood (Vincent, 1990). Though, variations in clutch, brood size have been recorded in seahorse species world wide, such information is lacking for *Hippocampus kuda*, an abundant seahorse in Indian waters (Murugan *et al.*, 2008). The interrelationship between the size of parents which can possibly alter the reproductive output, is to be evaluated. Hence, the present article analyses the interrelationship between the parental size and clutch size, egg size and mass, young size and brood size in *H. kuda*.

MATERIALS AND METHODS

Animal collection: Adult *Hippocampus kuda* were collected from the Gulf of Mannar (Tuticorin), coast as by-catch. The total body length and wet weight were measured by standard protocol suggested by Lourie *et al.* (1999). The seahorses were acclimated to laboratory conditions in 1000 L Fibre Reinforced Plastic (FRP) tanks supplied with filtered seawater, mild aeration and water circulation. The brood stock was fed with adult *Artemia* twice every day morning and evening besides *Mysids* and *Tilapia* juveniles were occasionally provided *ad-libitum*. Routine husbandry practices such as removal of waste and water exchange of 25% were carried out.

Water quality parameters: The water quality was maintained as temperature $27.5 \pm 0.85^\circ\text{C}$, dissolved oxygen 4.29 ± 0.24 ppm; salinity 35 ± 0.25 ppt and pH 7.53 ± 0.26 with photoperiod 10 L/14 D cycle.

Daily observation and data analysis: The adults were observed daily for breeding and feeding behavior. Occasionally due to lack of suitable male to the matured females or some times during egg transfer, many eggs were dropped down. All these eggs were collected and counted at 10X magnification in a dissection microscope (Olympus) and twenty eggs from each clutch were measured by micrometer. During egg transfer almost all eggs were deposited directly in to the male's pouch so the best available estimate of female clutch size was male brood size (Vincent, 1990). The offspring length was recorded immediately after birth before being weighed. The interrelationship between the observed traits and their correlations were analyzed by SPSS 13.0 software.

RESULTS AND DISCUSSION

The maternal body mass had a positive correlation with the egg diameter ($R^2 = 0.5832$; $p < 0.05$; $n = 39$) and the egg mass ($R^2 = 0.3905$; $p < 0.05$; $n = 39$, Fig. 1). Maternal body mass also showed more significant correlation with clutch size ($R^2 = 0.802$; $p < 0.05$; $n = 39$) and clutch mass ($R^2 = 0.819$; $p < 0.05$; $n = 39$) (Fig. 1). But there was less significant correlation between paternal body mass and brood size ($R^2 = 0.0133$; $p > 0.05$; $n = 35$, Fig. 2). Interestingly, there was a positive correlation between paternal body mass and young length ($R^2 = 0.8712$; $p < 0.05$; $n = 35$, Fig. 2) and brood mass ($R^2 = 0.1013$; $p < 0.05$; $n = 35$, Fig. 2). There was no significant positive correlation between the brood size vs. young mass ($R^2 = 0.0168$; $p > 0.05$; $n = 35$) and also brood size vs. young length ($R^2 = 0.0073$; $p > 0.05$; $n = 35$, Fig. 3).

Parental investment models among organisms with variable clutch size suggest that maximized parental fitness can be achieved under a given set of environmental conditions which are optimal value for egg/young size (Brockelman, 1975). According to Kolm (2002), the clutch weight increases in pairs where females are given a larger male and decreases when females are given smaller male in the Banggai cardinalfish. In the present study, the female *H. kuda* body weight correlated positively with the egg size (length+width) and weight. The maternal body weight also showed significant positive correlation with clutch size. Higher survival and fast growth rates have also been observed from larger fish eggs (Heinrich, 1988). In a sex role reversed species, *Syngnathus typhle* both sexes exhibit increased reproductive success with increased size (Gwynne, 1991) and the larger males provide more care for increased number of offsprings

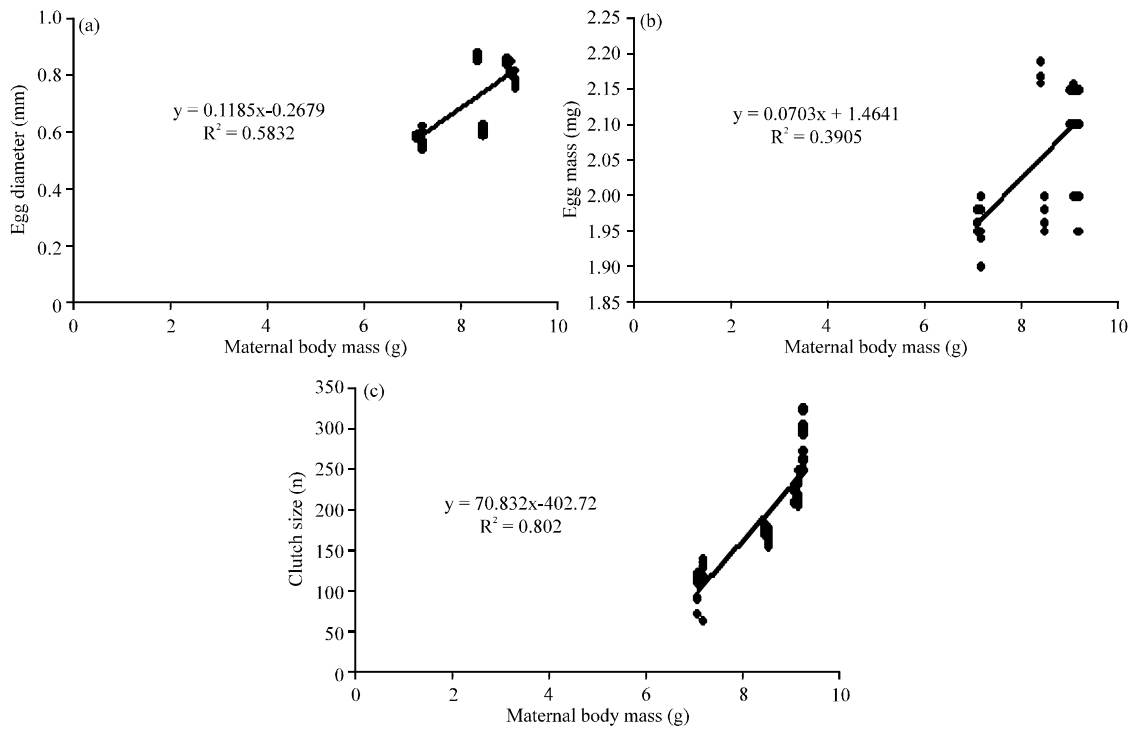


Fig. 1(a-c): Relationship between maternal body mass and (a) Egg diameter, (b) Egg mass and (c) Clutch size

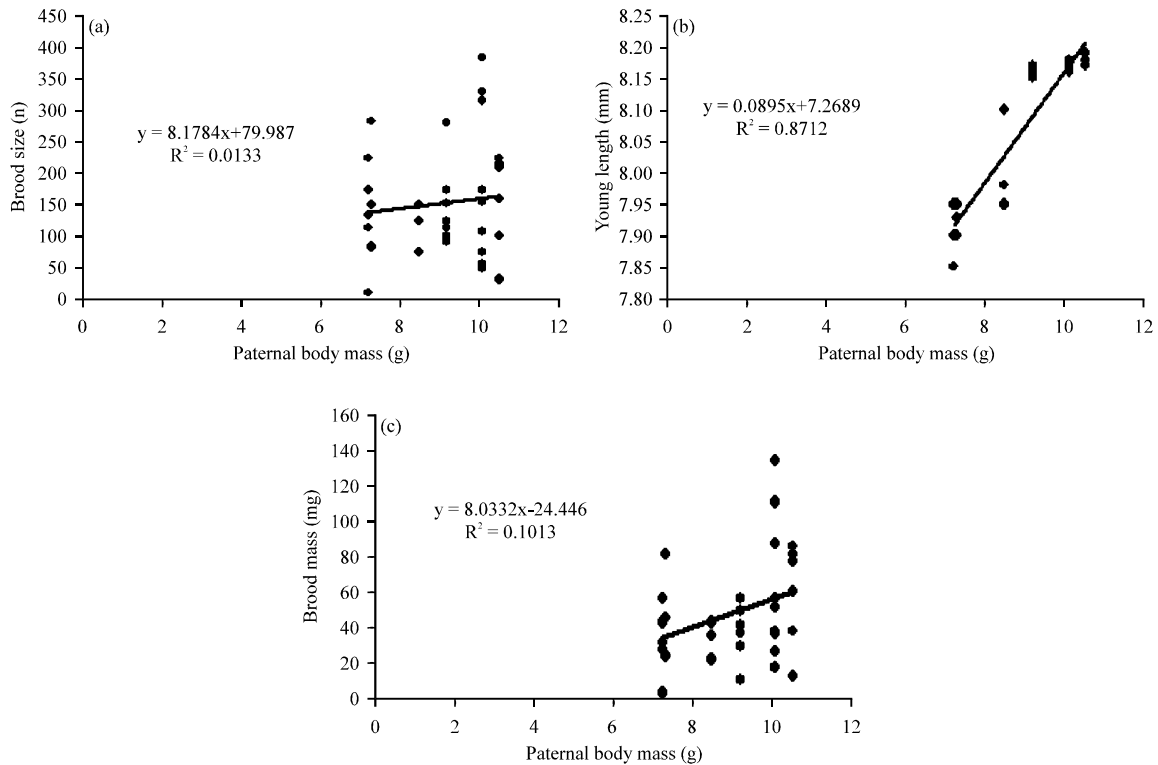


Fig. 2(a-c): Relationship between paternal body mass and (a) Brood size, (b) Young length and (c) Brood mass

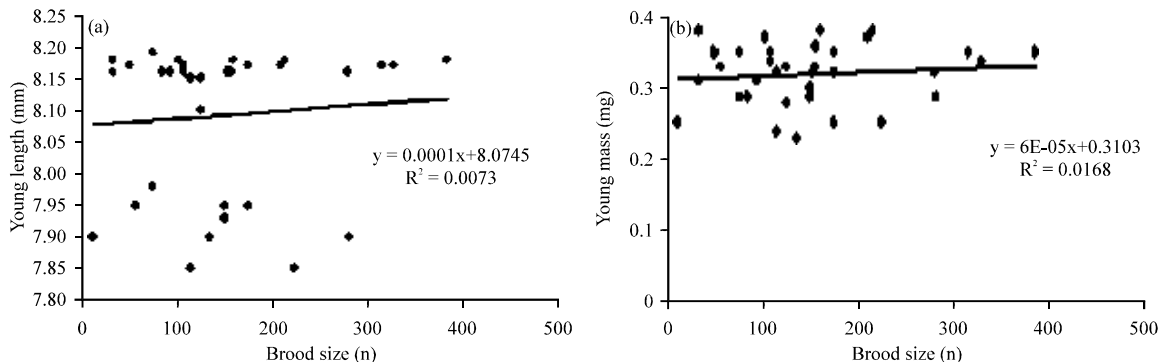


Fig. 3(a-b): Relationship between brood size and (a) Young length and (b) Young mass

(Berglund *et al.*, 1986). The positive correlation of male size between young length and mass in *H. kuda* is comparatively similar as that of earlier results with other seahorse species, *Hippocampus zosterae* (Strawn, 1958) and *Hippocampus fuscus* (Vincent, 1990). In *H. kuda* the paternal body mass plays less significant role in determining the brood size, although it play a important role to produce healthy and larger offspring. Moreover, brood size did not affect the length and weight of young ones. Paternal body sizes had less effect on reproductive output by means of brood size but they decide the survival and fitness of the baby.

ACKNOWLEDGMENTS

The authors thank The Director, CMFRI and The officials, Annamalai University for the facilities and encouragement. M.T. and A.P.L. are also much thankful to the Ministry of Environment and Forest, Government of India, New Delhi for the financial assistance in the form a sponsored research project.

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