

**RHYTHMIC CHANGE IN GONADAL ACTIVITY WITH LUNAR
PERIODICITY IN THE FORKTAIL RABBITFISH, *SIGANUS*
*ARGENTEUS***

M.S. Rahman
Sesoko Station, Tropical Biosphere Research Center, University of the Ryukyus,
3422 Sesoko, Motobu, Okinawa 905-0227, Japan
+81-980-47-6215/+81-980-47-4919/rahmanmdsaydur@hotmail.com

A. Takemura, B.-H. Kim and K. Takano
Sesoko Station, Tropical Biosphere Research Center, University of the Ryukyus,
3422 Sesoko, Motobu, Okinawa 905-0227, Japan

EXTENDED ABSTRACT ONLY - DO NOT CITE

Introduction

Our recent studies have demonstrated that rabbitfishes are restricted to lunar-synchronized spawners, and the gonad of each species develops toward and the mature gametes released at the specific lunar phase (Hoque et al., 1999; Rahman et al., 2000a,b; Harahap et al., 2001). In order to understand environmental regulation of rhythmic change in reproductive activity, it is necessary to elucidate objectively relationship between possible environmental factor and gonadal activity. However, precise correlation between the lunar periodicity and changes in gonadal activities has been studied only in some rabbitfish species (Hoque et al., 1999; Rahman et al., 2000a,b; Harahap et al., 2001). In the present study, the rhythmic changes in ovarian activity of the forktail rabbitfish, *Siganus argenteus*, which is one of the conspicuous species for aquaculture in the tropical and the subtropical region, were assessed by histological observation of ovaries, immunological measurements of plasma steroid hormones, estradiol-17 β (E₂), testosterone (T) and 17 α ,20 β -dihydroxy-4-pregnen-3-one (DHP), and by *in vitro* production of steroid hormones in intact follicles of oocytes.

Materials and Methods

Forktail rabbitfish were caught from the coral reef area and housed to rearing conditions in a floating sea net cage. The fish were sampled every week from May through July following the lunar periodicity. Plasma was separated after centrifugation the blood samples. The ovaries were dissected out and weighed for gonadosomatic index (GSI) calculation. Small pieces of ovaries were fixed in Bouin's solution, serially sectioned, and stained with haematoxylin-eosin solution.

For *in vitro* culture, ovaries were rinsed with L-15 medium and incubated with human chorionic gonadotropin (hCG) and several steroid hormones according to the methods of Rahman et al. (2002). Steroid hormones in plasma and media were measured by enzyme-immunoassay (Rahman et al., 2000a).

Results and Discussion

Weekly changes in GSI of female forktail rabbitfish showed three peaks at the last quarter moon during the reproductive season from May through July. It was observed histologically that many fresh empty follicles, an indicator of spawning (Rahman et al., 2000a), appear in an ovary among the oocytes developed over the tertiary yolk stage at the same lunar quarter. Therefore, it is obvious that the spawning of this species occurs around the last quarter moon.

In the present study, fluctuation of the plasma steroid hormones seems to reflect the ovarian characteristics of forktail rabbitfish. Weekly changes in plasma E_2 and T levels showed three peaks around the full moon, while plasma DHP level reached its peak around the last quarter moon. When the intact follicles of oocytes were incubated with hCG, the production of E_2 decreased, but that of DHP increased from the full moon to the last quarter moon. These results show that the ovarian follicles produce E_2 around the full moon and DHP around the last quarter moon, and that the production of the steroid hormones is under the influence of gonadotropin (GtH). It is suggested that the ovary develops toward and the spawning occurs around the last quarter moon, and that the ovarian activity of forktail rabbitfish is synchronized with the lunar periodicity.

In conclusion, the synchronous increase in gonadal activity supports the hypothesis that the characteristic natures of reproductive rhythmicity in rabbitfishes are the use of lunar factors and their utilization for synchronized

reproduction.

References

- Harahap, A.P., A. Takemura, S. Nakamura, M.S. Rahman and K. Takano. 2001. Histological evidence of lunar-synchronized ovarian development and spawning in the spiny rabbitfish, *Siganus spinus* (Linnaeus), around the Ryukyus. *Fisheries Sci.* 67: 888-893.
- Hoque, M.M., A. Takemura, M. Matsuyama, S. Matsuura and K. Takano. 1999. Lunar spawning in *Siganus canaliculatus*. *J. Fish Biol.* 55: 1213-1222.
- Rahman, M.S., A. Takemura and K. Takano. 2000a. Correlation between plasma steroid hormones and vitellogenin profiles and lunar periodicity in the female golden rabbitfish, *Siganus guttatus* (Bloch). *Comp. Biochem. Physiol.* 127B: 113-122.
- Rahman, M.S., A. Takemura and K. Takano. 2000b. Lunar synchronization of testicular development and plasma steroid hormone profiles in the golden rabbitfish. *J. Fish Biol.* 57: 1065-1074.
- Rahman, M.S., A. Takemura and K. Takano. 2002. Lunar synchronization of *in vitro* steroidogenesis in ovaries of the golden rabbitfish, *Siganus guttatus* (Bloch). *Gen. Comp. Endocrinol.* 125: 1-8.

Acknowledgements

This study was supported in part by Grants-in-Aid for Scientific Research from the Ministry of Education, Science, Sports and Culture, Japan (AT) and by a JSPS Research Fellowships grants for Young Scientists, Japan (MSR).

