熱帯性ハタ科魚類カンモンハタにおける月周性産卵機構の解明

（様式第３号）

論　文　要　旨

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Elucidation of lunar-synchronized spawning mechanism in tropical grouper fish, *Epinephelus merra*

The lunar-synchronized spawning is a rhythmic event observed in many marine animals, including corals and fish, that is repeated monthly during the spawning season. Physiological activity and behavioral responses related to lunar reproduction cycles are activated before and maximized during a particular moon phase. Moon-derived cues observed from Earth are a potent entrainer for behavioral synchrony, although the extent to which such cues are perceived by animals and transduced into internal stimuli to drive lunar rhythmicity remains unclear. To address the mechanisms of lunar-synchronized spawning, in the present study focused on (1) the reproductive mechanism of lunar-synchronized spawning. (2) the endogenous time-keeping system which generates full moon preference. (3) the function of the moonlight in the occurrence of spawning behavior and performed investigation using the honeycomb grouper in Okinawa. To elute the mechanisms of reproduction which has a moon phase depending fluctuation, Weekly changes in reproductive activity in the HPG axis such as degree of gonadal development, expression of reproductive related genes (*gnrh1*, *2*, *fshβ*, and *lhβ*) in the brain was examined, and further investigation to evaluate the function of melatonin on the HPG axis was performed. We concluded that hormones secreted from the respective endocrine organs of the HPG axis repeat lunar-related fluctuations during the spawning season and that melatonin functions as a key mediator and transducer of moonlight information. To evaluate the mechanism of the endogenous time-keeping system, the expression profiles of circadian clock genes were investigated. Weekly collection at midnight showed increases in the transcript levels of *cry1* and *cry2* in the diencephalon, but not the pituitary gland, from the first quarter moon through the last quarter moon. In comparison to the new moon, these transcript levels were significantly lower at all other sampling times. The artificial full moon conditions for 1 month resulted in increased *cry* transcript levels in both tissues at 2 (*cry1*) or 2 and 4 (*cry2*) weeks after the initiation of full moon conditions. Furthermore, the effect of artificial light at night on the spawning was evaluated. When fish were kept under long-day conditions in the absence of artificial moonlight, small amount of eggs was released in tanks. On the other hand, fish exposed to long-day conditions with artificial moonlight released a large amount of eggs at week 3, consistent to the full moon in natural. These results were indicated that the importance of transient changes in "brightness at night" in the response to moonlight for the phase shift and of "darkness at night" during the new moon for the phase set to the determined moon phase. We concluded that the moon phase-dependent oscillation of clock genes plays a role in lunar cycle-dependent behaviors in fish. In conclusion, it was produced that the involvement of two systems, reproductive system which consisted mainly HPG axis, and time-keeping systems which is driven by endogenous timer, in the lunar-synchronized spawning of the honeycomb grouper.

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