カワムツの遊泳行動におけるサーカディアンリズム

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Short Paper

Circadian Locomotor Activity in Kawamutsu *Zacco temmincki*

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Fish display diel locomotor activity under the light and dark cycles.[1,2] It is controversial, however, whether the diel locomotor activity is influenced endogenously or exogenously. The present study was undertaken to determine the existence of circadian rhythmicity and its participation on the diel locomotor activity in kawamutsu *Zacco temmincki*.

Kawamutsu of 25–85 g in body weight and 14–18 cm in total length were used. They were placed in an acclimatized tank under 12 hr light and 12 hr dark (LD 12: 12, L=100 lx, D=complete darkness) at 20°C. Then they were maintained in the same experimental conditions described elsewhere.[3,4] Locomotor act tivity was examined under the combination of light and dark (LD) cycles, continuous light (LL; 0.01 lx) and continuous dark (DD). In the present experiment, the methods for detection and recording of locomotor activity were the same as described elsewhere.[3,4] Period lengths (τ) for the locomotor activity and their statistical significance relative to random "noise" in the time-series data records were determined by the periodogram. Circadian rhythm was determined by a 95% confidence limit.

When the fish was exposed to LD cycles, higher activities were observed in the dark phase than in the light phase as shown in Fig. 1. The locomotor activity tended to reduce at the beginning of light phase. When exposed to DD, the fish displayed free running rhythmicity with the τ of 23.9 hr as shown in the periodogram (Fig. 1, B). Resynchronization was observed by the reexposure to the second LD cycles, which was employed as the entrainment for subsequent LL. The circadian activity was also observed in LL with the τ of 26.1 hr. In general, the amount of locomotor activity was higher in DD than LL. This tendency was also observed in catfish.[4,5] Unprolonged period of freerunning rhythmicity in the present and in the other fish[6] is a common character. One of the reasons for this property is considered to be the multiple component system[7] of the locomotor activity in fish.

Delaying or advancing of the LD light regime is one of the methods commonly used to know the participation of circadian rhythm on the diel locomotor activity. In the present experiment, delaying 6 hr of LD regime (onset 12: 00, offset 00: 00) was made after 9 day entrainment (onset 6: 00, offset 18: 00). By this procedure, resynchronization to the new LD cycles was immediately observed in the whole locomotor activity. Similarly, immediate resynchronization of the activity was also observed by advancing light regime (onset 6: 00, offset 18: 00).

However, during the LD regime, some fish displayed an activity peak at 2–3 hr before the onset of light, which was considered as an anticipated behavior. By shifting the LD regime, the anticipated behavior needed 3–4 LD cycles for resynchronization to the new LD cycles.

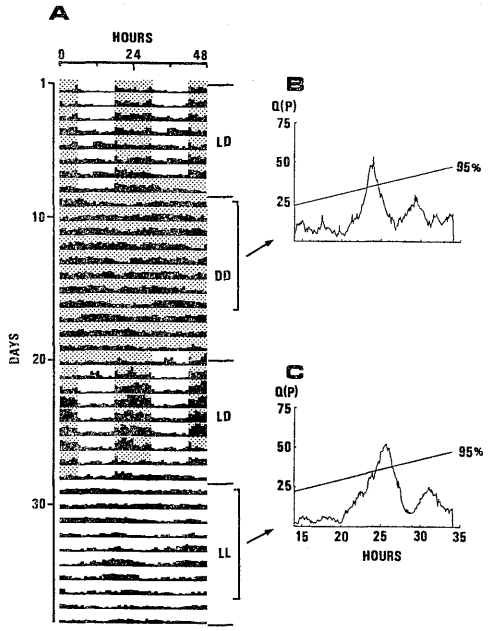

Fig. 1. Actogram (A) of kawamutsu under LD 12: 12 (LD), constant dark (DD) and constant light (LL). Shadowy and white areas indicate the dark and light phase, respectively. The records were double plotted for clarity. Periodograms (B & C) were obtained from the indicated period. The $Q(p)$ value indicates a predominant rhythmic component. Slanted line indicates 95% confidence limit.

It is assumed from these findings that the endogenous circadian rhythms weakly influence on the diel locomotor activity in kawamutsu.

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