Reproductive Color Changes in the Pearl Gourami, Trichogaster leeri (Bleeker) [1]

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Introduction

The pearl gourami is a small (up to 100 mm total length), tropical anabantoid fish native to Southeast Asia. Both sexes show pronounced morphological, color, and behavioral changes with the onset of the breeding season. Only color and body marking changes will be discussed in detail in this report.

Earlier studies by Baerends and Baerends-van Roon (1950) on cichlid fishes; Miller (1964) on the blue gourami, *Trichogaster trichopterus;* Barlow (1962) on the Asian teleost *Badis badis;* and Forselius (1957) on several species of anabantoid fishes have examined color changes occurring during reproductive cycles and discussed some of the possible implications of these changes. The functions of many of these changes are not well understood and the present study does little to clarify this situation. However, color changes during the reproductive cycle in *T. leeri* are striking and useful guides in determining the motivational states of the sexual partners. These indicators of spawning readiness may be used to advantage by aquarists, ethologists, and ichthyologists who are interested in the propagation and study of this species.

Materials and Methods

This study was conducted in the Constant Temperature Room of the Oklahoma State University Aquatic Biology Laboratory, Stillwater, Oklahoma. The temperature of this room was maintained at 24-27 C for the duration of the study.

At least six pairs of *T. leeri* were maintained throughout the study. All fishes were of breeding or near-breeding age when paired. Sizes ranged from 40-90 mm standard length. Males and females of equal or near-

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equal size were paired in order to prevent excessive aggression and lessen the danger of infection and mortality. Most fishes were obtained from aquarium dealers in Stillwater and Oklahoma City. Food consisted of *Daphnia,* dried foods, and midge larvae. Lighting was provided by overhead fluorescent and incandescent lamps. A 12-hour (6 AM - 6 PM) photoperiod was maintained with electric appliance timers.

Data were obtained primarily by daily or twice-daily 15-minute observations per aquarium over a period of one year.

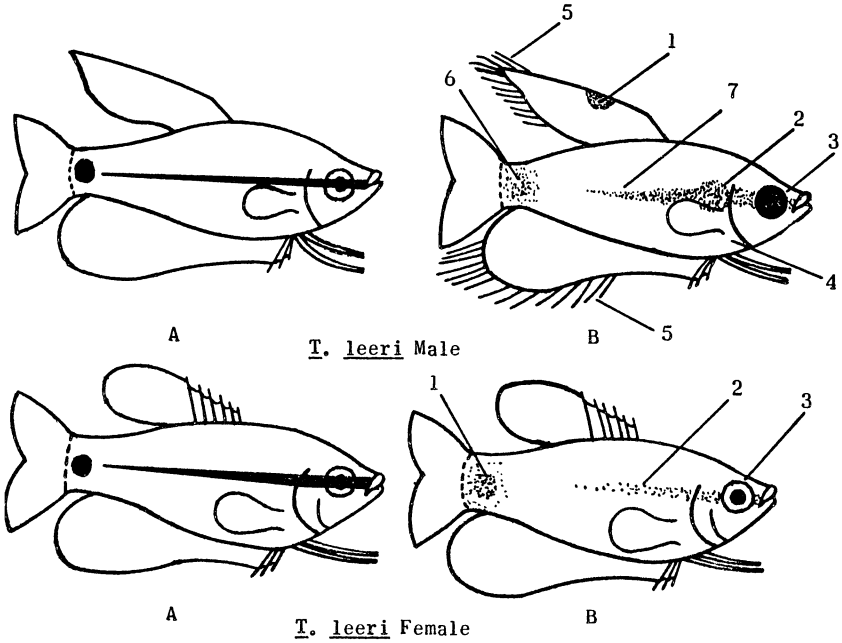

Fig. 1. Morphological, color, and body marking changes in male and female *Trichogaster leeri.* A. Nonbreeding B. Breeding (Diagrammatic only).

Results

Changes in color patterns and body markings are shown in figure 1. The following numbers correspond to diagram numbers in figure 1.

Male

1. DORSAL FIN OCELLUS. Some, but not all, breeding males develop a small orange spot (or spots) in the posterior soft-rayed portion of the dorsal fin. The functional significance of this characteristic has not been determined.

2. POST-OPERCULAR OCELLUS. The formation of a dark post-opercular ocellus is characteristic of breeding males. It is not a "remnant of

the horizontal band" as Forselius (1957) stated because the horizontal band is still present, although somewhat diffuse. Also, the diameter of the ocellus is greater than the width of the original horizontal band. The functional significance of this body marking is unknown. The ocellus does not appear to serve as a target for female courtship butting.

3. EYE COLOR. The eye of a breeding male becomes uniformly dark at the time of spawning, in contrast to the gray eye, traversed by a dark horizontal band observed in non-breeding males. This is one of the most reliable indicators of spawning readiness in males of this species, but is not present in all.

4. VENTRAL COLORATION. Most breeding males acquire a deep yellow or orange coloration on the ventral surface, especially on the throat, breast, and pelvic fins. The intensity of coloration varies in and among individuals.

5. DORSAL AND ANAL FIN EXTENSIONS. Filamentous extensions of the soft rays of the dorsal and anal fins are characteristic of breeding males. These extensions become broken and disappear at or near the end of the spawning cycle. The growth of these extensions is presumably related to the phenomenon of general increase in rate of mitosis associated with increased gonadal hormone levels (Bullough, 1961).

6. CAUDAL OCELLUS. The caudal spot also changes in form and intensity, but these are less marked than most other changes. The well-defined, usually circular caudal ocellus of non-breeding males anastomoses with the melanophore network of the caudal peduncle and becomes diffuse and much less distinct.

7. HORIZONTAL BAND. In breeding males the horizontal band anastomoses with reticulations of the body melanophore system and usually becomes diffuse and somewhat shortened. Instead of extending almost to the caudal ocellus it may extend only one-half to two-thirds the original length. The horizontal band does not include the lateral line, except posteriad on the caudal peduncle, and does not appear to serve as a target for female courtship butting. Most female courtship butts are directed at the base of the anal fin, sides, and the base of the dorsal fin.

Female

Non-breeding *T. leeri* females are marked much like non-breeding males. Breeding females may acquire some yellow coloration ventrally, but not the intense gold and reddish-orange colors of breeding males.

1. CAUDAL OCELLUS. Diffusion of the caudal ocellus is usually more pronounced in breeding females than in breeding males and in some cases no remnant of it can be seen. This marking usually disappears during or shortly before the onset of a spawning sequence, but normally begins to re-appear at or near the end of the sequence and remains quite distinct until the onset of the next spawning sequence.

2. HORIZONTAL BAND. The horizontal band usually disappears completely during spawning and re-appears at or near the end of the spawning sequence. The body color usually becomes uniformly pale with vague reticulations.

3. EYE COLOR. One of the most striking color changes in females is the change in eye color associated with spawning. The female's eye, with few exceptions, becomes uniformly light with no trace of the original horizontal band, whereas the eye of the male becomes uniformly dark.

Discussion

The functional implications of many of these changes are unknown. Picciolo (1964) found that sex and species discrimination are dependent upon visual stimuli in *T. leeri*. He stated that "No conclusive evidence was obtained to support the hypothesis that the horizontal band displayed by males and females of *T. leeri* functioned as a cue for sex or species discrimination." Furthermore, "No evidence was obtained to indicate that the reddish-orange throat and abdomen displayed by the males of *T. leeri* functioned as a cue for sex discrimination." These statements, however, are based on model experiments involving only males of apparently indeterminate reproductive condition, with a maximum of 30 trials. Inasmuch as approach frequency was the only criterion measured, there is some doubt as to the nature of the response itself and the causal factors involved. The nature and quantity of the data seem not to justify strong confidence in the conclusions stated. Present observations strongly suggest that body markings, color, and body configuration all are highly important stimulus sources for sex recognition in *T. leeri*. Coloration in teleosts is influenced by a number of factors such as, diet; neural and hormonal factors; temperature; and genetic differences. Therefore, it cannot be assumed that the changes and variations described herein will be observed in all populations of *T. leeri*.

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