

# 水槽内におけるレンテンヤッコの繁殖と卵および仔魚

誌名	東海大学紀要. 海洋学部
ISSN	13487620
著者名	日置,勝三 鈴木,克美
発行元	東海大学海洋学部
巻/号	24号
掲載ページ	p. 133-140
発行年月	1987年1月

農林水産省 農林水産技術会議事務局筑波産学連携支援センター  
Tsukuba Business-Academia Cooperation Support Center, Agriculture, Forestry and Fisheries Research Council  
Secretariat



## Reproduction and Early Development of the Angelfish, *Centropyge interruptus*, in an Aquarium\*

Syozo HIOKI and Katsumi SUZUKI

### Abstract

Reproduction of the angelfish *Centropyge interruptus* (TANAKA) in captivity was observed repeatedly at least 44 times over a period of 71 days from 24 February to 2 May, 1984, in the Marine Science Museum of Tokai University. Spawning followed lengthy courtship behavior and took place at 17:15~18:00, which was approximately 20 minutes before sunset.

Fertilized eggs were pelagic and measured 0.68~0.70mm in diameter. Hatching took place from 15 hours 38 minutes in water temperature of 24.8~25.5°C. Newly hatched larvae measured 1.30~1.40mm in total length, and had a large ellipsoid yolk sac. The front tip of the yolk sac clearly protruded beyond the snout of the larva. These larval characteristics are shared with those of the related angelfish species studied. The larvae were maintained for the first five days after hatching and to an early post-larval stage.

*Centropyge interruptus* (TANAKA) is a beautiful angelfish which inhabits rather deep and warm temperate waters in southern Japan. It is distributed along the Pacific coast of central Japan from Boso Peninsula to Kochi Prefecture, and its distribution extends only as far as the islands of Izu and Ogasawara. Although one young specimen was captured recently from Kure Atoll, Hawaii, it seemed to have been transported accidentally from Japan by "an ocean current" (RALSTON, 1981).

MOYER and NAKAZONO (1978) reported on the reproductive behavior and protogynous sex succession of *C. interruptus* based on several underwater observations off the coast of Miyake-jima, Izu Islands. However, the ontogeny of the present species has thus far been unknown. In fact, as THRESHER (1985) pointed out, little has hitherto been known on early life stages among the family Pomacanthidae, except for the only five species studied, i. e., *Chaetodontoplus septentrionalis* (TEMMINCK et SCHLEGEL) (see FUJITA and MITO, 1960), three species belonging to the genus *Genicanthus* (see SUZUKI et al., 1979; HIOKI et al., 1982), and *Centropyge argi* WOOD and KANAZAWA (see BAUER and BAUER, 1981). The present paper contains the first description of the early developmental stages for five days after hatching from natural spawning under aquarium rearing conditions in the Marine Science Museum of Tokai University, 1984.

---

\* Contribution A No. 351 from the Faculty of Marine Science and Technology, Tokai University.  
Accepted October 9, 1986.

Contributions from the Marine Science Museum, Tokai University, No. 93.

## Materials and methods

Four adult fish were used for the present experiment. They were collected from Hachijo Island, Izu Islands, by SCUBA divers on 5 October 1983, and had been in captivity for at least 131 days with no other fishes together. The aquarium tank used for spawning of *C. interruptus* was made of acrylic resin, measured  $1.3 \times 2.0 \times 0.75$  (H) m, and had a capacity of  $1.95\text{m}^3$ . Water was filtered by means of an external sand filter and water temperature was kept between  $24.0$  and  $25.9^\circ\text{C}$ . The adult fish had received no special treatment to encourage their reproduction other than rather heavy and careful feedings. They were fed once daily with chopped or sliced meat of fishes, clams, and prawns.

Courtship behavior in captivity was observed carefully almost every day. Whenever spawning was confirmed, the floating eggs were immediately scooped into a small net and transferred into 30-liter plastic receptacles in which the fertilized eggs were initially maintained. When spawning occurred but was not observed, the eggs were collected the next morning in a small trap-net set outside of the overflow hole of the aquarium tank. Still water with weak aeration was used for maintenance of eggs and larvae. The water was occasionally renewed. Water temperature was kept between  $24.8$  and  $25.5^\circ\text{C}$  for the duration of experiments.

## Results and discussion

### Spawning

At least in captivity, *C. interruptus* released their gametes in harem behavior. Spawning took place between one territorial male, measuring  $169.5\text{mm}$  in total length, and three females, measuring  $137.0\sim 154.0\text{mm}$  in total length. The successful reproduction was observed at first on 24 February, then continued to 2 May, and was confirmed on at least 44 occasions over a period of 71 days (Fig. 1). Spawning, which followed lengthy courtship behavior beginning in early afternoon, occurred mostly in approximately 20 minutes before sunset, i. e., between  $17:15$  and  $18:10$ . Mutual courtship and spawning behaviors in captivity seemed to bear a close resemblance to those observed in the field as previously reported (MOYER and NAKAZONO, 1978).

### Fertilized and developing eggs

The fertilized eggs of *C. interruptus* were buoyant, transparent, colorless, spherical, and non-adhesive with a narrow perivitelline space. The eggs measured  $0.68\sim 0.70\text{mm}$  in diameter with a rather large yolk which contained a single oil globule measuring  $0.15\sim 0.16\text{mm}$  in diameter. Neither structure nor appendage was found on the surface of the yolk or egg membrane.

The following developmental stages were recorded: 32 minutes after fertilization, the first cleavage; 50 minutes after fertilization, 4-cell stage (Fig. 2A); 60 minutes, morula stage

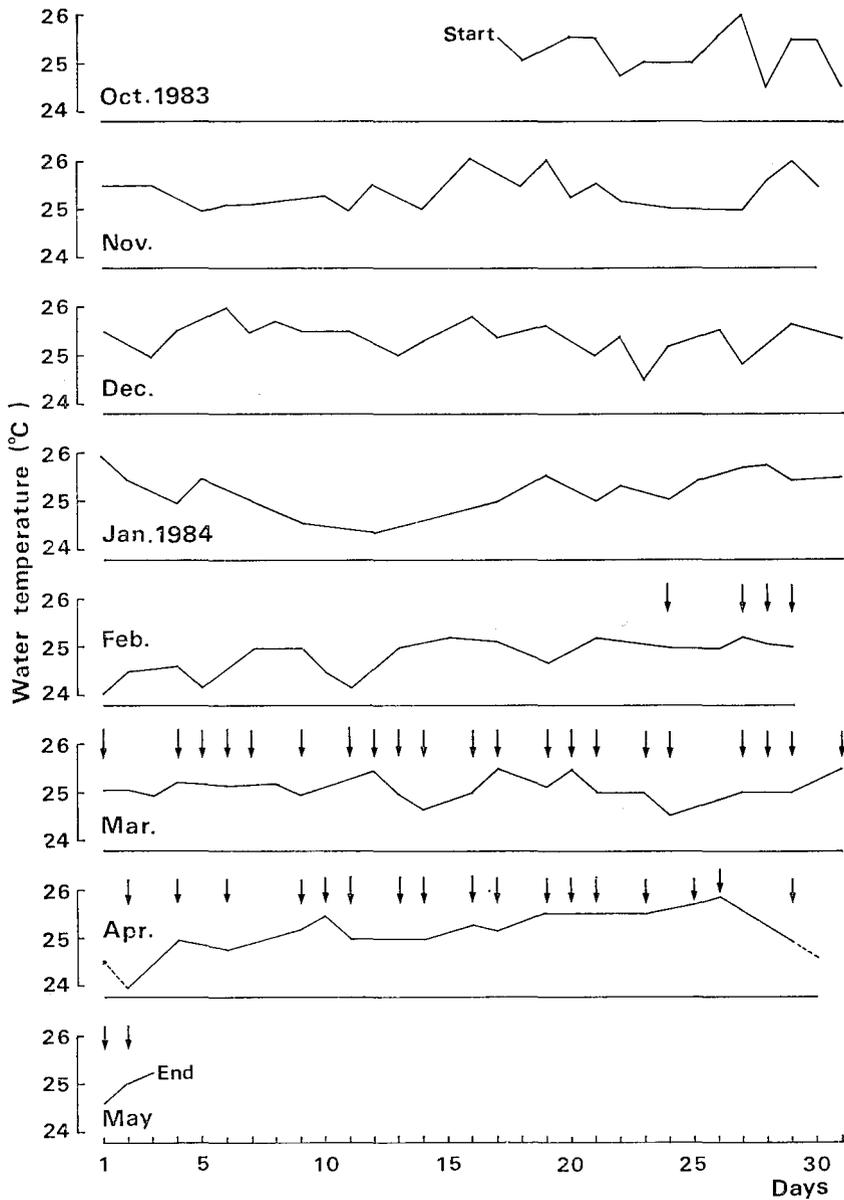


Fig. 1. Water temperature during maintenance of parental fish of *C. interruptus* from 17 October 1983 to 3 May 1984. Spawning data are shown as vertical arrows.

(Fig. 2B); 5 hours and 10 minutes, blastoderm covered two-third of the yolk and the embryonal body appeared (Fig. 2C); 9 hours, nine myotomes were seen and Kupffer's vesicle and optic vesicles appeared. A large number of punctate melanophore pigments appeared; thirty or forty of these were along the dorsal surface of the embryonal body (Fig. 2D).

Immediately before hatching, 22 myotomes were seen distinctly, a lens was formed in

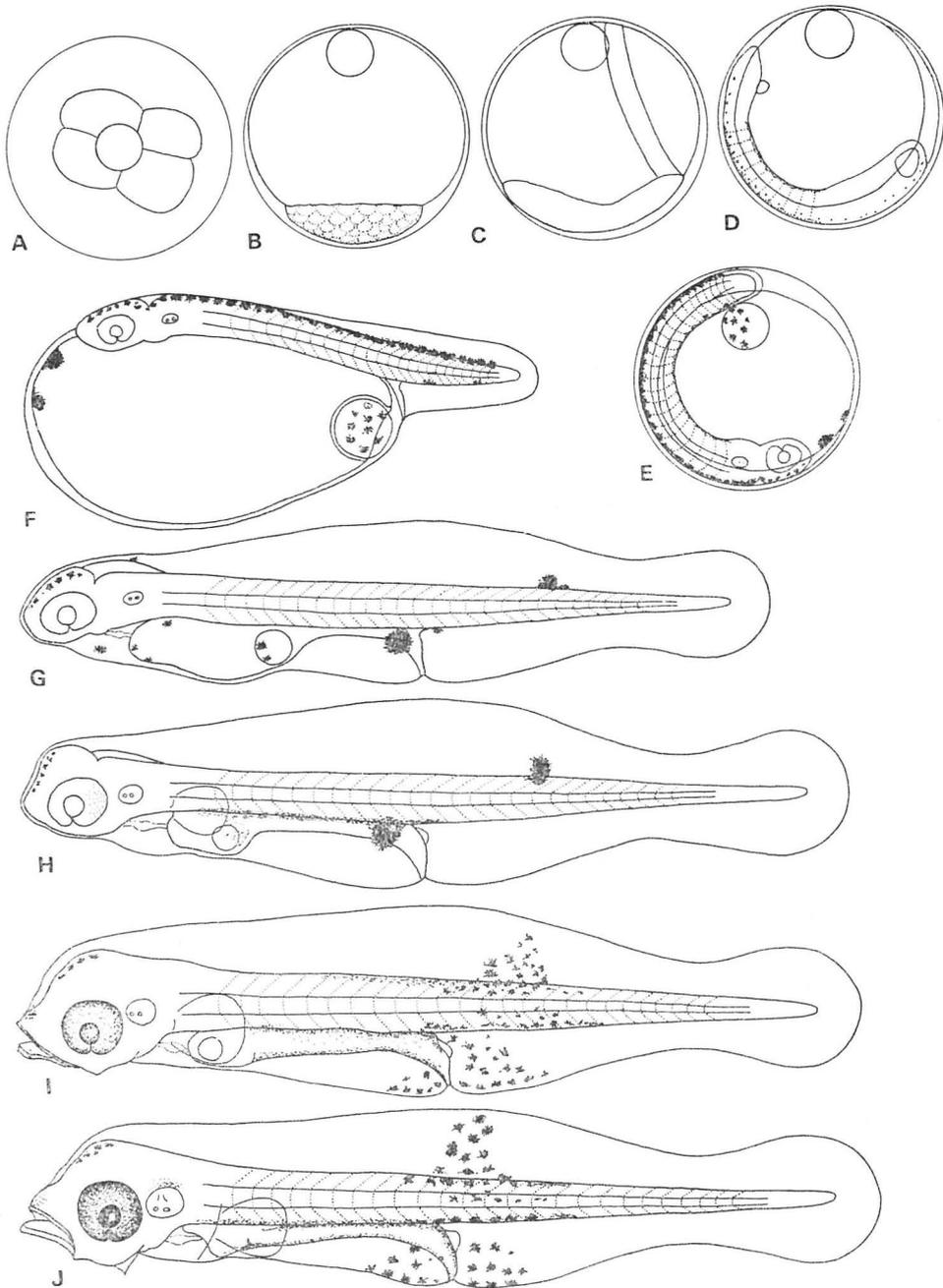


Fig. 2. Developing eggs and larvae of *C. interruptus*. A. 4-cell stage, 50min. after fertilization. B. Molura stage, 1hr. 50min. C. Formation of embryo, 5hr. 10min. D. 9-myotome stage, 9hr. E. 22-myotome stage, immediately before hatching, 15hr. 38min. F. Newly hatched larva, 1.40mm in total length. G. Early larva, 1 day after hatching, 2.30mm. H. Early larva, 2 days, 2.44mm. I. Early larva, 3 days, 2.50mm. J. Post-larva, 5 days, 2.60mm.

Table 1. Developmental process in embryonal stage of *C. interruptus*.

Stage	Time after spawning		Code in Fig. 2.
	hr.	min.*	
2-cell stage	00	32	
4-cell stage	00	50	A
8-cell stage	01	00	
Morula stage	01	50	B
Formation of embryo	05	10	C
9-myotome stage : Appearance of Kupffer's vesicle, optic vesicles, and melanophores.	09	00	D
22-myotome stage : Immediately before hatching.	15	38	E

\* At water temperature of 24.8-25.5°C.

each of the optic vesicles, the oil globule was fixed at the caudal part of the embryonal body, seven or eight melanophores were present on the surface of the oil globule and two were present close to the front tip of the embryonal body. A few tubercles were dispersed on the surface of the yolk (Fig. 2E).

Hatching took place from 15 hours 38 minutes after fertilization. Almost all the larvae hatched out within 30 minutes after the first hatching.

#### Early larvae

The newly hatched larvae measured 1.30~1.40mm in total length and contained a large ellipsoid yolk sac (1.00~1.05mm in largest diameter). The front tip of the yolk sac extended beyond the snout of the larva. A single oil globule, a part of which protruded out of the yolk, was situated at the rear end of the yolk sac. The number of myotomes was 12~13+9~10=22~23. The anus was located at an anterior point two-third of the total length, and was close to the rear margin of the yolk sac. Numerous branched melanophores were seen along the dorsal body axis; approximately ten were on the surface of the oil globule, and two were at the front tip of the yolk. A number of small tubercles were seen over the whole body surface of the larva (Fig. 2F).

One day after hatching, larvae measured 2.30~2.50mm in total length, and had 13+12=25 myotomes. Branched melanophores along the dorsum had mostly disappeared except for a large one on the nineteenth and twentieth myotomes, one large melanophore and a number of small ones were seen on the digestive organ, and six or seven were seen at the head of the larva (Fig. 2G).

Two days after hatching, larvae measured 2.30mm in total length and had 9~10+14=23~24 myotomes. The yolk sac was remarkably absorbed. The pectoral fins appeared. The pigmentations along the body axis and membranous fin were mostly similar in number and in location to those of the prior stage above mentioned. The eyes became slightly blackish in color with the increase in the number of melanophore pigments within (Fig. 2H).

Three days after hatching, larvae measured 2.50~2.80mm in total length and had 10~11+13~14=24 myotomes. The yolk sac was almost completely absorbed but left a small

remnant of the oil globule. The mouth and anus were open. The jaws began to be formed. The eyes became completely blackish. Numerous small punctate melanophores were seen along the surface of the digestive organ. A few rather deep branched melanophores were present at the head of the larva (Fig. 2I).

### Post-larvae

Five days after hatching, larvae measured 2.40~2.60mm in total length and had 10+14=24 myotomes (Fig. 2J). Despite attempts to feed them with the rotifer *Brachionus plicatilis*, no noticeable increase in size or change in shape were seen in the larvae, and the last one died seven days after hatching.

### Discussion

Characteristics of the newly hatched larvae of *C. interruptus* above mentioned bore a close resemblance to those of the other angelfishes previously studied, despite their belonging to three different genera. It shared the following common characteristics with the other five species: 1) Larvae had a large ellipsoid yolk sac and the front tip of the yolk extended beyond the snout. 2) A single oil globule was situated close to the rear end of the yolk. 3) The anus was situated a little behind the rear margin of the yolk sac. 4) A number of melanophore pigments were seen on the surface of the oil globule.

Except for *C. argi* reported by BAUER and BAUER (1981) in which the larval character-

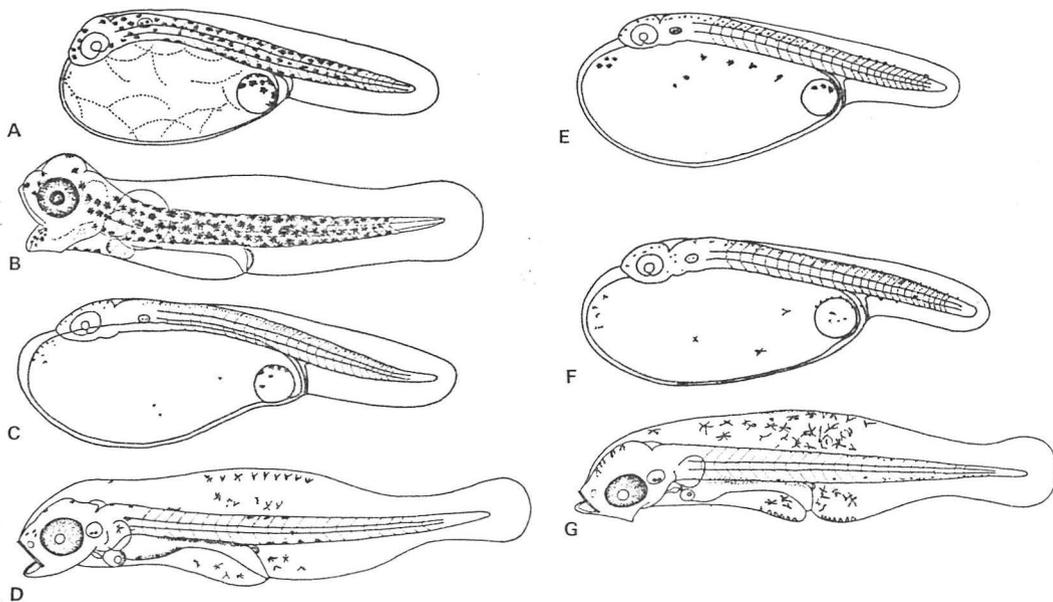


Fig. 3. Comparisons of larval form and pigmentation in the newly-hatched and early post-larvae of the pomacanthid fishes previously reported.

A,B. *Chaetodontoplus septentrionalis* (after FUJITA and MITO, 1960). C,D. *Genicanthus lamarck* (after SUZUKI et al., 1979). E. *Genicanthus melanospilos* (after HIOKI et al., 1982). F,G. *Genicanthus semifasciatus* (after SUZUKI et al., 1979).

istics were only briefly described, the previous and present studies showed that the newly hatched larvae of each species resembled closely together and were yet distinguishable from each other solely on the basis of the pigmentations on the larval body (Fig. 3).

FUJITA and MITO (1960) described a rough segmentation over the surface of the yolk sac in the newly hatched larvae of *C. septentrionalis* (Fig. 3 A), and it was confirmed by the senior present author (HIOKI, pers. obs.). However, it was not found such a larval characteristic in the other pomacanthid species studied.

### Acknowledgement

The authors are thankful to Messrs. Yoshihisa SHIOBARA, Marine Science Museum of Tokai University, Hiroshi KOBAYASHI, Sunshine International Aquarium, and Makoto TANAHASHI, Tokyo Tower Aquarium, for their considerable assistance with the present study.

### References

- BAUER, J.T., and S.E. BAUER (1981) : Reproductive biology of the genus *Centropyge* (Pomacanthidae). Bull. Mar. Sci., **31**(3), 495-513.
- FUJITA, S. and S. MITO (1960) : Egg development and hatched larvae of a chaetodontid fish, *Chaetodontoplus septentrionalis*. Bull. Japan. Soc. Sci. Fish., **26**(3), 227-229 (in Japanese with English abstract).
- HIOKI, S., K. SUZUKI, and Y. TANAKA (1982) : Spawning behavior, egg and larval developments, and sex succession of the hermaphroditic pomacanthine, *Genicanthus melanospilos* in the aquarium. J. Fac. Mar. Sci. Technol., Tokai Univ., (15), 359-366 (in Japanese with English abstract).
- MOYER, J.T. and A. NAKAZONO (1978) : Population structure, reproductive behavior and protogynous hermaphroditism in the angelfish *Centropyge interruptus* at Miyake-jima, Japan. Japan. J. Ichthyol., **25**(1), 25-39.
- RALSTON, S. (1981) : A new record of the pomacanthid fish *Centropyge interruptus* from the Hawaiian Islands. Japan. J. Ichthyol., **27**(4), 327-329.
- SUZUKI, K., S. HIOKI, Y. TANAKA and K. IWASA (1979) : Spawning behavior, eggs, larvae, and sex reversal of two pomacanthine fishes, *Genicanthus lamarck* and *G. semifasciatus*, in the aquarium. J. Fac. Mar. Sci. Technol., Tokai Univ., (12), 149-165 (in Japanese with English abstract).
- THRESHER, R.E. (1984) : Reproduction in reef fishes. TFH Publ., Neptune City, etc., 399p.

## 水槽内におけるレンテンヤッコの 繁殖と卵および仔魚

日置勝三・鈴木克美

### 要 旨

1983年10月に八丈島沿岸で潜水採集されたレンテンヤッコ（雄1尾，169.5mmTL；雌3尾，137.0～154.0mmTL）を東海大学海洋科学博物館で飼育したところ，1984年2月24日に最初の産卵が観察され，以後5月2日までの71日間に少なくとも44回観察された．産卵時刻は17時15分～18時10分の間であり，日没の約20分前を中心に行なわれた．

産卵行動は MOYER and NAKAZONO (1978) の野外観察による報告とほぼ同様であった．

受精卵は油球1個を有する無色透明の球形分離浮性卵で，卵径0.68～0.70mm，油球径0.15～0.16mm．卵膜腔は狭く，卵膜及び卵黄表面に特殊な構造はない．水温24.8～25.5℃で受精15時間38分後に最初の孵化が観察された．

孵化直後の仔魚は全長1.30～1.40mm，卵黄が大きくその一部は頭部より前方に突出する．油球は卵黄の後端に位置する．肛門は卵黄後縁に接して位置する．頭部から尾部の体背面に多数，油球上に約10個，卵黄前端に2個の黒色素胞が認められる．仔魚は孵化5日後の後期仔魚まで記載された．

孵化直後の仔魚の形態について，キンチャクダイ科の既知5種との比較を行なった．本種の孵化直後及び卵黄吸収前後までの仔魚の形態は既知5種のそれに全体において類似し，色素胞の配列及び位置などを除くと，相互の識別は困難であった．