

The Breeding Behavior and the Behavior of Larvae and Juveniles of the Sharksucker, *Echeneis naucrates*

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Abstract Eleven sharksuckers, *Echeneis naucrates*, in the Oita Ecological Aquarium spawned from 2 June to 3 December 1974. The spawning behavior began as soon as the lights were turned off. Just before a female spawned, it was driven toward the surface of the water by a group of males. The spawned eggs were pelagic and 2.6 mm in diameter. Approximately 500 eggs were spawned each day. Seventy larvae were hatched on 15 July, and 26 of them were reared until 1 September. We observed the behavior of their larvae and juvenile stages, from the hatching to the attaching phases. The caudal fins of the larvae expanded as they grew. They swam near the bottom with their caudal fins folded. When the sucking disk began to form on the back of a larva's pectoral fin, it stood still with its caudal fin bent on bottom. After the formation of the sucking disk, a larva would lie on its stomach or back. Some quickly-growing specimens began to stick to the walls, pipes, or plates when they attained 55 mm SL, 35 days after hatching.

The early life history of the sharksucker, *Echeneis naucrates*, is not well known, and reports about it are few. Sanzo (1927) and Delsman (1931) reported on the embryonic development of the sharksucker and John (1950) described in detail its post-embryonic development two days after hatching. Akasaki et al. (1976) gave a detailed description of the morphological development during larval and juvenile stages.

Concerning the beginning of the attaching life, Strasburg (1964) presumed that it occurred when the fish attained between 40 to 80 mm SL. Cressey and Lachner (1970) reported on their finding of a shark's parasitic copepod in the stomach of one shark-sucker larva belonging to a group measuring 57 to 85 mm BL. However, the early life history and behavior is wholly unknown.

The purpose of this paper is to present a detailed description of the breeding behavior of eleven sharksuckers, *E. naucrates*, observed in a display aquarium from July to December, 1974, and the behavior of larvae and juveniles from hatching to attaching phases based on 26 specimens reared in the laboratory.

Materials and methods

Adult *E. naucrates* imported from Singapore, were used for the observation of spawning. Thirty specimens (20.8 cm SL in average) were obtained in May 1972, and kept in an aquarium with 4.1

tons of water. By July 1974 when we first noticed the spawning, eleven specimens among them had survived and had grown to 65.5 cm SL in average. Spawning was carried out for a total of 140 days from 2 June to 3 December, when the temperature was maintained at 27.5–30.5°C. However, spawning was not carried out when the temperature fell below 25°C.

The aquarium was illuminated by three 40 wt. fluorescent lights above the aquarium from 7:00 to 18:00, though the light-off time was made 30 to 60 minutes earlier from 1 October.

Spawning was observed five times during 7:16–7:38 p.m. on 7 July, and almost all of the eggs (a total of 477) were collected. Seventy larvae hatched on 15 July and were raised and observed in a 100 l cylindrical polyethylene tank with water temperature of 27–30.5°C. They were fed with collected plankton and cultured *Tigriopus* during the earlier stage, and with adult *Artemia* or minced shrimp during the later period. 26 specimens survived until 1 September when we finished our observations.

Results

Breeding behavior. Before courtship, sharksuckers in the aquarium usually attached themselves to the glass wall at the front. When the lights were turned off at 18:00, the fish going to spawn still adhered to the glass; the others which

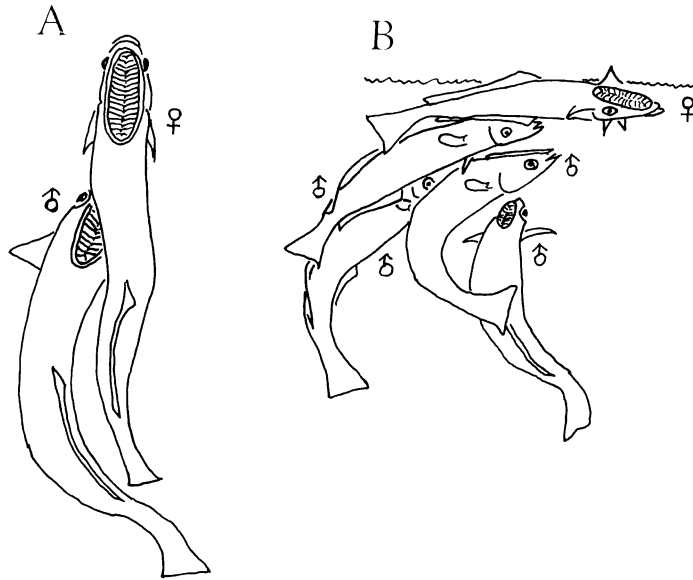


Fig. 1. Breeding behavior of *Echeneis naucrates* in the tank. A: A male stimulates the abdomen of a female with its disk, and the female has a convulsive fit responding to the stimuli. B: The female moves away slowly from the glass wall of the tank, a group of males driving the female rapidly upward and push her abdomen with their disks at the surface. After the release of eggs and sperm, they then return to the glass wall.

had nothing to do with breeding were driven to the side walls. There were usually 7 or 8 specimens remaining at the glass wall.

A group of males first began to give incessant pushes to the abdominal region of one female with their sucking disks. Responding to this stimulus the female showed a convulsive fit (Fig. 1 A). As soon as the female left the wall on which she attached, 4–6 males followed after her. The female moved slowly upward into the center of the aquarium, and the group of males dashed up to her and drove her to the surface with their heads. The spawning group released gametes simultaneously (Fig. 1B) and then dove back to the glass wall.

Hatching. The eggs of the sharksucker sank to the floor of the aquarium unless aeration was carried out. The hatching hole about 1 mm in diameter appeared on the egg membrane within 62 hours after fertilization at 28°C, and the larva hatched out in an hour (needed strong aeration).

Larval stage before the disk formation. The larva of 4 to 12 days after hatching usually swam in the lower layer a few centimeters above the bottom with its head inclining upward and its caudal fin folded (Fig. 2A). It moved very little.

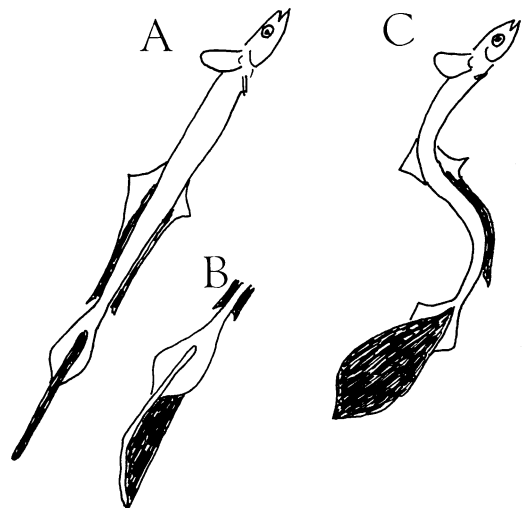


Fig. 2. The larvae of *Echeneis naucrates* feeding on plankton. A: The caudal fin of a larvae is closed except when it is feeding. B: The enlarged figure of a closed fin. C: An S-shaped larva with the caudal fin spread out. This posture is made when it finds food. Then it flaps the water with the opened fin, stretches its body and catches the food, after which it returns to the posture of A.

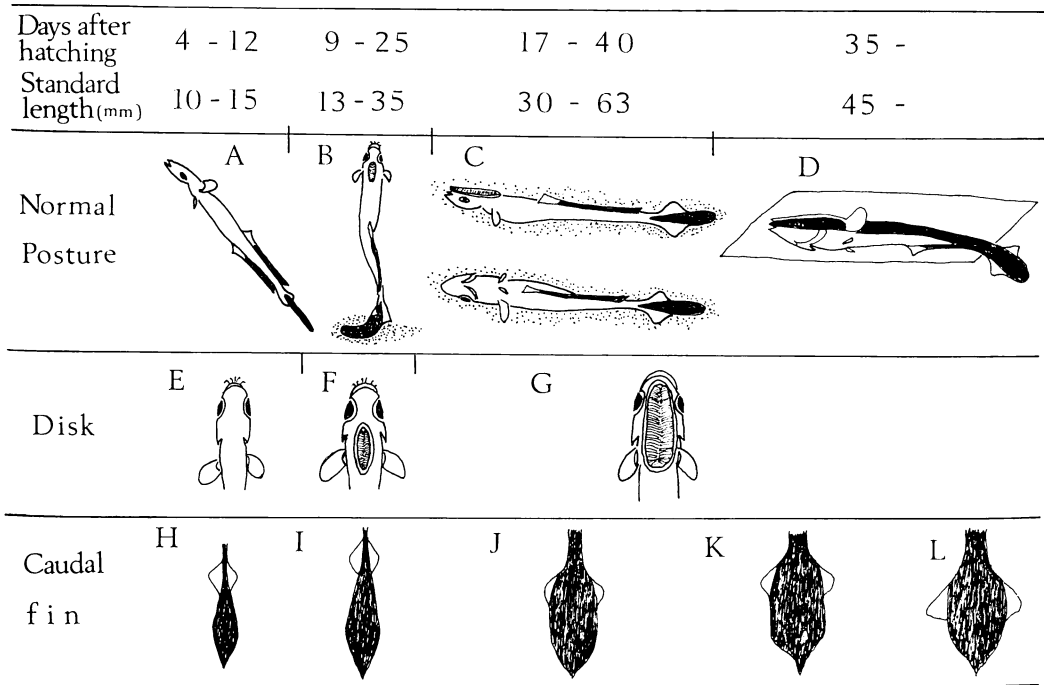


Fig. 3. The change in the normal posture with reference to the development of disk and the change of caudal fin in the early life history of sharksucker, *Echeneis naucrates*. A: 4-12 day old larvae are usually swimming a few centimeters above the bottom, inclining with head upward and caudal fin folded and moving very little. B: 9-25 day old larvae are usually found at the bottom of the tank, standing straight with caudal fin spread out, but bent in the mid section. C: 17-40 day old juveniles are lying on their backs or abdomens at the bottom of the tank. D: 35 day old and over juveniles attach to the walls or the plates in the tank.

The caudal fin which became remarkably larger with growth consisted of two parts. The wide, black part was usually folded horizontally and the upper and lower projections of the light-colored part were situated perpendicularly at the base of the former. Therefore these two parts were situated at right angles except when feeding (Fig. 2B). When the larva tried to catch food organisms, it made its body S-shaped with the caudal fin spread like a fan, and flapped the fin vigorously to dash to the food organisms. The caudal fin was folded again at the moment it caught the food (Fig. 2A).

Larval measurements before the disk formation were as follows: 8.8 mm SL with 1.7 mm caudal length (CL) in 4-day old larvae and 15 mm SL with 1.7 mm CL in 12 day old larvae.

Behavior during the disk formation. In a rapidly growing larva, the disk began to form above its pectoral fin by 9 days after hatching (35 mm SL,

14.5 mm CL) (Fig. 3G). A larva at this stage was usually found at the bottom of the tank, standing straight with its caudal fin spread but bent in the midsection (Fig. 3B). This standing posture was kept unless it moved to feed.

At this stage the caudal fin became the largest in ratio to the total length, as it attained 30% of total length (Fig. 3I).

Juvenile stage after the disk formation. Shifting of the disks came to an end in the quick growing larvae, on the 17th day after hatching (30 mm SL, 14.0 mm CL) (Fig. 3G). Just after the disk had settled in its destinate position, the juvenile began to lie on the bottom of the tank on its back or abdomen (Fig. 3C), and continued this posture until the beginning of attaching life.

Beginning of attachment. A quickly growing juvenile began to attach to the walls, pipes or plates in the tank by 35 days after hatching (55 mm SL, 17.5 mm CL) (Fig. 3D).

At this stage they fed well on such foods as minced meat of shrimp or saurel. When feeding, a juvenile that went far from its attaching place to take food was often driven away by those near the feeding spot. If the food was located near the attaching place, the juvenile returned there swiftly as soon as it had taken the food into its mouth. By this point the behavior of a juvenile came to resemble closely that of an adult.

Discussion

Regarding the spawning location and season of the sharksucker, Tåning (1927) presumed that this species would spawn in shallow water near the West Indies, presumably in midsummer. Judging from the facts described in this report, his presumption seems appropriate. Spawning and hatching occurred at water temperatures above 25°C. Moreover, the larva stayed near the bottom of the tank.

The waters satisfying all these conditions are tropical and subtropical shallow seas. After Tåning's observations, eggs were collected in the Red Sea (Sanzo, 1927) and in the Java Sea (Delsman, 1931), and juveniles were caught off the coast of Waikiki, Hawaii and Beaufort, North Carolina (Strasburg, 1964).

The stage when the sharksucker begins attaching to its host is estimated by Strasburg (1964) to be when the sharksucker reaches 40–80 mm SL, judging from his observations on the material obtained in the sea. Cressey and Lachner (1970) examined the parasitic copepod diet of diskfishes. They found one parasitic copepod in the stomach of one of 9 specimens (57–85 mm SL) and 65 parasitic copepods in 4 of 10 specimens (85–125 mm SL). During our observations, quickly developed juveniles began to attach to the wall or the plate within 35 days after hatching (55 mm SL). Therefore, it can be presumed that the attaching ability appears in the shark sucker's head when the fish attains 55 mm SL.

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コバンザメの産卵行動と仔稚魚の行動

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1974年6月3日から12月3日まで、大分生体水族館の11尾のコバンザメ *Echeneis naucrates* を展示している水槽で、水温が25°C以下に低下した時以外は、連日消灯後、産卵行動がみられ、直径2.6mmの浮遊性卵が1日平均して約500個産卵された。

産卵行動は、オスがメスの腹部を吸盤で刺激し、メスは産卵しそうになると水槽中央上方に泳ぎ出し、4–6尾のオスはそのメスを追ひ、吸盤で水面に押し上げ、同時に産卵と放精が起こるといったものであった。

6月15日にふ化した70尾の仔魚の飼育を試み、9月1日まで26尾の成育が認められ、並行してその時の仔稚魚の行動を吸盤により吸着がみられる時期まで記録した。仔稚魚の形態変化における特徴は、吸盤の形成と尾鰭の伸長であり、それらの変化に対応して行動もいちじるしく変化した。

吸盤が出現しはじめるまでの時期は尾鰭を折りたたみ、斜め上を向いて泳ぎ、餌をとる時には尾鰭を開き、体をS字型に曲げ、尾鰭をあおり、体をまっすぐにして動物プランクトンに突進し、餌をとった瞬間には、尾鰭は元の状態に戻っていた。吸盤が出現しはじめると、尾

鰭を折り曲げて水槽底で立ち、吸盤の形成が完成すると、体をおお向けにしたり、腹ばいになったりして、水槽底に横たわるようになった。もっとも成長の早い個体でふ化後 35 日、体長 55 mm で水槽内に設置したパイプや板に吸着するようになった。

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