Schindlerioidei: Development and Relationships

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THIS suborder contains a single paedomorphic family composed of two species of the genus *Schindleria*. Both species inhabit neritic surface waters of the subtropical and tropical Indian and Pacific Oceans (Bruun, 1940; Schindler, 1932; R. J. Lavenberg, pers. comm.). Their early life histories are known from the work of Watson and Leis (1974), Miller et al. (1979), and Ozawa and Matsui (1979). Classification of Schindlerioidei is speculative, and its placement here by Nelson (1976) follows Gosline (1971), who tentatively considered this taxon a percoid derivative, possibly related to Ammodytoidei.

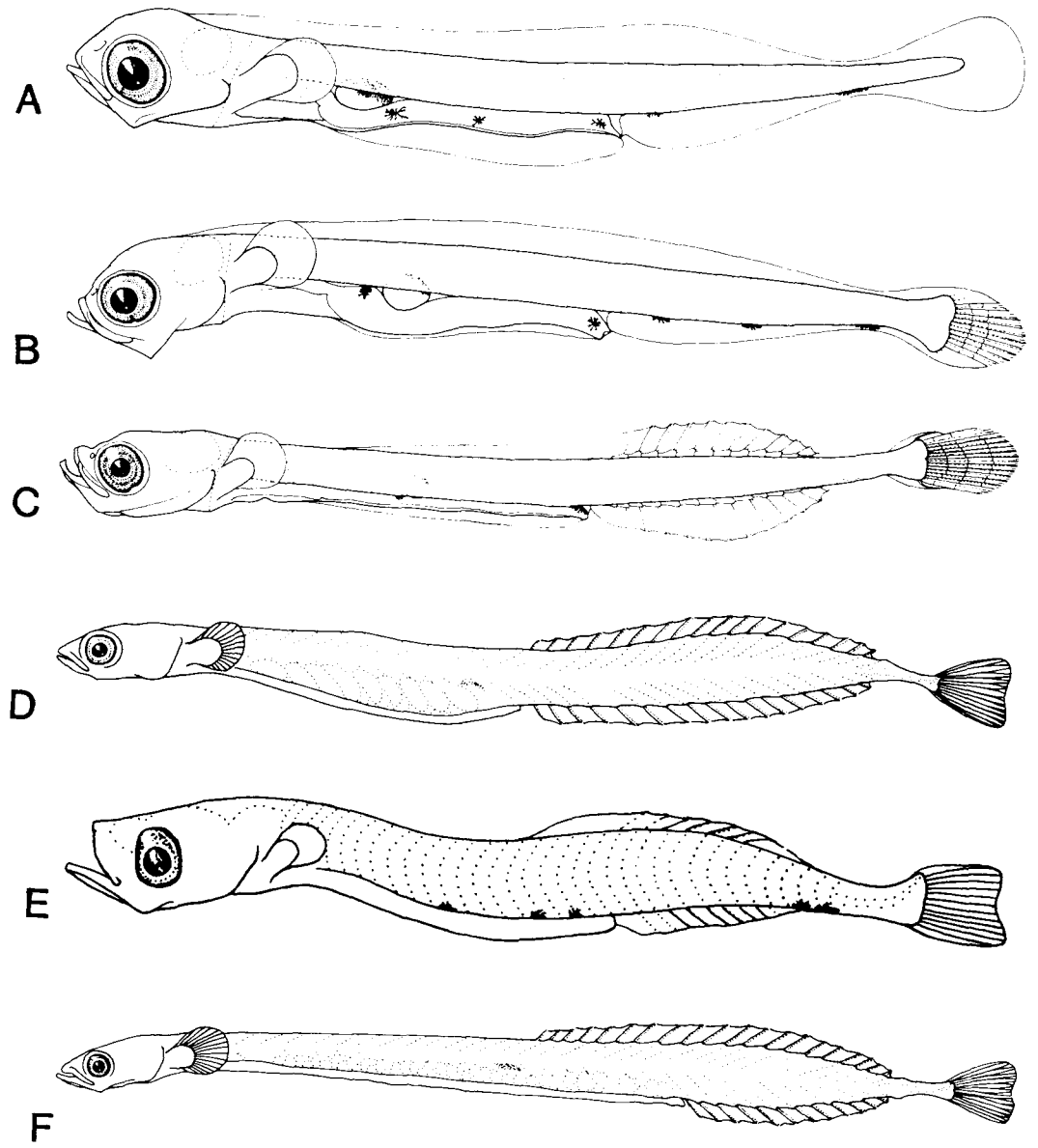

Fig. 298. Lateral views of: (A) *Schindleria pietschmanni* larva, 2.7 mm; (B) *S. pietschmanni* larva, 3.5 mm (redrawn from Miller et al., 1979); (C) *S. pietschmanni* larva, 4.7 mm (from Miller et al., 1979); (D) *S. pietschmanni* adult female, 15.1 mm (redrawn from Jones and Kumaran, 1964); (E) *S. praematura* larva, 3.6 mm (from Ozawa and Matsui, 1979); and (F) *S. praematura* adult female, 20.1 mm (redrawn from Jones and Kumaran, 1964).

Development

Eggs

Although ovarian eggs are well-known for both species (Jones and Kumaran, 1964; Sardou, 1974), the mode of spawning is unknown. Watson and Leis (1974) reported planktonic *Schindleria* sp. eggs which they suggested were either pelagic or perhaps dermersal eggs extruded in the net. The largest ovarian eggs lack oil droplets and are irregular in shape, 0.35–0.40 mm in diameter (*S. praematura*), or oval, 0.30 × 0.65 mm (*S. pietschmanni*). Hydrated, planktonic eggs of *Schindleria* sp. are oval,

0.50 × 1.30 mm, contain no droplets, and have an unsculptured chorion with a cap-like structure at one end. Incubation time is not known.

Larvae

Morphology.—Larval size and degree of development at hatching are unknown. However, *S. pietschmanni* at 1.9 mm NL has a rather large yolk sac (containing an apparently segmented yolk) in addition to pigmented eyes and an open, presumably functional, mouth. Notochord flexion occurs after 2.7 mm but before 3.5 mm NL in *S. pietschmanni*, and before 4.3 mm in *S. praematura*. Development to the essentially larval mature form is gradual. The juvenile stage may be taken to begin with completion of the dorsal and anal fins and the acquisition of the principal caudal rays (ca. 4–5 mm), and the adult stage to begin when the male genital papilla or the ovaries of the female become discernable (longer than ca. 9 mm SL). The distinctive schindleriid terminal section at the rear of the vertebral column does not become apparent until the late larval or early juvenile period.

Aside from fin development, morphology changes little during larval development. The swim bladder moves posteriorly from myomeres 6–8 to myomeres 14–15 in *S. pietschmanni*; a similar migration presumably occurs in *S. praematura* (e.g., Sardou, 1974). Preanal length is greater in *S. praematura* than in *S. pietschmanni*.

Pigmentation.—Schindleriids are lightly pigmented throughout development (e.g., Miller et al., 1979; Ozawa and Matsui, 1979). During the larval and early juvenile period, *S. pietschmanni* has one to four pairs of melanophores along the sides of the gut (usually two or three pairs), one to four melanophores along the ventral midline of the tail (usually two or three), and pigment on the posterior dorsal surface of the swim bladder. The posterior tail melanophore is typically more elongate than the others (Fig. 298). All but the swim bladder pigment is lost during the juvenile stage. Larval pigmentation of *S. praematura*, as shown by Ozawa and Matsui (1979), and juvenile pigment, shown by Sardou (1974), are very similar to that of *S. pietschmanni*. Like *S. pietschmanni*, *S. praematura* retains only the posterior swim bladder pigment in the adult stage (Fig. 298).

Meristics.—Meristics for *Schindleria* are: Vertebrae 15–25 + 12–21 = 33–44; D 15–22; A 10–14; P 15–17; and C 13 prin. A combination of caudal vertebrae and anal fin ray counts usually will distinguish the two species.

The caudal fin rays are the first to develop, followed by the dorsal and anal fin rays (forming simultaneously). Pectoral fin rays are the last to ossify. Pelvic fins never form.

Relationships

Early life history characters, to the extent that they are presently known, do little to clarify the phylogenetic position of the Schindlerioidei. For example, Gosline (1963b, 1971) speculated that Schindlerioidei might be derived from an ammodytoid ancestor; however, while both suborders share some characters (e.g., an elongate larval form with preanal length just over 50% body length), they differ in other important ways (e.g., late development of pectoral fin rays in schlindleriids and early development in ammodytoids). Knowledge of spawning and early development might aid in ascertaining schindleriid relationships although at present this group seems destined to remain an enigma.

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