

The Fish *Dinolestes lewini* with Comments on its Osteology and Relationships

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Abstract Aspects of the anatomy of *Dinolestes lewini* (Griffith, 1834) are discussed in relation to the erroneous conclusion that this fish is a member of the Apogonidae. The monotypic family Dinolestidae is recognized and relationships are suggested with the Centropomidae and Sciaenidae. Relationships are not supported for the Pomatomidae and Sphyraenidae.

For nearly one hundred years the only species of the genus *Dinolestes* Klunzinger, 1872 has been generally placed in the family Apogonidae (Günther, 1872; Gill, 1874; Starks, 1899; Gregory, 1933; Schultz, 1940; Norman, 1966; Greenwood et al., 1966). Günther originally suggested this possible relationship and Starks' osteological study (abetted by Gill) has been the basis of subsequent agreement by many ichthyologists. Klunzinger (1872, 1880) and Castelnau (1872) however related *Dinolestes* with the Sphyraenidae. Some ichthyologists, particularly Australians (e.g. Scott, 1962) have placed *Dinolestes* in the monotypic family Dinolestidae but without giving reasons to dispute Starks' placement in the Apogonidae. Gosline (1966: 108) disagreed with the allocation in the Apogonidae on the basis of having "a scaly axillary process in the pelvis" but did not pursue the matter further. Data presented here suggest that *Dinolestes* can no longer be satisfactorily placed in the Apogonidae and is better considered in the monotypic family Dinolestidae with distant relationships to the Centropomidae and Sciaenidae.

Material examined

(All cleared and stained except where indicated. Numbers following the catalogue number are the quantity of specimens and standard length in millimeter)

Dinolestes lewini (Griffith, 1834). IB 2682 (2, 61.0 and 182.3) Australia, New South Wales, Camp Cove, 1945.

Comparative material

Centropomidae

Lucioides stappersi Boulenger, 1914. USNM 176298 (1, 79.7) Africa, Lake Tanganyika, X-ray. MAC 90928 (1, 36.5) Africa, Lake Tanganyika.

Pomatomidae

Scombrops boops (Houttuyn in Lacépède, 1802). USNM 49933 (1, 77.0) Japan, Enoshima, Sagami.

Scombrops oculatus (Poey, 1860). UMML 29018 (1, 390.0) Cay Sal Bank at 250 m off Elbow Cay, 13 Aug. 1967 (dried skeleton).

Sciaenidae

Cynoscion nebulosus (Cuvier, 1830). UMML 7921 (1, 27.5) Florida, Dade Co., Virginia Key at Bear Cut, 16 July 1958.
Equetus pulcher (Steindachner, 1867). UMML 4028 (1, 25.9) Florida, Dade Co., N. end of Virginia Key, 13 July 1958.

Sphyraenidae

Sphyraena obtusata Cuvier, 1829. RUSI 1588 (1, 81.4) Mozambique, Pinda Reef, 29 Sept. 1956.

Description

(Figs. 1-8)

Starks' (1899) study is an excellent descrip-

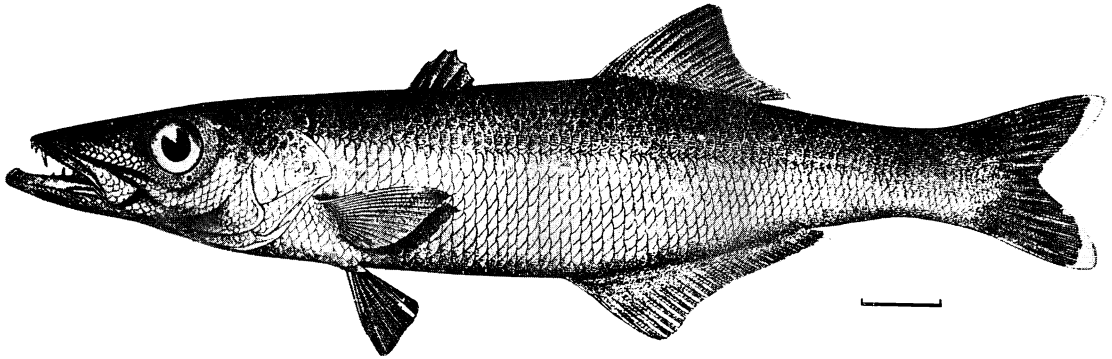


Fig. 1. A lateral view of *Dinolestes lewini* after Starks (1899).

tion of the species. I intend only to add some new, overlooked and unillustrated facts about *Dinolestes lewini* (Fig. 1).

Dinolestes is unusual among the more primitive Percoidei in having the last three branchiostegals articulating with the epihyal (Fig. 2). McAllister (1968) does not describe this pattern for any percooid (Percoidei) in particular nor is it illustrated although in his summary of the Carangoidei (Tominaga,

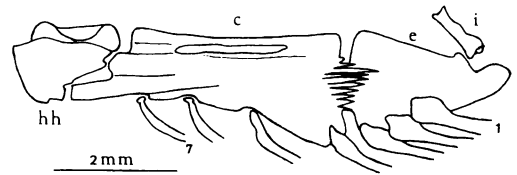


Fig. 2. A lateral view of the left hyal series of *Dinolestes lewini*. hh—hypohyals, c—ceratohyal, e—epihyal, i—interhyal, and branchiostegal rays 1–7.

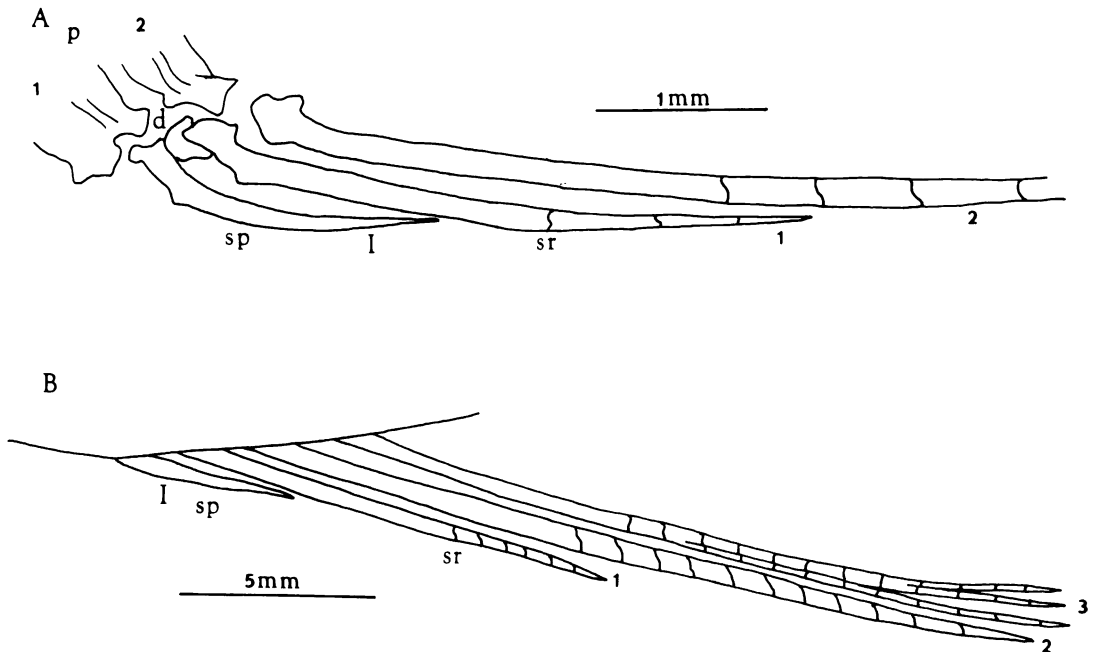


Fig. 3. Aspects of the anterior portion of the anal fin in *Dinolestes lewini*. A. The first three elements of a 61.0 mm SL specimen showing the lower portion of the basal supports and the differentiation of spines and rays. B. The first four elements of a 182.3 mm SL specimen showing the differentiation of spines and rays and the unbranched condition of the first two segmented rays. p—proximal pterygiophore, d—distal pterygiophore, sp—spine (I), sr—segmented rays (1–3).

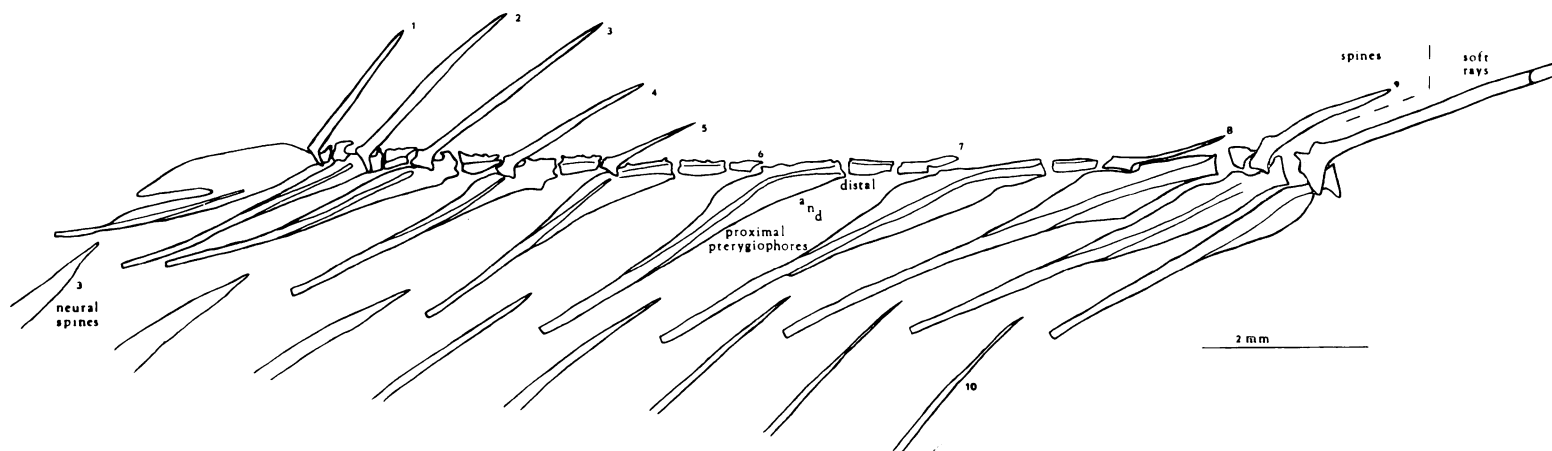


Fig. 4. A lateral view of the spinous dorsal fin and its supports in *Dinolestes lewini*. Spines 6-8 are hidden by skin and scales.

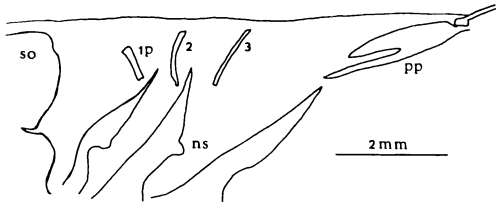


Fig. 5. A lateral view of the predorsals of *Dinolestes lewini*. ns—neural spine, p—predorsals (1–3), pp—first proximal pterygiophore, so—supraoccipital.

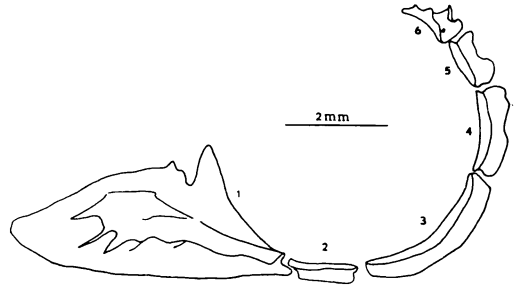


Fig. 6. A lateral view of the left infraorbitals of *Dinolestes lewini*.

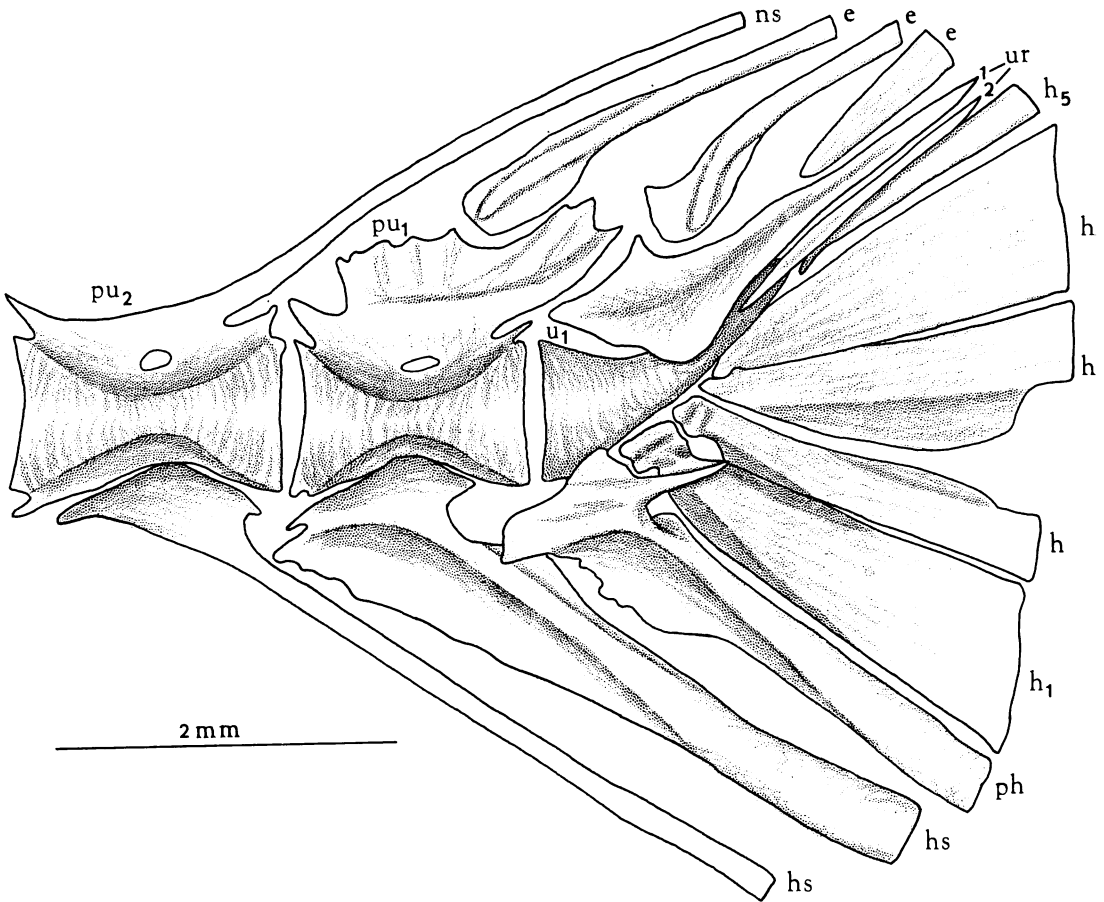


Fig. 7. A lateral view of the caudal skeleton of *Dinolestes lewini*. e—epurals, h—hypurals, hs—autogenous haemal spines, ns—neural spine, ph—parhypural, pu₁—first pre-ural centrum, pu₂—second pre-ural centrum, u₁—first ural centrum, ur—paired uroneurals (1 and 2).

1965 on *Leptobrama*), Chaetodontoidei and Pomacentroidei three branchiostegals are recorded as present on the epihyal of at least some species (families?). The ceratohyal and

epihyal are sutured together on the inner and outer faces. Usually sutures are present only on the inner face of the ceratohyal and epihyal in lower percoids (pers. obs.).

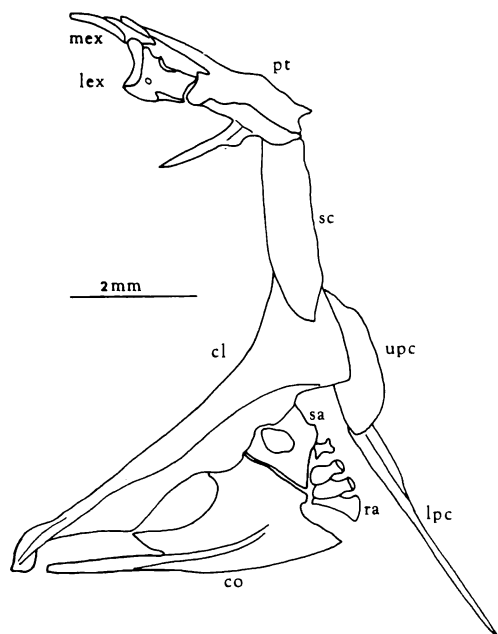


Fig. 8. A lateral view of the left pectoral girdle of *Dinolestes lewini*. cl—cleithrum, co—coracoid, lex—lateral extrascapular, lpc—lower postcleithrum, mex—medial extrascapular, pt—posttemporal, ra—radials, sa—scapula, sc—supracleithrum, upc—upper postcleithrum.

I can find only one anal spine, not two as all previous authors record (Fig. 3). The second ray is simple and has visible segmentations distally and I believe such will be the case for specimens larger than examined here (182.3 mm SL). The first anal pterygiophore bears one spine and one unbranched segmented ray.

The visible first dorsal fin ray count is IV or V. My specimens have several (three) reduced spines hidden by skin and scales, in the space between the first and second dorsal fins. There are a total of nine dorsal spines (Fig. 4) with the first dorsal pterygiophore (which bears one spine) over the third neural spine.

Three predorsals are present (Fig. 5).

Six infraorbitals are present with the lachrymal being very large (Fig. 6). There are no infraorbital shelves.

The caudal skeleton (Fig. 7) consists of five hypurals, a parhypural, two autogenous

haemal spines, two pairs of uroneurals, three epurals, and a low crest on the first pre-ural centrum and is the primitive percoid pattern (Patterson, 1968: 87). Principal caudal fin-rays are 9+8, upper- and lower-most unbranched.

Free medial and lateral extrascapulars are present (Fig. 8).

The swimbladder has small anterior horns and a tough external theca with an oval present on the mid-dorsal region of the inner tunic. There are many composite bundles of retia mirabilia extending to the level of the oval on the ventral surface of the bladder. Posteriorly the finely tapered swimbladder extends past the haemal pterygiophores only on the left side.

Discussion

Firstly, does *Dinolestes* share any combination of apogonid characters? I can find none which cannot be better interpreted in another way. Only the presence of an oval on the swimbladder and the erroneous observation of two anal spines could suggest a relationship. I have not seen any apogonid exhibiting transformation of a segmented ray into a spine. The presence of the oval is reduced in significance because other families have this character and because unlike any apogonid the external theca is fibrous and very strong (Fraser, in press). The following characters suggest, if *Dinolestes* is related to the Apogonidae, it must have subfamily status, for no known apogonid (Fraser, in press) possesses these characters: 10+17 vertebrae; reduced sixth, seventh and eighth dorsal spines (usually hidden in the skin); maxilla, snout and occiput scaled; well developed axillary scale at the base of the pelvis; three of the four posterior branchiostegals attached to the outer surface of the epihyal; perforated ceratohyal; lateral line continuing onto the caudal fin and then branching into two parts; one anal spine; tough and fibrous swimbladder. *Dinolestes* shares with some apogonids (mainly

the Epigoninae) the following characters many of which are primitive percoid states and are found in other families as well: a supra-maxilla; three predorsals; a free medial extrascapular; epihyal and ceratohyal with a dentate suture on the mesial side; two pair of uroneurals, three epurals, five hypurals, a parhypural, two autogenous haemal spines; teeth on the premaxilla, dentary, vomer and palatine; scales on the soft dorsal and anal fins; intercalary facet not included on the otic bulla.

To summarize: *Dinolestes* differs from all known Apogonidae in having 10+17 vertebrae, scalation of the maxilla, snout, occiput and fins, number and form of the dorsal and anal spines, well-developed axillary scale at the base of the pelvic fin, an unusual hyal region and a tough and fibrous swimbladder with small anterior horns and extending past the first anal pterygiophore only on the left side. We must look elsewhere for its nearest relatives.

Is *Sphyraena* related to *Dinolestes*? Evidence for such a relationship is suggested by the body shape and the lateral line extending far onto the caudal fin. In addition to Starks' (1899) evidence given for *Dinolestes* (thoracic pelvics, anchylosed teeth which are rounded, and lack of epiotic processes) against such a relationship also may be added the number of vertebrae (not 11+13), one anal spine (not two), presence of the sixth, seventh, and eighth dorsal spines and supports (not reduced internal supports only), scales on the maxilla, snout, occiput, and soft dorsal and anal fins (not scaleless), shape of the swimbladder not (divided anteriorly into two parts with two separate gas gland complexes) and type of swimbladder (not diaphragm). *Dinolestes* and *Sphyraena* thus are only convergent in body shape and a close relationship is not supported.

Gunther (1872) suggested that *Scombrops* (as an apogonid) is an ally. No one has pursued this possibility since he suggested it. *Scombrops* has a diaphragm swimbladder,

three anal spines and 10+16 vertebrae and differs in a host of minor characters as well. A relationship is not supported.

The freshwater genus *Luciolates*, a centropomid with a similar body shape, has many of the primitive percoid characters found in *Dinolestes* (Gregory, 1933 and pers. obs.). However *Dinolestes* cannot be considered closely related because some salient characters of centropomids (excluding the Chandinae) are not present, viz. serrated lachrymal, three anal spines, 24—25 vertebrae, infraorbital shelf on the third infraorbital, lateral line extending to the tip of the caudal fin and scaleless maxilla, snout, occiput, and dorsal and anal fins.

The Sciaenidae may have a closer relationship with *Dinolestes* than the Centropomidae. Characters of *Dinolestes* which suggest such a relationship are: one anal spine (even if it were two), number of vertebrae (sciaenids have counts of 24—29), scaled areas on the head and fins, a tough fibrous swimbladder, developed axillary scale, long soft dorsal and anal fins (in some species), and extension of the lateral line far onto the caudal fin. Several characters may indicate that no such relationship exists—no vomer or palatine teeth in sciaenids, shape of the caudal fin (forked instead of truncate or rounded as in sciaenids), lateral line not reaching the tip of the caudal fin (reaches tip in sciaenids), and the relative simplicity of the swimbladder (not modified to produce sounds or with many complex appendages as in sciaenids).

One remaining question is that of recognizing *Dinolestes* in a monotypic family related to the Sciaenidae and Centropomidae or as a member of either family. The state of knowledge at this level in percoid fishes leaves us with a very subjective decision. I prefer to place *Dinolestes* in the Dinolestidae, but I view monotypic percoidean families with some reservations. Further analyses of the Centropomidae (in progress) or by some future workers in the Sciaenidae may clarify the suggested relationships.

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Dinolestes lewini の骨格と類縁について

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Dinolestes lewini の内部形態を調べた結果、この魚がネブツダイ科に含まれているのは誤りであることが明らかになった。*Dinolestes* 属のみを含む Dinolestidae を独立させるべきである。Dinolestidae は Centropomidae やイシモチ科に類縁関係があるようであり、Pomatomidae (ムツを含む) やカマス科とは関係がない。

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