NOAA Technical Memorandum NMFS-SEFSC-437

PRELIMINARY GUIDE TO THE IDENTIFICATION OF THE EARLY LIFE HISTORY STAGES OF CALLIONYMID FISHES OF THE WESTERN CENTRAL ATLANTIC

BY

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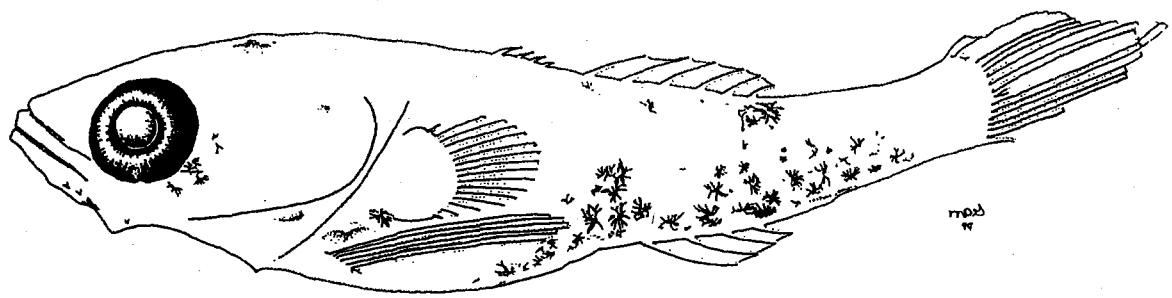

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Callionymidae: Dragonets

A. B. Powell and M. Greene

Callionymidae, along with the Draconettidae and Gobiesocidae, previously were placed in the order Gobiesociformes (Allen, 1984). Recently, Nelson (1994) placed the Callionymidae and Draconettidae in the perciform suborder Callionymoidei. The family is represented by three species in the western central North Atlantic Ocean, *Diplogrammus pauciradiatus*, *Paradiplogrammus bairdi* and *Foetorepus agassizi* (Davis, 1966; Robins and Ray, 1986). A detailed review of the family including early life history information is given by Houde (1984) and Watson (1996).

The callionymids are small tropical and sub-tropical demersal fishes that, in our area, occur in shallow seagrass beds and in waters to depths of 650 m. Representatives of the family in the western central North Atlantic Ocean are chacterized by a small gill opening reduced to a pore and a preopercle spine that is useful for specific identification (Robins and Ray, 1986). All three species in our area appear to occupy different habitats. *Diplogrammus pauciradiatus* is found in shallow seagrass beds in tropical waters and based on ichthyoplankton collections (Olney and Sedberry, 1983; Powell and Robbins, 1998) this species is abundant in open-shelf waters (18-55 m) in the South Atlantic Bight (Cape Hatteras, NC to Cape Canaveral, FL). *Paradiplogrammus bairdi* are reported to occur only in south Florida (shallow reefs to 91m) within our area (Robins and Ray, 1986), but larvae, although in small numbers, occur throughout the year in South Atlantic Bight outer-shelf waters in close proximity to the Gulf Stream (Olney and Sedberry, 1983). *Fortorepus agassizi* ranges from Georgia south in depths of 91-650 m and collections of larvae have not been confirmed nor have their larvae been described.

Callionymids, in general, have colorless, pelagic, spherical eggs measuring from 0.55 to 0.97 mm and lack oil globules. The chorion may be sculptured in some species, but in some it is not. Newly hatched larvae are small (generally <1.5 mm). Preflexion larvae are robust, laterally

compressed with moderate to heavy pigment. A characteristic series of lateral melanophores develops during the preflexion stage and remains throughout the larval period. The diagnostic preopercle spine begins to develop between 3.5 to 5.0 mm, during or just following notochord flexion. By postflexion they are more cylindrical in body shape and have developed the diagnostic elongate notochord tip (Houde, 1984; Watson, 1996).

Callionymid larvae should be readily separated from other larvae on the basis of their characteristic pigment pattern, preopercle spination, body morphology, low myomere count and the elongate notochord tip. At least in our area, they could be confused with preflexion tetraodonts or monacanthids, but the characteristic callionymid lateral pigment should readily separate these larvae. Callionymids might also be confused with early stage sciaenids such as deep-bodied *Menticirrhus* spp., and *Cynoscion nebulosus*, both of which exhibit lateral pigment. Myomere counts will readily separate callionymids from these sciaenids. The following descriptions of *D. pauciradiatus* and *P. bairdi* were derived from specimens ranging from 1.2 mm NL – 3.6 mm SL, and 2.1 mm NL – 6.0 mm SL, respectively collected from waters off North Carolina. We did not observe any flexion larvae in our collections. Meristic data were obtained from our collections, Davis (1966) and Olney and Sedberry (1983). Ecological information was obtained from Davis (1966), Olney and Sedberry (1983) and Powell and Robbins (1998).

Table Callionymidae 1. Meristic characters for the callionymid species occurring in the western central North Atlantic. All species have I,5 pelvic fin rays, IV first dorsal fin spines and 7 principal caudal rays.

Species	Vertebrae			Fin rays		
	PrCV	CV	Total	D	A	P_1
Diplogrammus pauciradiatus	7	11	18	6(5-7)	4(4-5)	16-19
Paradiplogrammus bairdi	7	14(15)	21(21-22)	9(8-10)	8(6-9)	19-20
Foetorepus agassizi	7	14	21	8	7	21-22(20-23)

MERISTICS

Vertebrae:	
Precaudal	7
Caudal	11
Total	18
Number of Fin Spines and Rays:	
First Dorsal	IV
Second Dorsal	6(5-7)
Total Dorsal Elements	10(9-11)
Anal	4(4-5)
Total Anal Elements	4(4-5)
Pectoral	17-18(16-19)
Pelvic	I,5
Dorsal Secondary	3
Principal	7
Ventral Secondary	3
Total	13
Branchiostegals	6

LIFE HISTORY

Range: North Carolina, Bermuda to Columbia
Habitat: Seagrass beds in sub-tropical and tropical waters; continental shelf waters (18-55 m) in temperate waters.
ELH Pattern: Oviparous, planktonic larvae
Spawning:
Season: Throughout the year in tropical waters; spring through fall in temperate and subtropical waters
Area: Bays and shallows in sub-tropical and tropical waters; continental shelf in temperate waters.
Mode: Planktonic eggs and larvae
Age at First Maturity: Males at 12-15 mm; females 11-12 mm.

LITERATURE

Davis (1966)
Olney and Sedberry (1983)
Houde and Lovdal (1984)
Robins and Ray (1986)
Powell and Robbins (1998)

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Hatch Size: <1.2 mm NL

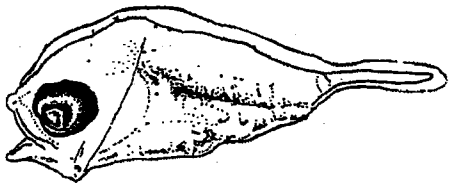
LARVAE:

Length at Flexion: Between 2.2 mm NL and 2.8 mm NL
Sequence of Fin Development: D_1 & A, C_1 & P_2, C_2, P_1
Pigmentation: *Preflexion*—Dorsal head and body pigment generally absent, nape pigment might be present; pigment at gular and lower jaw angle; heavy gut pigment; dashes along lateral midline at mid-body; ventrolateral caudal pigment extending over gut.
Flexion – postflexion– embeddded pigment edge of midbrain and minute punctate over midbrain and hindbrain; lower jaw angle and along lower jaw; below and behind eyes; base of pelvic fin; dorsal pigment forms in aggregates, at 4.0 mm three saddles form; minute punctate from midbrain to beyond nape and between saddles; embeddded over gut.
Diagnostic Characters: Long notochord tip; heavy ventrolateral gut pigment; three distinctive dorsal saddles; low myomere count.
Distinguish from *Paradiplogrammus bairdi* by heavy ventrolateral gut pigment, absence of scattered dorsal pigment, but presence of saddles; meristic characters.

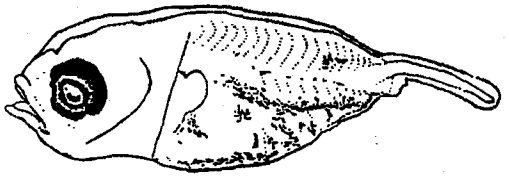
JUVENILES: Like adults

I LLUSTRATIONS (Illustrator)

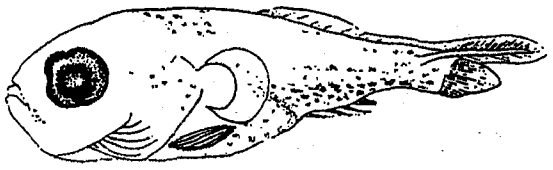
Preflexion larvae, 1.2 mm, 1.9 mm (original-M. Greene)
Postflexion larvae, 3.4 mm, 3.6 mm (original-M. Greene)
Flexion larva 2.5 mm from Olney & Sedberry 1983
Postflexion larvae 3.4, 3.6, 4.3 mm from Olney & Sedberry 1983



1.2 mm



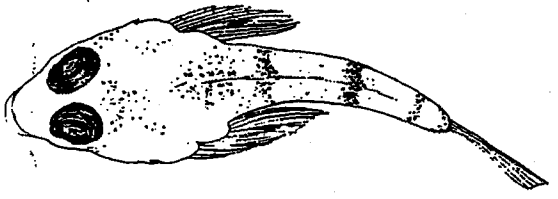
1.9 mm



2.5 mm

3.4 mm

3.6 mm



4.3 mm

MERISTICS

Vertebrae:	
Precaudal	7
Caudal	14(15)
Total	21(21-22)
Number of Fin Spines and Rays:	
First Dorsal	IV
Second Dorsal	9(8-10)
Total Dorsal Elements	13(22-24)
Anal	8(6-9)
Pectoral	19-20
Pelvic	I,5
Caudal	
Dorsal Secondary	4(5)
Principal	7
Ventral Secondary	4
Total	15(16)
Branchiostegals	6

LIFE HISTORY

Range: Bermuda, sothern Florida, and Bahamas to northern South America
Habitat: Reefs and rocky rubble areas to 91 m.
ELH Pattern: Oviparous, planktonic larvae
Spawning:
Season: Possibly every month.
Area: Subtropical and tropical waters.
Mode: Pelagic eggs and larvae.
Migration: Movement from shallows to deeper water with increasing size.

LITERATURE

Davis (1966)
Olney and Sedberry (1983)
Powell and Robbins (1998)

EARLY LIFE HISTORY DESCRIPTION

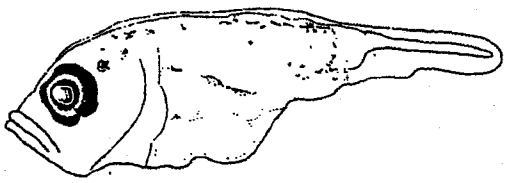
EGGS:
Hatch Size: <1.7 mm NL

LARVAE:
Length at Flexion: >2.1 mm NL
Length at Transformation:
Sequence of Fin Development:
Pigmentation: *Preflexion*—semicircle along edge of midbrain and hindbrain; ventrolateral; ventral midline extends over anterior of gut; dorsolateral in two indistinct rows.
Postflexion—semicircle along edge of midbrain and hindbrain; two discrete rows at dorsal midline; sparse ventral caudal pigment; over gut.
With increasing size—pelvic membranes pigmented; midbrain and hindbrain extends over entire surface and extends along dosolateral surface; gular pigment. Large postlexion, ca. > 5.5 mm,
appear devoid of pigment except for pelvic fin membranes and brain pigment.
Diagnostic Characters: Long notochord tip; dorsal pigment; low myomere count
Distinguish from *Diplogrammus pauciradiatus* by lack of ventrolateral gut pigment; presence of two rows of caudal dorsal pigment; unique brain pigment ; meristic characters.

JUVENILES: Like adults

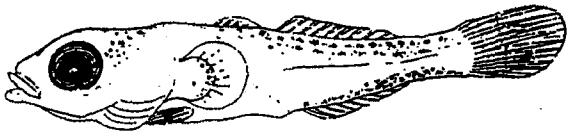
ILLUSTRATIONS (Illustrator)

Preflexion larvae, 2.1 mm (original - M. Greene)
Postflexion larvae, 3.4mm, 4.3 mm (original-M. Greene); 4.2 mm from Olney & Sedberry 1983

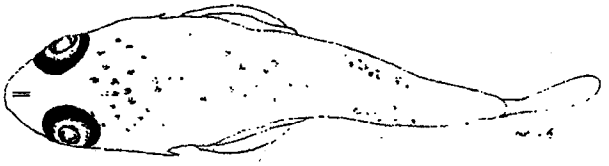


2.1 mm

3.4 mm



4.2 mm



4.3 mm

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