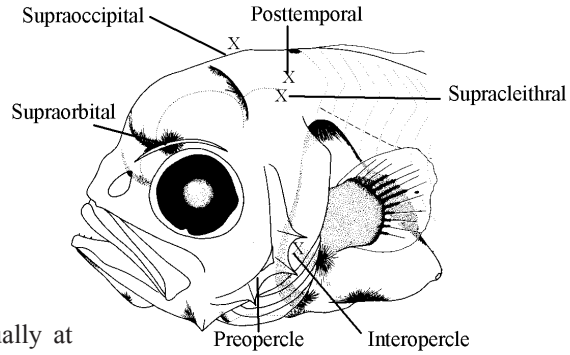
## Family Sciaenidae

Members of the family Sciaenidae are moderate to large, usually carnivorous, fishes that occur most commonly in coastal and continental shelf waters of temperate and tropical regions (Chao, 1978; 2002). Most species are demersal, and many occur in estuaries and bays, as well as oceanic habitats. Larvae are well known for most of the species in the study area, but eggs are less well known.

**Larval morphology**:

- Body shape relatively unspecialized, moderately deep (especially through pectoral region), laterally compressed, tapering, with short triangular gut, deep head with large, oblique mouth
- Preanus length increases through ontogeny, to about 66% SL in later larvae
- Conspicuous air bladder above gut, usually capped with pigment
- Range of myomeres: 23–27 (most with 25)
- Highly developed head spines lacking in larvae, but obvious spines usually form early on preopercle and later in the posttemporal region; spines sometimes also occur on the supraoccipital, supracleithral, supraorbital or interopercle bones




*Larimus fasciatus*, 3.8 mmSL (after Ditty, 1989) illustrating preopercle spines and locations of other potential spines (×) in sciaenid larvae. A supraoccipital crest occurs in the larvae of some genera, but does not occur in any sciaenid larvae that occur in the present study area.

- Dorsal and anal fin rays form early; bases usually at <5.0 mmSL; fin rays complete at <10.0 mmSL
- $D_2$ fin base usually twice as long as A fin base (and number of dorsal fin rays is about twice number of anal fin rays)
- Usual sequence of fin ray development: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$ (*Larimus* differs in forming $P_1$ fin rays early, at time of notochord flexion
- Larvae of most species exhibit a marked gap between the anus and the anal fin origin. In early larvae this gap may be equal to about 20% SL, but the gap closes in postflexion larvae. Exceptions include *Cynoscion nebulosus* and *Menticirrhus* spp. where there is no obvious anus-anal fin gap.
- Body depth similar in early stages (about 30% SL in larvae <3.5 mm), but varies among larger sciaenid larvae; species fall into 2 broad groups based on maximum body depth (*Cynoscion regalis* and *Menticirrhus* spp. are intermediate in body depth)

| Shallow-bodied (BD <32% SL) | Deep-bodied (BD >32% SL) |
|---|---|
| *Cynoscion nebulosus* | *Cynoscion nothus* |
| *Leiostomus xanthurus* | *Larimus fasciatus* |
| *Micropogonias undulatus* | *Stellifer lanceolatus* |
| *Pogonias cromis* | *Bairdiella chrysoura* |
| *Sciaenops ocellata* | *Umbrina coroides* |
| | *Pareques acuminatus, P. umbrosus* |

## Family Sciaenidae

**Larval pigmentation**:

- Ranges from sparse to moderately heavy
- All have row of melanophores along ventral midline of tail in early stages; with development, this row exhibits fewer spots and forms characteristic sequences of small and large spots relative to anal fin base; the patterns that form are useful in identifying larvae of genera and species
- Pigment often occurs internally on anterior surface of gut and in nape region; pigment in these 2 locations is better developed than in larvae of other families
- Pigment loci that are similar to larvae in other families:
  - Melanophores at angle of lower jaw
  - Pigment anterior to cleithral symphysis
  - Pigment on dorsal, ventral and posterior surfaces of gut
  - Pigment (internal) on ventral surface of brain
  - Melanophores on base of ventral lobe of caudal fin

**Important characters distinguishing larvae of sciaenid species**:

- Relative body depth
- Relative development of preopercle and other head spines
- Shape of caudal fin in larger larvae and juveniles
- Pattern of melanophores associated with anal fin base
- Other pigment patterns (including anterior to cleithral symphysis, internal on anterior gut)
- Dorsal and anal fin ray counts
- Presence or absence of barbels at tip of lower jaw
- Seasonality: most species spawn during spring-summer, but some spawn during fall or winter-spring

**Similar larvae**:

- Apogonidae: (early stages) dorsal and anal fin rays form early (at about 5.0 mm); 2 dorsal fins well separated, the 2nd short, with low fin ray count (<10); larvae rarely collected north of Cape Hatteras
- Gerreidae: distinct melanophores on dorsal midline posterior to 2nd dorsal fin; slimmer-bodied than sciaenids; fin ray counts differ and usually exhibit greater space between successive fin rays; larvae rarely collected north of Cape Hatteras
- Haemulidae: bases of 2nd dorsal and anal fins about equal; slimmer-bodied than sciaenids, with less deepening through pectoral region; head spines very weak, usually restricted to preopercle; pigment typically prominent on posterior midline
- Polynemidae: almost complete lack of head spines; snout generally well-rounded, bulbous; bases of 2nd dorsal and anal fins about equal (or slightly more anal fin rays than 2nd dorsal fin rays); pectoral fin migrates ventrally in postflexion larvae, splits into 2 components. *Considered by some authors to be related to Sciaenidae in the superfamily Polynemoidea, largely based on ontogenetic evidence (e.g. Johnson and Patterson (1993); Leis and Trnski (2004c). This family is treated under the perciform suborder Polynemoidei in the present study, with the acknowledgment that this classification may be unsupported by adequate morphological data*.
- Pomacentridae: (early stages) 2nd dorsal and anal fin rays form early (at about 5.0 mm); lengths and fin ray counts about equal for both fins; 7+6 branched caudal fin rays; larvae rarely collected north of Cape Hatteras
- Sparidae: shorter gap between anus and anal fin origin than in sciaenids; many lack melanophore at lower jaw angle; slimmer-bodied than sciaenids; fin ray counts and greater space between successive fin rays
- Stromateidae: (early stages) high myomere counts (>30); no gap between anus and anal fin origin; numbers of 2nd dorsal and anal fin rays about equal

**Juveniles**: See table relating morphological characters to feeding ecology in six species on *Umbrina coroides* page

## Family Sciaenidae

Important characters allowing for the identification of sciaenid larvae and juveniles. Also see pigmentation characters in table on opposite page.

| Species | Spawn Date | Caudal Fin (Larvae) | Caudal Fin (Juveniles) | Barbels | Anal Fin |
|---|---|---|---|---|---|
| *Bairdiella chrysoura* | Jun–Aug | Rounded | Rounded | No | II, 8–10 |
| *Cynoscion nebulosus* | Mar–Sep | Rounded | Central Rays Longest | No | II, 9–12 |
| *Cynoscion nothus* | Jun–Aug | Central Rays Longest | Central Rays Longest | No | II, 8–10 |
| *Cynoscion regalis* | Mar–Aug | Rounded | Central Rays Longest | No | II, 10–13 |
| *Larimus fasciatus* | May–Oct | Central Rays Longest | Central Rays Longest | No | II, 6–7 |
| *Leiostomus xanthurus* | Dec–Apr | Rounded | Squared Off | No | II, 12–13 |
| *Menticirrhus americanus* | May–Aug | Central Rays Longest | Central Rays Longest | Yes (Juv) | I, 6–8 |
| *Menticirrhus littoralis* | May–Aug? | Rounded | Lower Lobe Longest | Yes (Juv) | I, 6–8 |
| *Menticirrhus saxatilis* | Apr–Aug | Rounded | Lower Lobe Longest | Yes (Juv) | I, 7–9 |
| *Micropogonias undulatus* | Sep–Dec | Central Rays Longest | Lower Lobe Longest | Yes (>30 mmSL) | II, 7–9 |
| *Pareques acuminatus* | Unknown | Rounded | Lower Lobe Longest | No | II, 7–8 |
| *Pareques umbrosus* | Year–round? | Rounded | Lower Lobe Longest | No | II, 7 |
| *Pogonias cromis* | Feb–May | Rounded | Lower Lobe Longest | Several | II, 5–7 |
| *Sciaenops ocellata* | Sep–Oct | Rounded | Central Rays Longest | No | II, 7–9 |
| *Stellifer lanceolatus* | May–Jul | Central Rays Longest | Central Rays Longest | No | II, 8–10 |
| *Umbrina coroides* | Unknown | Rounded | Lower Lobe Longest | Yes (Juv) | II, 6 |

Characters allowing for the identification of 3 commonly collected sciaenid larvae in present study area

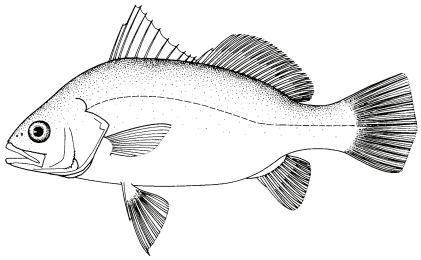
| Character | *Cynoscion regalis* | *Leiostomus xanthurus* | *Micropogonias undulatus* |
|---|---|---|---|
| Internal gut pigment | Present on anterior surface | Present on anterior surface | Absent |
| Preanal ventral pigment | 1 or 2 spots | Triangle pattern | Linear pattern |
| Eye diameter | Small | Large | Small |
| Anal fin formula | II, 10–13 | II, 12–13 | II, 8–9 |

## Family Sciaenidae

Pigment characters in sciaenid larvae and juveniles. Larvae of most species have internal pigment on anterior gut; exceptions are noted. Also see individual species-treatments for more detail.

| Species | Larval Pigmentation | Juvenile Pigmentation |
|---|---|---|
| *Bairdiella chrysoura* | 2 dark, vertical swatches; 1 through cleithral region, 1 2/3 distance from anus to tail | Uniform silver-grey over most of body |
| *Cynoscion nebulosus* | Mid-lateral and ventral line on caudal peduncle; vague spot anterior to anus | Dark, longitudinal bands on body |
| *Cynoscion nothus* | Light pigment; prominent spot over origin and insertion of anal fin; spot in anus-anal fin gap | Blotches on dorsal half of body become bars |
| *Cynoscion regalis* | Ventral line on caudal peduncle; prominent spots anterior to anus; spot over mid-anal fin; spot on dorsum over anal spot (later) | Dusky vertical bands on body |
| *Larimus fasciatus* | Pigment encircles midbrain; ventral row reduced to prominent spot over origin and insertion of anal fin | Dorsal pigment spreads from nape region |
| *Leiostomus xanthurus* | Ventral row of spots from anus to caudal fin base; triangular pattern anterior to anus | Light; blotches along mid-lateral line; light saddles on dorsum |
| *Menticirrhus americanus* | Lighter than congeners; lower, lateral gut unpigmented; palatine pigment (roof of mouth) | Dark over-all except venter |
| *Menticirrhus littoralis* | Intermediate among congeners; lower, lateral gut lightly pigmented; light palatine pigment (roof of mouth) | Dark over-all, paler ventrally |
| *Menticirrhus saxatilis* | Heavier than congeners; lower, lateral gut well-pigmented; palatine pigment (roof of mouth) | Dark over-all |
| *Micropogonias undulatus* | Prominent spot at anus; no internal pigment on anterior gut; lacks dorso-lateral pigment; linear pattern anterior to anus | Spots or dusky bands along dorsum and lateral line |
| *Pareques acuminatus* | Large blotch crosses body through cleithral region; few bold blotches along mid-lateral line; $D_1$ and $P_2$ dark | Longitudinal bands length of head and body; $D_1$ and $P_2$ dark |
| *Pareques umbrosus* | Large blotch crosses body through cleithral region; few bold blotches along mid-lateral line become solid stripe; $D_1$ and $P_2$ dark | 3-stripe phase followed by 4-stripe phase; $D_1$ and $P_2$ dark |
| *Pogonias cromis* | Prominent spot over middle of anal fin; no internal pigment on anterior gut; blotches laterally | Bands form on sides of body; no ventral pigment |
| *Sciaenops ocellata* | Prominent spot over anal fin insertion; at least 2 spots along dorsum | Blotches form on dorsum and along mid-lateral line |
| *Stellifer lanceolatus* | Light pigment; prominent spots over origin and insertion of anal fin; few spots on dorsum; | Light; most pigment on dorsal half of body |
| *Umbrina coroides* | Light pigment; prominent spots over origin and insertion of anal fin; scattered spots on dorsal half of body | Dorsal saddles and longitudinal stripes form |

## *Bairdiella chrysoura* (Lacepède, 1803)
## Sciaenidae
Silver croaker (or silver perch)



**Range**: Western North Atlantic Ocean from Cape Cod to Florida and northern Gulf of Mexico

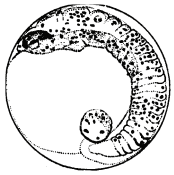
**Habitat**: Demersal in coastal waters over sandy or muddy substrates; often found in estuarine nursery areas, rarely in fresh water habitats; also often associated with marshes and seagrass beds

**Spawning**: Summer; Jun–Aug in New Jersey, late spring to early summer in Chesapeake Bay; usually occurs in nearshore waters, but also at sea

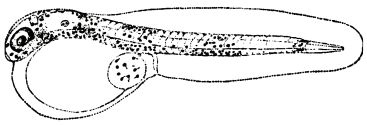
**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 11 + 14 = 25 |
| Dorsal fin rays: | XI–XII, 19–23 |
| Anal fin rays: | II, 8–10 |
| Pectoral fin rays: | 15–17 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 8–9+9+8+5–8 |
| Supraneurals: | 0/0/0/2 |

**Eggs**:
- Pelagic, spherical
- Diameter: 0.66–0.88 mm
- Chorion: thin and horny
- Oil globule: single, 0.2–0.6 mm in diameter, pigmented
- Perivitelline space: narrow



**Larvae**:
- Body moderately deep, especially through pectoral region
- Preanus length increases from 40% SL to about 55% SL
- Body depth >32% SL in later larvae
- Head and snout rounded, blunt; head length increases from 27% SL in preflexion to 35% SL in later larvae
- Mouth large, reaching beyond middle of eye
- Flexion occurs at 3.8–4.5 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; all fin rays complete by 8.8 mmSL
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes internal pigment on anterior gut, over air bladder, under hindbrain, embedded in anterior myomeres and at cleithral symphysis forming a swath along the cleithrum; series of spots along venter of tail reduces in number, enlarged melanophore at insertion of anal fin; pigment on top of head and nape increases in later larvae; no pigment along isthmus of lower jaw

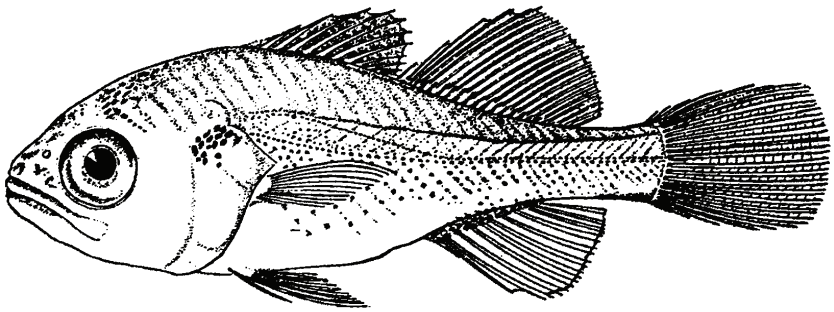


Yolk-sac larva

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small, simple spines along posterior edge and lateral ridge |
| Posttemporal: | single, small spine at 5.0–7.7 mmSL; 2 spines present at 8.8 mmSL |
| Supraorbital: | weak, spineless ridge forms at flexion |
| Opercle: | weak spine at upper angle |

**Early Juvenile**:

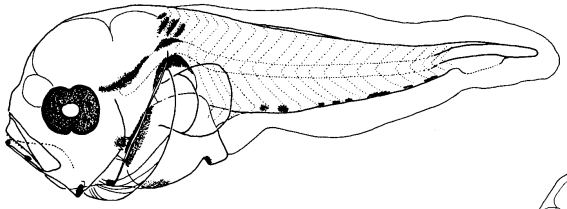


**F. 30.0 mmTL**

**Figures**: Adult: Chao, 2002; Egg, yolk-sac larva: Kuntz, 1915; **A–C**, **E**: Powles, 1980; **D**: Wayne Laroche (Ditty and Shaw, 1994b); **F**: Kuntz, 1915

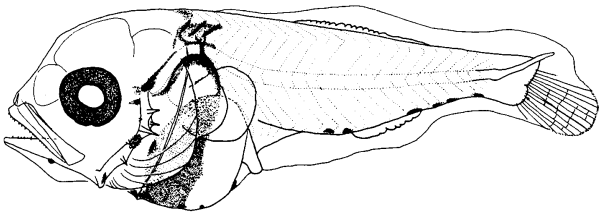
**References**: Powles and Stender, 1978; Powles, 1980; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Able and Fahay, 1998; Leis and Trnski, 2004a

***Bairdiella chrysoura***

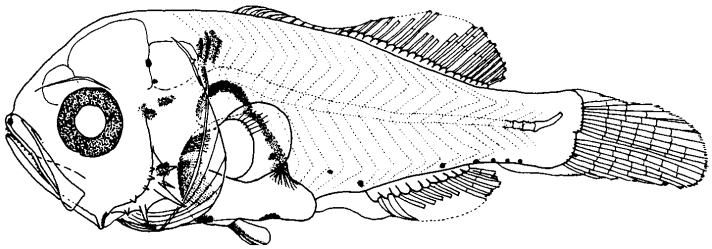


**A. 3.5 mmNL**

Note pattern of melanophores relative to anal fin base; 1 or 2 at fin origin, 1 at insertion, few on ventral peduncle



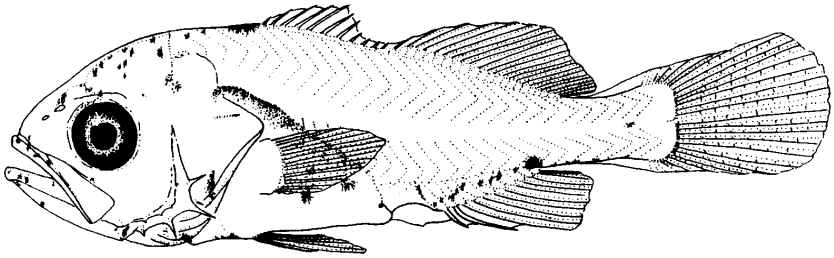
**B. 4.1 mmSL**



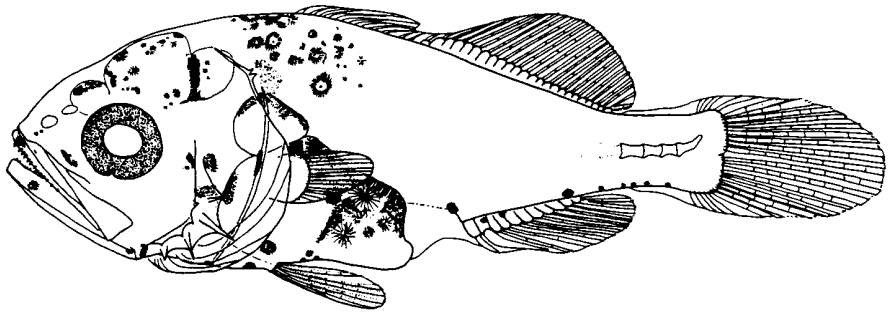
**C. 5.7 mmSL**

Caudal fin rounded

No barbel on lower jaw

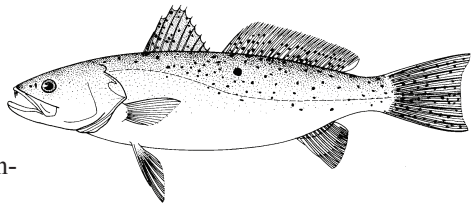


**D. 8.6 mmSL**



**E. 8.8 mmSL**

## *Cynoscion nebulosus* (Cuvier, 1830)
## Sciaenidae
Spotted weakfish



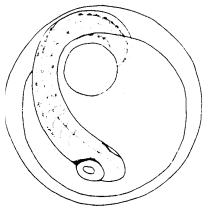
**Range**: Western North Atlantic Ocean from Long Island to Florida and northern and western Gulf of Mexico; rare north of Delaware Bay

**Habitat**: Shallow, coastal oceanic waters and estuaries, usually over sandy substrates; often associated with seagrass beds, salt marshes, tidal creeks and pools; grass beds used as nursery areas

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 12 + 13 = 25 |
| Dorsal fin rays: | X–XI, 24–28 |
| Anal fin rays: | II, 9–12 |
| Pectoral fin rays: | 18–20 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 6–9+9+8+5–7 |
| Supraneurals: | 0/0/0/2 |

**Spawning**: Mar–Sep in estuarine or coastal ocean waters



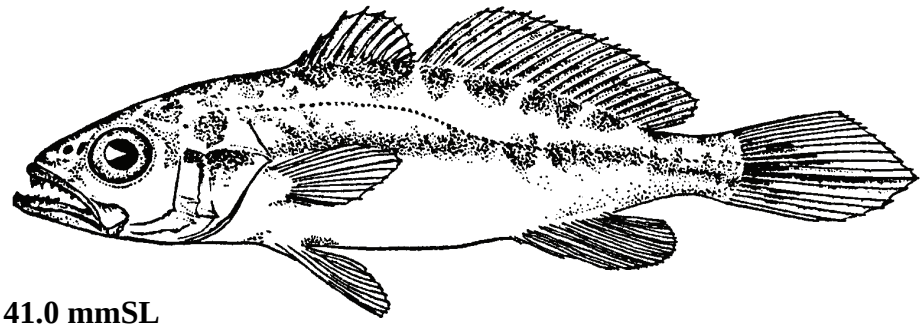
**Eggs**:
- Pelagic, spherical
- Diameter: 0.70–0.85 mm
- Chorion: smooth, transparent
- Yolk: homogeneous
- Oil globule: single, 0.18–0.27 mm in diameter
- Perivitelline space: moderately narrow

**Larvae**:
- Body moderately elongate, deepest through pectoral region
- Preanus length increases from about 40% SL to about 65% SL
- Body depth <32% SL throughout development
- Head and snout moderately pointy; head length increases from about 30% SL to <40% SL
- Mouth large, almost reaching posterior edge of eye in later larvae
- Flexion occurs at 3.7–4.8 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; all fin rays complete by 10.0 mmSL
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes series of melanophores along dorsum and along midline of tail; few spots along venter of tail; pigment on palatines; bar forms from snout through eye, onto opercle; top of head and nape heavily spotted in larger larvae; dorsal surface of gut well-pigmented

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines on posterior edge and lateral ridge |
| Posttemporal: | multiple spines form in later larvae |
| Supraorbital: | weak, spineless ridge forms after flexion |
| Opercle: | weak spine at upper angle |

**Early Juvenile**:

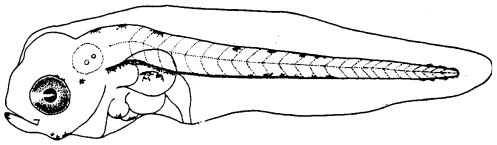


**H. 41.0 mmSL**

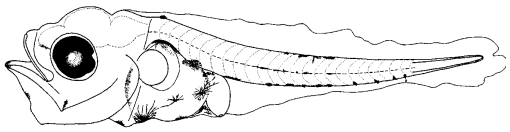
**Figures**: Adult: Chao, 2002; Egg and **A**: Fable *et al*., 1978; **B–C**: Ditty, 1989; **D**: Hildebrand and Cable, 1934; **E–G**: Jack Javech (Ditty and Shaw, 1994b); **H**: Welsh and Breder, 1923

**References**: Fable *et al*., 1978; Powles and Stender, 1978; Ditty, 1989; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

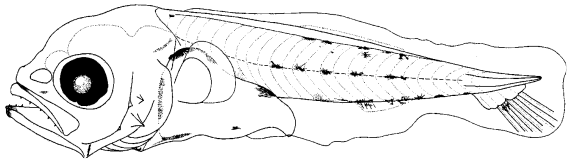
***Cynoscion nebulosus***



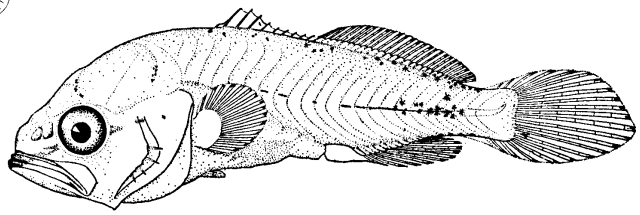
**A. 2.1 mmNL**



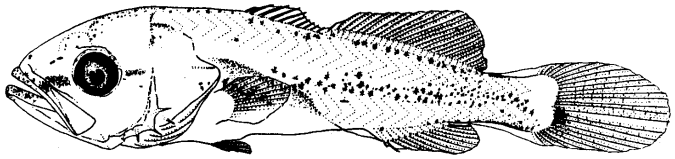
**B. 2.6 mmNL**



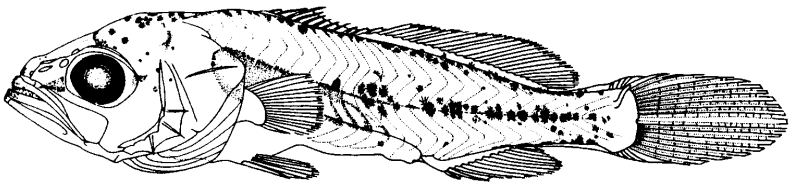
**C. 4.2 mmNL**



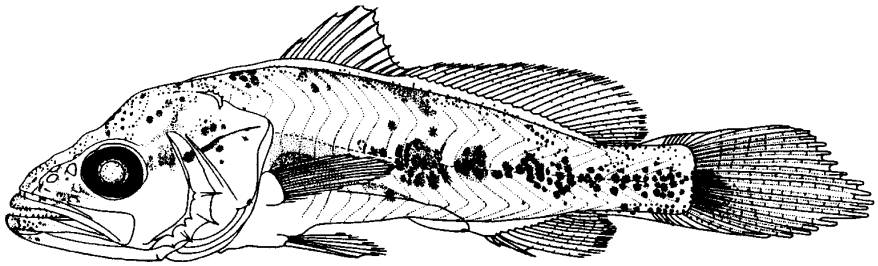
**D. 7.0 mmSL**



**E. 8.4 mmSL** Note heavy pigment along midline of tail, ‘bar’ through eye

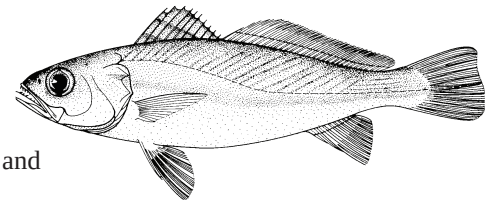


**F. 9.5 mmSL** Central caudal fin rays elongate



**G. 14.5 mmSL** No barbel on lower jaw

## *Cynoscion nothus* (Holbrook, 1848)
## Sciaenidae
Silver weakfish (or silver seatrout)



**Range**: Western North Atlantic Ocean from Chesapeake Bay to Florida and northern Gulf of Mexico; uncommon in study area

**Habitat**: Coastal waters over sandy substrates, often along beaches or near river mouths

**Spawning**: May–Nov with peak Aug–Oct in coastal waters throughout range; Jun–Aug off North Carolina; may not spawn in study area

**Eggs**:
- Undescribed

**Larvae**:
- Body moderately stout, deepest through pectoral region
- Preanus length increases from about 50% SL to >60% SL in juveniles
- Body depth >32% SL throughout development
- Head moderately rounded, with slightly pointy snout; head length about 40% SL through development
- Mouth large, extending to posterior edge of eye
- Flexion occurs at 3.5–5.0 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation is relatively light; note pattern of melanophores along venter, with a spot at origin and insertion of anal fin, a prominent spot over anus-anal fin gap, and very few spots on venter of caudal peduncle; dorsum of gut well-pigmented; note pigment on gular membrane, between lower 2 jaw rami; single spot on nape; early juveniles develop clusters of spots over body, become vague bars

**Meristic Characters**

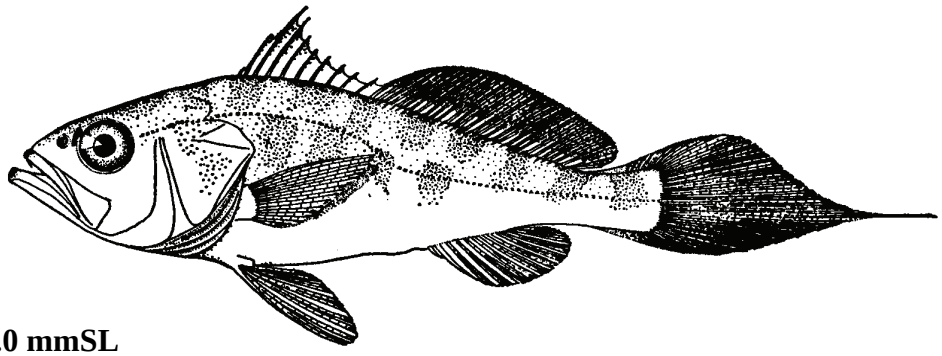
| | |
|---|---|
| Myomeres: | 27 |
| Vertebrae: | 15 + 12 = 27 |
| Dorsal fin rays: | XI, 26–31 |
| Anal fin rays: | II, 8–10 |
| Pectoral fin rays: | 18–19 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 7–8+9+8+6–8 |
| Supraneurals: | 0/0/0/2 |

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines (proportionately larger in small larvae) along posterior edge and lateral ridge |
| Posttemporal: | two small spines form in postflexion larvae |
| Supraorbital: | very weak, spineless ridge |
| Opercle: | 1 or 2 weak spines at upper angle |

**Note**: 1. High myomere count compared to other sciaenids

**Early Juvenile**:

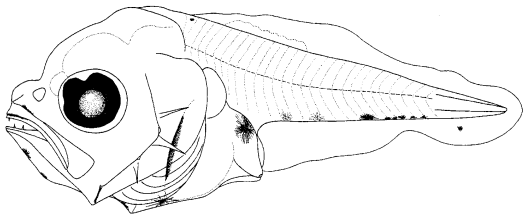


**F. 67.0 mmSL**

**Figures**: Adult: Chao, 2002; **A–B**: Ditty, 1989; **C–D**: Stender, 1980; **E–F**: Hildebrand and Cable, 1934

**References**: Powles and Stender, 1978; Stender, 1980; G.D. Johnson, 1984; Ditty, 1989; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

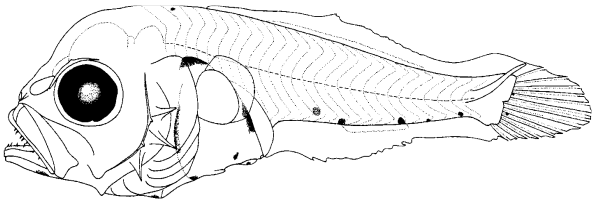
***Cynoscion nothus***

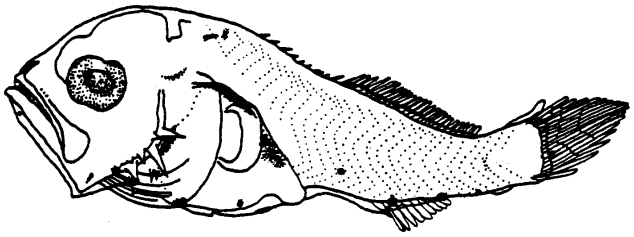


**A. 3.0 mmNL**

Note pigment on midline of lower jaw

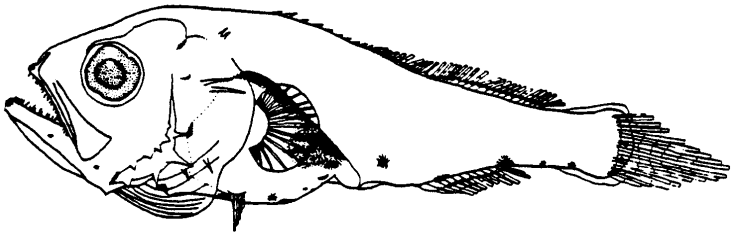
**B. 4.7 mmNL**



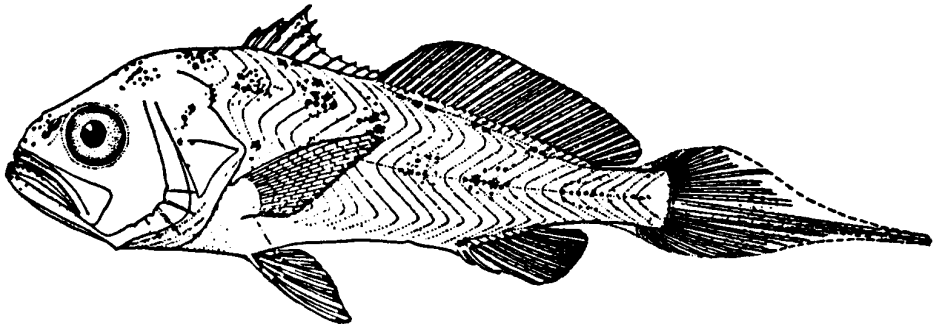


**C. 6.1 mmNL**

Note light pigment along venter of tail, with melanophores at origin and insertion of anal fin; 1 or 2 spots on ventral caudal peduncle; prominent spot over anus-anal fin gap

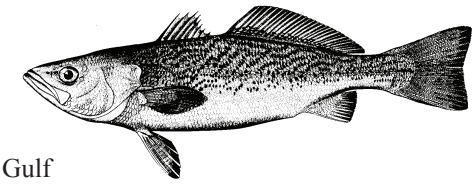


**D. 9.7 mmSL** Central caudal fin rays elongate in juveniles



**E. 26.0 mmSL** No barbel on lower jaw

## *Cynoscion regalis* (Bloch and Schneider, 1801)
## Sciaenidae
Weakfish



**Range**: Western North Atlantic Ocean from Nova Scotia to Florida; rarely Gulf of Mexico off west coast of Florida

**Habitat**: Usually in shallow coastal waters, including bays and estuaries, over sandy or muddy substrates; estuaries used as nurseries

**Spawning**: Spring through summer (Mar–Aug), often in coastal waters near inlets, bay mouths or in estuaries

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 13 + 12 = 25 |
| Dorsal fin rays: | XI, 24–29 |
| Anal fin rays: | II, 10–13 |
| Pectoral fin rays: | 18 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 7–9+9+8+5–7 |
| Supraneurals: | 0/0/0/2 |

**Eggs**:

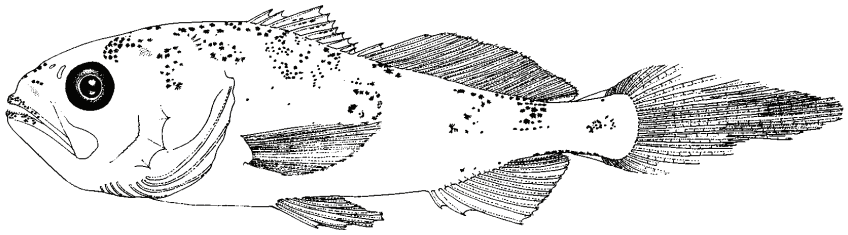
- Pelagic, spherical
- Diameter: 0.75–0.98 mm
- Chorion: smooth, transparent
- Yolk: homogeneous, amber
- Oil globule: usually single, 0.20–0.25 mm in diameter (sometimes multiple if damaged by collecting net)
- Perivitelline space: narrow

**Larvae**:
- Body moderately elongate, deepest through pectoral region
- Preanus length increases from about 40% SL to <60% SL in larger larvae
- "Hump" on dorsal outline of gut over anus
- Body depth about 32% SL, intermediate between shallow-bodied and deep-bodied sciaenids
- Head deep and rounded, with moderately blunt snout; head length 30–40% SL
- Mouth large, reaches beyond middle of eye
- Flexion occurs at 4.0–4.3 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; all fin rays complete at 9–10 mmSL
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation light; dorsal spot present in nape region and under 2nd dorsal fin insertion (both internalize); ventral pigment includes spot over middle of anal fin base, a spot over anus-anal fin gap (<4.7 mm), 0–3 spots along venter posterior to anal fin and a spot forms over origin of anal fin (>9.4 mm); 1–4 spots on ventral midline of lower jaw; lateral pigment spreads along midline in larger larvae; spots at tip of snout and on each side of lower jaw

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines present along posterior edge and lateral ridge; increase in number |
| Posttemporal: | 1 to 4 small spines present between 5 and 25 mm |
| Supraorbital: | weak, spineless crest |
| Opercle: | 1 or 2 weak spines present at upper angle |

**Early Juvenile**:

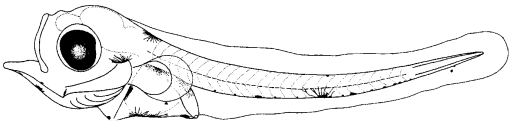


**H. 31.0 mmTL**

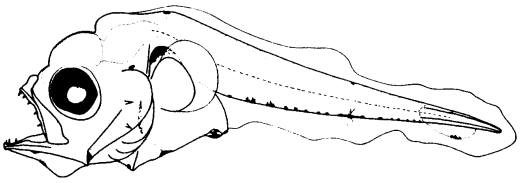
**Figures**: Adult: L. E. Cable (Klein-MacPhee, 2002q); Egg: Welsh and Breder, 1923; **A**, **C**: Ditty, 1989; **B**, **D–G**: Jack Javech (Ditty and Shaw, 1994b); **H**: Nancy Arthur (Able and Fahay, 1998)

**References**: Perlmutter, 1939; Pearson, 1941; Powles and Stender, 1978; G. D. Johnson, 1984; Cowan and Birdsong, 1985; Ditty, 1989; Ditty and Shaw, 1994b; Able and Fahay, 1998; Leis and Trnski, 2004a

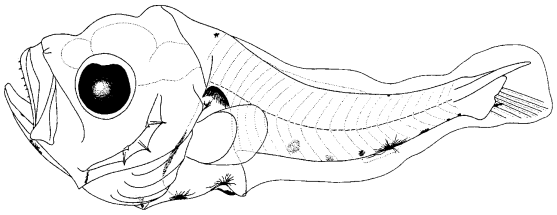
***Cynoscion regalis***



**A. 2.8 mmNL**

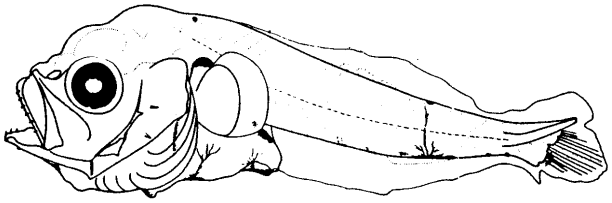


**B. 3.2 mmNL**

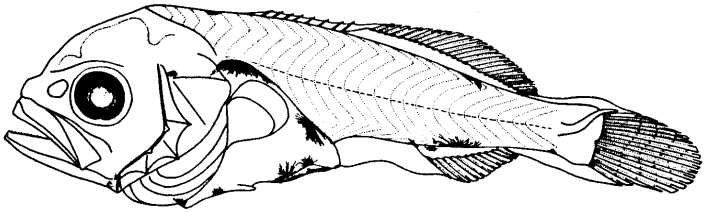


Note pigment on midline of lower jaw

**C. 4.1 mmSL**



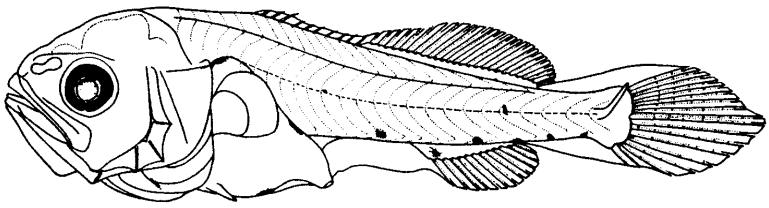
**D. 4.5 mmNL**



Note light pigment along venter of tail, with spot in anus-anal fin gap and over mid-anal fin; few spots on venter of caudal peduncle

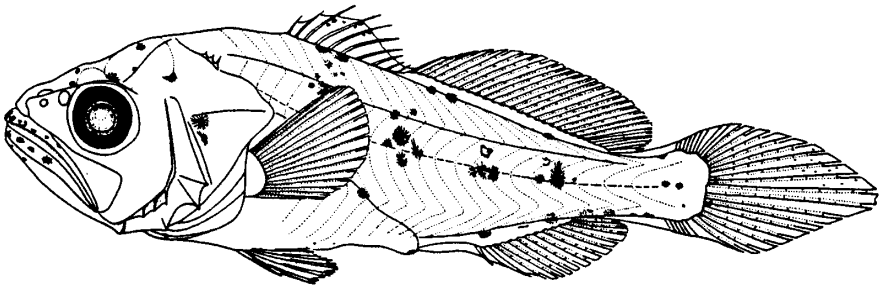
**E. 5.4 mmSL**

Central caudal fin rays elongate in juveniles



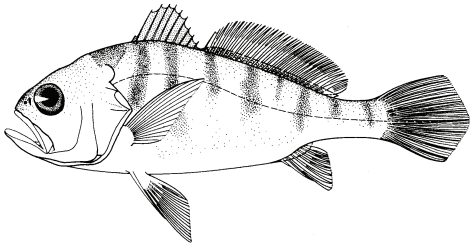
**F. 7.5 mmSL**

No barbel on lower jaw



**G. 13.5 mmSL**

## *Larimus fasciatus* Holbrook, 1855
## Sciaenidae
Banded drum



**Range**: Western North Atlantic Ocean from Massachusetts to Florida and northern Gulf of Mexico; absent southern Florida

**Habitat**: Coastal waters over sandy and muddy substrates in depths to 60 m; uncommon in estuaries

**Spawning**: May–Oct with peak during summer (Apr–Nov in Gulf of Mexico); probably in continental shelf waters

**Eggs**: – Undescribed

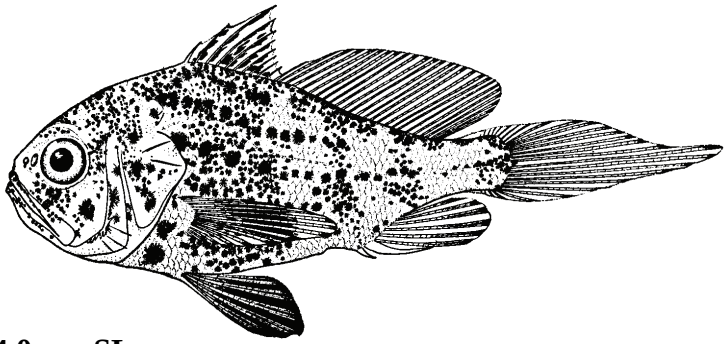
| **Meristic Characters** | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 11 + 14 = 25 |
| Dorsal fin rays: | XI–XII, 24–27 |
| Anal fin rays: | II, 6–7 |
| Pectoral fin rays: | 16–17 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 6–7+9+8+4–7 |
| Supraneurals: | 0/0/0/2 |

**Larvae**:
- Body deep, especially through pectoral region
- Preanus length >50% SL in early larvae, increasing to about 60% SL in later stages; short anus-anal fin gap
- Body depth about 40% SL throughout development
- Head large, deep with rounded, blunt snout; eye large; mouth large, extending beyond mid-point of eye
- Flexion occurs at 3.6–4.0 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $P_1$ – $D_1$, $P_2$: all fin rays (except $P_1$) complete by 5.8 mmSL: note $P_1$ fin rays begin forming during flexion, an unusual sequence for sciaenids
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation heaviest on anterior parts of head and body; internal pigment on anterior forebrain, anterior and posterior midbrain and posterodorsal hindbrain (midbrain appears 'ringed' when viewed dorsally); pectoral fin and base densely pigmented; large melanophores appear on gut >4.0 mmSL; 2 to 4 spots on ventral midline of lower jaw; spots occur on preopercle and opercle; spot anterior to cleithral symphysis; 3 spots on venter of gut in small larvae, spot at anus disappears in larger larvae; series of 6 melanophores ($5^{th}$ largest) along venter of tail reduced to 2 in larger larvae, 1 at insertion of anal fin, 1 just behind origin of anal fin; dorsal pigment most prominent under $D_1$ fin, spreads from this location in larger larvae; lateral pigment begins as few spots on midline of tail, spreading in larger larvae

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines on posterior edge and lateral ridge |
| Posttemporal: | 1 or 2 small spines appear at about 5.5 mmSL |
| Supraorbital: | low, serrated ridge forms at about 5.5 mmSL |
| Opercle: | small, weak spine at upper angle |

**Early Juvenile**:

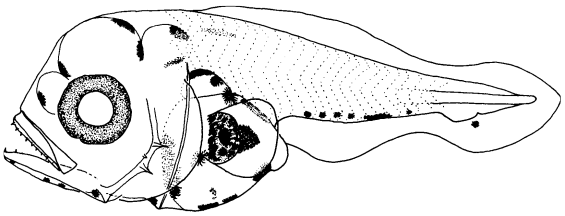


**G. 24.0 mmSL**

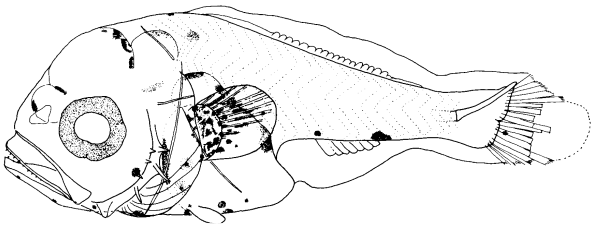
**Figures**: Adult: Chao, 2002; **A–C**: Powles, 1980; **D**: Jack Javech (Ditty and Shaw, 1994b); **E–G**: Hildebrand and Cable, 1934

**References**: Hildebrand and Cable, 1934; Powles and Stender, 1978; Powles, 1980; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

***Larimus fasciatus***

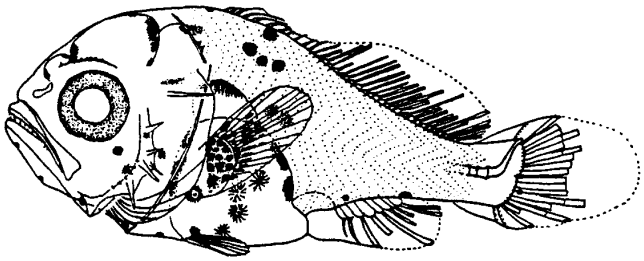


**A. 3.0 mmNL**

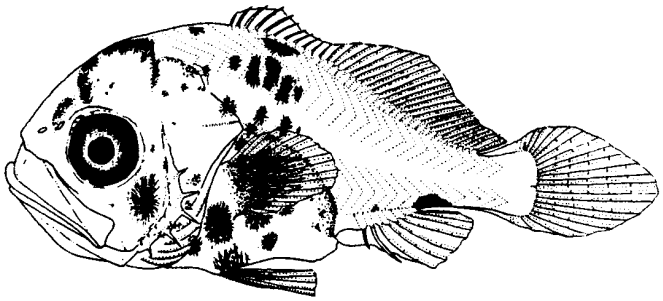


**B. 4.0 mmSL**

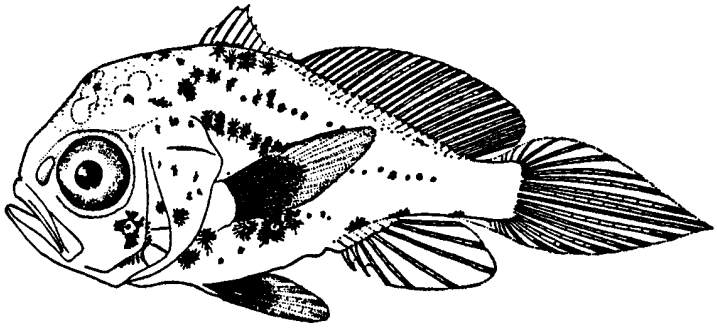
Note series of 6 melanophores along venter of tail, reduced to 2 spots



**C. 5.8 mmSL**

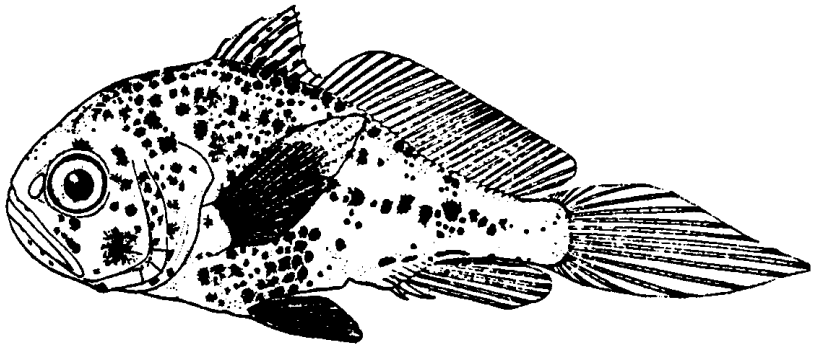


**D. 6.9 mmSL**



Central caudal fin rays elongate in juveniles, only slightly longer in adults

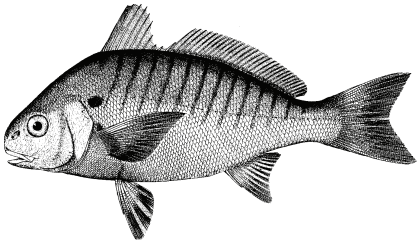
**E. 10.5 mmSL**



**F. 17.0 mmSL**

No barbel on lower jaw

## *Leiostomus xanthurus* Lacepède, 1802
## Sciaenidae
Spot



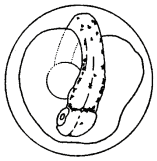
**Range**: Western North Atlantic Ocean from Cape Cod to Florida and northern-Gulf of Mexico

**Habitat**: Coastal waters, including brackish and freshwater, over sandy or muddy substrates in depths to 60 m; often spend summer and fall in estuaries; young stages use estuaries as nurseries

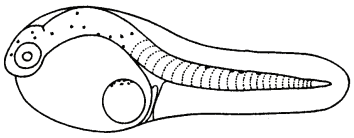
**Spawning**: Winter to early spring in continental shelf waters, often near Gulf Stream front off North Carolina; most larvae collected south of New Jersey, juveniles as far north as Massachusetts

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15=25 |
| Dorsal fin rays: | X–XII, 33–35 |
| Anal fin rays: | II, 12–13 |
| Pectoral fin rays: | 21–22 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 6–8+9+8+6–8 |
| Supraneurals: | 0/0/0/2 |



**Eggs**:
- Pelagic, spherical, transparent
- Diameter: 0.72–0.87 mm
- Chorion: smooth, unsculptured
- Yolk: homogeneous
- Oil globules: multiple, coalesce into 1, 0.18–0.28 mm diameter
- Perivitelline space: narrow



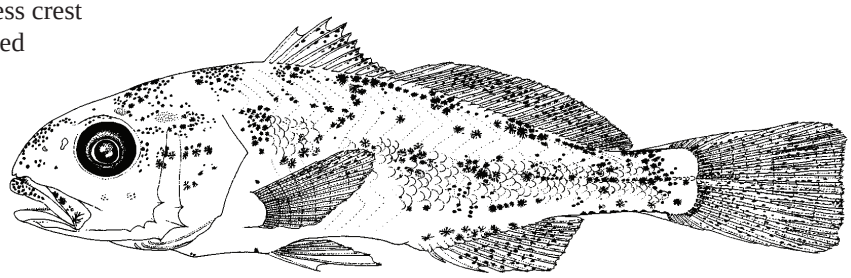
Yolk-sac larva

**Larvae**:
- Body relatively elongate, deepest through pectoral region
- Preanus length increases from 20% SL in yolk-sac larvae to 50% SL in larger larvae
- Body depth increases from 20% SL in early larvae to 30% SL in post-flexion stage; remains shallow-bodied
- Head moderate in size, with slightly pointy snout; mouth fairly large, reaches mid-point of eye
- Flexion occurs at 3.8–5.3 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation light; series of melanophores along venter of tail, with 2 more prominent, become reduced in number, including several over anal fin base and on venter of caudal peduncle; spot occurs in anus-anal fin gap; internal pigment on anterior surface of gut

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines on posterior edge and lateral ridge |
| Posttemporal: | none reported |
| Supraorbital: | low, spineless crest |
| Opercle: | none reported |

**Early Juvenile**:



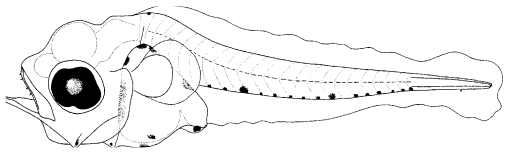
**F. 23.5 mmSL**

Eye diameter about equal to snout length (compare to *Micropogonias undulatus*)

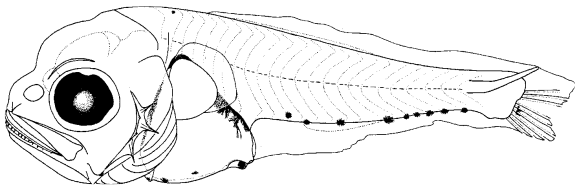
**Figures**: Adult: H. L. Todd (Klein-MacPhee, 2002q); Egg and yolk-sac larva: Powell and Gordy, 1980; **A–B**: Ditty, 1989; **C–E:** Peter Berrien (Lippson and Moran, 1974b; **F**: Nancy Arthur (Able and Fahay, 1998). Also see illustrations of larvae in Hildebrand and Cable (1930); Powell and Gordy (1980); Ditty and Shaw (1994)

**References**: Powles and Stender, 1978; Fahay, 1983; G. D. Johnson, 1984; Cowan and Birdsong, 1985; Govoni, 1993; Ditty and Shaw, 1994b; Able and Fahay, 1998; Leis and Trnski, 2004a

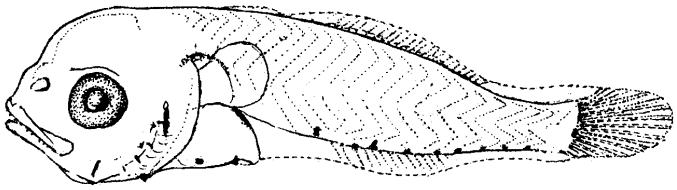
***Leiostomus xanthurus***



**A. 2.8 mmSL**

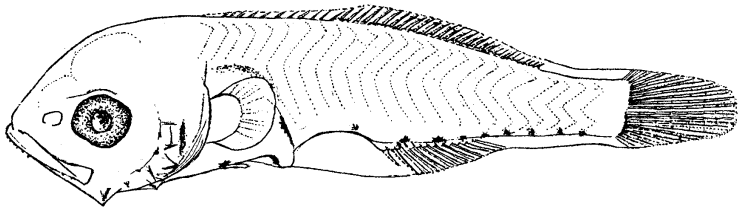


**B. 4.3 mmSL**



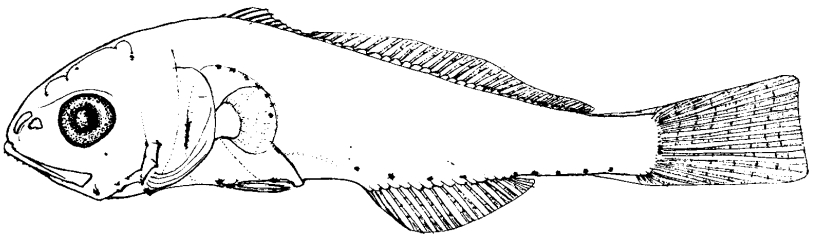
**C. 5.6 mmSL**

Note pigment pattern along ventral edge of tail, including melanophore in anus-anal fin origin gap



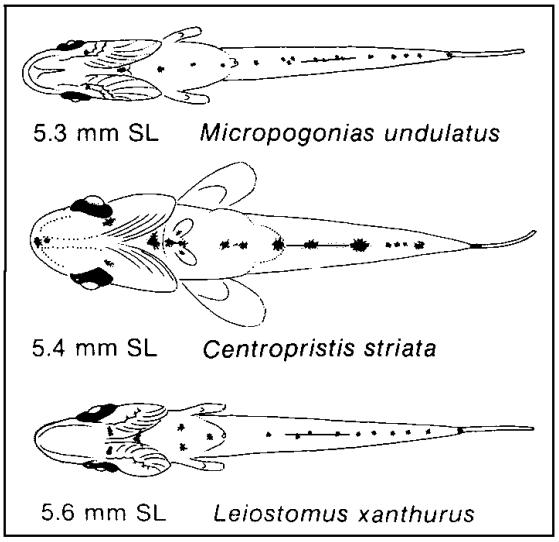
**D. 7.5 mmSL**

Note squared off caudal fin



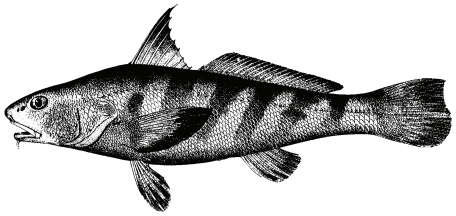
No barbel on lower jaw

**E. 12.8 mmSL**




- Note difference in development of pectoral and pelvic fins in these 3 similar larvae (ventral views)
- Note space between anus and anal fin origin in *M. undulatus* and *L. xanthurus*; no space in *C. striata*
- Note triangular pigment pattern anterior to anus in *L. xanthurus* (compare to pattern in other 2 species)

## *Menticirrhus americanus* (Linnaeus, 1758)
## Sciaenidae
Southern kingfish



**Range**: Western Atlantic Ocean from Cape Cod to northern Argentina, including Gulf of Mexico

**Habitat**: Shallow, coastal waters, including surf zone and estuaries, over sandy or sand-mud substrates; juveniles often in brackish habitats

**Spawning**: Spring and summer in coastal ocean

**Eggs**:
- Undescribed

**Larvae**:
- Body moderately elongate, deepest through pectoral region
- Preanus length increases from <50% SL to <60% SL in juveniles
- Body depth about 32% SL, intermediate between shallow-bodied and deep-bodied sciaenids
- Head deep, with short, rounded snout
- Mouth large, extending beyond mid-point of eye
- Flexion occurs at about 3.0–6.0 mmSL (estimate)
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; all fin rays formed by 7.0 mmSL
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation is the lightest of 3 species of *Menticirrhus*; lateral surface of gut with almost no pigment; pigment along lateral midline begins in earliest stages, quite extensive by end of flexion; spots at tip of snout and along ventral midline of lower jaw; few spots in nape region; pigment along venter of tail begins as series of many spots, reduce to a few, spaced evenly from anal fin origin to caudal finbase; dorsal pigment begins as single spot under $D_2$, spreads along single line in later larvae; no spot anterior to cleithral symphysis; vague 'bar' through eye, formed partly by palatine pigment

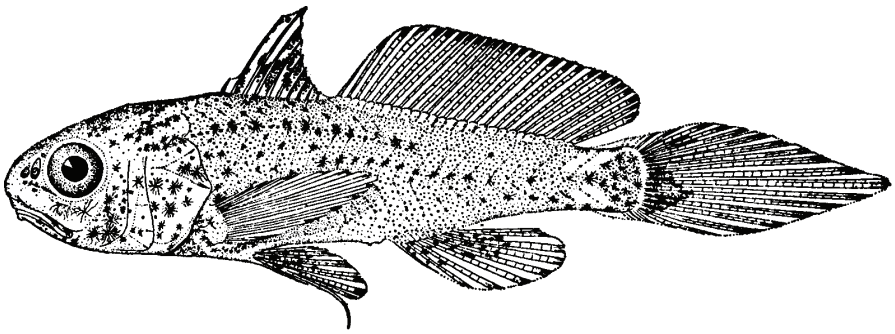
**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | XI, 20–26 |
| Anal fin rays: | I, 6–8 |
| Pectoral fin rays: | 18–24 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 8–9+9+8+7 |
| Supraneurals: | 0/0/0/2 |

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines present on posterior edge and lateral ridge |
| Posttemporal: | 2 tiny spines present |
| Supraorbital: | not described |
| Opercle: | very small spine at upper angle (may be short-lived) |

**Early Juvenile**:

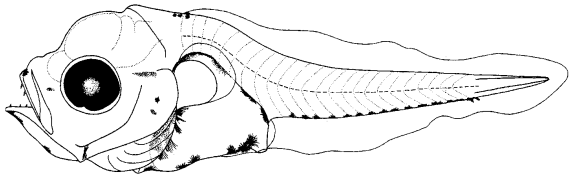


**E. 20.0 mmSL**

**Figures**: Adult: Goode, 1884; **A–B**: Ditty, 1989; **C**: Joanne Lyczkowski-Shultz (Ditty and Shaw, 1994b); **D–E**: Hildebrand and Cable, 1934

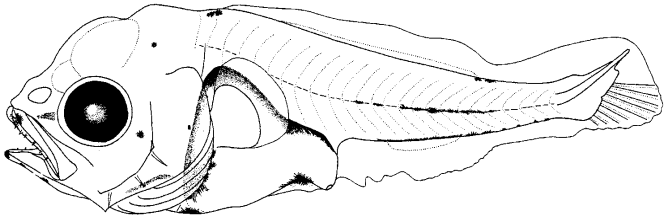
**References**: Hildebrand and Cable, 1934; Powles and Stender, 1978; G. D. Johnson, 1984; Ditty, 1989; Ditty and Shaw, 1994b; Leis and Trnski, 2004a; Joanne Lyczkowski-Shultz (pers. comm.)

## *Menticirrhus americanus*

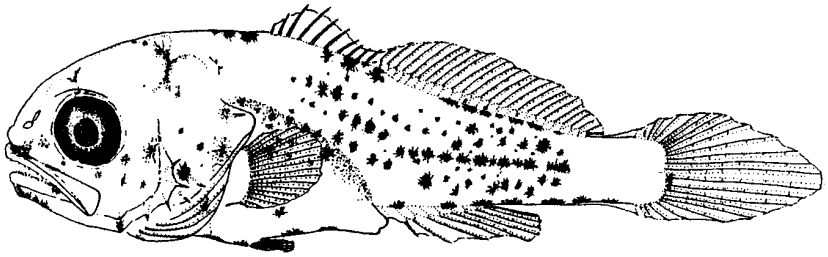


**A. 2.8 mmNL**

Note reduction in number of melanophores in ventral series along tail

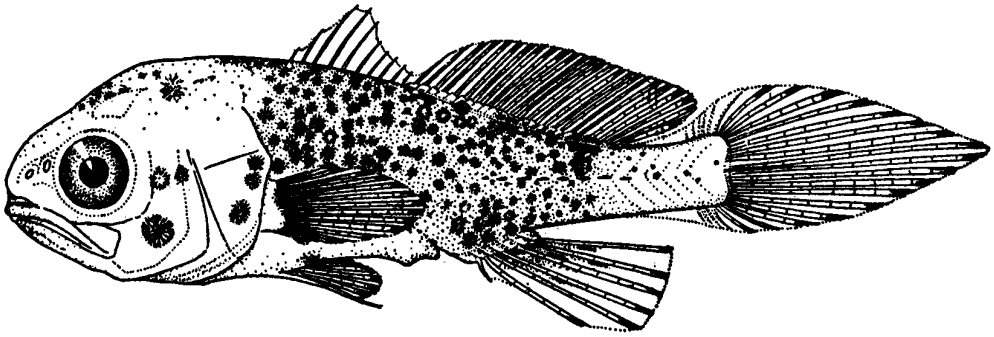


**B. 3.7 mmNL**



**C. 6.5 mmSL**

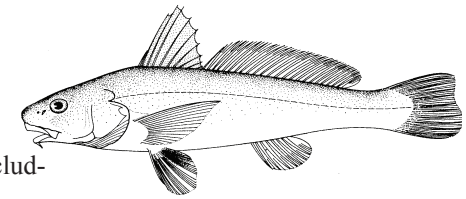
Fin rays in lower lobe of caudal fin longer than in rest of fin (in juveniles and adults)



**D. 11.0 mmSL**

Barbel on lower jaw develops in juveniles

## *Menticirrhus littoralis* (Holbrook, 1847)
## Sciaenidae
Gulf kingfish



**Range**: Western Atlantic Ocean from Chesapeake Bay to southern Brazil, including Gulf of Mexico and continental coast of Caribbean Sea

**Habitat**: Coastal waters over sandy or sand-mud substrates, especially in surf zone, occasional in polyhaline estuaries; juveniles usually in surf zone

**Spawning**: Spring through summer in coastal waters

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | XI, 21–26 |
| Anal fin rays: | I, 6–8 |
| Pectoral fin rays: | 18–21 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 7–8+9+8+6 |
| Supraneurals: | 0/0/0/2 |

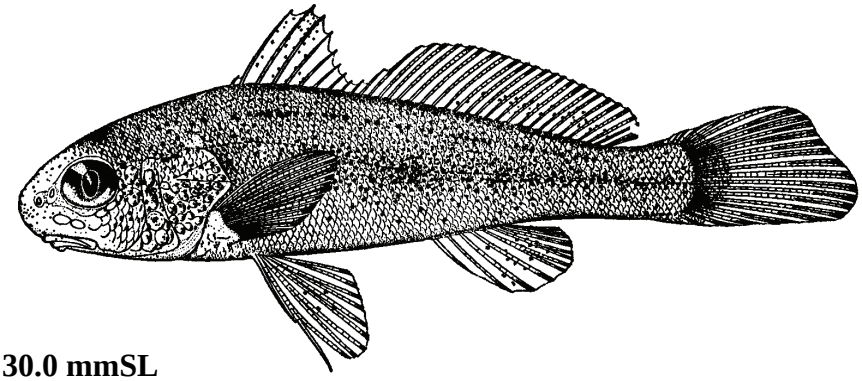
**Eggs**:
- Undescribed

**Larvae**:
- Body moderately elongate, deepest through pectoral region
- Preanus length increases from <50% SL to <60% SL in juveniles (estimate)
- Body depth about 32% SL, intermediate between shallow-bodied and deep-bodied sciaenids
- Head deep, with short, rounded snout
- Mouth large, extending to mid-point of eye
- Flexion occurs at about 3.0–6.0 mmSL (estimate)
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; all fin rays formed by 7.0 mmSL
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation density intermediate between *M. americanus* and *M. saxatilis*; few spots on lateral surface of lower gut; pigment along midline begins in earliest stages, fairly extensive by end of flexion; few spots at tip of snout; few spots in nape region; pigment along venter of tail begins as series of many spots, reduce to a few, spaced evenly from anal fin origin to caudal fin base; dorsal pigment begins as single spot under $D_2$, spreads as scattered group in later larvae; spot present anterior to cleithral symphysis; palatine pigment inconspicuous

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | very small spines along posterior edge |
| Posttemporal: | none described |
| Supraorbital: | none described |
| Opercle: | none described |

**Early Juvenile**:

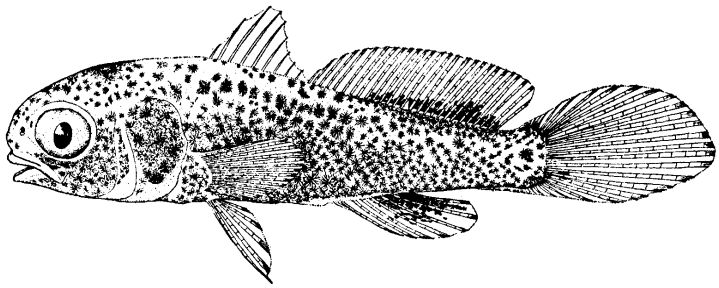


**C. 30.0 mmSL**

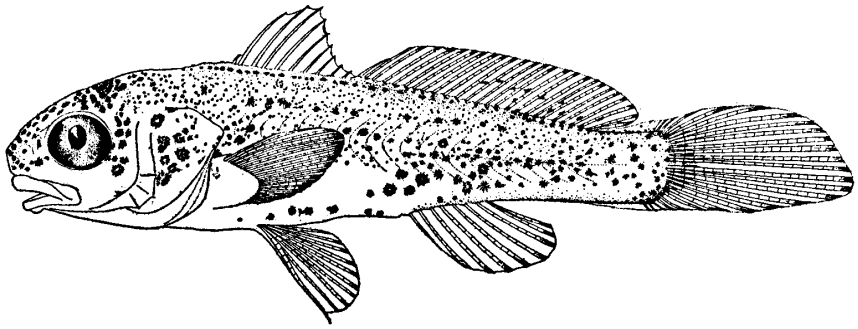
**Figures**: Adult: Chao, 2002; **A–C**: Hildebrand and Cable, 1934

**References**: Hildebrand and Cable, 1934; Powles and Stender, 1978; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

## *Menticirrhus littoralis*

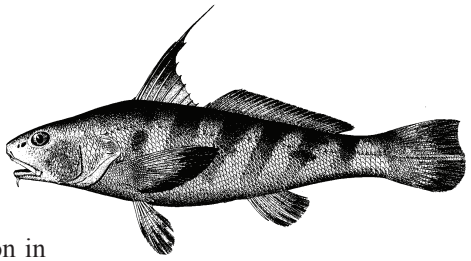


**A. 11.9 mmSL** Fin rays in lower lobe of caudal fin longer than in rest of fin (in juveniles and adults)



**B. 19.0 mmSL** Barbel develops on lower jaw in juveniles

## *Menticirrhus saxatilis* (Bloch and Schneider, 1801)
## Sciaenidae
Northern kingfish



**Range**: Western North Atlantic Ocean from Gulf of Maine to Gulf of Mexico; common from Cape Cod to Cape Hatteras

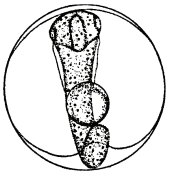
**Habitat**: Shallow, coastal waters over sandy to sand-mud substrates; common in surf zone and estuaries; juveniles enter oligohaline tidal creeks

**Spawning**: Jun–Aug off New Jersey, Apr–May off North Carolina; probably over inner continental shelf

**Meristic Characters**

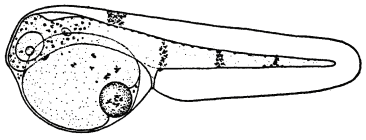
| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | XI, 22–27 |
| Anal fin rays: | I, 7–9 |
| Pectoral fin rays: | 18–21 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 6–8+9+8+6 |
| Supraneurals: | 0/0/0/2 |

**Eggs**:



- Pelagic, spherical
- Diameter: 0.80–0.85 mm
- Chorion: faintly yellowish
- Oil globules: as many as 18 coalesce to 1; 0.19–0.26 mm diameter when single
- Perivitelline space: narrow

**Larvae**:



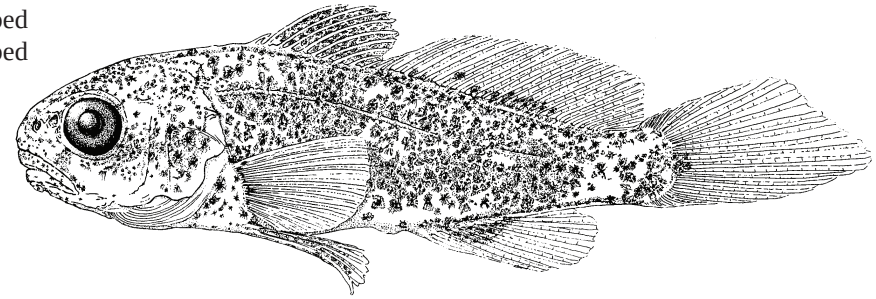
Yolk-sac larva

- Body moderately elongate, deepest through pectoral region
- Preanus length increases from <50% SL to <60% SL in juveniles
- Body depth as much as 40% SL in early stages; body depth in postflexion larvae about 32% SL, intermediate between shallow-bodied and deep-bodied sciaenids
- Head deep, with short, rounded snout
- Mouth large, extending to mid-point of eye
- Flexion occurs at about 2.4–4.0 mmSL
- Sequence of fin ray formation: $C - D_2$, $A - D_1 - P_2 - P_1$
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation is the heaviest of the 3 species of *Menticirrhus*; lateral surface of gut heavily pigmented; pigment along lateral midline begins in earliest stages, quite extensive by end of flexion; spots at tip of snout and prominent spots along ventral midline of lower jaw; few spots in nape region; pigment along venter of tail begins as series of many spots, becomes line of dense spots from anus to caudal peduncle; dorsal pigment begins as few spots under $D_2$, spreads ventrally in later larvae; spot present anterior to cleithral symphysis; vague 'bar' through eye, formed partly by palatine pigment; larger larvae and juveniles densely pigmented

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | very small spines along posterior edge |
| Posttemporal: | none described |
| Supraorbital: | none described |
| Opercle: | none described |

**Early Juvenile**:

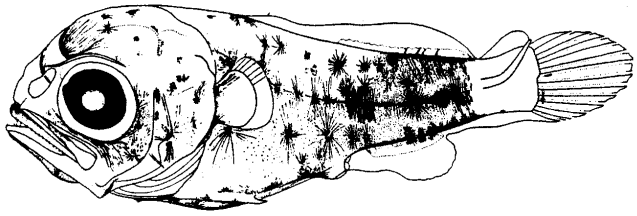


**C. 16.4 mmTL**

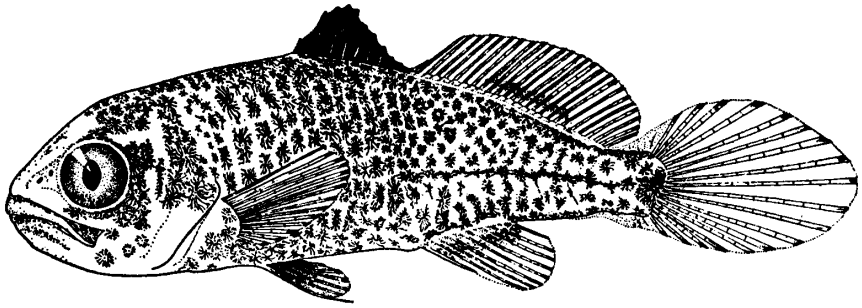
**Figures**: Adult: H. L. Todd (Klein-M$^{ac}$Phee, 2002q); Egg and yolk-sac larva: Welsh and Breder, 1923; **A**: Ditty, 1989; **B**: Hildebrand and Cable, 1934; **C**: Susan Kaiser (Able and Fahay, 1998)

**References**: Hildebrand and Cable, 1934; Powles and Stender, 1978; G. D. Johnson, 1984; Ditty, 1989; Ditty and Shaw, 1994b; Leis and Trnski, 2004a; Joanne Lyczkowski-Shultz (pers. comm.)

## *Menticirrhus saxatilis*



**A. 4.0 mmSL** Dense pigment includes membranes of $D_1$ fin

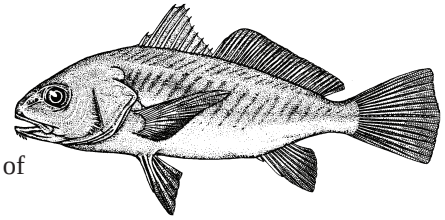


**B. 10.0 mmSL**

Fin rays in lower lobe of caudal fin longer than in rest of fin (in juveniles and adults)

Barbel develops on lower jaw in juveniles

## *Micropogonias undulatus* (Linnaeus, 1766)
## Sciaenidae
Atlantic croaker



**Range**: Western North Atlantic Ocean from Cape Cod to Florida and Gulf of Mexico to Bay of Campeche, Mexico

**Habitat**: Coastal waters and estuaries over mud and sand-mud substrates in depths to 100 m; juveniles use estuaries as nurseries

**Spawning**: Fall and winter (Sep–Dec) over continental shelf between Delaware Bay and Cape Hatteras in study area

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | XI, 26–31 |
| Anal fin rays: | II, 7–9 |
| Pectoral fin rays: | 17–18 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 8–9+9+8+8 |
| Supraneurals: | 0/0/0/2 |

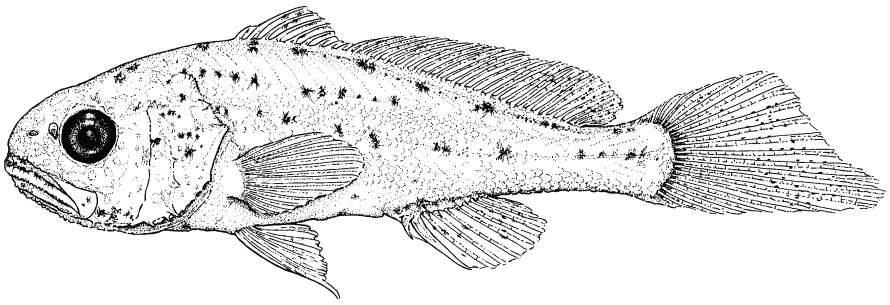
**Eggs**:
- Undescribed

**Larvae**:
- Body moderately elongate, somewhat deeper through pectoral region
- Preanus length increases from about 45% SL in preflexion larvae to <60% SL in late larvae
- Body depth remains <32% SL throughout development
- Head deep, moderately rounded; head length increases slightly from 30% SL to 35% SL
- Mouth large, reaching beyond mid-point of eye in larger larvae
- Flexion occurs at 3.8–4.5 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation generally light; spot in nape area, otherwise dorsal pigment lacking until late larval stage; pigment on dorsal and ventral surfaces of gut, but lacking internally on anterior surface; note pattern of ventral melanophores anterior to anus; ventral pigment begins as series of spots from anus to caudal peduncle, number reduces leaving a spot over origin of anal fin and over insertion of anal fin, with a few spots on venter of caudal peduncle; late larvae develop a few spots along lateral midline of body and these spread to upper parts of flank as transformation approaches

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines along posterior edge and lateral ridge |
| Posttemporal: | two small spines |
| Supraorbital: | none reported |
| Opercle: | none reporte( |

**Early Juvenile**: Barbels form on lower jaw at sizes >30 mmSL



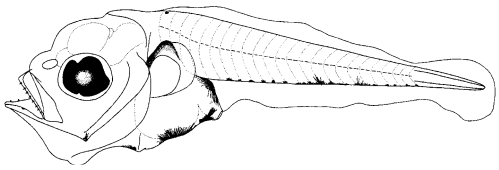
**G. 19.0 mmSL**

Eye diameter less than snout length (compare to *Leiostomus xanthurus*)

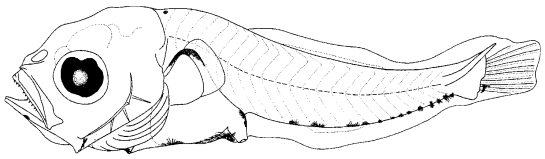
**Figures**: Adult: James Seagle (Darovec, 1983); **A–B**: Ditty, 1989; **C–E**: Peter Berrien (Lippson and Moran, 1974); **F**: Jack Javech (Ditty and Shaw, 1994b); **G**: Susan Kaiser (Able and Fahay, 1998). Also see illustrations of larvae in Welsh and Breder (1923); Hildebrand and Cable (1930); Ditty and Shaw (1994b)

**References**: Hildebrand and Cable, 1930; Powles and Stender, 1978; Morse, 1980; Fahay, 1983; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Able and Fahay, 1998; Leis and Trnski, 2004a

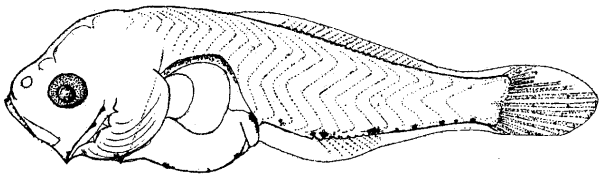
***Micropogonias undulatus***



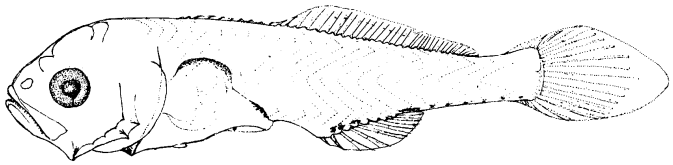
**A. 2.8 mmNL**



**B. 4.1 mmSL**

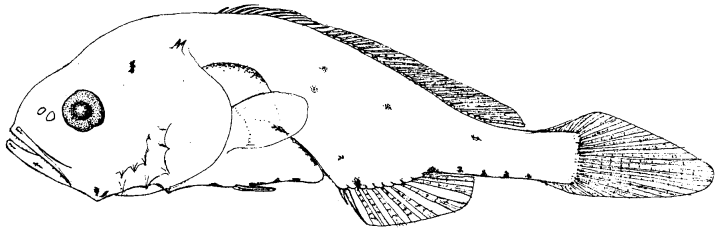


**C. 5.3 mmSL**

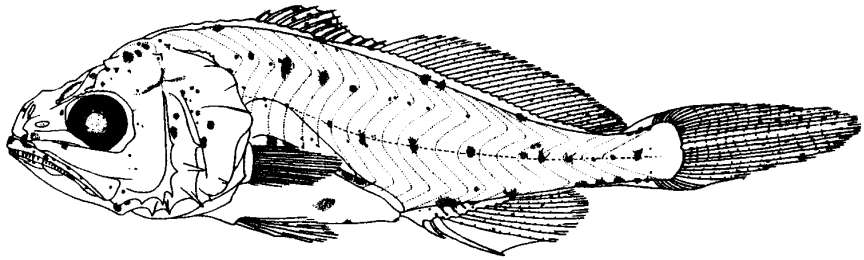


**D. 7.7 mmSL**

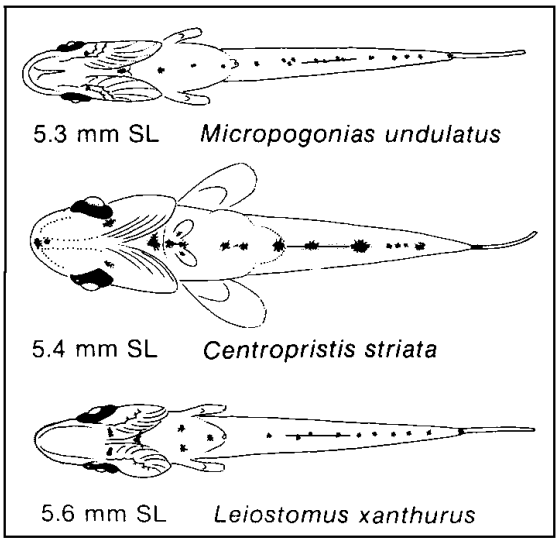
Note reduction in number of melanophores along venter of tail



**E. 12.2 mmSL**



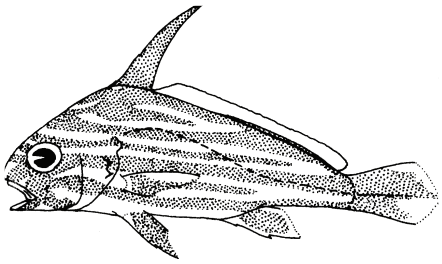
**F. 17.0 mmSL**




Fin rays in lower lobe of caudal fin longer than in rest of fin (in juveniles); caudal fin becomes squared off in adults

- Note difference in development of pectoral and pelvic fins in these 3 similar larvae (ventral views)
- Note space between anus and anal fin origin in *M. undulatus* and *L. xanthurus*; no space in *C. striata*
- Note triangular pigment pattern anterior to anus in *L. xanthurus* (compare to pattern in other 2 species)

## *Pareques acuminatus* Bloch and Schneider, 1801
## Sciaenidae
High hat

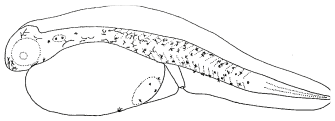


**Range**: Western North Atlantic Ocean from Chesapeake Bay to Brazil, including Gulf of Mexico and Caribbean Sea

**Habitat**: Coastal waters over sandy or muddy substrates in depths to 60 m; also over reefs or under rocky ledges

**Spawning**: Undescribed

**Eggs**: – Undescribed

**Larvae**:

Yolk-sac larva

- Body very deep anteriorly, tapering to narrow caudal peduncle
- Preanus length about 50% SL throughout development
- Body depth <40% SL in larvae; remain relatively deep-bodied through development
- Head large, deep; head length decreases from about 40% SL in larvae to about 30% SL in adults
- Mouth large, reaching mid-point of eye in larvae
- Flexion occurs at 4.3–6.3 mmSL
- Sequence of fin ray formation: C, $D_1$, $P_2$ – $D_2$, A – $P_1$ (unusual sequence for sciaenids)
- Pelvic fin rays elongate in early stages; anterior $D_1$ spines also elongate
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes a wide, dark swath of melanophores from nape, through base of pectoral to pelvic fin, also including much of opercle; a band of pigment crosses tail, dissolves to become several isolated spots on venter of caudal peduncle during flexion; pigment spreads from a few bold spots along midline of body, becoming a broad band of pigment from eye to middle caudal fin rays in juveniles; pigment heavy on $D_1$ and $P_2$ fins; note development of stripes in juveniles

**Meristic Characters**

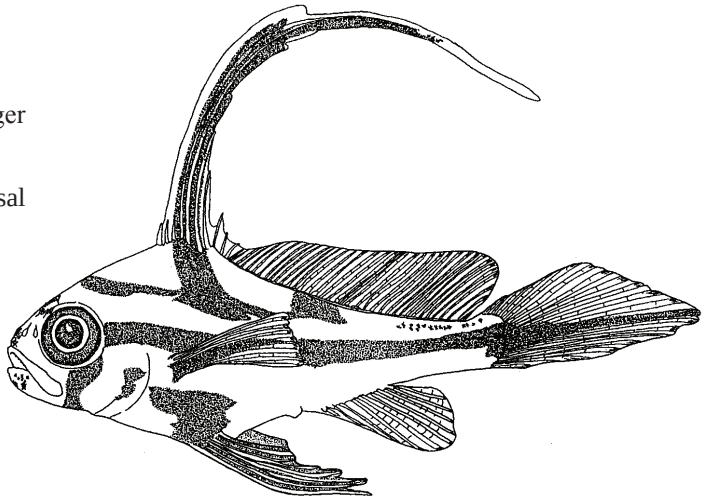
| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | VIII–X, I, 37–41 |
| Anal fin rays: | II, 7–8 |
| Pectoral fin rays: | 16–17 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 7–8+9+8+6–7 |
| Supraneurals: | 0/0/0+2/1+1/ |

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | three small spines on posterior edge appear during flexion (2 in *Pareques umbrosus*) |
| Posttemporal: | none described |
| Supraorbital: | none described |
| Opercle: | none described |

**Early Juvenile**: Fin rays of lower lobe of caudal fin longer than rest of fin

Note white leading edges of elongate dorsal spine membrane and pelvic fin spine

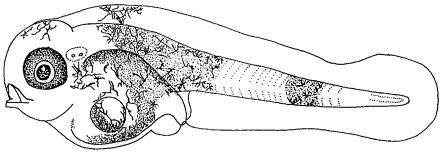


**G. 19.3 mmSL**

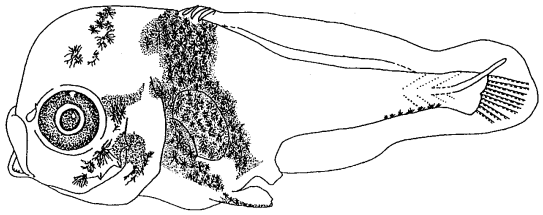
**Figures**: Adult: Chao, 2002; Yolk-sac larva, **A–B**, **D–E**, **G**: Cecilia Riley (Holt and Riley, 1999); **C**, **F**: Howard Powles (Powles and Burgess, 1978)

**References**: McPhail, 1961; Powles and Stender, 1978; Powles and Burgess, 1978; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Holt and Riley, 1999; Leis and Trnski, 2004a

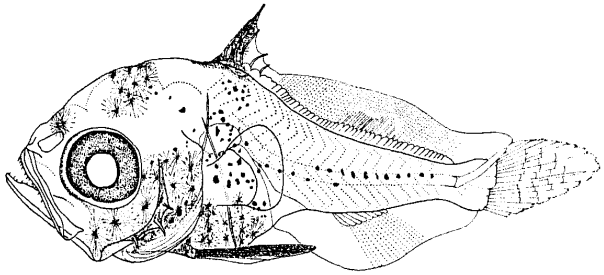
***Pareques acuminatus***



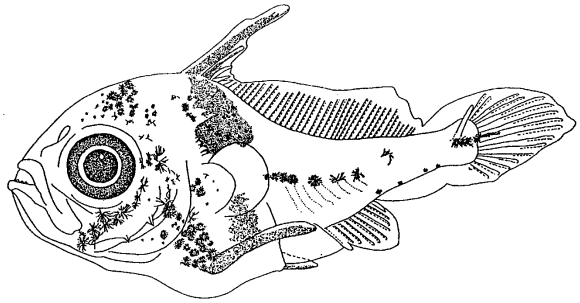
**A. 2.6 mmNL**



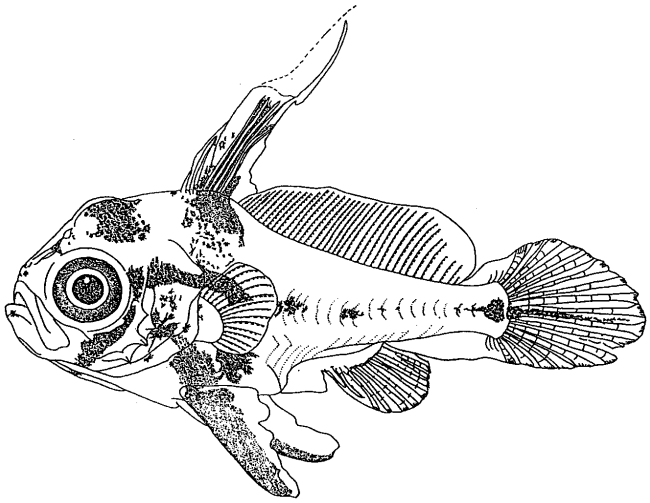
**B. 5.2 mmSL**



**C. 4.4 mmSL**

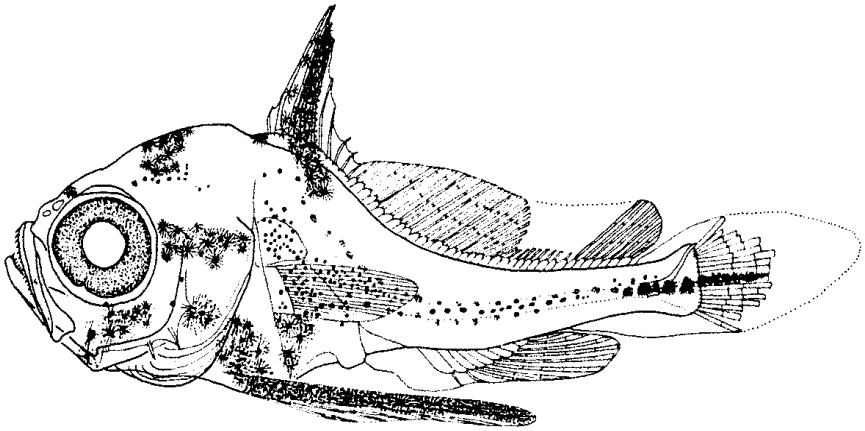


**D. 5.9 mmSL mmSL**



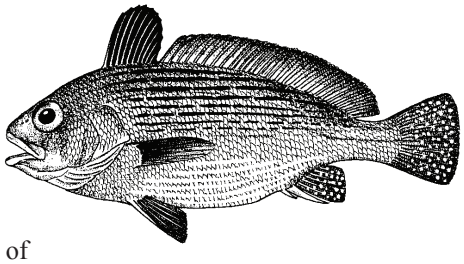
**E. 7.7 mmSL**

No barbel on lower jaw



**F. 7.6 mmSL**

## *Pareques umbrosus* (Jordan and Eigenmann, 1889)
## Sciaenidae
Cubbyu



**Range**: Western North Atlantic Ocean from Chesapeake Bay to western Gulf of Mexico

**Habitat**: Shallow, coastal waters over sand-mud substrates in maximum depth of 90 m

**Spawning**: Not well described; possibly year-round, although smallest juveniles collected during summer in Gulf of Mexico

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | IX–X, I, 38–40 |
| Anal fin rays: | II, 7 |
| Pectoral fin rays: | 15 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 7–8+9+8+7 |
| Supraneurals: | 0/0/0+2/1+1/ |

**Eggs**: – Undescribed

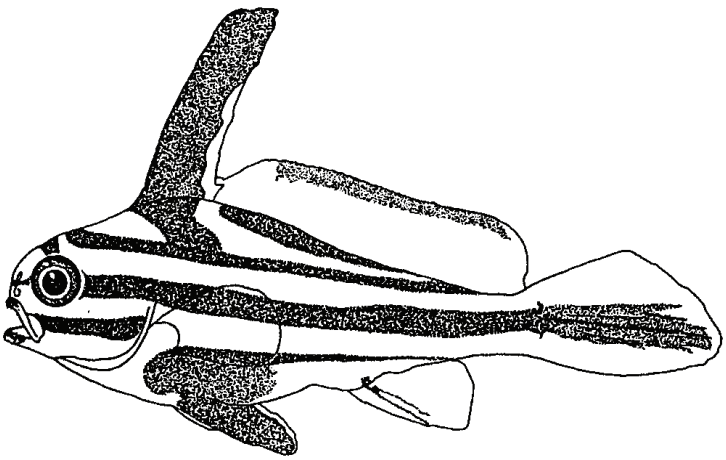
**Larvae**:
- Body very deep anteriorly, tapering to narrow caudal peduncle
- Preanus length increases from 40% SL in early larvae to <60% SL in juveniles
- Body depth about 40% SL throughout development
- Head large and deep with rounded snout
- Mouth initially fairly large, becomes inferior in juveniles; barely reaches mid-point of eye
- Flexion occurs at about 4.1–5.1 mmSL
- Sequence of fin ray formation: C, $D_1$, $P_2$ – $D_2$, A – $P_1$ (unusual sequence for sciaenids)
- Pelvic fin rays elongate in early stages; anterior $D_1$ spines also elongate
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes a wide, dark swath of melanophores from nape, through base of pectoral to pelvic fin, also including opercle; a band of pigment crosses tail, becoming an isolated spot during flexion; pigment spreads from a few bold spots along midline of body, becoming a broad band of pigment from eye to middle caudal fin rays; pigment heavy on $D_1$ and $P_2$ fins; note development of stripes in juveniles

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | two small spines appear just before flexion (3 in *P. acuminatus*) |
| Posttemporal: | none described |
| Supraorbital: | not described |
| Opercle: | none described |

**Early Juvenile**: Smaller juveniles (13.7–27.0 mmSL) go through a 3-stripe phase; adults are characterized by multiple stripes

Note white trailing edges on dorsal spines and pelvic fin and white leading edge on pelvic fin

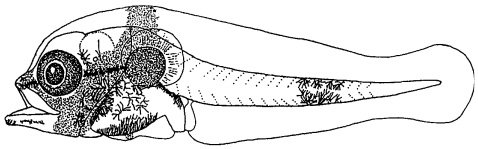


**G. 30.0 mmSL** (4-stripe phase; 27-41 mmSL)

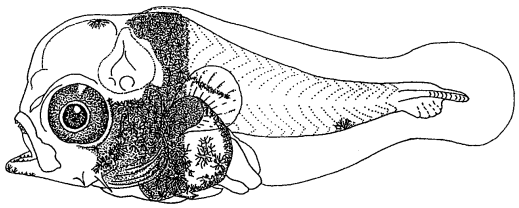
**Figures**: Adult: Chao, 2002; **A–G**: Cecilia Riley (Holt and Riley, 1999)

**References**: McPhail, 1961; Powles and Stender, 1978; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Holt and Riley, 1999; Leis and Trnski, 2004a

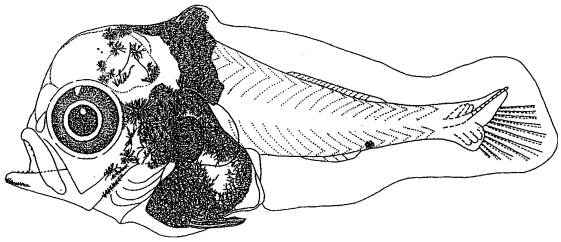
***Pareques umbrosus***



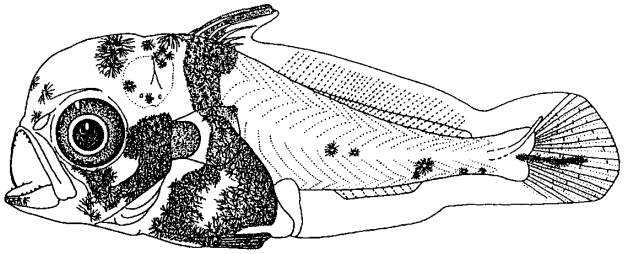
**A. 2.6 mmNL**



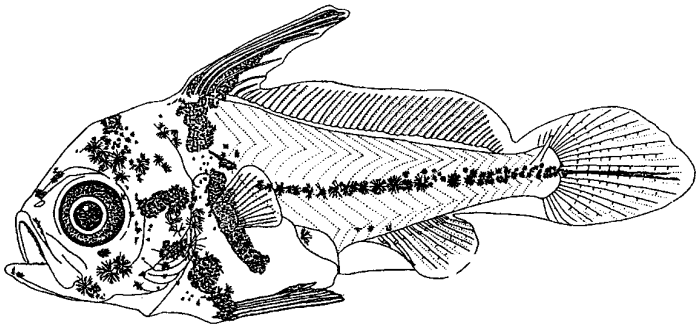
**B. 4.5 mmNL**



**C. 4.7 mmNL**



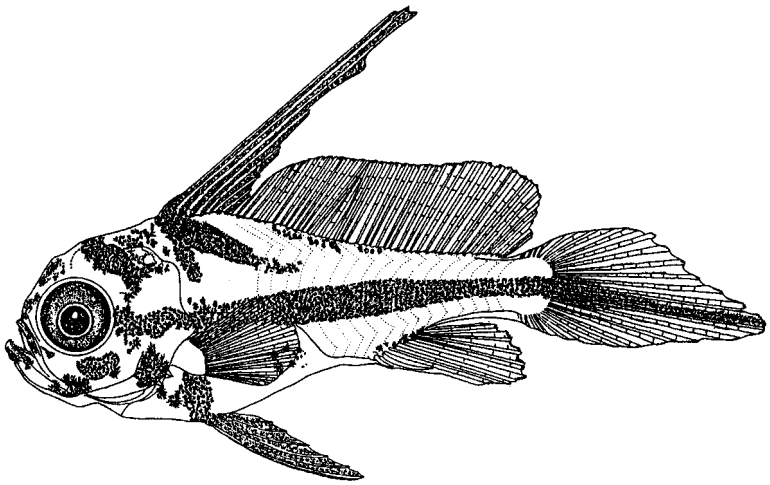
**D. 5.4 mmSL**



Fin rays in lower lobe of caudal fin longer than in rest of fin in early juveniles

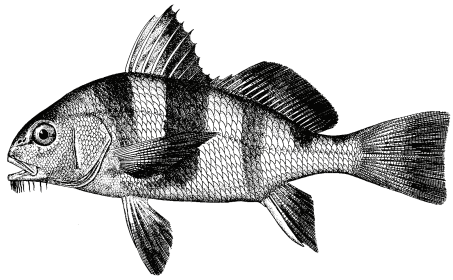
**E. 8.2 mmSL**

No barbel on lower jaw



**F. 12.2 mmSL**

## *Pogonias cromis* (Linnaeus, 1766)
## Sciaenidae
Black drum



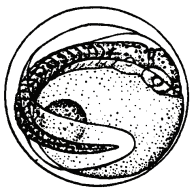
**Range**: Western Atlantic Ocean from Gulf of Maine to Argentina, including northern Gulf of Mexico, Caribbean islands; absent from northeast Brazil

**Habitat**: Coastal waters, estuaries and surf zone over sandy and sand-mud substrates; juveniles often in estuaries

**Spawning**: Spring in lower bays and coastal ocean, possible second spawning in fall

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 24 |
| Vertebrae: | 10 + 14 = 24 |
| Dorsal fin rays: | XI, 19–23 |
| Anal fin rays: | II, 5–7 |
| Pectoral fin rays: | 18 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 8–9+9+8+7 |
| Supraneurals: | 0/0/0/2 |



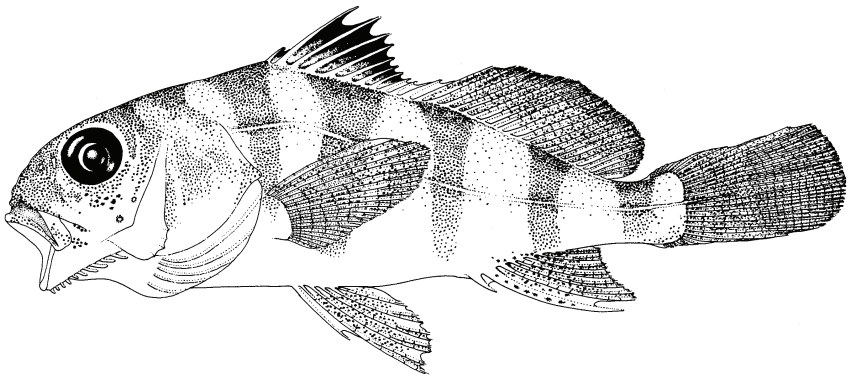
**Eggs**:
- Pelagic, spherical
- Diameter: 0.82–1.02 mm
- Oil globules: multiple initially, coalescing to single, pigmented; 0.22–0.26 mm in diameter when single

**Larvae**:
- Body moderately elongate, slightly deeper through pectoral region
- Preanus length increases from about 40% SL in early larvae to 55% SL in larger larvae
- Body depth remains <32% SL throughout development, but increases in juvenile stage
- Head moderately large and deep; head length 30–40% SL
- Mouth large, extending to mid-point of eye
- Flexion occurs at 4.0–5.0 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_1$ – $P_2$
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes early forming melanophore on dorsal edge, under site of $D_2$; lateral pigment spreads from two early accumulations, one over anus, one midway back on tail; internal pigment on notochord absent; no prominent spot at origin of $D_2$; 2–5 spots on ventral edge of tail reduce to 2 prominent spots, over mid-anal fin and at anal fin insertion; early larvae lack pigment on top of head; late larvae have scattered pigment over much of flank, becoming bars in early juveniles

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | few, small spines, most prominent before flexion |
| Posttemporal: | none described |
| Supraorbital: | not described |
| Opercle: | none described |

**Early Juvenile**: Note barred pigment pattern, dense pigment on $D_1$ membrane, and multiple mandibular barbels

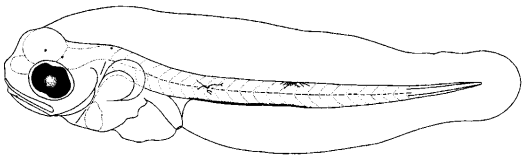


**G. 43.5 mmTL**

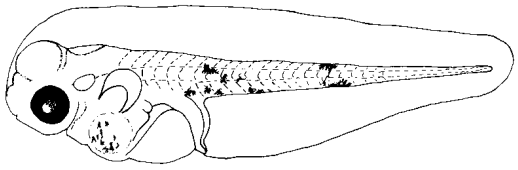
**Figures**: Adult: Klein-M$^{ac}$Phee, 2002q; Egg and **B**, **D–E**: Joseph *et al*., 1964b (redrawn); **A**, **C**: Ditty, 1989; **F**: Pearson, 1929; **G**: Nancy Arthur (Able and Fahay, 1998)

**References**: Pearson, 1929; Joseph *et al*., 1964b; Powles and Stender, 1978; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Able and Fahay, 1998; Leis and Trnski, 2004a

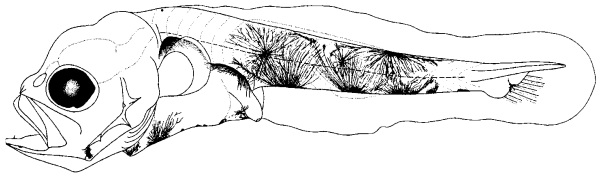
***Pogonias cromis***



**A. 2.7 mmNL**

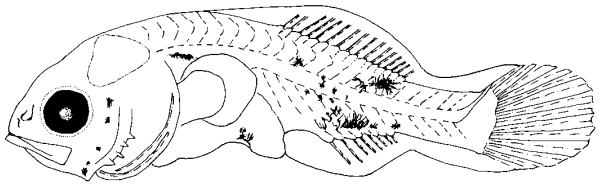


**B. 2.9 mmTL**

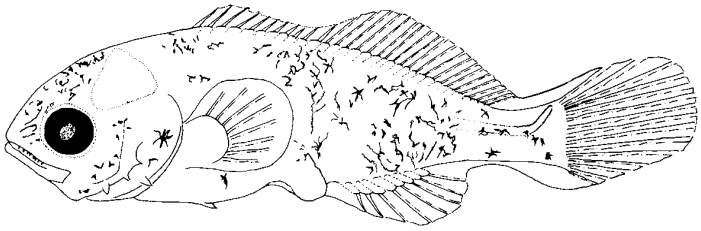


**C. 5.2 mmNL**

Ventral pigment includes prominent spot over middle of anal fin and a spot over anal fin insertion; a spot in anus-anal fin gap may occur

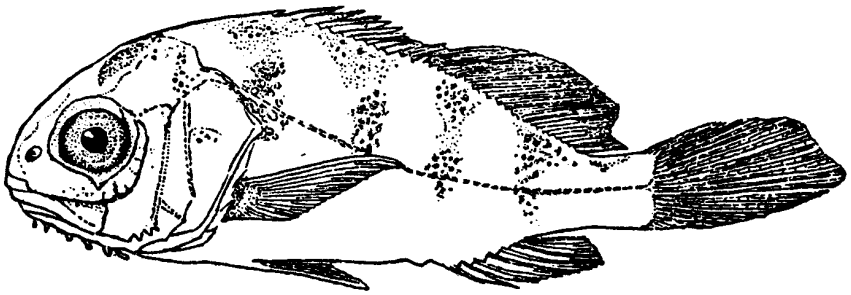


**D. 5.5 mmTL**



**E. 8.0 mmTL**

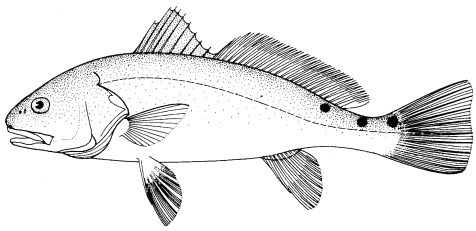
Fin rays in lower lobe of caudal fin longer than in rest of fin in early juveniles; fin is evenly rounded in later juveniles and squared off in adults



**F. 18.0 mmSL**

Multiple barbels form on lower jaw

## *Sciaenops ocellata* (Linnaeus, 1766)
## Sciaenidae
Red drum



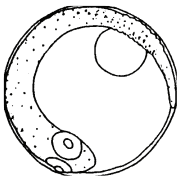
**Range**: Western North Atlantic Ocean from Long Island to western Gulf of Mexico

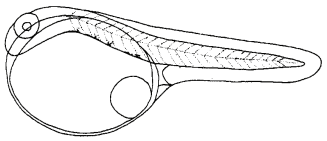
**Habitat**: Coastal waters including surf zone and estuaries over sandy and sand-mud substrates; young stages often in estuaries

**Spawning**: Fall-winter, often near mouths of bays

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | XI, 23–25 |
| Anal fin rays: | II, 7–9 |
| Pectoral fin rays: | 17 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 8–10+9+8+7–9 |
| Supraneurals: | 0/0/0+2/1+1/1/2/ |

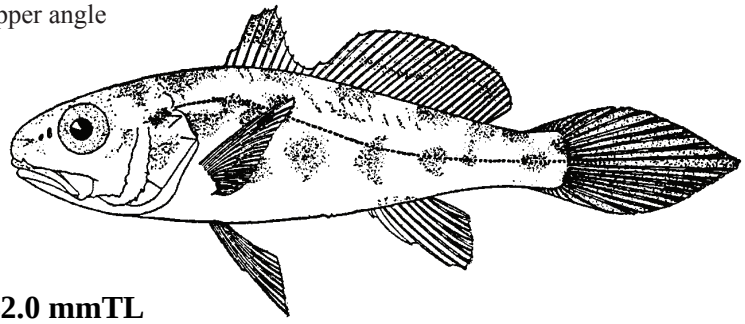
**Eggs**:

- Pelagic, spherical
- Diameter: 0.86–0.98 mm
- Chorion: smooth, transparent
- Oil globule: multiple to single; 0.22–0.36 mm when single
- Perivitelline space: narrow

**Larvae**:

Yolk-sac larva
- Body moderately elongate, slightly deeper through pectoral region
- Preanus length increases from 45% SL in early larvae to <60% SL after transformation
- Body depth remains <32% SL through development
- Head moderately deep; head length 30–35% SL through larval development
- Mouth very large, extending to posterior edge of eye in late larvae
- Flexion occurs at 3.2–5.1 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; fin rays complete at <10.0 mmSL
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes dorsal pigment in 3 locations from nape to middle of $D_2$ in early stages, spreading in later larvae; a prominent spot at origin of $D_2$; midline pigment begins early, becomes more widespread in later larvae, eventually becomes concentrated in clumps in juveniles; internal pigment present on notochord; posterior surface of gut heavily pigmented; prominent ventral spots at anus, lower edge of gut and anterior to cleithral symphysis in early larvae; ventral series of melanophores becomes reduced with development, includes a prominent spot in anus-anal fin gap until gap closes up in postflexion larvae; few spots at tip of lower jaw

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines on posterior edge and lateral ridge |
| Posttemporal: | none described |
| Supraorbital: | none described |
| Opercle: | 1 or 2 weak spines at upper angle |

**Early Juvenile**:

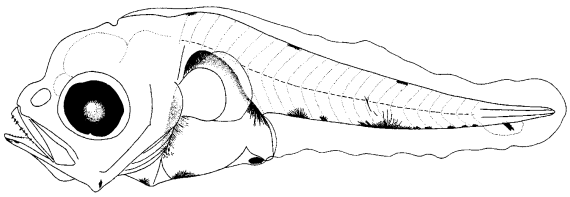


**G. 42.0 mmTL**

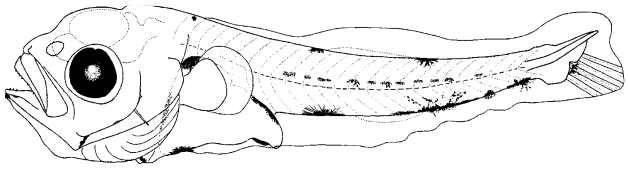
**Figures**: Adult: Chao, 2002; Egg, yolk-sac larva and **C**: Dinah Bowman (Holt *et al*., 1981); **A–B**: Ditty, 1989; **D–F**: Jack Javech (Ditty and Shaw, 1994b); **G**: Pearson, 1929

**References**: Pearson, 1929; Topp and Cole, 1968; Powles and Stender, 1978; Holt *et al*., 1981; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

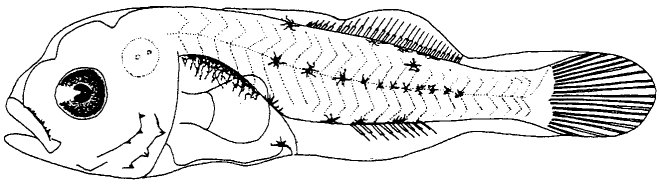
***Sciaenops ocellata***



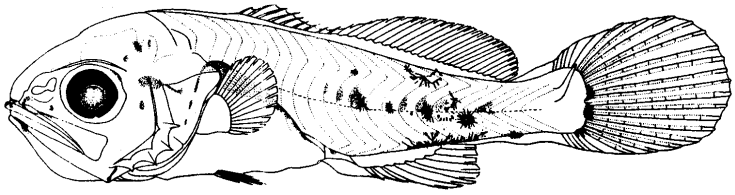
**A. 2.8 mmNL**



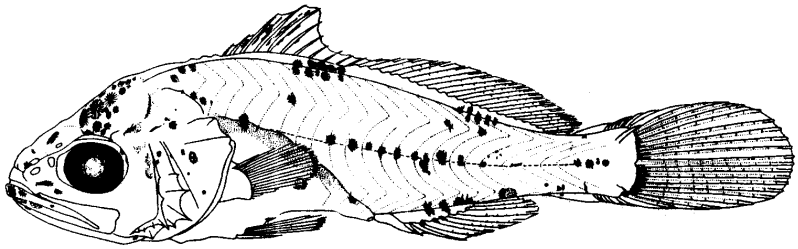
**B. 4.4 mmNL**



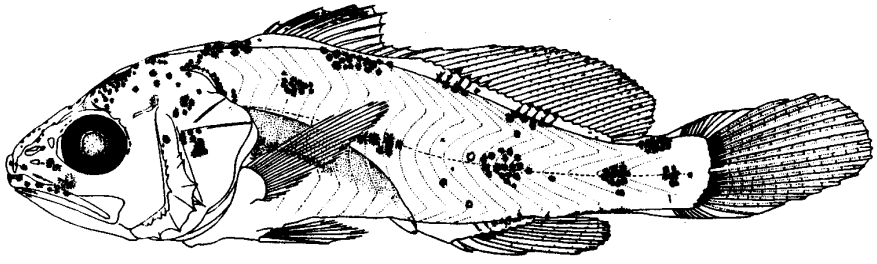
**C. 5.1 mmSL**



**D. 8.2 mmSL**

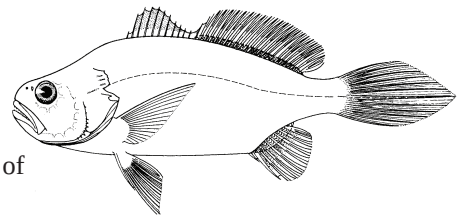


**E. 11.0 mmSL** Central caudal fin rays become elongate in juveniles, caudal fin squared off in adults



**F. 15.0 mmSL** No barbel on lower jaw

## *Stellifer lanceolatus* (Holbrook, 1855)
## Sciaenidae
Star drum



**Range**: Western North Atlantic Ocean from Chesapeake Bay to northern Gulf of Mexico; also Belize

**Habitat**: Coastal ocean and river estuaries over hard sand-mud substrates in depths <20 m

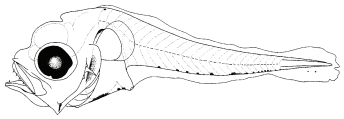
**Spawning**: Early summer in estuaries and coastal waters south of Chesapeake Bay

**Eggs**: – Undescribed

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 10 + 15 = 25 |
| Dorsal fin rays: | XI–XII, 19–21 |
| Anal fin rays: | II, 8–10 |
| Pectoral fin rays: | 18–20 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 7–9+9+8+6–9 |
| Supraneurals: | – |

**Larvae**:
- Body deep through pectoral region, then tapers to narrow caudal peduncle
- Preanus length increases from 40% SL to 55% SL
- Body depth >32% SL throughout development (increases from 34% SL to 41% SL)
- Head moderately large and deep; head length increases from about 30% SL to <40% SL
- Mouth large, extends to mid-point of eye
- Flexion occurs at 3.3–4.3 mmSL
- Sequence of fin ray formation: C – $D_2$, A – $D_1$ – $P_2$ – $P_1$; fin rays complete by 8.0 mmSL (except $P_1$ at 14.0 mm)
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation generally light; dorsal pigment includes short-lived spot in nape and under posterior end of $D_2$; internal pigment on anterior surface of gut; posterior surface of gut prominently pigmented; ventral row of melanophores reduces to isolated spots at origin and insertion of anal fin, on venter of caudal peduncle, but no pigment over anus-anal fin gap; 3 ventral spots at cleithral symphysis, under mid-gut and anterior to anus; spot at anus disappears at 5.8 mmSL; pigment forms at upper angle of opercle >7.4 mmSL; a few, light melanophores on flank after flexion

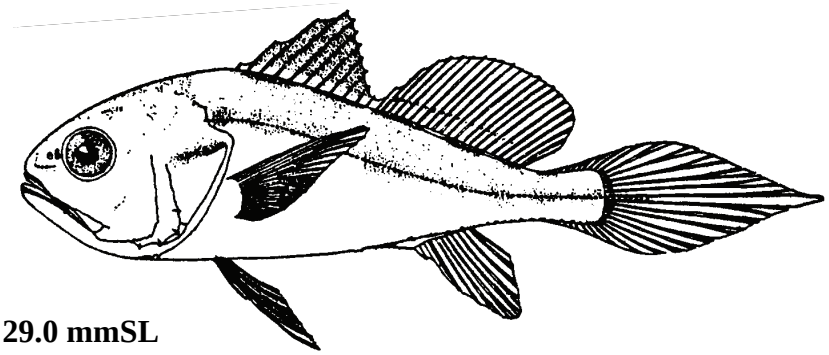


Preflexion larva, 2.5 mmNL

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines along posterior edge and lateral ridge; most prominent before flexion |
| Posttemporal: | small spine present (at least between 5.1 and 7.8 mmSL) |
| Supraorbital: | low crest with small spine |
| Interopercle: | none described |

**Early Juvenile**: Central caudal fin rays remain elongate into adult stage

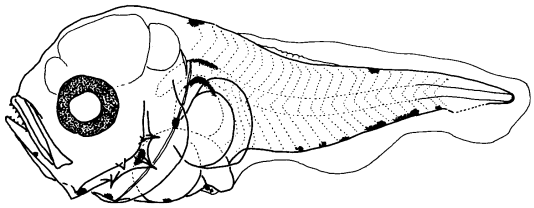


**H. 29.0 mmSL**

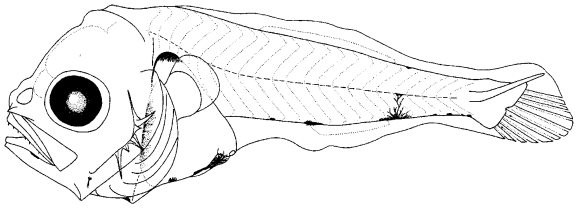
**Figures**: Adult: Chao, 2002; **A**, **C–E**: Powles, 1980; preflexion larva and **B**: Ditty, 1989; **F**: Hildebrand and Cable, 1934 (redrawn); **G**: Jack Javech (Ditty and Shaw, 1994b); **H**: Hildebrand and Cable, 1934

**References**: Powles and Stender, 1978; G.D. Johnson, 1984; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

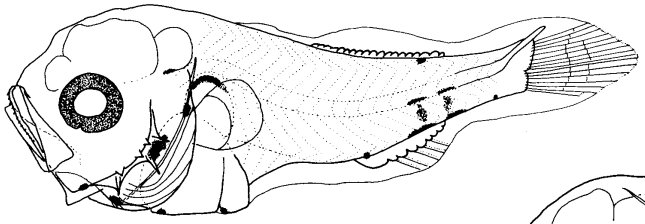
***Stellifer lanceolatus***



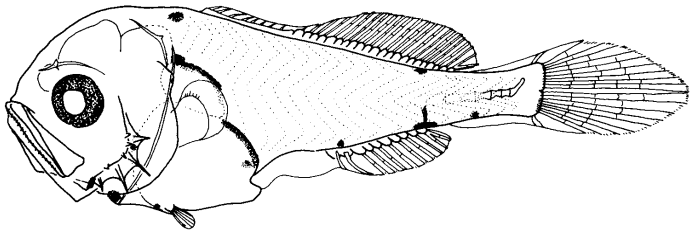
**A. 2.9 mmNL**



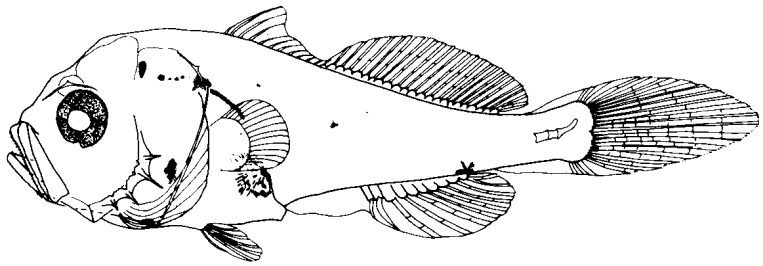
**B. 3.7 mmNL**



**C. 4.3 mmSL**

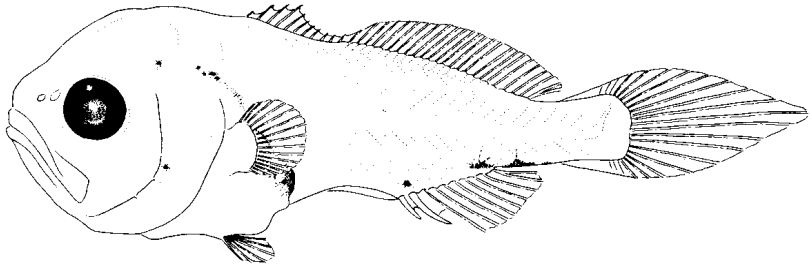


**D. 6.2 mmSL**



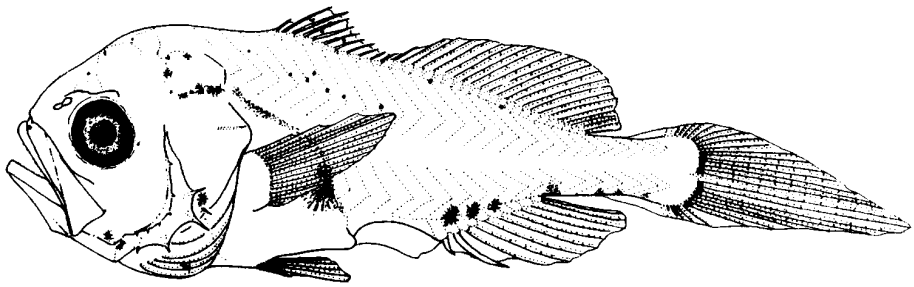
Central caudal fin rays become elongate in early stages

**E. 7.6 mmSL**



**F. 9.0 mmSL**

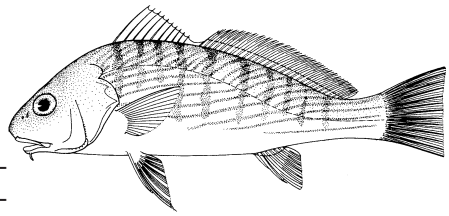
Spot posterior to anal fin in 9.0-mm larva may be an error (Powles and Stender, 1978)



No barbel on lower jaw

**G. 9.4 mmSL**

## *Umbrina coroides* Cuvier, 1830
## Sciaenidae
Sand drum



**Range**: Western North Atlantic Ocean from Chesapeake Bay to Florida, Caribbean islands and northern South America to northeast Brazil; also western Gulf of Mexico from Texas to Campeche Bay

**Habitat**: Shallow, coastal waters over sandy beaches or over mud substrates in estuaries; occasionally over coral reefs

**Spawning**: Undescribed

**Eggs**: – Undescribed

**Meristic Characters**

| | |
|---|---|
| Myomeres: | 25 |
| Vertebrae: | 11 + 14 = 25 |
| Dorsal fin rays: | IX–X, I, 26–30 |
| Anal fin rays: | II, 6 |
| Pectoral fin rays: | 16–18 |
| Pelvic fin rays: | I, 5 |
| Caudal fin rays: | 8–9+9+8+7–8 |
| Supraneurals: | – |

**Larvae**:
- Body deep through pectoral region, then tapers to moderately narrow caudal peduncle
- Preanus length about 50–55% SL
- Body depth >32% SL throughout development
- Head large, deep; head length decreases from about 40% SL to about 30% SL
- Mouth large, extending beyond mid-point of eye
- Flexion occurs at unknown size
- Sequence of fin ray formation: $C - D_2$, $A - D_1 - P_2 - P_1$
- Head spines weakly developed except for those on preopercle (see checklist below)
- Pigmentation includes isolated melanophores on nape, above and near pectoral fin base, over anterior gut and top of head; ventral series characterized by a melanophore at origin and at insertion of anal fin and on venter of caudal peduncle; few, lateral spots form pattern of blotches on flanks in late larvae and early juveniles

**Head spine checklist**:

| | |
|---|---|
| Preopercle: | small spines on posterior edge and lateral ridge |
| Posttemporal: | none described |
| Supraorbital: | not described |
| Opercle: | none described |

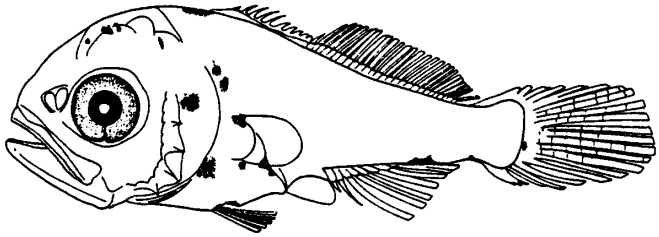
Morphological characters related to feeding ecology in juveniles of six sciaenid species (after Chao and Musick, 1977)

| Species (juveniles) | Protrusible premaxillae | Eye diameter (% SL) | Mouth Size Index | Intestine Lnth (% SL) | Caudal fin shape | Where feed |
|---|---|---|---|---|---|---|
| *Cynoscion regalis* | No | 8.2–11.5 | 1.93–3.54 | 35.5–49.6 | Central rays longest | Midwater |
| *Larimus fasciatus* | No | 7.4–9.8 | 3.17–5.90 | 73.1–97.7 | Central rays longest | Midwater |
| *Bairdiella chrysoura* | No | 8.3–10.8 | 1.76–3.08 | 46.1–64.1 | Nearly squared off | Midwater |
| *Micropogonias undulatus* | Yes | 6.5–9.5 | 1.20–2.41 | 52.3–88.6 | Central rays longest | Bottom |
| *Leiostomus xanthurus* | Yes | 7.1–11.1 | 0.77–2.64 | 73.6–97.8 | Central rays shortest | Bottom |
| *Menticirrhus saxatilis* | Yes | 6.0–8.6 | 0.50–1.37 | 56.6–88.2 | Lower lobe longest | Bottom |

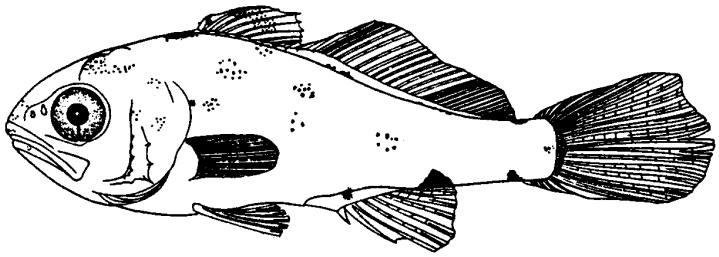
**Figures**: Adult: Chao, 2002; **A–D**: Matsuura and Nakatani, 1979

**References**: Powles and Stender, 1978; Matsuura and Nakatani, 1979; G. D. Johnson, 1984; Ditty and Shaw, 1994b; Leis and Trnski, 2004a

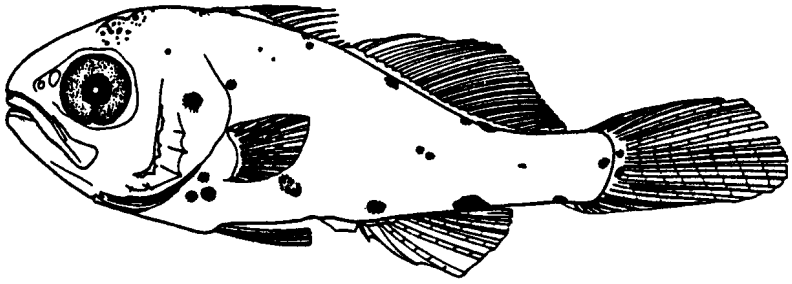
***Umbrina coroides***



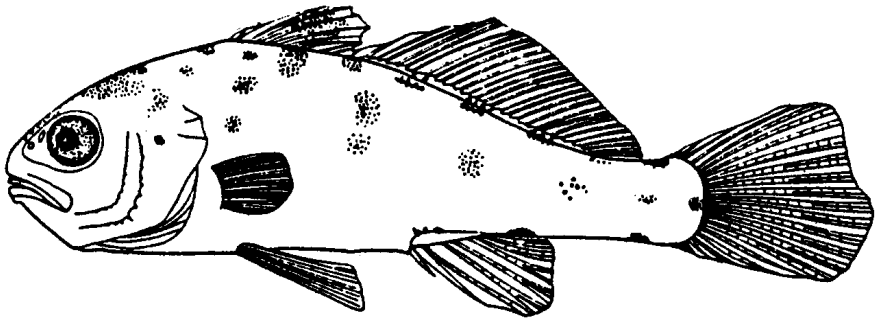
**A. 6.9 mmSL**



**B. 11.1 mmSL**



**C. 17.3 mmSL** Fin rays in lower lobe of caudal fin slightly longer than those in rest of fin



**D. 23.5 mmSL** Barbel forms on lower jaw in juveniles