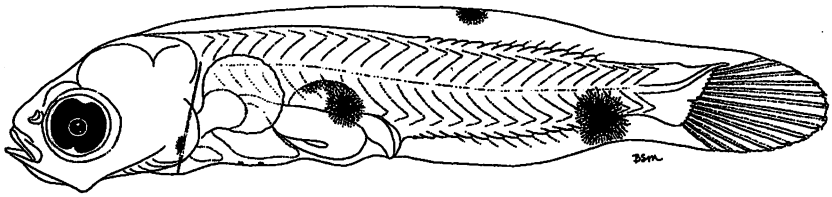


# Chapter 16

## Perciformes

## Order Perciformes

| | |
|---|---|
| Number of suborders | 18 (Percoidei, Elassomatoidei, Labroidei, Zoarcoidei, Notothenioidei, Trachinoidei, Blennioidei, Icosteoidei, Gobiesocoidei, Callionymoidei, Gobioidei, Kurtoidei, Acanthuroidei, Scombrolabracoidei, Scombroidei, Stromateoidei, Anabantoidei, Channoidei; in recent years two additional suborders have been recognized: Pholidichthyoidei, the convict blennies, were removed from Trachinoidei, and Caproidei, the boarfishes, were removed from Zeiformes; perciform classification remains unsettled and will undoubtedly change further, e.g., Nelson 2006). |
| Number of families | 160 |
| Number of genera | approx. 1539 |
| Number of species | > 10,033 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | World-wide in all seas, widely distributed in fresh and brackish water; three suborders, Elassomatoidei, Anabantoidei, and Channoidei occur exclusively in freshwater. |
| Relative abundance | Numerous abundant species; many are important in subsistence, sport, and commercial fisheries; the order includes some of the world's most highly prized sport species and most valuable commercial species. |
| Adult habitat | Benthic to epipelagic, marine taxa occur in all depth zones but are predominantly in the epipelagic zone, on continental shelves, and associated with reefs, with highest diversity in tropical and subtropical waters. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Predominantly oviparous, predominantly with planktonic eggs and larvae but many taxa with demersal eggs; some viviparous taxa. |
| Knowledge of ELH | Eggs and larvae known for numerous species, but still only a fraction of the total. |
| ELH Characters: | **Eggs:** both demersal and planktonic eggs range from spherical to spindle-shape, ca. 0.5–5.0 mm, often with 1 or more oil globule(s); planktonic eggs commonly are spherical, near 1 mm, with 1 oil globule; demersal eggs commonly are hemispherical to oval, approx. 0.5–2 mm, with > 1 oil globules, and commonly are attached to the nest or substrate via adhesive filaments.<br><br>**Larvae:** highly diverse, ranging from elongate to deep-bodied, strongly compressed to depressed, with preanal length ranging from near one-quarter to near three-quarters of body length; spines commonly are pres- |

ent on at least some bones of the head and pectoral girdle, most often the preopercle, at least; the head spines may become very large or numerous in some species, but are entirely lacking in others; fin spines and/or rays may become very elongate, and may become variously ornamented in some species; myomere counts range from approx. 20 to approx. 160; pigmentation ranges from nearly absent to nearly complete; metamorphosis occurs from as small as approx. 5 mm to > 60 mm; a "typical" perciform larva is moderately slender to moderately deep-bodied, somewhat compressed, with preanal length approx. 40–60%BL, small to moderate preopercular spines, approx. 22–40 myomeres, pigment dorsally on the head, on the dorsal margin, on the gut, and on the ventral margin of the tail, and metamorphosis in about the 10–25 mm size range.

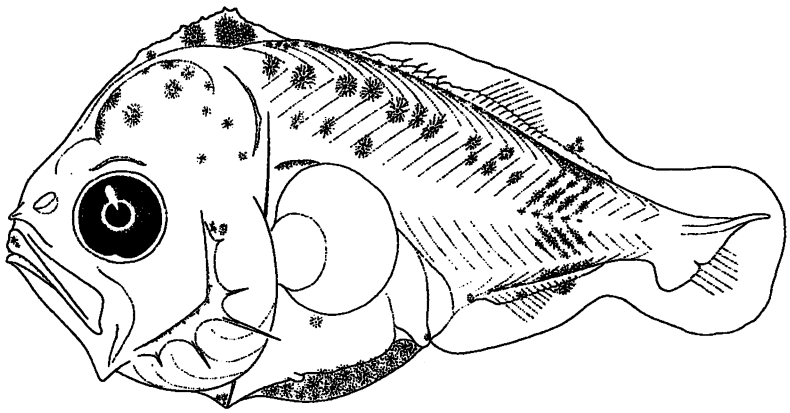
Example species:

PERCOIDEI: *Caranx sexfasciatus* (Carangidae).
LABROIDEI: *Halichoeres semicinctus* (Labridae).
ZOARCOIDEI: *Plectobranchus evides* (Stichaeidae).
NOTOTHENIOIDEI: *Bovichtus angustifrons* (Bovichtidae).
TRACHINOIDEI: *Ammodytes hexapterus* (Ammodytidae).
BLENNIOIDEI: *Hypsoblennius brevipinnis* (Blenniidae).
ICOSTEOIDEI: *Icosteus aenigmaticus* (Icosteidae).
GOBIESOCOIDEI: *Gobiesox maeandricus* (Gobiesocidae).
CALLIONYMOIDEI: *Callionymus decoratus* (Callionymidae).
GOBIOIDEI: *Ilypnus gilberti* (Gobiidae).
KURTOIDEI: *Kurtus gulliveri* (Kurtidae).
ACANTHUROIDEI: *Chaetodipterus zonatus* (Ephippidae).
SCOMBROLABRACOIDEI: *Scombrolabrax heterolepis* (Scombrolabracidae).
SCOMBROIDEI: *Sarda chiliensis* (Scombridae).
STROMATEOIDEI: *Icichthys lockingtoni* (Centrolophidae).

REFERENCES

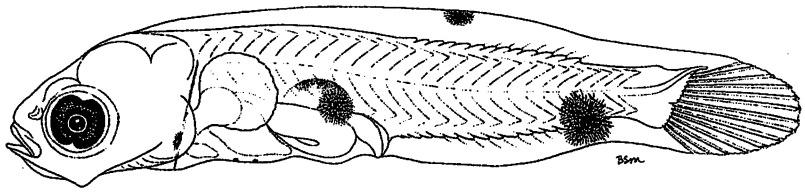
Collette et al. 1984b, de Sylva 1984, Horn 1984, Johnson, G.D. 1984, Leis and Richards 1984, Matarese et al. 1984, Richards and Leis 1984, Stevens et al. 1984a, b, Fahay 2007b, also see the references cited in the suborder sections.

Perciformes/Percoidei/Carangidae



***Caranx***
*C. sexfasciatus* 4.0 mm
(Watson et al. 1996)

Perciformes/Labroidei/Labridae

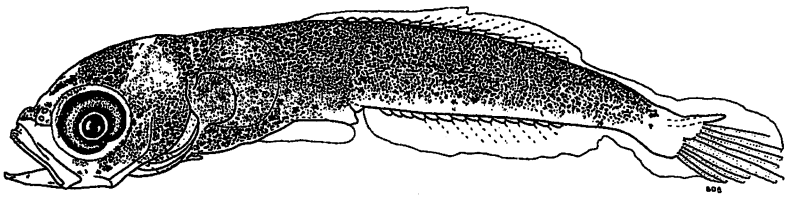


***Halichoeres***
*H. semicinctus* 5.4 mm
(Watson 1996j)

Perciformes/Zoarcoidei/Stichaeidae

***Plectobranchus***
*P. evides* 16.9 mm
(Matarese et al. 1989)

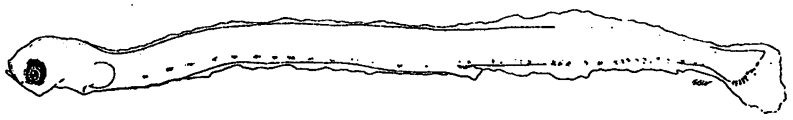
Perciformes/Notothenioidei/Bovichtidae



***Bovichtus***
*B. angustifrons*
10.2 mm
(Sutton and Bruce 1998)

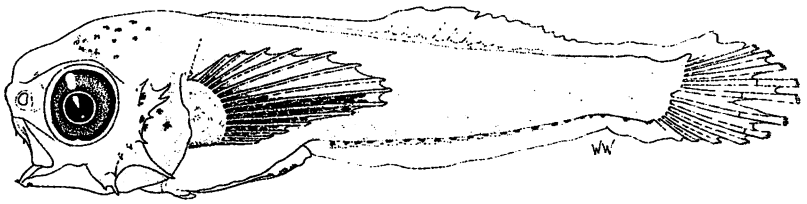
Perciformes/Trachinoidei/Ammodytidae

***Ammodytes***
*A. hexapterus* 16.0 mm
(Stevens et al. 1984a)



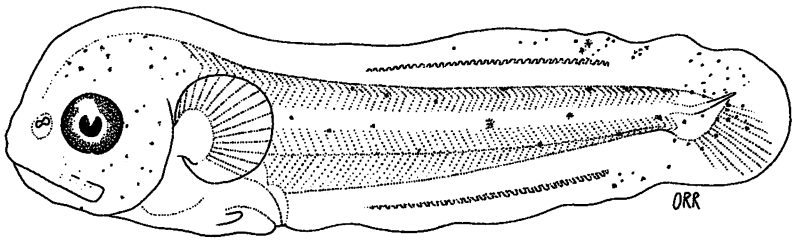
Perciformes/Blennioidei/Blenniidae

***Hypsoblennius***
*H. brevipinnis* 4.6 mm
(Watson 1996r)



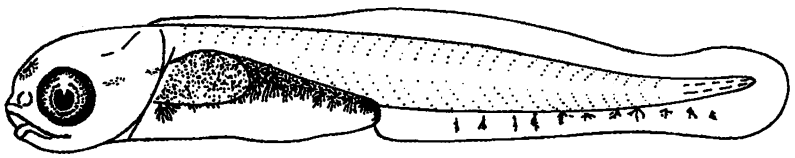

Perciformes/Icosteoidei/Icosteidae

***Icosteus***
*I. aenigmaticus* 10.2 mm
(Watson 1996s)

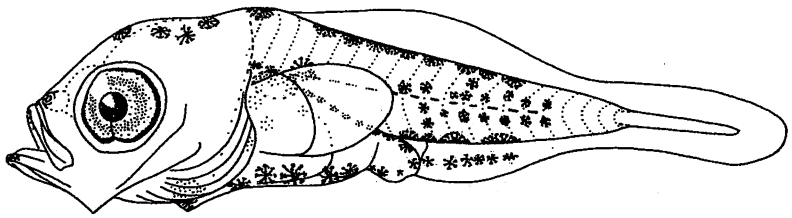



Perciformes/Gobiesocoidei/Gobiesocidae

***Gobiesox***
*G. maeandricus* 7.0 mm
(Matarese et al. 1989)

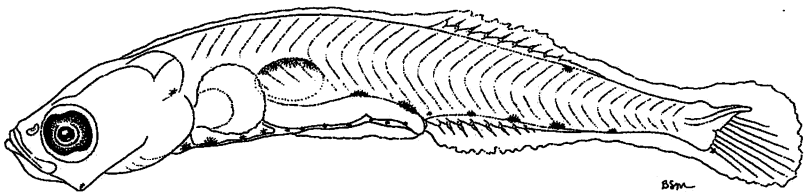


Perciformes/Callionymoidei/Callionymidae



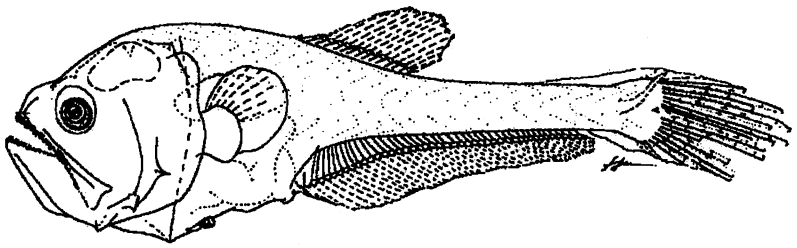
***Callionymus***
*C. decoratus* 2.5 mm
(Miller et al. 1979)

Perciformes/Gobioidei/Gobiidae



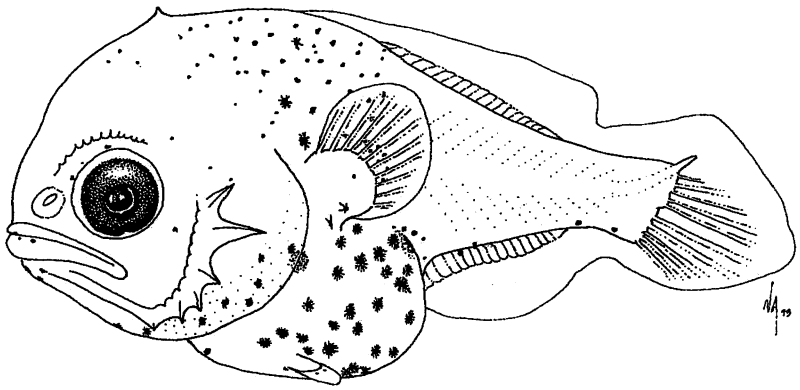
***Ilypnus***
*I. gilberti* 5.7 mm
(Watson 1996u)

Perciformes/Kurtoidei/Kurtidae



***Kurtus***
*K. gulliveri* 6.7 mm
(Berra and Neira 2003)

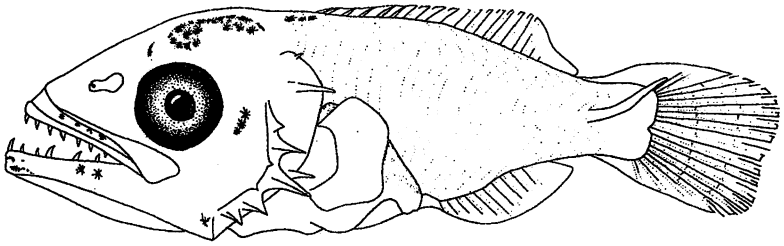
Perciformes/Acanthuroidei/Ephippidae



***Chaetodipterus***
*C. zonatus* 4.3 mm
(Ambrose 1996p)

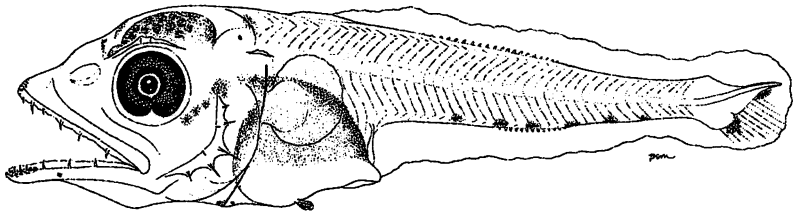
Perciformes/Scombrolabracoidei/Scombrolabracidae

***Scombrolabrax***
*S. heterolepis* 5.0 mm
(Collette et al. 1984b)



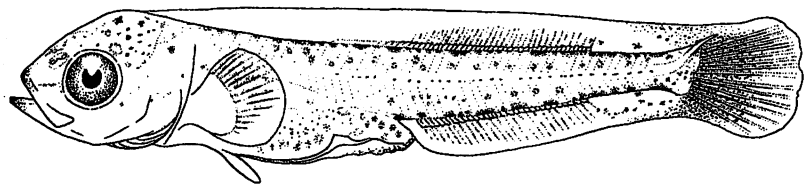
Perciformes/Scombroidei/Scombridae

***Sarda***
*S. chiliensis* 8.0 mm
(Ambrose 1996q)



Perciformes/Stromateoidei/Centrolophidae

***Icichthys***
*I. lockingtoni* 10.4 mm
(Watson 1996v)



**Order Perciformes**

| | |
|---|---|
| Suborder | Percoidei |
| Family | **Lutjanidae (Snappers, Fusiliers)** (Percoid larvae with precocious, very long fin spines and extensive larval head spination). |
| Number of genera | 21 genera (in 5 subfamilies). |
| Number of species | about 125 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Circumtropical and warm temperate, primarily marine, a few freshwater. |
| Relative abundance | Often abundant. Of considerable commercial and artisanal importance. |
| Adult habitat | Found mostly on reefs, but caesionines are semi-pelagic and etelines and apsilines are found in 100–300 m depths. Prominent medium-sized carnivores. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs known for few species, and larvae well known for many species. |
| ELH Characters | **Eggs:** planktonic, 0.7–1.0 mm. |
| | **Larvae:** head and body compressed, elongate to deep with gut coiled early in development. Preanal length 40–67%BL. 24 myomeres. Moderate to large head with extensive spination, especially preopercular spines (head spines smooth in most species). Largest head spine at angle of preopercle. Other spines on P1 girdle, including small postcleithral spine. Mouth large, horizontal to oblique. Notochord flexion at 4–5 mm. First fin elements to form (at 2–3 mm) are D spine 2 and P2 spine. These become very elongate, and vary from extremely long and terete to robust and serrate. Dsp2 may reach 96%BL in some species. Some rays of P2 as long or longer than P2 spine. Full ray complements attained by 8 mm in all but P1 (to 14 mm). Scales begin to form at 6 to > 25 mm, depending on species. Pigment initially limited to gut and ventral melanophore series on tail, later on head, fins and portions of dorsal midline. Larvae settle at 10 to 40 mm, depending on species. |
| Example species: | *Lutjanus malabaricus* (Lutjaninae), *Paracaesio* sp (Apsilinae). |
| Meristics (family): | D: IX–XV, 8–22, A: III, 7–13, P1: 15–24, P2: I,5, V: 10+14=24, C: 9+8. |
| REFERENCES | Allen 1985, Carpenter 1988, Kojima and Mori 1988, Leis and Bray 1995, |

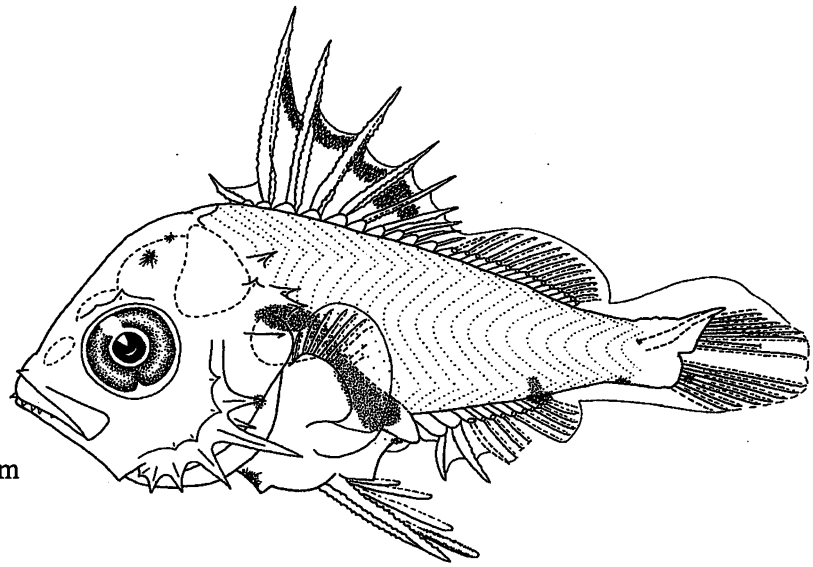


*Lutjan*

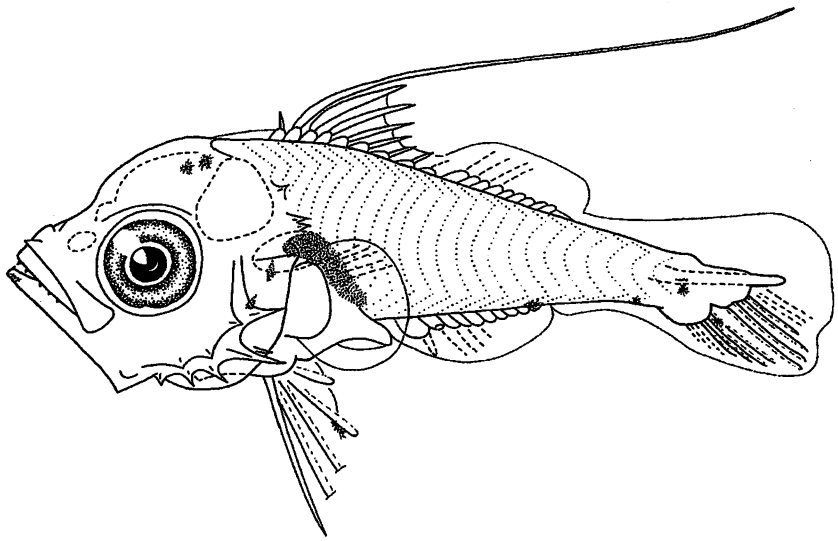
*Paraca*

Leis and Lee 1994, Leis and Rennis 2000f, Leis et al.1998, Reader and Leis 1996, Richards et al.1994, Watson and Brogan 1996.

Perciformes/Percoidei/Lutjanidae
from: Leis and Rennis 2000f



*Lutjanus malabaricus* 5.4 mm



*Paracaesio* sp. 4.5 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Percoidei |
| Family | **Girellidae (Nibblers)** (Percoid larvae with minimal head spination) nb: Nelson (1994) considers Girellidae a Kyphosidae subfamily. |
| Number of genera | 2 (*Girella* and *Graus*) |
| Number of species | about 17 |

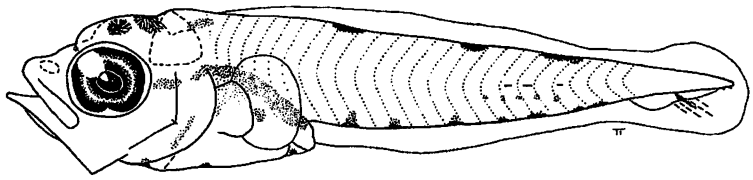
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Pacific and E. Indian oceans, marine temperate to subtropical. |
| Relative abundance | Locally abundant. Of minor commercial and artisanal importance. |
| Adult habitat | Mostly on shallow reefs, kelp forests and sea grass meadows in estuaries and bays. Medium-sized, mostly herbivores. |

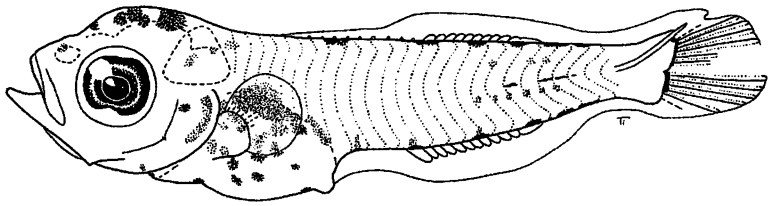
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae known for some *Girella* spp. *Graus* is being described by F. J. Neira. |
| ELH Characters | **Eggs:** planktonic, ca. 1.0 mm.<br><br>**Larvae:** head and body compressed, elongate to moderate in depth, with gut coiled very early in development: compact and rounded thereafter. Preanal length 30–50% BL. Large gap between anus and origin of anal fin that closes following flexion. 27 (*Girella*) or 34 (*Graus*) myomeres. Moderate size, rounded head with limited spination: a few, very small preopercular spines, weak opercular spine and very small supracleithral spines. Mouth moderate in size, horizontal to oblique. Notochord flexion at 4–8 mm. Fins begin to form during flexion. Soft rays form first, and no elongate elements. Fin spines remain weak and smooth. Full fin complements attained by about 8–10 mm. Scales begin to form at settlement at 12–25 mm, depending on species. Pigment initially on gut, top of head, and dorsal, ventral and lateral midlines of trunk and tail. Pigment spreads markedly from about 10 mm. |
| Example species: | *Girella tricuspidata.* |
| Meristics: | D: XIV–XVI, 11–13, A: III, 11–12, P1: 16, P2: I,5, V: 11+16=27, C: 9+8. |
| REFERENCES | Konishi 1988, Johnson and Fritzsche 1989, Miskiewicz and Trnski 1998, Watson 1996h. |

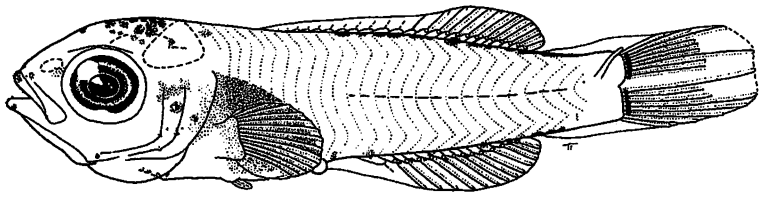
Perciformes/Percoidei/Girellidae
*Girella tricuspidata*
from: Miskiewicz and Trnski 1998



4.1 mm



5.0 mm



6.9 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Labroidei |
| Family | **Labridae (Wrasses)** (many authors include Scaridae and Odacidae in this family). |
| Number of genera | 68 |
| Number of species | 485 (2nd largest family of marine fishes – after gobiids). |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, tropical to temperate. |
| Relative abundance | Very abundant. Of some commercial and artisanal importance. |
| Adult habitat | Mostly on reefs, kelp forests and sea grass meadows in shallow water, but some on deep reefs or on sandy habitat. Small to large carnivores. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae known for many species, but this constitutes a small proportion of this very speciose family. |
| ELH Characters | **Eggs:** planktonic, ca. 0.7–1.0 mm, except demersal in some species of N. Atlantic temperate subfamily Labrinae. |

**Larvae:** diverse larval morphology. Head and body moderately to strongly compressed, elongate to moderate in depth, with a deep caudal peduncle. Gut initially straight, but coils at mid preflexion to late postflexion stage. Preanal length 50–80 %BL prior to gut coiling, and 37–74 %BL thereafter. 23–28 myomeres in tropical species, up to 40 in temperate species. Head small to moderate and rounded to pointed, usually with no spination: a very few species have very small preopercular spines. Mouth small to moderate, horizontal to moderately oblique. Some species with narrow eyes. Notochord flexion at 3–6 mm. In most species, fins begin to form during flexion or shortly thereafter, but in a few species dorsal fin anterior spines form before flexion, and become especially elongate. Otherwise, soft rays form first, and no fin elements are particularly elongate. Fin spines weak and smooth. Full fin complements attained by 6–7 mm in most species. P2 fins often form later, or even following settlement. In most species, scales begin to form after settlement. Pigment limited in vast majority of tropical species, usually confined to a few melanophores on fins, and often entirely lacking. Temperate species more heavily pigmented, and may have extensive pigment over most of body. Settlement usually at 8–12 mm, but some species remain pelagic to twice that size.

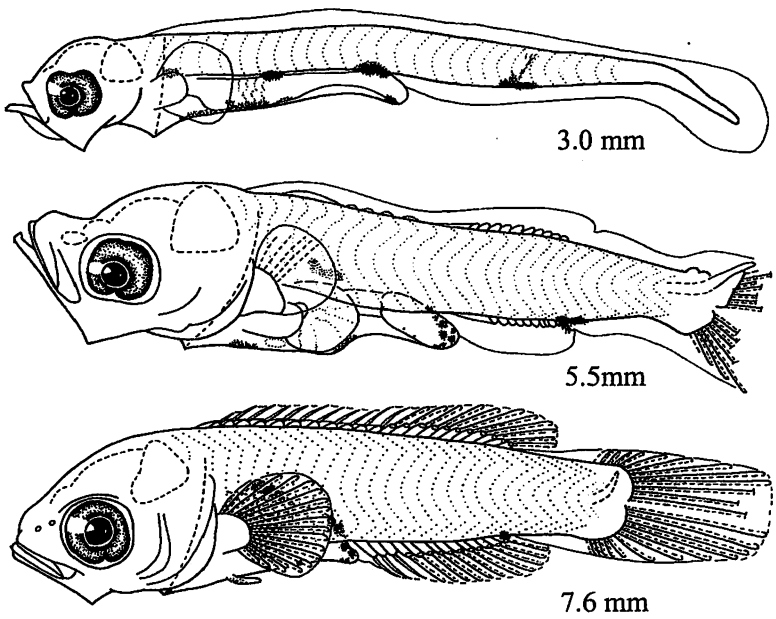
Example species: *Achoerodus viridis*; Julidin labrid; *Xyrichthys* sp.

Meristics (*A. viridis*): D: XI,10–11, A: III,10–11, P1: 16–18, P2: I,5, V: 11–17=28, C: 9–10, 6+6, 8–10.

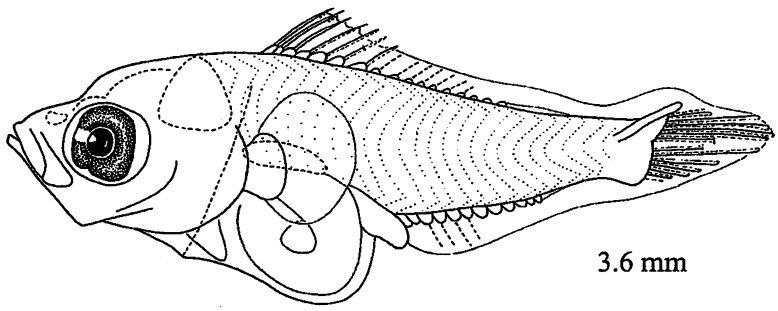
REFERENCES Fahay 1983, Richards and Leis 1984, Kojima 1988a, Watson 1996j, Leis and Rennis 2000g, Parenti and Randall. 2000, Westneat 2001, Leis and Hay 2004.

Perciformes/Labroidei/Labridae

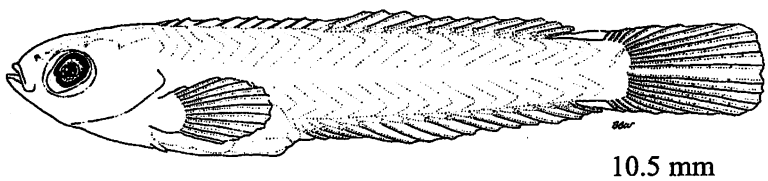
*Achoerodus viridis*
(Leis and Hay 2004)




*Julidin labrid*
(Leis and Rennis 2000g)




*Xyrichthys* sp.
(Richards and Leis 2000g)



**Order Perciformes**

| | |
|---|---|
| Suborder | Labroidei |
| Family | **Pomacentridae (Damselfishes)** Nb: there is some doubt that this family belongs in the Labroidei (see Watson 1996i). |
| Number of genera | 28 |
| Number of species | about 350 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, primarily tropical. |
| Relative abundance | Very abundant. Of very limited artisanal importance, but important in the aquarium trade. |
| Adult habitat | Mostly on shallow reefs. Small carnivores and herbivores. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs or larvae known for about 15% of species in the family. |
| ELH Characters | **Eggs:** demersal and oblong, ca. 0.7–4.0 by 0.4–1.2 mm. |

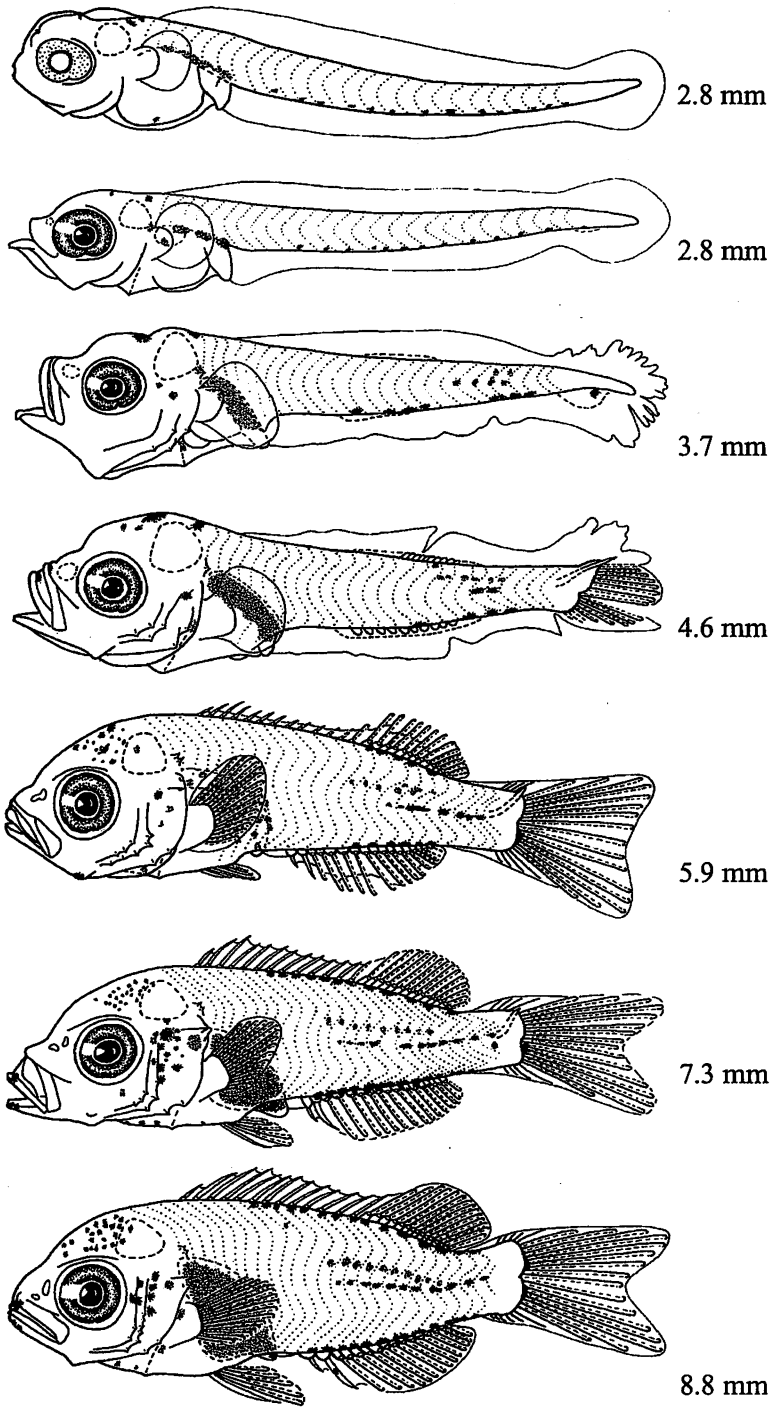
**Larvae:** this speciose family has less diverse larval morphology than Labridae. Head and body compressed, elongate to deep, gut coiled, compact. Preanal length 30–68% BL. 26–27 myomeres. Gap between anus and anal fin small to absent. Head small to large: short snout becomes relatively larger following flexion. Mouth moderate in size, horizontal to slightly oblique. Head spination weak in most species: small spines form prior to flexion on preopercle, opercle, interopercle and supracleithrum. Some species of *Chromis* have more extensive head spination (Kavanagh et al. 2000). Notochord flexion at 2.5–4.4 mm. In most species, fins begin to form during or shortly after flexion, but in a few species P2 fin and anterior D spines are first to form (prior to flexion). Otherwise, soft rays form first, and no fin elements very elongate. Fin spines weak and smooth. Full fin complements attained by 4–7 mm. Scales form prior to settlement, as early as 3 mm in some species. Pigment present over the brain, over the gut and on ventral and often lateral midlines of tail. Some species become more heavily pigmented abruptly during flexion. Settlement at 8–20 mm.

| | |
|---|---|
| Example species: | *Pomacentrus amboinensis.* |
| Meristics: | D: XIII, 14–15, A: 14–16, P1: 16–18, P2: I, 5, V: 11+15=26, C: 9+7. |

REFERENCES

Allen 1991, Kavanagh et al. 2000, Kinoshita 1988, Murphy et al. 2007, Richards and Leis 1984, Watson 1996i.

Perciformes/Labroidei/Pomacentridae
*Pomacentrus amboinensis*
from: Murphy et al. 2007



Chapter 16

## Order Perciformes

| | |
|---|---|
| Suborders | Zoarcoidei (Northern Blennioids) |
| Number of Families | 9 (Bathymasteridae, Zoarcidae, Stichaeidae, Cryptacanthodidae, Pholididae, Anarhichadidae, Ptilichthyidae, Zaproridae, Scytalinidae). |
| Number of genera | 98 |
| Number of species | 318 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Worldwide, but found primarily in colder marine waters of the Northern Hemisphere; most in N. Pacific with some in the N. Atlantic. |
| Relative abundance | Some families contain species that can be abundant locally (e.g., Bathymasteridae and Stichaeidae) or at various depths (Zoarcidae), while other families are quite rare (e.g., Scytalinidae and Ptilichthyidae). None of commercial value. |
| Adult habitat | Generally, little is known of adult habits. Most are found from intertidal areas to the deepest waters. Zoarcids occur from the intertidal zone to depths of almost 2,000 m. Pholids inhabit areas from tidepools to depths of 75 m. Bathymasterids, stichaeids, and most zoarcids are bottom-dwelling, occupying a variety of habitats from subtidal to shelf floors. Anarhichadids and zaprorids inhabit shallow to moderately deep waters. Several taxa bury in the sand/mud: cryptacanthodids, scytalinids, and ptilichthyids. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous; demersal eggs, paired spawning, nest guarding and parental care. *Zoarces* spp. (3) are ovoviviparous; other zoarcids are oviparous, some showing parental care. Pholids and anarhichadids are noted for paired spawning and subsequent guarding; one or both partners may guard eggs during incubation by coiling around them. |
| Knowledge of ELH | Eggs and larvae known for many (except zoarcids and *Scytalina cerdale*). |
| ELH Characters: | **Eggs:** demersal, often deposited in adhesive masses. Can be large (up to 9.0 mm bathymasterids 0.9–1.1 mm, pholids 1.4–3.0 mm, and zoarcids 1.7–9.0 mm) typically with an oil globule. Long incubation periods (14–20 days). Zoarcid eggs are adhesive, spherical, and have one oil globule.<br><br>**Larvae**: generally elongate and slender with long dorsal and anal-fin bases. Several taxa are highly pigmented (*Cryptacanthodes* spp. and |

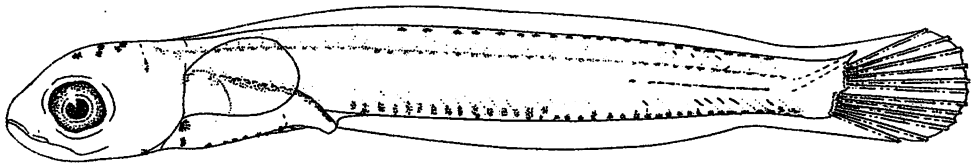
*Zaprora silenus*) while most others are identified by subtle differences in postanal pigment patterns. Bathymasterids are most commonly confused with stichaeids, but can be separated by myomere counts. Newly-hatched zoarcid larvae have large yolk sacs, but are otherwise quite advanced and strongly resemble adult zoarcids; they probably become demersal or semi-demersal soon after hatching because they are virtually never collected in plankton nets. Larvae of only five zoarcid taxa have been illustrated.

Example species: *Ronquilus jordani* (Bathymasteridae), *Lumpenus sagitta* (Stichaeidae), *Cryptacanthodes aleutensis* (Cryptacanthodidae), *Zaprora silenus* (Zaproridae).

REFERENCES

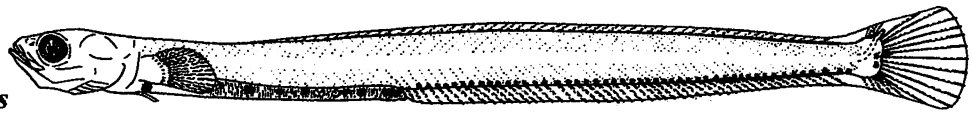
Anderson, M.E. 1984, Barsukov 1986, Breder and Rosen 1966, Fahay 1983, 2007b, Fitch and Lavenberg 1975, Haryu and Nishiyama 1981, Kendall et al. 1983, Matarese et al. 1989, Mecklenburg et al. 2002, Mecklenburg and Sheiko 2004, Nelson 1994, Pavlov 1986, Shiogaki 1982, Sokolovskii and Sokolavskaya 1996, Watson 1996k–o.

Perciformes/Zoarcoidei/Bathymasteridae



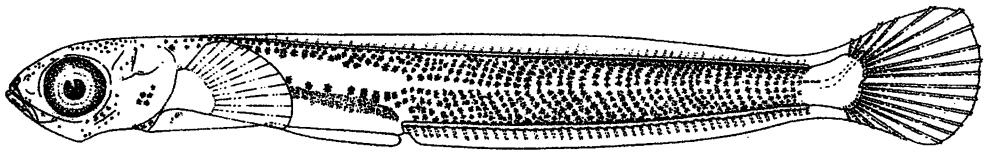
***Ronquilus***
*R. jordani* 10.4 mm
(Matarese et al. 1989)

Perciformes/Zoarcoidei/Stichaeidae



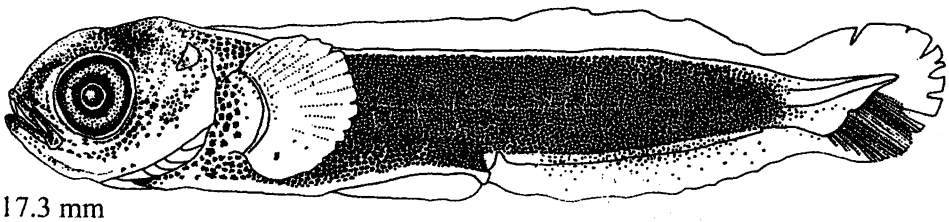
***Lumpenus***
*L. sagitta* 35.1 mm
(Matarese et al. 1989)

Perciformes/Zoarcoidei/Cryptacanthodidae



***Cryptacanthodes***
*C. aleutensis* 16.0 mm
(Matarese et al. 1989)

Perciformes/Zoarcoidei/Zaproridae



***Zaprora***
*Z. silenus* 17.3 mm
(Haryu and Nishiyama 1981)

**Order Perciformes**

| | |
|---|---|
| Suborder | Zoarcoidei |
| Family | **Stichaeidae (Pricklebacks)** |
| Number of genera | 36 |
| Number of species | 65 |

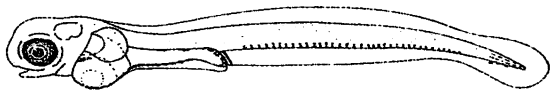
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Primarily N. Pacific demersal fishes, temperate to boreal with some extending into the Arctic and N. Atlantic. |
| Relative abundance | Some can be abundant locally while others are quite rare or inadequately sampled (e.g., *Chirolophis tarsodes, Allolumpenus hypochromis*). |
| Adult habitat | Bottom-dwelling, occupying a variety of habitats from intertidal and subtidal to depths of 250 m on the outer shelf floor. |

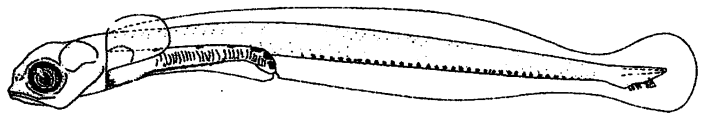
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae are poorly known. |
| ELH Characters: | **Eggs:** demersal, spherical, about 1.5–2.5 mm in diameter, with one or more oil globules. Form adhesive masses that are cared for by one or both parents.<br><br>**Larvae:** generally elongate and slender with long dorsal and anal-fin bases. Short preanal length. Several taxa are moderately pigmented (*Stichaeus punctatus, Bryozoichthys* spp., *Plectobranchus evides*), while most others are identified by subtle differences in postanal pigment patterns. Most commonly confused with pholids and bathymasterids, but can be separated by myomere counts. |
| Example species: | *Anoplarchus purpurescens.* |
| Meristics: | D: LIV–LX, A: I, 35–41, P1: 9–10, P2: (absent), V: 17–19+40–46=58–64, C: 1–4, 6–7+6–7, 1–3. |
| REFERENCES | Anderson, M.E. 1984, Breder and Rosen 1966, Faber 1976, Fahay 1983, 2007b, Fitch and Lavenberg 1975, Haryu and Nishiyama 1981, Matarese et al. 1989, Matarese et al. unpubl., Nelson 1994, Watson 1996m. |

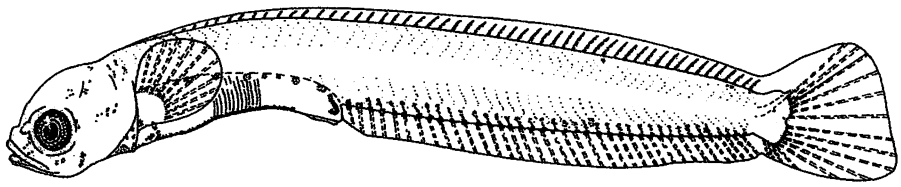
Perciformes/Zoarcoidei/Stichaeidae
*Anoplarchus purpurescens*
from: Matarese et al. 1989



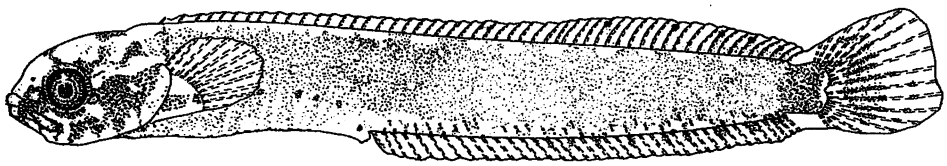
6.1 mm



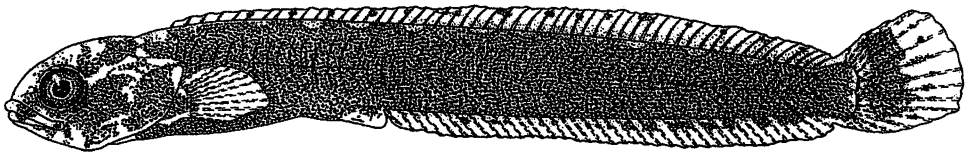
9.0 mm



12.0 mm



12.0 mm



12.0 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Notothenioidei |
| Families | 5 (Bovichtidae, Nototheniidae, Harpagiferidae, Bathydraconidae, Channichthyidae; some authors differ in the composition of the Nototheniidae and status of subfamilies and families within the suborder, with 8 families currently recognized, e.g., Anderson, N.C. 1984, Dewitt et al. 1990, Eakin 1990, Balushkin 2000, Nelson 2006). |
| Number of genera | approx. 47 |
| Number of species | approx. 125 |

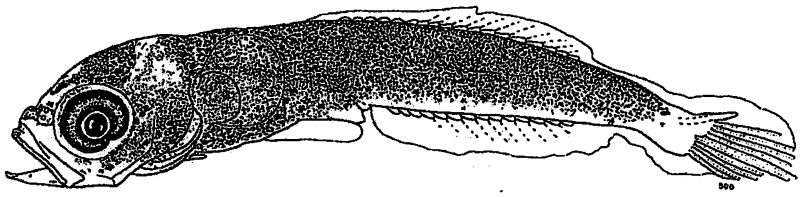
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Mostly marine, southern ocean, primarily Antarctic, some estuarine and freshwater species. |
| Relative abundance | Relatively abundant, some commercially important. |
| Adult habitat | Most are benthic and benthopelagic, primarily on shelf but some range to ≥ 800 m depth, some pelagic to ca. 2,600 m. |

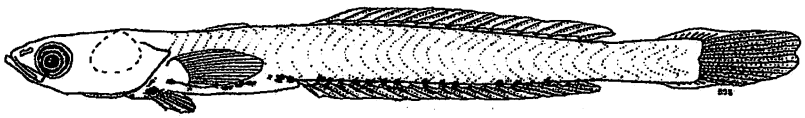
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous, with planktonic or demersal eggs, planktonic larvae. |
| Knowledge of ELH | Eggs known for all families except Bovichtidae, larvae known for all families (22 genera). |
| ELH characters: | **Eggs:** spherical, ca. 0.8–5 mm diameter; demersal, sticky, adhering to one another and to substrate; no oil globule.<br><br>**Larvae:** hatch at ca. 6–14 mm with pigmented eyes, open mouth, large yolk sac; notochord flexion at ca. 9–40 mm, settlement at ca. 18– > 60 mm; elongate, compressed, slender, becoming deep-bodied in some genera; gut straight or coiled, ca. 30–70% BL, commonly ≤ 50% BL; head moderate with bluntly acute to long, pointed snout, small to large mouth, moderate to large eyes; head spines lacking except in some Bovichtidae, Bathydraconidae and Channichthyidae; myomeres ca. 34–65, commonly 40's–50's; pigmentation commonly moderate to heavy, primarily on head, gut, dorsal and/or ventral margins, often laterally and on P1, P2. |
| REFERENCES | Efremenko 1983, Evseenko et al. 1995, Koubbi et al. 1990, Stevens et al. 1984b, Sutton and Bruce 1998, Voskoboinikova 1998, Voskoboinikova and Bruce 2001, Voskoboinikova and Skura 1996. |

Perciformes/Notothenioidei/Bovichtidae

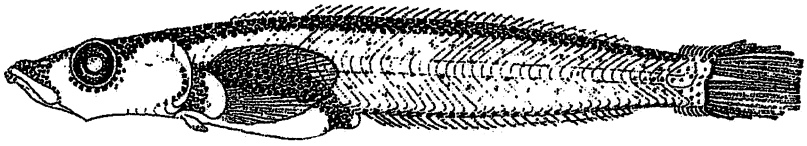


***Bovichtus***
*B. angustifrons*
10.2 mm
(Sutton and Bruce 1998)

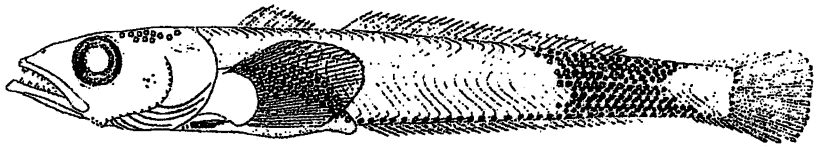


***Pseudaphritis***
*P. urvillii* 15.9 mm
(Sutton and Bruce 1998)
[Currently considered a separate family, Pseudapritidae]

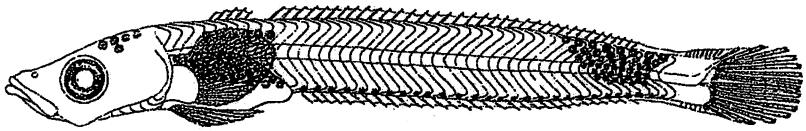
Perciformes/Notothenioidei/Nototheniidae



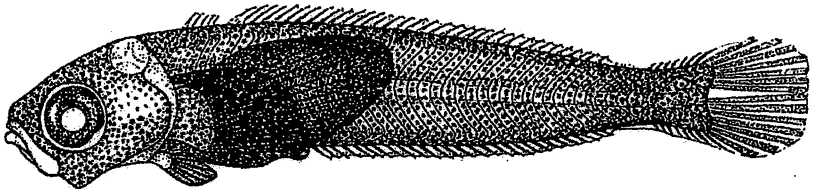
***Aethotaxis***
*A. mitopteryx* 38.5 mm
(Efremenko 1983)



***Dissostichus***
*D. eleginoides* 55.5 mm
(Efremenko 1983)



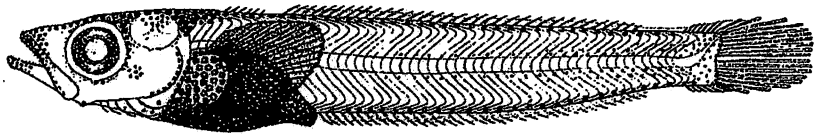
***Lepidonotothen***
*L. squamifrons*
30.5 mm
(Efremenko 1983)



***Notothenia***
*N. coriiceps* 28.8 mm
(Efremenko 1983)

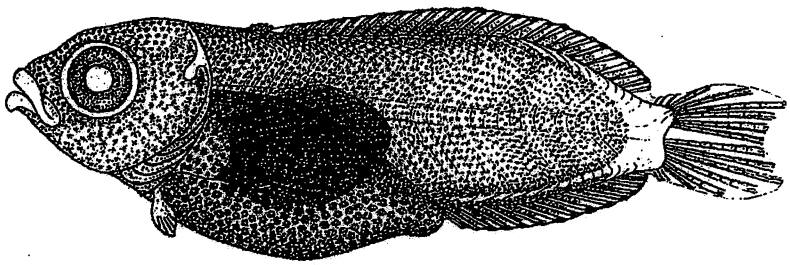
***Pleuragramma***
*P. antarcticum* 53.7 mm
(Efremenko 1983)

***Trematomus***
*T. eulepidotus* 40.5 mm
(Efremenko 1983)

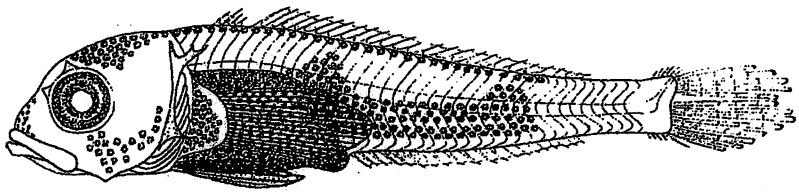


Perciformes/Notothenioidei/Harpagiferidae

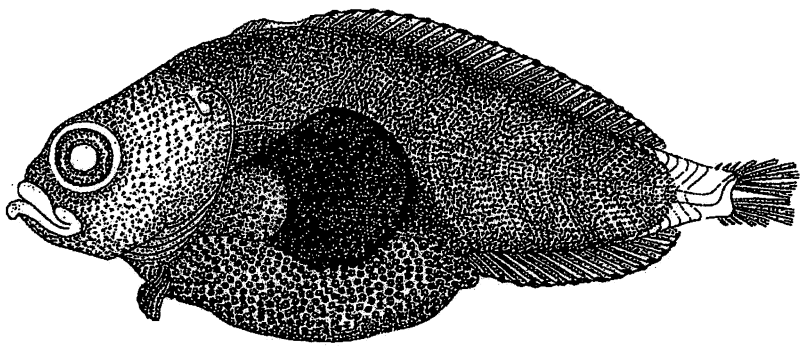
***Artedidraco***
*A. mirus* 24.0 mm
(Efremenko 1983)
[Currently considered a separate family, Artedidraconidae]



***Harpagifer***
*H. bispinis* 24.5 mm
(Efremenko 1983)

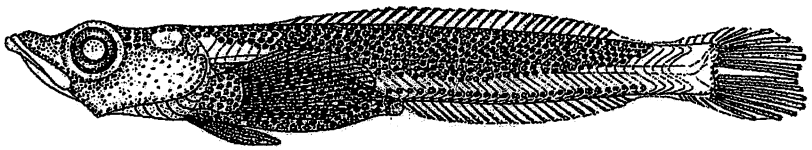


***Pogonophryne***
*P. marmorata* 25.5 mm
(Efremenko 1983)

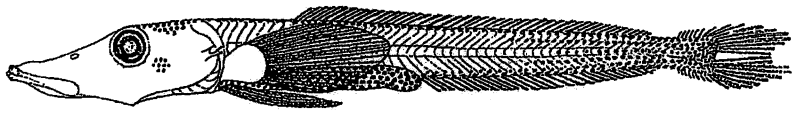


Perciformes/Notothenioidei/Bathydraconidae

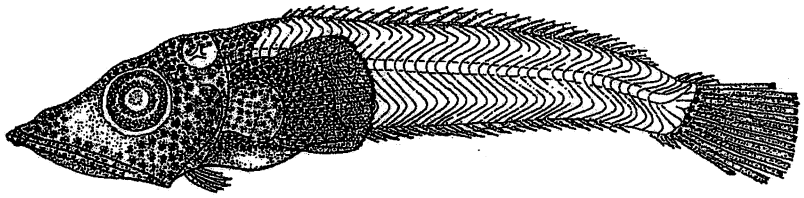
***Gymnodraco***
*G. acuticeps* 33.7 mm
(Efremenko 1983)



***Parachaenichthys***
*P. georgianus* 55.5 mm
(Efremenko 1983)

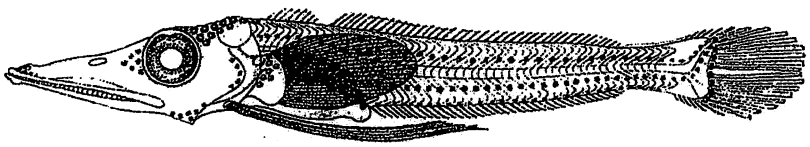


***Psilodraco***
*P. breviceps* 30.5 mm
(Efremenko 1983)

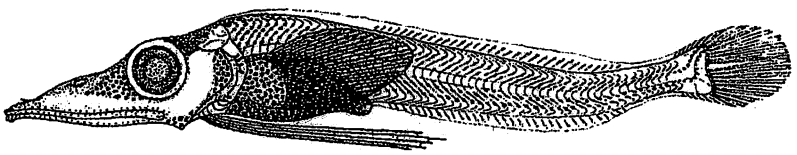


Perciformes/Notothenioidei/Channichthyidae

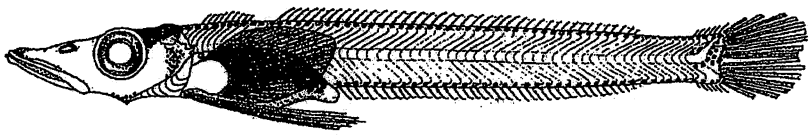
***Chaenocephalus***
*C. aceratus* 46.0 mm
(Efremenko 1983)



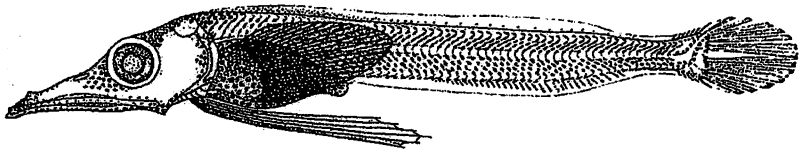
***Chaenodraco***
*C. wilsoni* 43.5 mm
(Efremenko 1983)



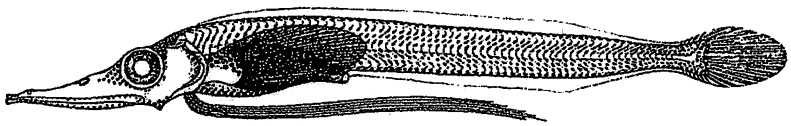
***Champsocephalus***
*C. gunnari* 47.5 mm
(Efremenko 1983)



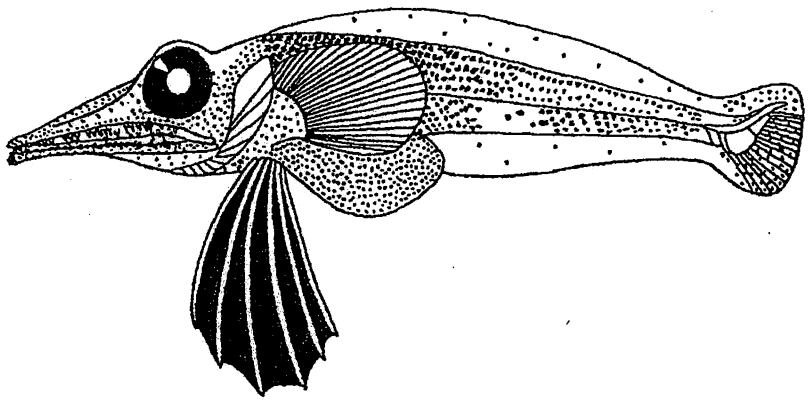
***Chionodraco***
*C. hamatus* 43.5 mm
(Efremenko 1983)



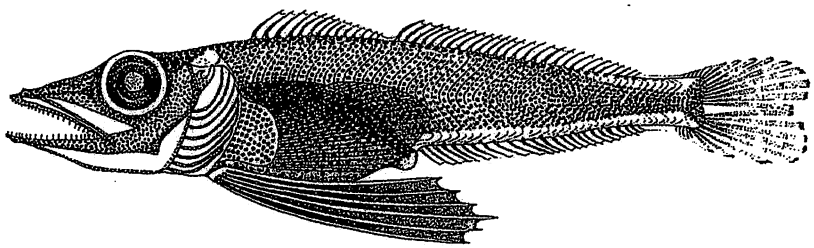
***Cryodraco***
*C. antarcticus* 34.6 mm
(Efremenko 1983)



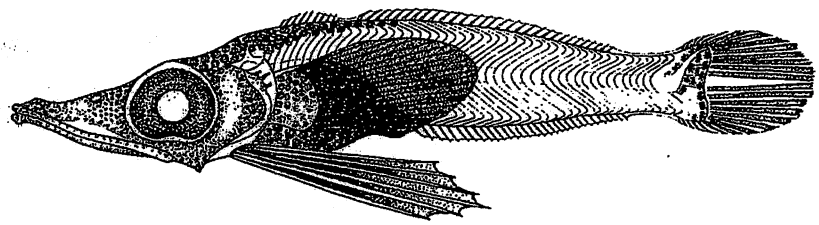
***Neopagetopsis***
*N. ionahi* 32.5 mm
(Voskoboinikova and
Skura 1996)



***Pagetopsis***
*P. macropterus*
54.5 mm
(Efremenko 1983)



***Pseudochaenichthys***
*P. georgianus* 35.0 mm
(Efremenko 1983)



## Order Perciformes

| | |
|---|---|
| Suborder | Trachinoidei |
| Families | 12 (Chiasmodontidae, Pholidichthyidae [currently placed in its own suborder, Pholidichthyoidei], Trichodontidae, Pinguipedidae, Cheimarrhichthyidae, Trichonotidae, Creediidae, Percophidae, Leptoscopidae, Ammodytidae, Trachinidae, Uranoscopidae; composition of the suborder is unsettled, with several families perhaps belonging elsewhere, e.g., Mooi and Johnson 1997, Springer and Johnson 2004, Nelson 2006). |
| Number of genera | 53 |
| Number of species | approx. 237 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Primarily tropical and subtropical marine fishes, some temperate and boreal marine and freshwater. |
| Relative abundance | Uncommon to abundant; includes some commercially important species, primarily ammodytids and trachinids. |
| Adult habitat | Small to medium size (generally < 75 cm) shallow subtidal to bathypelagic residents, some demersal; cheimarrichthyids inhabit freshwater streams and some leptoscopids and uranoscopids may be estuarine. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | All known or presumed to be oviparous (except perhaps pholidichthyids), with planktonic or demersal eggs, planktonic larvae (pholidichthyids may lack a planktonic phase). |
| Knowledge of ELH | Eggs known for all families except Cheimarrhichthyidae, Percophidae, and Pholidichthyidae, larvae known for all families except Cheimarrichthyidae. |
| ELH characters: | **Eggs:** planktonic (Chiasmodontidae, Creediidae, Leptoscopidae, Pinguipedidae, Trachipteridae, Uranoscopidae, perhaps *Ammodytoides*), spherical, ca. 0.7–2.5 mm in diameter, with unornamented chorion (except *Uranoscopus*), homogeneous yolk, 0–many oil globules ca. 0.01–0.28 mm; demersal adhesive (Trichodontidae, Trichonotidae, most Ammodytidae, possibly Pholidichthyidae) approximately spherical, 0.6–3.5 mm in diameter, with unornamented chorion, 0–1 oil globule up to ca. 0.5 mm.<br><br>**Larvae:** hatch at 2–4 mm with unpigmented eyes (partially to fully pigmented in Trachinidae), unformed mouth, moderate yolk sac (taxa with planktonic eggs), or 3–15 mm with pigmented eyes, functional mouth, small yolk reserve (taxa with demersal eggs); elongate to robust, preanal |

length approx. 33–66%BL; myomeres 25–101, commonly approx. 25–30 or approx. 50–60; spines present or absent on head and body; fin-spines present or absent; pigmentation light to heavy, commonly light.

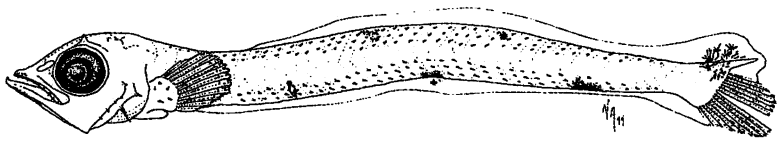
Example Species: Chiasmodontidae: *Chiasmodon subniger*, Ammodytidae: *Ammodytoides gilli*.

REFERENCES

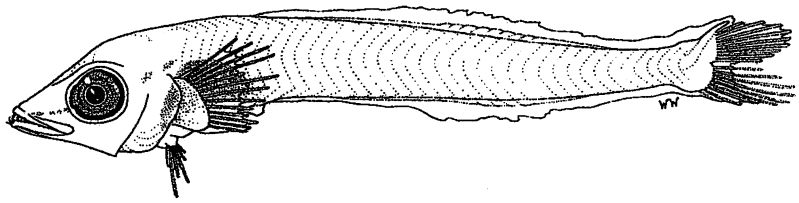
Beltrán-León and Herrera 2000, Fahay 2007b, Fritzsche 1978, Hardy 2006b, Jackson 2006, Kojima and Mori 1988c, Landaeta et al. 2003, Leis 1982, Leis and Rennis 2000h, i, Marliave 1981, Matarese et al. 1989, Matsuura and Suzuki 2000, Mito 1966, Mori 1988a, b c, Neira 1998a, b, Neira and Gaughan 1989, Okiyama 2000, Reader and Neira 1998a, b, Reader et al. 2000, Richards 2000, 2006o, p, Robertson 1975a, Russell 1976, Shiganova 1990, Stevens et al.1984a, Trnski et al. 2000b, Velez et al. 2003a, Watson 1996p, q, Watson and Sandknop 1996e, Watson et al. 1984.

Perciformes/Trachinoidei/Chiasmodontidae

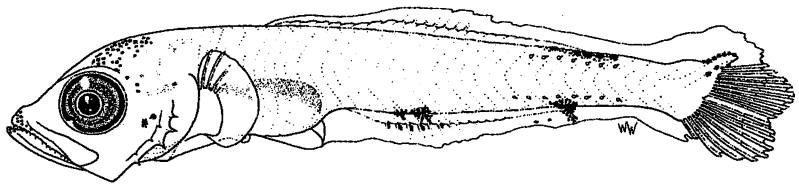
***Chiasmodon***
*C. subniger* 10.0 mm
(Watson and Sandknop 1996e)



***Kali***
*K. normanni* 7.2 mm
(Watson and Sandknop 1996e)

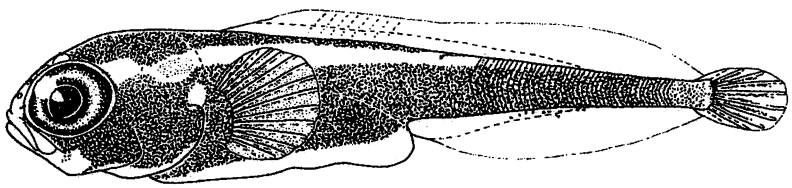


***Pseudoscopelus***
*P.* sp. 7.4 mm
(Watson and Sandknop 1996e)



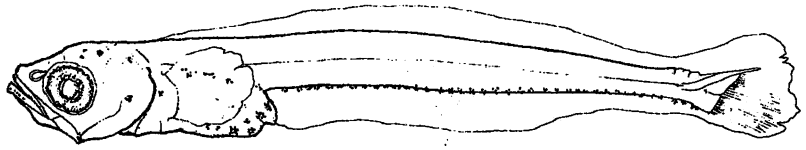
Perciformes/Trachinoidei/Pholidichthyidae

***Pholidichthys***
*P. leucotaenia* 7.1 mm
(Trnski et al. 2000b)

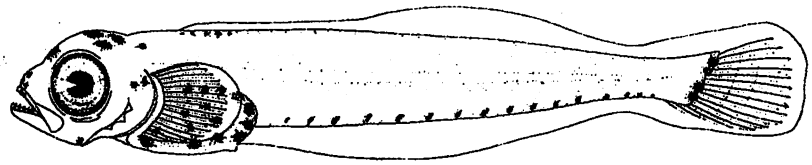


Perciformes/Trachinoidei/Trichodontidae

***Arctoscopus***
*A. japonicus* 14.2 mm
(Okiyama 1988c)

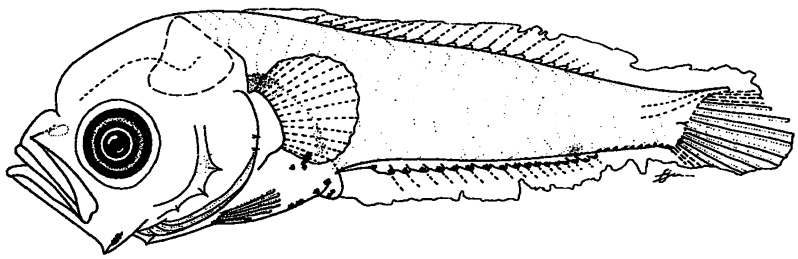


***Trichodon***
*T. trichodon* 14.5 mm
(Marliave 1981)

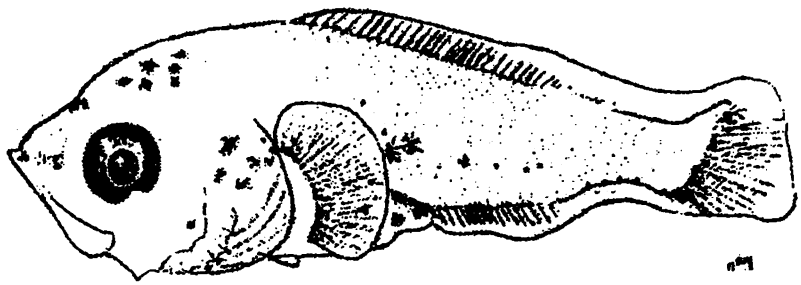


Perciformes/Trachinoidei/Pinguipedidae

***Parapercis***
*P. haackei* 4.3 mm
(Neira 1998b)

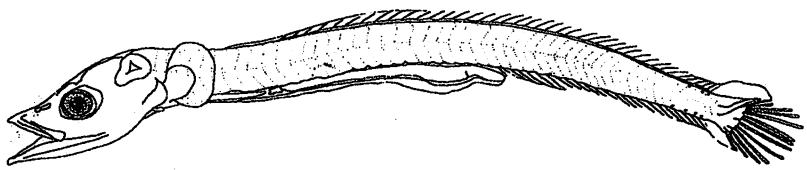


***Prolatilus***
*P. jugularis* 6.5 mm
(Velez et al. 2003a)



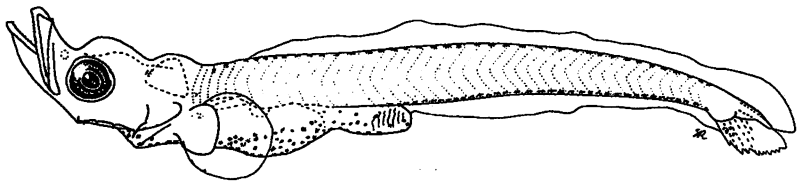
Perciformes/Trachinoidei/Trichonotidae

***Trichonotus***
*T. filamentosus* 8.3 mm
(Kojima and Mori
1988c)

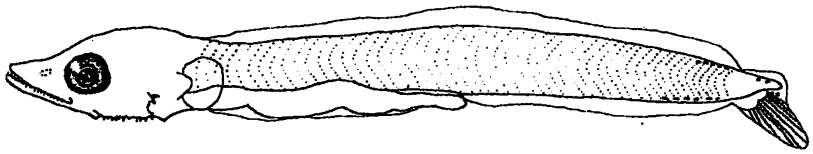


Perciformes/Trachinoidei/Creediidae

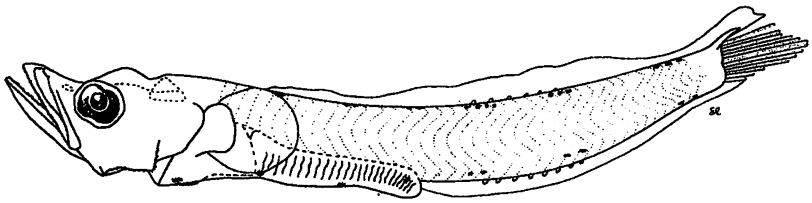
***Creedia***
*C. haswelli* 7.3 mm
(Reader and Neira 1998a)



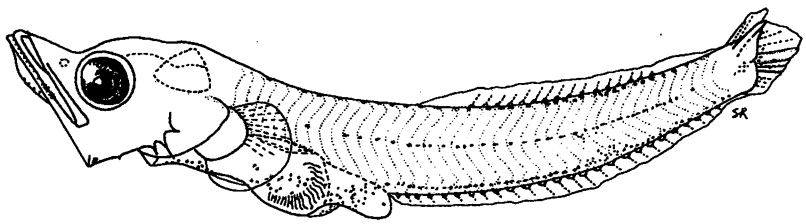
***Crystallodytes***
*C. cookie* 7.8 mm
(Leis 1982)



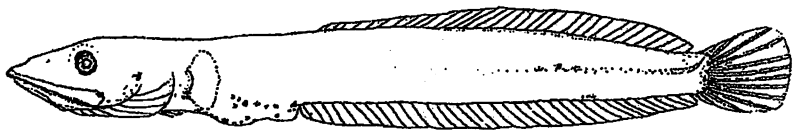
***Limnichthys***
*L. fasciatus* 5.9 mm
(Reader and Neira 1998a)



***Schizochirus***
*S. insolens* 5.6 mm
(Reader and Neira 1998a)

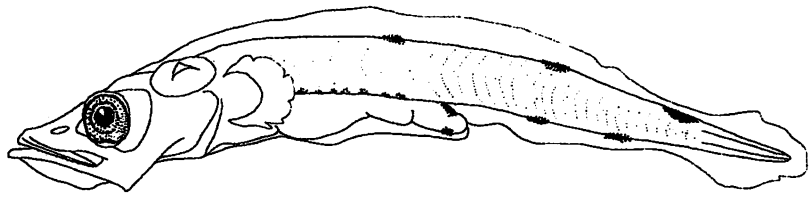


***Tewara***
*T. cranwellae* 16.7 mm
(Crossland 1982)

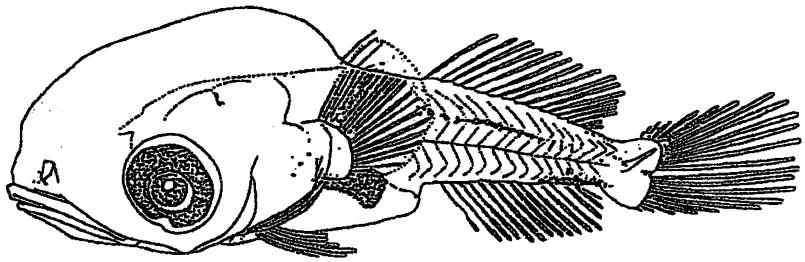


Perciformes/Trachinoidei/Percophidae

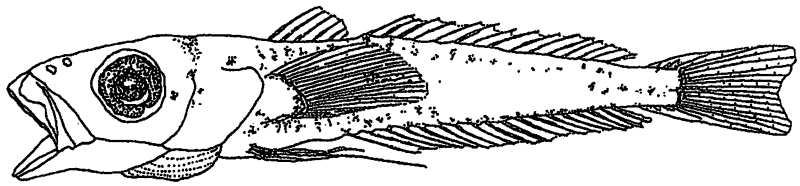
***Acanthaphritis***
*A. unoorum* 4.2 mm
(Mori 1988a)



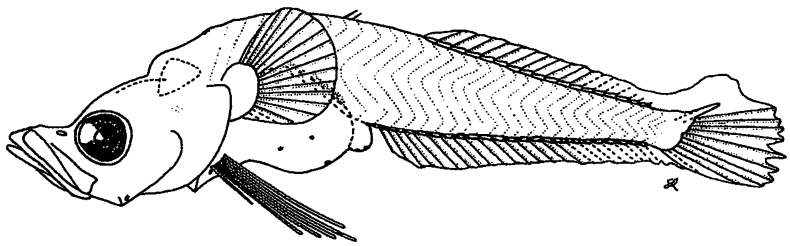
***Bembrops***
*B. curvatura* 10.3 mm
(Okiyama 1997)



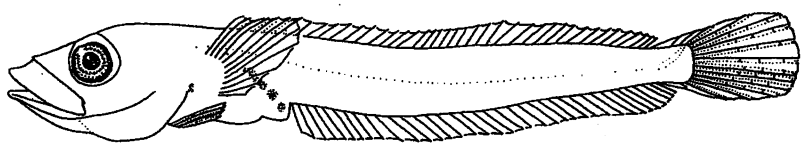
***Chironema***
*C.* sp. 16.3 mm
(Okiyama 1997)



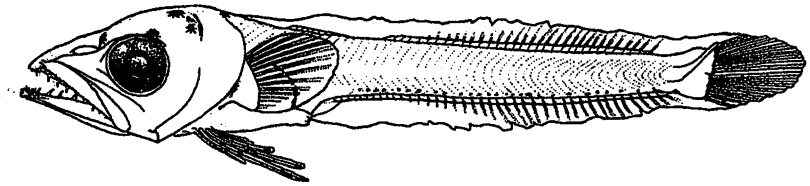
***Enigmapercis***
*E. reducta* 6.4 mm
(Reader and Neira
1998b)



***Heterocoetes***
*H.* sp. 16.0 mm
(Watson et al. 1984)

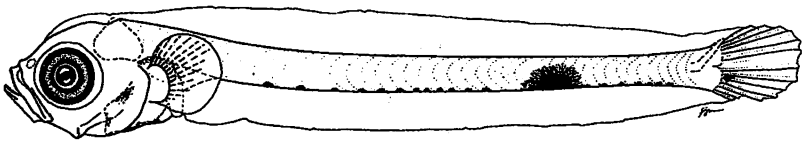


***Percophis***
*P. brasiliensis* 9.0 mm
(Matsuura and Suzuki
2000)



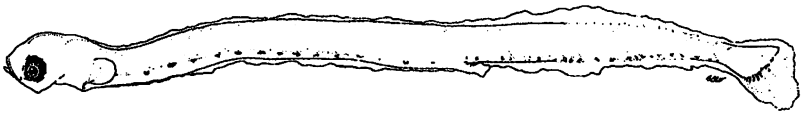
Perciformes/Trachinoidei/Leptoscopidae

***Lesueurina***
*L. platycephala* 7.4 mm
(Neira and Gaughan 1989)

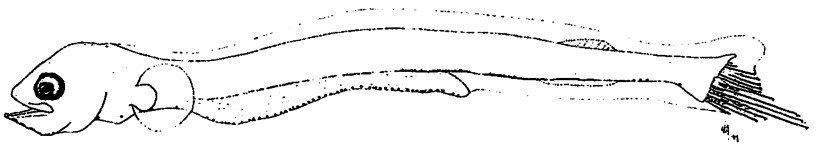


Perciformes/Trachinoidei/Ammodytidae

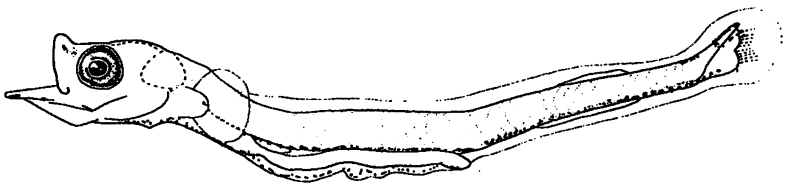
***Ammodytes***
*A. hexapterus* 16.0 mm
(Stevens et al. 1984a)



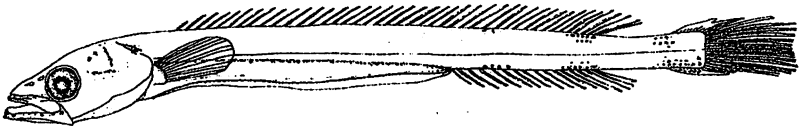
***Ammodytoides***
*A. gilli* 6.1 mm
(Watson 1996p)



***Bleekeria***
*B. viridianguilla* 4.8 mm
(Okiyama et al. 2000)

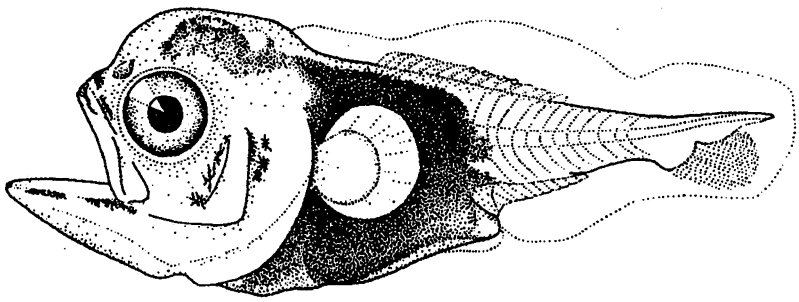


***Embolichthys***
*E. mitsukurii* 17.2 mm
(Okiyama 1988d)

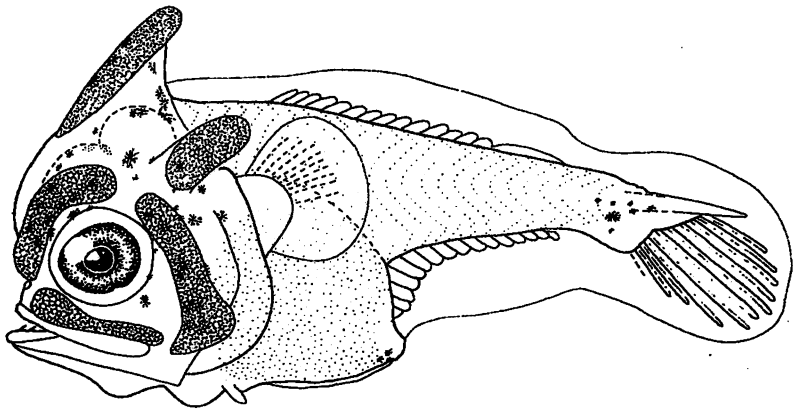


Perciformes/Trachinoidei/Uranoscopidae

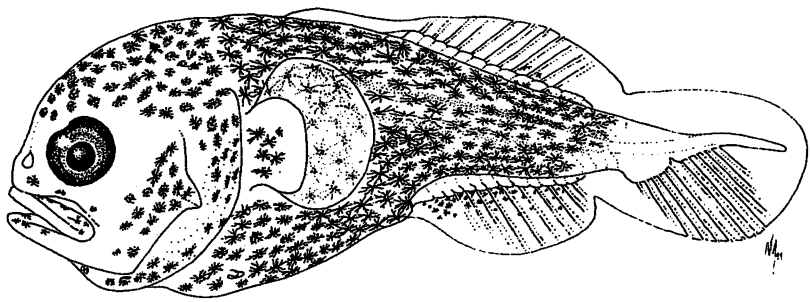
***Astroscopus***
*A. guttatus* 4.9 mm
(Pearson 1941)

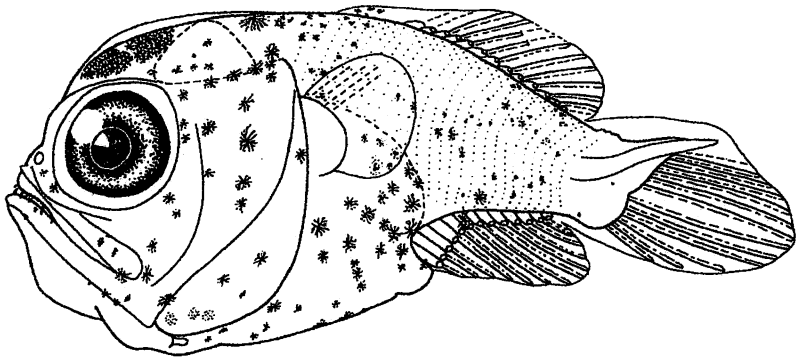


***Ichthyoscopus***
*I.* sp. 5.3 mm
(Trnski and Leis 2000a)

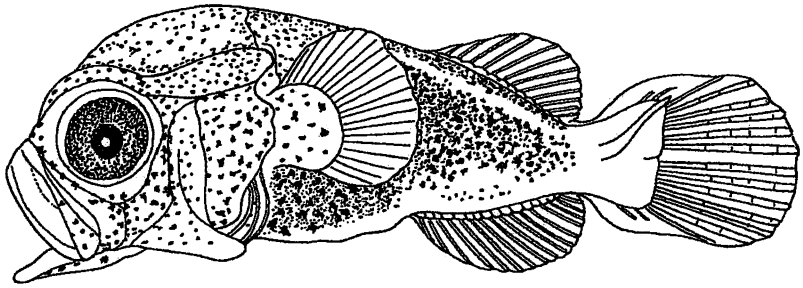


***Kathetostoma***
*K. averruncus* 6.8 mm
(Watson 1996r)





***Uranoscopus***
*U.* sp. 4.1 mm
(Trnski and Leis 2000a)



***Xenocephalus***
*X. elongatus*
7.8 mm
(Mori 1988c)

**Order Perciformes**

| | |
|---|---|
| Suborder | Trachinoidei |
| Family | **Chiasmodontidae (Swallowers)** |
| Number of genera | 4 (*Chiasmodon, Dysalotus, Kali, Pseudoscopelus*) |
| Number of species | approx. 15 |

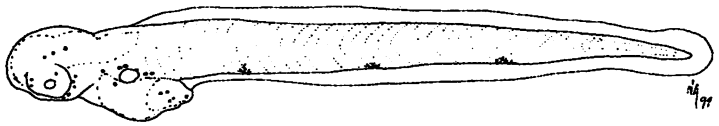
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, world-wide mainly in tropical and subtropical waters, but some range into subarctic and subantarctic waters. |
| Relative abundance | Apparently not abundant. |
| Adult habitat | Meso- and bathypelagic. |

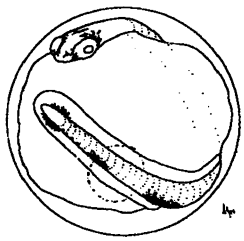
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous, with planktonic eggs and larvae. |
| Knowledge of ELH | Eggs known for *Chiasmodon*, larvae known for all genera except *Dysalotus*. |
| ELH Characters: | **Eggs:** spherical, ca. 1.1–1.2 mm in diameter; homogeneous yolk; 1 to several oil globules 0.01–0.28 mm in diameter, condensing to 1. |
| | **Larvae:** moderately elongate with coiled gut, preanal length < 50% BL (commonly near 33% BL); snout elongates and mouth becomes large by postflexion stage; small preopercular spines form by flexion stage (none in *Kali*); all genera except *Kali* develop spinules on body by late preflexion stage; *Kali* develops very large P1 and P2, with rays forming during preflexion stage; myomeres 33–46; pigmentation commonly light, predominantly on head and gut, and in distinct patches on dorsal and/or ventral margins in some species. |
| Example species: | *Chiasmodon subniger* (eastern Pacific, 48°N–29°S). |
| Meristics: | D: X–XIII+24–27, A: 24–27, P1: 12–13, P2: I,5 (thor.), V: 20–22+21–24=43–46, C: 9–11, 9+8–9, 9–11. |
| REFERENCES | Beltrán-León and Herrera 2000, Fahay 2007b, Hardy 2006b, Shiganova 1990, Watson and Sandknop 1996e, Watson et al. 1984. |

Perciformes/Trachinoidei/Chiasmodontidae
*Chiasmodon subniger*
from: Watson and Sandknop 1996e

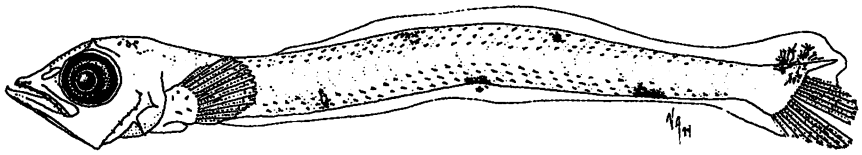


3.2 mm

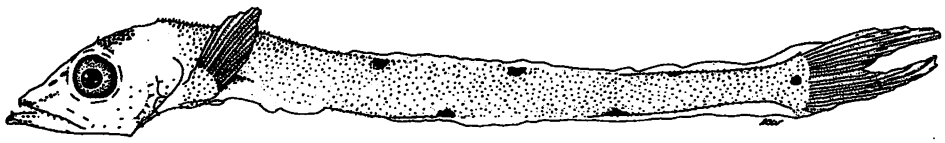


1.1 mm

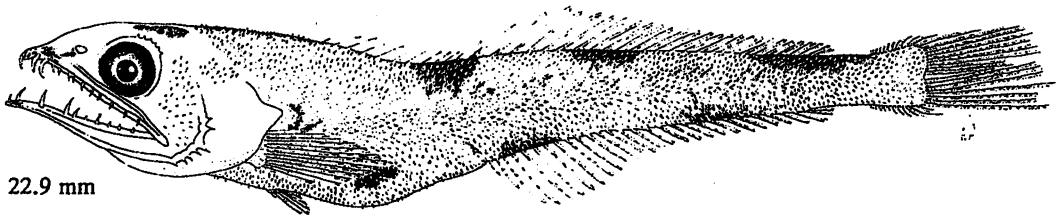
6.5 mm



10.0 mm



14.0 mm



22.9 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Trachinoidei |
| Family | **Ammodytidae (Sand Lances)** |
| Number of genera | 8 |
| Number of species | approx. 23 |

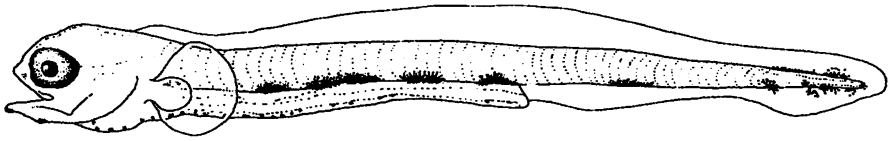
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, boreal to tropical, Arctic, Pacific, Indian, Atlantic oceans. |
| Relative abundance | Common forage fishes; some commercially important. |
| Adult habitat | Shallow subtidal to deep shelf, usually associated with soft bottom, some epipelagic. |

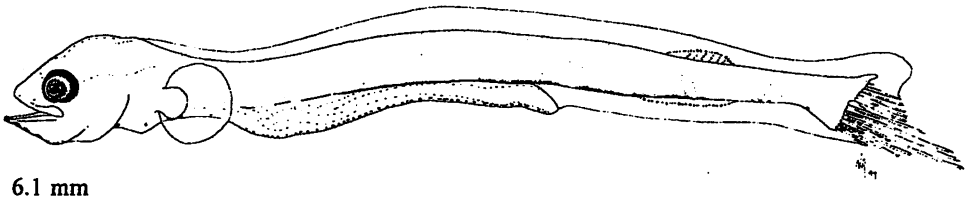
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous, with demersal, adhesive eggs (possibly planktonic eggs in *Ammodytoides*), and planktonic larvae. |
| Knowledge of ELH | Eggs known for *Ammodytes* and larvae known for all genera. |
| ELH Characters: | **Eggs:** approximately spherical, 0.7–1.2 mm in diameter, single oil globule 0.2–0.4 mm in diameter.<br><br>**Larvae:** elongate, compressed, with straight gut and preanal length approx. 60–70% BL; snout short initially, becoming moderately elongate and more or less pointed with projecting lower jaw by postflexion stage; eyes moderate to small; no spines on head (except small preopercular spines in *Bleekeria* and some *Ammodytoides*); myomeres approx. 49–69; pigmentation light, primarily on gut and ventrum, with some on head and/or posteriorly on dorsum and/or laterally in some species, dorsal and lateral pigment may spread forward with larval development. |
| Example species: | *Ammodytoides gilli* (Eastern Pacific, Baja California Sur, Mexico, to Panama). |
| Meristics: | D: 46–47, A: 22–24, P1: 13–15, P2: 0, V: 32+25=57, C: 14, 8–9+7–8, 14. |
| REFERENCES | Fahay 2007b, Fritzsche 1978, Matarese et al. 1989, Okiyama 1988c, Okiyama et al. 2000, Richards 2006o, Russell 1976, Stevens et al. 1984a, Watson 1996p. |

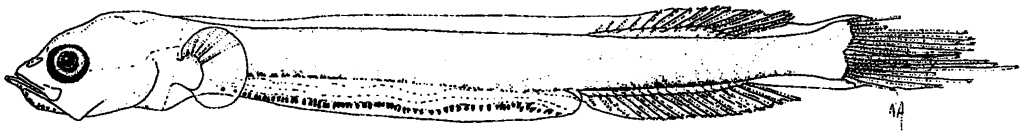
Perciformes/Trachinoidei/Ammodytidae
*Ammodytoides gilli*
from: Watson 1996p



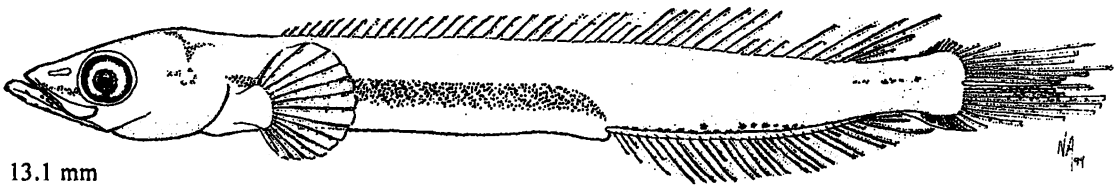
3.3 mm



6.1 mm



7.6 mm



13.1 mm

**Order Perciformes**

| | |
|---|---|
| Suborder | Blennioidei |
| Families | 6 (Tripterygiidae, Blenniidae, Dactyloscopidae, Chaenopsidae, Clinidae, Labrisomidae; the systematic position of the suborder and interrelationships of the families are not settled, see Springer 1993, Hastings and Springer 2009). |
| Number of genera | approx. 151 |
| Number of species | approx. 883 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Temperate to tropical waters of all oceans, some estuarine. |
| Relative abundance | Uncommon to common, depending on species. |
| Adult habitat | Most are small, benthic inhabitants of intertidal to shallow reef, algal, or mangrove habitats, some on soft bottom. |

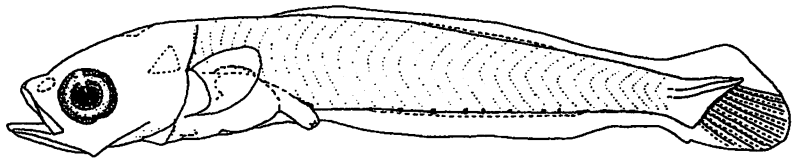
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Most are oviparous, with demersal, attached eggs brooded by one or both parents; many clinids (Clinini and Ophiclinini) and some labrisomids (Starksiini) are live-bearers; larvae are planktonic. |
| Knowledge of ELH | Eggs and larvae known for many genera of all families. |
| ELH characters: | **Eggs:** elliptical or spherical to hemispherical, approx. 0.5–1.5 mm in diameter; chorion ornamented in some; attachment is via adhesive filaments or pads, commonly at one pole; yolk commonly granular, colorless to red, brown, or green; 0–100 or more oil globules (commonly ≥ 1), usually ≤ 0.3 mm in diameter.<br><br>**Larvae:** hatch at ca. 2–7 mm with pigmented eyes, open mouth, small yolk sac; elongate, somewhat compressed body; most with coiled gut extending to ca. 30–50% BL; head spines lacking to large and/or numerous, depending on taxon, when present usually consisting of supraocular and opercular series spines; myomeres 28–135, commonly approx. 30–50; pigmentation light to heavy, commonly light, primarily on gas bladder, gut and ventral margin of tail. |
| Example species: | *Heterostichus rostratus* (Clinidae), *Hypsoblennius jenkinsi* (Blenniidae). |
| REFERENCES | Barnhart 1932, Beltrán-León and Herrera 2000, Breder 1939, 1941, Brogan 1992, Cavalluzzi 1997, Cavalluzzi and Olney 1998, 2006a, b, c, Ditty et al. 2006a, Fritzsche 1978, Graham 1939, Gunn and Thresher 1991, Herrera and Lavenberg 1999, Kojima and Shiogaki 1988, Leis |

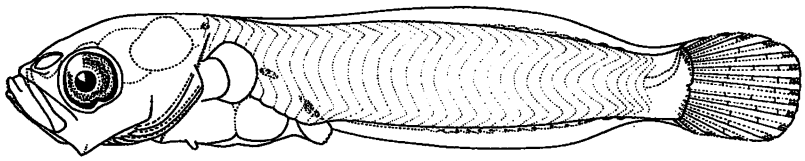
and Rennis 2000j, Lindquist 1981, Matarese et al. 1984, 1989, Miller et al. 1979, Padoa 1956b, Ruck 1973,1980, Russell 1976, Shiogaki and Dotsu 1973, 1988, Stepien 1986, Watson 1996r, 2000a, 2009, Watson and Miskiewcz 1998, Wirtz 1978.

Perciformes/Blennioidei/Tripterygiidae

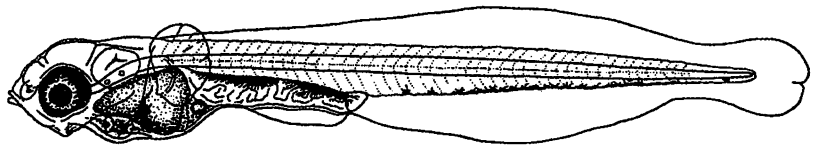
***Enneanectes***
*E. carminalis* 4.4 mm
(Brogan 1992)



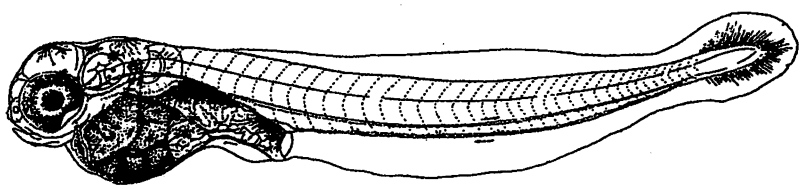
***Enneapterygius***
*E. atriceps* 5.8 mm
(Miller et al. 1979)



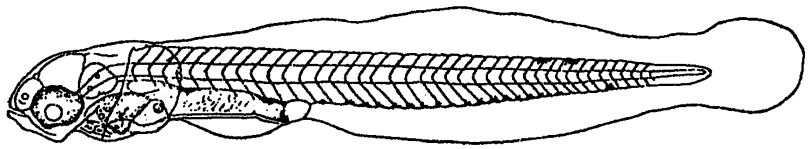
***Forsterygion***
*F. varium* 6.1 mm
(Ruck 1980)



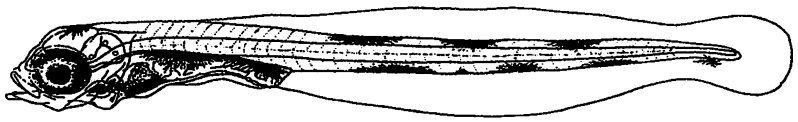
***Gilloblennius***
*G. tripennis* 5.9 mm
(Ruck 1980)



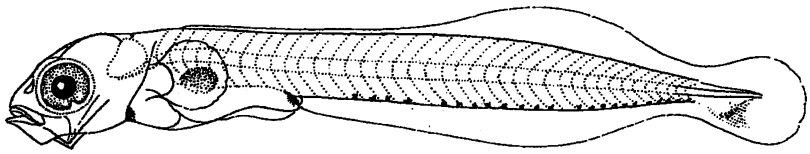
***Grahamina***
*G. capito* 5.1 mm
(Ruck 1973)



***Ruanoho***
*R. decemdigitatus*
5.8mm
(Ruck 1980)

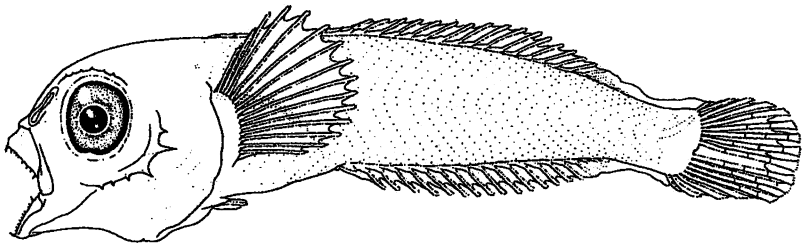


***Springerichthys***
*S. bapturus* 9.4 mm
(Shiogaki and Dotsu 1988)

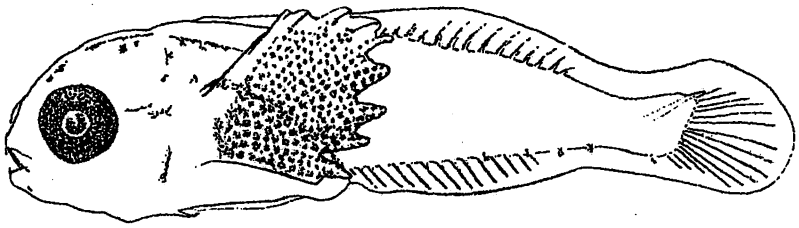


Perciformes/Blennioidei/Blenniidae

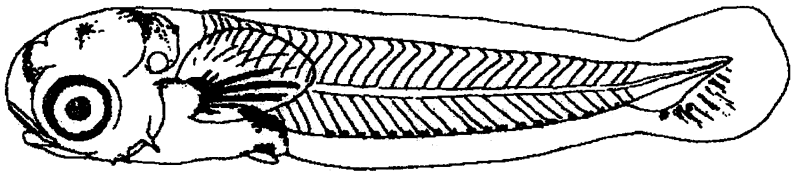
***Atrosalarias***
*A. fuscus* 7.4 mm
(Watson 2000a)



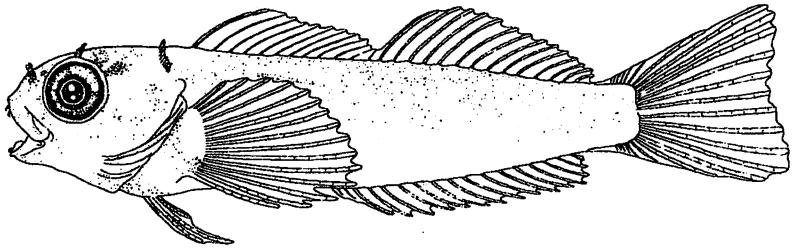
***Blennius***
*B. ocellaris* 8.5 mm
(Ford 1922)



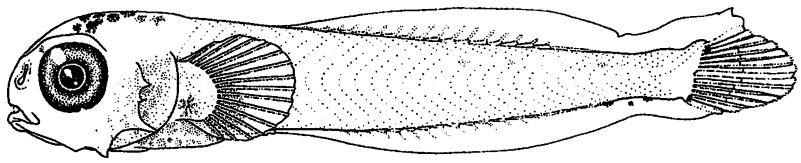
***Chasmodes***
*C. saburrae* 3.8 mm
(Peters 1981)



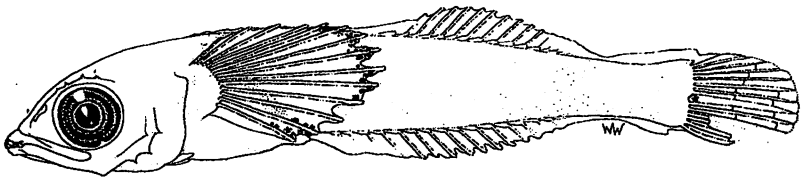
***Cirripectes***
*C.* sp. 19.0 mm
(Kojima and Shiogaki 1988)



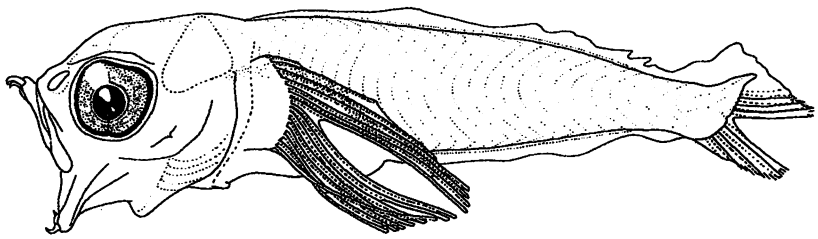
***Enchelyurus***
*E. ater* 5.4 mm
(Watson 2001)



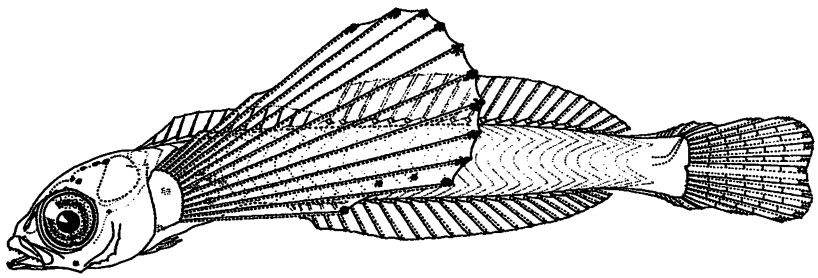
***Entomacrodus***
*E. chiostictus* 6.6 mm
(Watson 1996r)



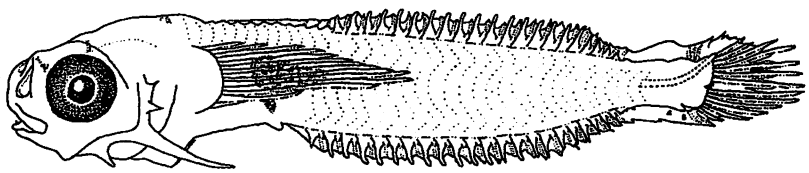
***Exallias***
*E. brevis* 4.6 mm
(Watson 2000a)



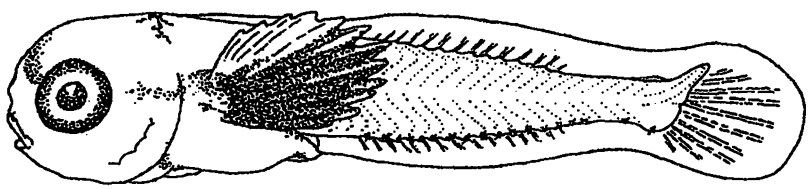
***Istiblennius***
*I. zebra* 11.0 mm
(Miller et al. 1979)



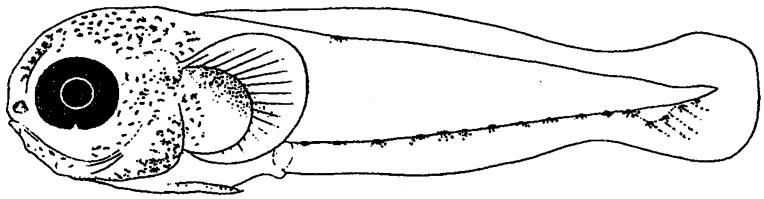
***Laiphognathus***
*L. multimaculatus*
5.9 mm
(Kubo and Sasaki 2000)



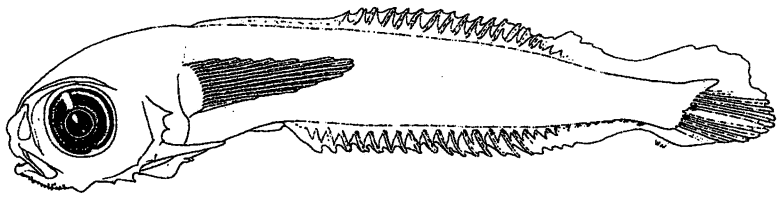
***Lupinoblennius***
*L. nicholsi* 4.1 mm
(Peters 1985)



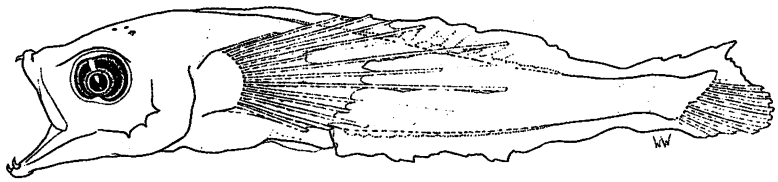
***Meiacanthus***
*M. nigrolineatus* 4.9 mm
(Fishelson 1976)



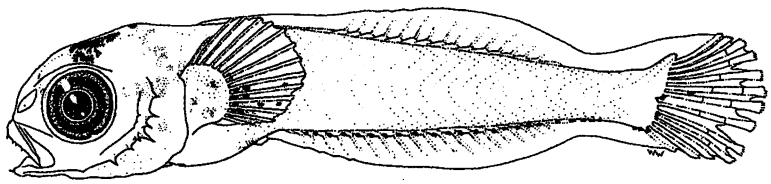
***Omobranchus***
*O. rotundiceps* 5.2 mm
(Watson and
Miskiewicz 1998)



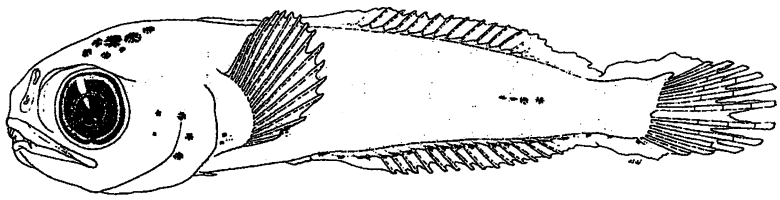
***Ophioblennius***
*O. steindachneri* 4.7 mm
(Watson 1996r)



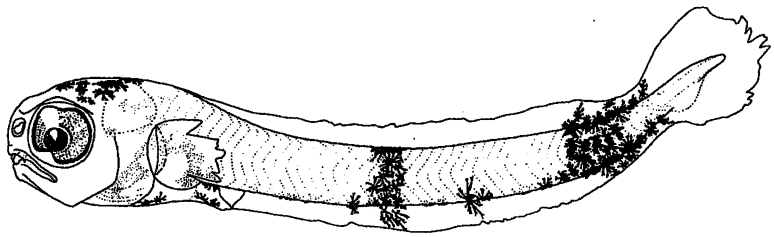
***Parablennius***
*P. postoculomaculatus*
6.8 mm
(Watson and Miskiewicz
1998)



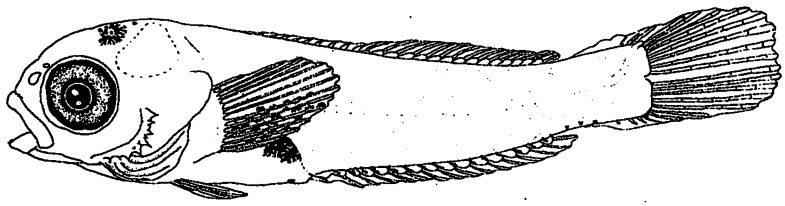
***Petroscirtes***
*P. lupus* 5.2 mm
(Watson and Miskiewicz
1998)



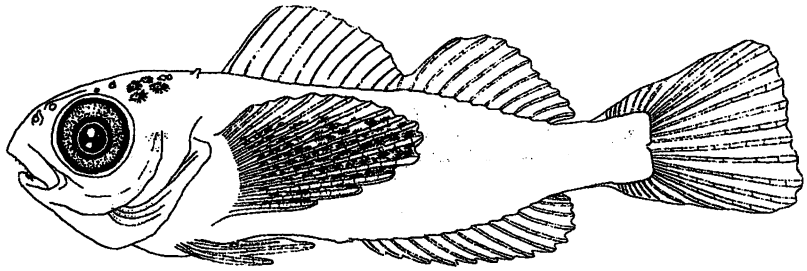
***Plagiotremus***
*P. rhinorhynchos* 4.6 mm
(Watson 2000a)



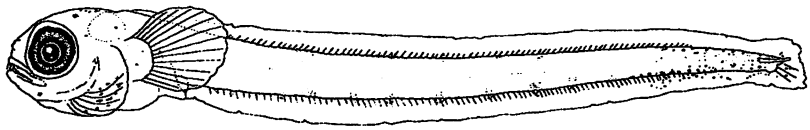
***Scartella***
*S. cristata* 6.2 mm
(Kojima and Shiogaki 1988)



***Stanulus***
*S. seychellensis* 10.1 mm
(Kojima and Shiogaki 1988)

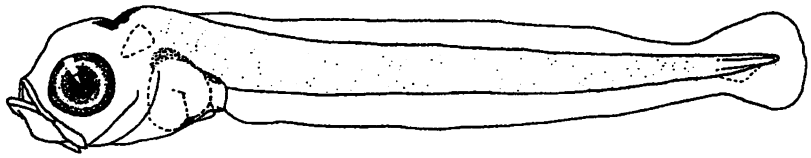


***Xiphasia***
*X. setifer* 10.5 mm
(Kojima and Shiogaki 1988)

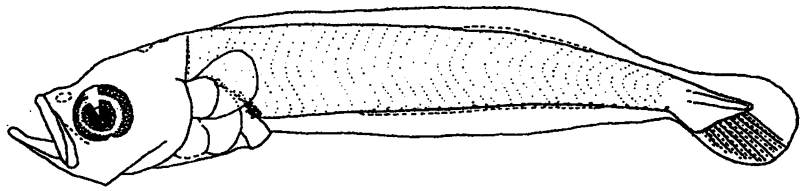


Perciformes/Blennioidei/Dactyloscopidae

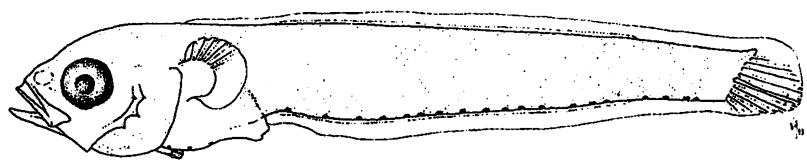
***Dactylagnus***
*D. mundus* 4.1 mm
(Brogan 1992)



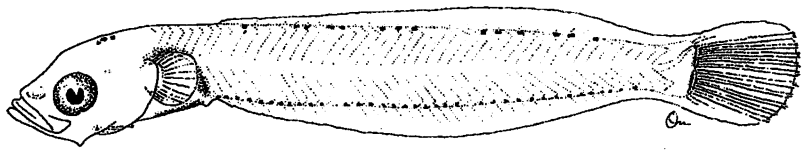
***Dactyloscopus***
*D. pectoralis* 4.6 mm
(Brogan 1992)



***Gillellus***
*G. semicinctus* 6.4 mm
(Watson 1996r)

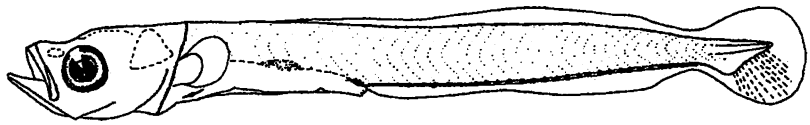


***Myxodagnus***
*M. opercularis* 9.0 mm
(Watson 1996r)

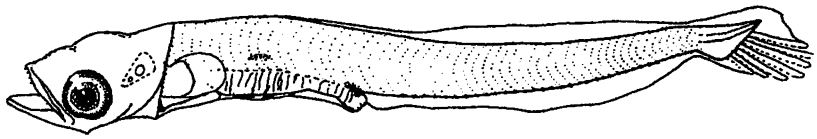


Perciformes/Blennioidei/Chaenopsidae

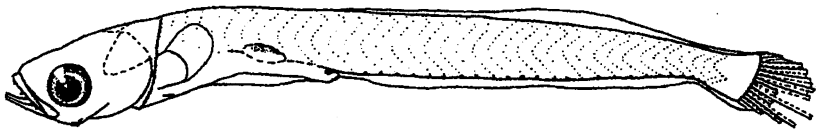
***Acanthemblemaria***
*A. crockeri* 6.4 mm
(Brogan 1992)



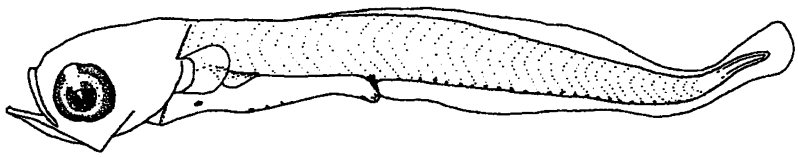
***Chaenopsis***
*C. alepidota* 5.3 mm
(Brogan 1992)



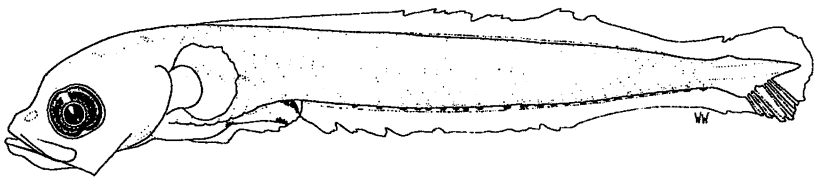
***Coralliozetus***
*C.* sp. (*micropes*)
6.5 mm
(Brogan 1992)



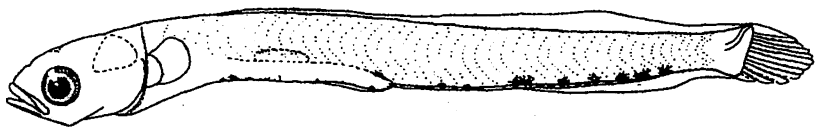
***Emblemaria***
*E. hypacanthus* 3.5 mm
(Brogan 1992)



***Neoclinus***
*N. stephensae* 7.0 mm
(Watson 1996r)

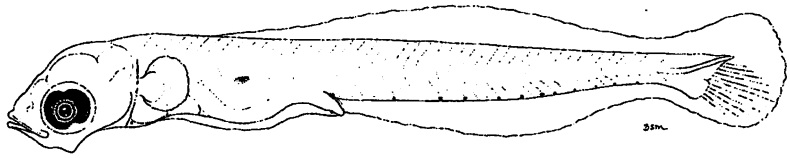


***Stathmonotus***
*S. sinuscalifornici*
6.4 mm
(Brogan 1992)

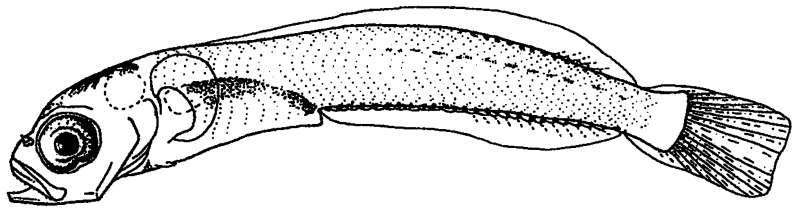


Perciformes/Blennioidei/Clinidae

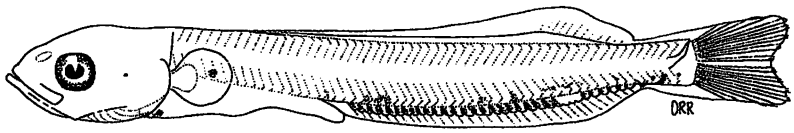
***Gibbonsia***
*G. elegans* 7.5 mm
(Watson 1996r)



***Heteroclinus***
*H. perspicillatus*
5.4 mm
(Gunn and Thresher
1991)

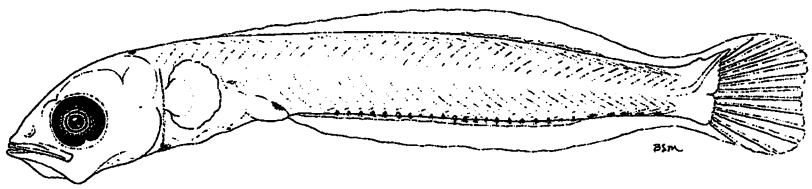


***Heterostichus***
*H. rostratus* 11.4 mm
(Watson 1996r)

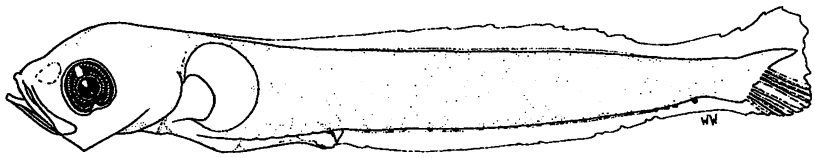



Perciformes/Blennioidei/Labrisomidae

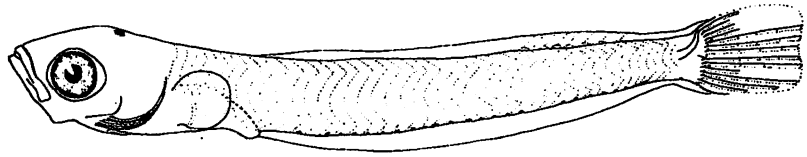
***Alloclinus***
*A. holderi* 8.7 mm
(Watson 1996r)



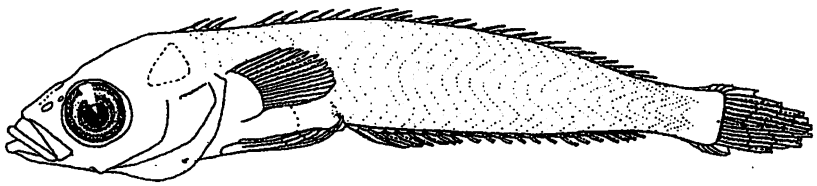
***Cryptotrema***
*C. corallinum* 8.6 mm
(Watson 1996r)



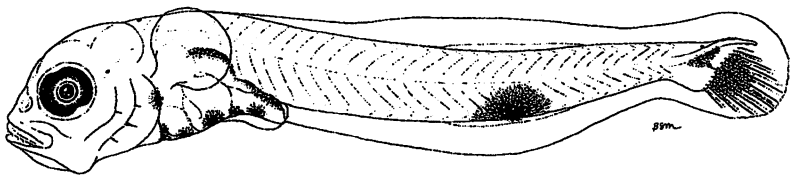
***Dialommus***
*D. fuscus* 8.4 mm
(Herrera and Lavenberg
1999)



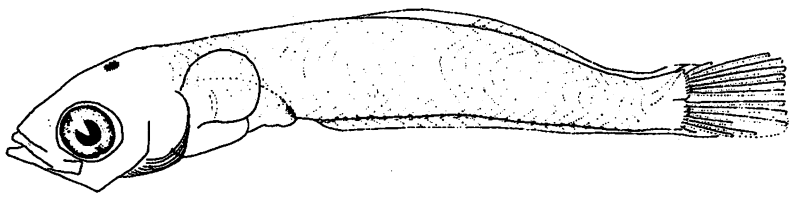
***Exerpes***
*E. asper* 9.2 mm
(Brogan 1992)



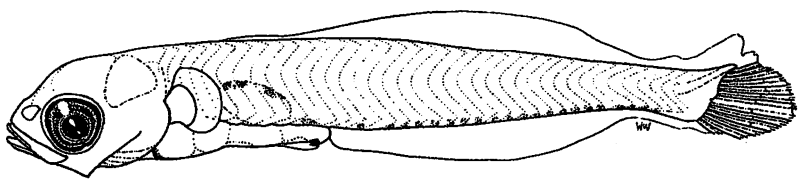
***Labrisomus***
*L. xanti* 6.8 mm
(Watson 1996r)



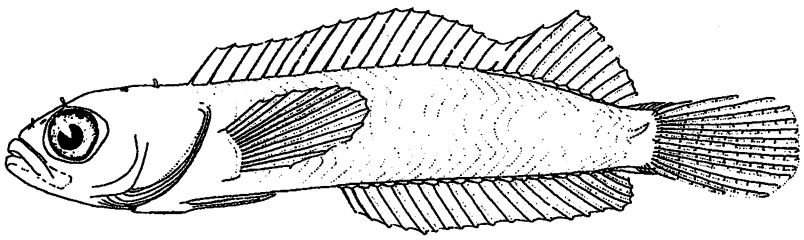
***Malacoctenus***
*M. zonogaster* 7.0 mm
(Herrera and Lavenberg 1999)



***Paraclinus***
*P. integripinnis* 6.7 mm
(Watson 1996r)



***Starksia***
*S. galapagensis*
11.6 mm
(Herrera and
Lavenberg 1999)



**Order Perciformes**

| | |
|---|---|
| Suborder | Blennioidei |
| Family | **Blenniidae (Combtooth Blennies)** |
| Number of genera | 57 |
| Number of species | 387 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, temperate to tropical (predominantly subtropical to tropical) waters world wide, some are estuarine and may enter freshwater. |
| Relative abundance | Uncommon to abundant, depending on species. |
| Adult habitat | Most species demersal, on intertidal to shallow subtidal hard bottom including reefs, pilings, buoys, etc., saber-tooth blennies (tribe Nemophini) commonly hover above reefs. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous, with demersal, attached eggs brooded by parent(s); planktonic larvae. |
| Knowledge of ELH | Eggs known for several genera (e.g., *Blennius, Hypsoblennius, Omobranchus, Parablennius, Petroscirtes*), larvae known for many genera (e.g., *Atrosalarias, Blennius, Chasmodes, Hypsoblennius, Istiblennius, Meiacanthus, Parablennius, Stanulus, Xiphasia*). |
| ELH characters: | **Eggs:** slightly flattened to hemispherical, ca. 0.4–0.8 mm by 0.6–1.1 mm; adhesive filaments or pad at basal pole; granular yolk, commonly yellow to red, with ≥ 1 oil globule. |
| | **Larvae:** hatch at ca. 2–5 mm, notochord flexes at ca. 4–8 mm, settlement at ca. 15–70 mm; moderately to very elongate, slightly to moderately compressed, some become moderately deep-bodied; gut coiled at hatching in some, initially straight but coiling during preflexion stage in others, extends to ca. 35–60% BL (usually < 50% BL); gas bladder anterior, usually not very conspicuous; head moderate; snout short to moderate, rounded to somewhat pointed; mouth small to moderate; large, hooked teeth form anteriorly in some Salariini, large canine teeth form anteriorly in some Nemophini; preopercular, and often supraocular, spines form in preflexion or flexion stage except in Nemophini and some Salariini, preopercular spines may become very large in some Omobranchini; pectoral-fin rays form early, usually beginning at, or soon after hatching, except in some Nemophini; myomeres ca. 28–135, approx. 30–40 in most species, commonly ca. 8–12 preanal myomeres; pigmentation light to nearly complete, commonly moderately light, on |

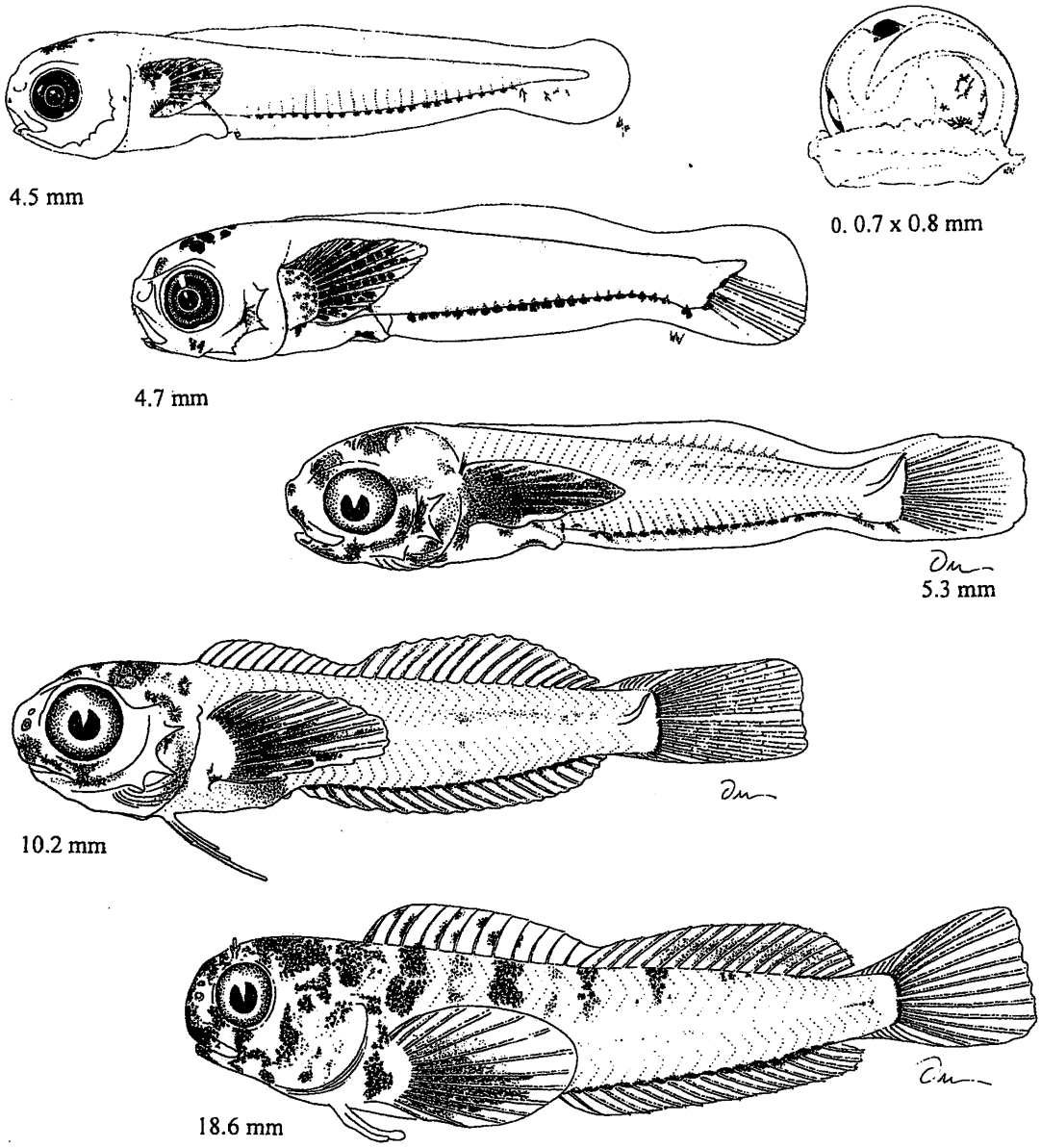
head (primarily dorsally), gas bladder, gut, ventral margin of tail, and commonly on pectoral fins.

Example species: *Hypsoblennius jenkinsi* (N.E. Pacific, coastal central California to Baja California Sur, Mexico, and upper Gulf of California).

Meristics: D: XI–XIII,15–19, A: II,15–20, P1: 12–15, P2: I,3 (thor.), V: 10+24–25=34–35, C: 6–8, 7+6, 6–8.

REFERENCES Beltrán-León and Herrera 2000, Brogan 1992, Cavalluzzi and Olney 1998, Ditty et al. 2006a, Fahay 2007b, Fritzsche 1978, Kojima and Shiogaki 1988, Matarese et al. 1984, Mito 1954, Padoa 1956b, Russell 1976, Watson 1996r, 2000a, 2009, Watson and Miskiewcz 1998.

Perciformes/Blennioidei/Blenniidae
*Hypsoblennius jenkinsi*
from: Watson 1996r



## Order Perciformes

| | |
|---|---|
| Suborder | Blennioidei |
| Family | **Clinidae (Clinid Kelpfishes)** |
| Number of genera | 26 |
| Number of species | 85 |

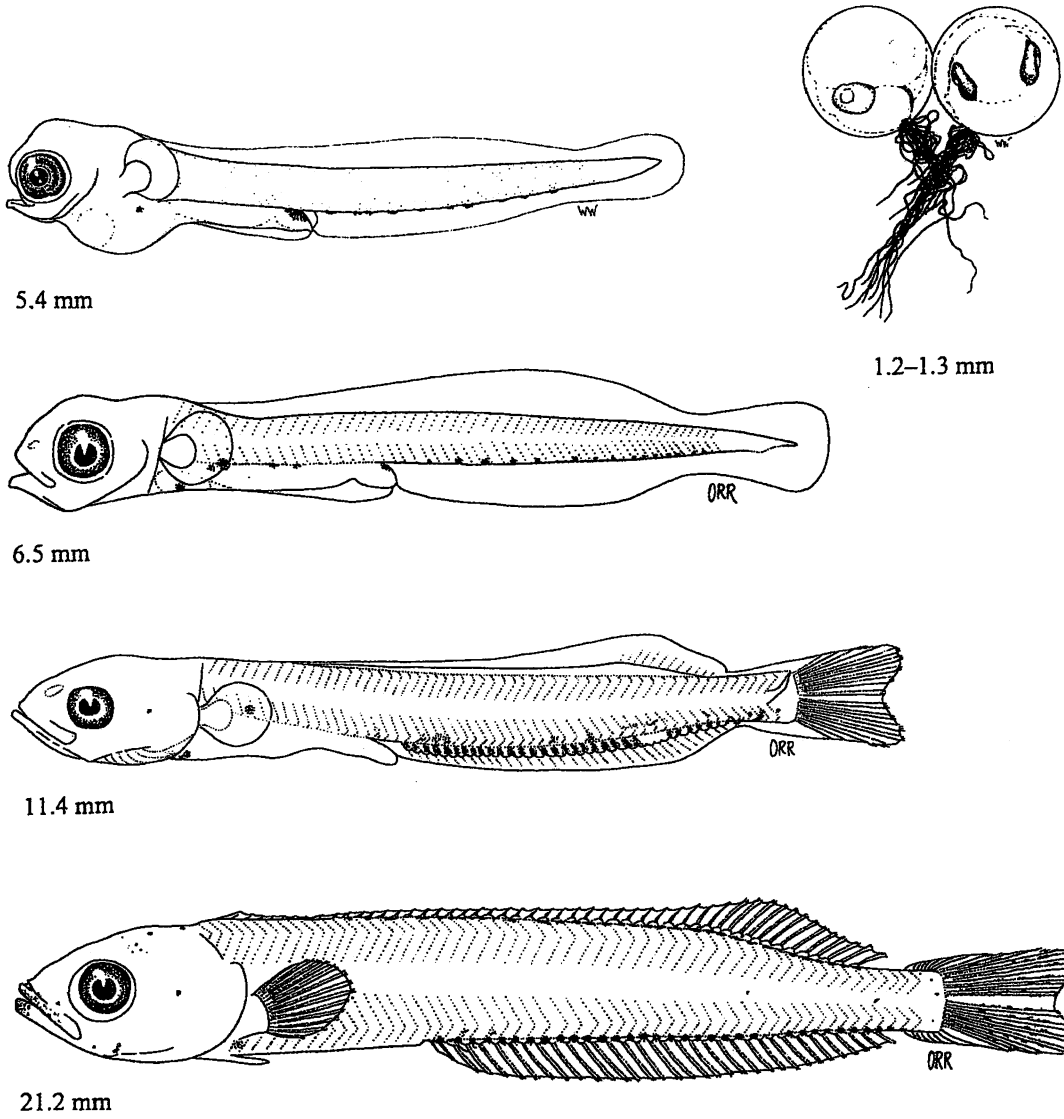
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, temperate to tropical Atlantic, Pacific and Indian oceans, most in temperate waters. |
| Relative abundance | Many common, some locally abundant. |
| Adult habitat | Benthic, intertidal to shallow subtidal on rocky reefs and algal beds, some on sandy bottom. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Clinini and Ophiclinini genera are ovoviviparous, myxodin genera (*Clinitrachus, Gibbonsia, Heterostichus, Myxodes, Ribeiroclinus*) are oviparous, with demersal, attached eggs; larvae are planktonic. |
| Knowledge of ELH | Eggs known for *Heterostichus rostratus*, larvae known for myxodin genera *Clinitrachus, Heterostichus, Gibbonsia*, and the clinin genus *Heteroclinus.* |
| ELH characters: | **Eggs:** spherical, 1.2–1.4 mm diameter; cluster of long filaments at basal pole; yolk green to purple, with 1 oil globule ca. 0.3 mm.<br><br>**Larvae:** myxodin larvae hatch at ca. 5–6 mm, notochord flexes at ca. 6–10 mm, settlement is at ca. 15–45 mm; clinin larvae are born at post-flexion stage, ca. 8–10 mm; all are elongate, slender, compressed; gut uncoiled through flexion stage, coils during postflexion stage, reaches to ca.45–50% BL; gas bladder initially anterior to midgut, shifts posteriorly with development; no spines on head or pectoral girdle; myomeres ca. 38–75 (commonly 40's–50's), usually ca. 15–20 preanal myomeres; pigmentation light, usually only on gas bladder, gut, and ventral margin of tail until late postflexion stage. |
| Example species: | *Heterostichus rostratus* (N.E. Pacific, coastal British Columbia, Canada, to Baja California Sur, Mexico). |
| Meristics: | D: XXXIII–XXXVIII,11–13, A: II,31–35, P1: 12–14, P2: I,3 (thor.), V: 21–23+34–36=56–58, C: 7, 7+6, 6–7. |
| REFERENCES | Barnhart 1932, Coyer 1982, Gunn and Thresher 1991, Matarese et al. 1984, 1989, Padoa 1956b, Stepien 1986, Watson 1996r, 2009. |

Perciformes/Blennioidei/Clinidae
*Heterostichus rostratus*
from: Watson 1996r




5.4 mm

1.2–1.3 mm

6.5 mm

11.4 mm

21.2 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Gobiesocoidei (phylogenetic position of the suborder is uncertain: see Gosline 1970, Springer and Fraser 1976, Allen 1984, Patterson and Rosen 1989, Nelson 2006). |
| Families | **Gobiesocidae (Clingfishes)** |
| Number of genera | 43 |
| Number of species | approx. 140 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Primarily marine, temperate–tropical Atlantic, Pacific, and Indian oceans; some freshwater species. |
| Relative abundance | Relatively common. |
| Adult habitat | Small, demersal fishes, mostly intertidal to shallow subtidal but a few are deeper and a few enter freshwater; most occur in hard bottom, mangrove, or algal habitats, some associated with invertebrates. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous, with demersal, attached eggs usually guarded by parent, usually with planktonic larvae (larvae of some species may be demersal). |
| Knowledge of ELH | Eggs known for 15 genera, larvae known for 16 genera. |
| ELH characters: | **Eggs:** oval to hemispherical, ca. 0.7–1.9 mm in diameter; yolk granular, often yellow to orange (pink to purple, or green in some); 1–100 oil globules, usually condensing to 1, ca. 0.5 mm in diameter.<br><br>**Larvae:** hatch at ca. 2–7 mm with pigmented eyes, open mouth, small yolk sac; notochord flexes at ca. 4–8 mm, settlement at ca. 10 mm; moderately elongate and cylindrical to slightly compressed in preflexion stage, becoming broader by postflexion stage; broad, straight gut, extending to ca.50–75% BL; gas bladder anterior, may be prominent in preflexion stage; small to moderate head, becomes ventrally flattened in postflexion stage; pelvic disc forms during preflexion to early flexion stage; no spines on head or pectoral girdle, no fin-spines; myomeres ca. 24–78, commonly high 20's to mid-30's; pigmentation absent to heavy, commonly light to moderate initially, primarily on gut, often dorsally on head and trunk, or ventrally on tail, or laterally on trunk and/or anterior postanal myomeres, or in all locations, generally increasing to cover most of body in postflexion stage in most species, but disappearing in some. |

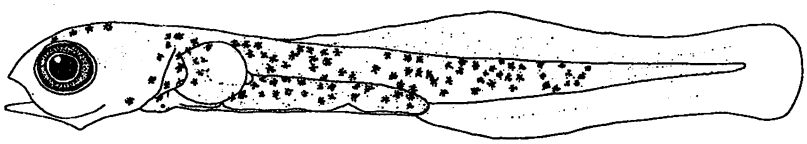
Example Species: *Gobiesox rhessodon* (coastal Eastern Pacific from central California to southern Baja California Peninsula).

Meristics: D: 10–12, A: 9–10, P1: 18–21, P2: I,4 (thor.), V: 13+15–16, C: 4–7, 5+5, 4–6.

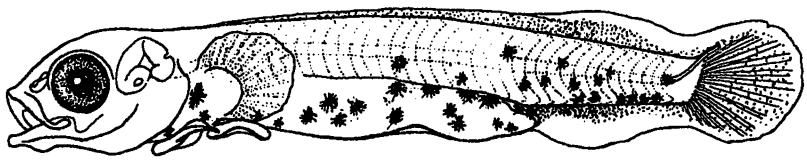
REFERENCES Allen 1979, 1984, Browder 2006, Fahay 2007b, Leis and Rennis 2000b, Martin and Drewry 1978, Olivar and Fortuño 1991, Perez 1981, Russell 1976, Shiogaki and Dotsu 1971a–c, 1972, Shiogaki et al. 1988, Watson 1996c.

Perciformes/Gobiesocoidei/Gobiesocidae

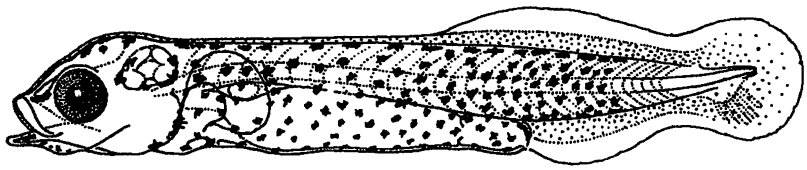
***Apletodon***
*A. microcephalus* 4.5 mm
(Allen 1984)



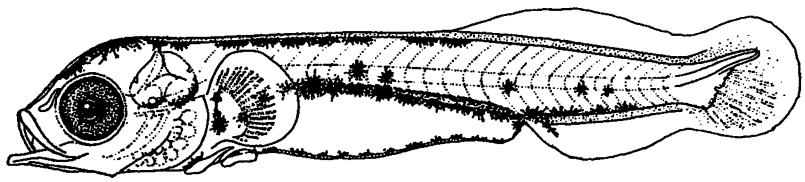
***Aspasma***
*A. minima* 6.8 mm
(Shiogaki and Dotsu 1971a)



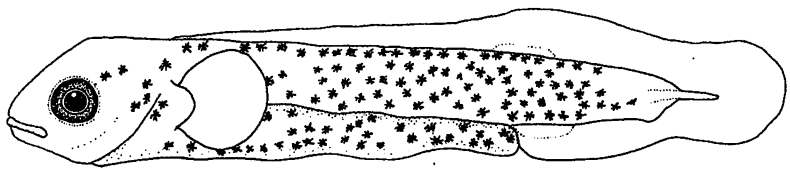
***Aspasmichthys***
*A. ciconinae* 6.9 mm
(Shiogaki and Dotsu 1972)



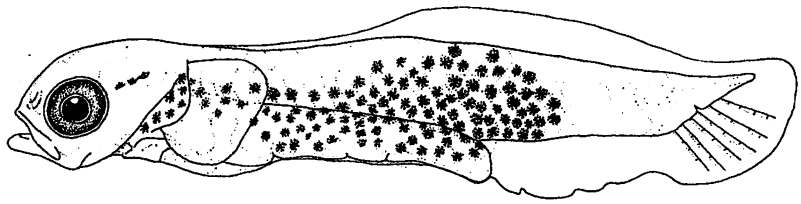
***Conidens***
*C. laticephalus* 5.5 mm
(Shiogaki and Dotsu 1971c)



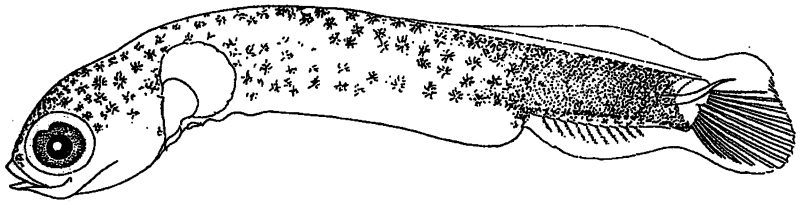
***Diplectogaster***
*D. bimaculata* 6.5 mm
(Allen 1984)



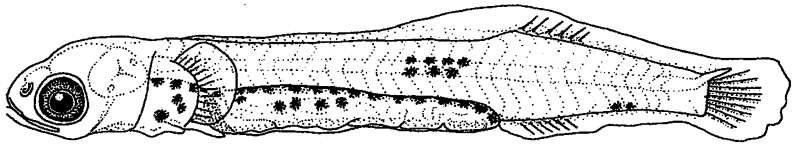
***Diplocrepis***
*D. puniceus* 7.7 mm
(Allen 1984)



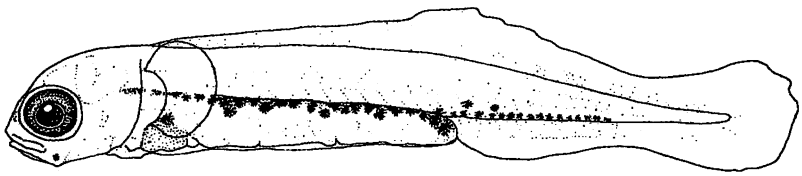
***Discotrema***
*D. crinophila* 5.3 mm
(Shiogaki et al. 1988)



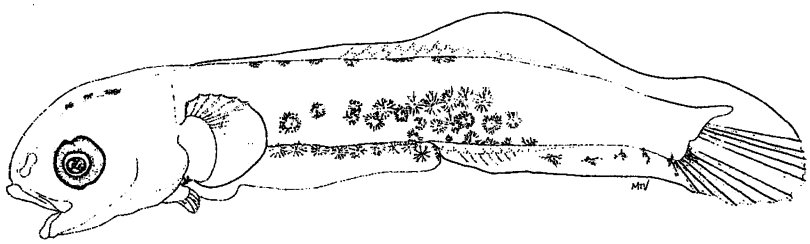
***Gastrocyanthus***
*G. gracilis* 6.9 mm
(Allen 1984)



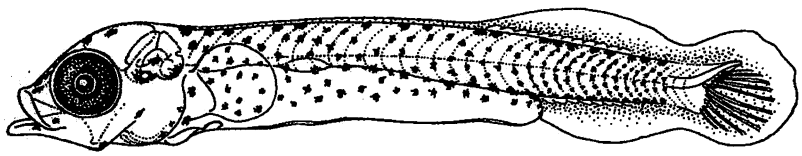
***Gastrocyphus***
*G. hectoris* 5.4 mm
(Allen 1984)



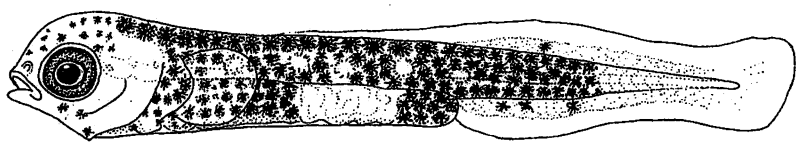
***Gobiesox***
*G. eugrammus* 7.5 mm
(Watson 1996c)



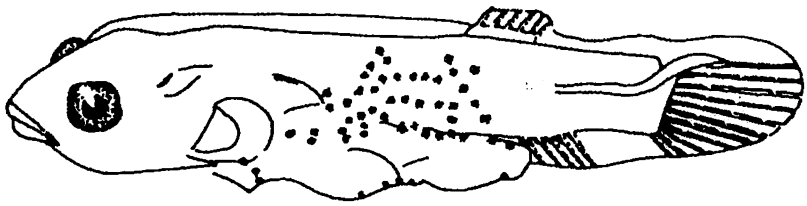
***Lepadichthys***
*L. frenatus* 7.3 mm
(Shiogaki et al. 1988)



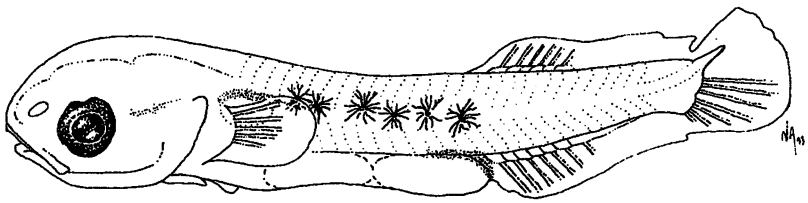
***Lepadogaster***
*L. lepadogaster* 6.0 mm
(Allen 1984)



***Leucanogaster***
*L. chrysea* 5.4 mm
(Olivar 1987b)

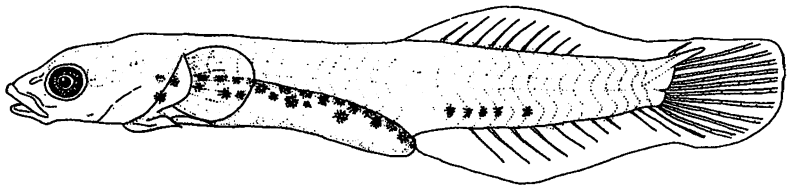


***Rimicola***
*R. eigenmanni* 4.4 mm
(Watson 1996c)

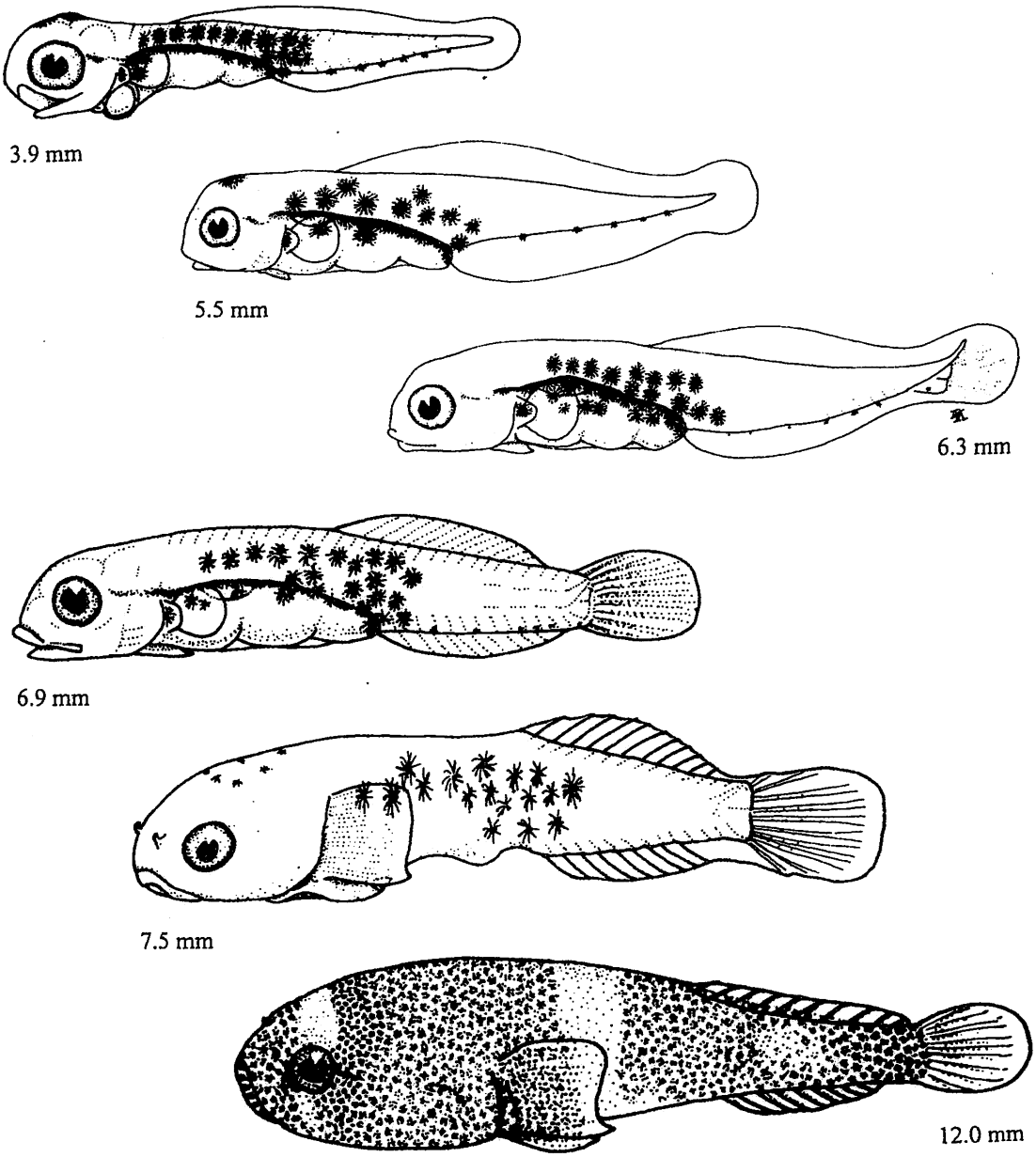


***Sicyases***
*S. sanguineous*
7.2 mm
(Perez 1981)

***Trachelochismus***
*T. melobesia* 7.8 mm
(Allen 1984)



Perciformes/Gobiesocoidei/Gobiesocidae
*Gobiesox rhessodon*
from: Watson 1996c



## Order Perciformes

| | |
|---|---|
| Suborder | Callionymoidei (phylogenetic position is not settled; the callionymoids sometimes are placed in a perciform suborder Gobiesocoidei, or in a separate order, Gobiesociformes, but currently most authors treat Callionymoidei and Gobiesocoidei as separate perciform suborders). |
| Number of Families | 2 (Callionymidae, Draconettidae) |
| Number of genera | approx. 22 (currently about 12 genera are recognized, e.g., Nelson 2006). |
| Number of species | approx. 194 |

GENERAL LIFE HISTORY

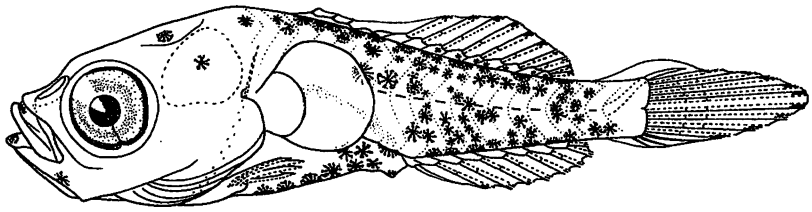
| | |
|---|---|
| Distribution | Marine, warm temperate to tropical waters of all seas but primarily Indo-Pacific, some may enter estuaries. |
| Relative abundance | Rare to common, depending on species. |
| Adult habitat | Benthic, primarily on soft bottom, to ca. 900 m depth. |

EARLY LIFE HISTORY

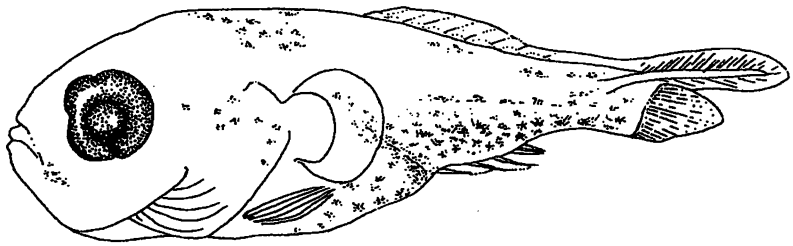
| | |
|---|---|
| Mode of reproduction | All are known or assumed to be oviparous, with planktonic eggs and larvae. |
| Knowledge of ELH | Eggs known for four genera (all callionymids), larvae known for six genera representing both families (most information is for Callionymidae). |
| ELH characters: | **Eggs:** spherical, ca. 0.5–1.0 mm in diameter; chorion with polygonal sculpturing or unornamented, depending on species; yolk may be weakly segmented; no oil globule.<br><br>**Larvae:** cylindrical to compressed in cross-section, becoming somewhat flattened in postflexion stage (Draconettidae remain compressed); gut coiled, reaching to approx. 50–70% BL; head moderately large, with rounded snout (more pointed in Draconettidae,) small mouth, moderate to large eyes; spines on one or more of opercular series bones by postflexion stage; myomeres 18–25, commonly 20–22; pigmentation light to heavy (moderate to heavy in most), commonly on head, gut, dorsal and ventral margins, and on lateral midline of tail. |
| Example species: | *Synchiropus atrilabiatus* (Callionymidae). |
| REFERENCES | Brownell 1979, Demir 1972, Fahay 2007b, Hartel and Nakabo 2002, 2006, Houde 1984b, Leis and Rennis 2000c, Miller et al. 1979, Mito 1962, Nakabo and Hartel 2000, Olney and Sedberry 1983, Powell and Greene 2000, 2006, Russell 1976, Sadovy et al. 2001, Takita 1980, 1983, Takita and Kojima 1988, Watson 1996t. |

Perciformes/Callionymoidei/Callionymidae

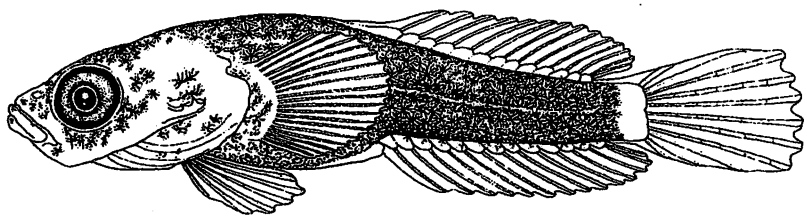
***Callionymus***
*C. decoratus*
4.1 mm
(Miller et al. 1979)



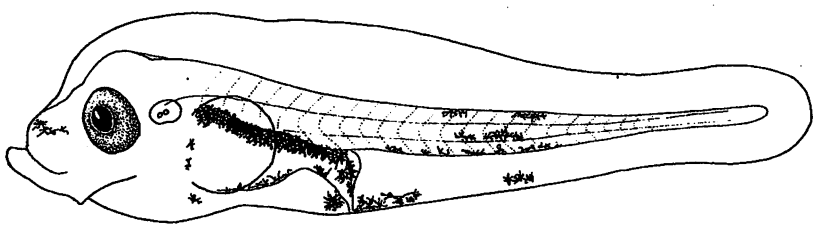
***Diplogrammus***
*D. pauciradiatus*
2.5 mm
(Olney and Sedberry 1983)



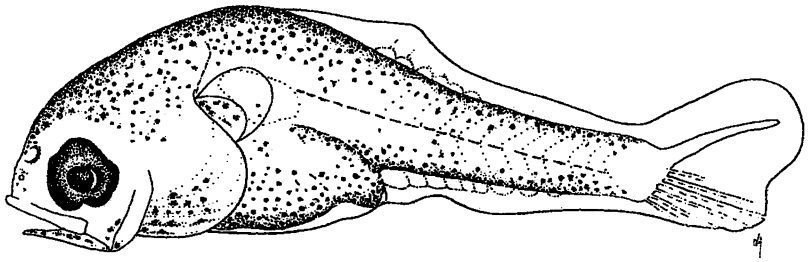
***Eleutherochir***
*E. mirabilis*
6.1 mm
(Takita and Kojima 1988)



***Paracallionymus***
*P. costatus* 2.3 mm
(Brownell 1979)

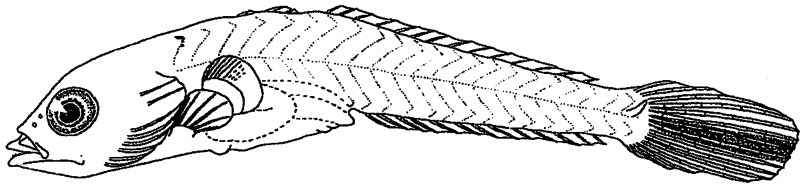


***Synchiropus***
*S. atrilabiatus*
4.1 mm
(Watson 1996t)



Perciformes/Callionymoidei/Draconettidae

***Centrodraco***
*C. acanthopoma*
8.6 mm
(Hartel and
Nakabo 2002)



**Order Perciformes**

| | |
|---|---|
| Suborder | Callionymoidei |
| Family | **Callionymidae (Dragonets)** |
| Number of genera | approx. 20 (number of genera and placement of species in genera are not settled; currently 10 genera are recognized, e.g., see Fricke 1983, 2002, Nakabo 1982, Nelson 2006). |
| Number of species | approx. 182 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, warm temperate to tropical waters of all seas, some enter estuaries; most species are in the Indo-West Pacific. |
| Relative abundance | Relatively common; some are popular in the aquarium trade. |
| Adult habitat | Small, demersal residents primarily of soft bottom but also may occur on coral rubble or rocky bottom, to ca. 900 m depth (most < 400 m depth). |

EARLY LIFE HISTORY

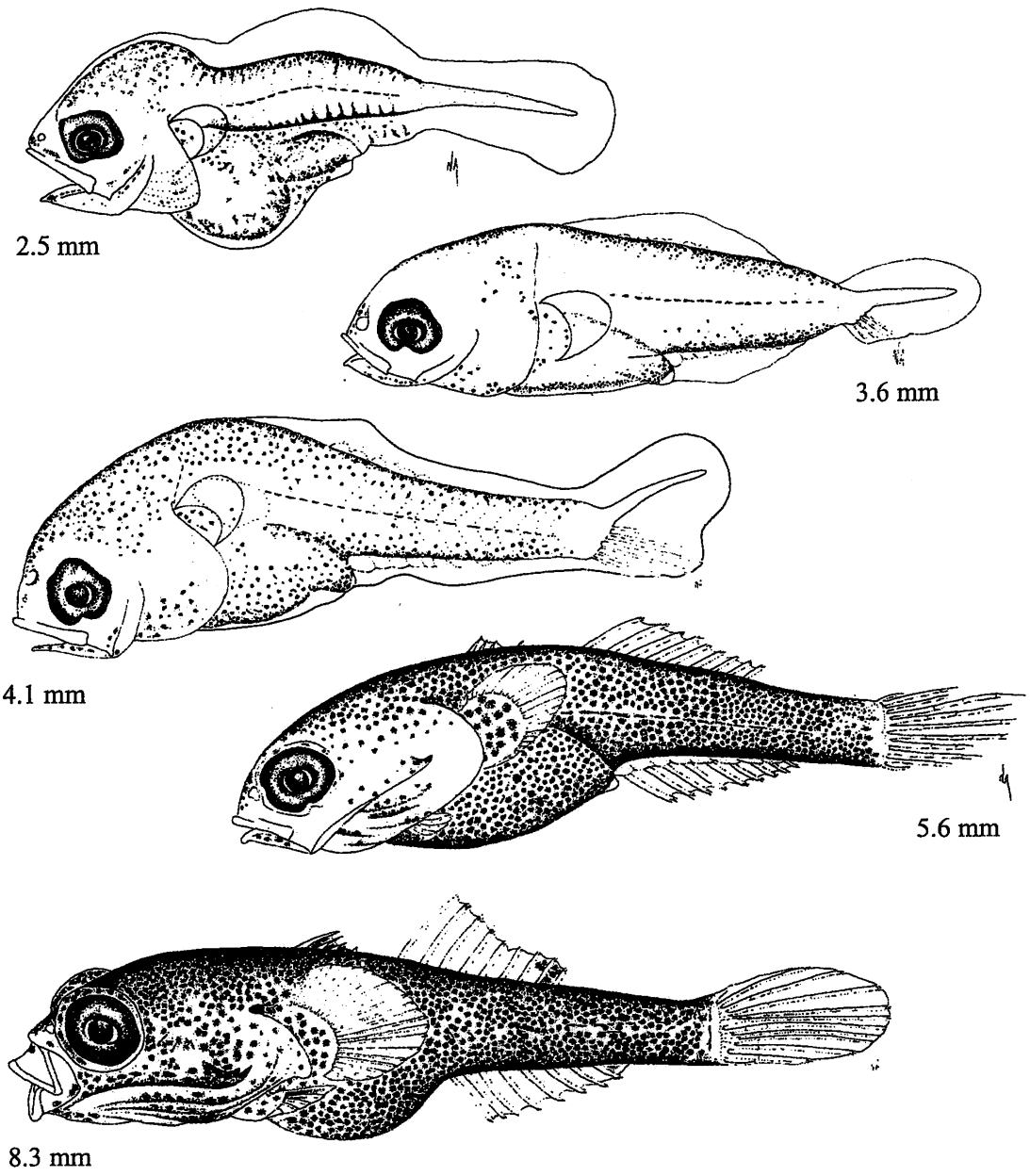
| | |
|---|---|
| Mode of reproduction | Oviparous, with planktonic eggs and larvae. |
| Knowledge of ELH | Eggs known for *Callionymus*, *Calliurichthys*, *Paradiplogrammus*, *Repomucenus*; larvae known for *Callionymus*, *Diplogrammus*, *Eleutherochir*, *Paracallionymus*, *Synchiropus*. |
| ELH characters: | **Eggs:** spherical, ca. 0.5–1.0 mm in diameter; chorion with polygonal sculpturing or unornamented, depending on species; yolk may be weakly segmented; no oil globule; *Paradiplogrammus* eggs initially in buoyant mass that breaks up before hatching, others with single eggs.<br><br>**Larvae:** hatch at 1–2 mm with large yolk sac, unpigmented eyes, lacking functional mouth, notochord flexes at 2–5 mm, settlement at ca. 8–12 mm; cylindrical to compressed in cross-section, becoming somewhat flattened in postflexion stage; head moderately large, with rounded snout, small mouth, moderate to large eyes; prominently elongated notochord tip is conspicuous through early postflexion stage; prominent preopercular spine forms during flexion or early postflexion stage and may develop accessory hooks or other ornamentation in postflexion stage; myomeres 18–25; pigmentation usually moderate to heavy, nearly always present on at least head, gut, dorsal and ventral margins, and lateral midline, usually increases with larval development. |
| Example species: | *Synchiropus atrilabiatus* (coastal eastern Pacific from southern Baja California Peninsula to Ecuador). |

Meristics: D: IV+9–10, A: 8–9, P1: 19–24, P2: I,5 (thor.), V: 7+14=21, C: 2–3, 5+5, 2.

REFERENCES

Brownell 1979, Demir 1972, Fahay 2007b, Houde 1984b, Leis and Rennis 2000b, Miller et al. 1979, Mito 1962, Olney and Sedberry 1983, Powell and Greene 2000, 2006, Russell 1976, Sadovy et al. 2001, Takai and Yoshioka 1979, Takita 1980, 1983, Takita and Kojima 1988, Watson 1996t.

Perciformes/Callionymoidei/Callionymidae
*Synchiropus atrilabiatus*
from: Watson 1996t



Chapter 16

## Order Perciformes

| | |
|---|---|
| Suborder | Gobioidei (gobioid monophyly is accepted but relationships and placement of taxa within the suborder are not settled, e.g., Birdsong et al. 1988, Hoese and Gill 1993, Nelson 2006, Winterbottom 1993). |
| Families | 9 (Rhyacichthyidae, Odontobutidae, Eleotridae, Gobiidae, Kraemeriidae, Xenisthmidae, Microdesmidae, Ptereleotridae, Schindleriidae) |
| Number of genera | approx. 274 |
| Number of species | approx. 2211 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Temperate–tropical seas, intertidal to deep shelf, estuarine and freshwater. |
| Relative abundance | Many species are abundant; larvae commonly are abundant in coastal ichthyoplankton samples. |
| Adult habitat | Primarily benthic on soft to hard bottom, mangrove, and algal habitats. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous; at least most with demersal, attached eggs; larvae are planktonic. |
| Knowledge of ELH | Eggs and larvae known for numerous taxa, primarily gobiids; ELH stages unknown for Rhyacichthyidae. |
| ELH characters: | **Eggs:** spherical to elliptical, often club- or pear-shaped, length ca. 0.4–5.8 mm (most < 2 mm long), diameter ca. 0.2–1.3 mm; adhesive filaments usually present at basal pole, but lacking in some; commonly one to several oil globules, but some lack oil globules.<br><br>**Larvae:** commonly hatch with partially to fully pigmented eyes, open mouth, and small yolk sac, but some hatch with unpigmented eyes, unformed mouth, moderately large yolk sac; slightly to moderately compressed, somewhat to very elongate; gut initially straight in most, subsequently coils or folds in eleotrids and some gobiids, ca. 40–70% BL initially (commonly ca. 50–60% BL); gut coiled throughout development in amblyopine gobiids and xenisthmids, may be as short as 33% BL in amblyopines; gas bladder typically prominent, near mid-gut, moves posteriorly with larval development in some; head commonly moderate to small, with short, rounded snout that elongates and becomes more acute, mouth small to moderate, eye moderate to large, becoming relatively smaller in postflexion stage of some taxa; no spines on head or pectoral girdle except in Xenisthmidae; myomeres ca. 24–76, commonly 20's–30's; pigmentation absent to heavy, commonly light, with mel- |

anophores on gas bladder, gut, and ventral margin of tail, often on isthmus, internally on head, and on dorsal margin, most commonly posteriorly.

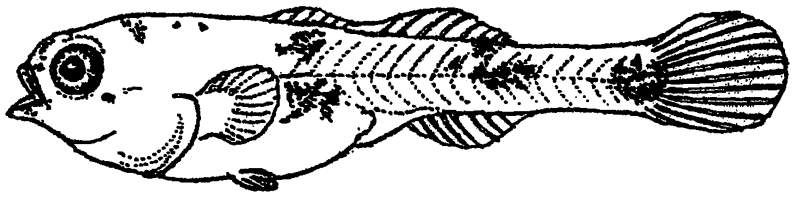
Example species: *Clevelandia ios* (Gobiidae), *Xenisthmus* sp. (Xenisthmidae), *Microdesmus* sp. (Microdesmidae), *Schindleria praematura* (Schindleriidae).

REFERENCES

Beltrán-León and Herrera 2000, Dotsu et al. 1988, Dôtu and Fujita 1959, Dufour and Iglésias 2000, Fahay 2007b, Fritzsche 1978, Gehrke and Neira 1998, Leis and Carson-Ewart 2000b, c, d, Leis and Rennis 2000k, l, Leis and Trnski 2000a, Leis et al. 1993, Neira and Miskiewicz 1998b, Ruple 1984, Russell 1976, Smith and Thacker 2000, Watson 1996u, Watson and Walker 2006, Watson et al. 2001, 2006, Yeung and Ruple 2006a, b.

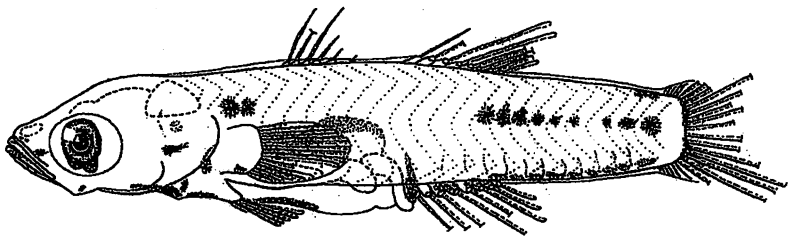
Perciformes/Gobioidei/Odontobutidae

***Odontobutis***
*O. obscura* 7.0 mm
(Dotsu et al. 1988)

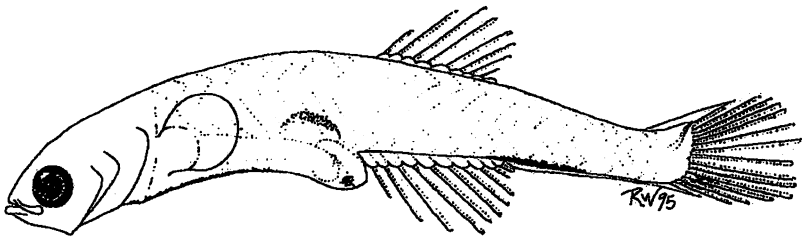


Perciformes/Gobioidei/Eleotridae

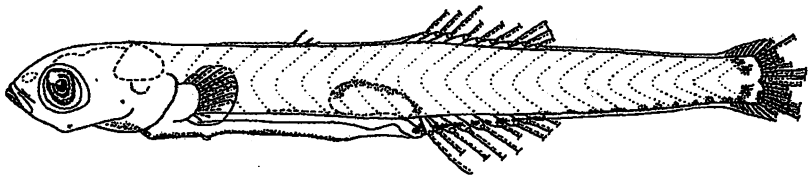
***Calumia***
*C. godeffroyi* 7.4 mm
(Leis and Carson-Ewart 2000b)



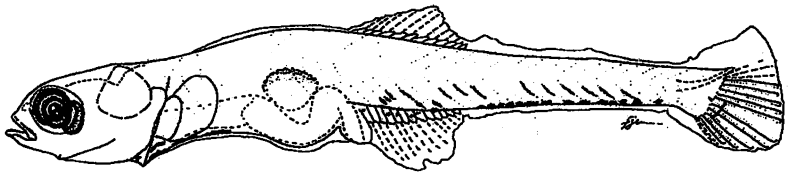
***Dormitator***
*D. latifrons* 3.5 mm
(Watson 1996u)



***Eleotris***
*E.* sp. 7.9 mm
(Leis and Carson-Ewart 2000b)

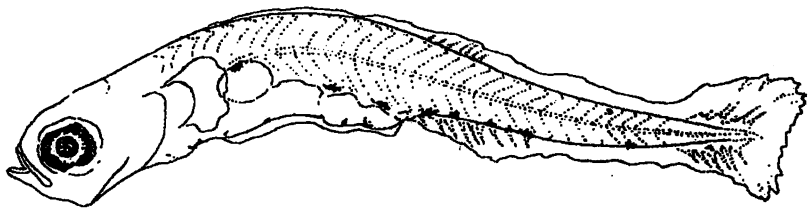


***Hypseleotris***
*H.* sp. 5.6 mm
(Gehrke and Neira 1998)

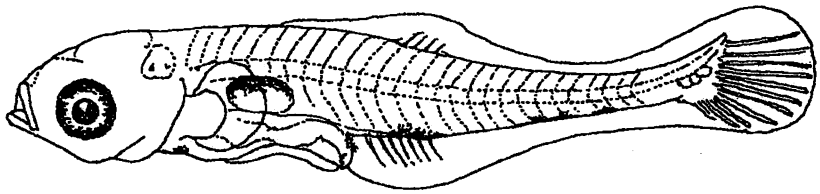


Perciformes/Gobioidei/Gobiidae

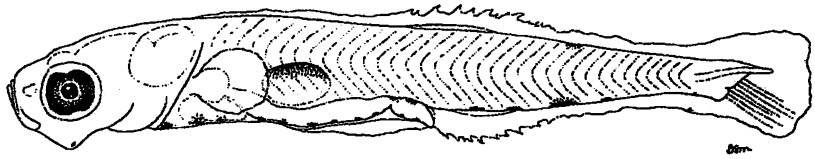
***Acanthogobius***
*A. flavimanus* 4.9 mm
(Dôtu and Mito 1955)



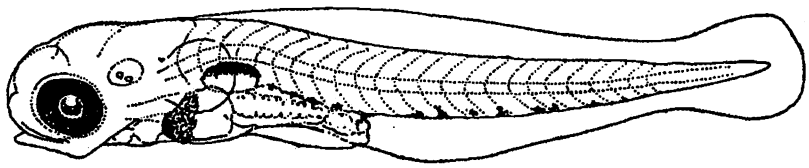
***Asterropteryx***
*A. semipunctatus*
3.6 mm
(Dotsu et al. 1988)



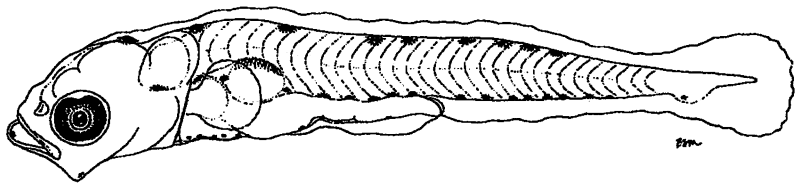
***Clevelandia***
*C. ios* 5.1 mm
(Watson 1996u)



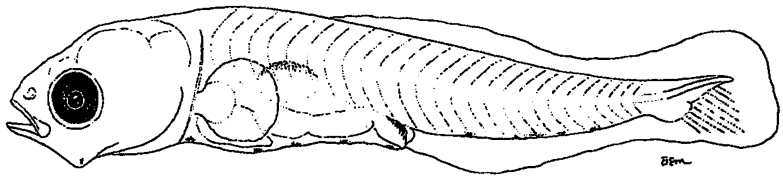
***Eviota***
*E. storhtynx* ca. 2 mm
(Dotsu et al. 1988)



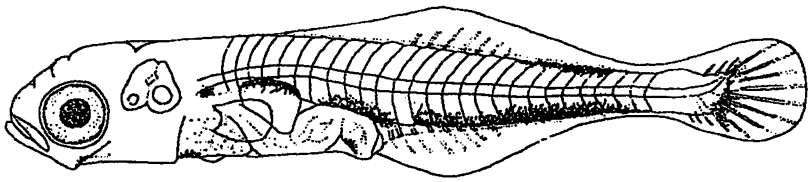
***Gillichthys***
*G. mirabilis* 4.6 mm
(Watson 1996u)



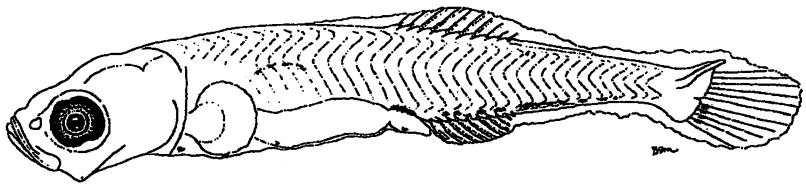
***Gobulus***
*G. crescentalis* 3.9 mm
(Watson 1996u)



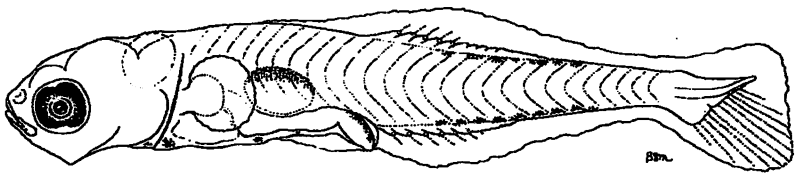
***Istiogobius***
*I. hoshinonus* 3.9 mm
(Dotsu et al. 1988)



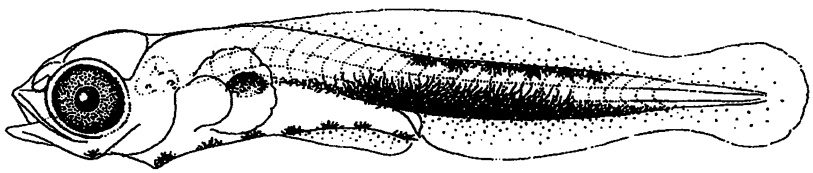
***Lepidogobius***
*L. lepidus* 6.4 mm
(Watson 1996u)



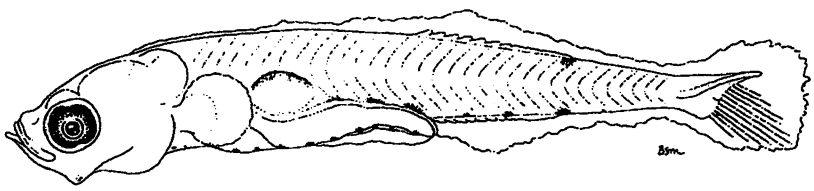
***Lythrypnus***
*L. zebra* 5.0 mm
(Watson 1996u)



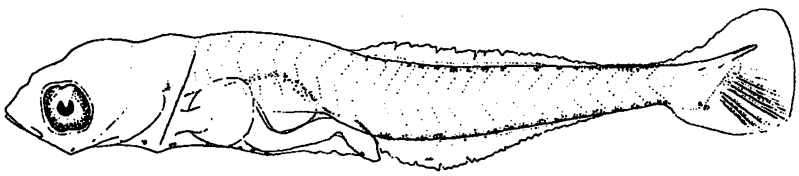
***Priolepis***
*P. boreus* 2.5 mm
(Dotsu et al. 1988)



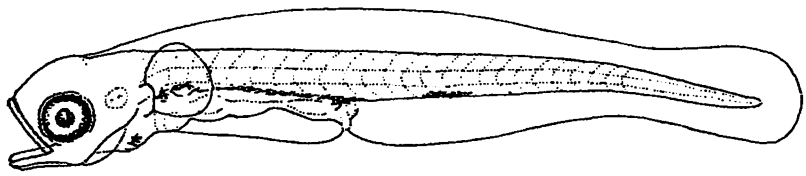
***Quietula***
*Q. y-cauda* 5.3 mm
(Watson 1996u)



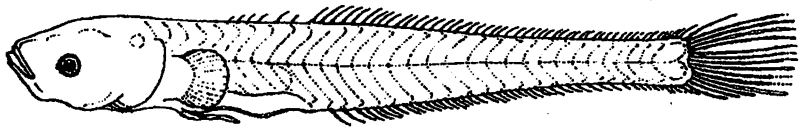
***Rhinogobiops***
*R. nicholsii* 5.6 mm
(Watson 1996u)



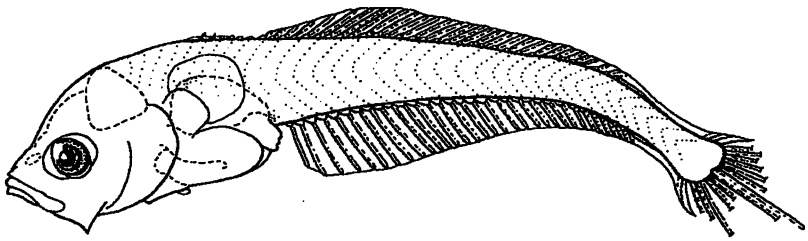
***Sicyopterus***
*S. japonicus*
ca. 2 mm
(Dotsu et al. 1988)



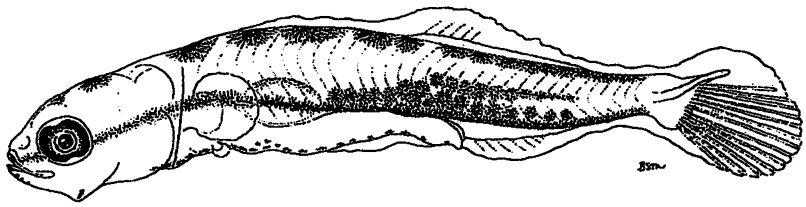
***Taenioides***
*T. cirratus* 9.3 mm
(Dotsu et al. 1988)



***Trypauchen***
*T.* sp. 6.2 mm
(Leis and Rennis
2000k)

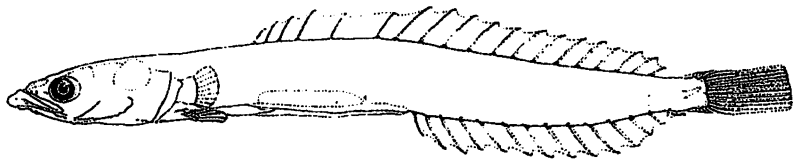


***Typhlogobius***
*T. californiensis* 5.8 mm
(Watson 1996u)



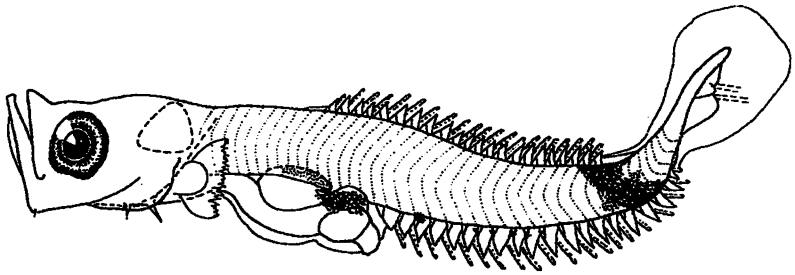
Perciformes/Gobioidei/Kraemeriidae

***Kraemeria***
*K. samoensis* 10.2 mm
(Dufour and Iglésias 2000)

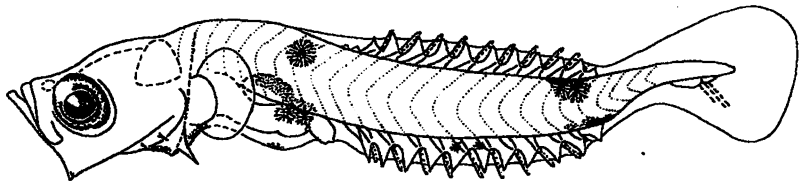


Perciformes/Gobioidei/Xenisthmidae

***Allomicrodesmus***
*A.* sp. 3.4 mm
(Leis et al. 1993)

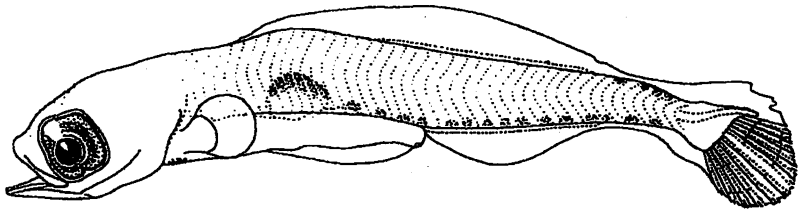


***Xenisthmus***
*X.* sp. 3.3 mm
(Leis at al. 1993)

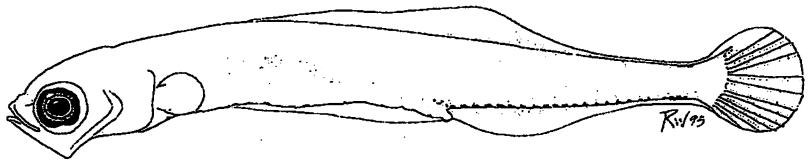


Perciformes/Gobiodei/Microdesmidae

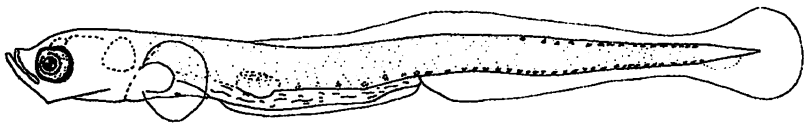
***Cerdale***
*C. floridana* 3.6 mm
(Watson et al. 2006)



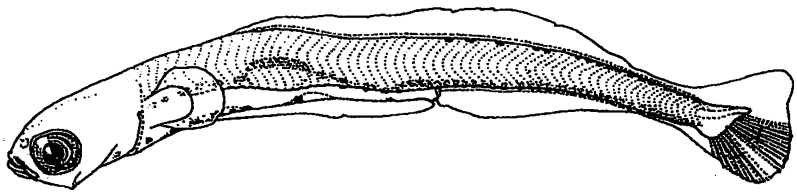
***Clarkichthys***
*C. bilineatus* 4.0 mm
(Watson 1996u)



***Gunnellichthys***
*G.* sp. 4.3 mm
(Leis and Rennis 2000l)

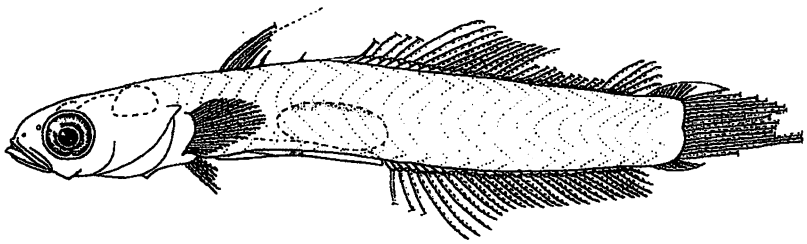


***Microdesmus***
*M. longipinnis* 4.6 mm
(Watson et al. 2006)

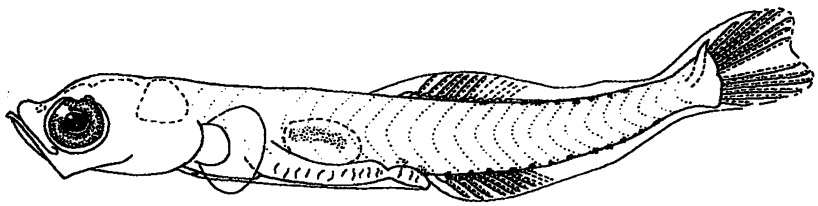


Perciformes/Gobioidei/Ptereleotridae

***Nemateleotris***
*N.* sp. 15.7 mm
(Leis and Rennis 2000l)

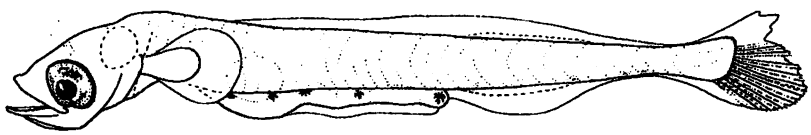


***Ptereleotris***
*P. microlepis* 4.3 mm
(Leis and Rennis 2000l)



Perciformes/Gobioidei/Schindleriidae

***Schindleria***
*S. praematura*
2.9 mm
(Watson 2000b)



## Order Perciformes

| | |
|---|---|
| Suborder | Gobioidei |
| Family | **Gobiidae (Gobies)** |
| Number of genera | > 210 |
| Number of species | > 1950 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Worldwide in temperate to tropical waters, predominantly tropical and subtropical, predominantly marine. |
| Relative abundance | Many species are abundant; some are utilized in artisanal fisheries; larvae often are common in coastal ichthyoplankton samples. |
| Adult habitat | Benthic on soft to hard bottom, intertidal to deep shelf, in algal and mangrove habitats, many estuarine and freshwater species. |

EARLY LIFE HISTORY

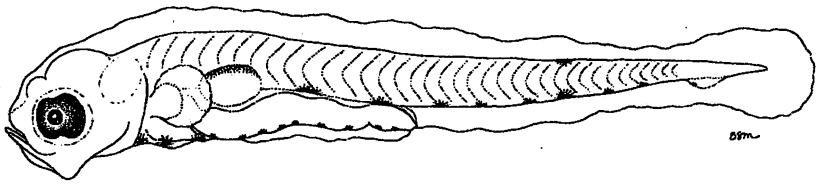
| | |
|---|---|
| Reproduction | Oviparous, with demersal, attached eggs and planktonic larvae. |
| Knowledge of ELH | Eggs and larvae known for many genera, e.g., eggs: *Acanthogobius, Clevelandia, Gillichthys, Ilypnus, Lythrypnus, Rhinogobius, Tridentiger*; larvae: *Acentrogobius, Coryphopterus, Eucyclogobius, Favonigobius, Gobius, Luciogobius, Microgobius, Pseudogobius, Redigobius.* |
| ELH characters: | **Eggs:** elliptical, ca. 0.2–1.3 mm X 0.4–5.8 mm; adhesive filaments at basal pole; 1–several oil globules.<br><br>**Larvae:** elongate, slightly to moderately compressed; gut straight in most taxa but fold forms posteriorly in some, gut coiled in amblyopines, ca. 45–60% BL in most gobiids but ca. 33% BL in amblyopines; prominent gas bladder over mid-gut vicinity; small to moderate head with short, rounded snout that elongates somewhat, usually becomes more acute; moderate to large eyes, become relatively small in postflexion stage of some taxa; no spines on head or pectoral girdle; myomeres ca. 24–38, commonly mid-20's in subtropical-tropical taxa and 30's in temperate taxa; pigmentation light to heavy, commonly light to moderate, primarily on gas bladder, gut, and ventrum, many taxa with melanophores dorsally on trunk and/or tail, some with melanophores internally and/or externally on head, laterally on body. |
| Example species: | *Clevelandia ios* (coastal Eastern Pacific, British Columbia to southern Baja California Peninsula). |
| Meristics: | D: IV–VI+0–I, 14–17, A: 0–I,13–17, P1: 18–21, P2: I, 5 (thor.), V: |

15+21–22=36–37, C: 8–11, 8+7, 7–11.

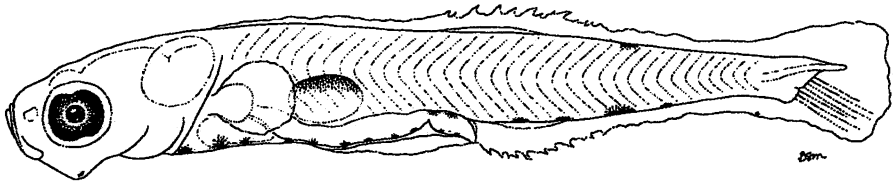
REFERENCES

Beltrán-León and Herrera 2000, Dotsu et al. 1988, Fahay 2007b, Fritzsche 1978, Leis and Rennis 2000k, Leis and Trnski 2000a, Neira and Miskiewicz 1998b, Ruple 1984, Russell 1976, Watson 1996u, Yeung and Ruple 2006a.

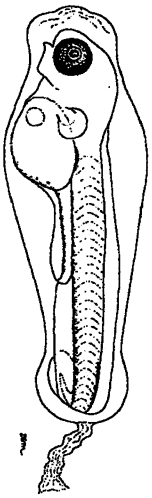
Perciformes/Gobioidei/Gobiidae
*Clevelandia ios*
from: Watson 1996u



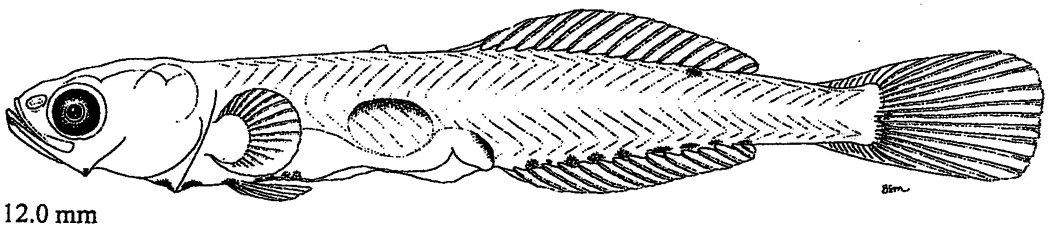
3.8 mm



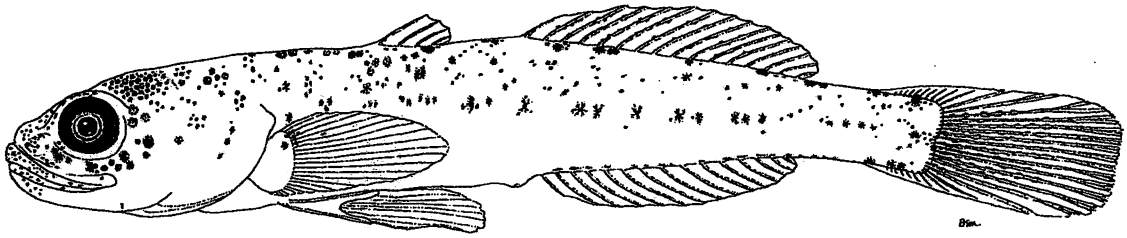
5.1 mm



2.5 mm



12.0 mm



14.9 mm

**Order Perciformes**

| | |
|---|---|
| Suborder | Gobioidei |
| Family | **Xenisthmidae (Wrigglers)** |
| Number of genera | 6 (*Allomicrodesmus, Kraemericus, Paraxenisthmus, Rotuma, Tyson, Xenisthmus*). |
| Number of species | 13 |

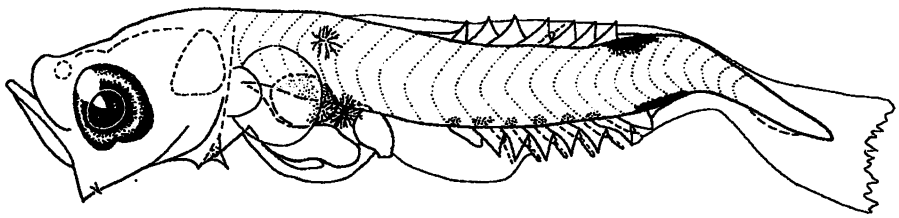
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Indo-Pacific, marine. |
| Relative abundance | Apparently rare to common, depending on species. |
| Adult habitat | Benthic, on sandy bottom near reefs and reef rubble, dive into sand. |

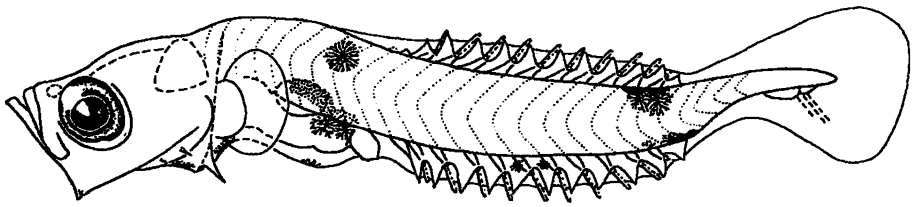
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Spawning mode unknown, planktonic larvae. |
| Knowledge of ELH | Eggs unknown, larvae known for *Allomicrodesmus* and *Xenisthmus*. |
| ELH characters: | **Eggs:** unknown. |
| | **Larvae:** elongate, compressed; gut typically just under 50% BL in preflexion stage, lengthening to just over 50% BL in postflexion stage, single coil posteriorly; gas bladder prominent, moves from mid-gut vicinity initially to near posterior end of gut by postflexion stage; head moderate with short snout, strongly oblique mouth, large eyes that become relatively smaller with development; many head spines, all ventral: on quadrates, cleithra, branchiostegal rays; dorsal- and anal-fin pterygiophores with prominent, triangular blades; dorsal- and anal-fin rays form early, during preflexion or early flexion stage; myomeres 26–27, 9–11 preanal, except 41–44 total and 16–19 preanal in *Allomicrodesmus*; pigmentation light, near cleithral symphysis, on gas bladder, hindgut, ventral margin of tail, and in diagonal bar posteriorly on tail. |
| Example species: | *Xenisthmus* sp. (specimens from Australia, Great Barrier Reef vicinity). |
| Meristics: | D: VI+13, A: I,11, P1:_, P2:_, V: 10+16, C: 8+7. |
| REFERENCES | Leis and Carson-Ewart 2000d, Leis et al. 1993. |

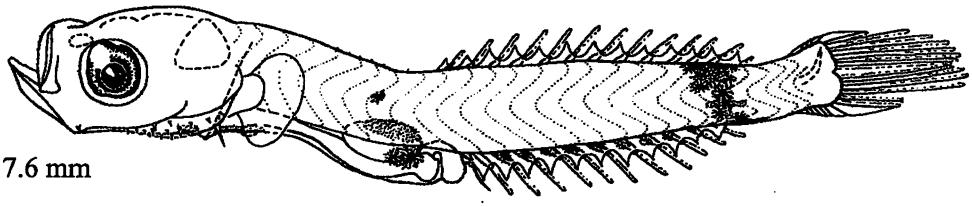
Perciformes/Gobioidei/Xenisthmidae
*Xenisthmus* sp.
from: Leis et al. 1993



2.4 mm



3.3 mm



7.6 mm

**Order Perciformes**

| | |
|---|---|
| Suborder | Gobioidei |
| Family | **Microdesmidae (Wormfishes)** |
| Number of genera | 5 (*Cerdale, Clarkichthys, Gunnellichthys, Microdesmus, Paragunnellichthys*) |
| Number of species | approx. 30 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Warm temperate to tropical seas. |
| Relative abundance | Some species are locally abundant. |
| Adult habitat | Benthic, near and on soft bottom, burrow into sediment; primarily in shallow coastal waters but occasionally estuarine. |

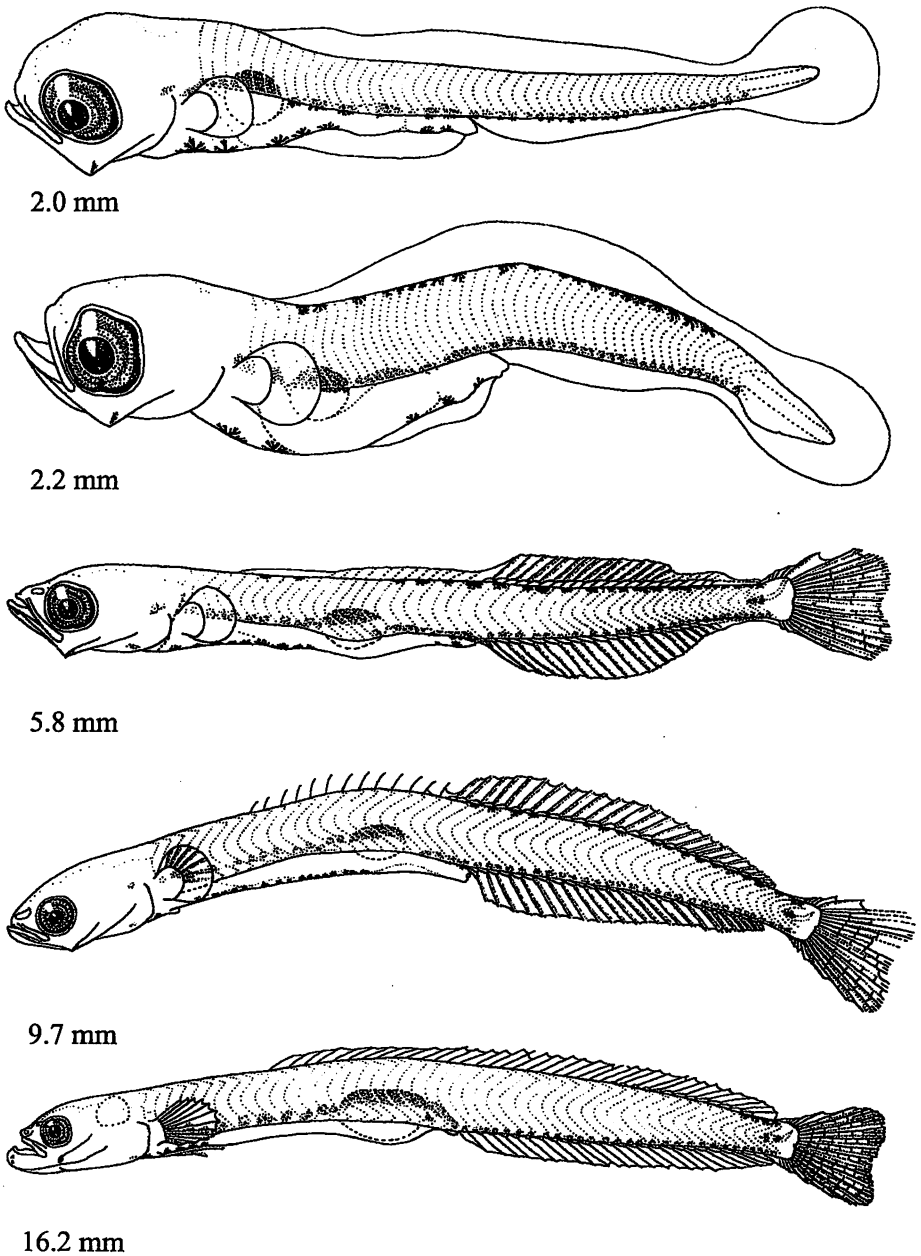
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous, eggs are demersal in at least two genera, larvae are planktonic. |
| Knowledge of ELH | Eggs known for *Clarkichthys* and *Gunnellichthys*, larvae known for all genera. |
| ELH characters: | **Eggs:** spherical to oval, 0.2–0.3 mm; demersal, but lack basal filaments.<br><br>**Larvae:** hatch near 2 mm with pigmented eyes, open mouth, small yolk sac, undergo notochord flexion at ca. 3–5 mm, settle at ca. 20–35 mm; somewhat compressed and elongate, becoming more elongate with development; gut straight, extending to ca. 50–60% BL; prominent gas bladder, moves from anteriorly above gut early in preflexion stage to near terminus by late postflexion stage; moderate head with short, rounded snout and large eyes initially, becomes relatively small with larger, moderately acute snout and relatively small eyes by postflexion stage; lower jaw extends beyond snout, becomes bulbous in postflexion stage; no spines on head or pectoral girdle; myomeres ca. 44–71; pigmentation light, on gas bladder, gut, and ventral margin of tail, often some posteriorly on dorsal margin, commonly spreading anteriorly through flexion stage, then retracting to caudal peduncle, commonly some on horizontal septum of caudal peduncle in postflexion stage. |
| Example species: | *Microdesmus bahianus* (Western Atlantic and Caribbean, Puerto Rico to Brazil). |
| Meristics: | D: IX–XII, 26–30, A: 24–28, P1: 10–12, P2: I, 3 (thor.), V: 21–26+25–26=46–52, C: 6–7, 7+6, 5–7. |

REFERENCES

Beltrán-León and Herrera 2000, Fahay 2007b, Leis and Rennis 2000l, Ruple 1984, Smith and Thacker 2000, Watson 1996u, Watson et al. 2001, 2006.

Perciformes/Gobioidei/Microdesmidae
*Microdesmus bahianus*
from: Watson et al. 2006u



## Order Perciformes

| | |
|---|---|
| Suborder | Gobioidei |
| Family | **Schindleriidae (Infantfishes; Schindler's Fishes)** |
| Number of genera | 1 (*Schindleria*) |
| Number of species | 3 (plus > 1 undescribed species). |

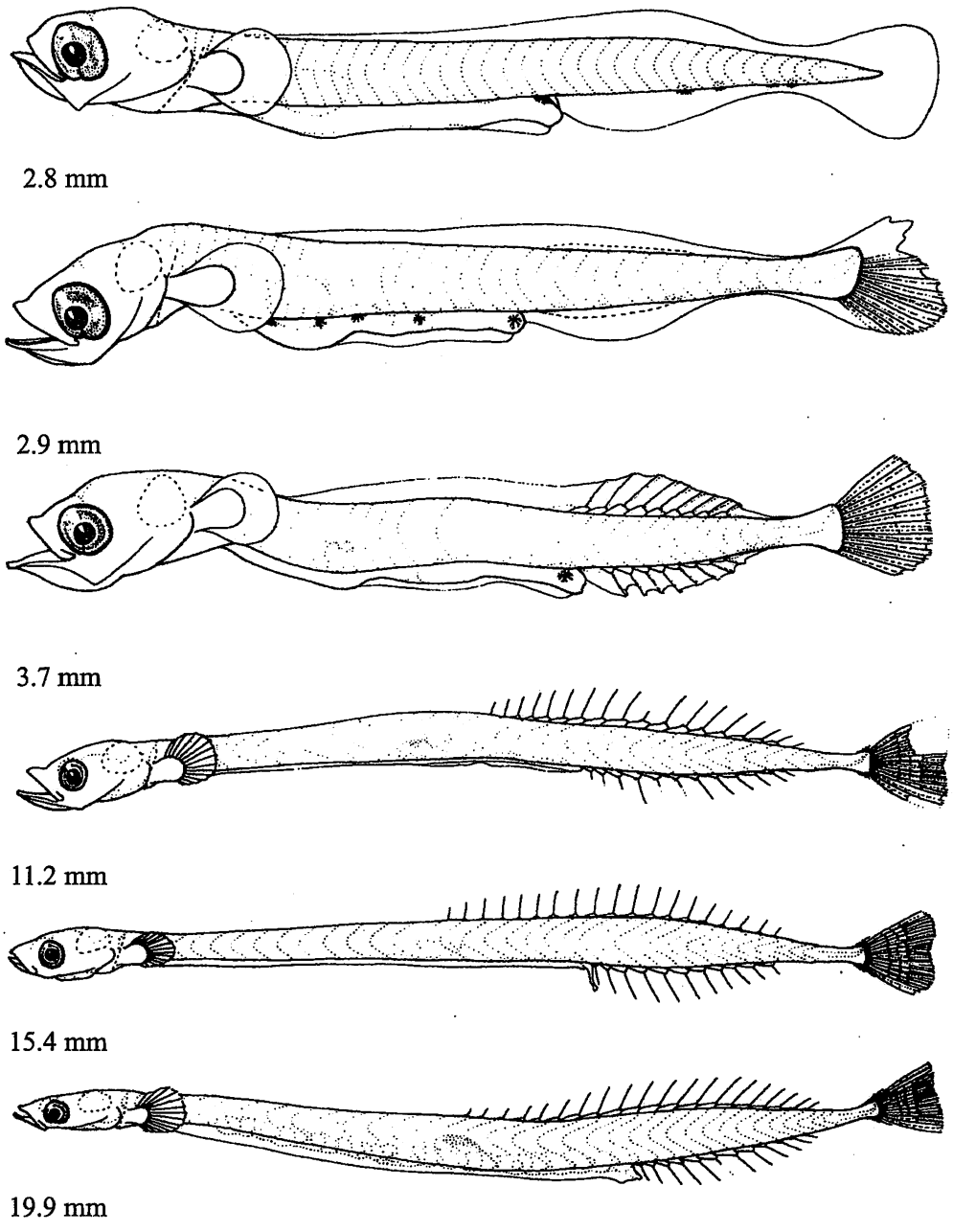
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, eastern Pacific through Indo-West Pacific. |
| Relative abundance | Can be locally very abundant around islands. |
| Adult habitat | Neritic, primarily around islands, common in coral reef lagoons, epibenthic during the day. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Mode of reproduction unknown, larvae planktonic. |
| Knowledge of ELH | Ovarian eggs known for all described species, larvae known for *S. pietschmanni* and *S. praematura.* |
| ELH characters: | **Eggs:** oval, > 0.3 mm by > 0.4 mm, up to ca. 1.3 mm long; no oil globule. |
| | **Larvae through adults:** paedomorphic, adults closely resemble postflexion stage larvae; compressed and elongate to very elongate; gut straight, ca. 50–70% BL, depending on species; gas bladder often prominent, moves posteriorly from over or anterior to mid-gut in preflexion stage to behind mid-gut in adults of *S. pietschmanni* and *praematura*; head small, initially with short, rounded snout that elongates somewhat, moderately large eyes that become relatively smaller; no spines on head or pectoral girdle; myomeres 31–44, 12–25 preanal; pigmentation absent to light, commonly on gas bladder and near terminus of gut, larvae often with a few additional melanophores more anteriorly along gut, often 1–few on ventral margin of tail in larvae, 0–1 in adults. |
| Example species: | *Schindleria praematura* (S. E. Pacific and Indo-Pacific). |
| Meristics: | D: 16–22, A: 10–14, P1: 15–17, P2: 0, V: 19–25+12–15=33–40, C: 5–6, 7+6, 5–6. |
| REFERENCES | Watson 2000b, Watson and Walker 2004, Watson et al. 1984. |

Perciformes/Gobioidei/Schindleriidae
*Schindleria praematura*
from: Watson 2000b



**Order Perciformes**

| | |
|---|---|
| Suborder | Acanthuroidei |
| Family | **Acanthuridae (Surgeonfishes)** |
| Number of genera | 6 |
| Number of species | about 75 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, all tropical and subtropical seas except Mediterranean. |
| Relative abundance | Locally very abundant. Of great artisanal and some commercial importance. |
| Adult habitat | Mostly on shallow reefs. Medium-sized herbivores, detritivores and carnivores. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae known for some species. |
| ELH Characters | **Eggs**: planktonic, 0.6–0.8 mm. |

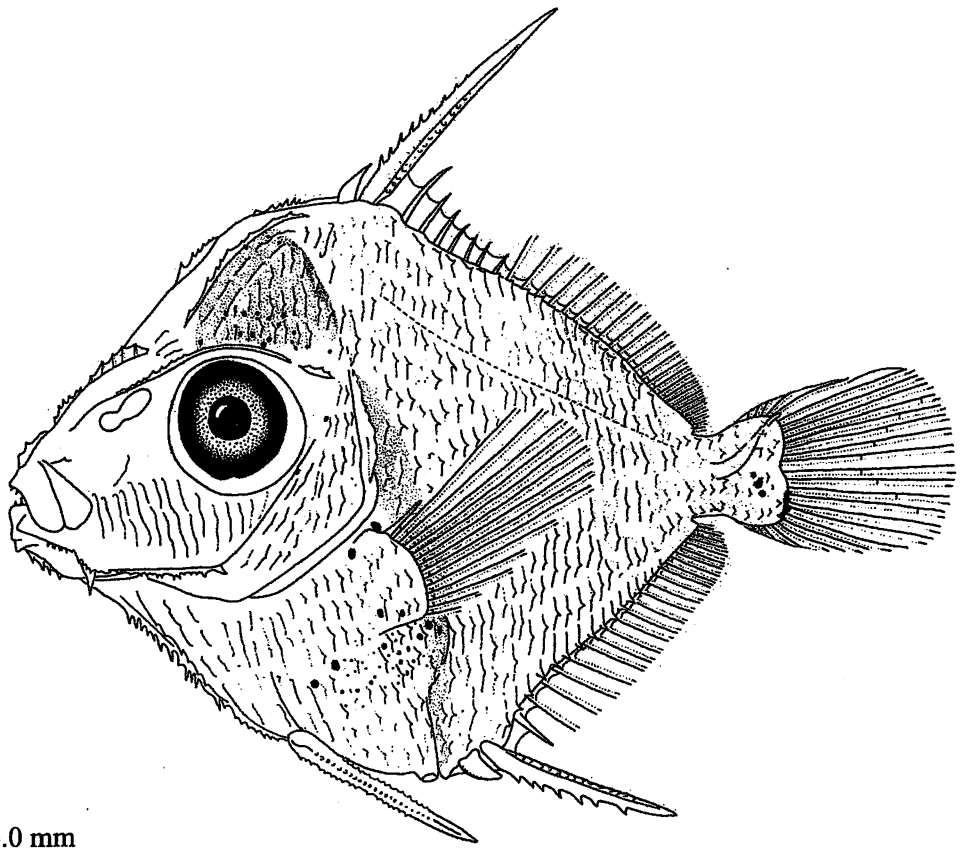
**Larvae:** Head and body very deep and very compressed, with coiled and compact gut. Body becomes kite-shaped at about flexion (body may become nearly as deep as long - D and A spines accentuate this). Preanal length 44–61% BL. 21–23 myomeres. Head moderate to large, long snout, brain case vaulted. Mouth small and horizontal. Head spination extensive, includes serrate ridges, but no elongate spines, on many bones of the head, pectoral and pelvic girdles. Notochord flexion at 3.5–4.5 mm. D sp 2, and P2 spine first fin elements to form at about 2.3 mm. Fin spines become elongate and strongly serrate, reaching maximum relative length at 12–17 mm. Soft fin rays form following flexion, with full fin complements present by 5–6 mm, except P2 at about 8 mm. Scales in the form of specialized lamina arrayed in vertical rows from about 5 mm. So-called acronurus stage begins with formation of caudal peduncle spine (a modified scale) at about 17 mm. Generally lightly pigmented, but localized areas of heavy pigment on brain and gut: following flexion, pigment spreads. Settlement at 20–60 mm.

| | |
|---|---|
| Example taxon: | *Acanthurus* sp. |
| Meristics (genus): | D: VI–IX, 22–33, A: III, 19–29, P1: 15–17, P2: I, 5, V: 9+13=22, C: 8+8. |

REFERENCES

Kuiter and Debelius 2001, Leis and Rennis 2000m, Leis and Richards 1984, Manabe and Ozawa 1988, Tyler et al. 1989.

Perciformes/Acanthuroidei/Acanthuridae
*Acanthurus* sp.
from: Leis and Richards 1984



6.0 mm

**Order Perciformes**

| | |
|---|---|
| Suborder | Scombroidei |
| Family | **Sphyraenidae (Barracudas)** |
| Number of genera | 1 |
| Number of species | 21 |

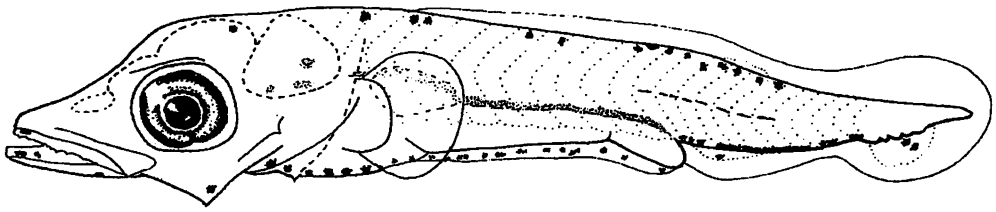
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, tropical and subtropical. |
| Relative abundance | Locally abundant. Of artisanal and commercial importance. |
| Adult habitat | Mostly in shallow, coastal waters: pelagic over reefs and nearby waters. Medium to large carnivores. |

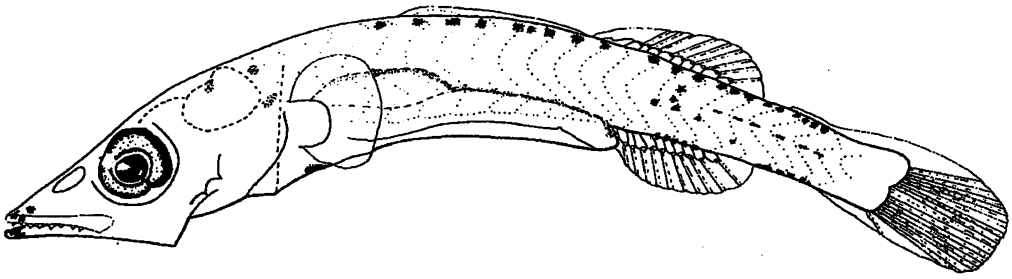
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae known for some species. |
| ELH Characters | **Eggs:** planktonic, 0.7–1.6 mm. |
| | **Larvae:** head and body elongate and slightly compressed to round in cross section, with straight, long gut. Preanal length 60–80% BL. 24 myomeres. Head initially of moderate size, but becomes large after 3 mm, and very large after flexion. Snout long and pointed. Mouth large to very large and horizontal with prominent teeth. Head spination limited to 1–2 small preopercular spines and a few small interopercular spines. Notochord flexion at 4.8–5.9 mm. Soft rays of D and A fins form at 5–6 mm, but weak spines of well separated D fin not formed until about 8 mm. Full complements of rays are present in all fins by about 16 mm. Scales form at about 23 mm. Moderate pigment usually consisting of prominent lines of melanophores on dorsal, ventral and often lateral surfaces of trunk, gut and tail. Pigment intensifies with growth. |
| Example taxon | *Sphyraena* sp. |
| Meristics (genus): | D: V+I,8–10, A: I–II,7–10, P1: 12–16, P2: I,5, V: 12–13+11–12=24, C: 9+8. |
| REFERENCES | de Sylva 1984, Johnson 1986, Kinoshita 1988a, Leis and Rennis 2000n, Sandknop and Watson 1996, Senou 2001. |

Perciformes/Scombroidei/Sphyraenidae
*Sphyraena* sp.
from: Leis and Rennis 2000n



4.5 mm



7.2 mm

**Order Perciformes**

| | |
|---|---|
| Suborder | Scombroidei |
| Family | **Scombridae (Mackerels, Tunas)** |
| Number of genera | 15 |
| Number of species | 49 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Marine, tropical to temperate. |
| Relative abundance | Abundant. Of immense artisanal and commercial importance. |
| Adult habitat | Epipelagic in coastal to oceanic marine waters, mainly tropical and subtropical. Medium to large carnivores. |

EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae known for most species. |
| ELH Characters | **Egg:** planktonic, 0.8–1.9 mm. |

**Larvae:** larval morphology, especially the head, varies among tribes. Head and body moderate to deep and compressed. Gut coiled, triangular to ovoid. Preanal length 38–65% BL in preflexion larvae and 53–81% BL in postflexion larvae. 31–64 myomeres. Gap between anus and anal fin moderate, not closing until late in postflexion stage. Head moderate to large, becoming relatively larger with BL. The snout and mouth vary greatly among species. In Scombrini moderate sized snout is rounded, and mouth moderate in size with medium-sized teeth. In Thunnini and Scomberomorini, large snout is pointed and mouth is large to very large with prominent teeth. Head spination absent in Scombrini, but in other tribes, preopercular spines well developed (but smooth), and other head spination may be present. Notochord flexion at 4.2–6.8 mm. In Scombrini, soft rays of D and A fins form first (following flexion), but in other tribes, D spines in first fin form either simultaneously or prior to the soft rays. Full rays complements present in all fins by 10–13 mm. Fin spines remain slender and smooth. Pigment light to moderate: usually melanophores on dorsal surfaces of head and gut, often with melanophores on ventral surface of tail, and in some species on dorsal surface as well. Pigment intensifies with growth.

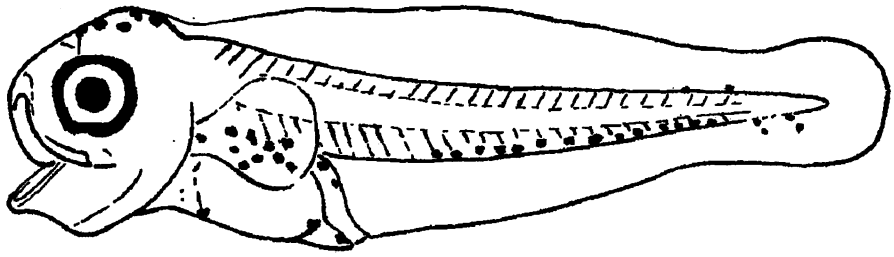
| | |
|---|---|
| Example species: | *Scomber japonicus.* |
| Meristics: | D: VIII–XIII+I, 9–14+4–6 finlets, A: I–II, 9–14+4–6 finlets, P1: 19–22, |

P2: I, 5, V: 13–15+16–18= 30–32, C: 10–11, 9+8, 10–12.

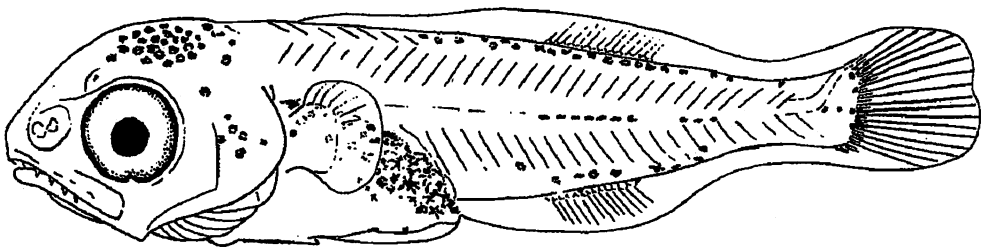
REFERENCES

Ambrose 1996q, Collette and Nauen 1983, Collette et al. 1984b, Johnson 1986, Ozawa 1988f, Richards and Jenkins 2000.

Perciformes/Scombroidei/Scombridae
*Scomber japonicus*
from: Ambrose 1996q



4.0 mm



7.8 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Stromateoidei |
| Family | **Nomeidae (Driftfishes)** |
| Number of genera | 3 |
| Number of species | 15 |

GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Oceanic, marine, tropical to temperate. |
| Relative abundance | Limited abundance. Of little artisanal or commercial importance. |
| Adult habitat | Epi- to bathy pelagic in oceanic waters. Medium-sized carnivores. |

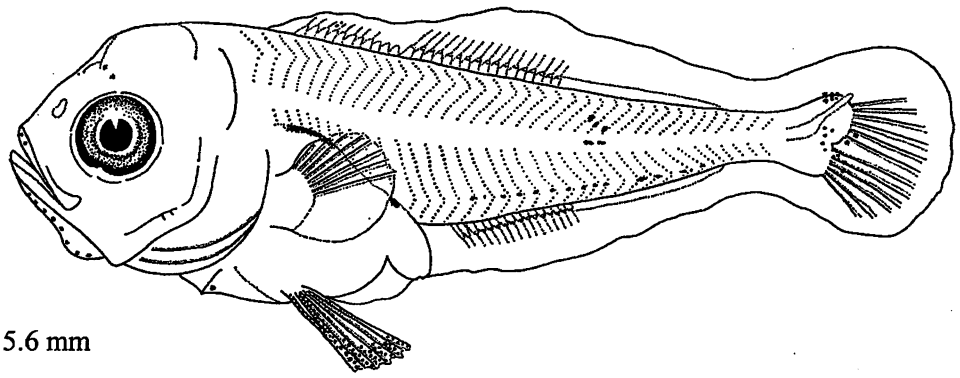
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | Oviparous. |
| Knowledge of ELH | Eggs and larvae known for some species. |
| ELH Characters: | **Eggs:** planktonic, 0.7–1.3 mm. |

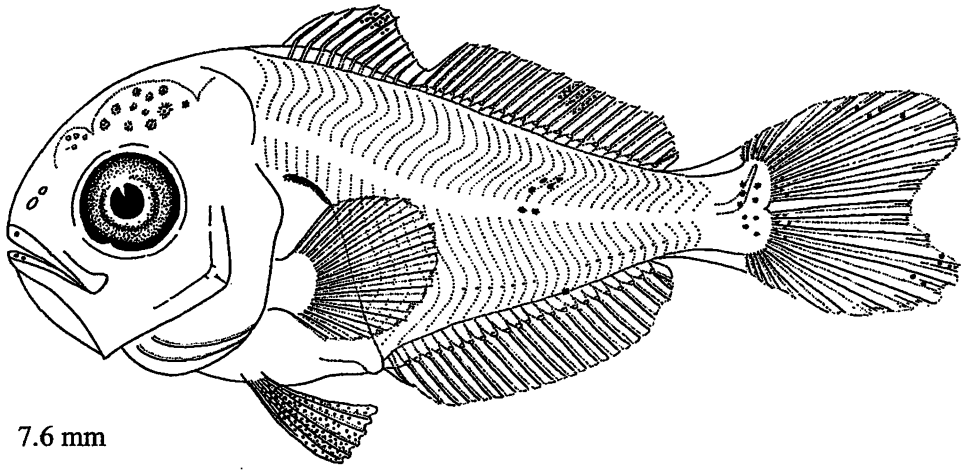
**Larvae:** head and body compressed, initially elongate, becoming moderate to deep. Gut initially straight, becomes coiled and triangular by 3 mm. Preanal length 32–65% BL. 30–42 myomeres. Head moderate to large and rounded. Mouth moderate in size and obliquity. Head spination limited to, at most, tiny preopercular spines. Notochord flexion at 3.7–6.0 mm. In *Nomeus* and *Psenes*, P2 is first fin to form at about 3.5 mm, becomes large, extending at least to anus, and moves anteriorly with development. In *Cubiceps*, P2 last fin to form, remaining small. Soft rays of D and A form during or shortly after flexion, and fin spines shortly thereafter. Full complements of rays are present in all fins by 7–8 mm. Fin spines slender and smooth. Pigment moderate, including melanophores dorsally on head and gut, and on early-forming P2 fin. Usually, melanophores on ventral surface of tail, and in some species on dorsal and lateral surface as well. Pigment intensifies with growth, spreading from these areas.

| | |
|---|---|
| Example species: | *Psenes sio.* |
| Meristics: | D: X–XII+I, 22–26, A: II, 23–26, P1: 17–19, P2: I, 5, V: 12–13+24–26, C: 7–10, 9+8, 8–9. |
| REFERENCES | Ahlstrom et al.1976a, Kimura 1988, Haedrich 1967, Horn 1984, Watson 1996w. |

Perciformes/Stromateoidei/Nomeidae
*Psenes sio*
from: Ahlstrom et al. 1976a



5.6 mm



7.6 mm

## Order Perciformes

| | |
|---|---|
| Suborder | Stromateoidei |
| Family | **Tetragonuridae (Squaretails)** |
| Number of genera | 1 |
| Number of species | 3 |

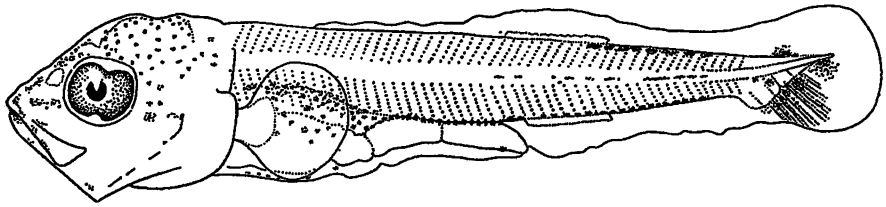
GENERAL LIFE HISTORY

| | |
|---|---|
| Distribution | Oceanic, marine, tropical to temperate. |
| Relative abundance | Limited abundance. Of no artisanal or commercial importance. |
| Adult habitat | Epipelagic, oceanic waters. Small to medium-sized salp-eaters. |

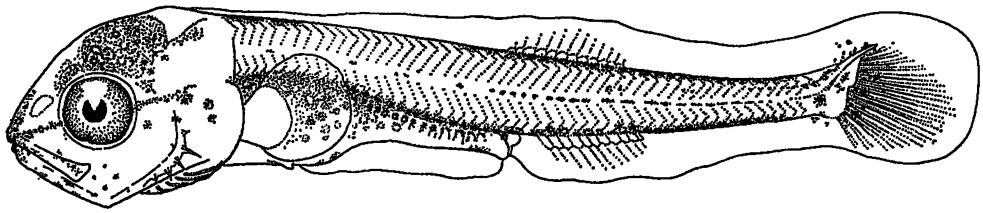
EARLY LIFE HISTORY

| | |
|---|---|
| Mode of reproduction | oviparous. |
| Knowledge of ELH | Eggs and larvae known for all species. |
| ELH Characters: | **Eggs:** planktonic, 1.1–1.3 mm. |
| | **Larvae:** head and body compressed, initially elongate, depth becoming moderate. Gut initially straight, becoming coiled during flexion, remaining considerably longer than deep. Preanal length 52–72% BL. 40–58 myomeres. Head initially small, becoming moderate to large and rounded. Mouth moderate in size and obliquity. Head spination limited to small to moderate preopercular spines. Notochord flexion at 7–10 mm. D and A soft rays form just prior to or during flexion, and fin spines later. Fin spines remain short, slender and smooth. Fewer soft D rays than spines. Full complements of rays not present in all fins until 8–15 mm. Pigment initially largely limited to ventral surfaces, except a pigment patch posteriorly on dorsal midline of tail. Pigment intensifies with growth, spreading from these areas. |
| Example species: | *Tetragonurus cuvieri.* |
| Meristics: | D: XIV–XVII, 10–13, A: I, 9–12, P1:14–18, V: 23–24+20–22, C: 9–10, 9+8, 9–10. |
| REFERENCES | Ahlstrom et al. 1976a, Kimura 1988, Haedrich 1967, Horn 1984, Watson 1996x. |

Perciformes/Stromateoidei/Tetragonuridae
*Tetragonurus cuvieri*
from: Ahlstrom et al. 1976a



7.6 mm



10.1 mm

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