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Blennioidea: Development and Relationships

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THE Blennioidea is composed of 16 families with about 182 genera and 759 species (Table 143). The families discussed here are those included in the infraorder Blennioidea by Nelson (1976), as amended by the current literature. For convenience we divide the infraorder into a tropical and a northern group. The tropical group is similar to Gosline's (1968) superfamily Blennioidae except for the following: 1) Ophiclinidae and Peronedysidae are synonymized with the Clinidae (George and Springer, 1980); 2) Dactyloscopidae is included (George and Springer, 1980); and 3) Congrogadidae is excluded (Winterbottom, 1982[1]). The northern group is similar to Gosline's (1968) superfamily Zoarceoidae except that we include the Bathymasteridae (Anderson, 1984). The Zoarcidae is treated separately (Anderson, this volume).

The majority of species (80%) belong to four tropical families: Tripterygiidae, Clinidae, Labrisomidae, and Blenniidae. Of the northern forms, only the family Stichaeidae represents a significant percentage (8%) of the species. Tropical Blennioidea inhabit primarily the Indo-West Pacific south to Australia, while northern fishes inhabit the North Atlantic and North Pacific (Table 143). Occasionally, representatives of mainly tropical families occur in boreal waters (e.g., Clinidae and Blenniidae), and members of northern families may occur in the subtropics. Some dactyloscopids inhabit fresh water. Four families are monotypic and three of these are endemic to the northeast Pacific.

As a group most of the 16 families in Blennioidea are not well understood, probably due to their lack of commercial importance, small size and cryptic habits. In general, the tropical and more speciose families (e.g., Blenniidae) are better known than the northern families. Monotypic families are quite poorly known. Although sparse and incomplete, some early life history information is available for 11 of the 16 families (Table 143). In most cases, however, the data on few species may not be representative of the family. Among the families in the infraorder, the Blenniidae has the greatest number of species (22) described; but with about 319 species in the family, this amounts to fewer than 10%. Morphology, pigment, and meristics of larvae in the infraorder are diverse (Figs. 302, 303).

Development

Eggs

Fishes in this infraorder spawn demersal eggs (Table 144), except for some clinids. Clinids of the tribe Ophiclinini are ovoviviparous (George and Springer, 1980), while those of the tribe Clinini are viviparous (Penrith, 1969; Hoese, 1976).

Most blennioid eggs are spherical to somewhat flattened, possess one to several oil droplets, are attached to one another (and often to a substrate) by filaments or other adhesions, and have a smooth unsculptured chorion. Sizes range from among the smallest of fish eggs (Blenniidae, 0.50 mm) to among the largest (Anarhichadidae, 8.0 mm). Incubation periods range from 6 to 70 days. Eggs are unknown for four families: Xenocephalidae, Ptilichthyidae, Zaproridae, and Scytalinidae.

Parental care is common among most families; e.g., in stichaeids, males or females may guard egg masses (Shiogaki and Dotsu, 1972a; Shiogaki, 1981, 1982). In an extreme example of parental care, male dactyloscopids incubate eggs in ball-like clusters carried beneath the pectoral fins (Dawson, 1982).

Larvae

Morphological characters.—Blennioidea larvae hatch at sizes ranging from as small as 2.0 mm (Blenniidae) to as large as 17.0 mm (Anarhichadidae) (Table 145). Larvae of the northernmost families hatch at more than twice the size of larvae of the more tropical families (i.e., averaging ca. 11.5 mm versus ca. 4.5 mm). Size at which notochord flexion is complete is also variable, but tropical larvae are usually fully flexed by ca. 10.0 mm whereas northern larvae do not complete flexion until ca. 20.0 mm. At least three families have larvae with an extended pelagic existence: Blenniidae, Cryptacanthodidae, and Zaproridae. Members of the blenniid tribe, Salariini, have the only well-documented, prejuvenile pelagic stage (Miller et al., 1979; Leis and Rennis, 1983). This has been termed the "ophiblennius" stage and usually occurs between 4.6 and 26.0 mm (Fig. 302). At least two families, Cryptacanthodidae (Shiogaki, 1982) and Zaproridae (Haryu and Nishiyama, 1981), have heavily pigmented larvae and prejuveniles that are extensively collected in surface nets suggesting an extended pelagic existence (Fig. 303C, G). Most blennioid larvae do not undergo a marked metamorphosis. Transformation is usually complete in tropical forms by 26.0 mm, but may begin as early as 10.0 mm in some families (Tripterygiidae and Blenniidae). Larvae in the more northern families transform at a slightly larger size, ca. 30.0–40.0 mm, although *Ptilichthys* transforms at ca. 114.0 mm.

Among the tropical families, larval Tripterygiidae, Clinidae, and Labrisomidae share many similar morphological features. They are moderately elongate, have a preanal length about 50% BL (slightly less in labrisomids), possess a large swimbladder, and usually lack preopercular spines (Figs. 302A, B, C, D). Heads are small, sometimes rounded, with a short snout. Mouths extend just beyond the anterior eye margin. In tripterygiid and clinid larvae, the gut is initially straight but coils during flexion.

The blenniids include many larval forms with diverse morphological features. According to Leis and Rennis (1983), however, larvae are more similar within tribes than between tribes. Most species are moderately elongate (Nemophini includes both slender and robust forms), becoming either more slender (Nemophini) or more robust (Salariini) with development. Heads are short, rounded, and broad becoming more elongate with development (except Salariini larvae in which the snout elongates early in the preflexion stage). The gut is short to moderate (usually < 50% BL), and eventually coiled if not so initially. Larval preopercular spination may be elaborate: spines can be numer-

[1] Winterbottom, R. 1982. The perciform fish family Congrogadidae—biogeography and evidence for monophyly. Amer. Soc. Ich. Herp., oral paper, 62nd annual meeting.

TABLE 143. GENERAL SUMMARY AND EARLY LIFE HISTORY (ELH) INFORMATION IN BLENNIOIDEA.

Taxon	Number of genera	Approx. number of species	Primary Distribution	Early life history: Number of genera	Number of species	Number of species illustrated	Primary early life history sources
Blennioidea							
Dactyloscopidae	6	20	Atlantic, Pacific (tropical)	1	1		Dawson 1982
Xenocephalidae	1	1	New Ireland, New Guinea	0	0		
Notograptidae	2	3	Australia	0	0		
Tripterygiidae	18–19	75–95	Atlantic, Pacific, Indian (tropical)	5	6	7	Graham, 1939; Leis and Rennis, 1983; Miller et al., 1979; Ruck, 1973a, 1980; Shiogaki and Dotsu, 1973; Watson, unpubl.; Wirtz, 1978
Clinidae	26	85	Atlantic, Pacific, Australia	4	5	14	Barnhart, 1932; Padoa, 1956h; Shiogaki and Dotsu, 1972b; Sparta, 1948; Stevens, unpubl.; Watson, unpubl.
Chaenopsidae	10	55	Atlantic, Pacific (tropical)	0	0		Böhlke, 1957; Stephens et al., 1966
Labrisomidae	14	100	New World (tropical)	2	3	3	Breder, 1939; Breder, 1941; Springer, 1958; Watson, unpubl.
Blenniidae	53	289–319	Indo-Pacific	17	22	27	Cipria, 1934, 1936; Dotsu, 1982; Dotsu and Moriuchi, 1980; Dotsu and Oota, 1973; Dutt and Rao, 1960; Eggert, 1932; Fishelson, 1963, 1976; Fives, 1970a; Ford, 1922; Fritzsche, 1978; Hildebrand and Cable, 1938; Lebour, 1927; Leis and Rennis, 1983; Lippson and Moran, 1974; Miller et al., 1979; Mito, 1954; Munro, 1955; Peters, 1981; Qasim, 1956; Rao, 1970; Russell, 1976; Stevens and Moser, 1982; Thomson and Bennett, 1953; Watson, 1974, unpubl.; Wickler, 1957
Bathymasteridae	3	7	North Pacific	2	3	1	Breder and Rosen, 1966; Fitch and Lavenberg, 1975; Matarese, unpubl.
Stichaeidae	37	54	North Atlantic, Pacific	14	18	15	Breder and Rosen, 1966; Faber, 1976; Hart, 1973; Marliave, 1975; Matarese, unpubl.; Peppar, 1965; Rass, 1949; Russell, 1976; Shiogaki, 1981; Shiogaki, 1983; Shiogaki and Dotsu, 1972a; Tokuya and Amaoka, 1980; Wourms and Evans, 1974
Cryptacanthodidae	3	4	North Atlantic, Pacific	3	3	2	Hart, 1973; Matarese, unpubl., Shiogaki, 1982
Pholidae	4	13	North Atlantic, Pacific	3	5	3	Breder and Rosen, 1966; Marliave, 1975; Rass, 1949; Sawyer, 1967; Tokuya and Amaoka, 1980
Anarhichadidae	2	6	North Atlantic, Pacific	2	3	2	Andriyashev, 1954; Barsukov, 1959; Breder, 1941; Kobayashi, 1961a; Marliave, 1975; Rass, 1949
Ptilichthyidae	1	1	Northeast Pacific	1	1	1	Kobayashi, 1961b; Richardson and Denhart, 1975
Zaproridae	1	1	Northeast Pacific	1	1	1	Chapman and Townsend, 1938; Haryu and Nishiyama, 1981
Scytalinidae	1	1	Northeast Pacific	0	0		

ous or large (Blenniini and Omobranchini) or completely lacking (Nemophini). Teeth develop early in most species; these become large (Nemophini) or hooked (Salariini) (Fig. 302E). Cirri may develop at the end of the larval period. Members of the Salariini have elongate pectoral fins (Fig. 302F).

Larvae of the northern families have an elongate body shape, but they range from moderately elongate (Zaproridae) to extremely long and thin (Ptilichthyidae) (Fig. 303). Heads are small, and initially pointed or rounded but become more pointed with development. Most species have a short to moderate snout. Preanal length is highly variable. Generally, preanal length is at least 50% BL, but it ranges from short (<50% BL in pre-

TABLE 144. SUMMARY OF EGG CHARACTERS IN BLENNIOIDEA. Blanks indicate data are unavailable.

Taxon	Egg type[1]	Single or mass	Egg diameter (mm)	Number of oil globules	Attachment processes or ornamentation	Pigmentation	Incubation (days)	Primary sources
Blennioidea								
Dactyloscopidae	D							Dawson, 1982
Xenocephalidae								
Notograptidae								
Tripterygiidae	D	Mass	0.90–1.40	Few to numerous	Filaments at one pole or everywhere	Embryo, yolk with "pigment spheres"	16–22	Graham, 1939; Miller et al., 1979; Ruck, 1973a; Ruck, 1980; Shiogaki and Dotsu, 1973
Clinidae	D[2]		0.96–1.7	Several	Filaments		12–40	Barnhart, 1932; Padoa, 1956h; Shiogaki and Dotsu, 1972b; Sparta, 1948; Stevens, unpubl.
Chaenopsidae	D							Stephens et al., 1966
Labrisomidae	D	Mass	1.15–1.33	1–6	Attach to each other, strands	Embryo, yolk	10	Breder, 1939
Blenniidae	D	Mass	0.58–1.6 × 0.4–0.96	0–several	Adhesive disk or pedestal	Embryo, yolk	6–61[3]	Cipria, 1934, 1936; Dotsu, 1982; Dotsu and Moriuchi, 1980; Dotsu and Oota, 1973; Dutt and Rao, 1960; Eggert, 1932; Fishelson 1963, 1976; Fritzsche, 1978; Hildebrand and Cable, 1938; Lebour, 1927; Mito, 1954; Munro, 1955; Peters, 1981; Qasim, 1956; Rao, 1970; Stevens and Moser, 1982; Thomson and Bennett, 1953; Watson, unpubl.; Wickler, 1957
Bathymasteridae	D	Mass	0.99–1.1	1	Non-adhesive mass		13–15	Breder and Rosen, 1966; Fitch and Lavenberg, 1975; Matarese, unpubl.
Stichaeidae	D	Mass	1.37–2.5	1	Adhesive		21	Breder and Rosen, 1966; Hart, 1973; Marliave, 1975; Matarese, unpubl.; Peppar, 1965; Shiogaki, 1983; Wourms and Evans, 1974
Cryptacanthodidae	D		1.8					Hart, 1973
Pholidae	D	Mass	1.4–3.0	1	Adhesive		42–70	Breder and Rosen, 1966; Marliave, 1975; Matarese, unpubl.; Sawyer, 1967
Anarhichadidae	D	Loose or clumps	4.0–8.0	1				Barsukov, 1959; Breder and Rosen, 1966; Matarese, unpubl.
Ptilichthyidae								
Zaproridae								
Scytalinidae								

[1] D = demersal.
[2] Ophiclini-ovoviparous George and Springer (1980). Clinini-viviparous (Penrith, 1969; Hoese, 1976).
[3] Usually 7–14 days.

TABLE 145. SUMMARY OF LARVAL SIZE AT SELECTED DEVELOPMENTAL STAGES IN BLENNIOIDEA (MM SL). Blanks indicate data are unavailable.

Taxon	Hatching	Notochord flexion	Special prejuvenile	Juvenile
Blennioidea				
Dactyloscopidae				
Xenocephalidae				
Notograptidae				
Tripterygiidae	2.7–6.1	4.8–<9.4	None	≥11.0
Clinidae	5.5–6.7	by 11.4–14.3	None	>16–25
Chaenopsidae				>16–17
Labrisomidae	4.1	4.9–6.9	None	>19–25
Blenniidae	2.0–5.4	3.6–10.75	4.6–26.0 Salariini	6.4–26.0
Bathymasteridae	5.5–6.0	<10.0	None	ca. 40.0
Stichaeidae	6.5–12.5 (8–9.5)	12.0–20.0 (13–15)	None	>25.0
Cryptacanthodidae	10.0–11.0	<18.0	Neustonic	ca. 30.0
Pholidae	10.0–12.5	ca. 19.0–30.0	None	>30.0
Anarhichadidae	17.0–18.0	<20.0	None	ca. 40.0
Ptilichthyidae	<20.0		None	ca. 114.0
Zaproridae	<12.0	<17.0	Neustonic	
Scytalinidae				

flexion Stichaeidae) to very long (Pholidae) (Fig. 303B, D). The family Anarhichadidae includes one genus with a long, thin bodied larva (*Anarrhichthys*) and another with only a moderately elongate larva (*Anarhichas*) (Fig. 303E). The monotypic family Ptilichthyidae has a unique larval form—it is highly elongate with a small head and extended postanal body (Fig. 303F).

Pigmentation characters.—Pigmentation is typically sparse for most families within this infraorder, and tends to be added subcutaneously with development. However, four families [Zaproridae, Anarhichadidae, Cryptacanthodidae, and some Nemophini (Blenniidae)] have larvae with dense body pigment that is not typical of the Blennioidea (Figs. 303C, E, and G). Important pigment areas are along the ventral body midline and in the gut area (Table 146).

Head.—Eyes are pigmented prior to hatching in all known groups. Pigment is generally absent or light during notochord flexion but usually increases dorsally, over the brain, by the time flexion occurs. Additionally, postflexion larvae may have pigment on the snout, mouth, and in the opercular area.

Gut.—Preflexion larvae in most species have peritoneal and some dorsolateral pigment. In families that have a gas bladder (e.g., Tripterygiidae, Labrisomidae, and Blenniidae), pigment is present on its dorsal surface (Fig. 302A, D). Ventral pigment may or may not be present. During notochord flexion, pigment increases on the lateral gut surface, and becomes subcutaneous in postflexion larvae.

Trunk and tail.—This is the most important pigment area for

TABLE 146. SUMMARY OF SOME PIGMENTATION CHARACTERS IN LARVAE OF BLENNIOIDEA. Key: D, dorsal; A, anal; P, pectoral; V, ventral; C, caudal; +, present; O, absent; An, anterior; Po, posterior; ↑, increasing; ↓, decreasing; →, with development; and O → +, unpigmented initially, becoming pigmented with development.

Taxon	Head							Gut			
	Eye at hatching	Brain	Jaw	Snout	Opercle	Isthmus	Nape	Anterior	Dorsal	Ventral	Lateral
Tripterygiidae	+	+	O	O	O	O	O	O	+	O, +Po	O
Clinidae	+	O	O	O	O	O	O → +	O	+	+Po	O
Chaenopsidae		O	O	O	O	O	O	O	O	O	O
Labrisomidae		O	O	O	O	O	O	O	+	+	O
Blenniidae	+	O, + → ↑	O	O	O	O	O	O	+ ↑	O → + ↑	+ → ↑
Bathymasteridae	+	O → +	O	O	O	+	O	O	+	+	O
Stichaeidae	+	O, +	O, +	O	O	+	O	O	+ → ↓	+	O
Cryptacanthodidae	+	+ ↑	+	+	+ ↑	O → +	+	O	+ → ↓	O	O
Pholidae	+	O → ↑	O	O	O	+	O	O	+	+	O
Anarhichadidae	+	+ ↑	+	+	+ ↑	+	O → +	O	+ ↑	O → +	+ → ↑
Ptilichthyidae		+	+	O	O	+	O	+	+	+	O → +An
Zaproridae	+	+ ↑	+	+	+ ↑	+	+	O	+	O	+ ↑

identifying specific groups within this infraorder. Except for the densely pigmented families listed above, pigment along the dorsal body midline is rare in preflexion larvae. With development, pigment may increase along the dorsal midline or on the nape. Initially, lateral pigment is either absent or consists of a few spots internally along the notochord. After notochord flexion, internal and external pigment can increase ventrolaterally, or above and below the notochord (Stichaeidae, Bathymasteridae, and Pholidae). Typically, a series of ventral midline melanophores occurs in preflexion larvae. Although these melanophores may be absent in some families (Chaenopsidae, some Tripterygiidae), a number of families have larvae with up to 50 melanophores here (e.g., Blenniidae). The number, size, and shape of these melanophores can be very important when identifying groups. These spots may change shape with development (becoming y-shaped in Tripterygiidae and some Blenniidae), decrease in number (some Blenniidae and Stichaeidae), or become subcutaneous (Stichaeidae).

Fins.—With the exception of zaprorids and some blenniids, fins are rarely pigmented in preflexion larvae. After notochord flexion pigment develops on the various fins of blenniids, anarhichadids, and ptilichthyids (Table 146).

Hypural margin.—Pigment in the caudal area is usually lacking in preflexion larvae, and in postflexion larvae its presence is limited to a few families (Table 146).

Meristic characters.—The number of dorsal fins varies from one to three and in most families some combination of spines and rays is present, with spines predominating. Tripterygiids, clinids, and labrisomids may have up to three dorsal fins, the first two composed of spines. The total number of dorsal elements is highly variable but in some groups (stichaeids, anarhichadids, and ptilichthyids) well over 100 elements are present. The anal fin in most groups may include 1–2 spines. Stichaeids may have up to 5 anal spines. Information on the caudal fin is incomplete. In addition, from data available in the literature, principal rays and branched rays are not consistently distinguished. Most groups have between 9 and 15 (usually about 12–13) principal caudal fin rays and about 25–30 total caudal fin rays. All possess a pectoral fin with as few as 3 (labrisomids and clinids) or as many as 25 (zaprorids) fin rays. Pelvic fins can be present or absent. The northern families, except some stichaeids and pholids, lack pelvic fins. Tropical families usually possess thoracic pelvic fins with 1 spine and fewer than 5 rays (mostly 2–3 soft rays).

Vertebral counts are unknown for many blennioids or are based on few specimens. The number of vertebrae is highly variable within some families (e.g., stichaeids, blenniids, anarchichadids). In general, tropical families have a lower vertebral count than do northern families.

The order of fin ray development is highly variable in the Blennioidea. Information available on this is also inadequate, since in most studies reviewed here larvae have not been cleared and stained to determine the onset of ossification. In the tropical families where notochord flexion occurs as early as 3.6 mm, fin ray development may begin as early as 2.5 mm. Caudal fin rays develop first in clinid and labrisomid larvae, followed by the remaining fin rays soon after notochord flexion is complete. Typically, pectoral fin rays develop first in blenniid larvae (Blenniini and Salariini). In Ombranchini larvae (Blenniidae), the pectoral fin rays and caudal fin rays develop simultaneously. Among the northern families, data are insufficient to allow any generalizations. Fin rays begin forming at 9–15 mm in stichaeid larvae (usually caudal fin rays first) but may not be complete until larvae are 30 mm (Fig. 303B). Zaprorid and cryptacanthodid larvae begin caudal ray development about the time notochord flexion occurs. Fin ray development in ptilichthyid larvae begins with the dorsals and second anal at 40 mm.

Relationships

Although the scope of the available egg and larval data within the Blennioidea is limited, early life history characters reviewed here do not support the cohesiveness of this group. Due to a lack of unifying characters, the infraorder Blennioidea, as presently arranged, probably does not form a monophyletic group. Early life history characters appear to be more useful in clarifying relationships between families or within families rather than

Table 146. Extended.

Trunk								
Dorsal margin	Dorso-lateral	Medio-lateral	Ventro-lateral	Ventral margin	Internal noto-chord	Hypural margin	Fin base	Diagnostic
+Po	O → +	O	O	+	O	O	P	Anus, ventral midline
+ → ↑	O → +	+ ↑	O	+	+	O	O	Gut, ventral midline
O	O	O	O	O	O	O	O	Lack of pigment
O, +Po	O	O	O	+	O	O	O	Swimbladder, ventral midline
O → + An	O → +	O → + ↑	O → O, +	+ → ↓	+	O → O, +	O → PV	Gut, ventral midline
O → +	O	O	O → +	+	+	O, +	O	Urostyle or lateral cross-checking
O → +	O	+ → ↑	O → +	+ → ↓	+	O → O, +	O	Gut, anus, ventral midline
+ ↑	+ ↑	+	+ ↑	+	−	O	O	Dense body
O → O, +	O	+	O	+	+	O → O, +	O	Gut, ventral midline
+ ↑	+ ↑	+ ↑	+ ↑	+	+	O	O → DA	Dense body, fins
+	O	O	O	+ ↑	O	O	AP O → C	Gut, dorsal and ventral margin, caudal fin
+ ↑	+ ↑	+ ↑	+ ↑	+ ↑	−	+ ↑	AP → ↑ D	Dense body

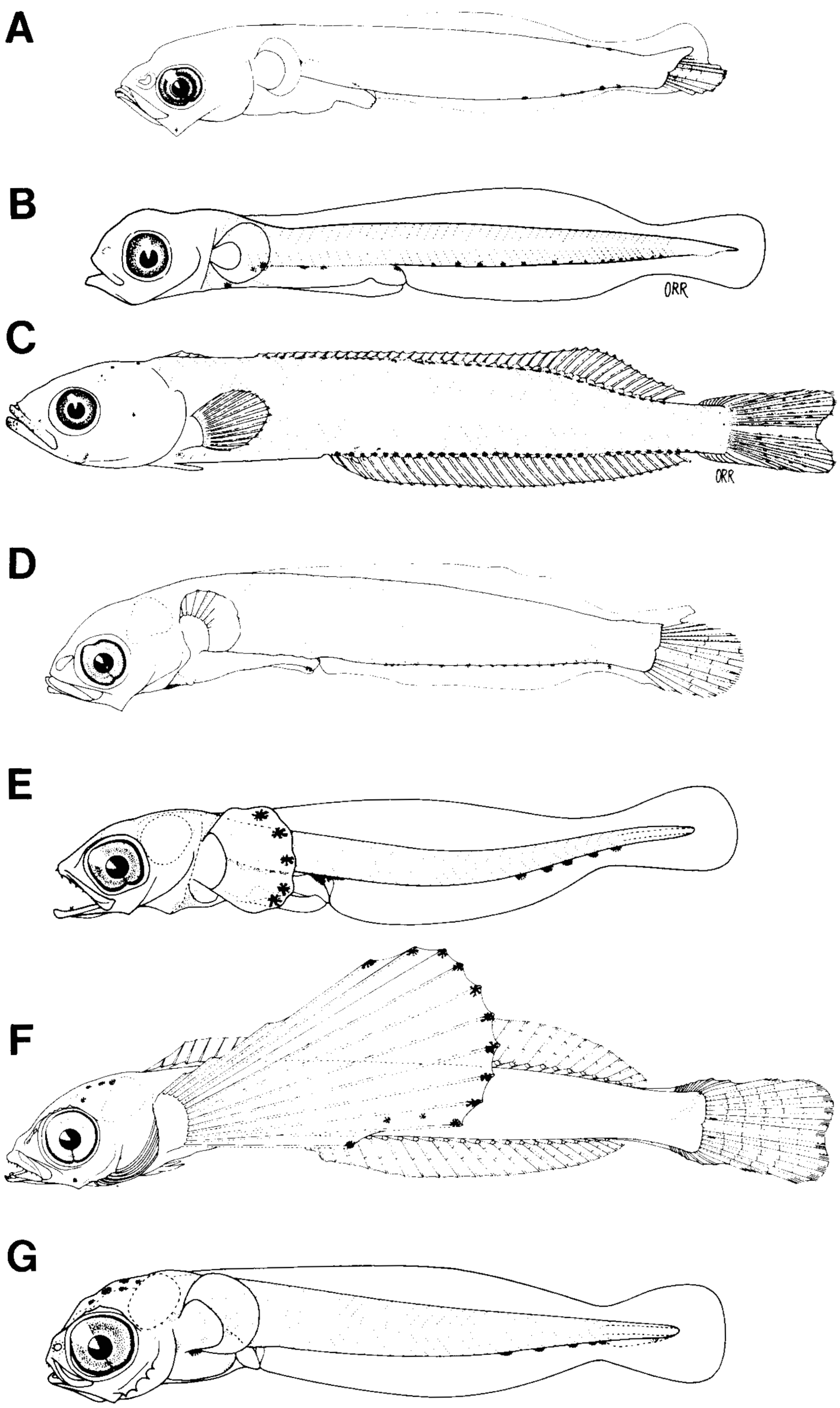

Fig. 302. Blennioidea larvae (tropical forms): (A) *Enneapterygius atriceps* (Tripterygiidae), 5.8 mm (from Miller et al., 1979 described as *Tripterygion atriceps*); (B–C) *Heterostichus rostratus* (Clinidae), 6.5 mm, 21.2 mm; (D) *Paraclinus integripinnis* (Labrisomidae), 7.2 mm; (E–F) *Istiblennius zebra* (Blenniidae), 3.3 mm, 11.0 mm (from Miller et al., 1979); (G) *Enchelyurus brunneolus* (Blenniidae), 3.2 mm (from Miller et al., 1979).

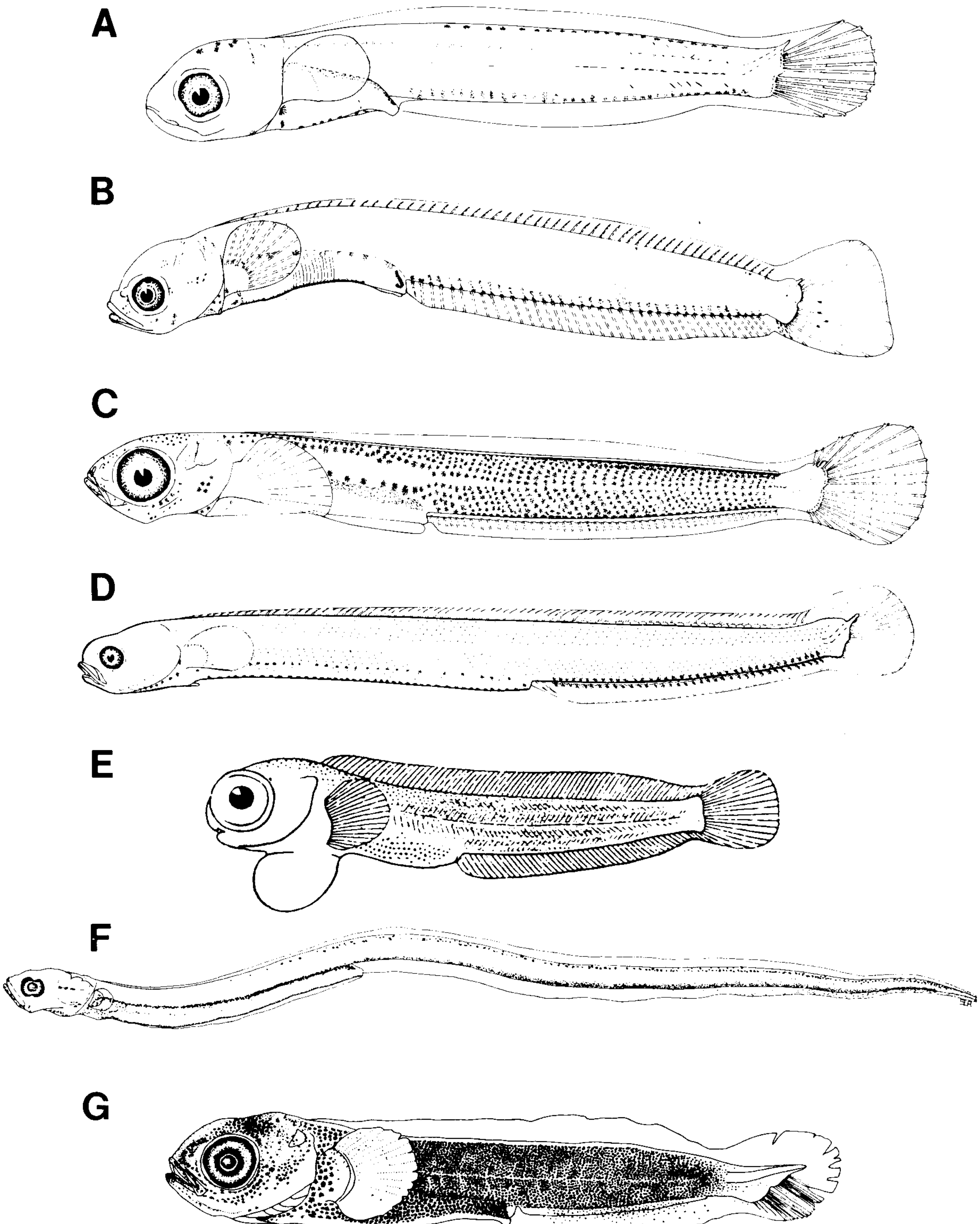

Fig. 303. Blennioidea larvae (northern forms): (A) *Ronquilus jordani* (Bathymasteridae), 10.4 mm; (B) *Anoplarchus purpurescens* (Stichaeidae), 12.0 mm; (C) *Lyconectes aleutensis* (Cryptacanthodidae), 16.0 mm; (D) *Pholis* sp. (Pholidae), 23.0 mm; (E) *Anarhichas lupus lupus* (Anarhichadidae), 24.5 mm (from Barsukov, 1959); (F) *Ptilichthys goodei* (Ptilichthyidae), 24.7 mm (from Richardson and Dehart, 1975); (G) *Zaprora silenus* (Zaproridae), 16.0 mm (from Haryu and Nishiyama, 1981).

TABLE 147. SUMMARY OF SELECTED MERISTICS IN BLENNIOIDEA. Blanks indicate data are unavailable.

Taxon	Fins: Dorsal Spines	Dorsal Rays	Anal Spines	Anal Rays	Pectoral	Pelvic
Blennioidea						
Dactyloscopidae	0–VII + V–XVIII	14–36	II	22–41	12–16	I, 3
Xenocephalidae	—	7	—	10	21	5
Notograptidae						I
Tripterygiidae	III–VII + X–XXIV	7–15	0–II	14–30	10–19	I, 2–3
Clinidae	III + XXIV–LXXXIV	1–14	II	14–62	3–18	I, 2–3
Chaenopsidae	XVII–XXXIII	10–34	II	18–38	12–14	I, 3
Labrisomidae	III + I–IV + XX–LII	7–14	I–II	15–28	3–17	0–I, 0–3
Blenniidae	III–XVII	9–119	II	10–119	10–18	I, 2–4
Bathymasteridae	II	39–49	I–II	27–36	17–21	I, 5
Stichaeidae	XXII–CXXI	0–43	I–V	24–95	8–21	Absent or I, 1–5
Cryptacanthodidae	LX–LXXVII	—	II	45–50	11–15	Absent
Pholidae	LXXIV–CCL	—	I–II	29–53	10–16	Absent or I, 0–1
Anarhichadidae	LXX–CCL	—	0–I	42–233	18–23	Absent
Ptilichthyidae	LXXXIII–XC	115–148	—	179–196	13	Absent
Zaproridae	LIV–LVII	—	—	24–30	20–25	Absent
Scytalinidae		41–51	—	41–51	8	Absent

between Blennioidei infraorders, e.g., the similarity between labrisomid and clinid larvae and the differences between larvae in the various blenniid tribes.

Many of the families in Blennioidea include a large number of intertidal forms and many of the similarities (e.g., demersal eggs, parental care, and advanced state of newly hatched larvae) may be related to environmental conditions rather than to a close phylogenetic relationship. Additional study on the complete life history of these fishes is needed to identify unifying characters, if any exist. Studies at the family level will improve our knowledge of this unsatisfactorily defined group and facilitate outgroup comparisons.

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TABLE 147. EXTENDED.

Fins	Vertebrae			
Principal caudal	Precaudal	Caudal	Total	Primary sources
9–11	11–14	25–41		Böhlke and Caldwell, 1961; Böhlke and Chaplin, 1968; Dawson, 1974a, 1975, 1976, 1982; Kanazawa, 1952; Miller and Briggs, 1962; Myers and Wade, 1946
				Munro, 1967; Nelson, 1976
				Nelson, 1976
13–15	10–13	20–30	40–50	Bath, 1973; Leis and Rennis, 1983; Rosenblatt, 1959, 1960; Wheeler and Dunn, 1975
10–15	13–35	25–63		Böhlke, 1960b; George and Springer, 1980; Hoese, 1976; C. Hubbs, 1952, 1953a; Penrith, 1969; Scott, 1955, 1962, 1966, 1967; Shen, 1971; Springer, 1955, 1970; Stevens and Springer, 1974
13, 19–23			39–57	Böhlke, 1957; Greenfield, 1972; Johnson and Greenfield, 1976; Robins and Randall, 1965; Rosenblatt and Stevens, 1978; Smith-Vaniz and Palacio, 1974; Stephens, 1963, 1970; Stephens et al., 1966
10–14	10–14	20–33		Böhlke and Robins, 1974; Böhlke and Springer, 1961, 1975; C. Hubbs, 1952, 1953b; Rosenblatt and Parr, 1969; Rosenblatt and Taylor, 1971; Smith, 1957; Springer, 1954, 1955, 1958, 1959; Springer and Gomon, 1975b
10–15	9–16	19–119	28–135	Bath, 1976, 1978; Smith-Vaniz, 1975, 1976; Smith-Vaniz and Springer, 1971; Springer, 1967, 1968, 1971, 1972a, 1972b, 1976; Springer and Gomon, 1975a; Springer and Smith-Vaniz, 1972; Springer and Spreitzer, 1978; Stephens, 1970
14	14–16	35–39	49–54	NWAFC, unpubl.
3–8 + 3–9	14–43	29–72	46–113	Makushok, 1958; NWAFC, unpubl.; Shiogaki, 1980, 1981
13–15, 14	24–27	47–51	72–78	NWAFC, unpubl.; Shiogaki, 1982
6–7 + 6–7			80–107	Makushok, 1958; NWAFC, unpubl.
7–8 + 19–26	24–39	46–214	72–250	Barsukov, 1959; Makushok, 1958; NWAFC, unpubl.
	53–59	170–181	227–240	Makushok, 1958
30–31	24–26		61–62	Chapman and Townsend, 1938; NWAFC, unpubl.
				NWAFC, unpubl.