FS/B10-4ATR 86-9

FISHES OF THE SACRAMENTO-SAN JOAQUIN ESTUARY AND ADJACENT WATERS, CALIFORNIA: A GUIDE TO THE EARLY LIFE HISTORIES

Johnson C. S. Wang

Technical Report 9
January 1986

Prepared for the

INTERAGENCY ECOLOGICAL STUDY PROGRAM
FOR THE SACRAMENTO-SAN JOAQUIN ESTUARY

A Cooperative Study by the

California Department of Water Resources
California Department of Fish and Game
U. S. Bureau of Reclamation
U. S. Fish and Wildlife Service

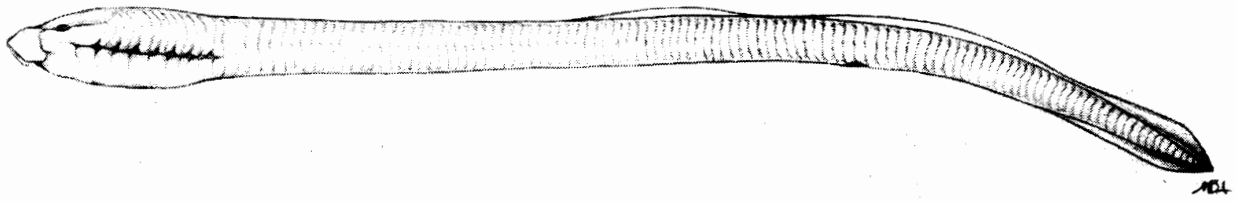


Figure 1-1. Lampetra ayresi, river lamprey ammocoete, 133 mm TL.

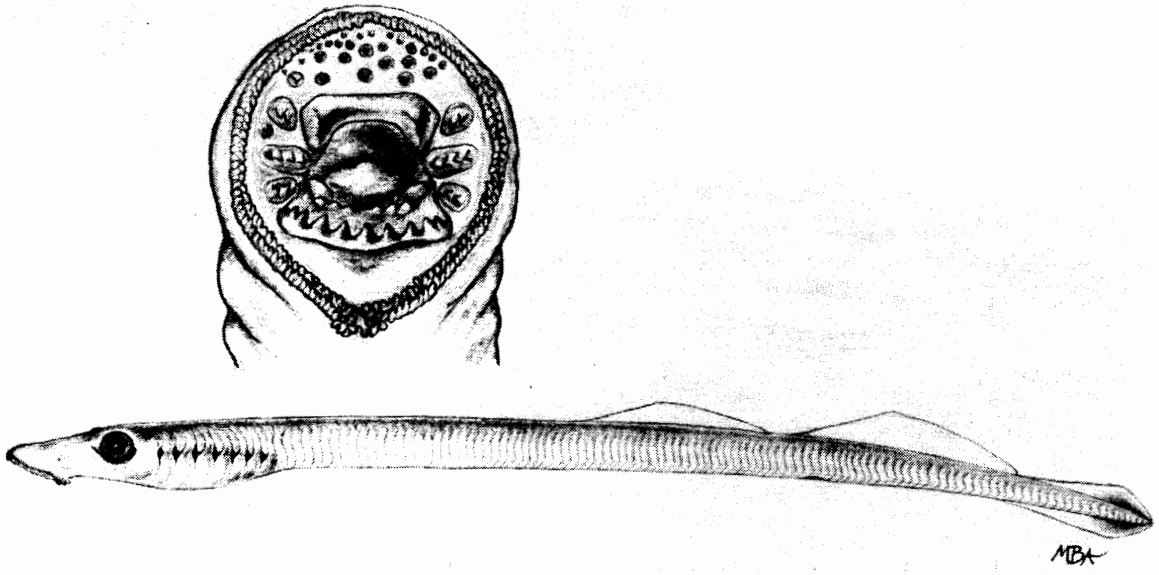


Figure 1-2. Lampetra ayresi, river lamprey adult, 127 mm TL.

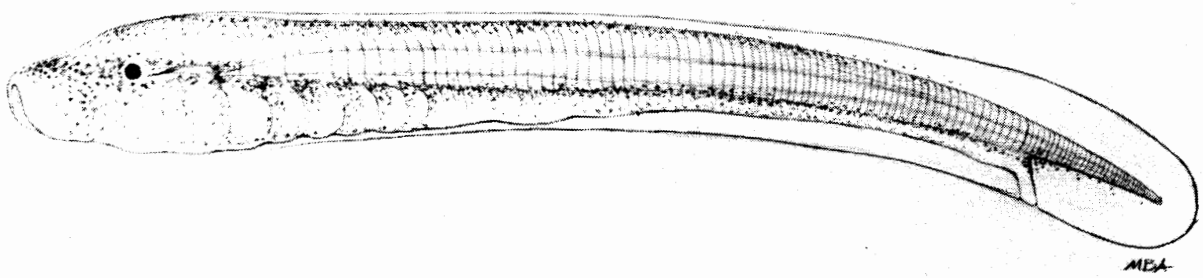


Figure 1-3 Lampetra tridentata, Pacific lamprey ammocoete, 8.7 mm TL.

Petromyzontidae: Lampreys.

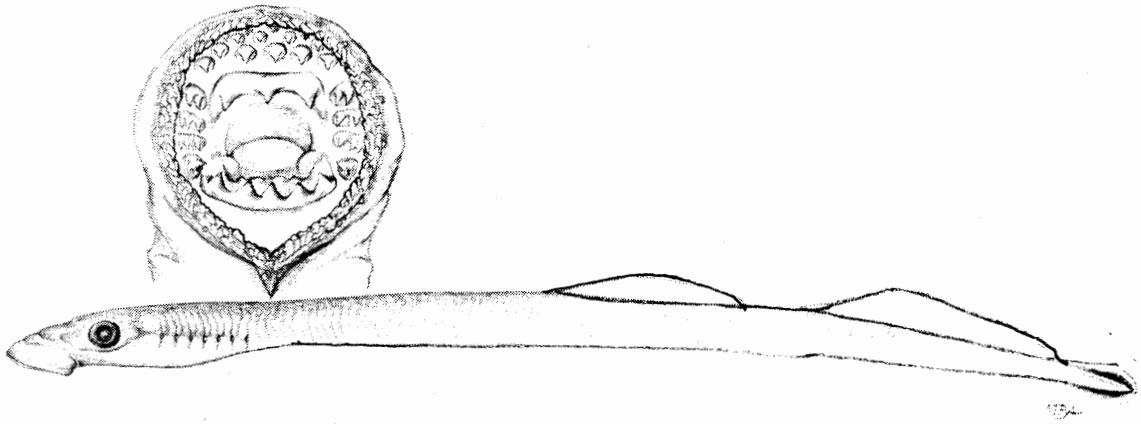


Figure 1-4. Lampetra tridentata, Pacific lamprey adult, 170 mm TL.

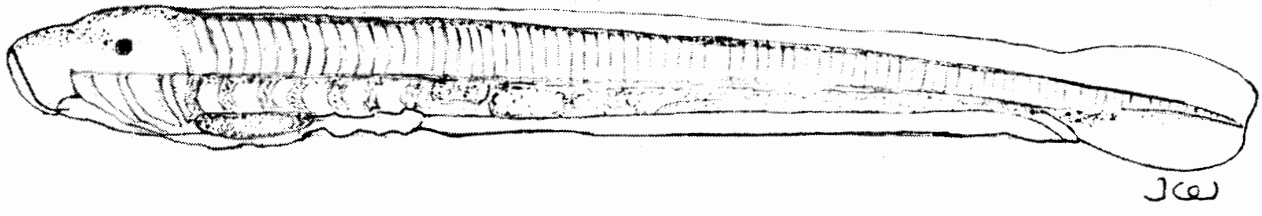


Figure 1-5. Lampetra spp., Pacific brook lamprey or Kern brook lamprey ammocoete, 10.4 mm TL.

Petromyzontidae: Lampreys.

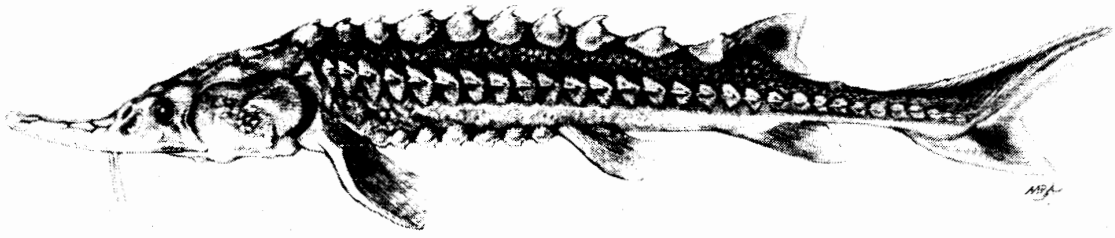


Figure 2-1. Acipenser medirostris, green sturgeon juvenile, 275 mm TL.

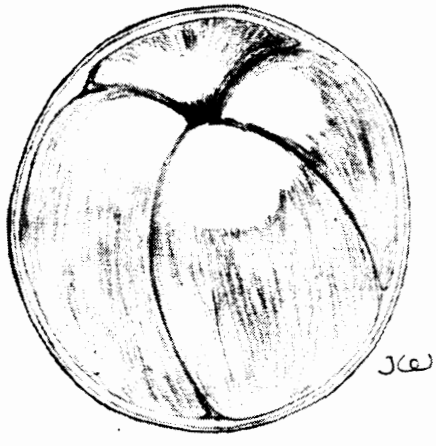


Figure 2-2. Acipenser transmontanus, white sturgeon egg, 4-cell stage, long axis 3.8 mm, short axis 2.6 mm diameter.

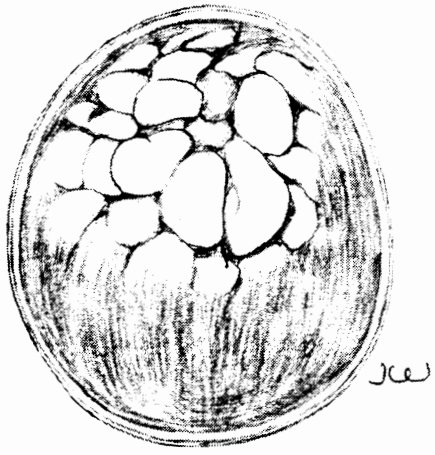


Figure 2-3. Acipenser transmontanus, white sturgeon egg, morula, long axis 3.9 mm, short axis 3.3 mm diameter.

Acipenseridae: Sturgeons

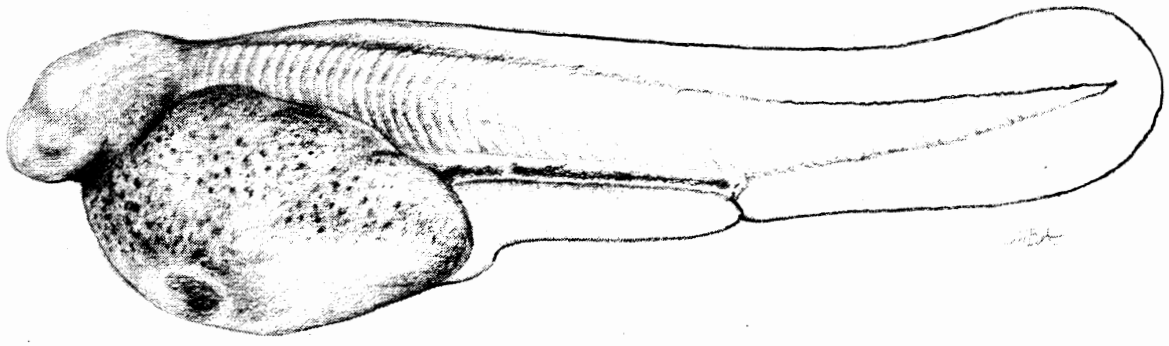


Figure 2-4. Prolarva, 11.6 mm TL.

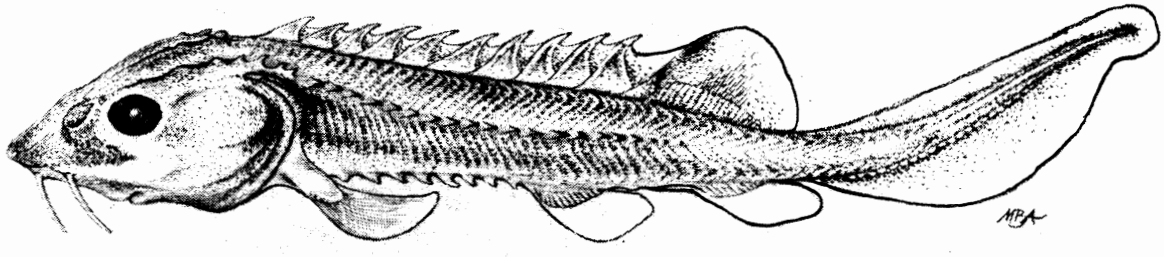


Figure 2-5. Postlarva, 31 mm TL.

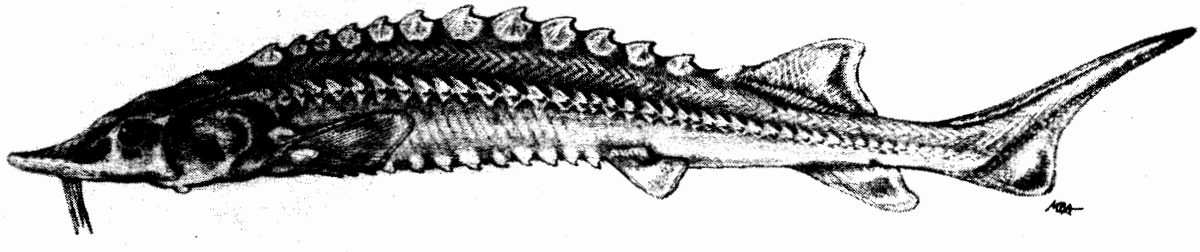


Figure 2-6. Juvenile, 237 mm TL.

Acipenseridae: Acipenser transmontanus, white sturgeon.

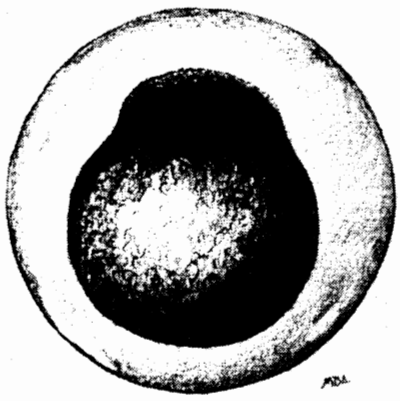


Figure 3-1. Egg, morula, 3.5 mm diameter.

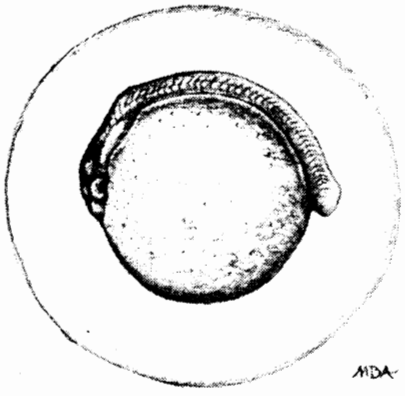


Figure 3-2. Egg, early embryo, 3.2 mm diameter.

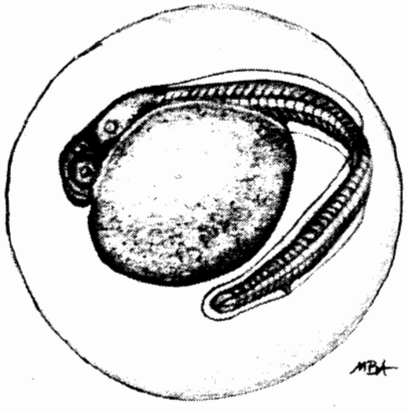


Figure 3-3. Egg, late embryo, 3.5 mm diameter.

Clupeidae: Alosa sapidissima, American shad.

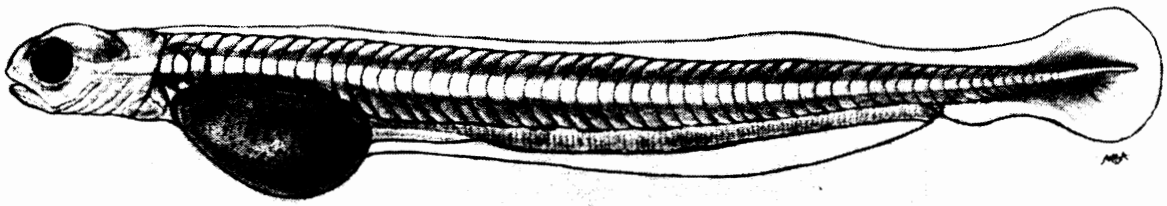


Figure 3.4. Prolarva, 10 mm TL.

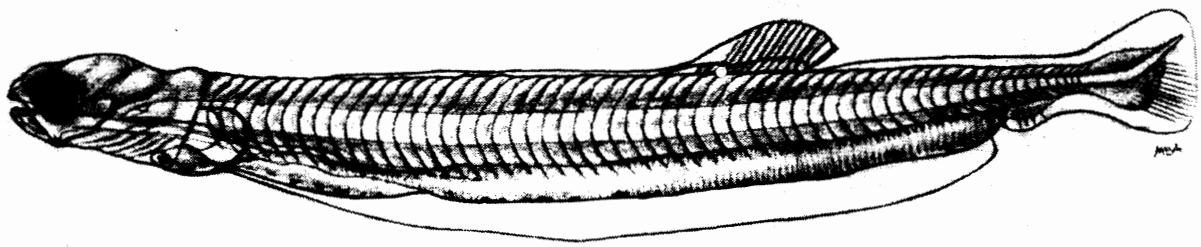


Figure 3-5. Postlarva, 12.2 mm TL.

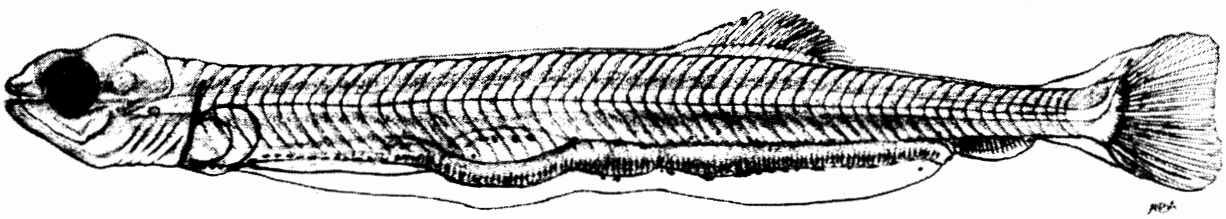


Figure 3-6. Postlarva, 16.5 mm TL.

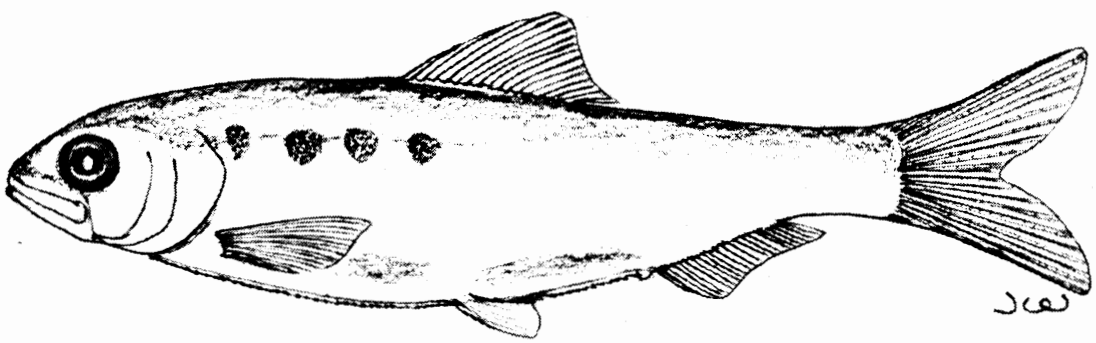


Figure 3-7. Juvenile, 83 mm TL.

Clupeidae: Alosa sapidissima, American shad.

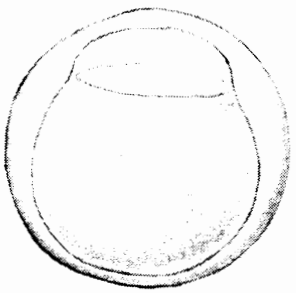


Figure 3-8. Egg, morula, 1.4 mm diameter.

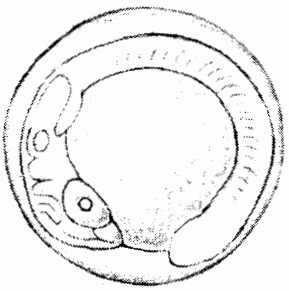


Figure 3-9. Egg, late embryo, 1.4 mm diameter.

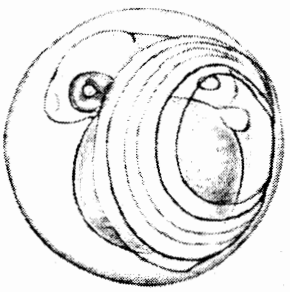


Figure 3-10. Egg, late embryo, 1.5 mm diameter.

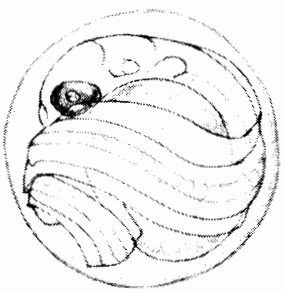


Figure 3-11. Egg, late embryo, 1.5 mm diameter.

Clupeidae: Clupea harengus pallasi, Pacific herring.

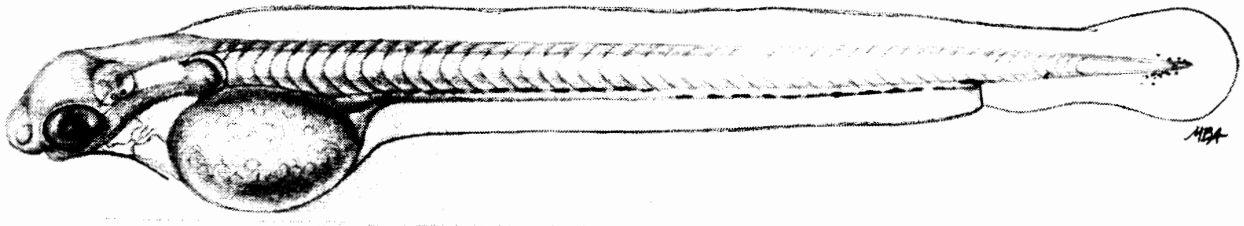


Figure 3-12. Prolarva, 8 mm TL.

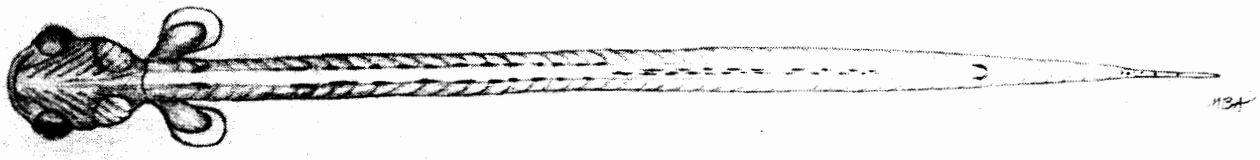


Figure 3-13, 3-14. Postlarva, lateral and ventral views, 10.3 mm TL.

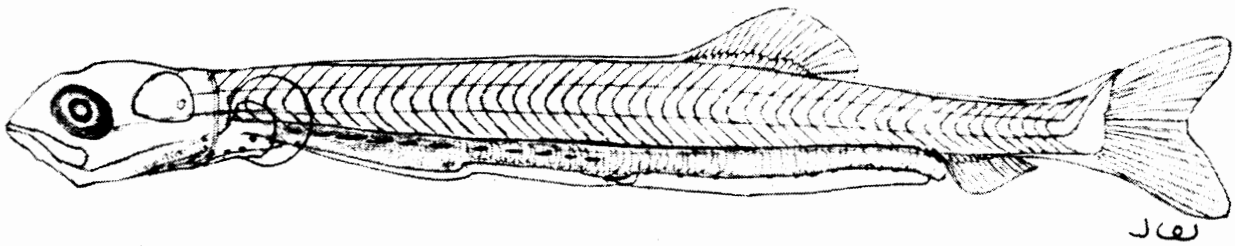


Figure 3-15. Postlarva, 18.8 mm TL.

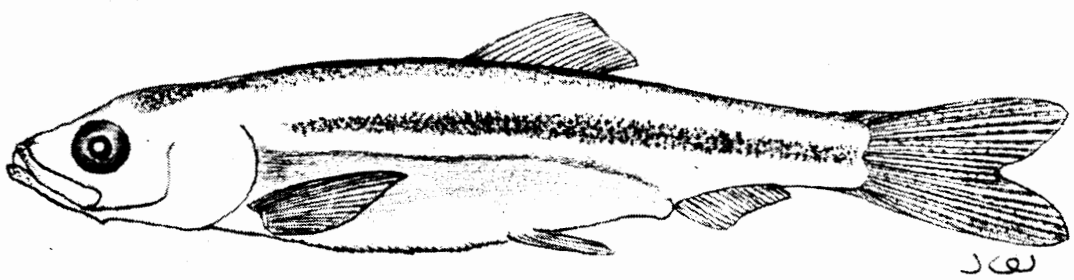


Figure 3-16. Juvenile, 40 mm TL.

Clupeidae: Clupea harengus pallasi, Pacific herring.

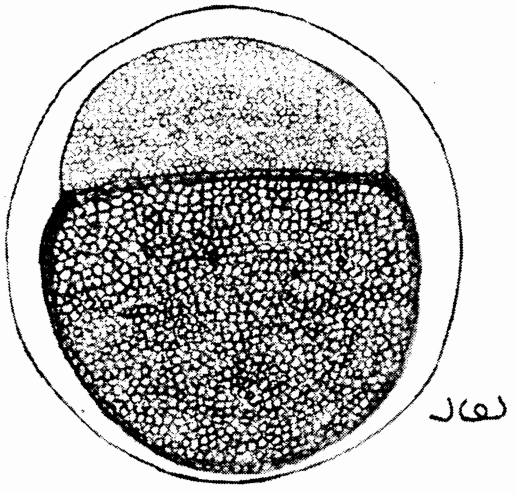


Figure 3-17. Egg, morula, 0.9 mm diameter.

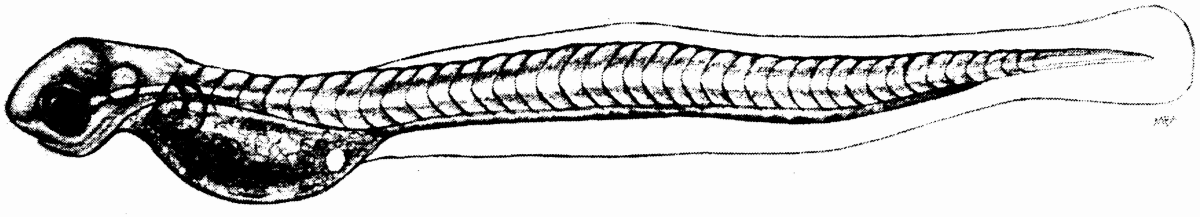


Figure 3-18. Prolarva, 4.7 mm TL.

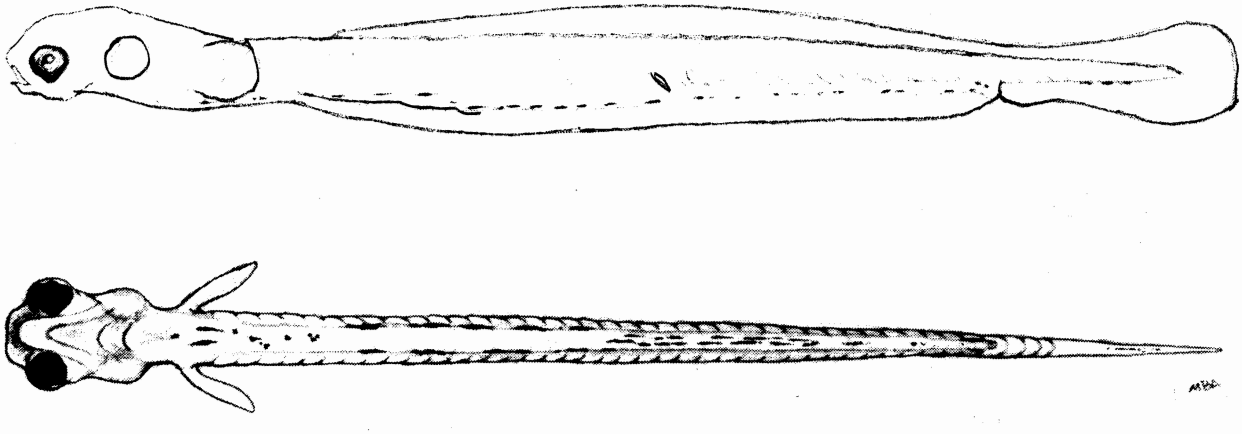


Figure 3-19, 3-20. Postlarva, lateral and ventral views, 5.3 mm TL.

Clupeidae: Dorosoma petenense, threadfin shad.

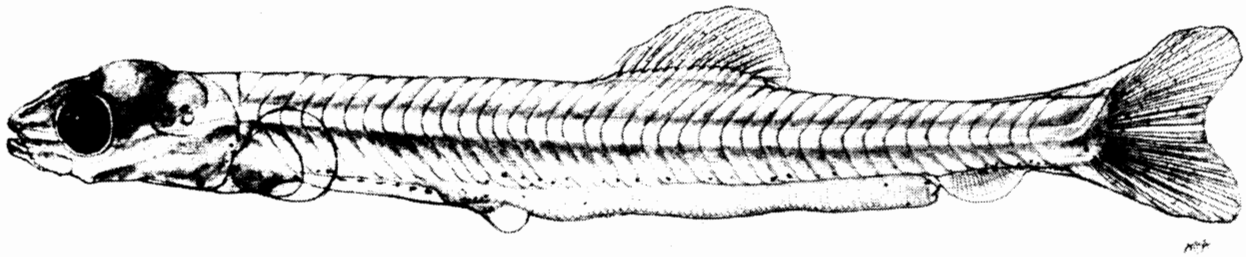


Figure 3-21. Postlarva, 16 mm TL.

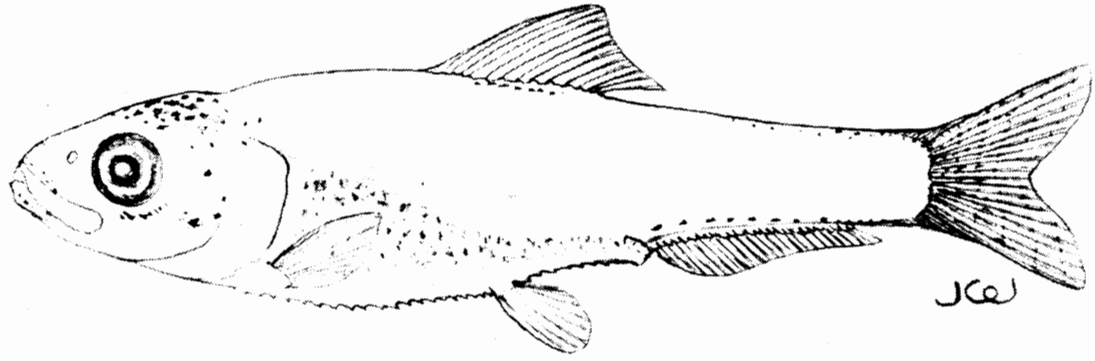


Figure 3-22. Juvenile, 24.5 mm TL.

Clupeidae: Dorosoma petenense, threadfin shad.

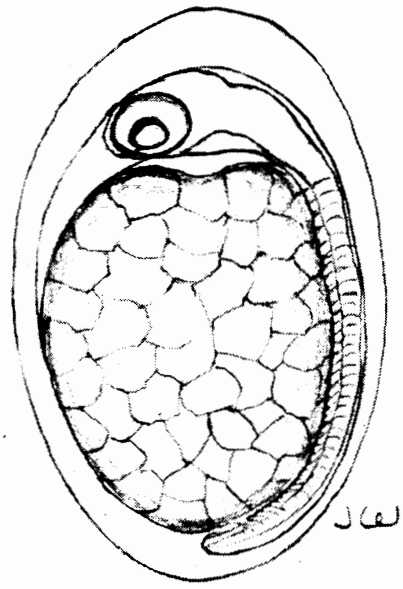


Figure 4-1. Egg, late embryo, long axis 1.4 mm, short axis 0.9 mm diameter.

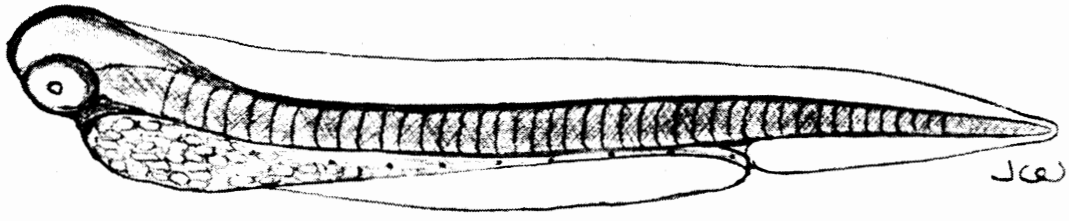


Figure 4-2. Prolarva, 3.6 mm TL.

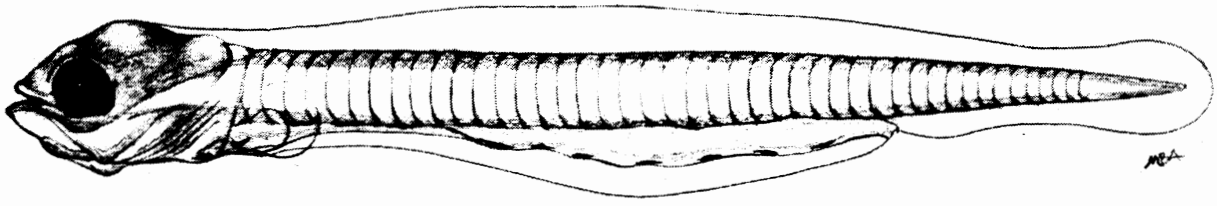


Figure 4-3. Postlarva, 3.9 mm TL.

Engraulidae: Engraulis mordax, northern anchovy.

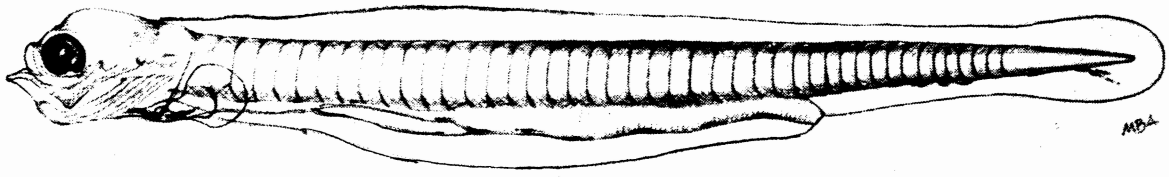


Figure 4-4. Postlarva, 6.0 mm TL.

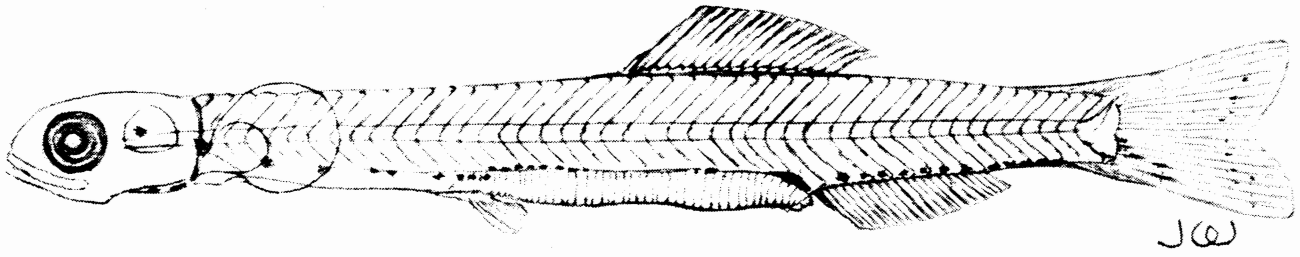


Figure 4-5. Postlarva, 27.5 mm TL.

Engraulidae: Engraulis mordax, northern anchovy.

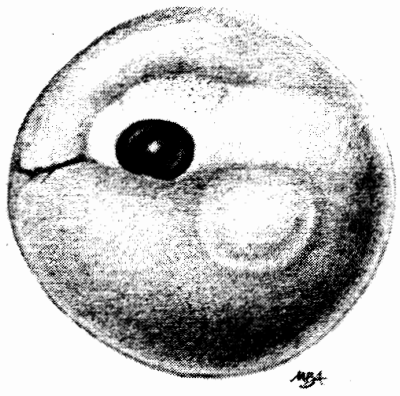


Figure 5-1. Egg, 9 mm diameter.

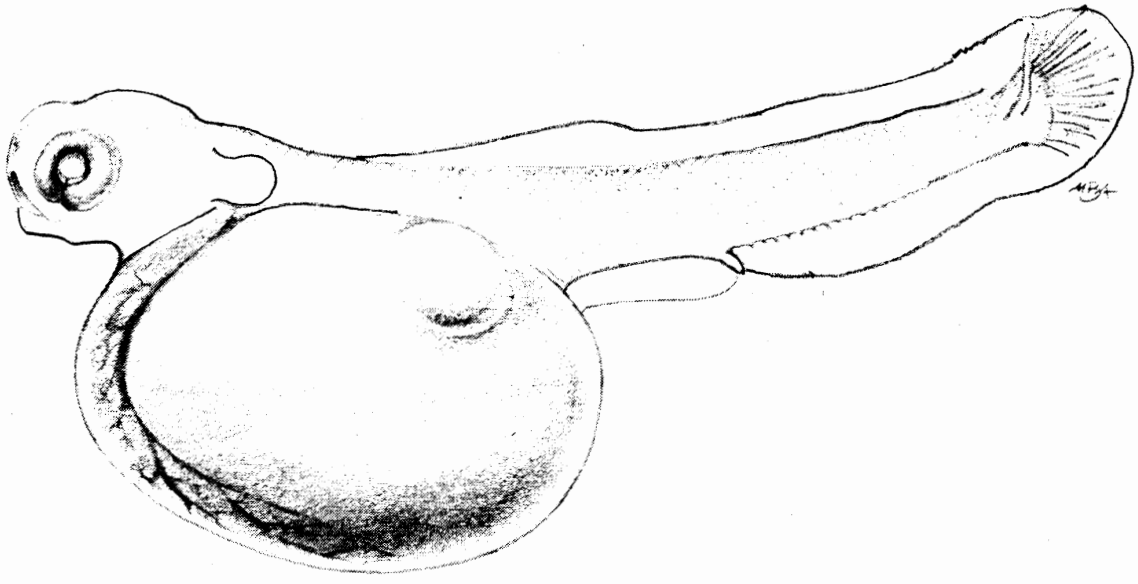


Figure 5-2. Prolarva, 23 mm TL.

Salmonidae: Oncorhynchus tshawytscha, chinook salmon.

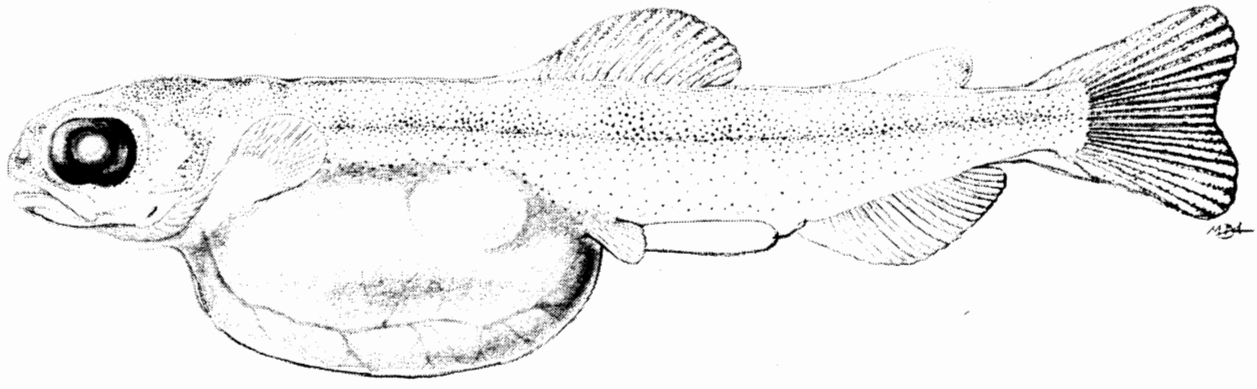


Figure 5-3. Prolarva, 32 mm TL.

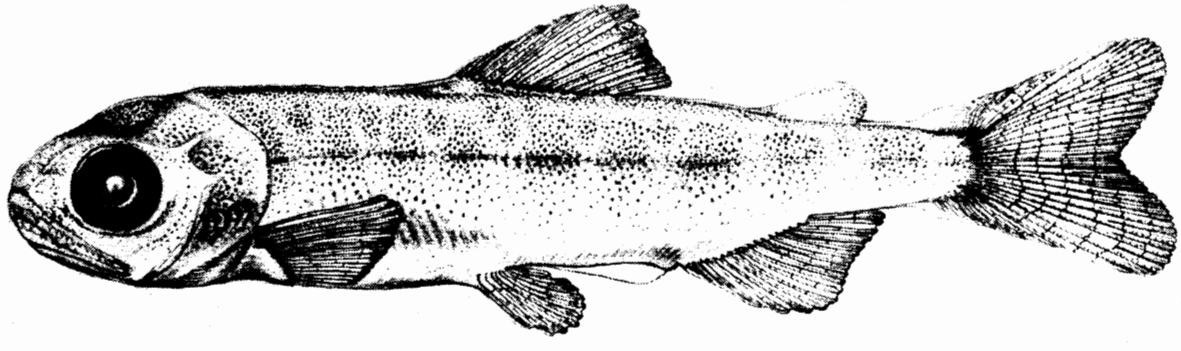


Figure 5-4. Juvenile, 37.5 mm TL.

Salmonidae: Oncorhynchus tshawytscha, chinook salmon.

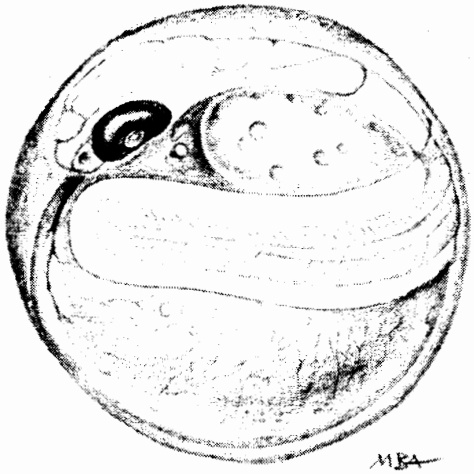


Figure 5-5. Egg, late embryo, 6 mm diameter.

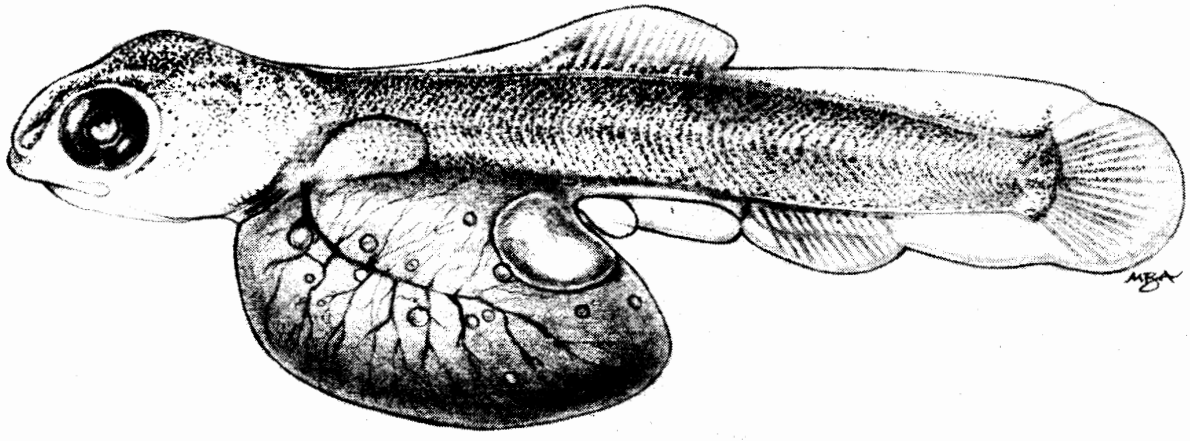


Figure 5-6. Prolarva, 17 mm TL.

Salmonidae: Salmo gairdneri, rainbow trout.

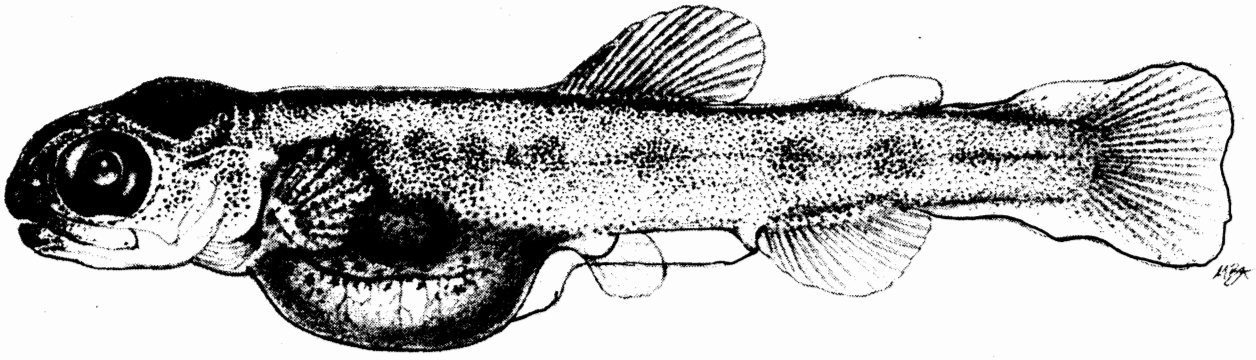


Figure 5-7. Prolarva, 25 mm TL.

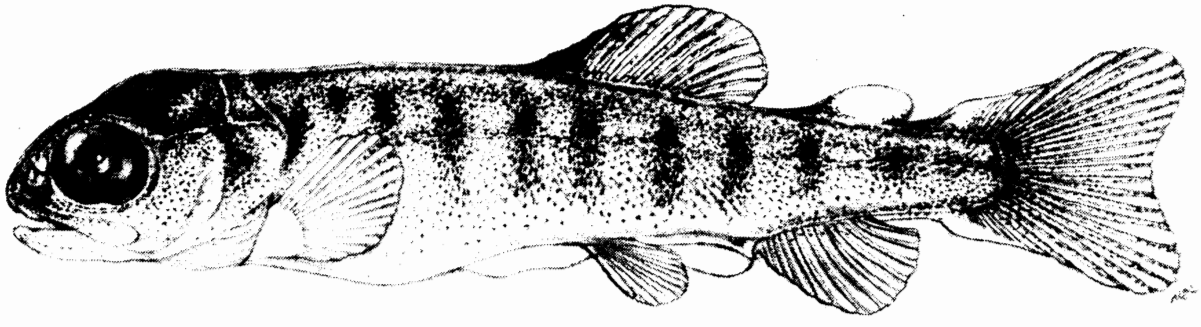


Figure 5-8. Juvenile, 28 mm TL.

Salmonidae: Salmo gairdneri, rainbow trout.

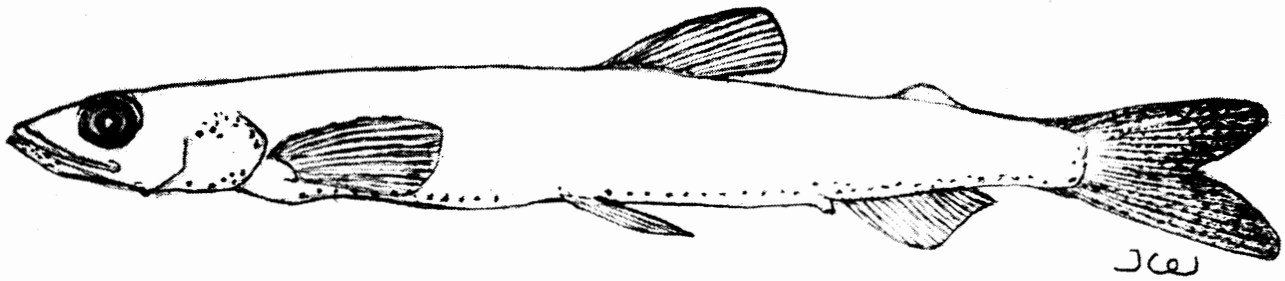


Figure 6-1. Allosmerus elongatus, whitebait smelt juvenile, 67 mm TL.

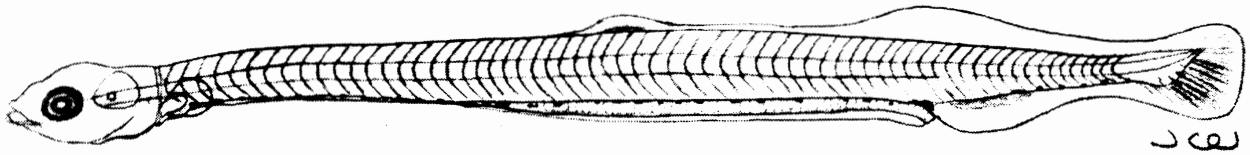


Figure 6-2. Hypomesus pretiosus, surf smelt postlarva, 14.7 mm TL.

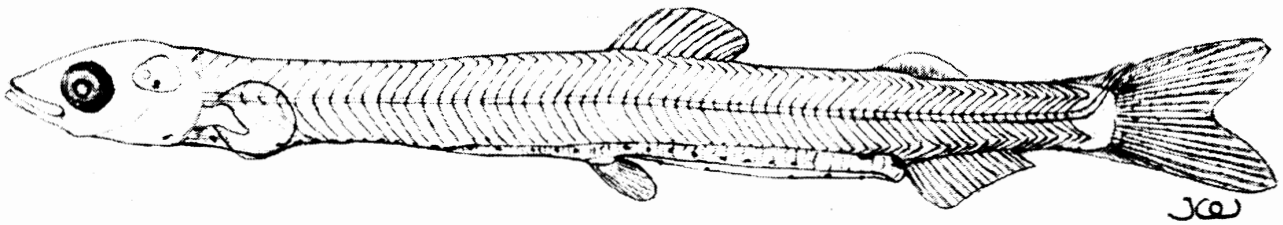


Figure 6-3. Hypomesus pretiosus, surf smelt postlarva, 30.5 mm TL.

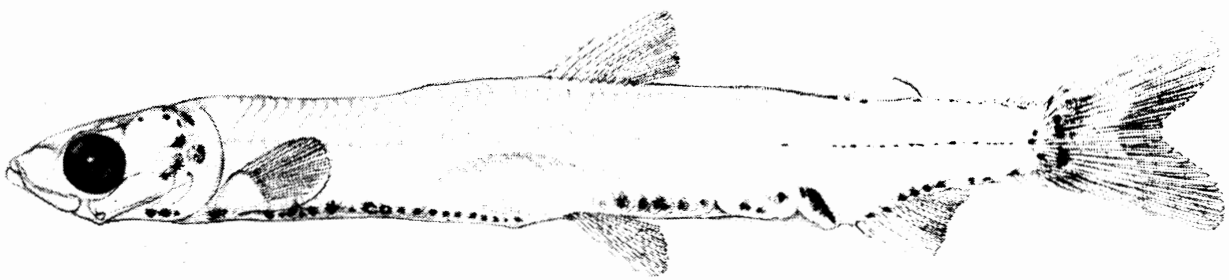


Figure 6-4. Hypomesus pretiosus, surf smelt juvenile, 42.5 mm TL.

Osmeridae: Smelts.

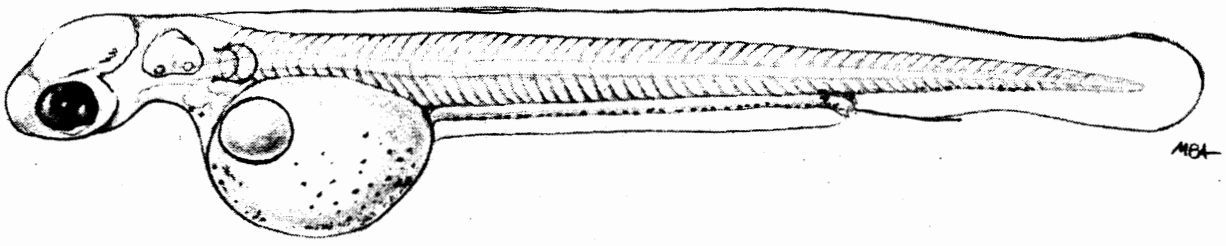


Figure 6-5. Prolarva, 4.3 mm TL.

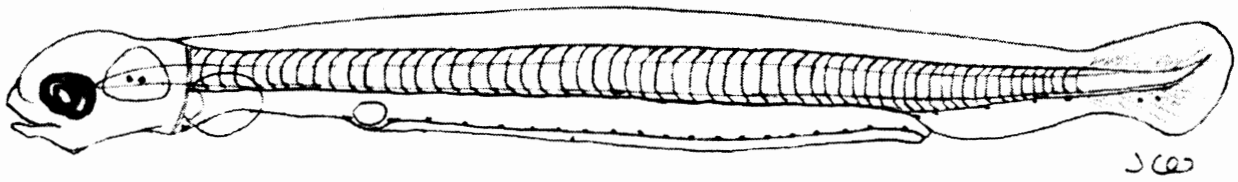


Figure 6-6. Prolarva, 7.2 mm TL.

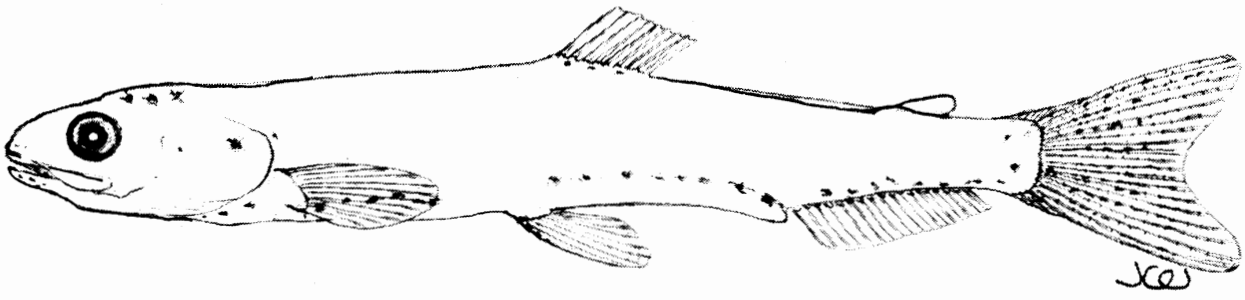


Figure 6-7. Juvenile, 55 mm TL.

Osmeridae: Spirinchus starksi, night smelt.

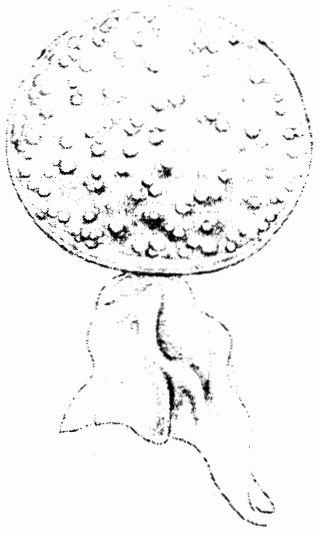


Figure 6-8. Unfertilized egg, 1.0 mm diameter.

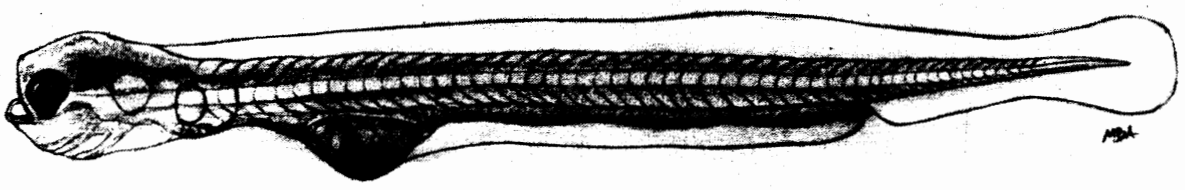


Figure 6-9. Prolarva, 6 mm TL.

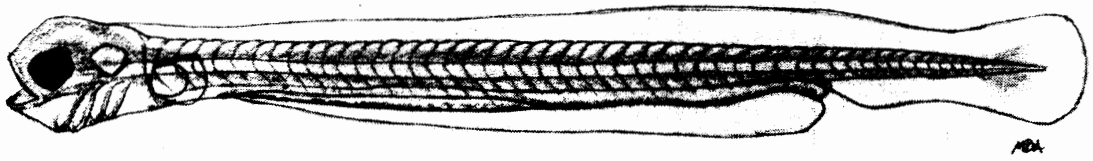


Figure 6-10. Postlarva, 8 mm TL.

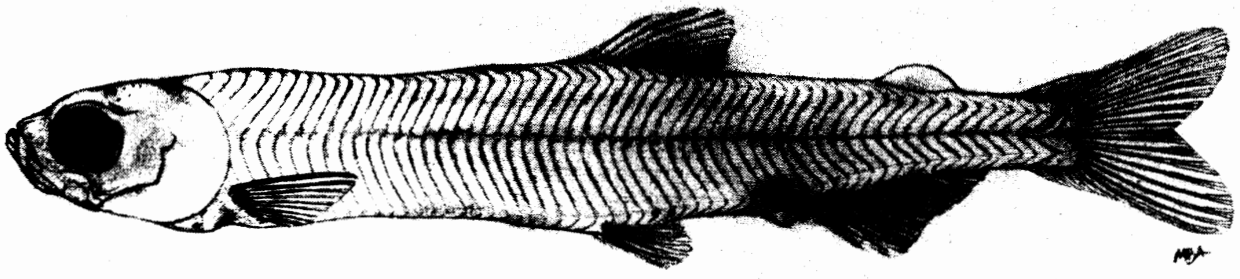


Figure 6-11. Juvenile, 29 mm TL.

Osmeridae: Hypomesus transpacificus, Delta smelt.

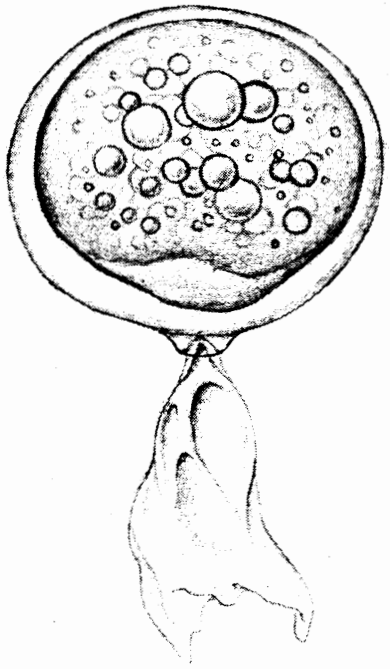


Figure 6-12. Egg, newly fertilized, 1 mm diameter.

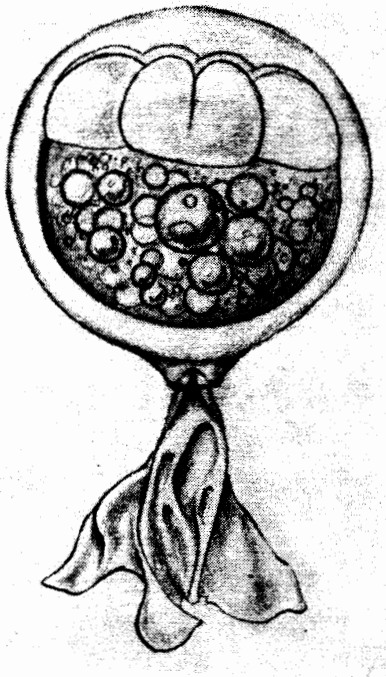


Figure 6-13. Egg, 16-cell stage, 1 mm diameter.

Osmeridae: Spirinchus thaleichthys, longfin smelt.

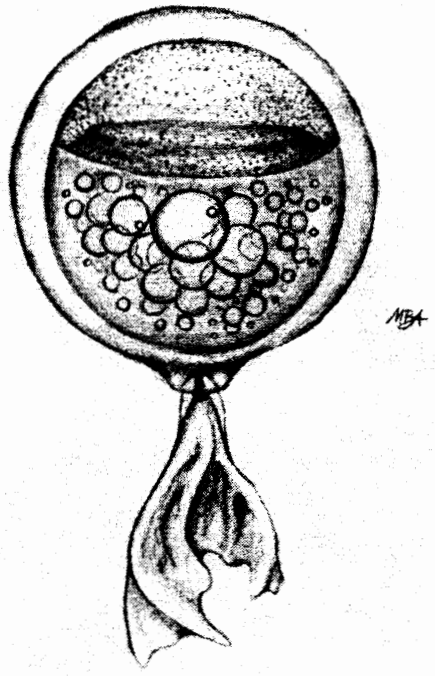


Figure 6-14. Egg, morula, 1 mm diameter.

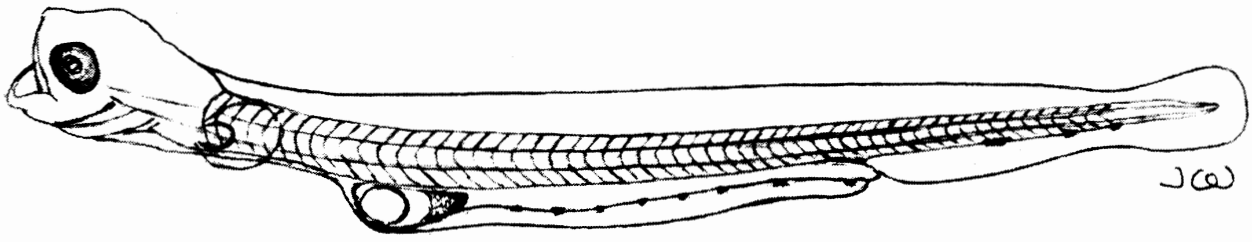


Figure 6-15. Prolarva, 6.2 mm TL.

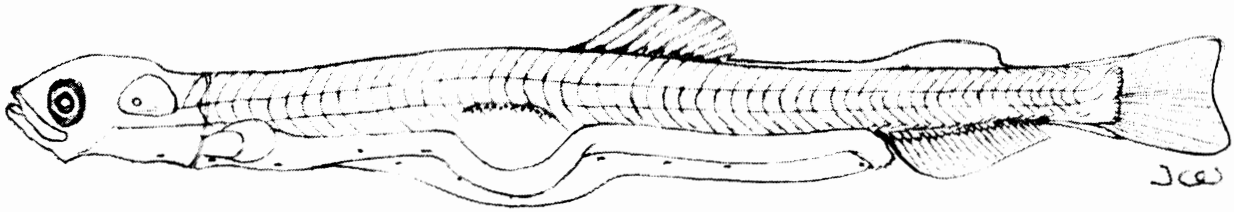


Figure 6-16. Postlarva, 20 mm TL.

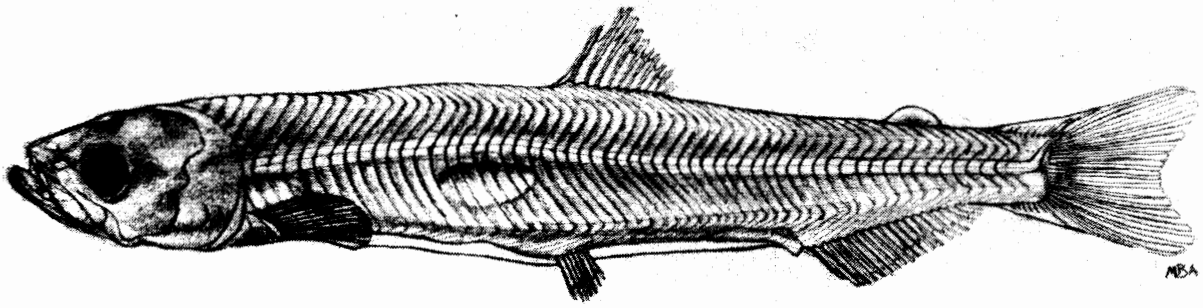


Figure 6-17. Juvenile, 32 mm TL.

Osmeridae: Spirinchus thaleichthys, longfin smelt.

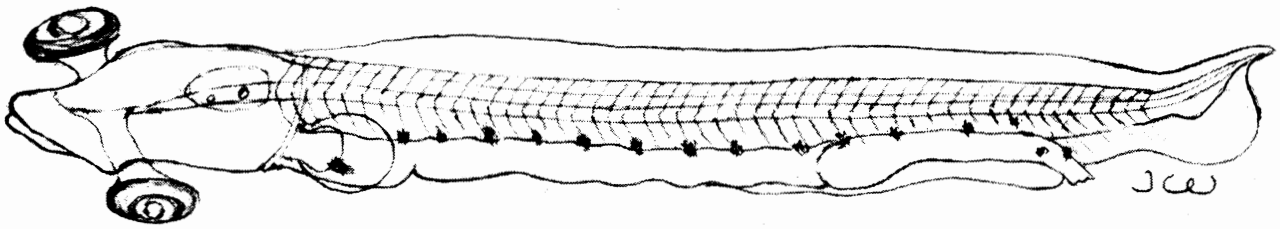


Figure 7-1. Bathylagus ochotensis, popeye blackmelt postlarva, 11.8 mm TL.

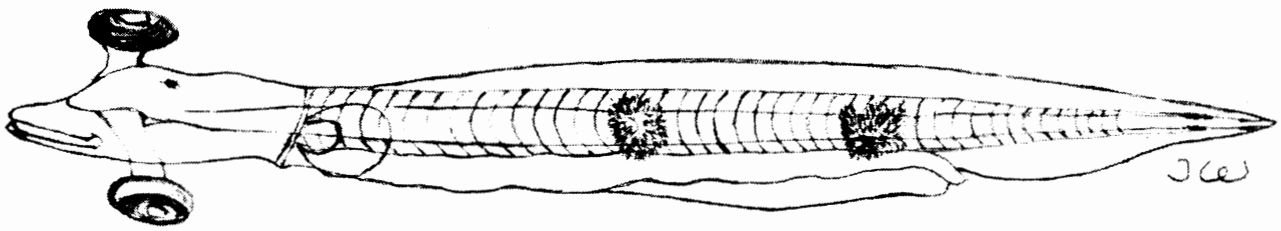


Figure 7-2. Bathylagus pacificus, Pacific blacksmelt postlarva, 10.6 mm TL.

Bathylagidae: Deepsea Smelts.

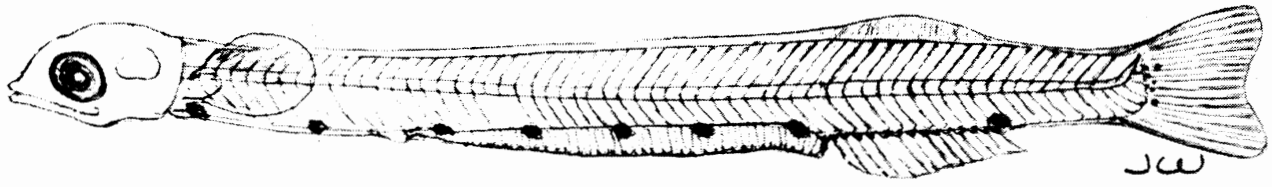


Figure 8-1. Postlarva, 25.5 mm TL.

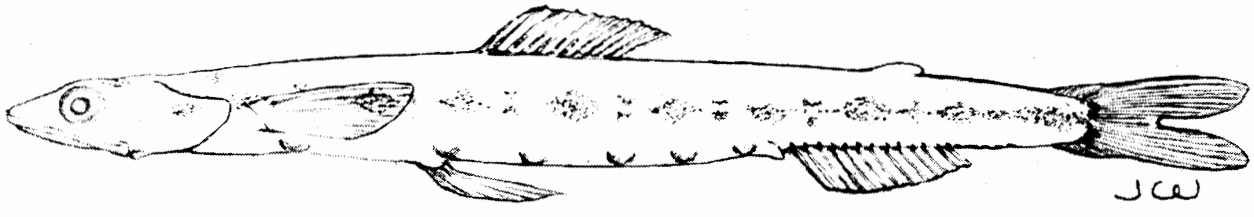


Figure 8-2. Juvenile, 80 mm TL.

Synodontidae: Synodus lucioceps, California lizardfish.

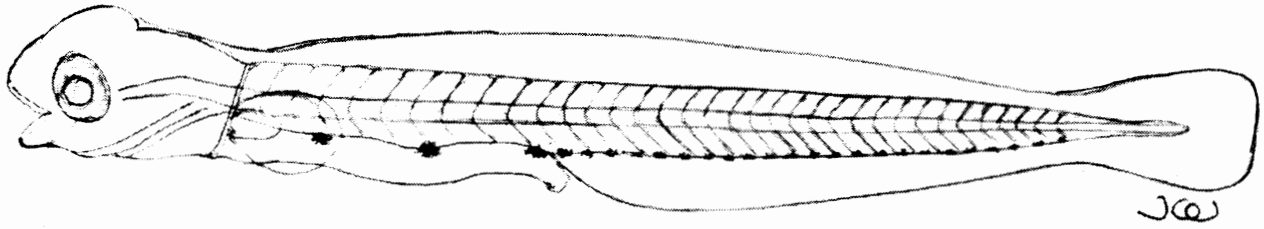


Figure 9-1. Stenobrachius leucopsarus, northern lampfish postlarva, 4.3 mm TL.

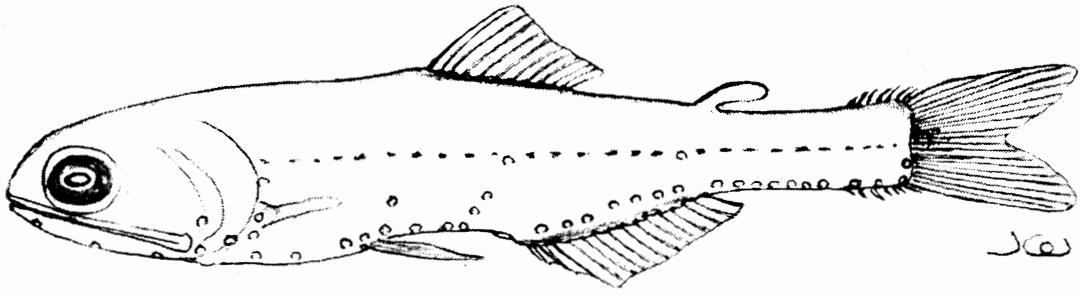


Figure 9-2. Stenobrachius leucopsarus, northern lampfish juvenile, 78 mm TL.

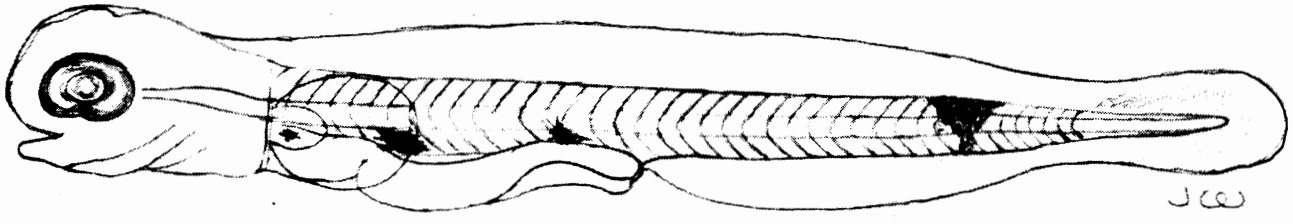


Figure 9-3. Tarletonbeania crenularis, blue lanternfish postlarva, 4.5 mm TL.

Myctophidae: Lanternfishes.

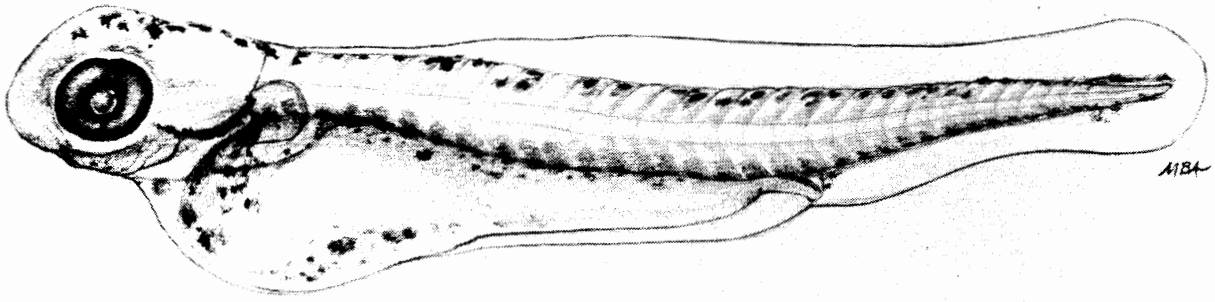


Figure 10-1. Prolarva, 4.8 mm TL.

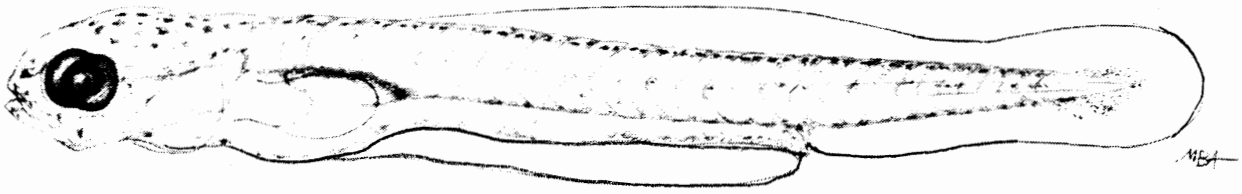


Figure 10-2. Postlarva, 5.8 mm TL.

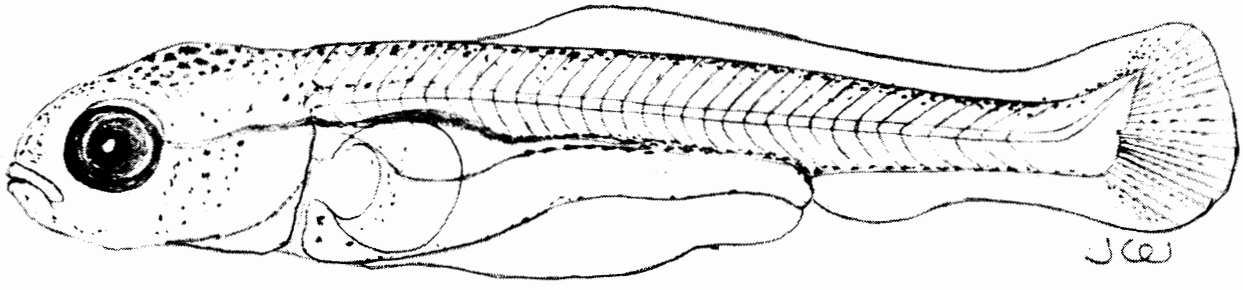


Figure 10-3. Postlarva, 9.5 mm TL.

Cyprinidae: Carassius auratus, goldfish.

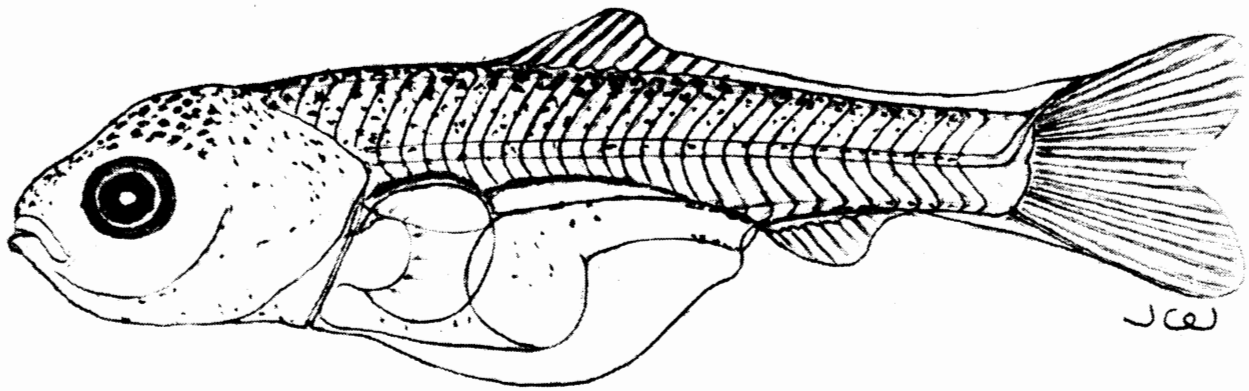


Figure 10-4. Postlarva, 13.8 mm TL.

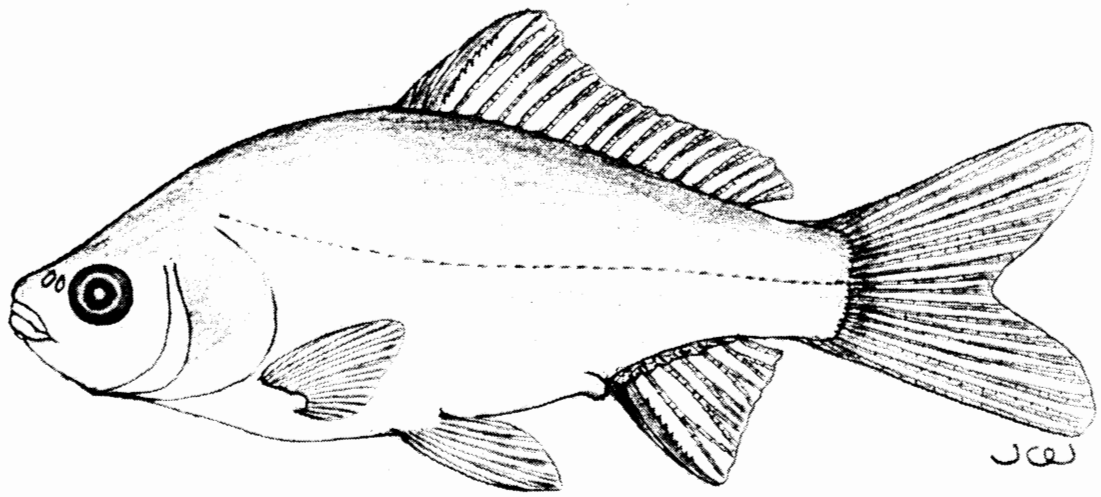


Figure 10-5. Juvenile, 48 mm TL.

Cyprinidae: Carassius auratus, goldfish.

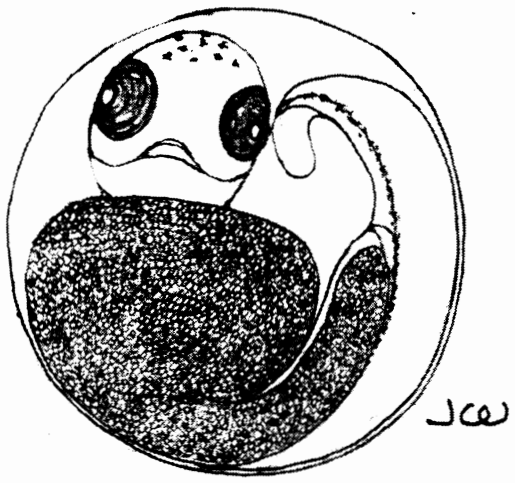


Figure 10-6. Egg, late embryo, 1.7 mm diameter.

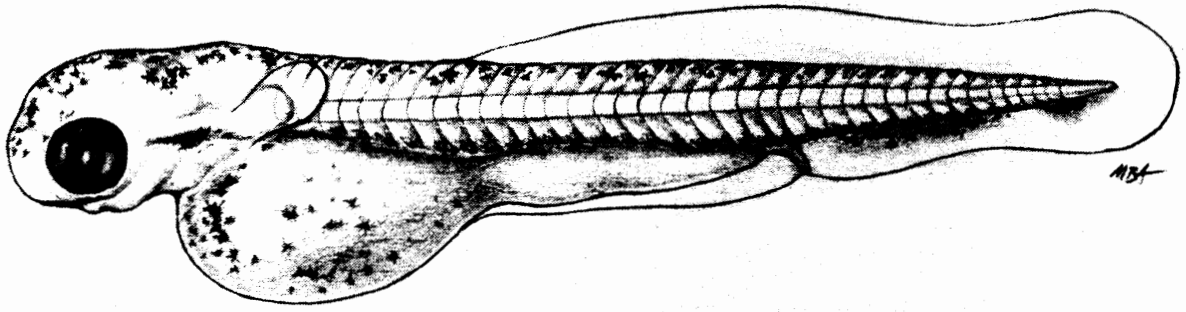


Figure 10-7. Prolarva, 5.4 mm TL.

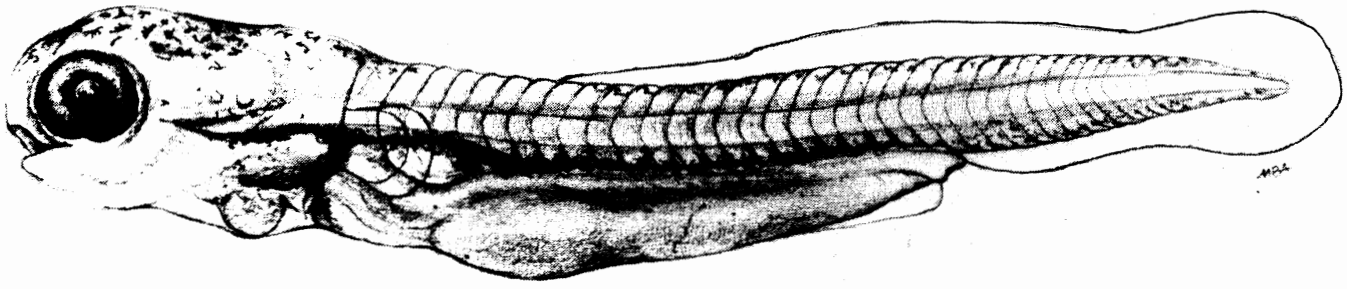


Figure 10-8. Prolarva, 6.2 mm TL.

Cyprinidae: Cyprinus carpio, common carp.

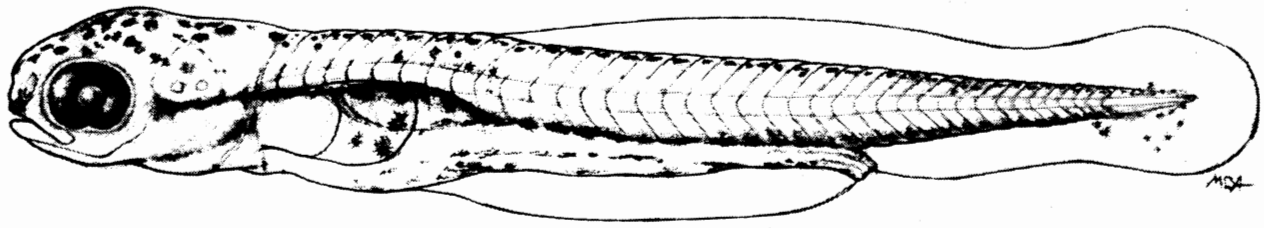


Figure 10-9. Postlarva, 6.6 mm TL.

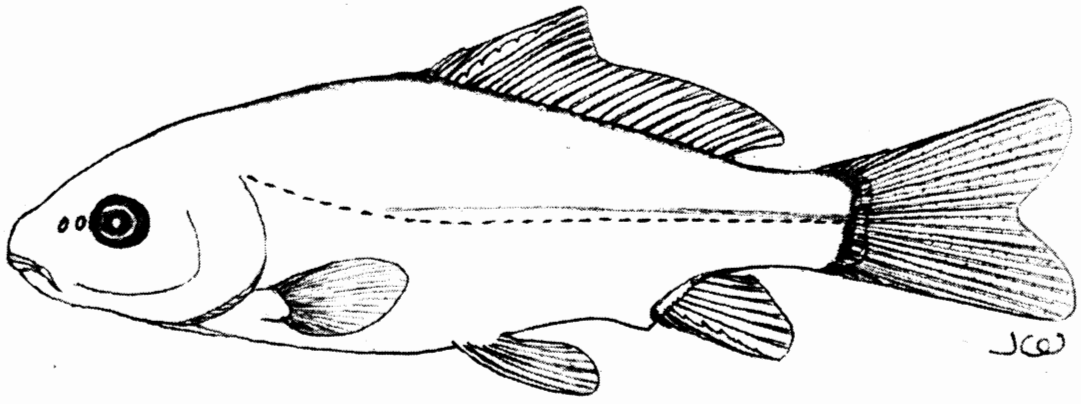


Figure 10-10. Juvenile, 42 mm TL.

Cyprinidae: Cyprinus carpio, common carp.

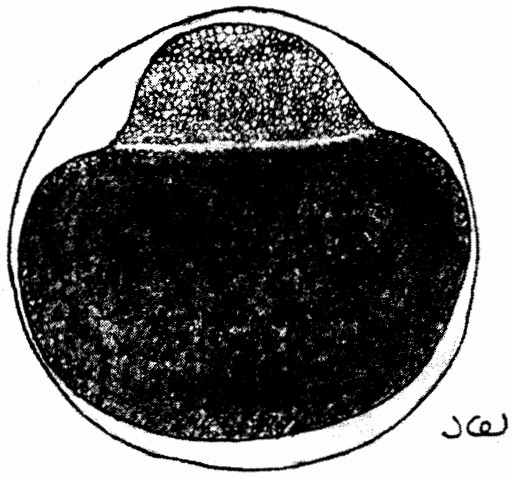


Figure 10-11. Egg, morula, 2.1 mm diameter.

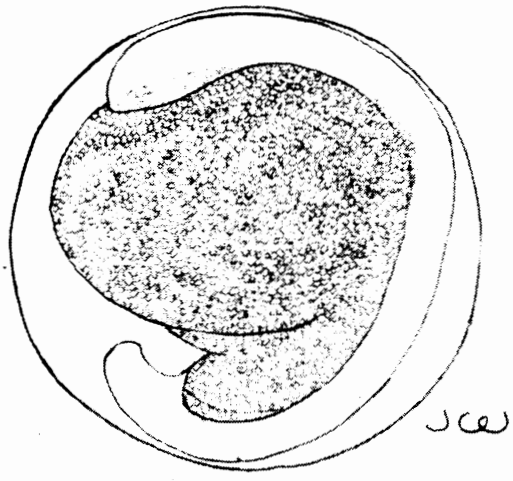


Figure 10-12. Egg, late embryo, 2.0 mm diameter.

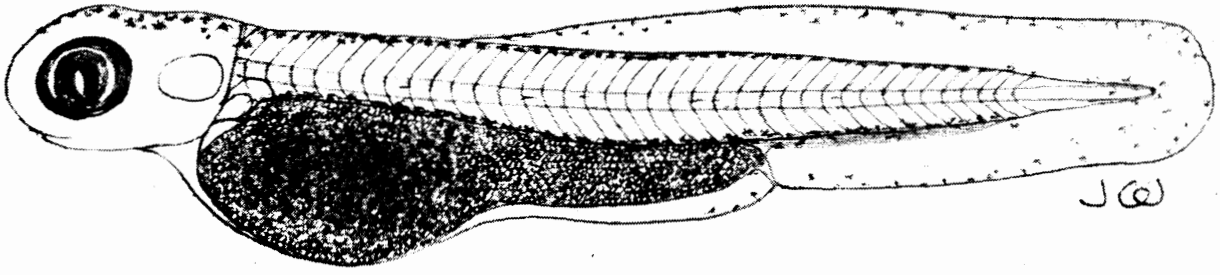


Figure 10-13. Prolarva, 6.9 mm TL.

Cyprinidae: Hesperoleucus symmetricus, California roach.

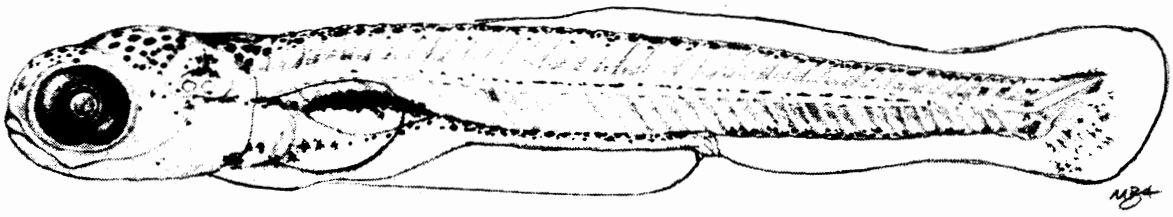


Figure 10-14. Postlarva, 7 mm TL.

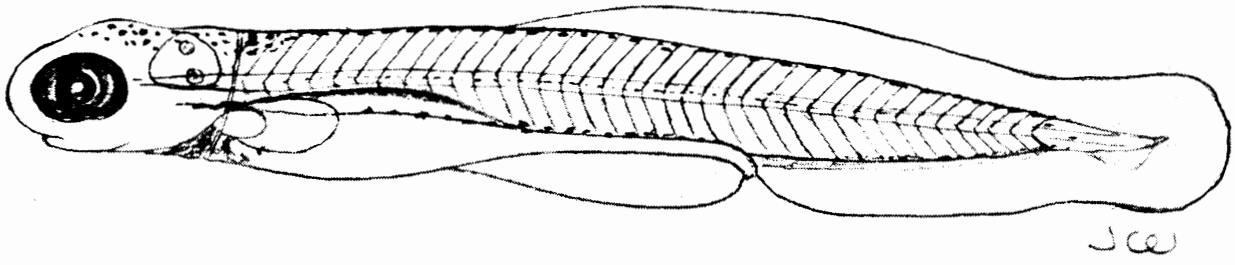


Figure 10-15. Postlarva, 8.2 mm TL.

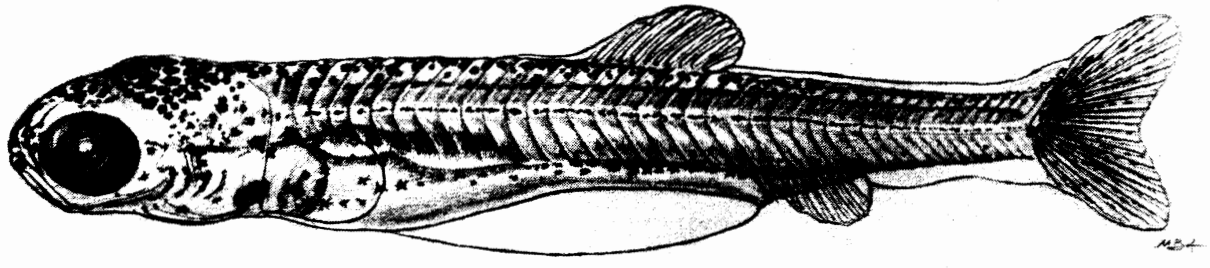


Figure 10-16. Postlarva, 11 mm TL.

Cyprinidae: Hesperoleucus symmetricus, California roach.

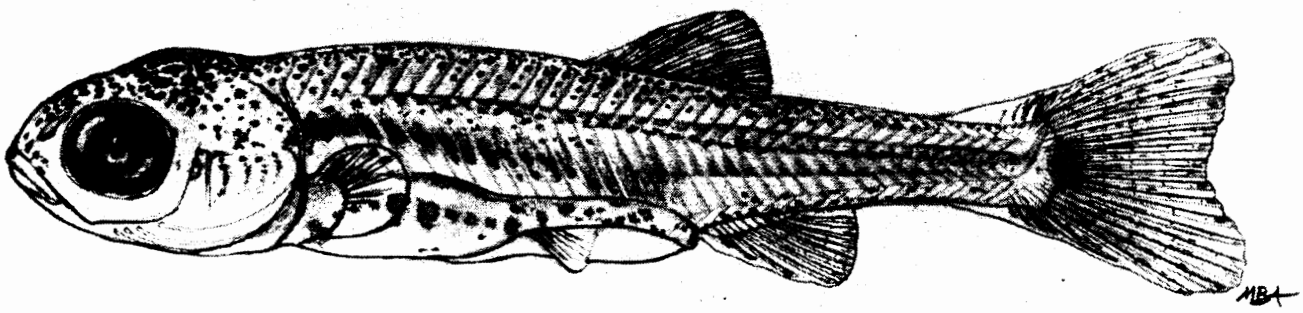


Figure 10-17. Postlarva, 15 mm TL.

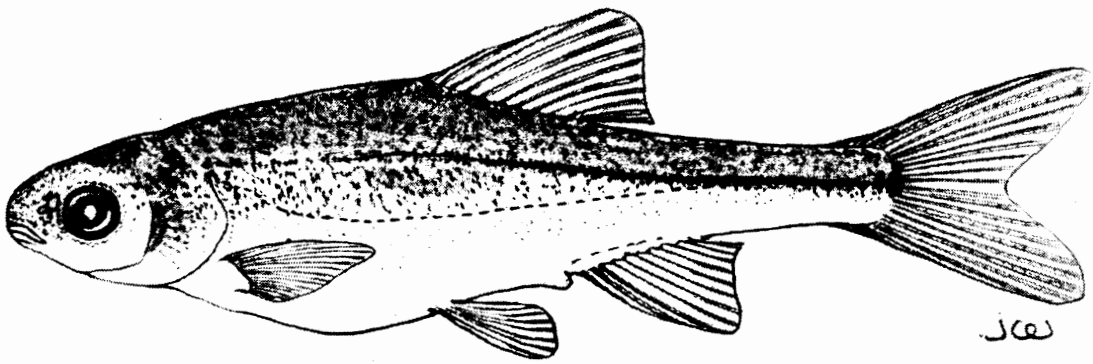


Figure 10-18. Juvenile, 35 mm TL.

Cyprinidae: Hesperoleucus symmetricus, California roach.

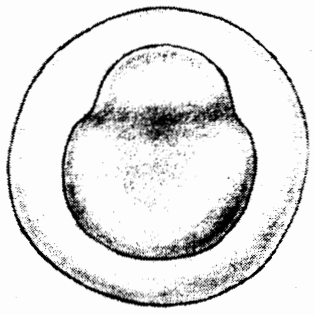


Figure 10-19. Egg, 2-cell, 1.6 mm diameter.

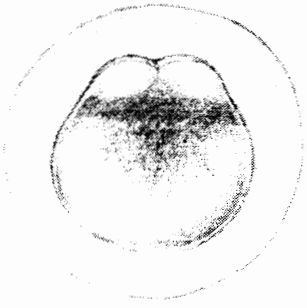


Figure 10-20. Egg, 4-cell, 1.6 mm diameter.

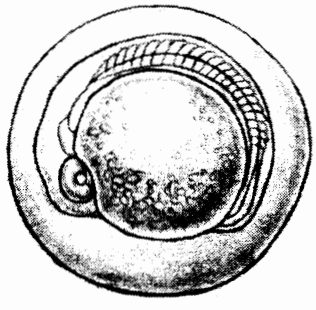


Figure 10-21. Egg, early embryo, 1.7 mm diameter.

Cyprinidae: Lavinia exilicauda, hitch.

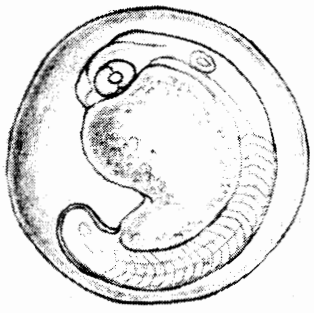


Figure 10-22. Late embryo, 1.7 mm diameter.

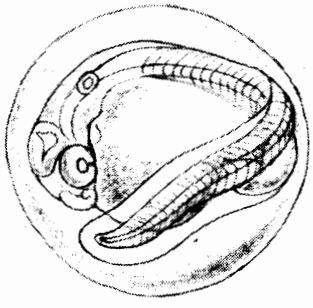


Figure 10-23. Late embryo, 1.7 mm diameter.

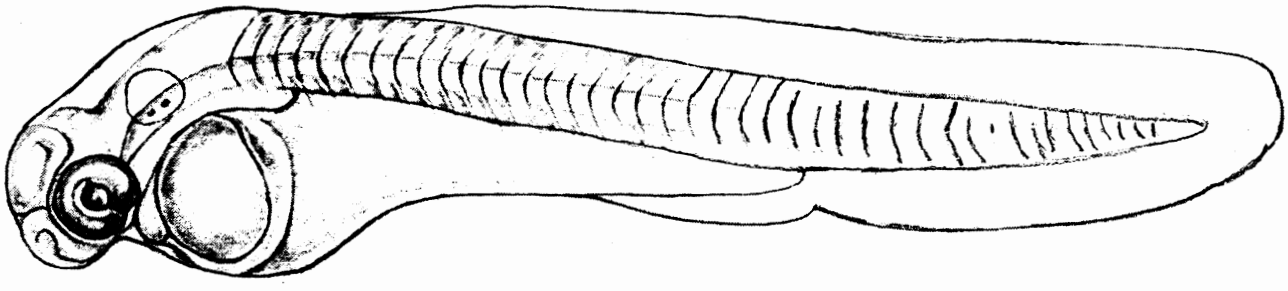


Figure 10-24. Prolarva, 5.5 mm TL.

Cyprinidae: Lavinia exilicauda, hitch.

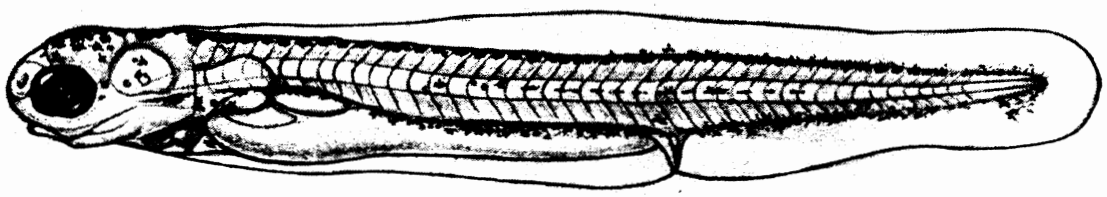


Figure 10-25. Postlarva, 7 mm TL.

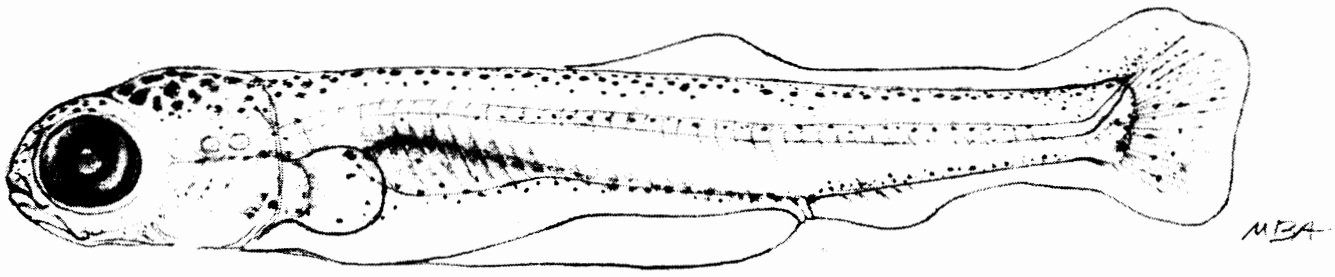


Figure 10-26. Postlarva, 10 mm TL.

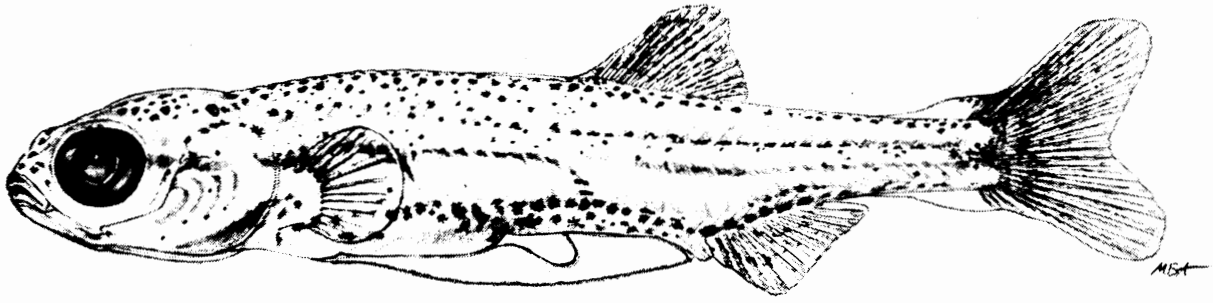


Figure 10-27. Postlarva, 13 mm TL.

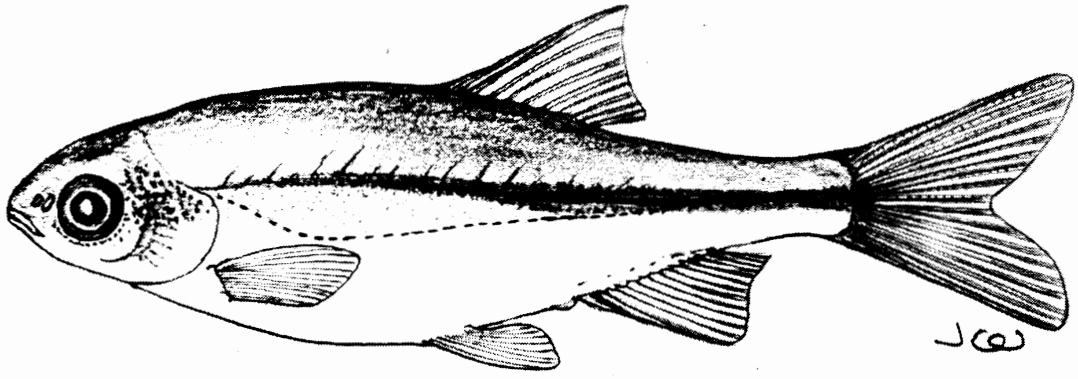


Figure 10-28. Juvenile, 65 mm TL.

Cyprinidae: Lavinia exilicauda, hitch.

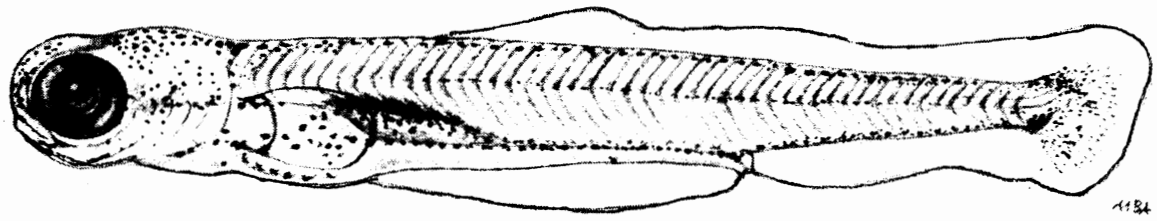


Figure 10-29. Postlarva, 11 mm TL.

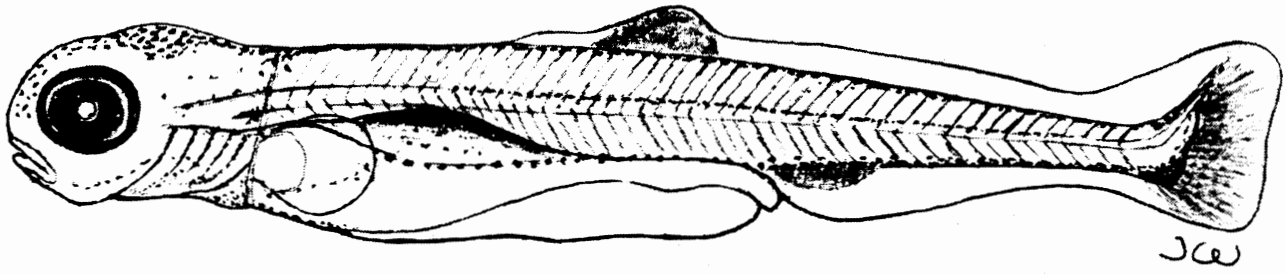


Figure 10-30. Postlarva, 12.3 mm TL.

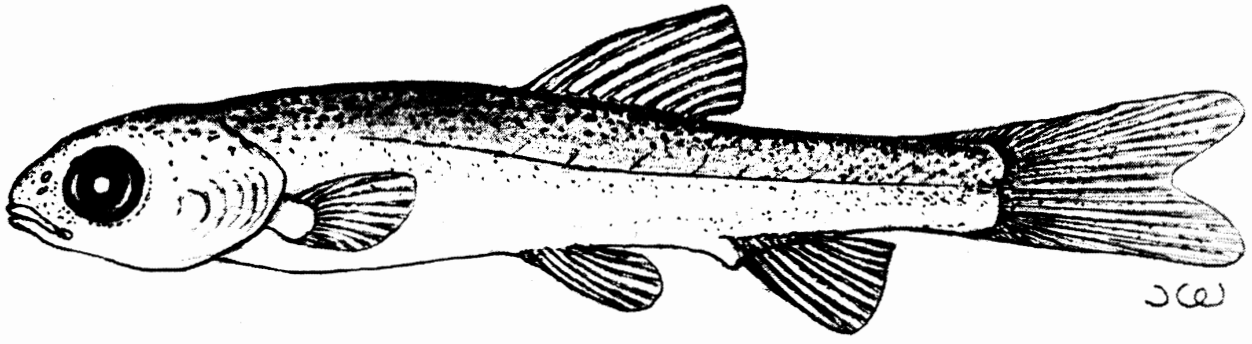


Figure 10-31. Juvenile, 22.5 mm TL.

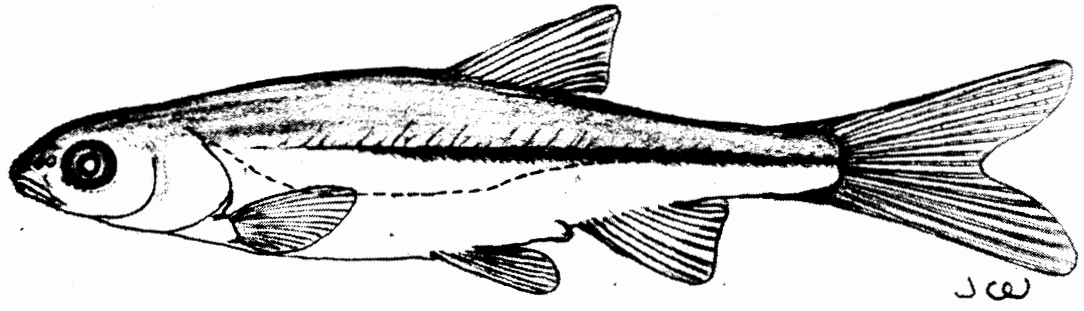


Figure 10-32. Juvenile, 67 mm TL.

Cyprinidae: Mylopharodon conocephalus, hardhead.

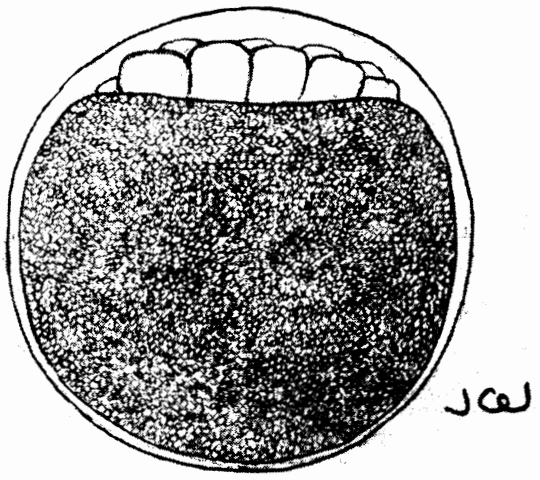


Figure 10-33. **Egg**, 16-cell, 1.2 mm TL.

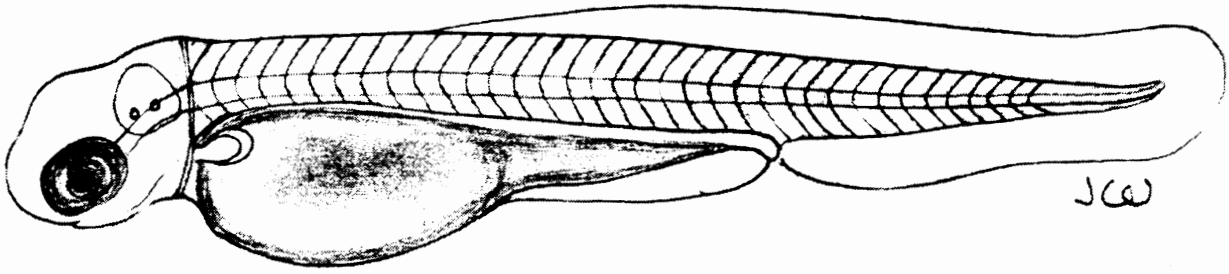


Figure 10-34. Prolarva, 4.5 mm TL.

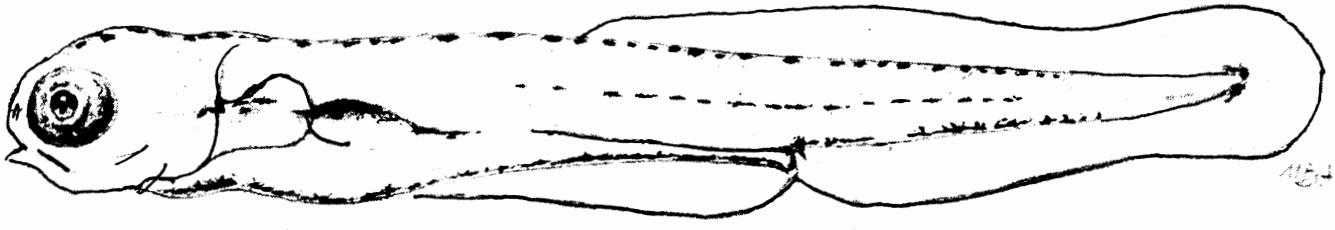


Figure 10-35. Postlarva, 5 mm TL.

Cyprinidae: Notemigonus crysoleucas, golden shiner.

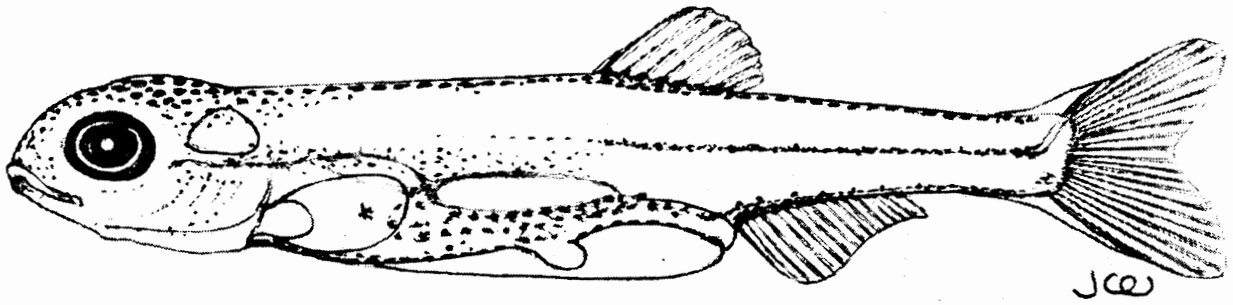


Figure 10-36. Notemigonus crysoleucas, golden shiner postlarva, 13.3 mm TL.

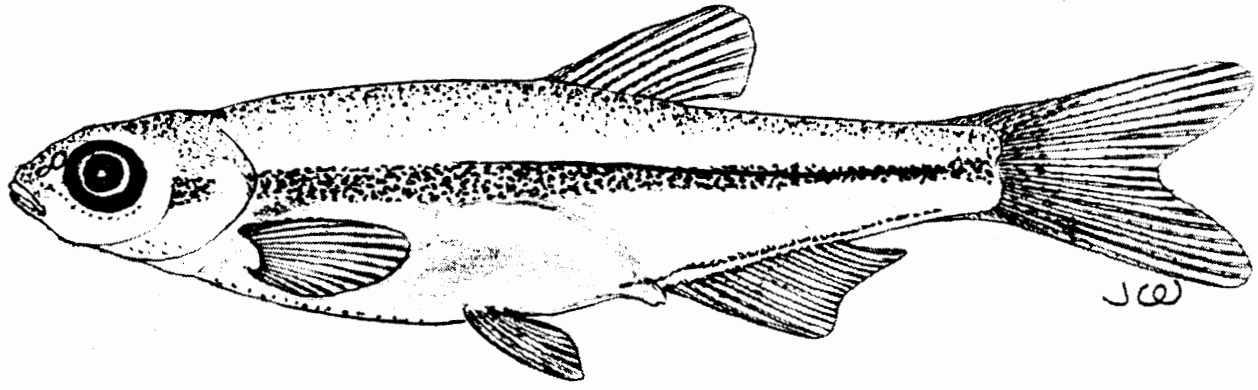


Figure 10-37. Notemigonus crysoleucas, golden shiner juvenile, 23.8 mm TL.

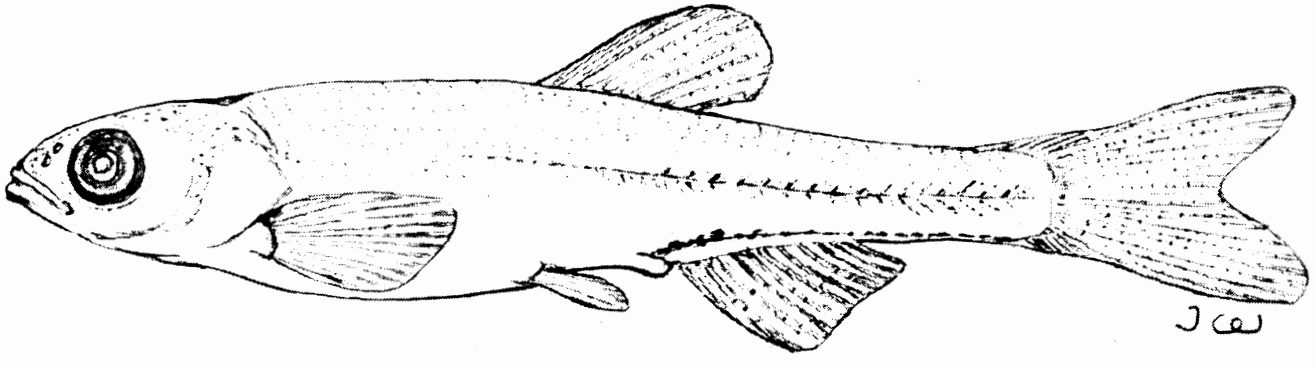


Figure 10-38. Notropis lutrensis, red shiner juvenile, 22.5 mm TL.

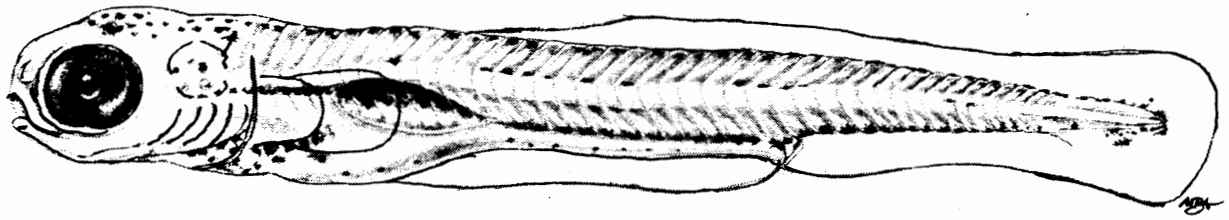


Figure 10-39. Postlarva, 6.5 mm TL.

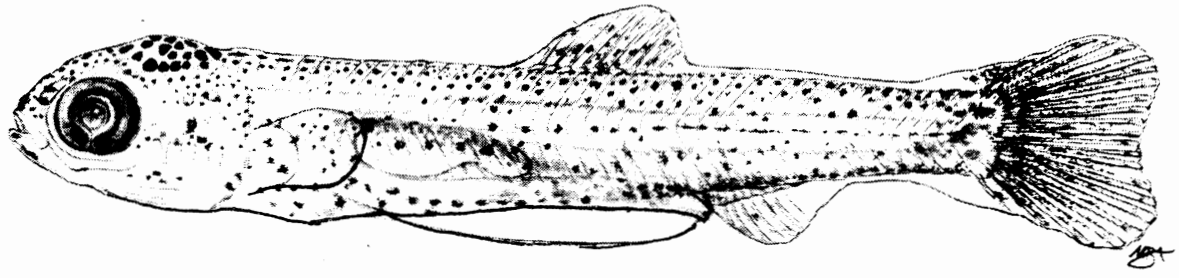


Figure 10-40. Postlarva, 12.6 mm TL.

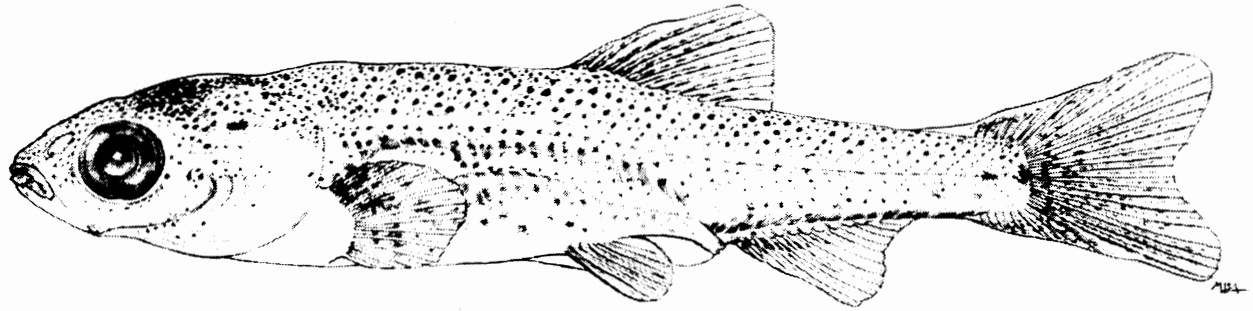


Figure 10-41. Juvenile, 17 mm TL.

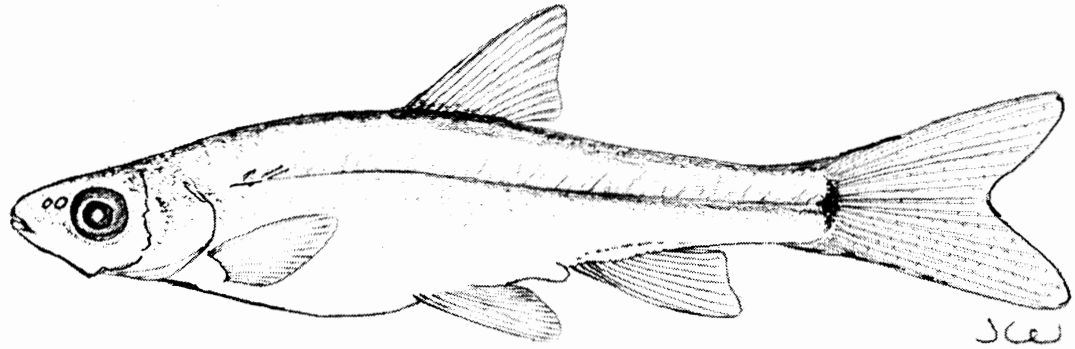


Figure 10-42. Juvenile, 78 mm TL.

Cyprinidae: Orthodon microlepidotus, Sacramento blackfish.

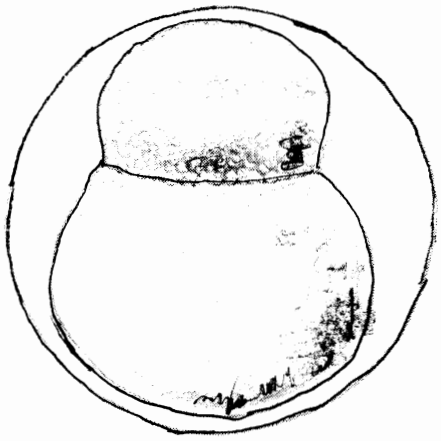


Figure 10-43. Egg, morula, 1.3 mm diameter.

Figure 10-44. Egg, late embryo, 1.2 mm diameter.

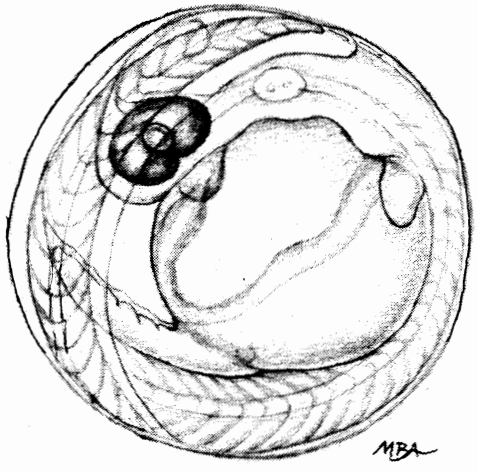


Figure 10-45. Egg, late embryo, 1.2 mm diameter.

Cyprinidae: Pimephales promelas, fathead minnow.

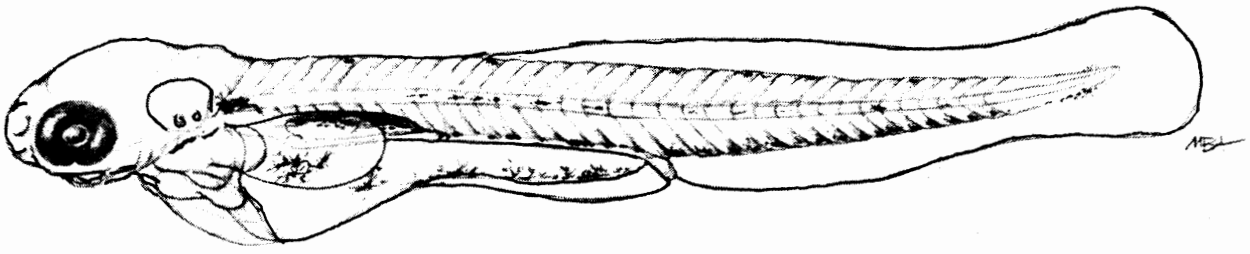


Figure 10-46. Prolarva, 5.2 mm TL.

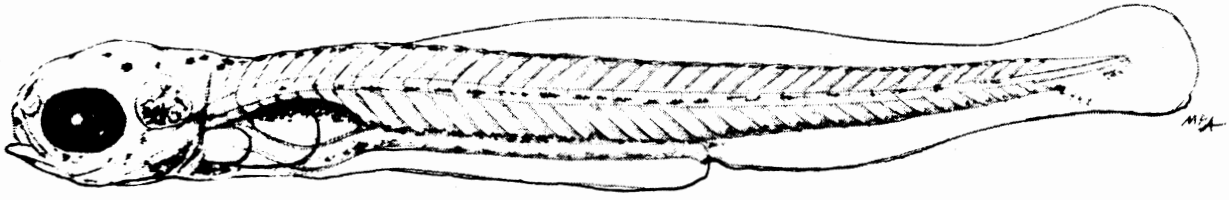


Figure 10-47. Postlarva, 5.9 mm TL.

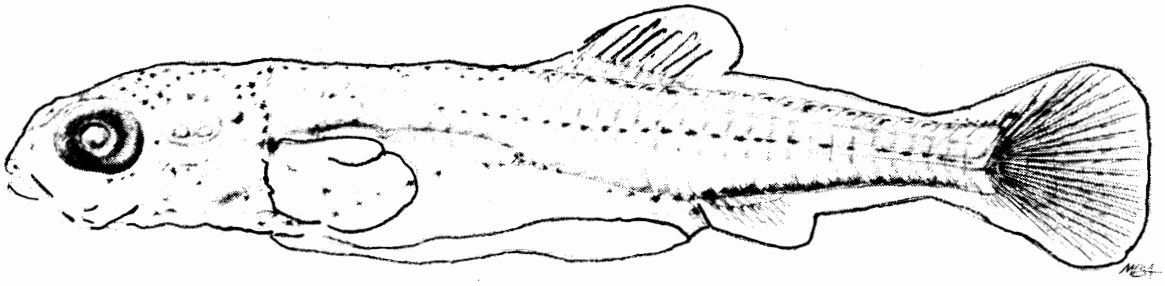


Figure 10-48. Postlarva, 9 mm TL.

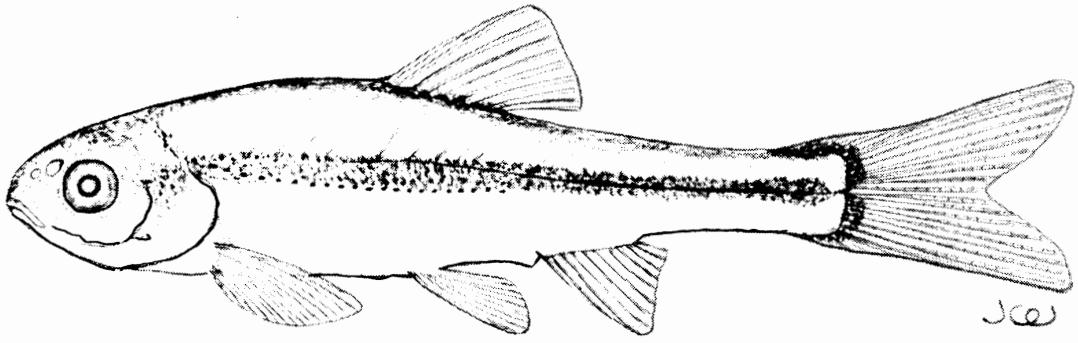


Figure 10-49. Juvenile, 42.5 mm TL.

Cyprinidae: Pimephales promelas, fathead minnow.

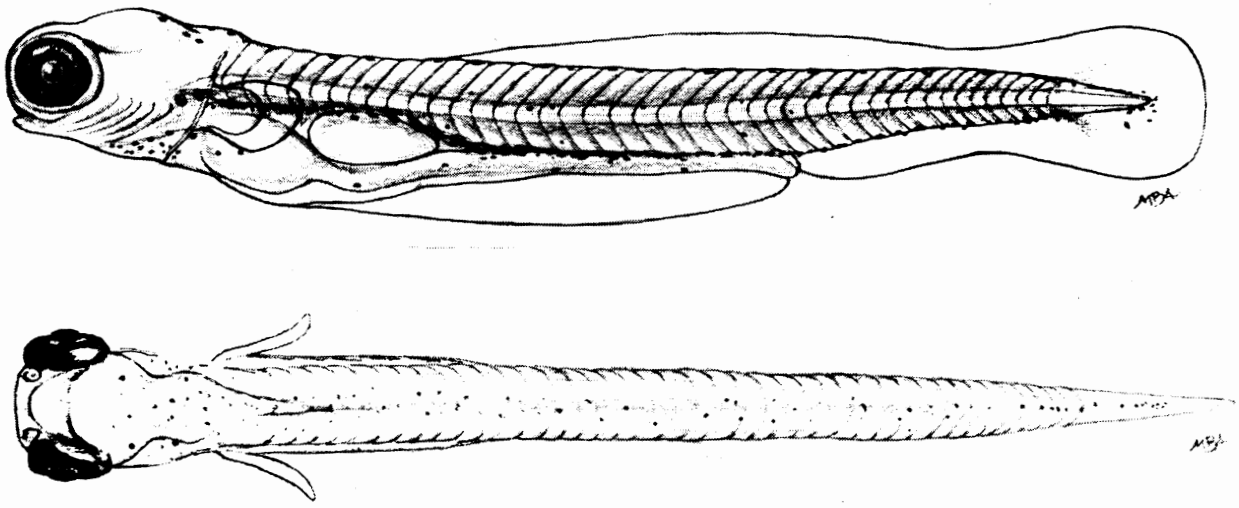


Figure 10-50, 10-51. Postlarva, lateral and dorsal views, 7.5 mm TL.

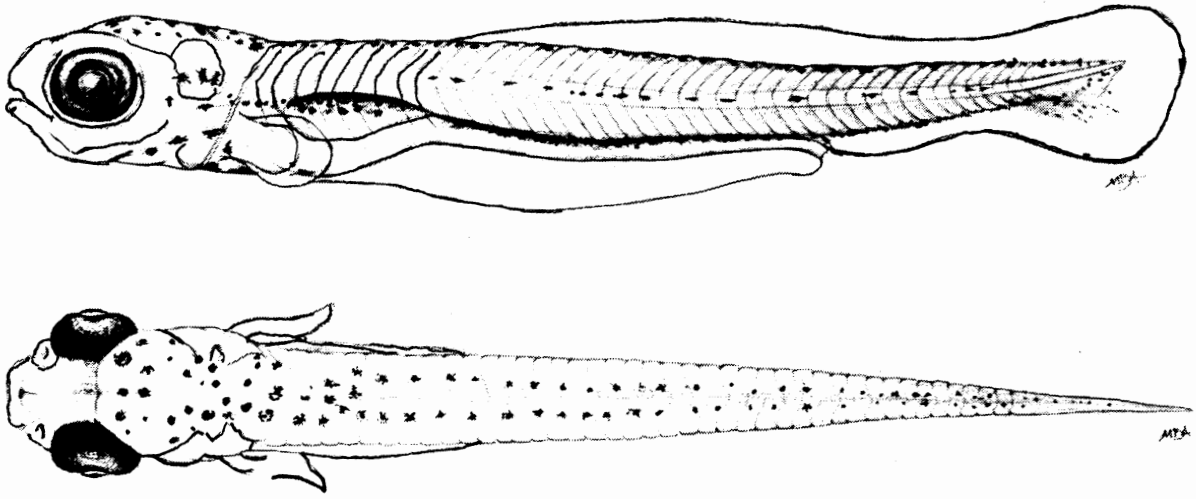


Figure 10-52, 10-53. Postlarva, lateral and dorsal views, 8.1 mm TL.

Cyprinidae: Pogonichthys macrolepidotus, splittail.

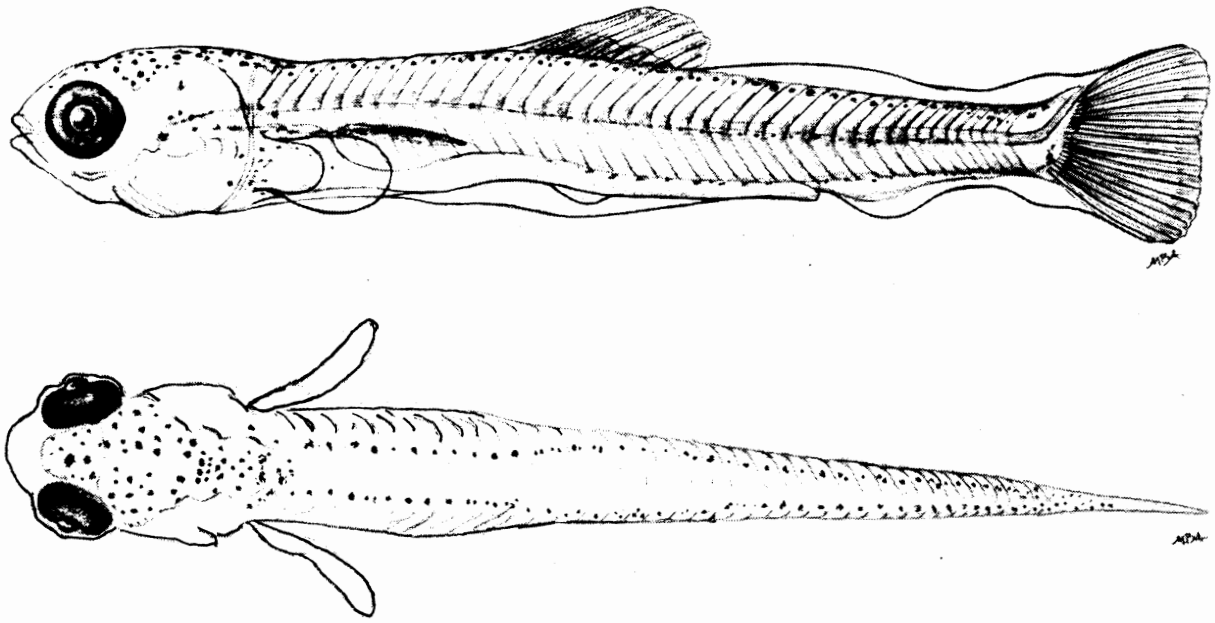


Figure 10-54, 10-55. Postlarva, lateral and dorsal views, 10.4 mm TL.

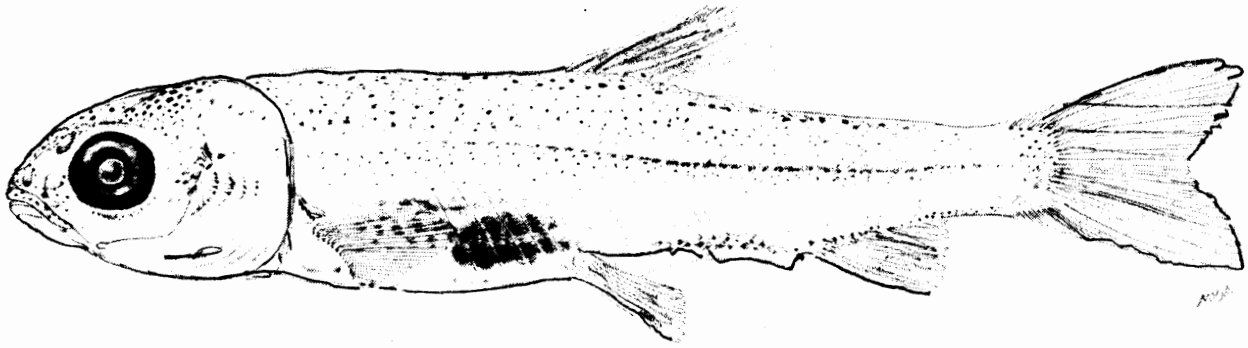


Figure 10-56. Juvenile, 24.2 mm TL.

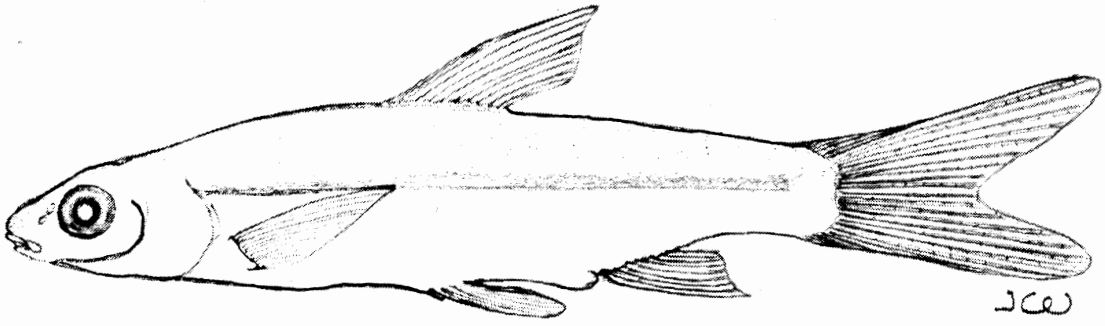


Figure 10-57. Juvenile, 57 mm TL.

Cyprinidae: Pogonichthys macrolepidotus, splittail.

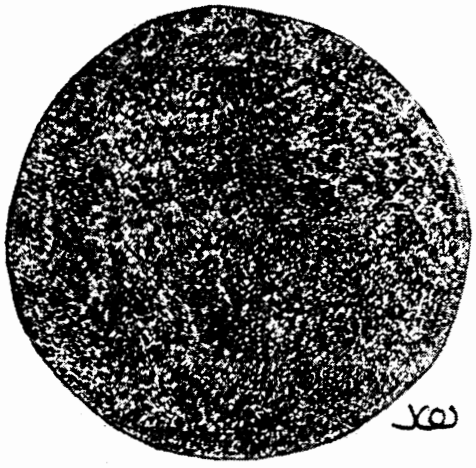


Figure 10-58. Unfertilized egg, 2.2 mm diameter.

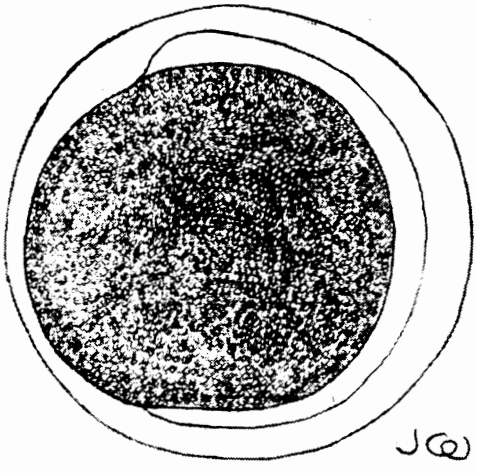


Figure 10-59. Egg, early embryo, 2.5 mm diameter.

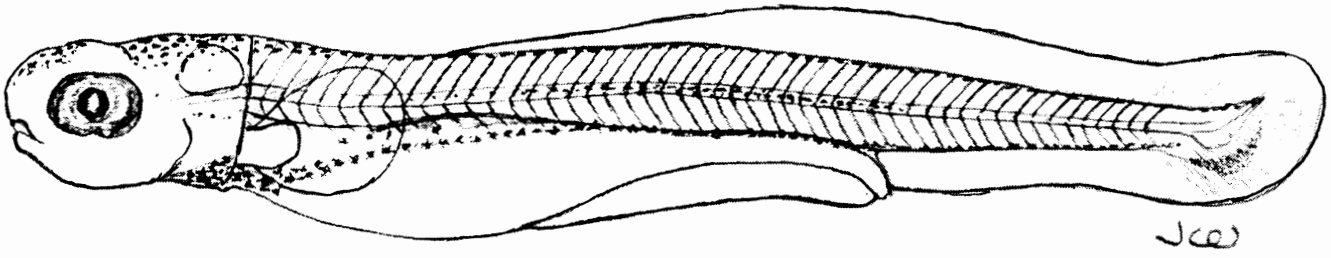


Figure 10-60. Prolarva, 10.6 mm TL.

Cyprinidae: Ptychocheilus grandis, Sacramento squawfish.

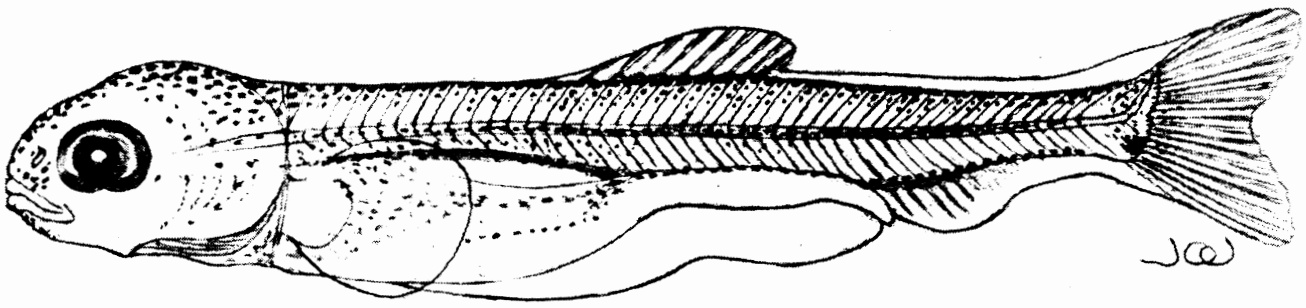


Figure 10-61. Postlarva, 12.3 mm TL.

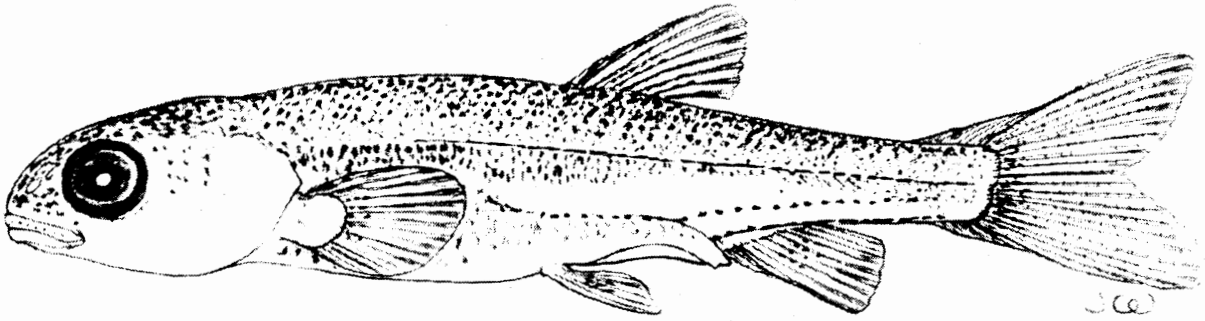


Figure 10-62. Juvenile, 23 mm TL.

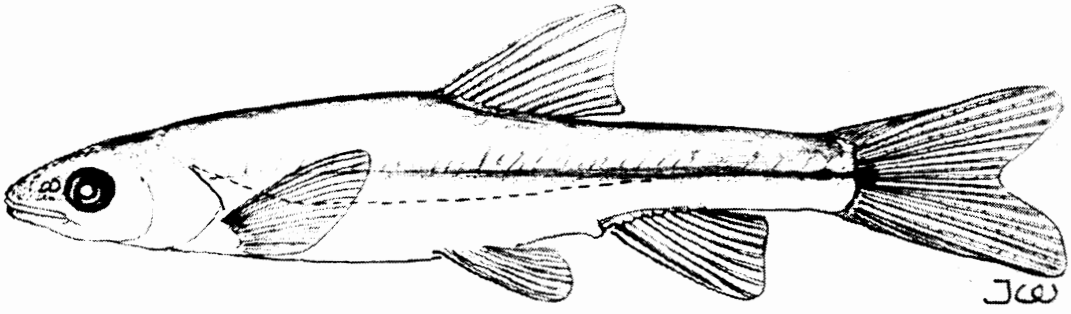


Figure 10-63. Juvenile, 75 mm TL.

Cyprinidae: Ptychocheilus grandis, Sacramento squawfish.

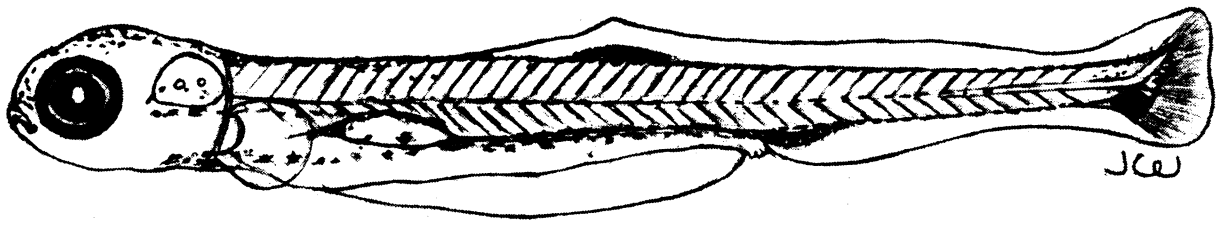


Figure 10-64. Postlarva, 7.5 mm TL.

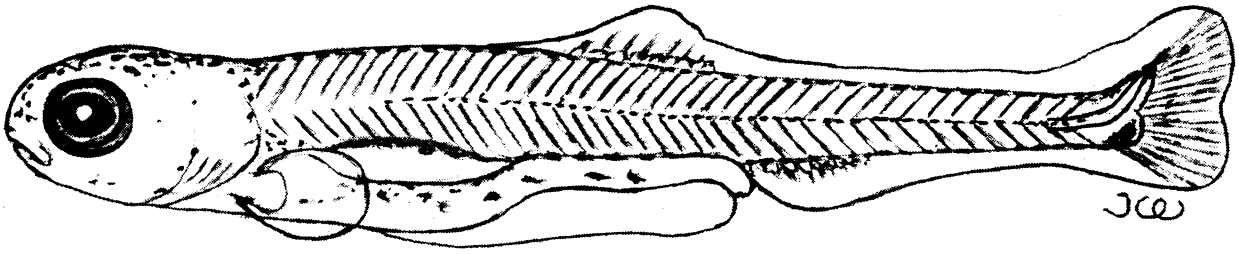


Figure 10-65. Postlarva, 9.9 mm TL.

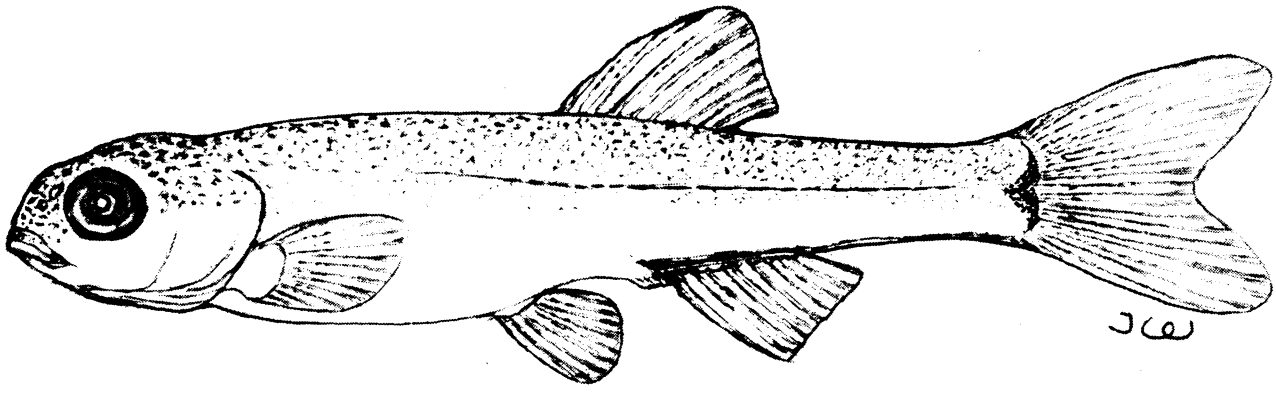


Figure 10-66. Juvenile, 22.5 mm TL.

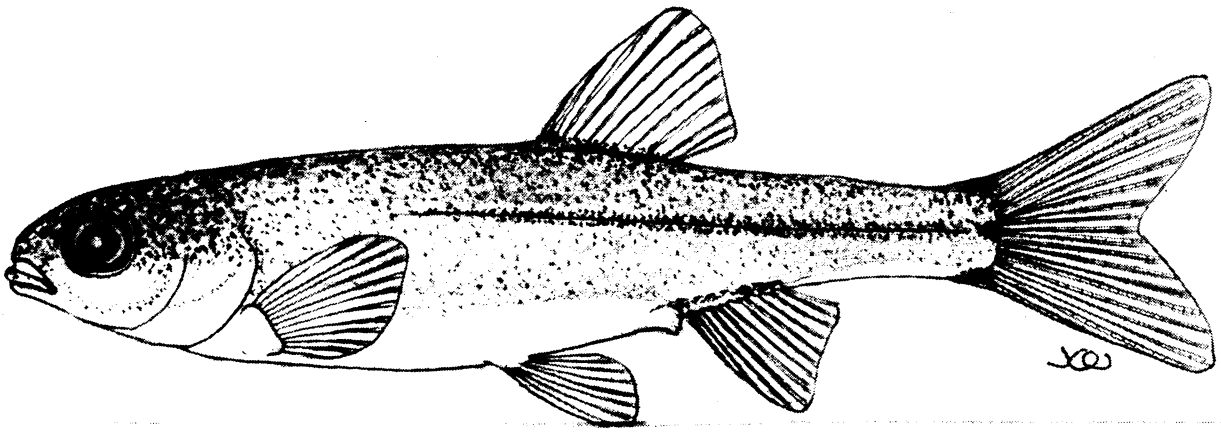


Figure 10-67. Juvenile, 30.5 mm TL.

Cyprinidae: Richardsonius egregius, Lahontan redside.

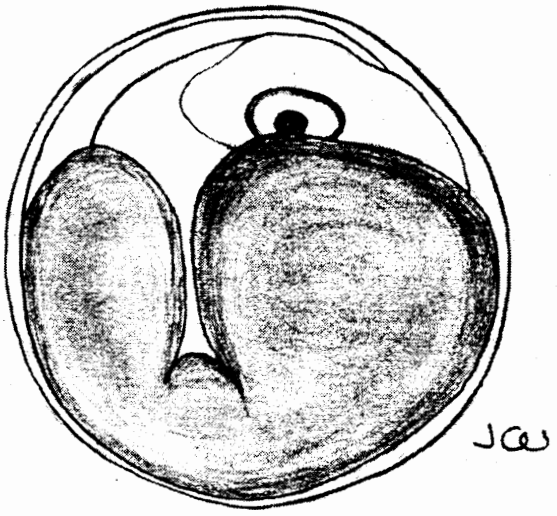


Figure 11-1. Egg, late embryo, 3.8 mm diameter.

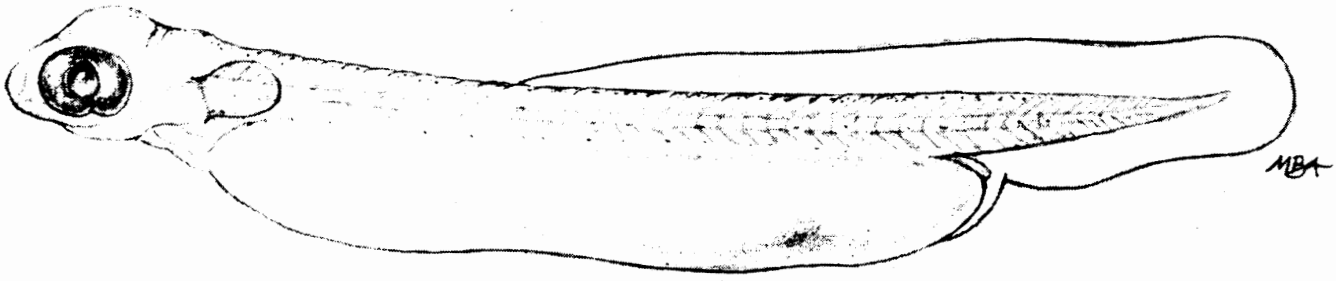


Figure 11-2. Prolarva, 13 mm TL.

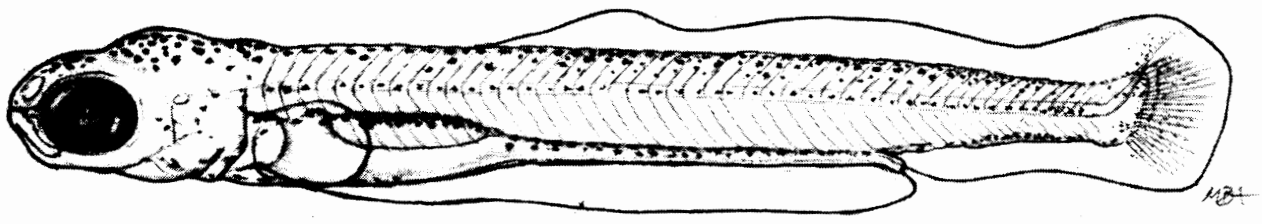


Figure 11-3. Postlarva, 13 mm TL.

Catostomidae: Catostomus occidentalis, Sacramento sucker.

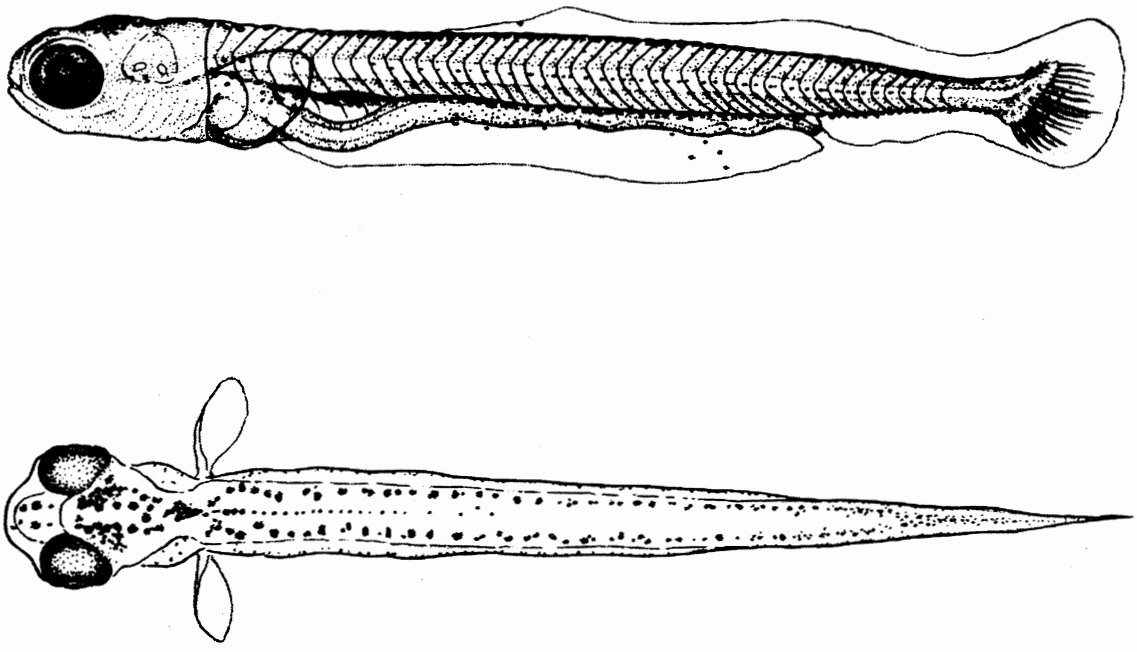


Figure 11-4, 11-5. Postlarva, lateral and dorsal views, 14 mm TL.

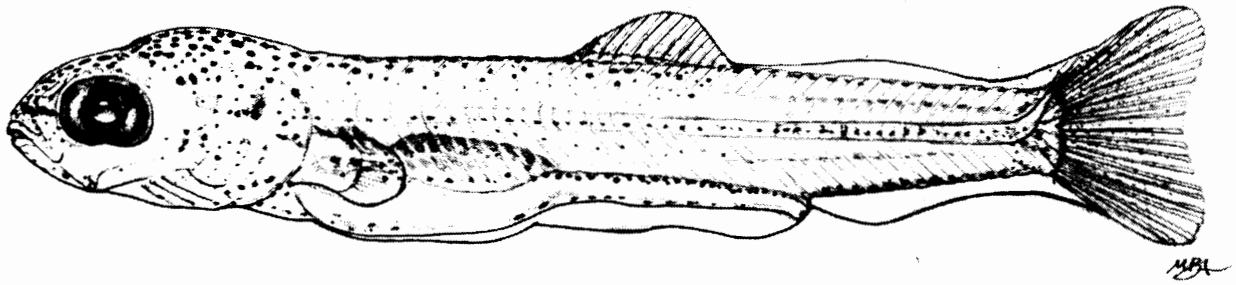


Figure 11-6. Postlarva, 16 mm TL.

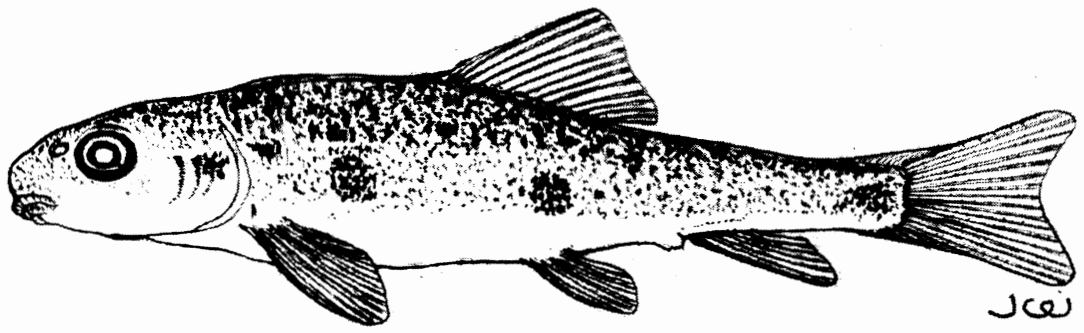


Figure 11-7. Juvenile, 41 mm TL.

Catostomidae: Castostomus occidentalis, Sacramento sucker.

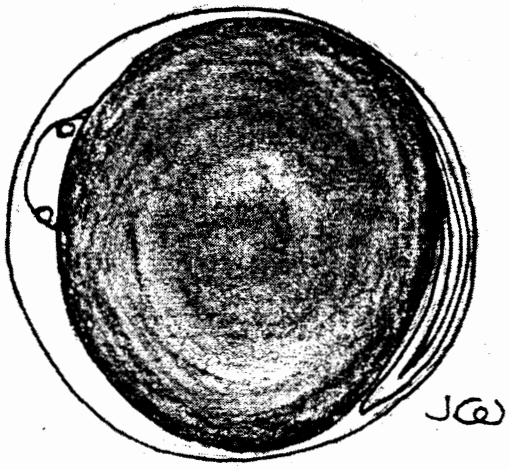


Figure 12-1. Egg, late embryo, 4.5 mm diameter.

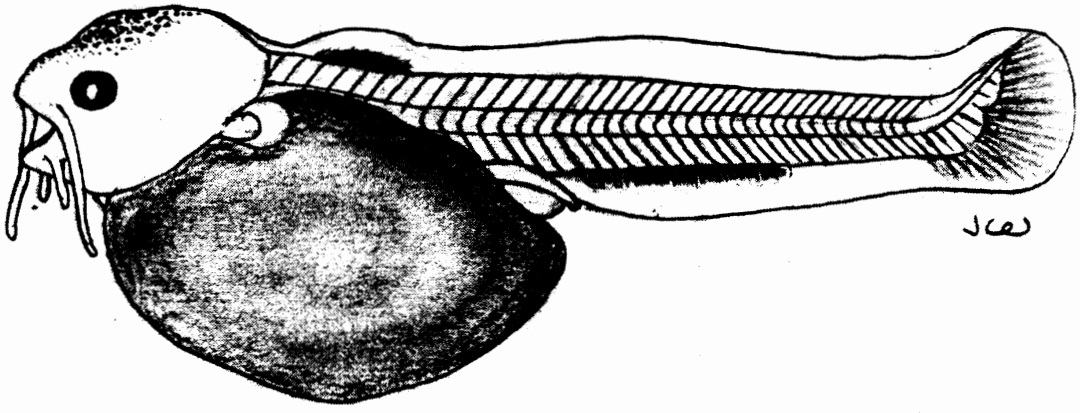


Figure 12-2. Prolarva, 10.2 mm TL.

Ictaluridae: Ictalurus catus, white catfish.

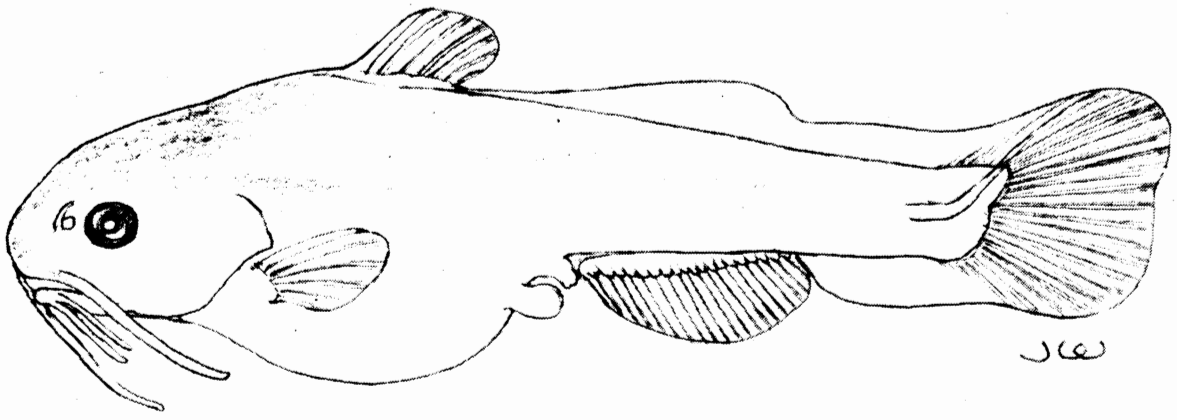


Figure 12-3. Postlarva, 13.7 mm TL.

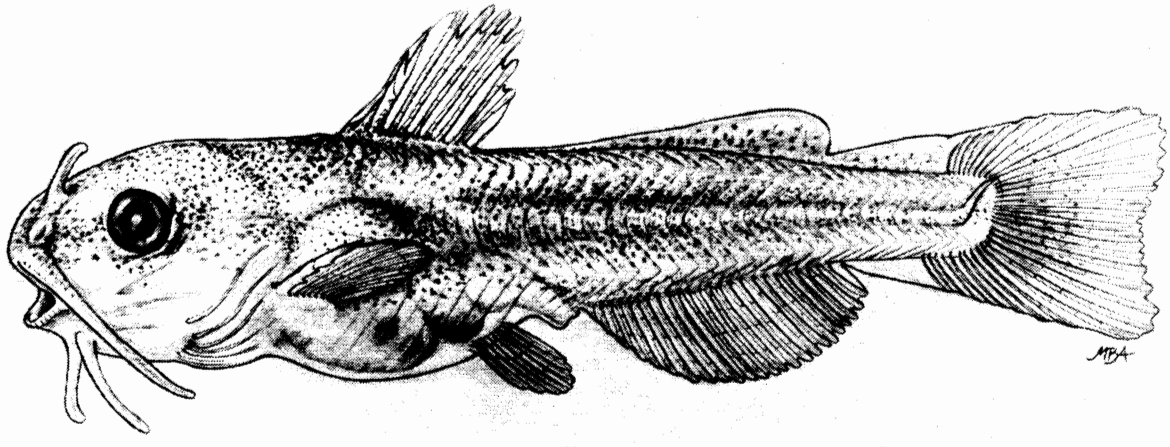


Figure 12-4 Juvenile, 16.6 mm TL.

Ictaluridae: Ictalurus catus, white catfish.

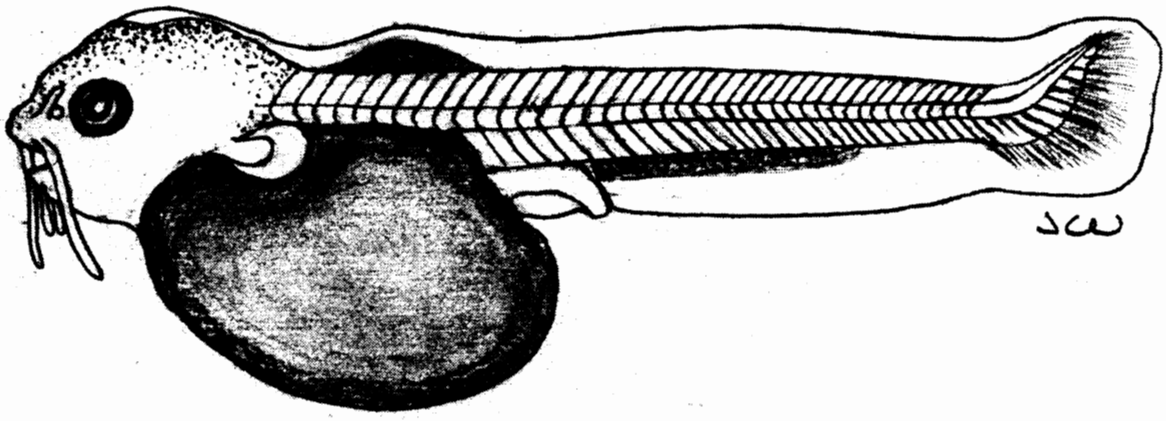


Figure 12-5. Prolarva, 8.5 mm TL.

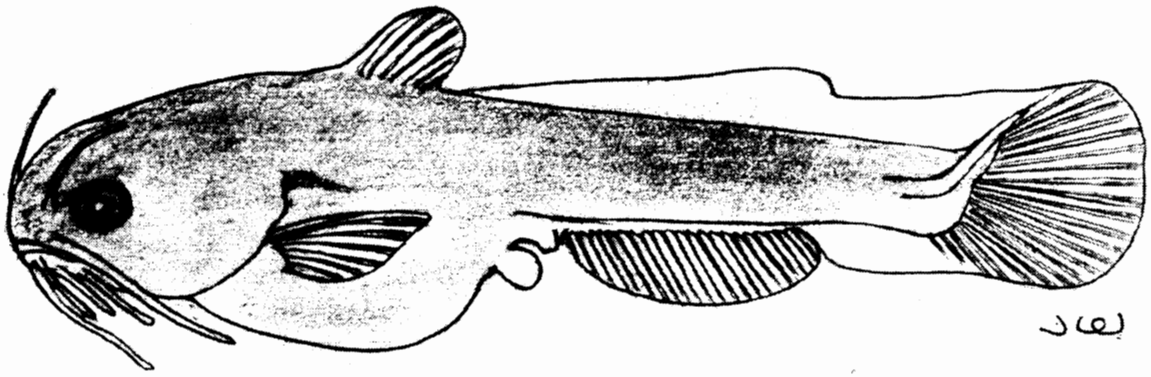


Figure 12-6. Postlarva, 12.2 mm TL.

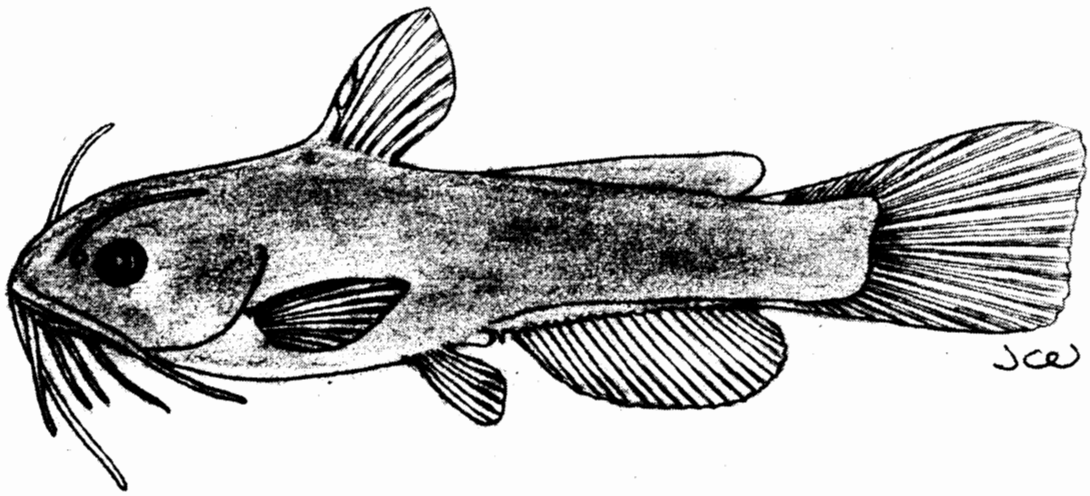


Figure 12-7. Juvenile, 20.8 mm TL.

Ictaluridae: Ictalurus nebulosus, brown bullhead.

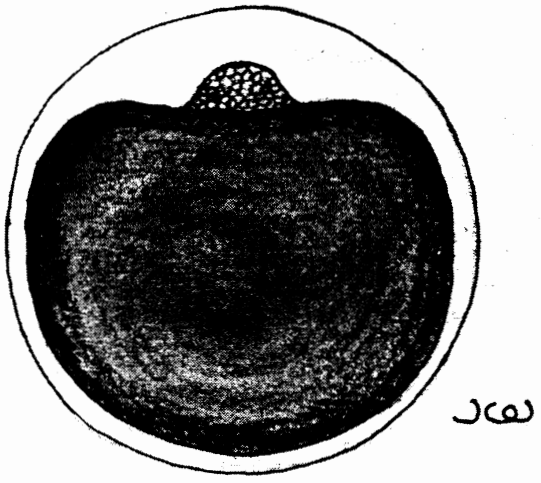


Figure 12-8. Egg, morula, 3.8 mm diameter.

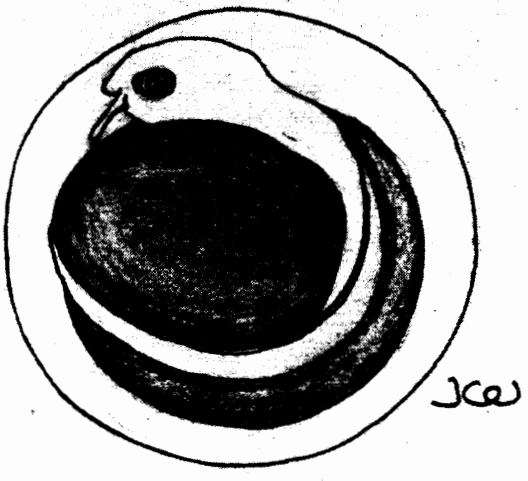


Figure 12-9. Egg, late embryo, 4.3 mm diameter.

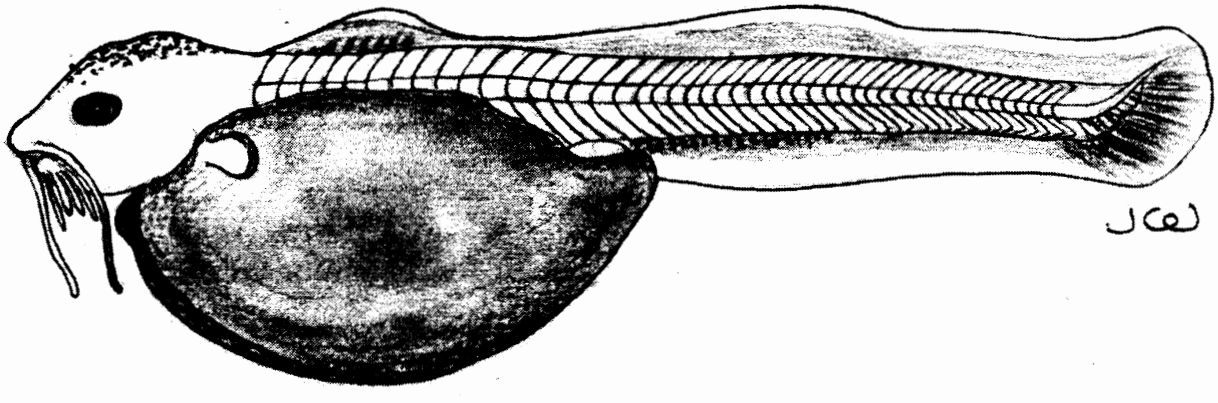


Figure 12-10. Prolarva, 11.4 mm TL.

Ictaluridae: Ictalurus punctatus, channel catfish.

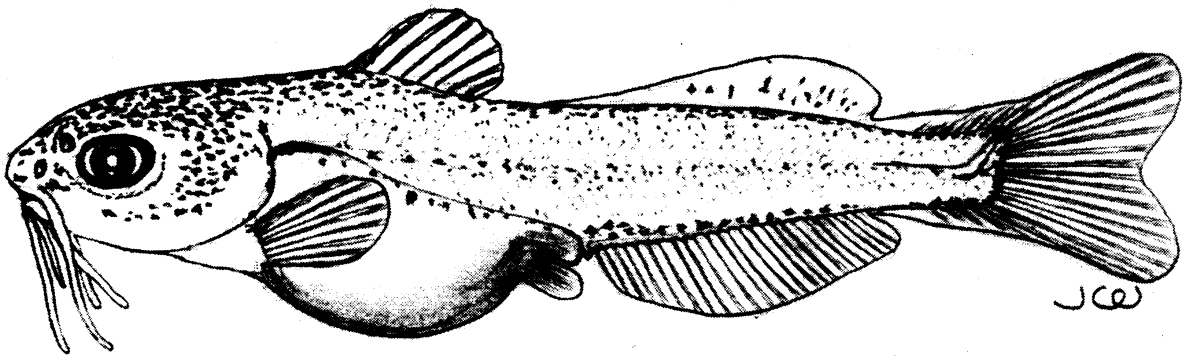


Figure 12-11. Prolarva, 15.5 mm TL.

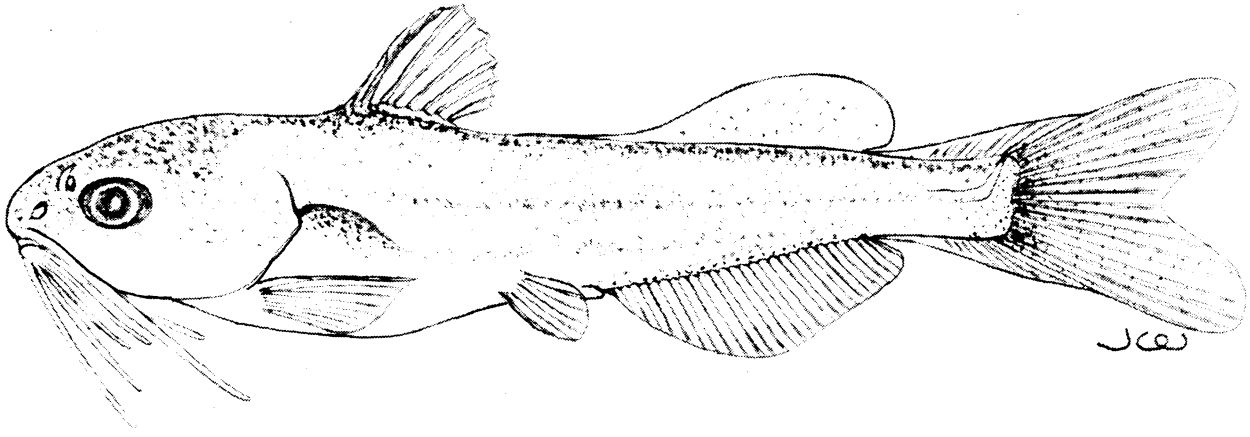


Figure 12-12. Juvenile, 17 mm TL.

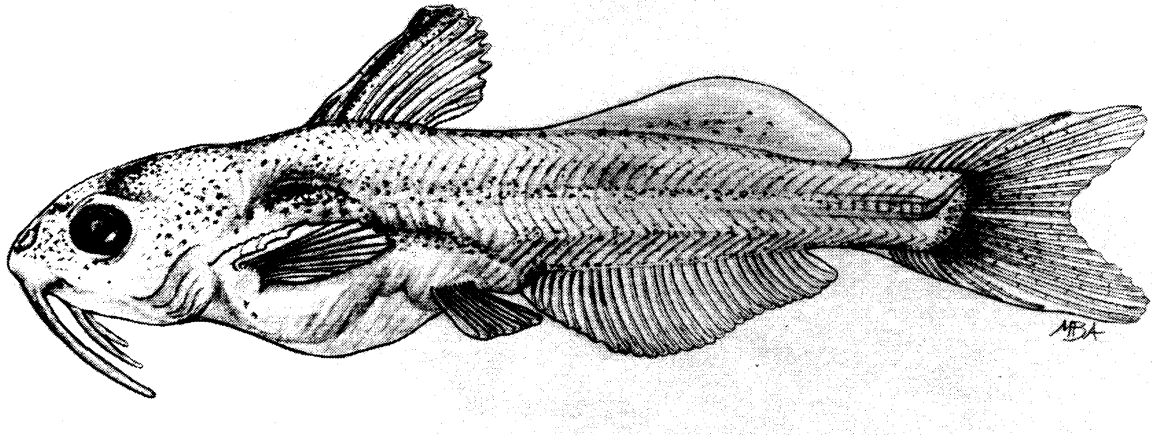


Figure 12-13. Juvenile, 19.5 mm TL.

Ictaluridae: Ictalurus punctatus, channel catfish.

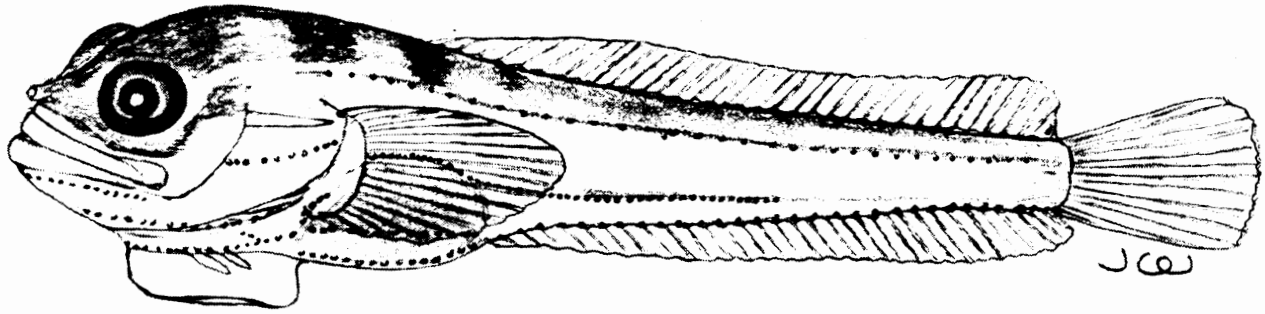


Figure 13-1. Prolarva, 19 mm TL.

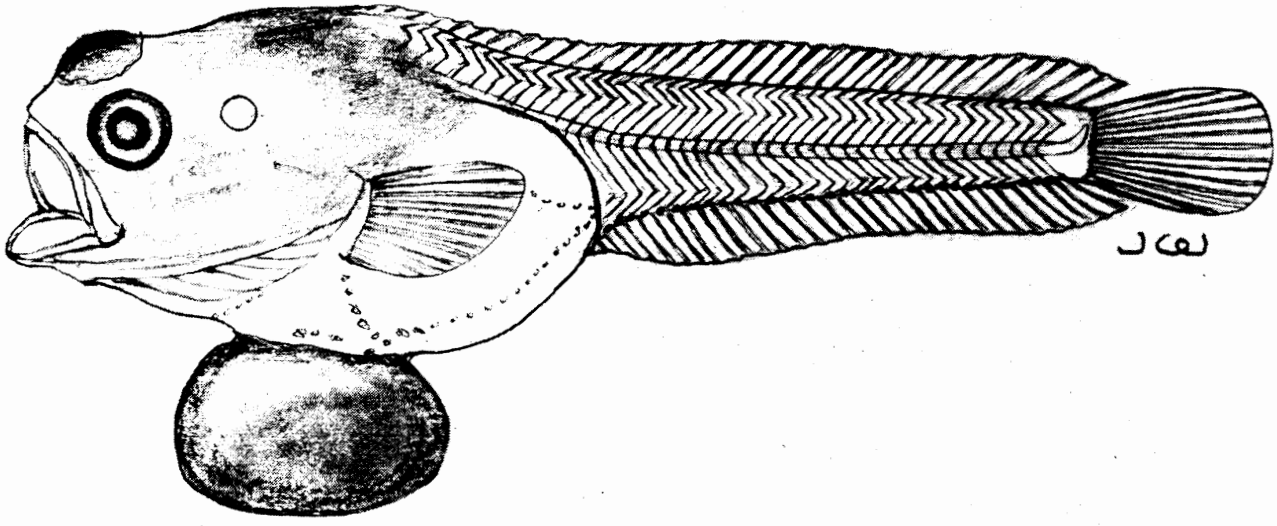


Figure 13-2. Postlarva, 21.7 mm TL.

Batrachoididae: Porichthys notatus, plainfin midshipman.

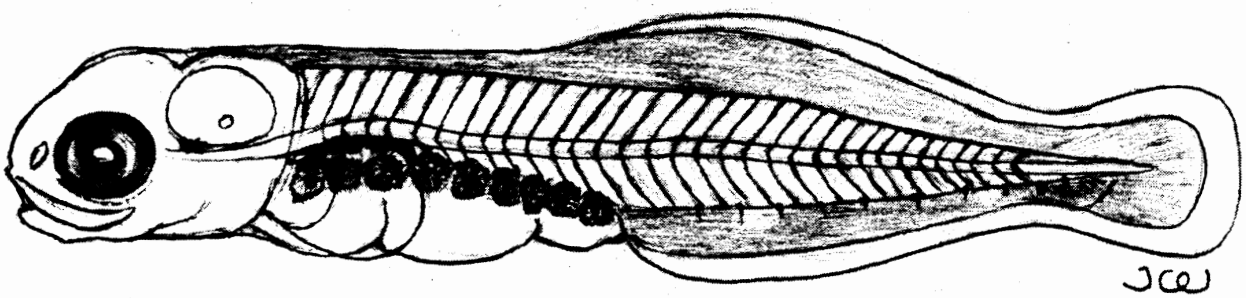


Figure 14-1. Postlarva 8.4 mm TL.

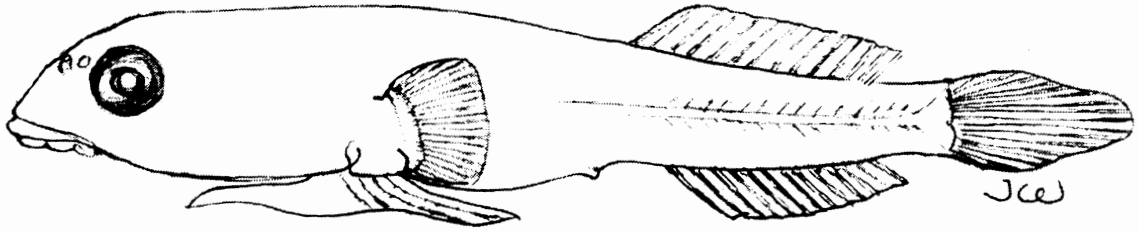


Figure 14-2. Juvenile, 27 mm TL.

Gobiesocidae: Gobiesox maeandricus, northern clingfish.

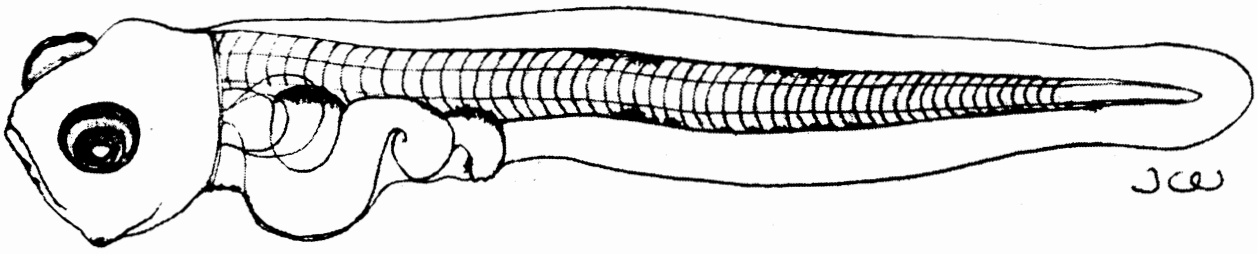


Figure 15-1. Postlarva, 3.7 mm TL.

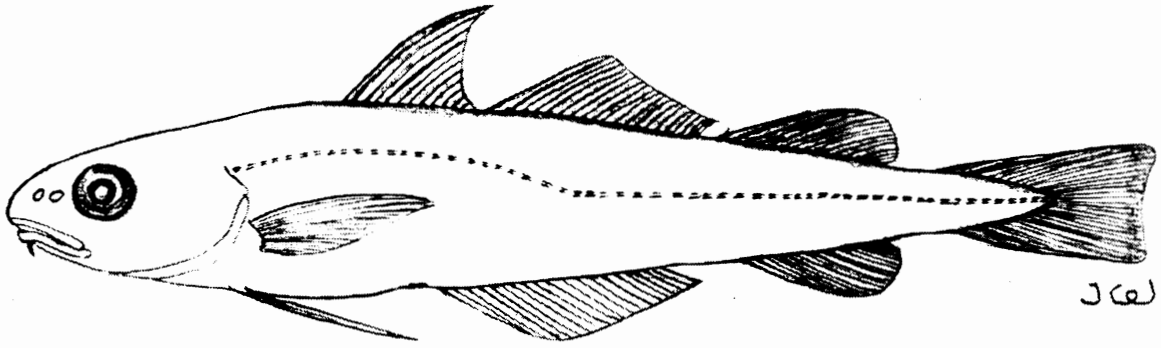


Figure 15-2. Juvenile, 108 mm TL.

Gadidae: Microgadus proximus, Pacific tomcod.

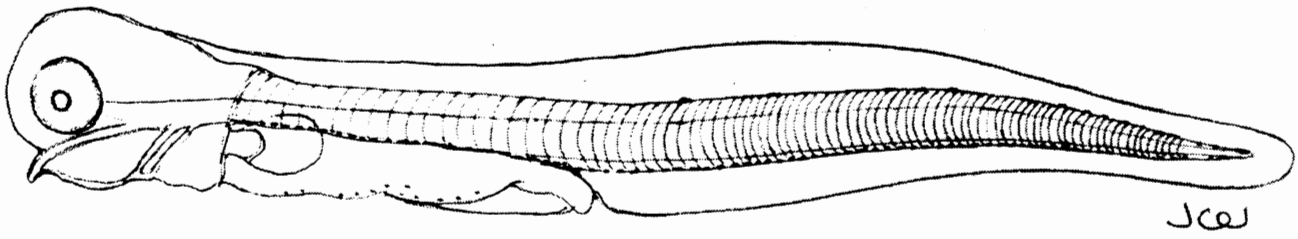


Figure 16-1. Postlarva, 4.6 mm TL.

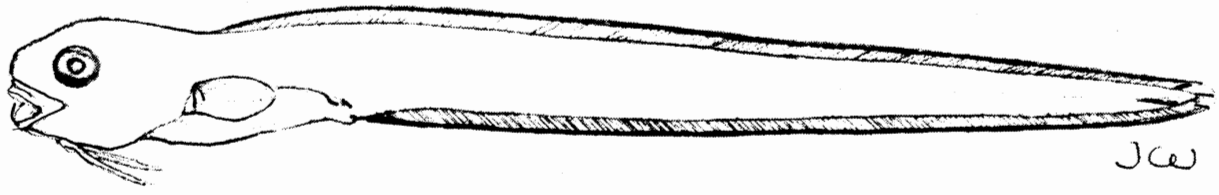


Figure 16-2. Juvenile, 86 mm TL.

Ophidiidae: Chilara taylori, spotted cusk-eel.

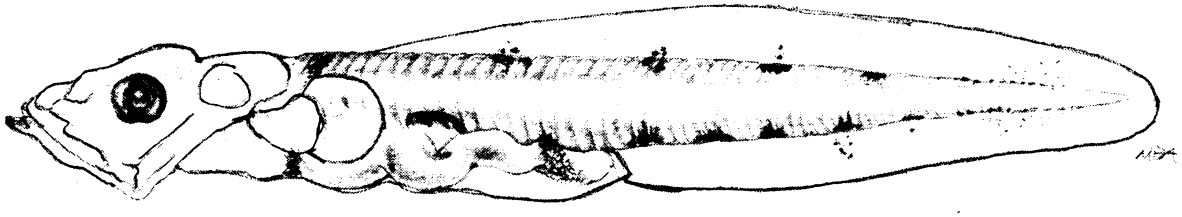


Figure 17-1. Postlarva, 6.5 mm TL.

Bythitidae: Brosmophycis marginata, red brotula..

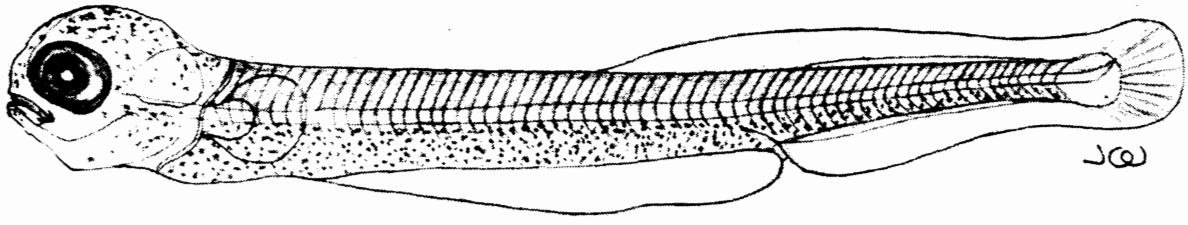


Figure 18-1. Postlarva, 7.8 mm TL.

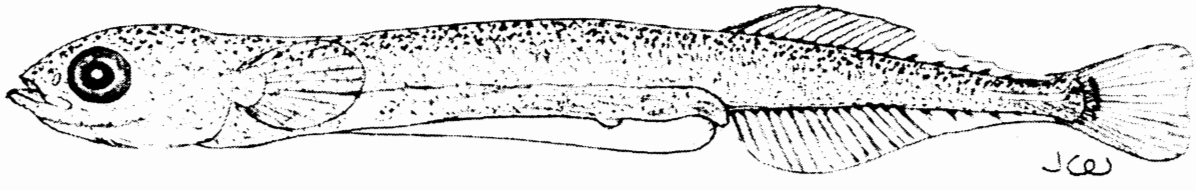


Figure 18-2. Postlarva, 18.2 mm TL.

Scomberesocidae: Cololabis saira, Pacific saury.

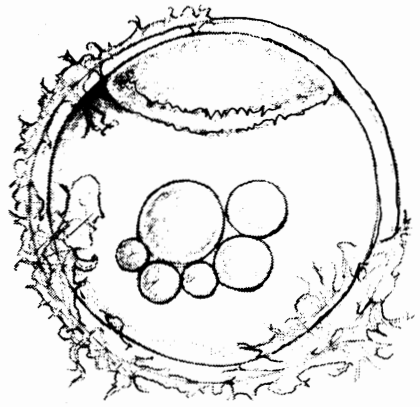


Figure 19-1. Egg, morula, 1.1 mm diameter.

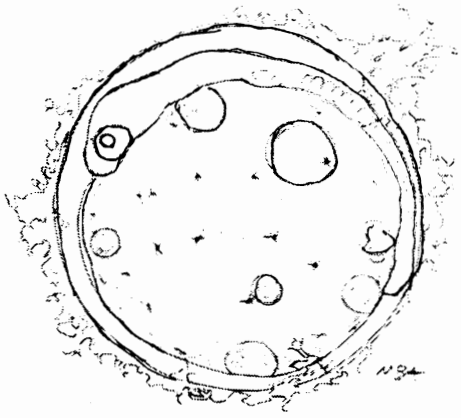


Figure 19-2. Egg, early embryo, 1.1 mm diameter.

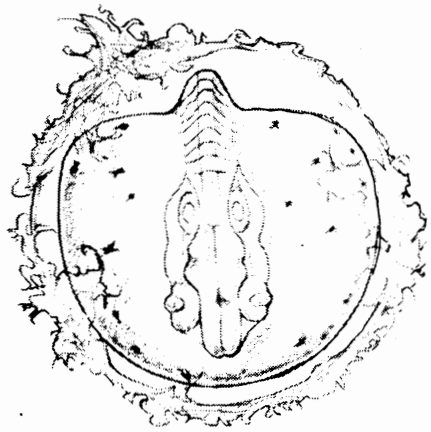


Figure 19-3. Egg, late embryo, 1.1 mm diameter.

Cyprinodontidae: Lucania parva, rainwater killifish.

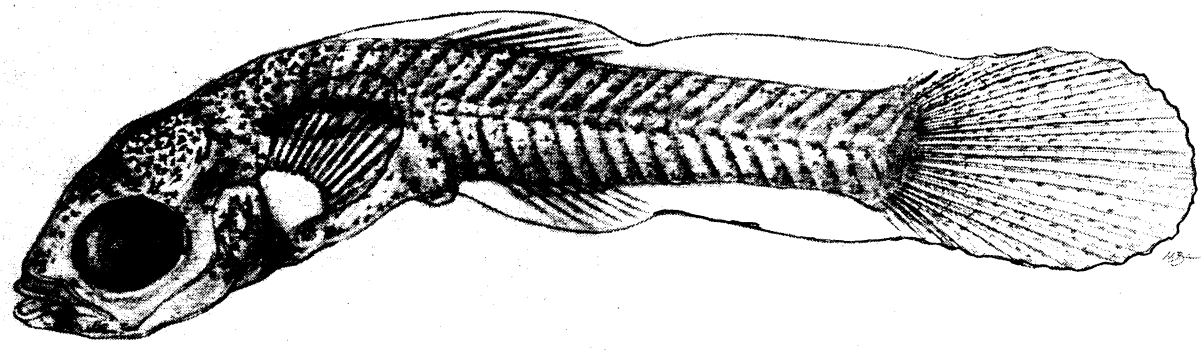


Figure 19-7. Postlarva, 8.1 mm TL.

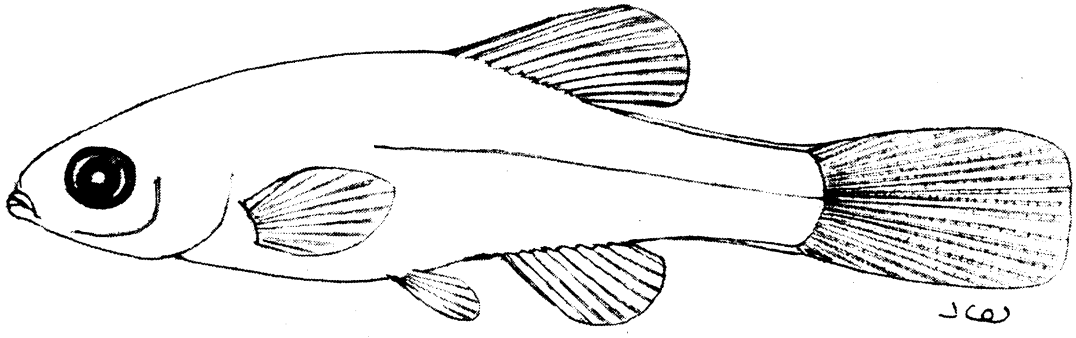


Figure 19-8. Juvenile, 16.5 mm TL.

Cyprinodontidae: Lucania parva, rainwater killifish.

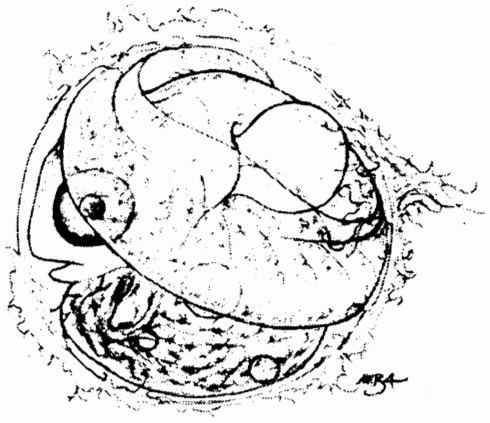


Figure 19-4. Egg, late embryo, 1.1 mm diameter.

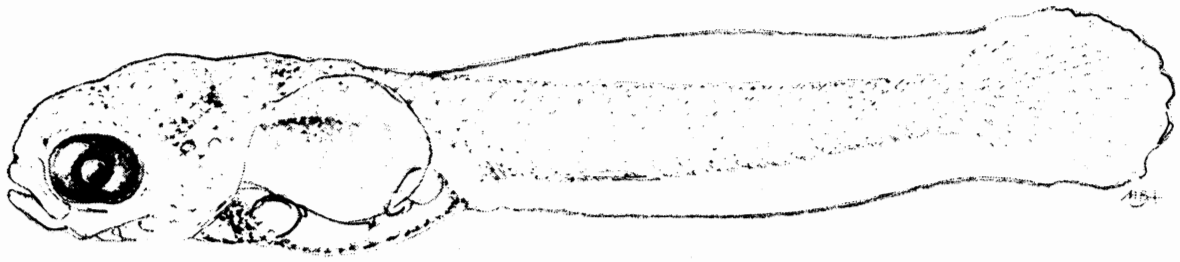


Figure 19-5. Prolarva, 5 mm TL.

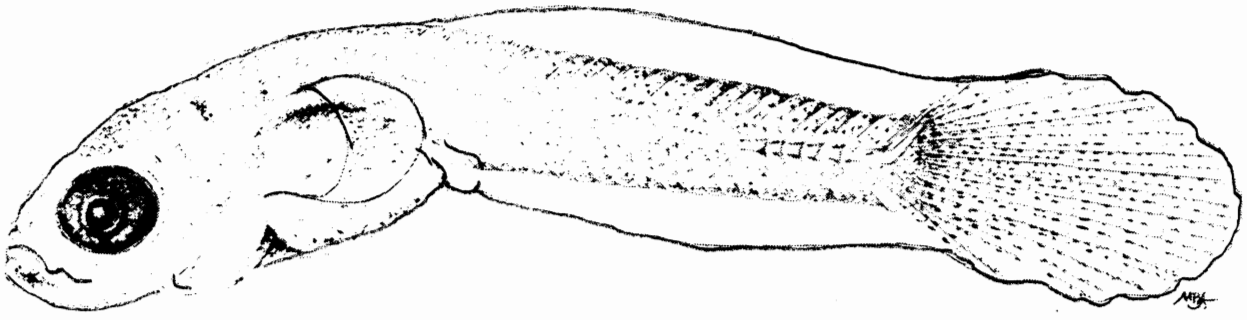


Figure 19-6. Postlarva, 7 mm TL.

Cyprinodontidae: Lucania parva, rainwater killifish.

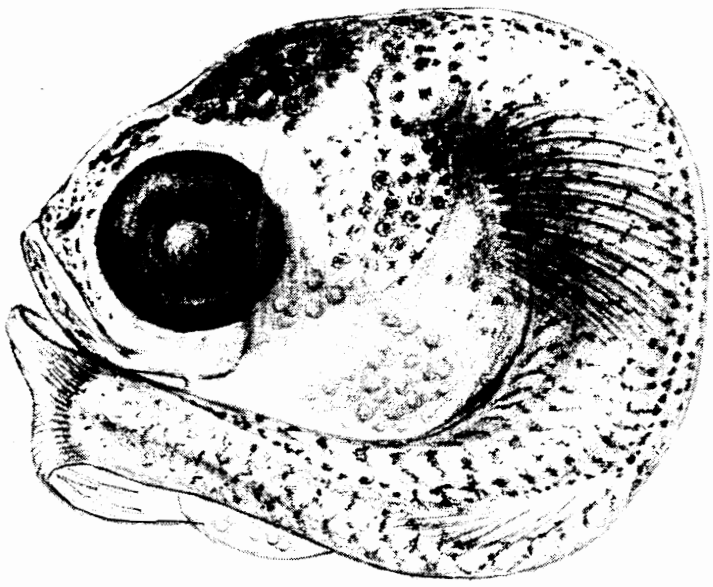


Figure 20-1. Dissected embryo, 3.2 mm diameter.

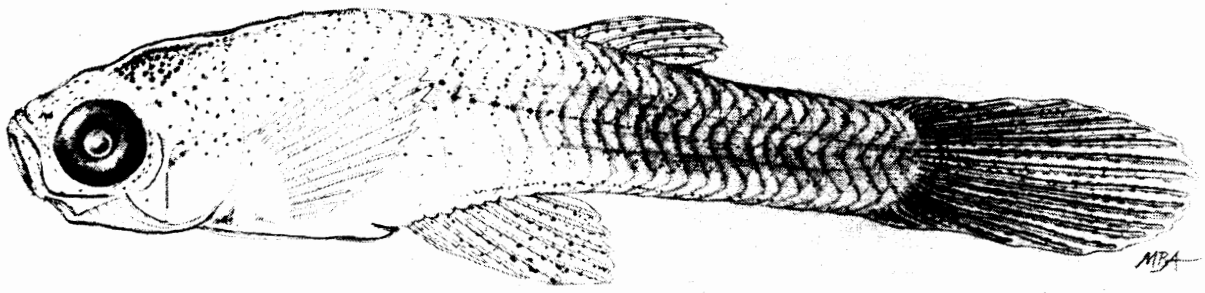


Figure 20-2. Newly born postlarva, 9.5 mm TL.

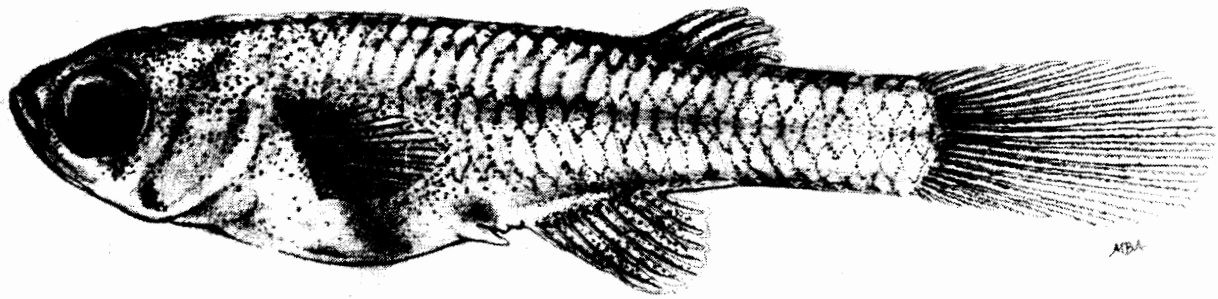


Figure 20-3. Juvenile, 11.6 mm TL.

Poeciliidae: Gambusia affinis, mosquitofish.

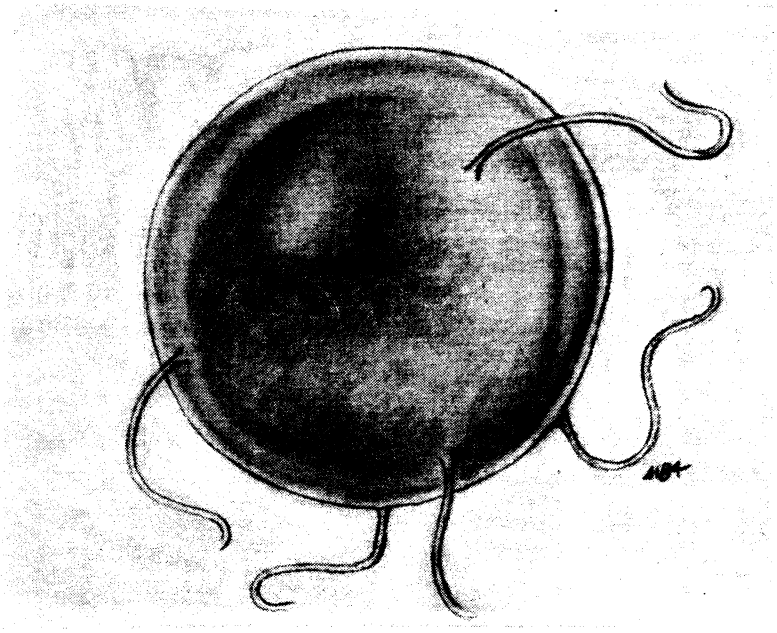


Figure 21-1. Egg, dead, 1.4 mm diameter.

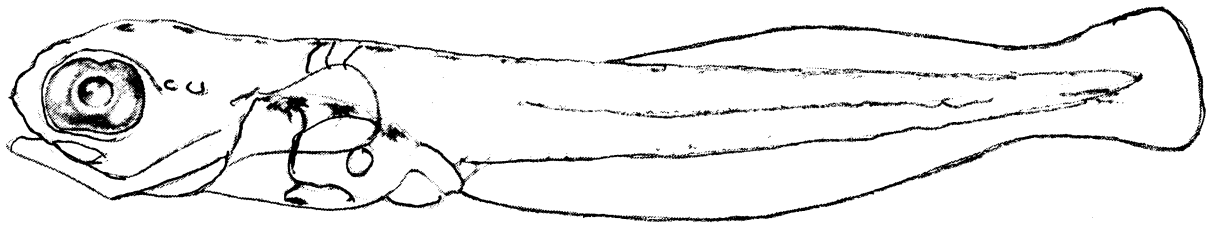


Figure 21-2. Postlarva, 5 mm TL.

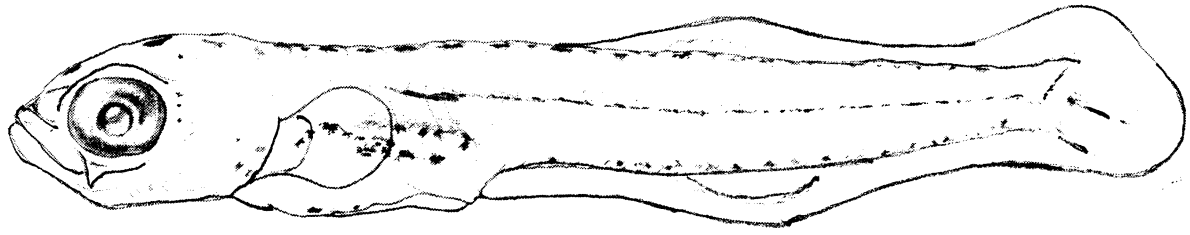


Figure 21-3. Postlarva, 10 mm TL.

Atherinidae: Atherinops affinis, topsmelt.

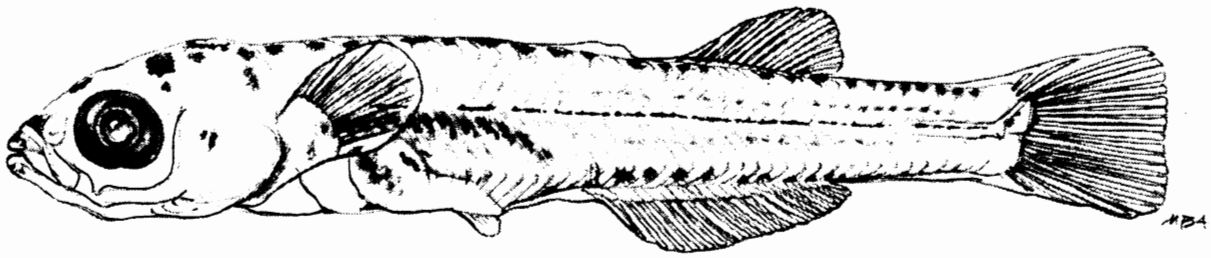


Figure 21-4. Postlarva, 14 mm TL.

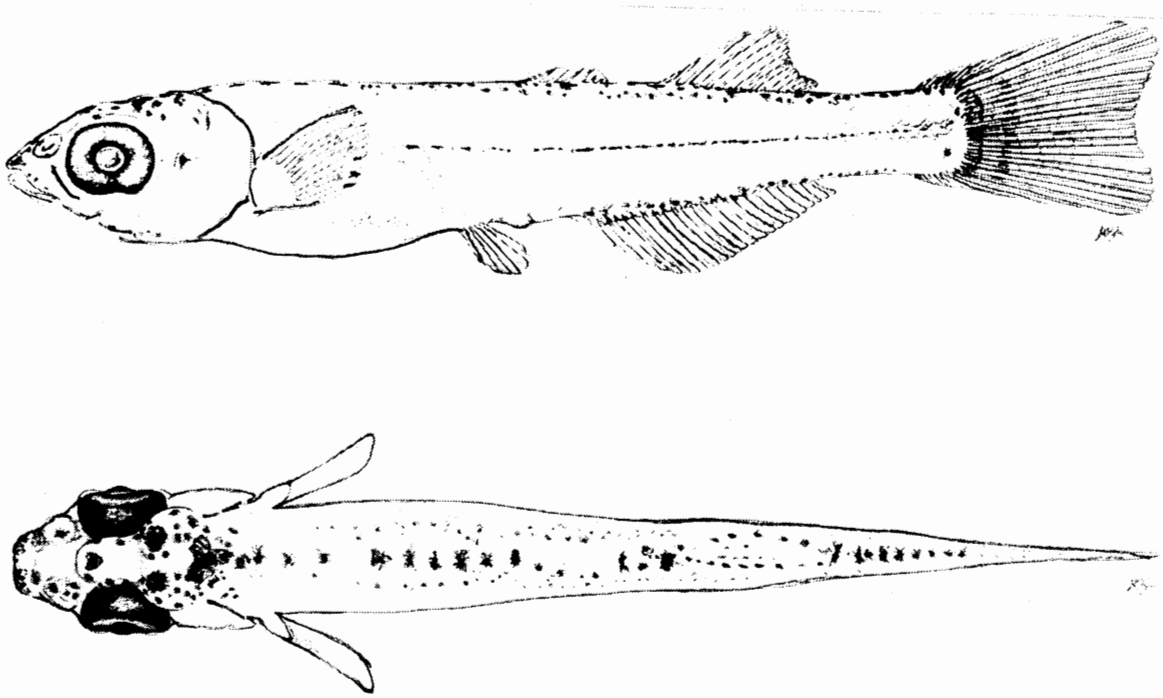


Figure 21-5, 21-6. Juvenile, lateral and dorsal views, 18.7 mm TL.

Atherinidae: Atherinops affinis, topsmelt.

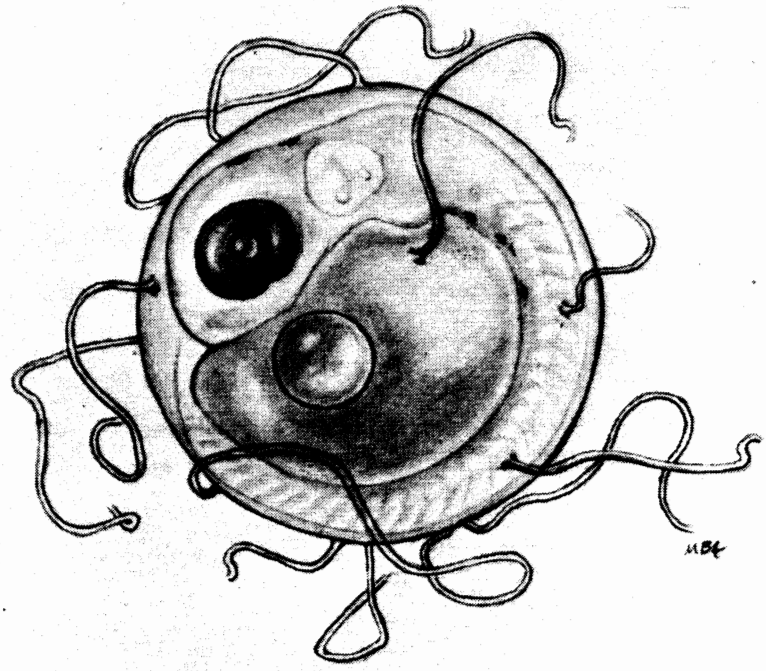


Figure 21-7. Egg, late embryo, 1.8 mm diameter.

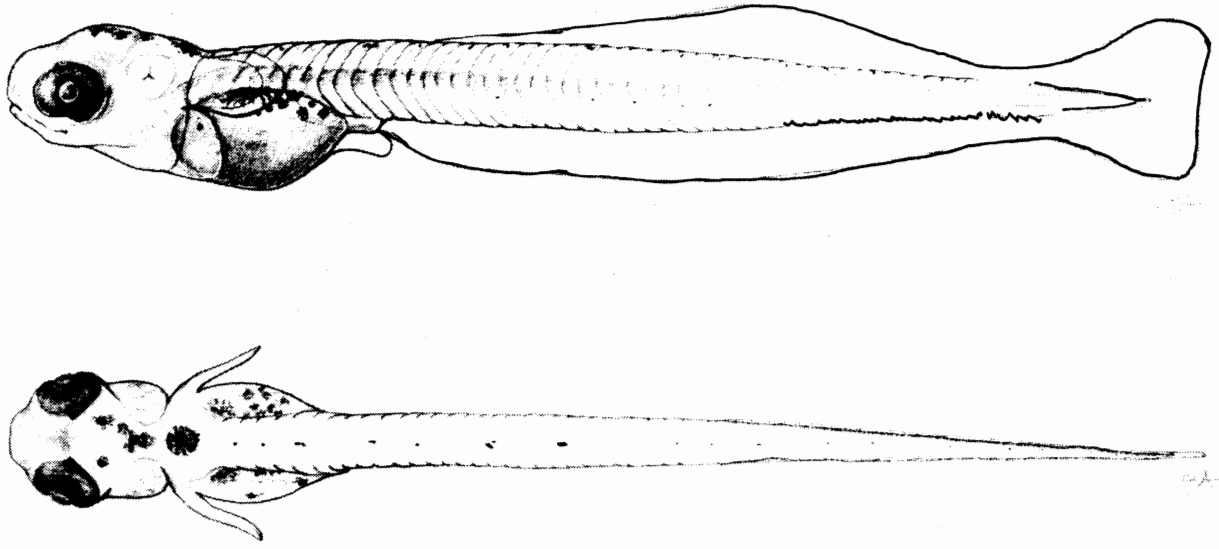
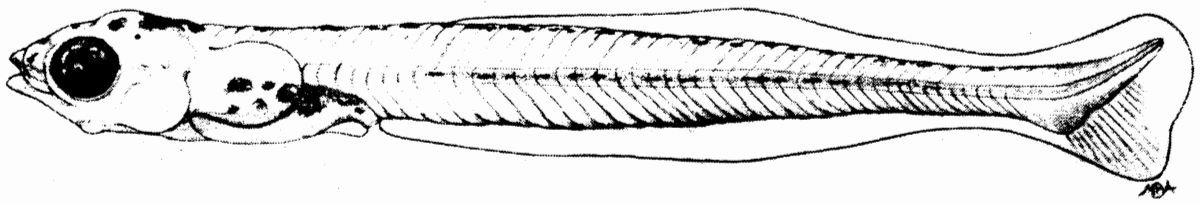


Figure 21-8, 21-9. Prolarva, lateral and dorsal views, 9.3 mm TL.

Atherinidae: Atherinopsis californiensis, jacksmelt.



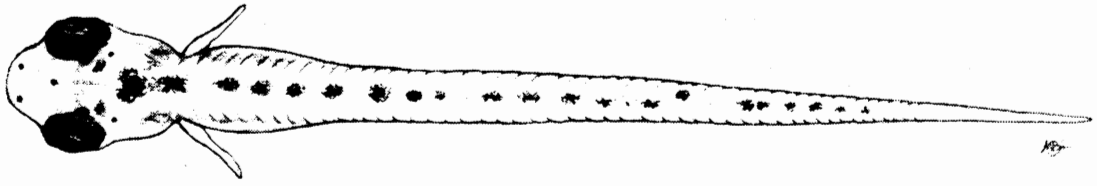


Figure 21-10, 21-11. Postlarva, lateral and dorsal views, 12.8 mm TL.

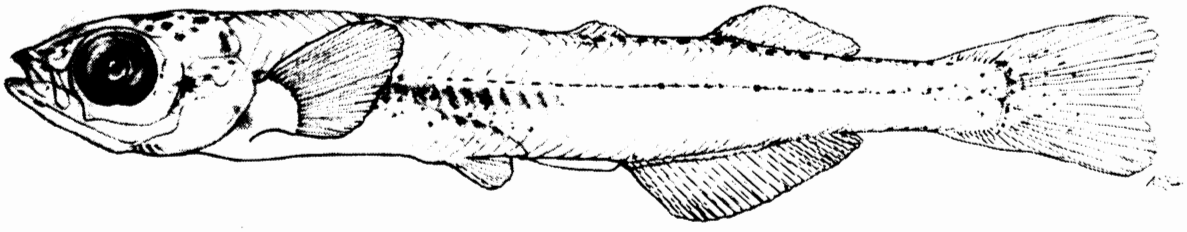


Figure 21-12. Juvenile, 35 mm TL.

Atherinidae: Atherinopsis californiensis, jacksmelt.

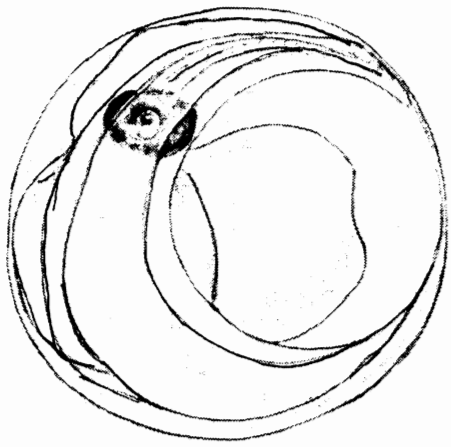


Figure 21-13. Egg, late embryo, 1.6 mm diameter.

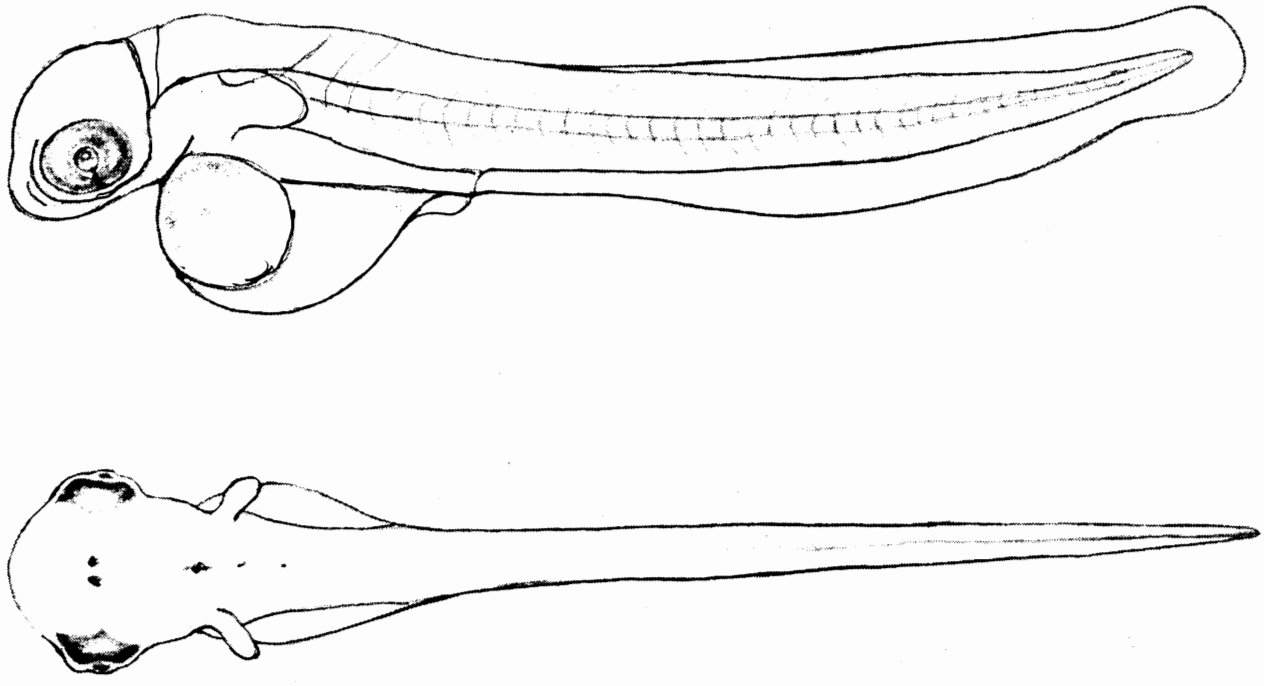


Figure 21-14, 21-15. Prolarva, lateral and dorsal views, 7.8 mm TL.

Atherinidae: Leuresthes tenuis, California grunion.

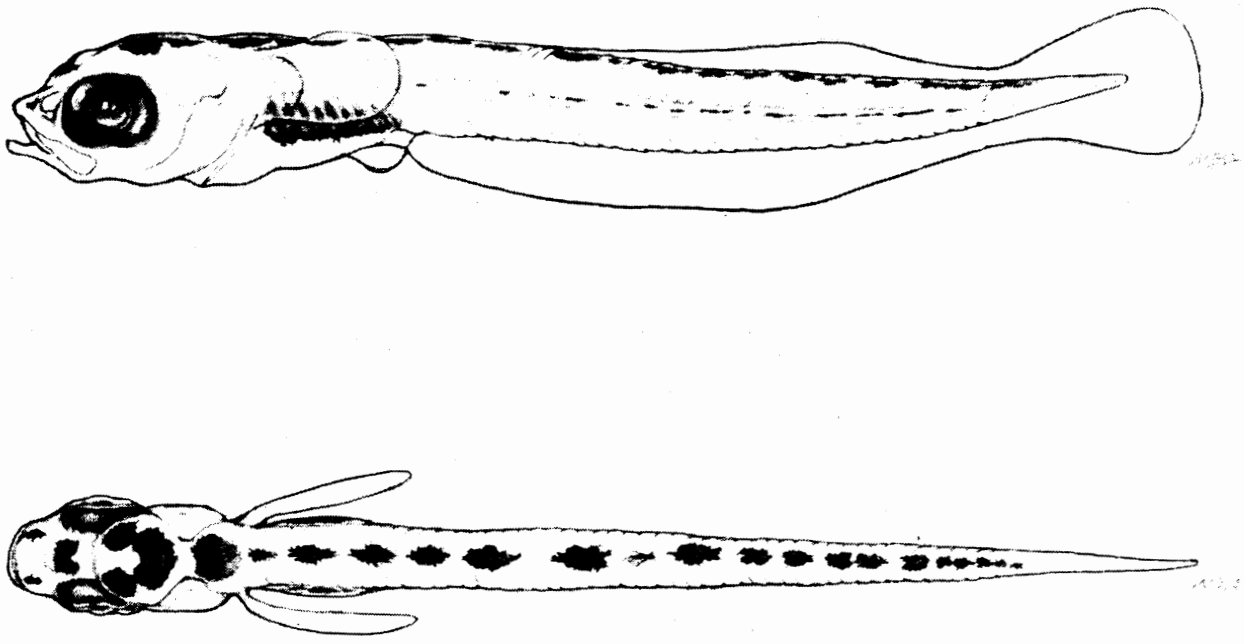


Figure 21-16, 21-17. Postlarva, lateral and dorsal views, 7.8 mm TL.

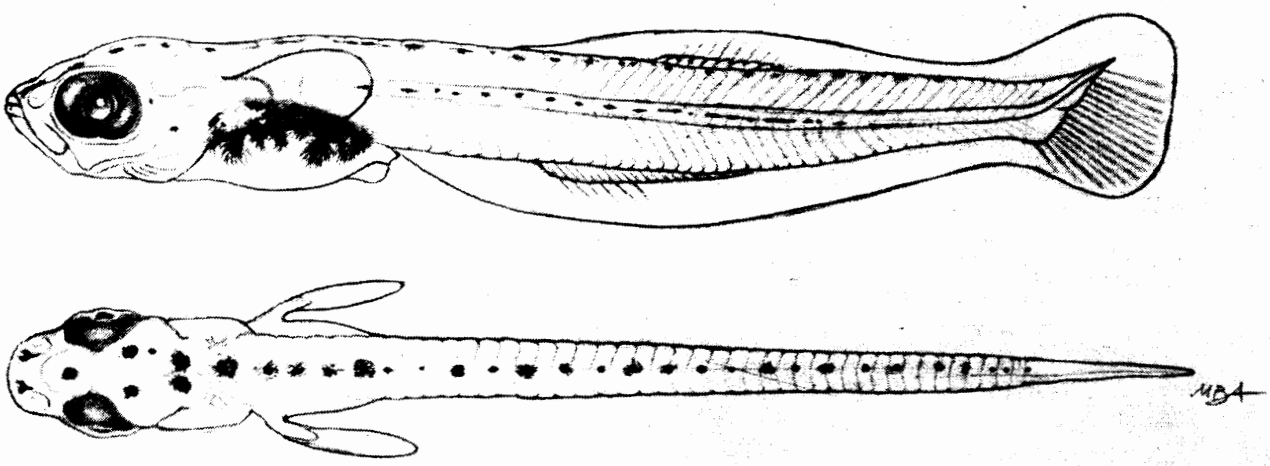


Figure 21-18, 21-19. Postlarva, lateral and dorsal views, 10 mm TL.

Atherinidae: Leuresthes tenuis, California grunion.

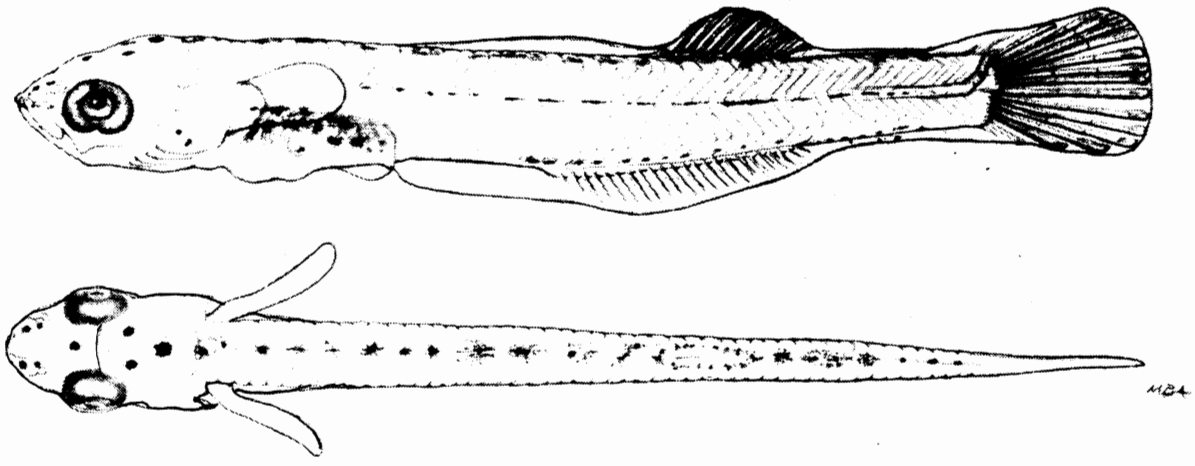


Figure 21-20, 21-21. Postlarva, lateral and dorsal views, 13 mm TL.

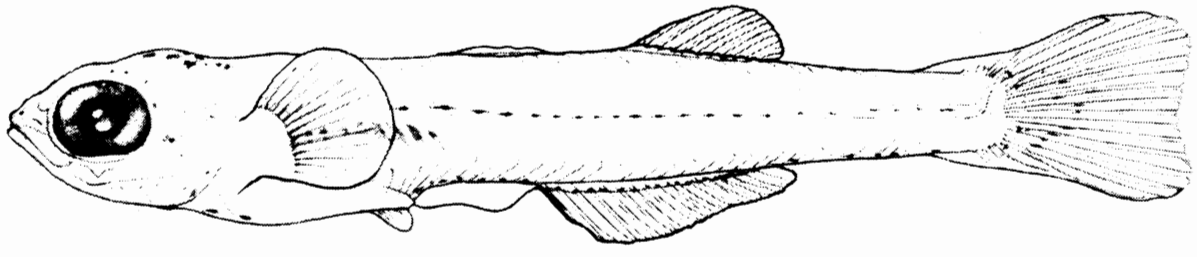


Figure 21-22. Postlarva, 15 mm TL.

Atherinidae: Leuresthes tenuis, California grunion.

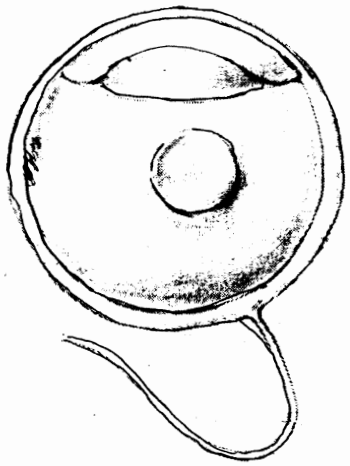


Figure 21-23. Egg, gastrula, 1.1 mm diameter.

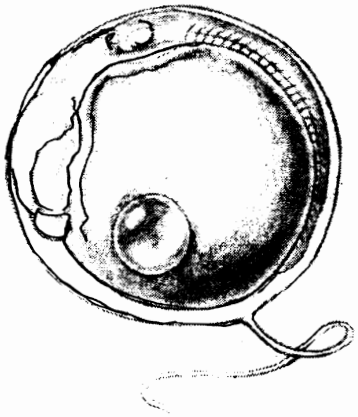


Figure 21-24. Egg, early embryo, 1.1 mm diameter.

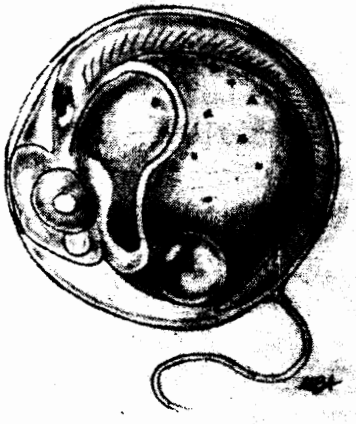


Figure 21-25. Egg, late embryo, 1.1 mm diameter.

Atherinidae: Menidia beryllina, inland silverside.

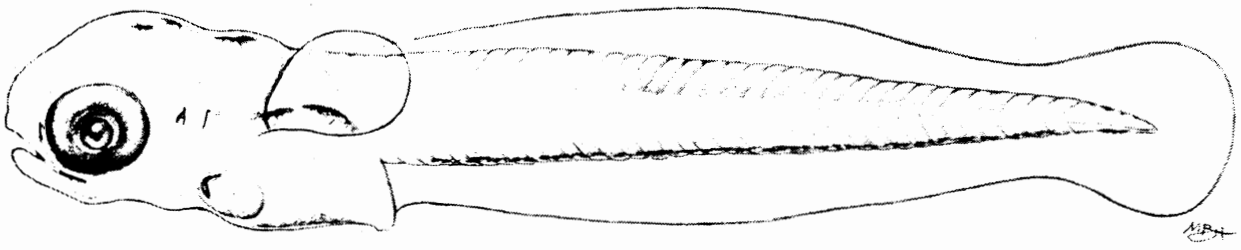


Figure 21-26. Prolarva, 4.3 mm TL.

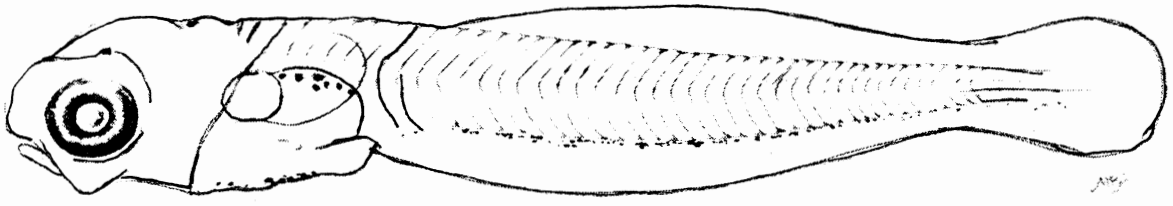


Figure 21-27. Postlarva, 5.0 mm TL.

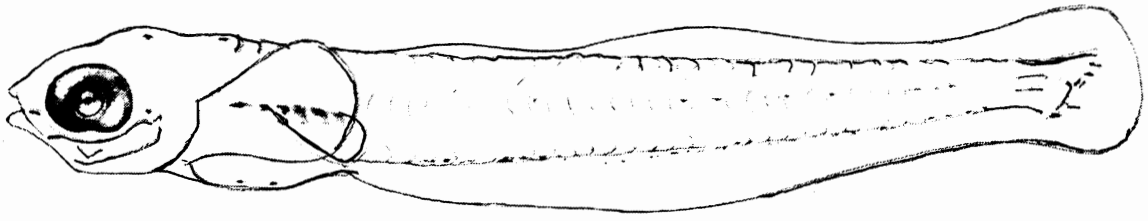


Figure 21-28. Postlarva, 8 mm TL.

Atherinidae: Menidia beryllina, inland silverside.

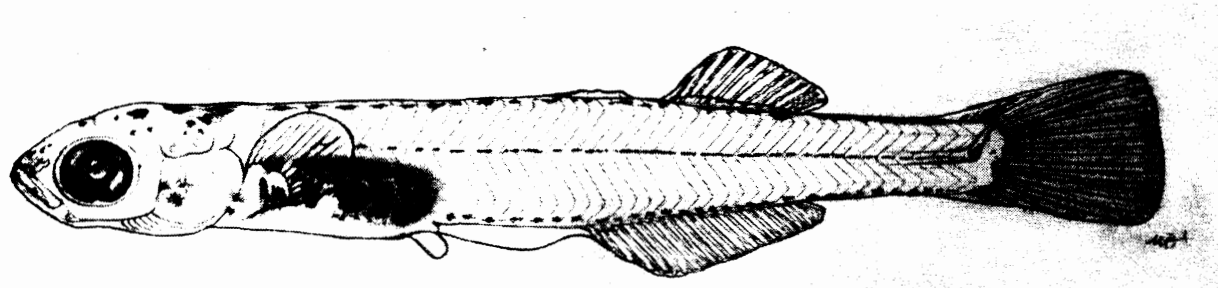


Figure 21-29. Postlarva, 10.5 mm TL.

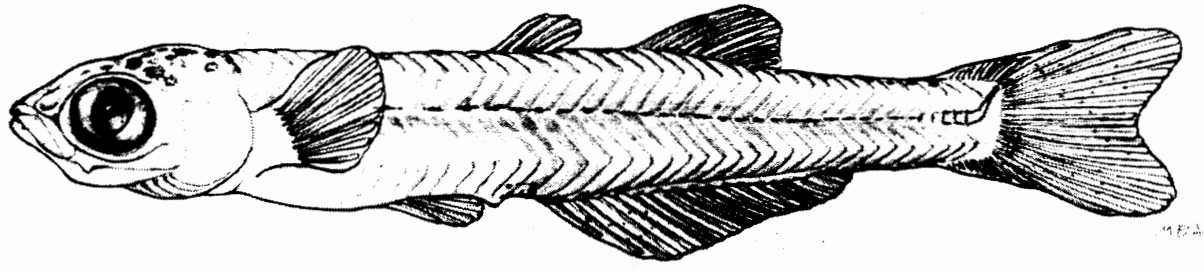


Figure 21-30 Juvenile, 15.5 mm TL.

Atherinidae: Menidia beryllina, inland silverside.

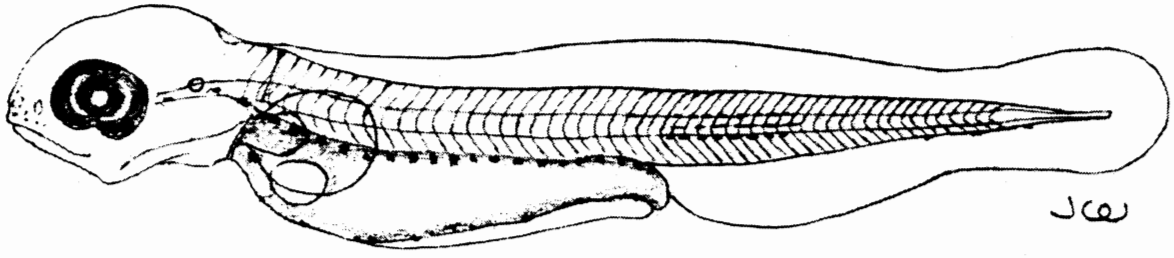


Figure 22-1. Prolarva, 6.5 mm TL.

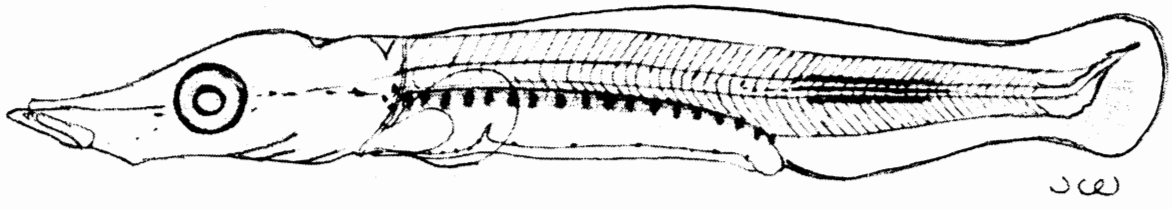


Figure 22-2. Postlarva, 14.3 mm TL.

Gasterosteidae: Aulorhynchus flavidus, tube-snout.

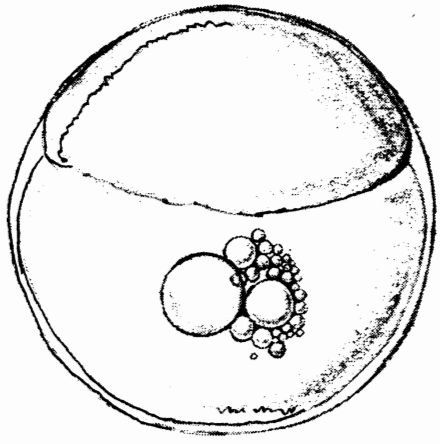


Figure 22-3. Egg, morula, 1.7 mm diameter.

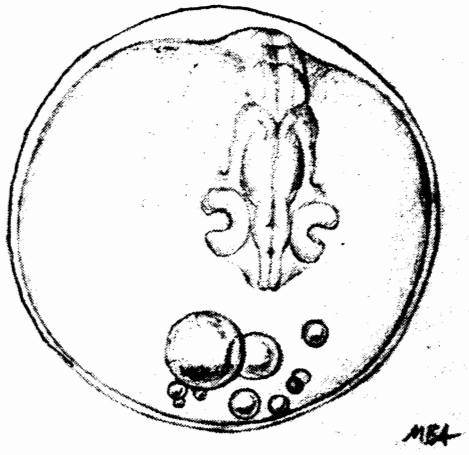


Figure 22-4. Egg, late embryo, 1.7 mm diameter.

Gasterosteidae: Gasterosteus aculeatus, threespine stickleback.

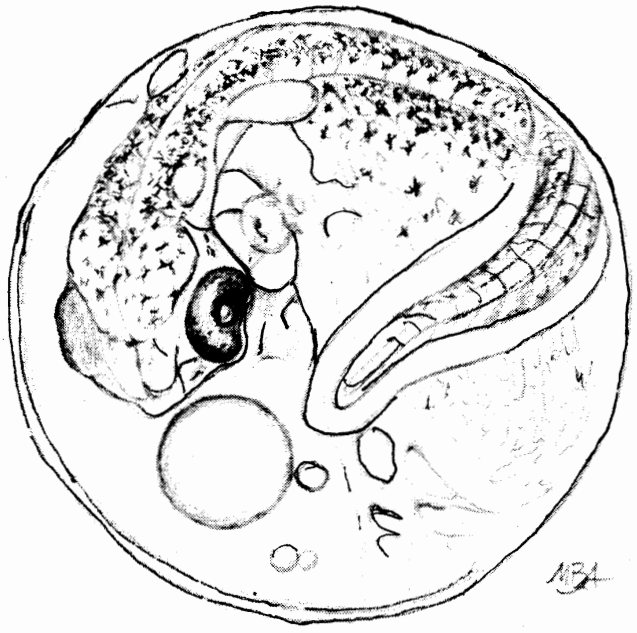


Figure 22-5. Egg, late embryo, 1.7 mm diameter.

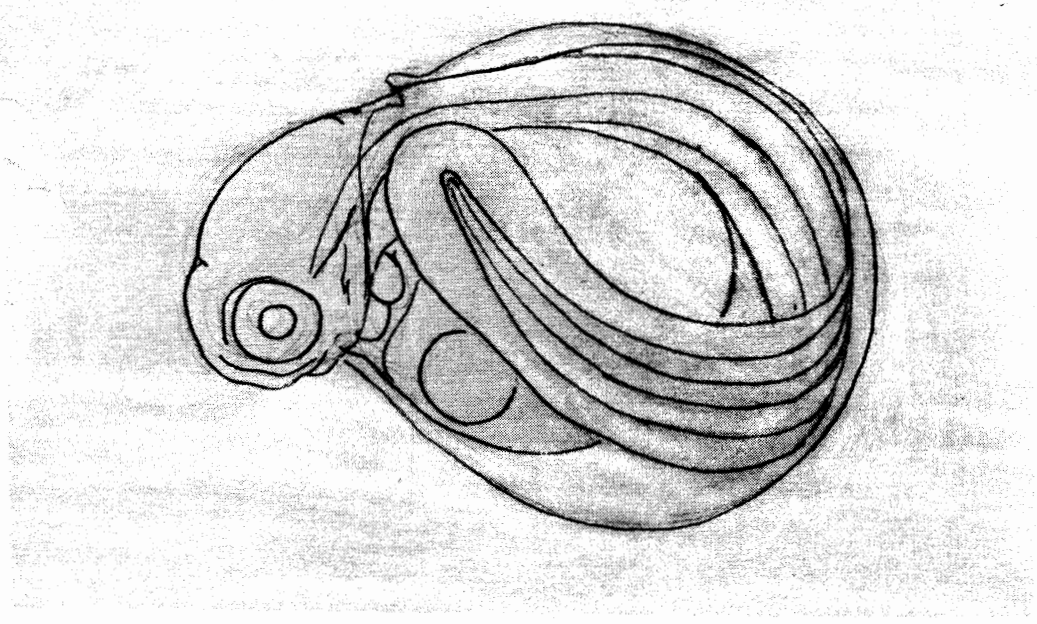


Figure 22-6. Hatching.

Gasterosteidae: Gasterosteus aculeatus, threespine stickleback.

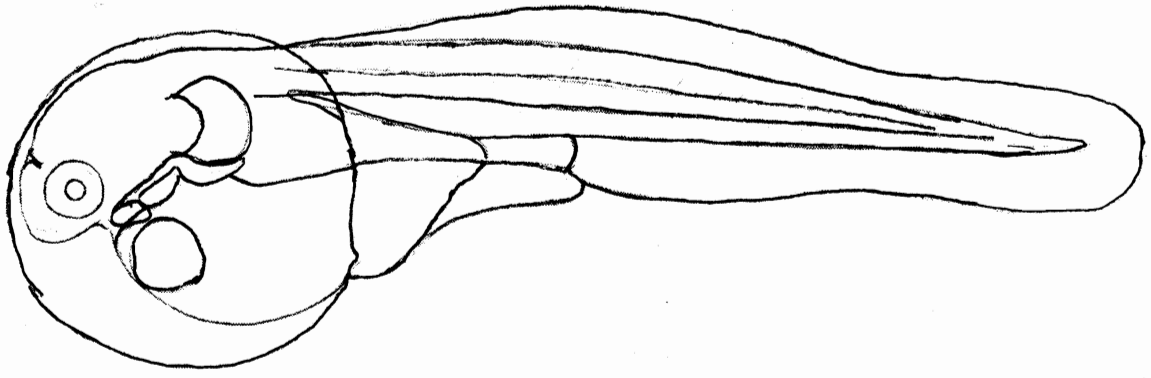


Figure 22-7. Hatching.

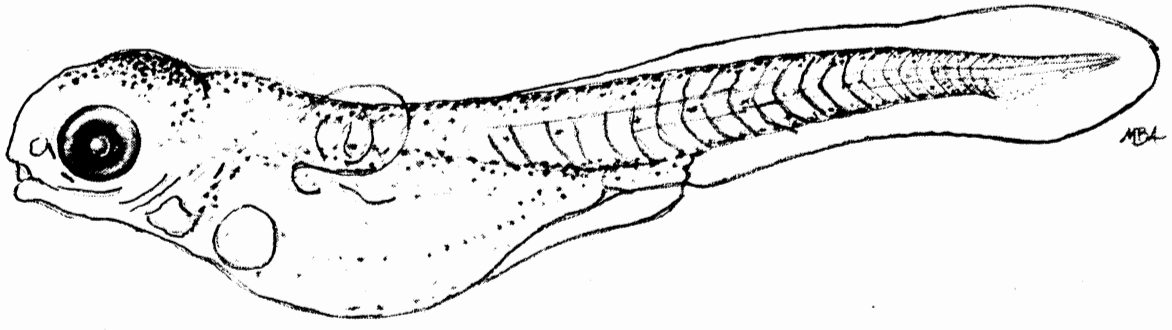


Figure 22-8. Prolarva, 6.6 mm TL.

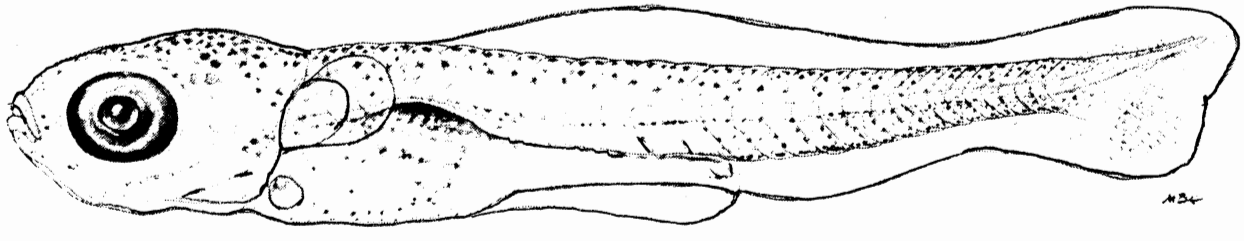


Figure 22-9. Postlarva, 6.6 mm TL.

Gasterosteidae: Gasterosteus aculeatus, threespine stickleback.

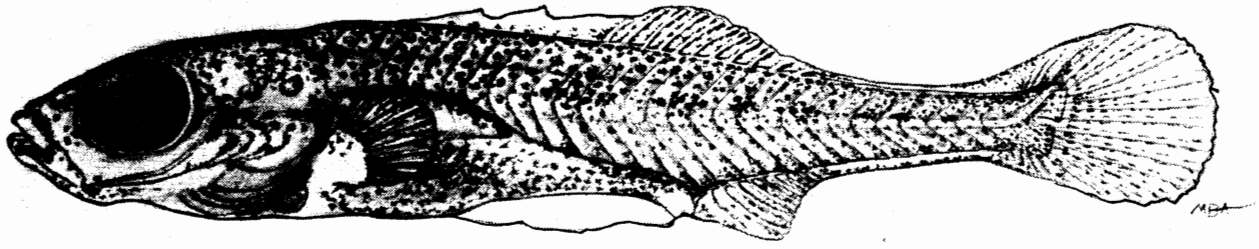


Figure 22-10. Postlarva, 9.2 mm TL.

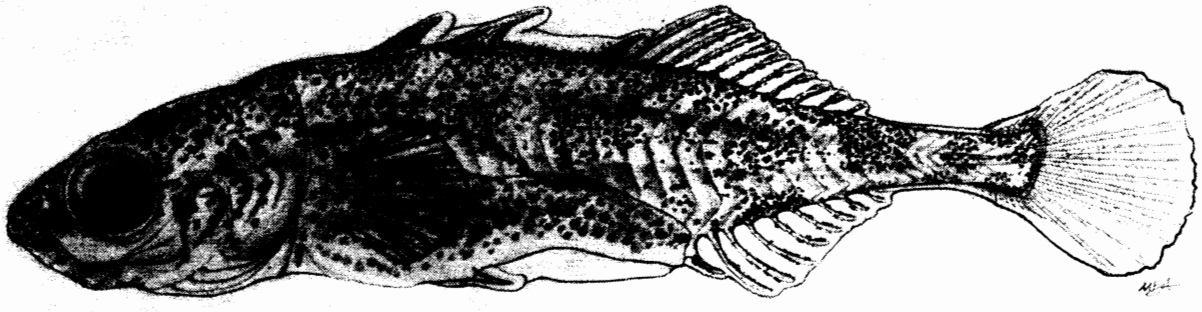


Figure 22-11. Juvenile, 14.5 mm TL.

Gasterosteidae: Gasterosteus aculeatus, threespine stickleback.

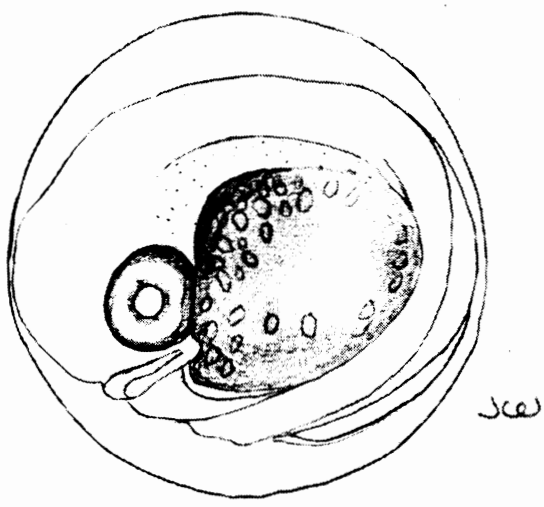


Figure 23-1. Dissected egg, 1.4 mm diameter.

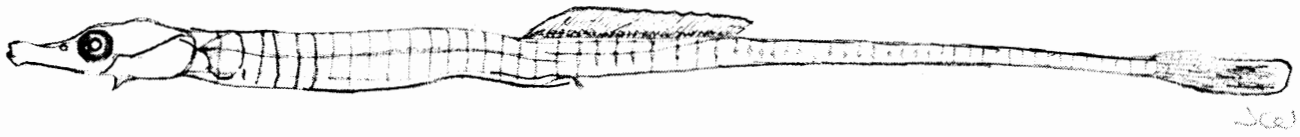


Figure 23-2. Juvenile, 47 mm TL.

Syngnathidae: Syngnathus leptorhynchus, bay pipefish.

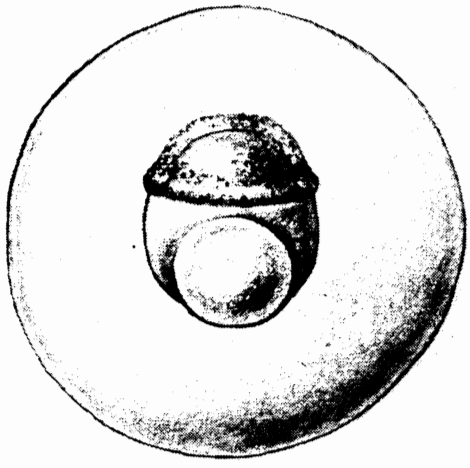


Figure 24-1. Egg, morula, 3.0 mm diameter.

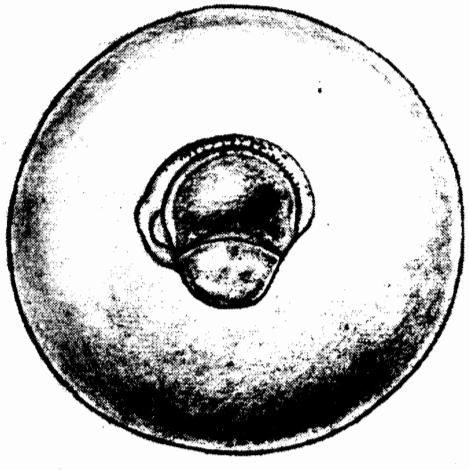


Figure 24-2. Egg, early embryo, 4.0 mm diameter.

Percichthyidae: Morone saxatilis, striped bass.

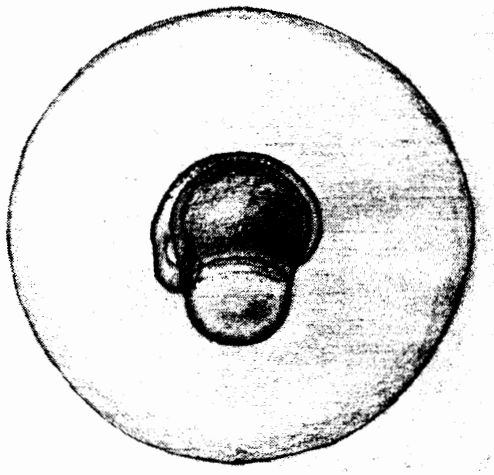


Figure 24-3. Egg, early embryo, 4.0 mm diameter.

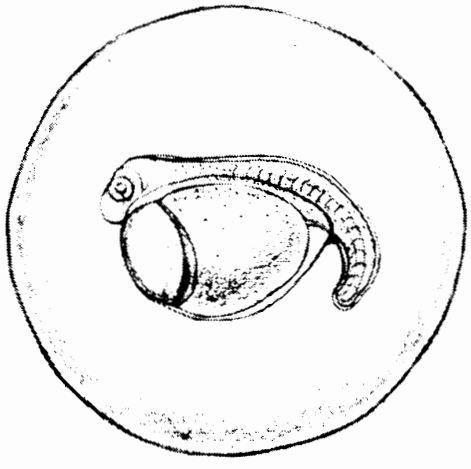


Figure 24-4. Egg, late embryo, 4.0 mm diameter.

Percichthyidae: Morone saxatilis, striped bass.

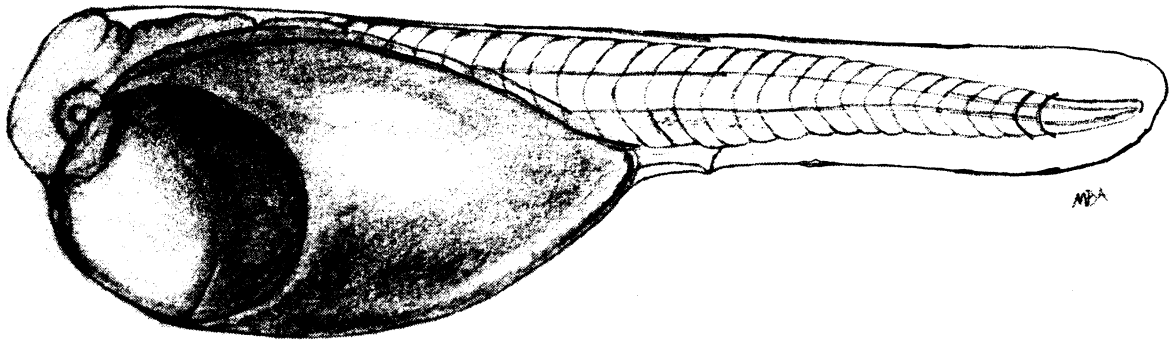


Figure 24-5. Prolarva, 3.6 mm TL.

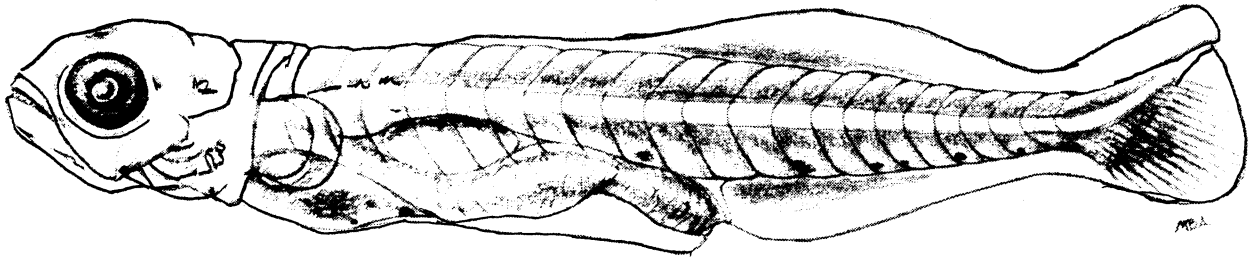


Figure 24-6. Postlarva, 9.5 mm TL.

Percichthyidae: Morone saxatilis, striped bass.

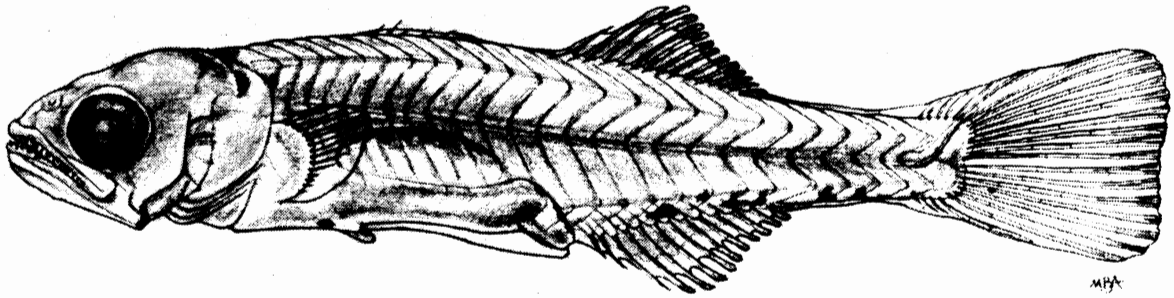


Figure 24-7. Postlarva, 15.2 mm TL.

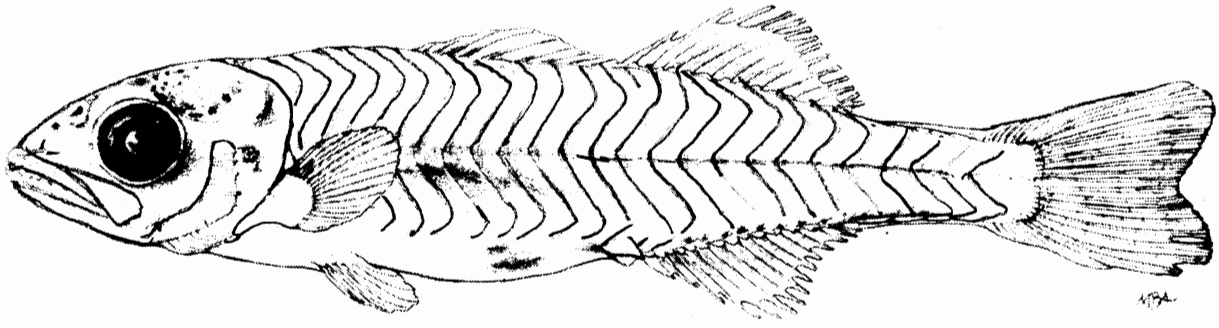


Figure 24-8. Juvenile, 18 mm TL.

Percicthyidae: Morone saxatilis, striped bass.

25. CENTRARCHIDAE - SUNFISHES

Moyle (1976) and Shapovalov et al. (1981) reported twelve species of centrarchids in California. In this study eleven of the twelve species were found in the Sacramento-San Joaquin river system.

Species	Distribution	
	River	Estuary
Sacramento perch, Archoplites interruptus	x	x
Green sunfish, Lepomis cyanellus	x	x
Pumpkinseed, Lepomis gibbosus	x	
Warmouth, Lepomis gulosus	x	x
Bluegill, Lepomis macrochirus	x	x
Redear sunfish, Lepomis microlophus	x	
Smallmouth bass, Micropterus dolomieui	x	
Spotted bass, Micropterus punctulatus	x	
Largemouth bass, Micropterus salmoides	x	x
White crappie, Pomoxis annularis	x	x
Black crappie, Pomoxis nigromaculatus	x	x

The Sacramento perch, Archoplites interruptus, is the only sunfish originally found west of the Rocky Mountains; the others were introduced from the eastern states. The reproductive behavior of the centrarchids is generally characterized by nest-building followed by parental care, although the Sacramento perch may behave differently. Eggs of sunfishes are demersal, and so are the newly hatched larvae. Postlarvae and juveniles use aquatic vegetation as their nursery area or shelter. Centrarchids are generally considered to be an excellent pan fish by anglers, particularly the largemouth bass and bluegill.

References

Moyle 1976; Shapovalov et al. 1981.

SACRAMENTO PERCH, Archoplites interruptus (Girard)

Spawning

Location: In weedy ponds and lakes such as Lake Anza, Jewel Lake, and an unnamed private pond near Sonoma Mountain Road, Sonoma County. Juvenile Sacramento perch were taken in the vicinity of Contra Costa Power Plant. Spawning may also occur in Delta sloughs.

Season: April through August (Murphy 1948; Johnson 1958; Mathews 1962, 1965); peaking in May and June (Mathews 1962; Aceituno and Vanicek 1976; Moyle 1976); April through June.

Temperature: 21.7-23.9 (Mathews 1962); 21-29 C (McCarraher and Gregory 1970); 20-24 C when the eggs were collected.

Salinity: Freshwater (Murphy 1968, Mathews 1962; this study); in mesohaline up to 17,000 ppm or alkalinities 800 ppm (McCarraher and Gregory 1970).

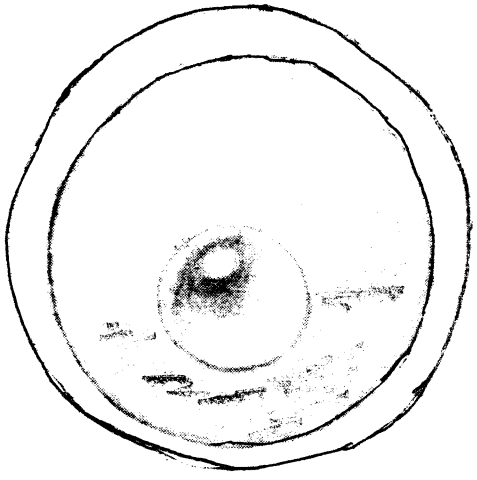


Figure 25-1. Newly fertilized egg, 1.1 mm diameter.

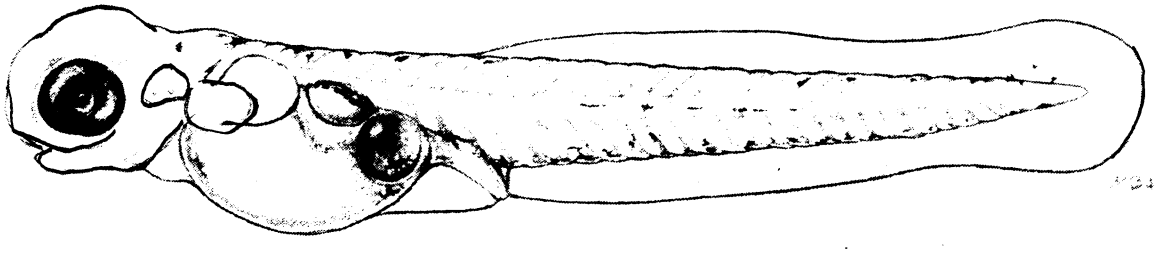


Figure 25-2. Prolarva, 4 mm TL.

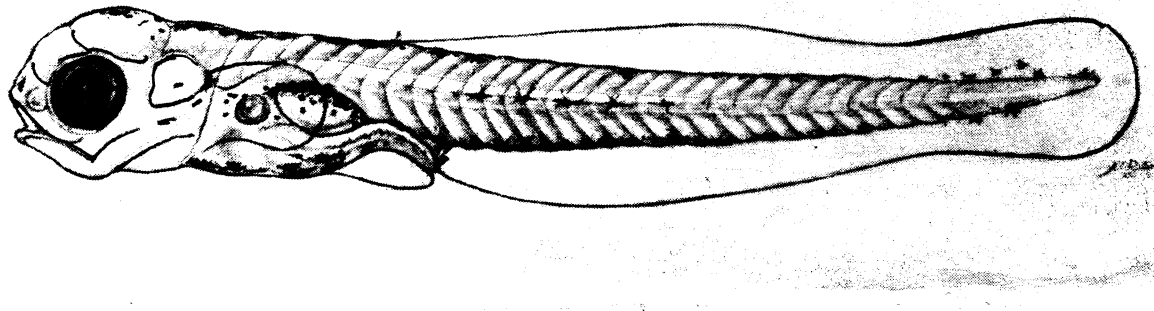


Figure 25-3. Postlarva, 4.7 mm TL.

Centrarchidae: Archoplites interruptus, Sacramento perch.

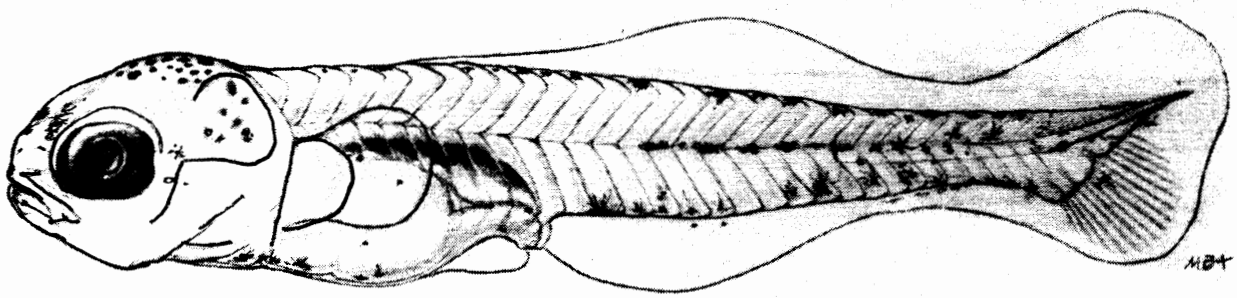


Figure 25-4. Postlarva, 5 mm TL.

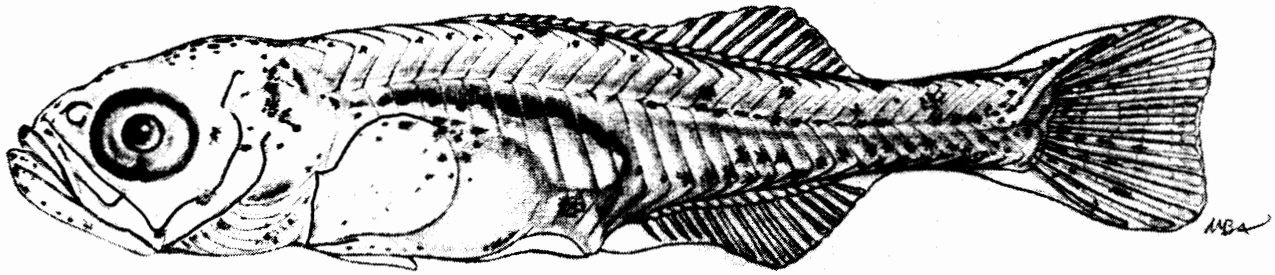


Figure 25-5. Postlarva, 12 mm TL.

Centrarchidae: Archoplites interruptus, Sacramento perch.

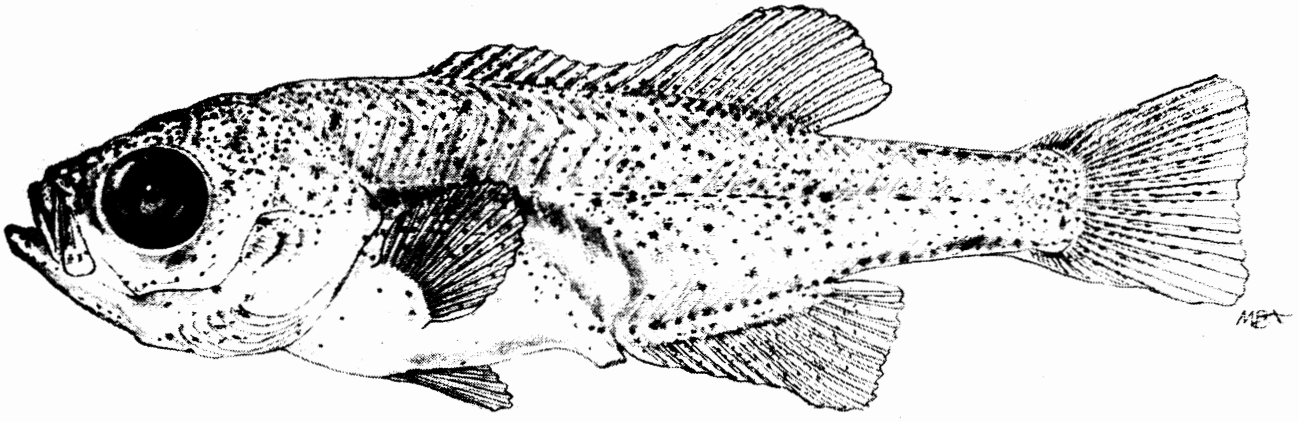


Figure 25-6. Juvenile, 18.2 mm TL.

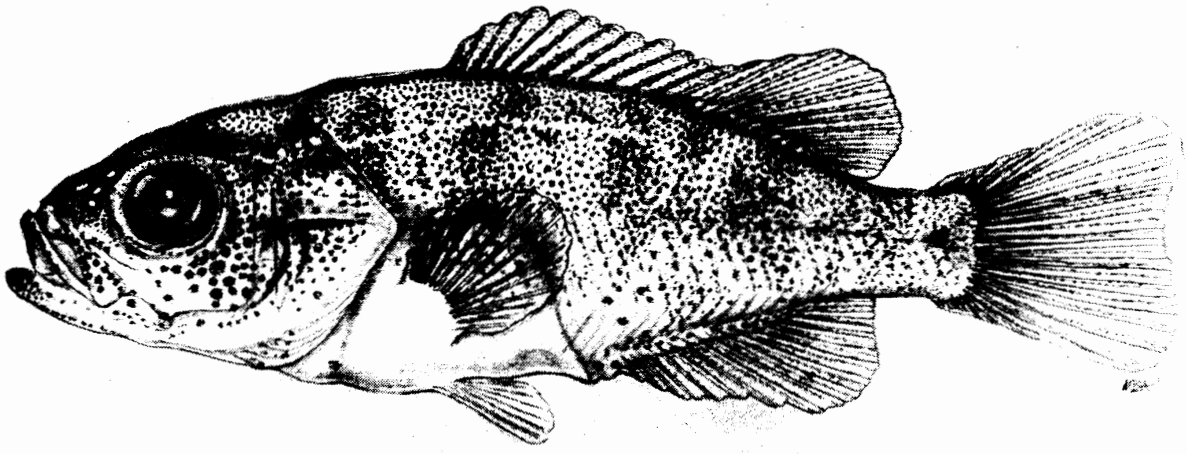


Figure 25-7. Juvenile, 26.5 mm TL.

Centrarchidae: Archoplites interruptus, Sacramento perch.

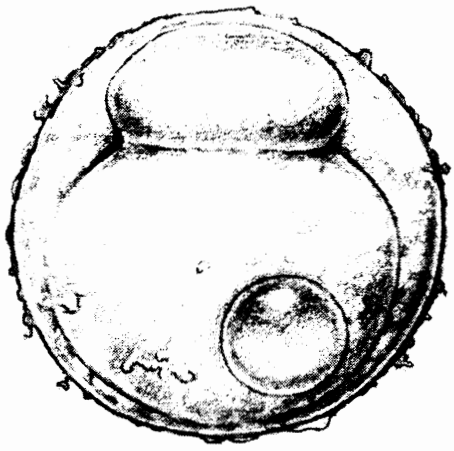


Figure 25-8. Egg, morula, 1.1 mm diameter.

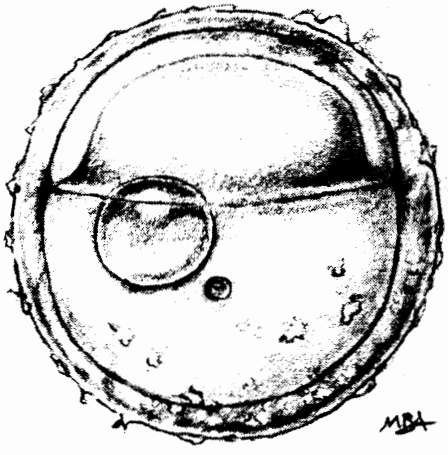


Figure 25-9. Egg, gastrula, 1.3 mm diameter.

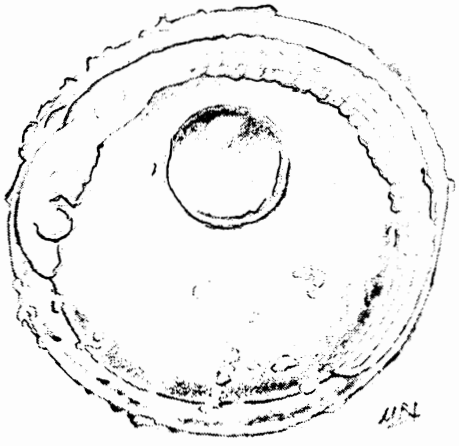


Figure 25-10. Egg, late embryo, 1.3 mm diameter.

Centrarchidae: Lepomis cyanellus, green sunfish.

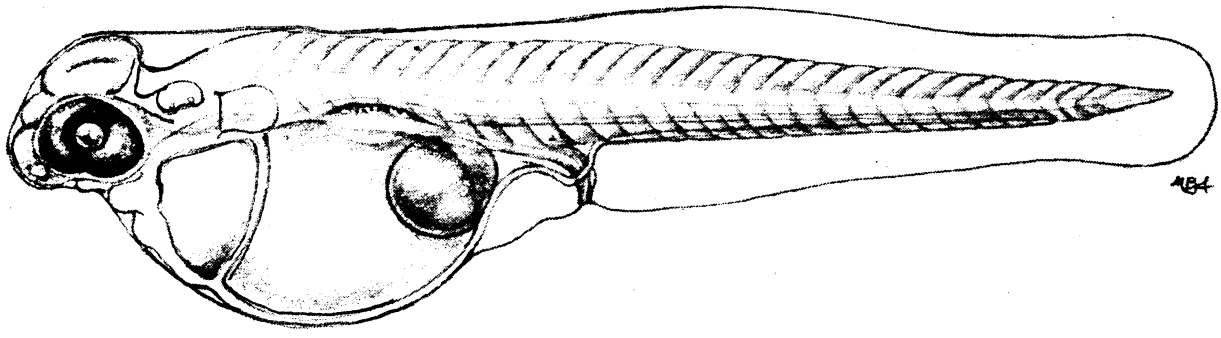


Figure 25-11. Prolarva, 4.5 mm TL.

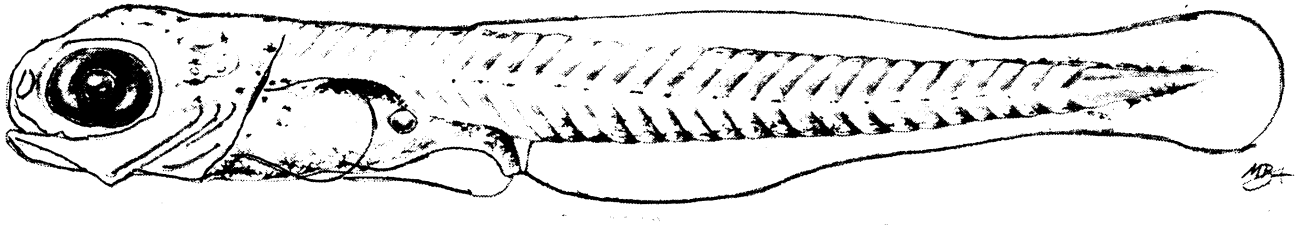


Figure 25-12. Postlarva, 5 mm TL.

Centrarchidae: Lepomis cyanellus, green sunfish.

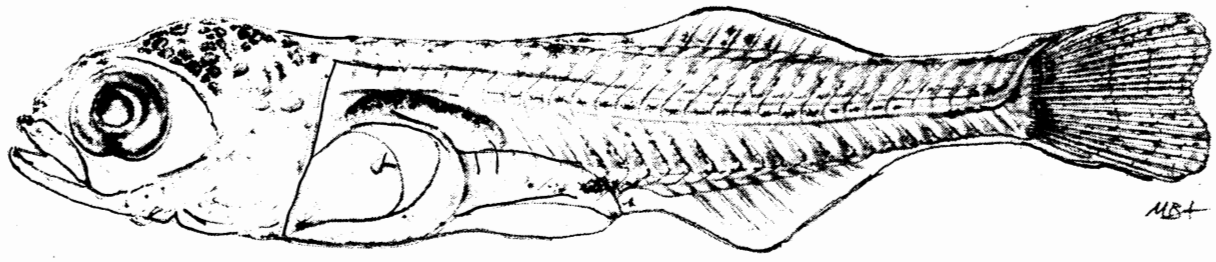


Figure 25-13. Postlarva, 9 mm TL.

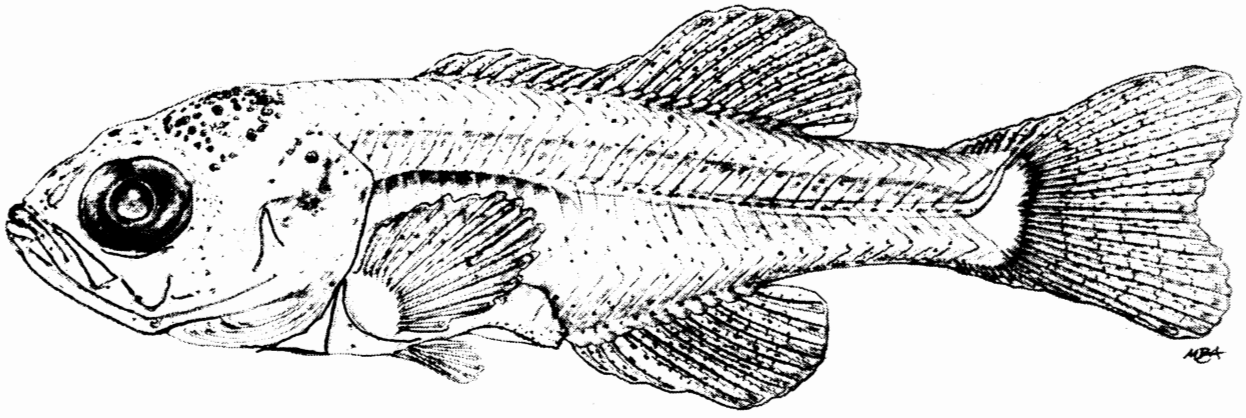


Figure 25-14. Juvenile, 11.6 mm TL.

Centrarchidae: Lepomis cyanellus, green sunfish.

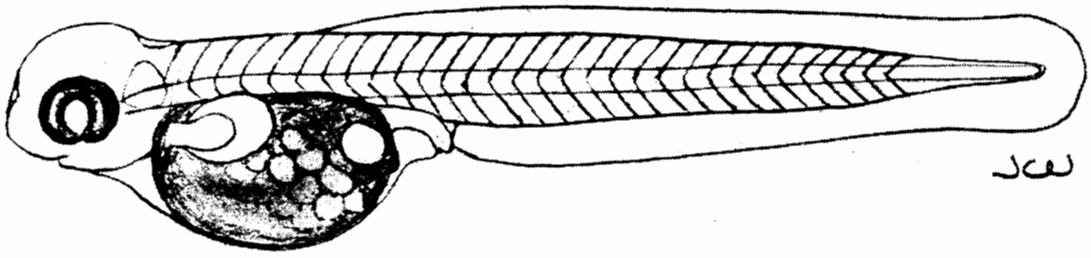


Figure 25-15. Prolarva, 4.2 mm TL.

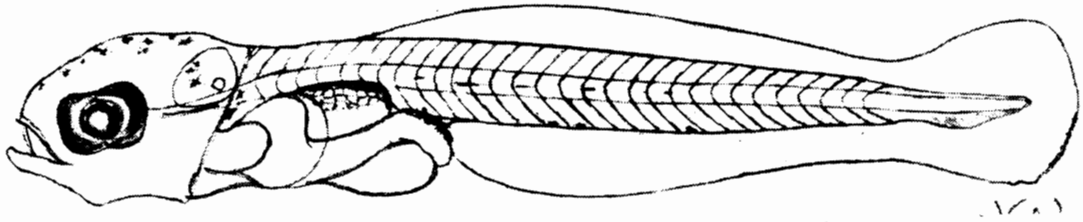


Figure 25-16. Postlarva, 5.5 mm TL.

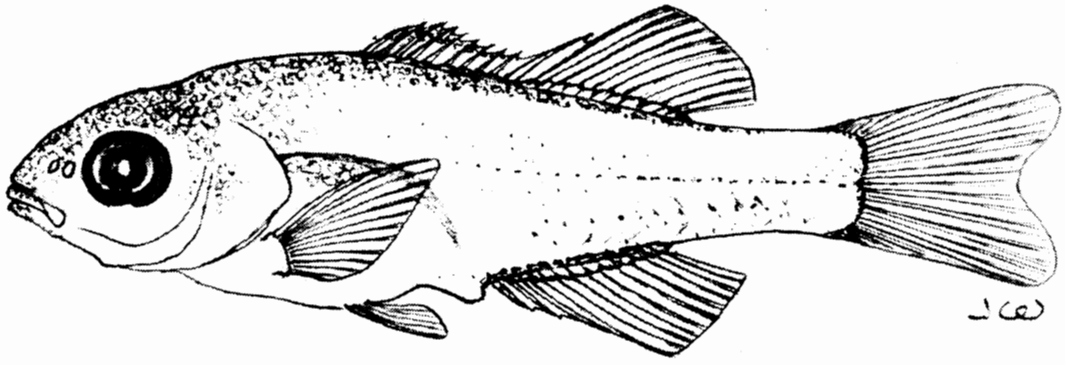


Figure 25-17. Juvenile, 15.1 mm TL.

Centrarchidae: Lepomis gibbosus, pumpkinseed.

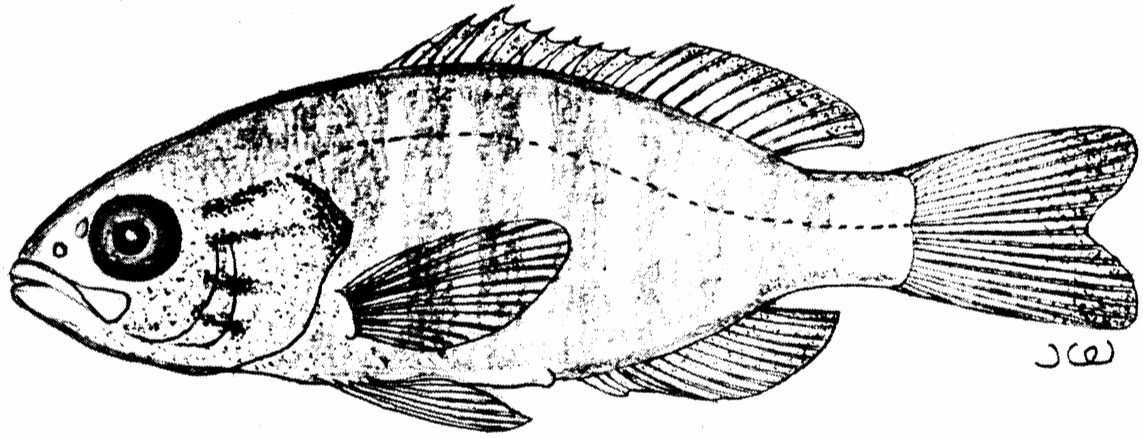


Figure 25-18. Lepomis gulosus, warmouth juvenile, 38 mm TL.

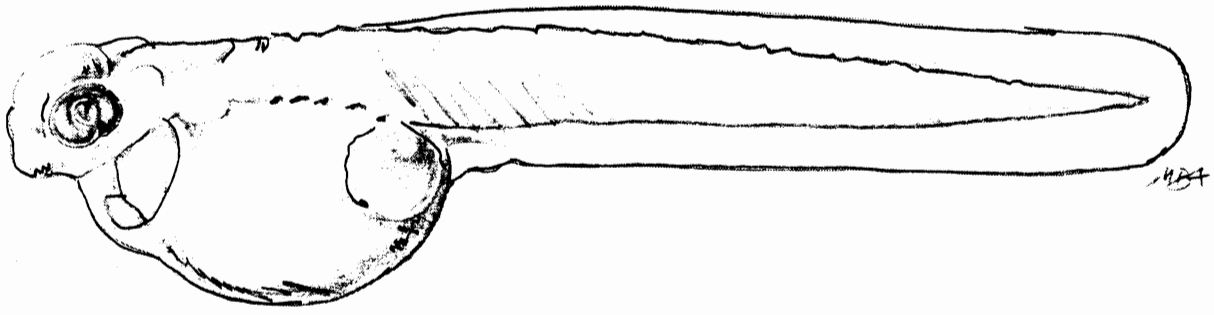


Figure 25-19. Lepomis macrochirus, bluegill prolarva, 3.8 mm TL.

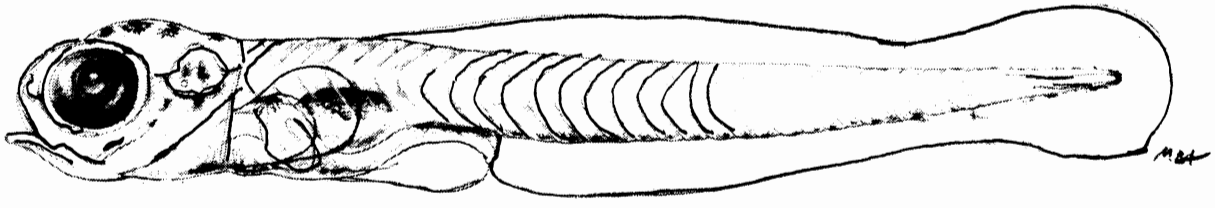


Figure 25-20. Lepomis macrochirus, bluegill postlarva, 5.2 mm TL.

Centrarchidae: Sunfishes.

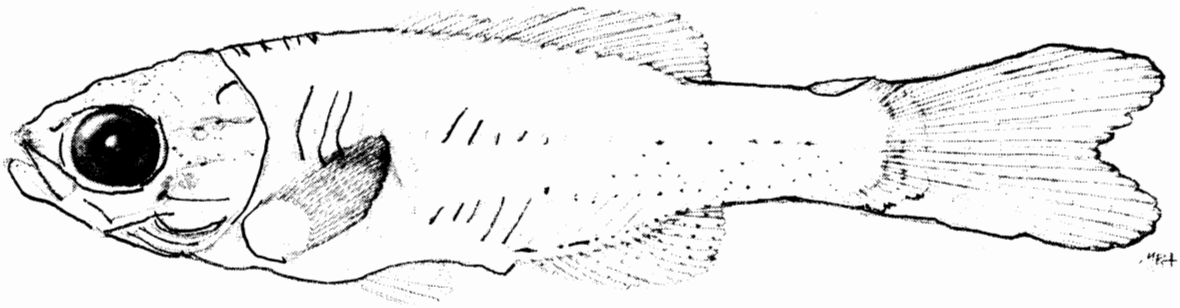


Figure 25-21. Juvenile, 14 mm TL.

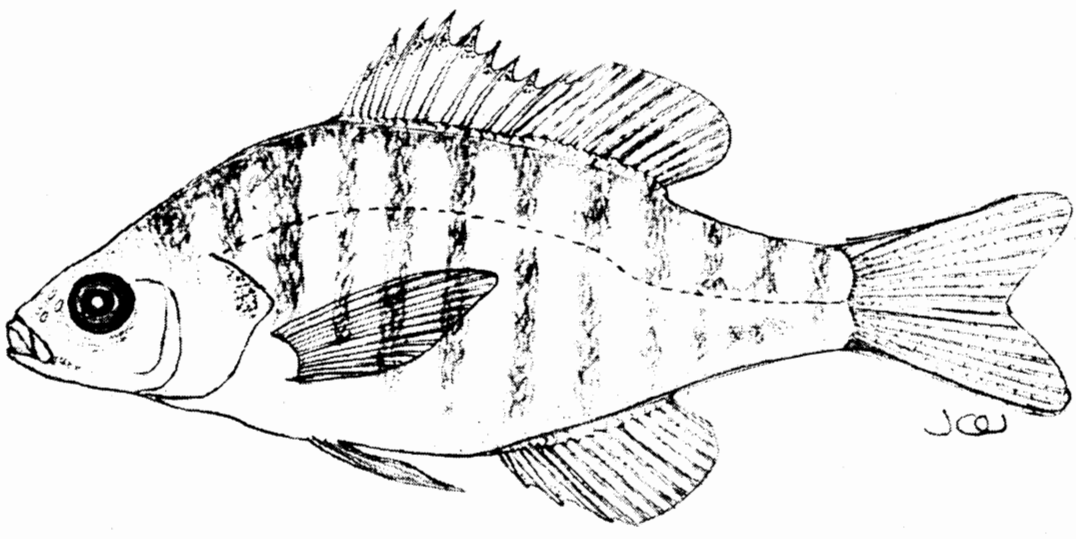


Figure 25-22. Juvenile, 42 mm TL.

Centrarchidae: Lepomis macrochirus, bluegill.

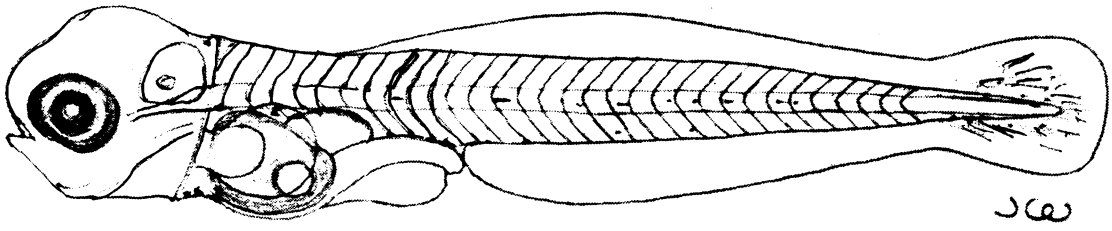


Figure 25-23. Prolarva, 6.4 mm TL.

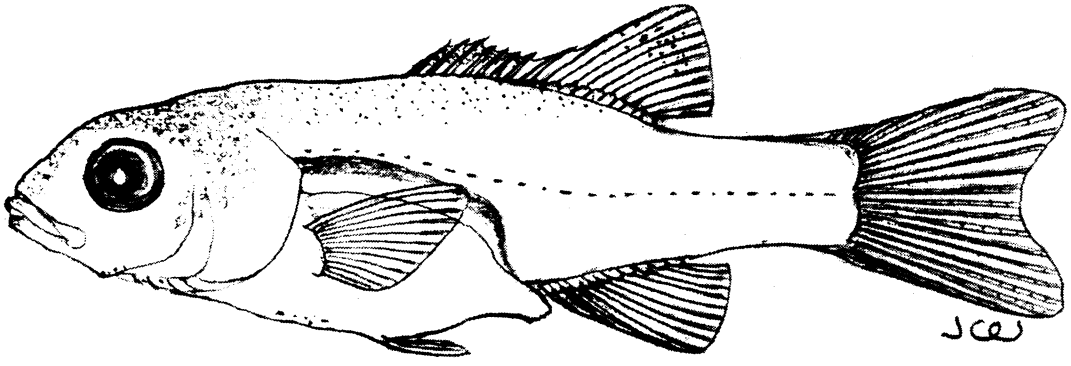


Figure 25-24. Juvenile, 13 mm TL.

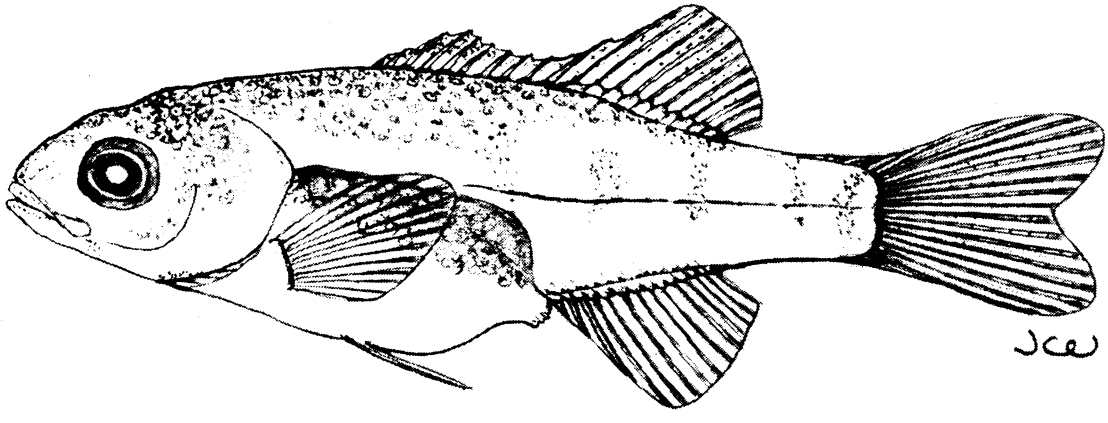


Figure 25-25. Juvenile, 14.3 mm TL.

Centrarchidae: Lepomis microlophus, redear sunfish.

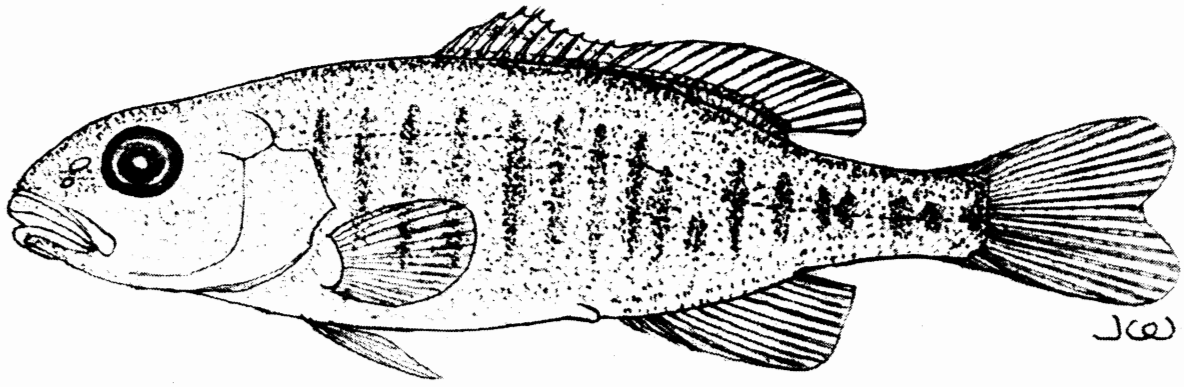


Figure 25-26. Micropterus dolomieui, smallmouth bass juvenile, 32 mm TL.

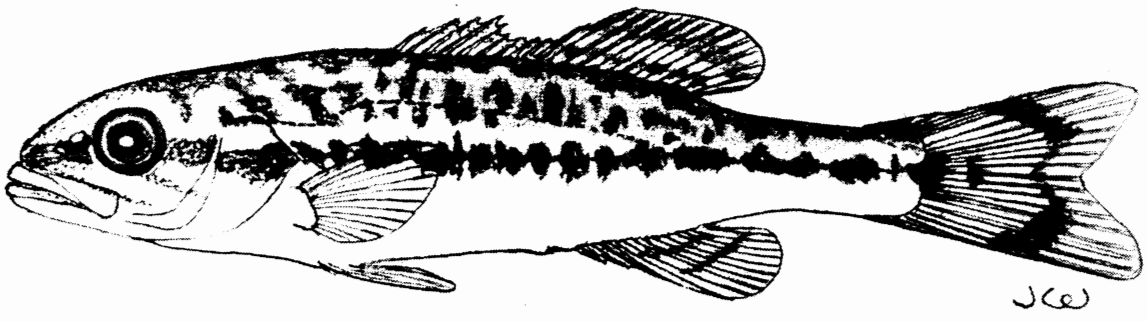


Figure 25-27. Micropterus punctulatus, spotted bass juvenile, 56 mm TL.

Centrarchidae: Sunfishes.

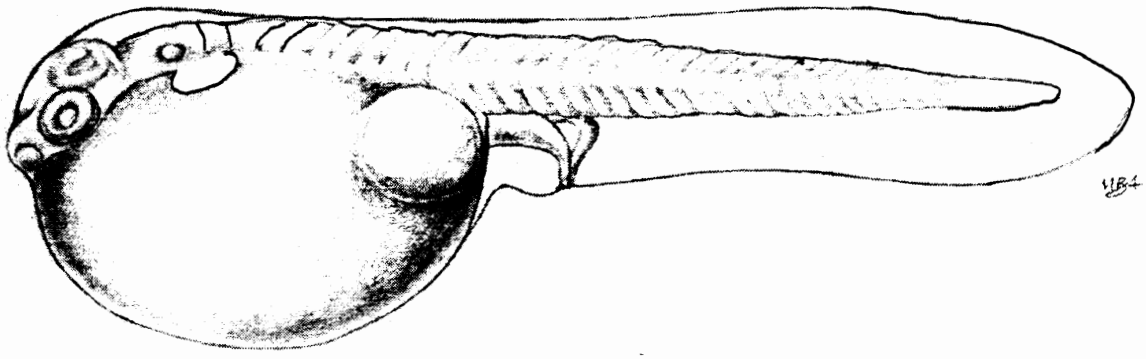


Figure 25-28. Prolarva, 4 mm TL.

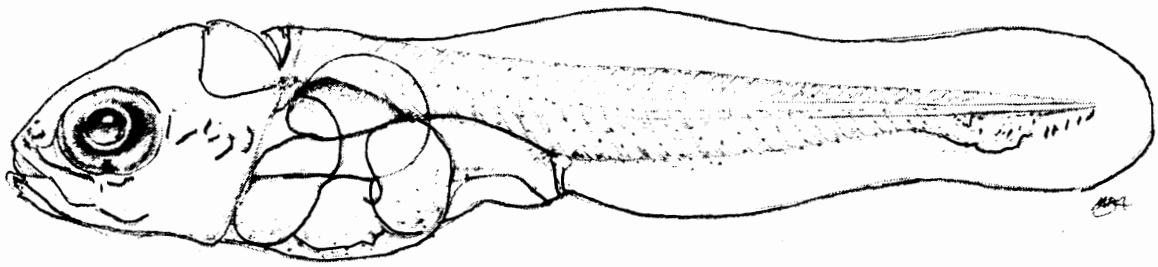


Figure 25-29. Postlarva, 7 mm TL.

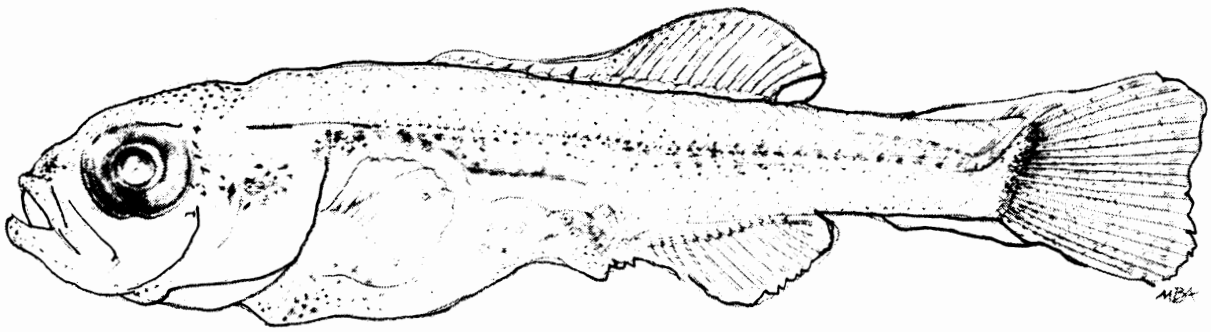


Figure 25-30. Postlarva, 9.6 mm TL.

Centrarchidae: Micropterus salmoides, largemouth bass.

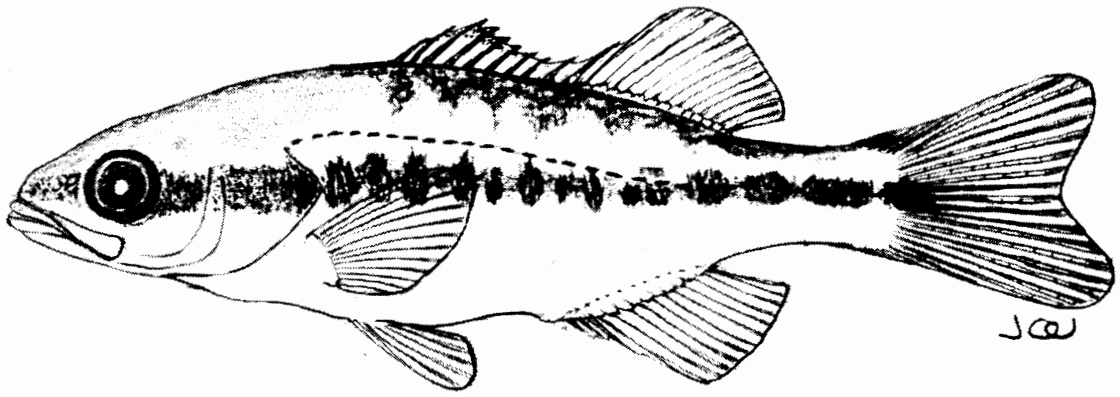


Figure 25-31. Micropterus salmoides, largemouth bass juvenile, 36 mm TL.

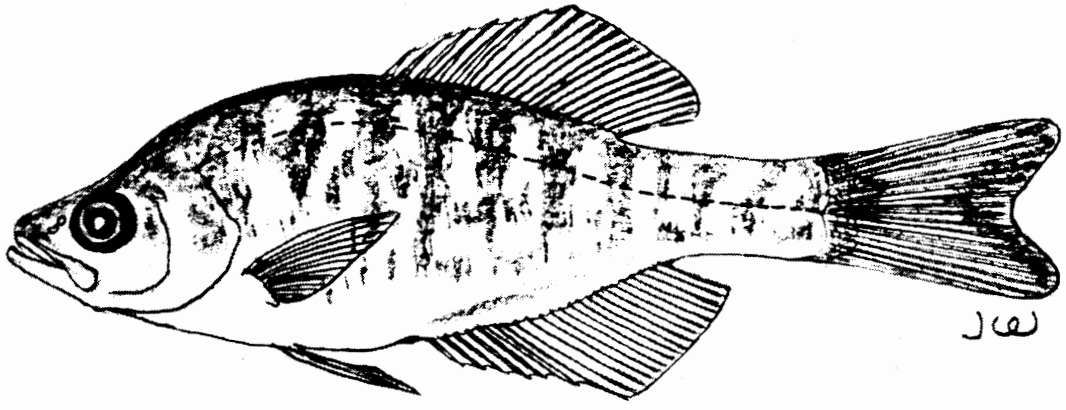


Figure 25-32. Pomoxis annularis, white crappie juvenile, 93 mm TL.

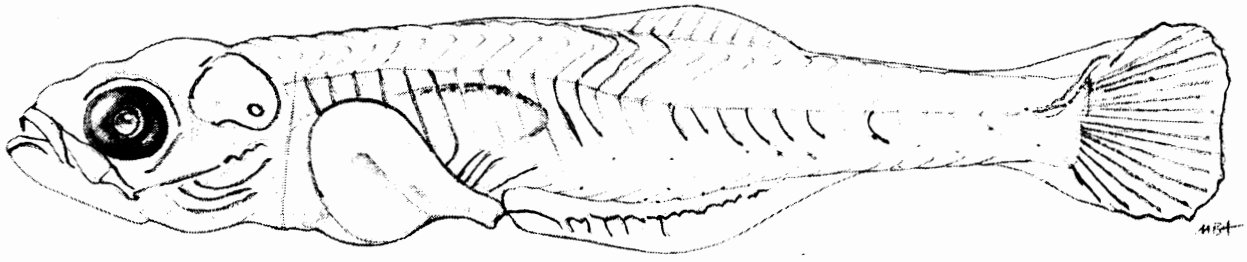


Figure 25-33. Pomoxis nigromaculatus, black crappie postlarva, 11.6 mm TL.

Centrarchidae: Sunfishes.

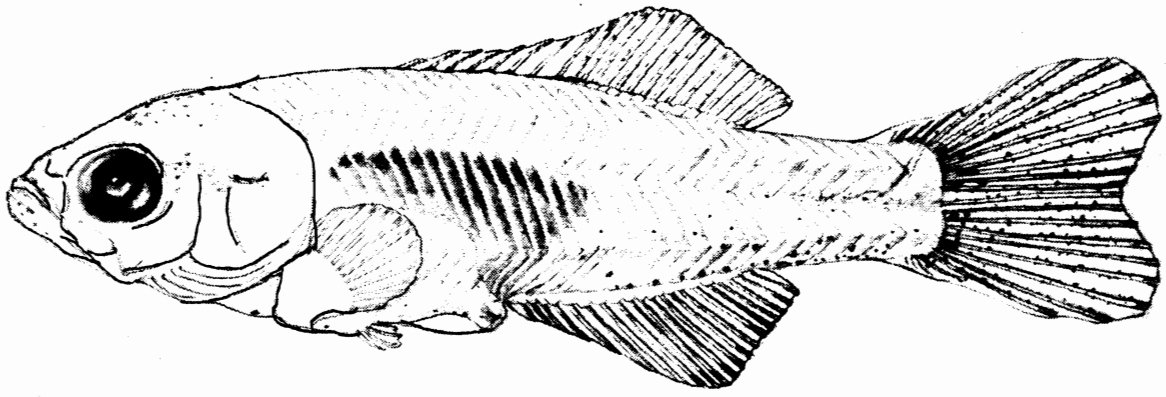


Figure 25-34. Juvenile, 16 mm TL.

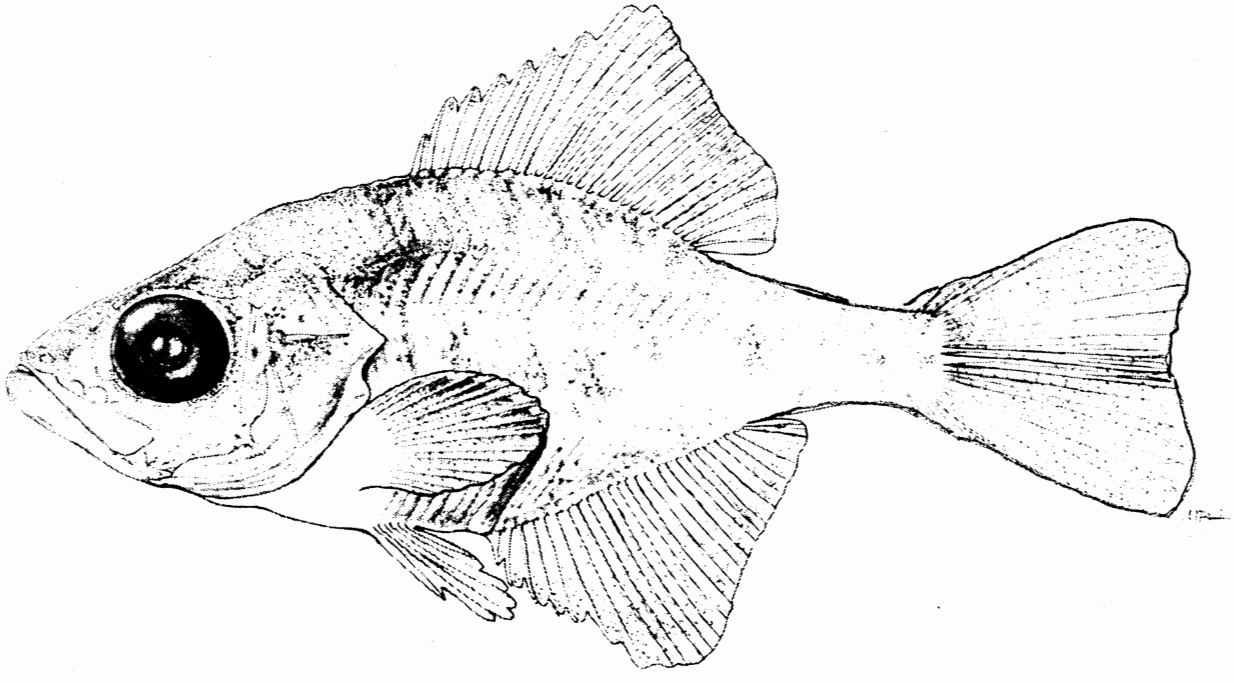


Figure 25-35. Juvenile, 43 mm TL.

Centrarchidae: Pomoxis nigromaculatus, black crappie.

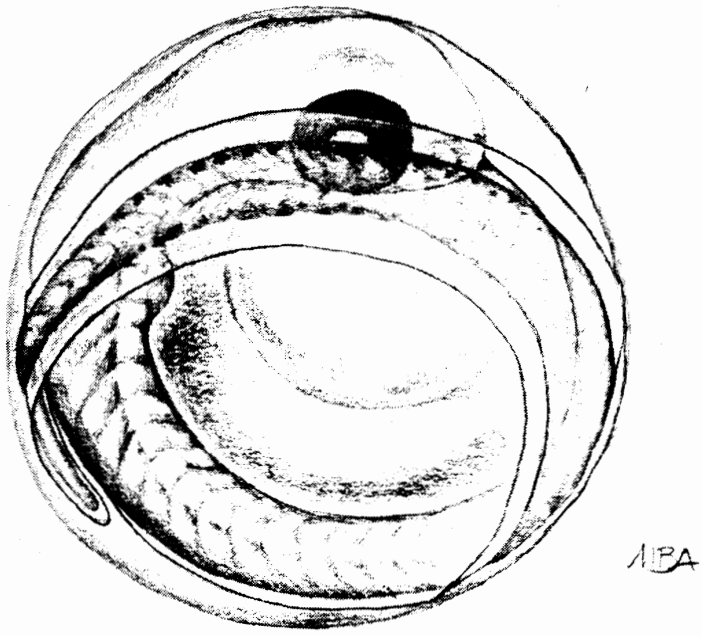


Figure 26-1. Egg, late embryo, 1.3 mm diameter.

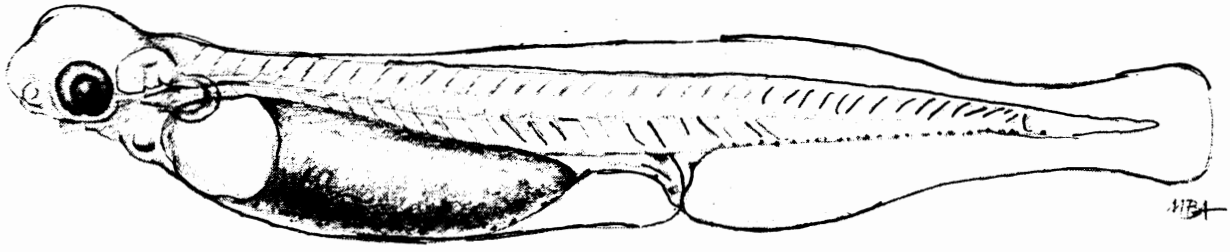


Figure 26-2. Prolarva, 5 mm TL.

Percidae: Percina macrolepida, bigscale logperch.

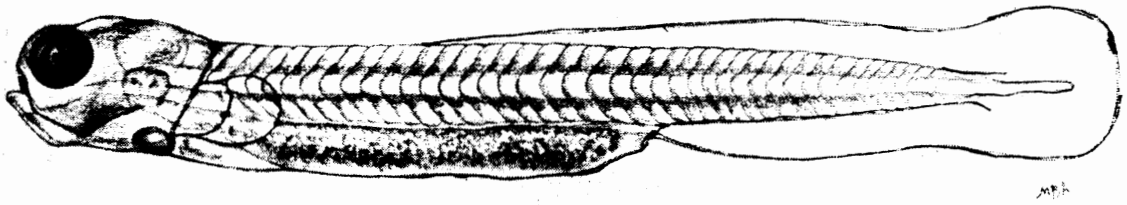


Figure 26-3. Postlarva, 5.3 mm TL.

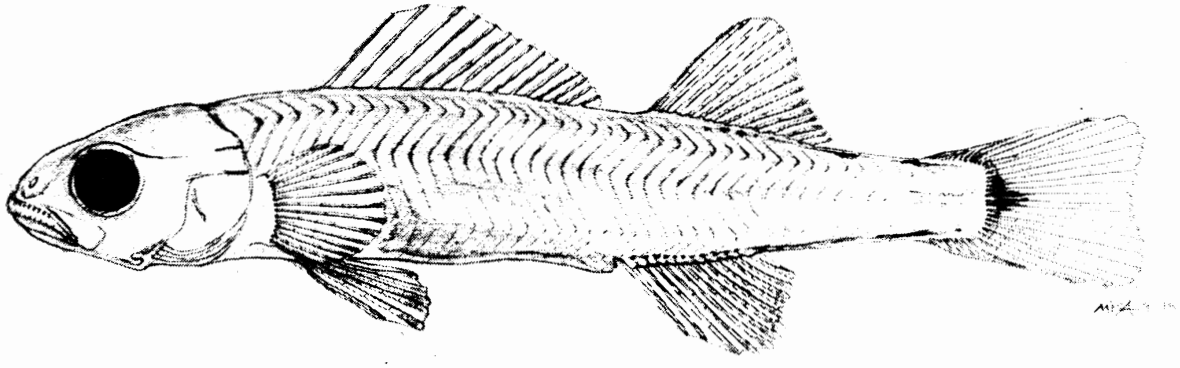


Figure 26-4. Juvenile, 22.5 mm TL.

Percidae: Percina macrolepida, bigscale logperch.

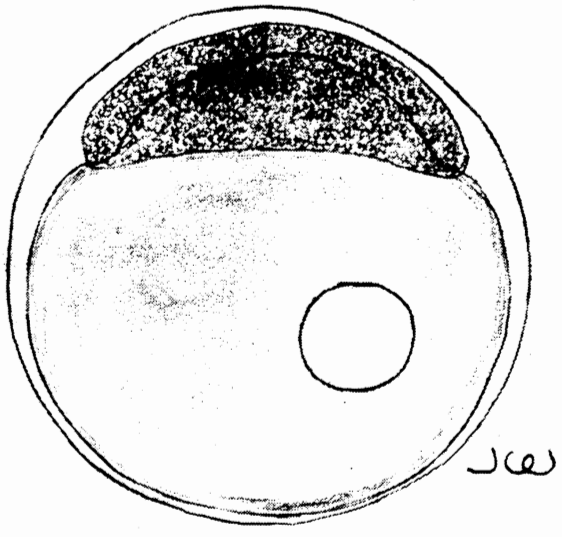


Figure 27-1. Egg, gastrula, 0.7 mm diameter.

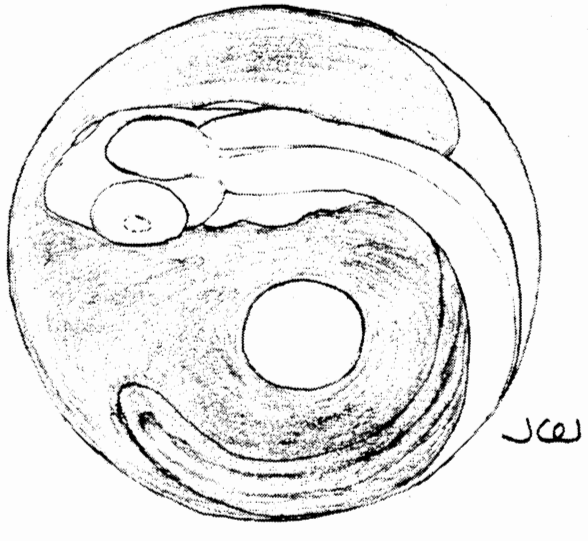


Figure 27-2. Egg, late embryo, 0.8 mm diameter.

Sciaenidae: Genyonemus lineatus, white croaker.

Figure 27-3. Prolarva, 3.3 mm TL.

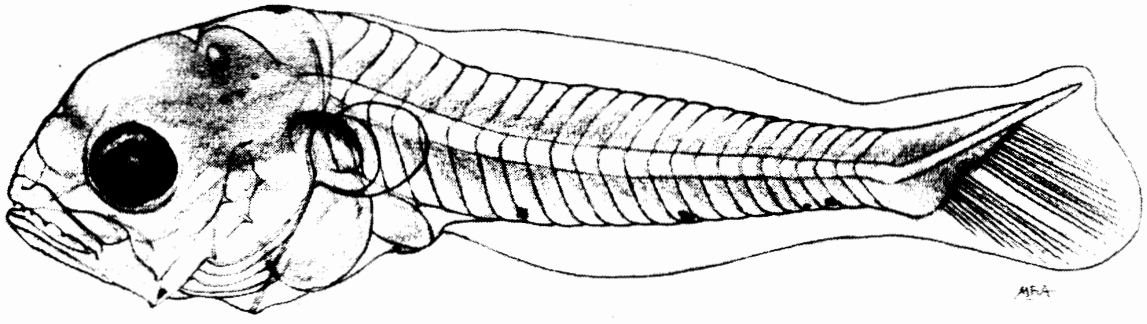


Figure 27-4. Postlarva, 6.5 mm TL.

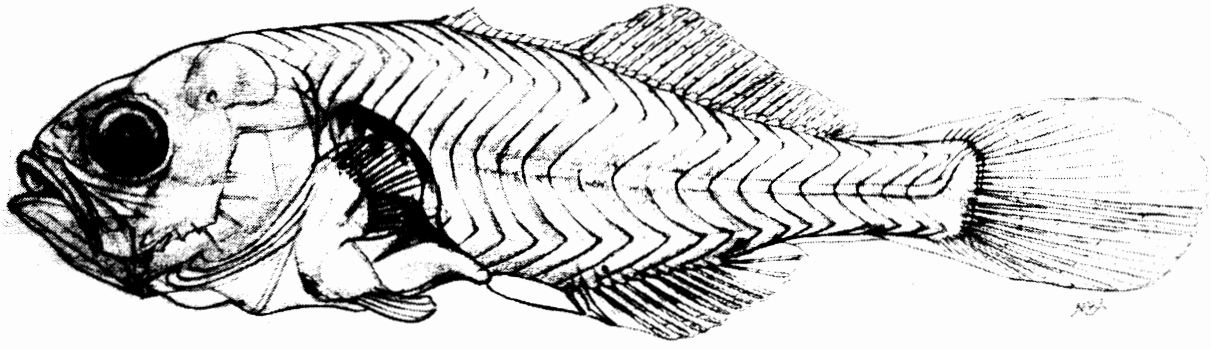


Figure 27-5. Juvenile, 13 mm TL.

Sciaenidae: Genyonemus lineatus, white croaker.

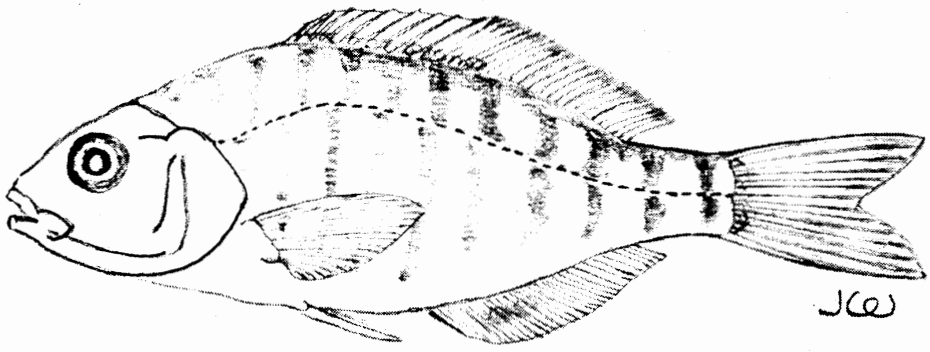


Figure 28-1. Amphistichus argenteus, barred surfperch, 86 mm TL.

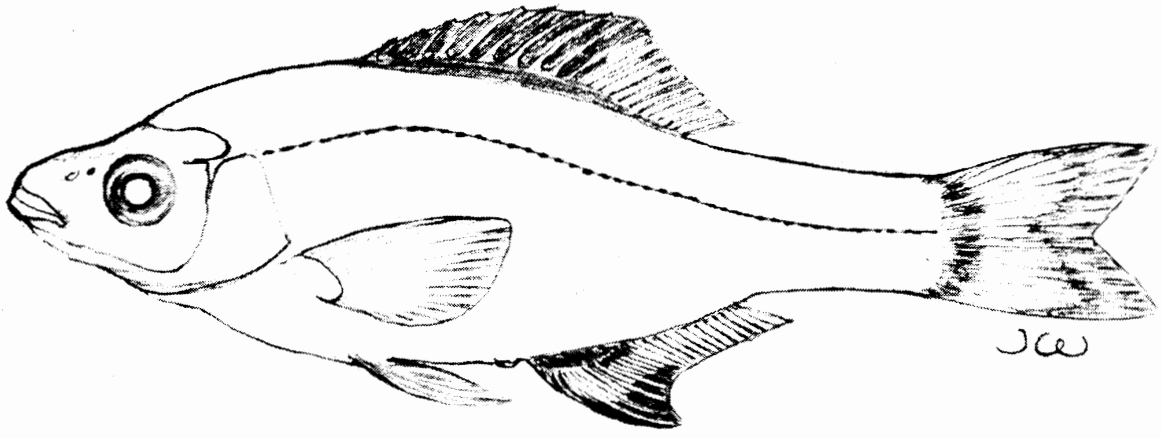


Figure 28-2. Brachyistius frenatus, kelp perch juvenile, 98 mm TL.

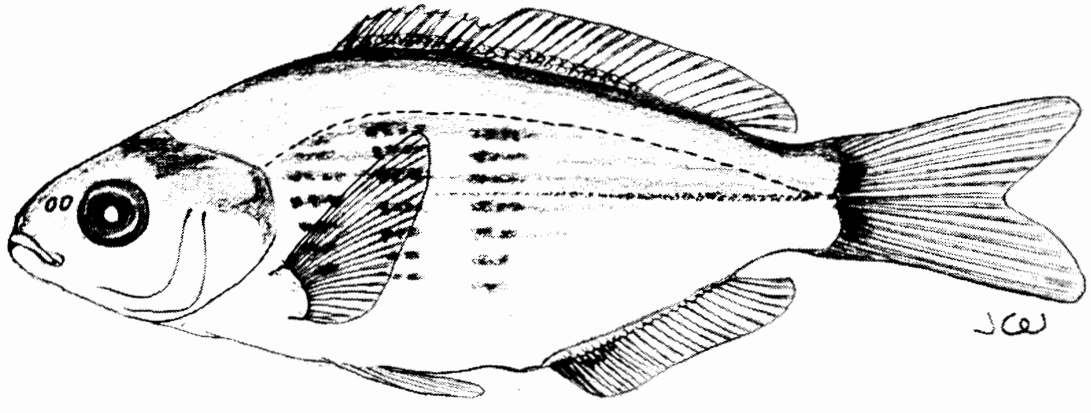


Figure 28-3. Cymatogaster aggregata, shiner perch juvenile, 51 mm TL.

Embiotocidae: Surfperches.

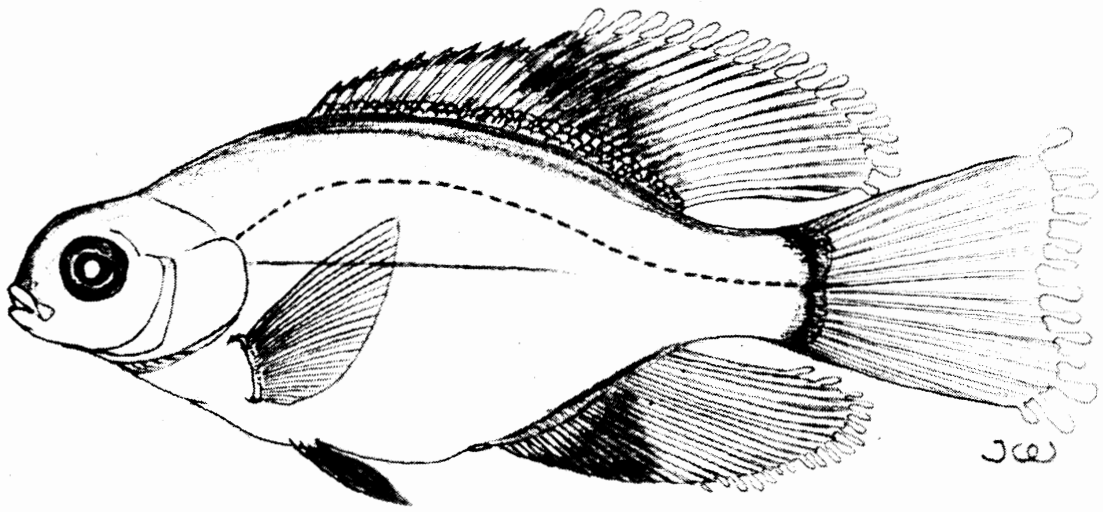


Figure 28-4. Embiotoca jacksoni, black perch juvenile, 54 mm TL.

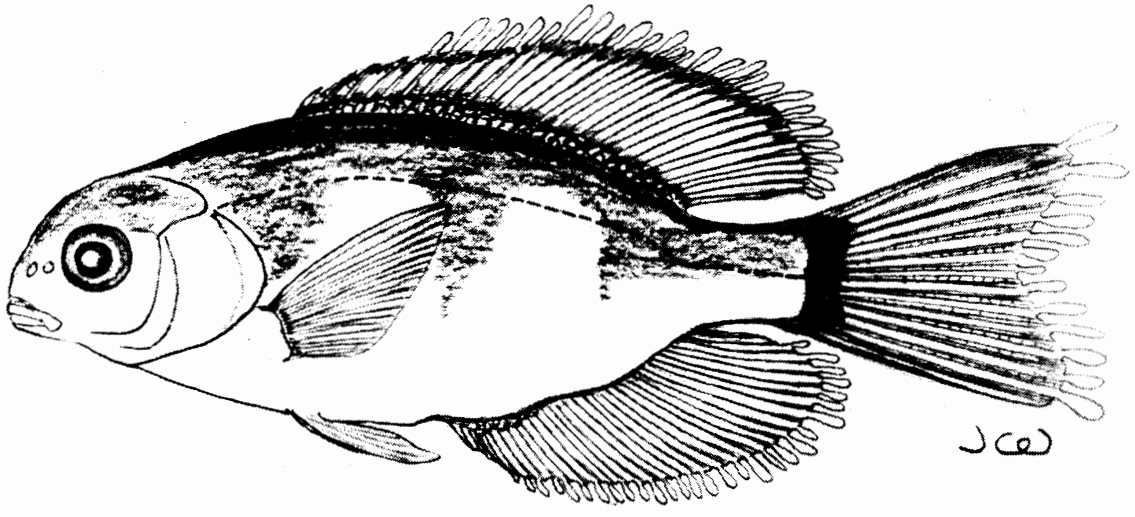


Figure 28-5. Embiotoca jacksoni, black perch juvenile, 72 mm TL.

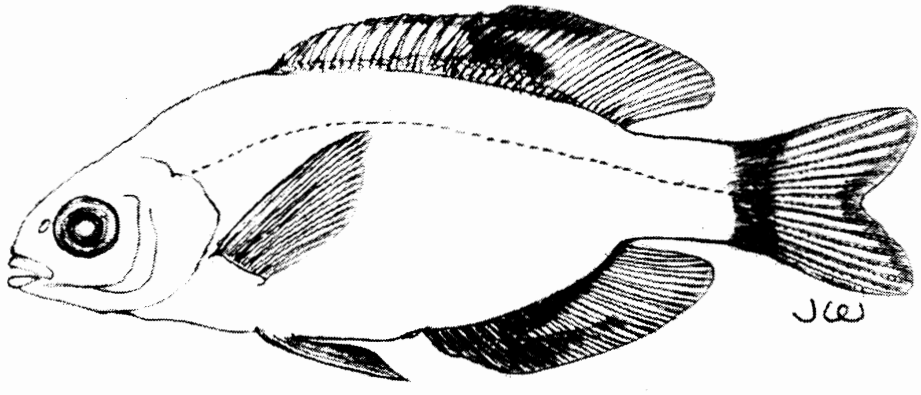


Figure 28-6. Embiotoca lateralis, striped surfperch juvenile, 70 mm TL.

Embiotocidae: Surfperches.

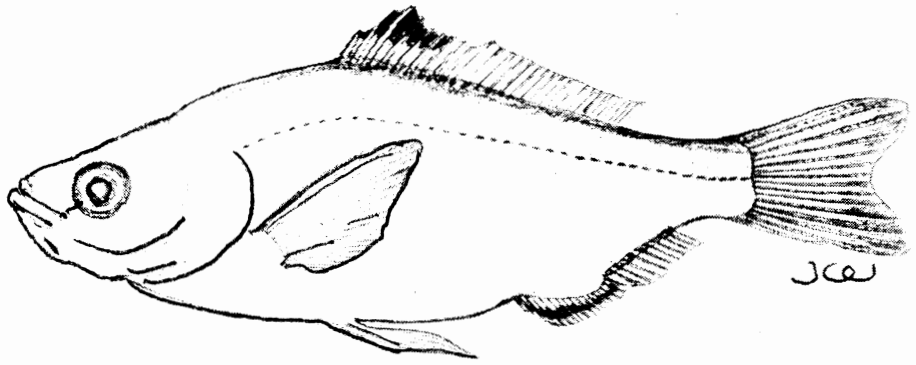


Figure 28-7. Hyperprosopon anale, spotfin surfperch juvenile, 86 mm TL.

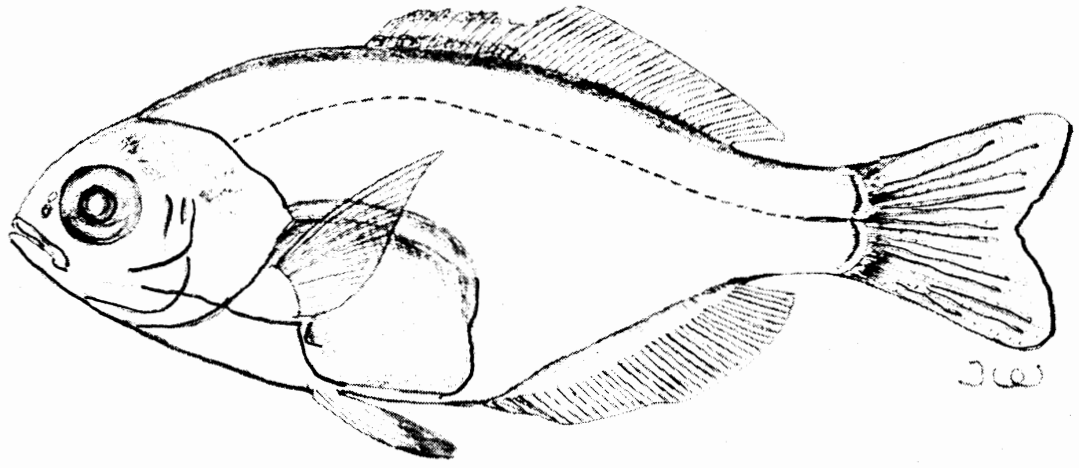


Figure 28-8. Hyperprosopon argenteum, walleye surfperch juvenile, 61 mm TL.

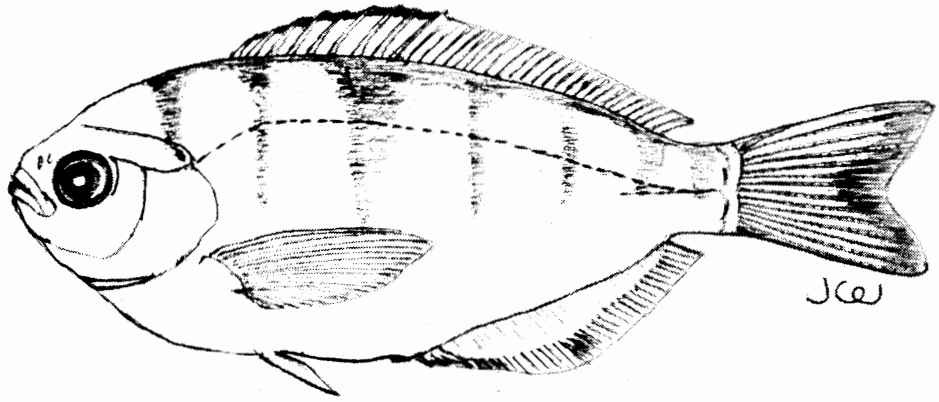


Figure 28-9. Hyperprosopon ellipticum, silver surfperch juvenile, 92 mm TL.

Embiotocidae: Surfperches.

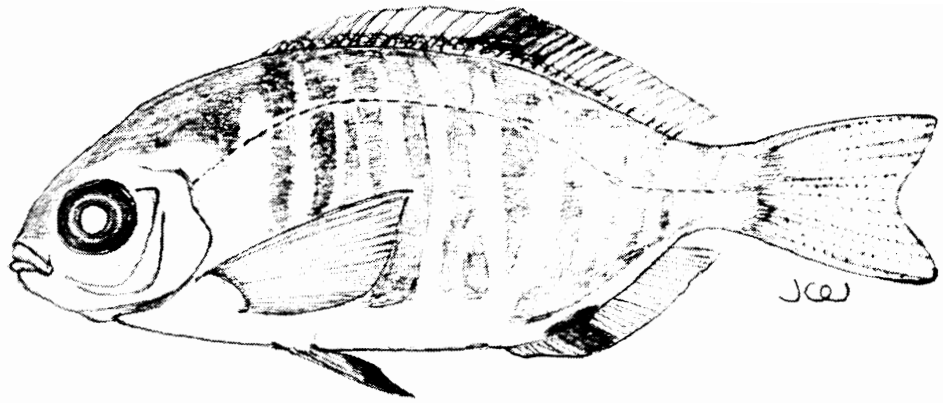


Figure 28-10. Hypsurus caryi, rainbow seaperch juvenile, 67 mm TL.

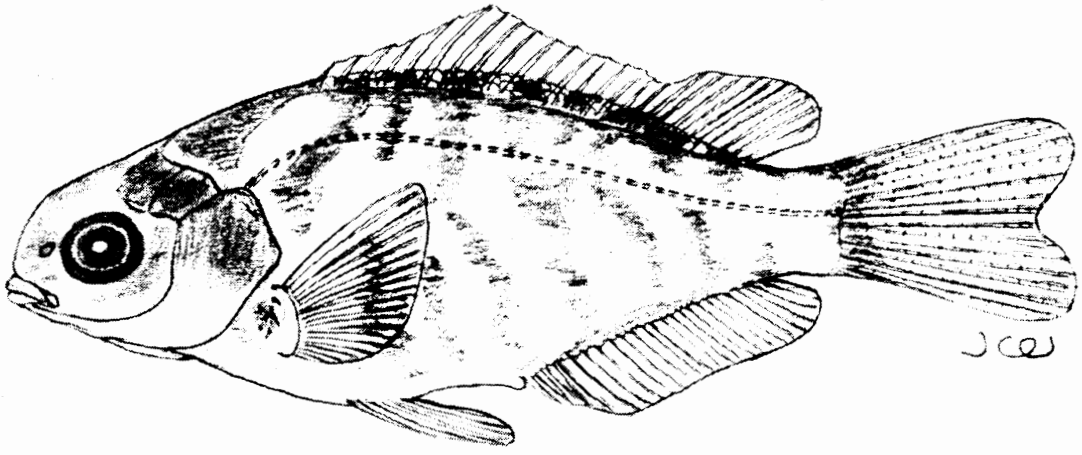


Figure 28-11. Hysterocarpus traski, tule perch juvenile, 36 mm TL.

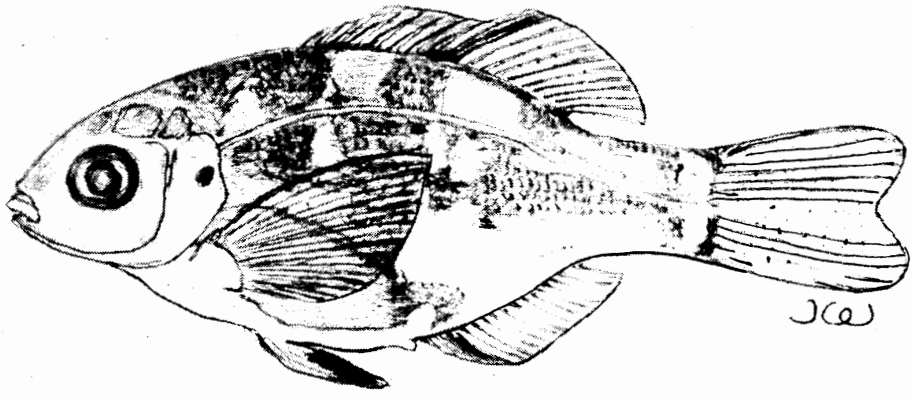


Figure 28-12. Micrometrus minimus, dwarf perch juvenile, 40 mm TL.

Embiotocidae: Surfperches.

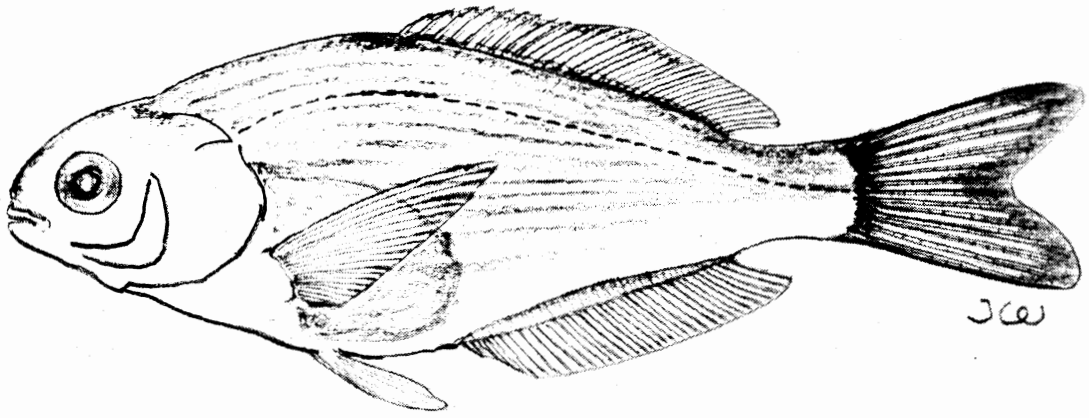


Figure 28-13. Phanerodon furcatus, white seaperch juvenile, 67 mm TL.

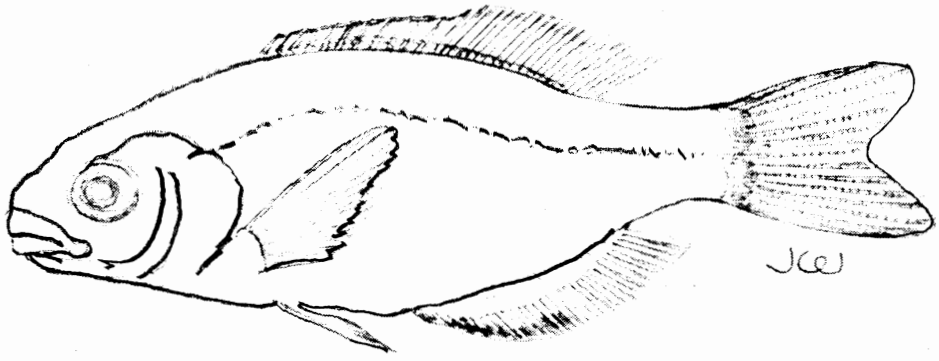


Figure 28-14. Rhacochilus toxotes, rubberlip seaperch juvenile, 100 mm TL.

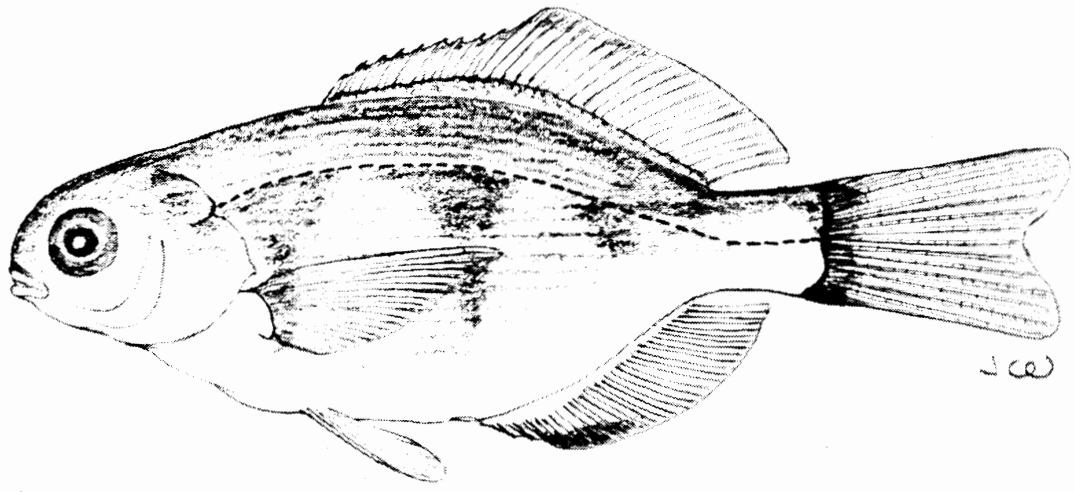


Figure 28-15. Rhacochilus vacca, pile perch juvenile, 82 mm TL.

Embiotocidae: Surfperches.

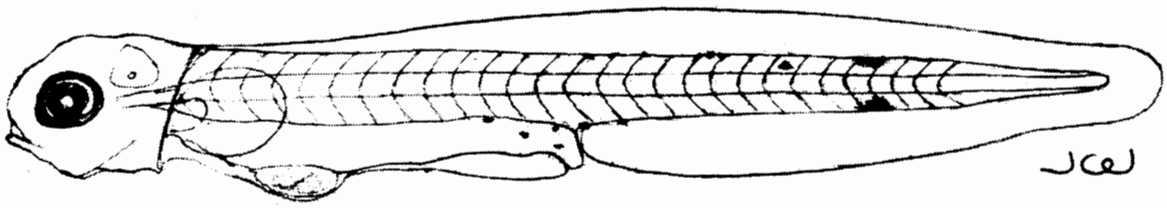


Figure 29-1. Prolarva, 2.7 mm TL.

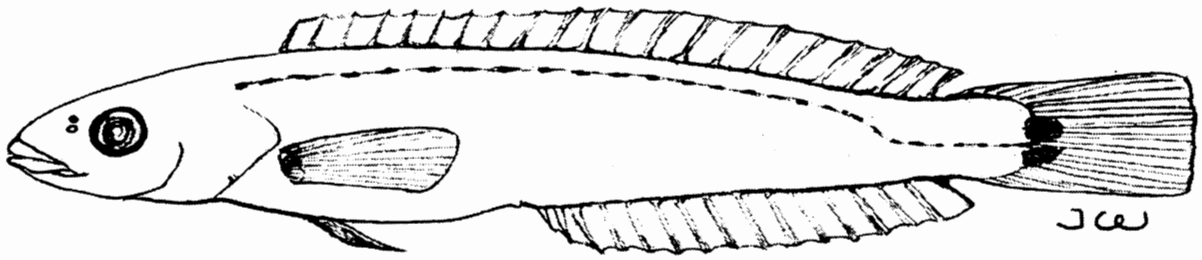


Figure 29-2. Juvenile, 74 mm TL.

Labridae: Oxyjulis californica, señorita.

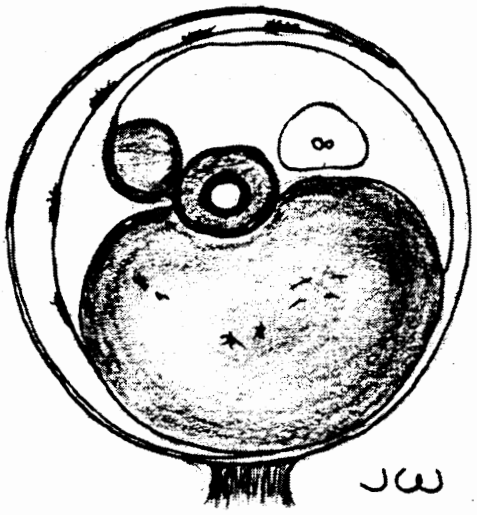


Figure 30-1. Egg, late embryo, 1.6 mm diameter.

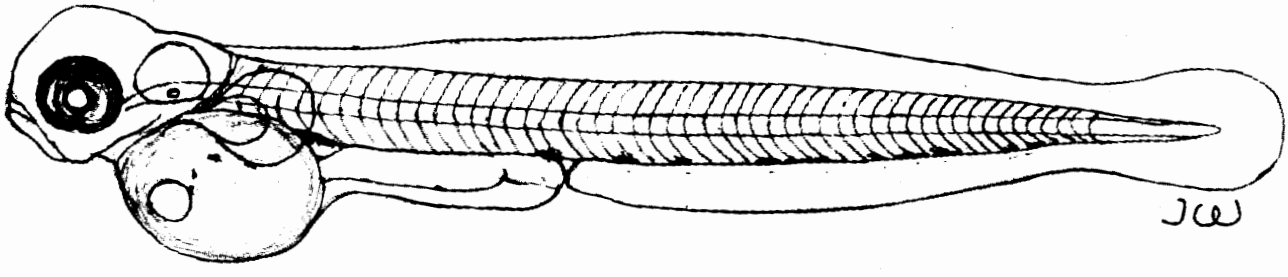


Figure 30-2 Prolarva, 7 mm TL.

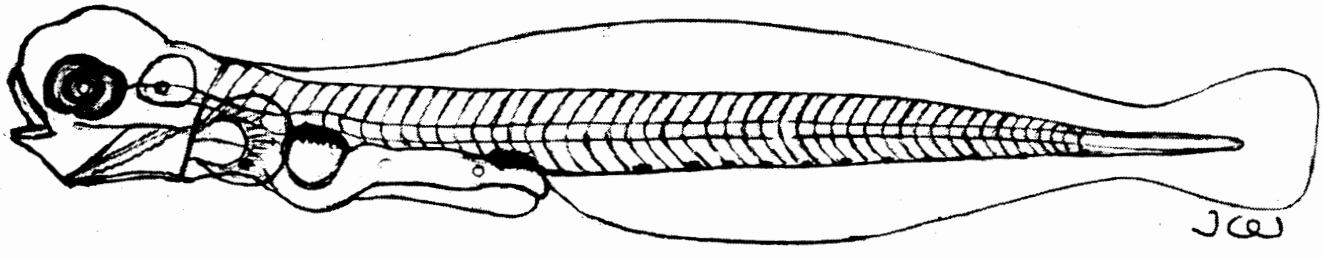


Figure 30-3. Postlarva, 8 mm TL.

Clinidae: Gibbonsia metzi, striped kelpfish.

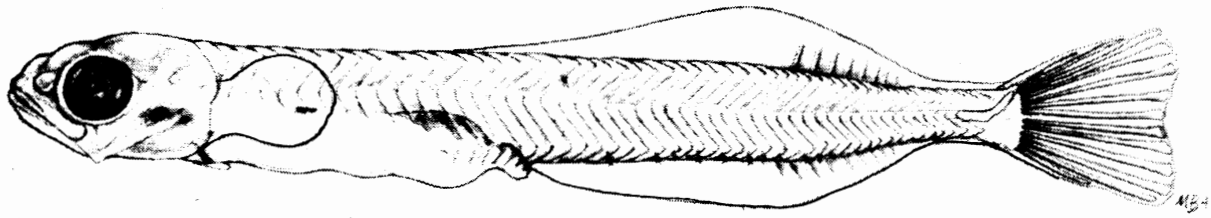


Figure 30-4. Postlarva, 15.6 mm TL.

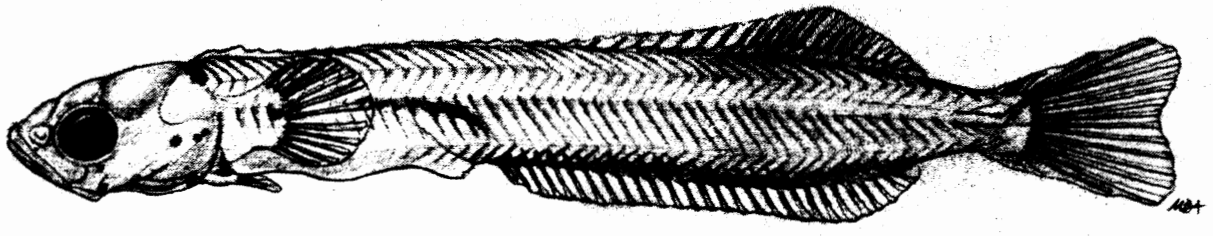


Figure 30-5. Postlarva, 23 mm TL.

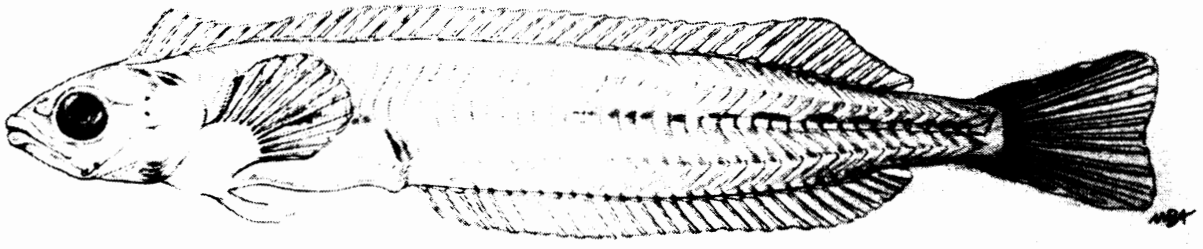


Figure 30-6. Juvenile, 32.5 mm TL.

Clinidae: Gibbonsia metzi, striped kelpfish.

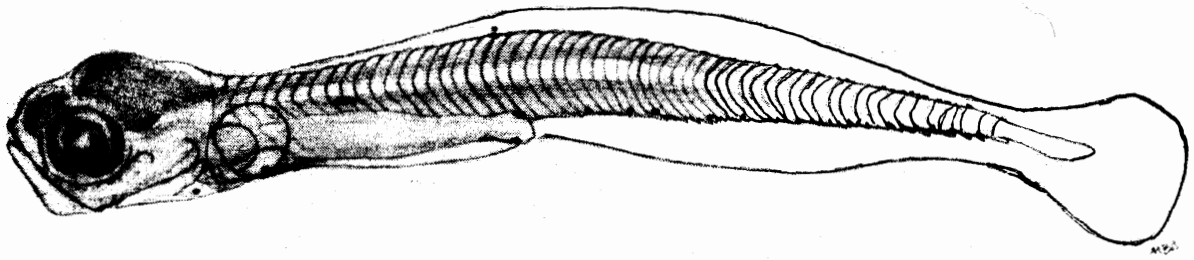


Figure 30-7. Postlarva, 8 mm TL.

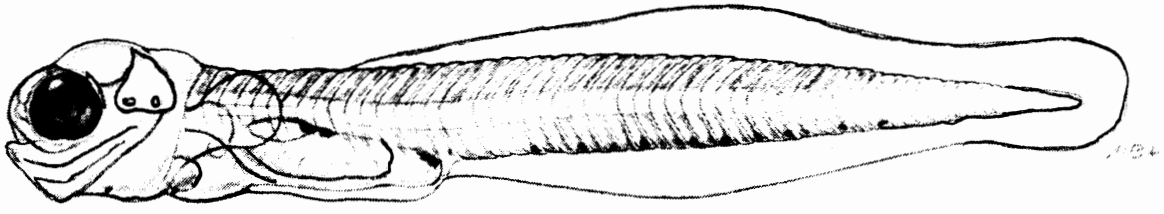


Figure 30-8. Postlarva, 8.5 mm TL.

Clinidae: Heterostichus rostratus, giant kelpfish.

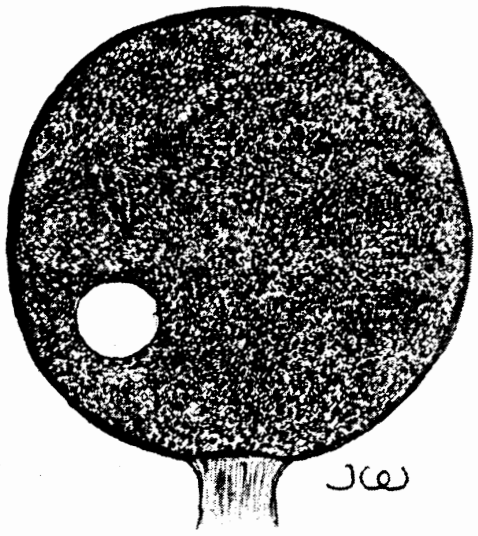


Figure 30-9. Unfertilized egg, 1.2 mm diameter.

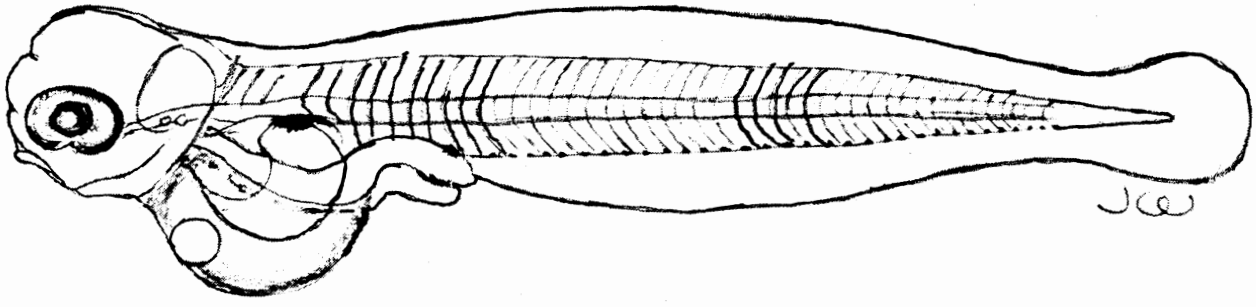


Figure 30-10. Prolarva, 3.6 mm TL.

Clinidae: Neoclinus uninotatus, onespot fringehead.

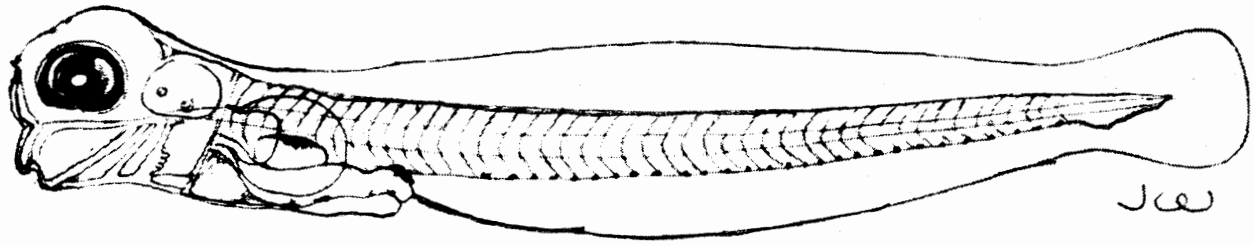


Figure 30-11. Postlarva, 6 mm TL.

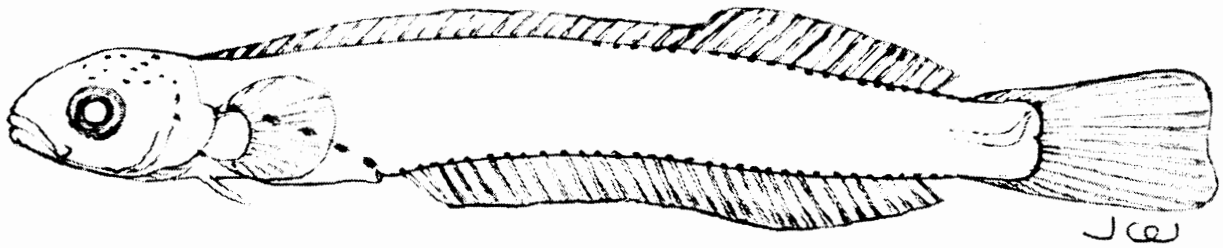


Figure 30-12. Juvenile, 24.8 mm TL.

Clinidae: Neoclinus uninotatus, onespot fringehead.

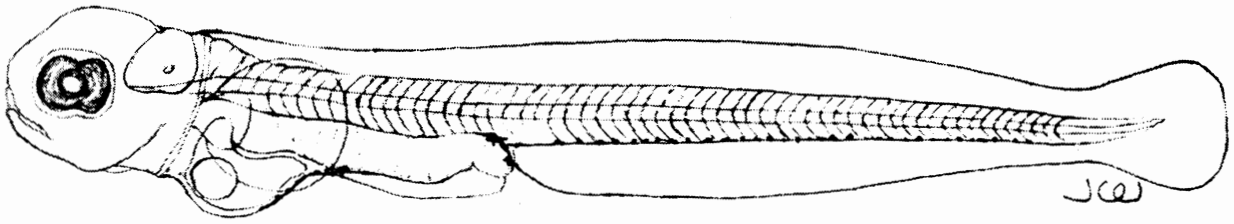


Figure 31-1. Prolarva, 7 mm TL.

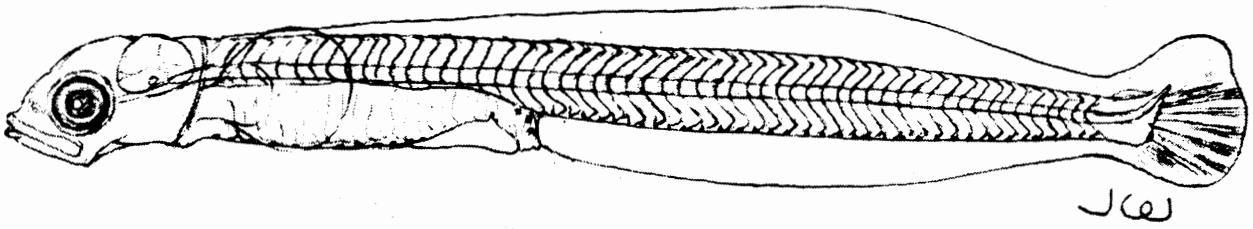


Figure 31-2. Postlarva, 12.1 mm TL.

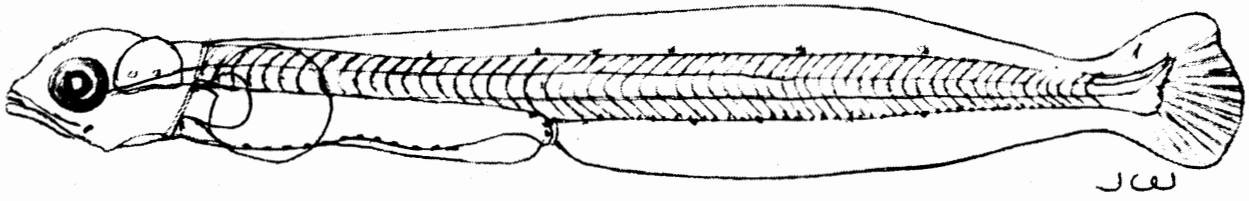


Figure 31-3. Postlarva, 12.3 mm TL.

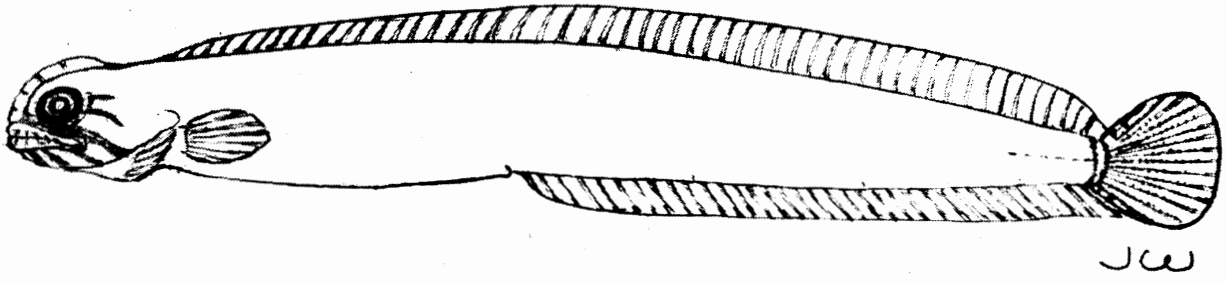


Figure 31-4. Juvenile, 58 mm TL.

Stichaeidae: Anoplarchus purpurescens, high cockcomb.

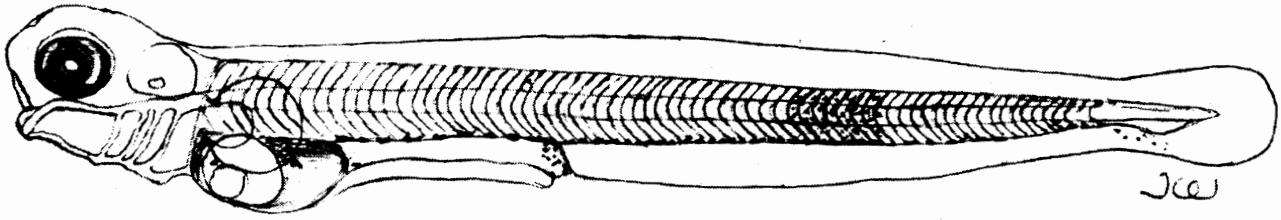


Figure 31-5. Prolarva, 8.1 mm TL.

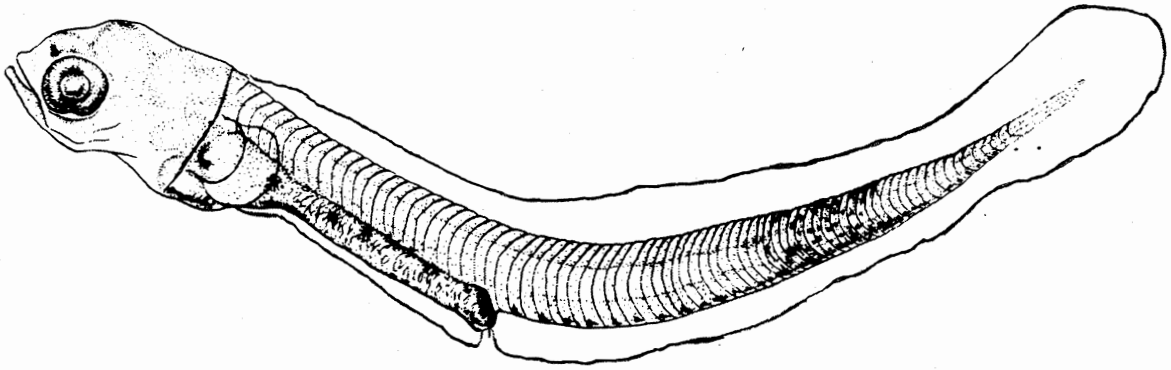


Figure 31-6. Postlarva, 6.9 mm TL.

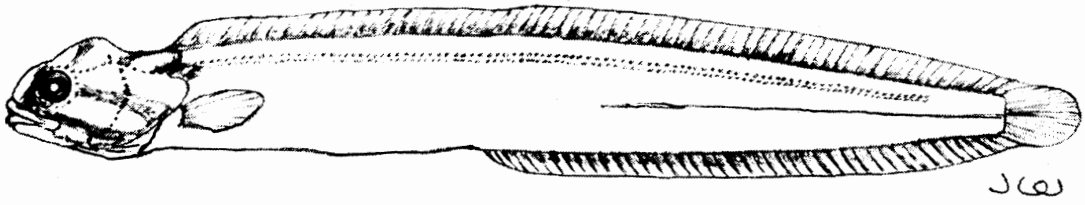


Figure 31-7. Juvenile, 126 mm TL.

Stichaeidae: Cebidichthys violaceus, monkeyface prickleback.

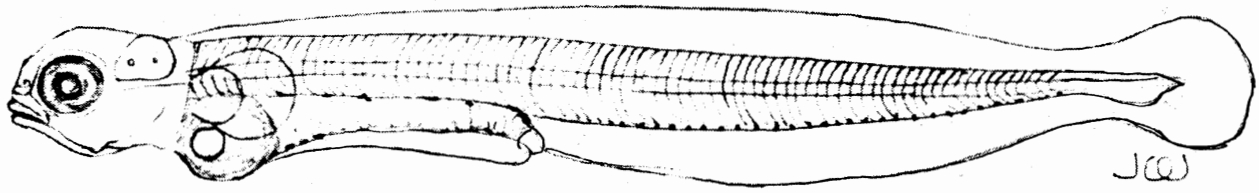


Figure 31-8. Prolarva, 10.6 mm TL.

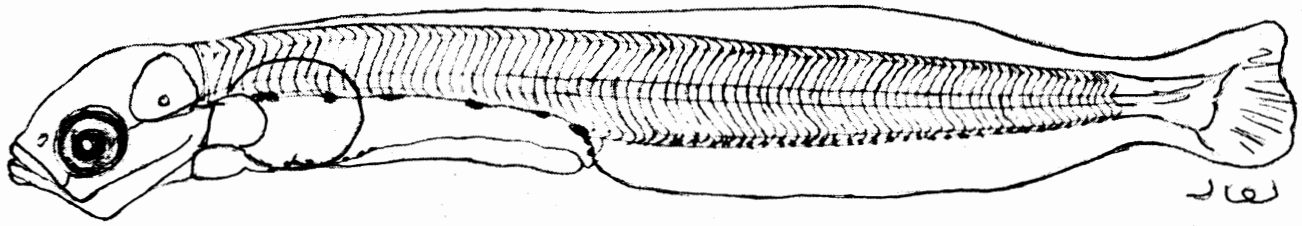


Figure 31-9. Postlarva, 13.2 mm TL.

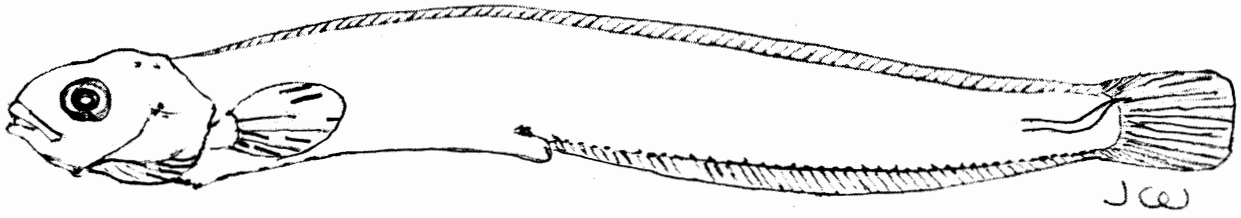


Figure 31-10. Juvenile, 19.8 mm TL.

Stichaeidae: Xiphister mucosus, rock prickleback.

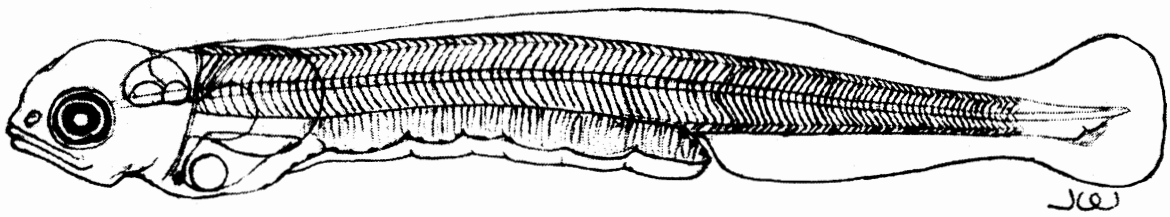


Figure 32-1. Prolarva, 12.3 mm TL.

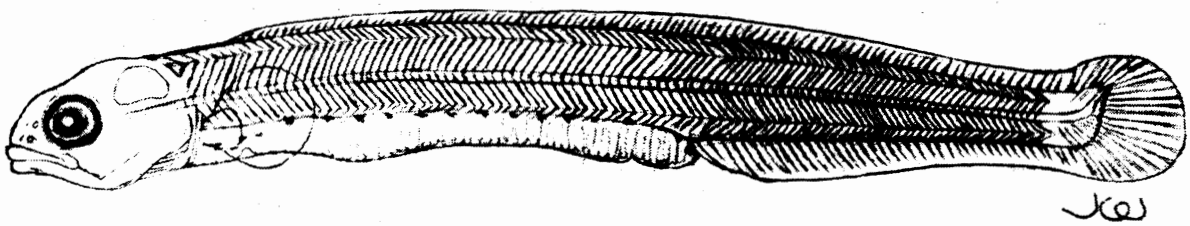


Figure 32-2. Postlarva, 24.4 mm TL.

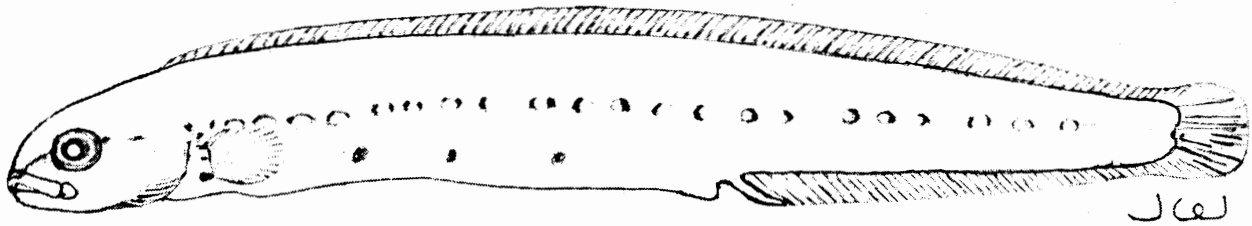


Figure 32-3. Juvenile, 46 mm TL.

Pholidae: Apodichthys flavidus, penpoint gunnel.

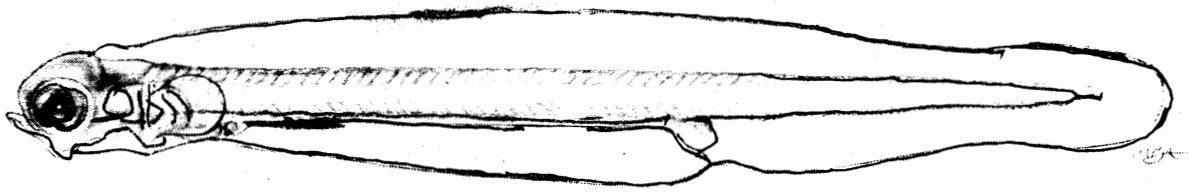


Figure 33-1. Prolarva, 5.3 mm TL.

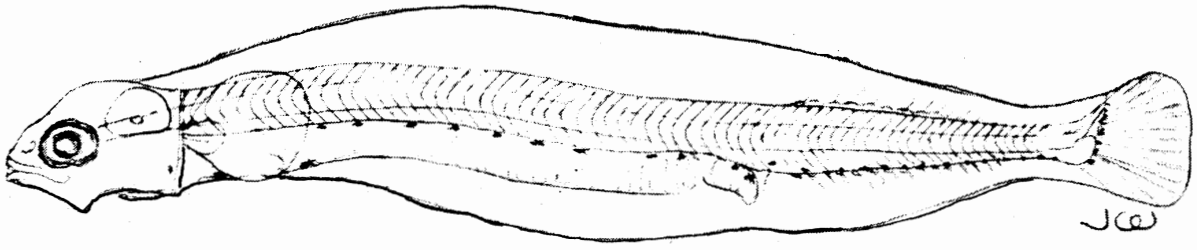


Figure 33-2. Postlarva, 12.1 mm TL.

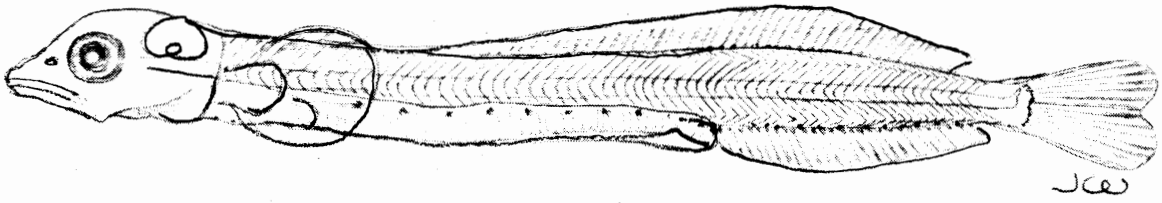


Figure 33-3. Postlarva, 19.4 mmTL.

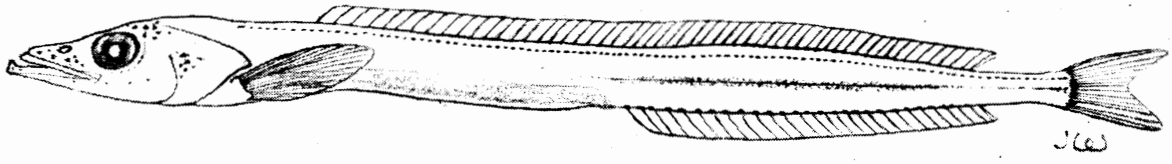


Figure 33-4. Juvenile, 50 mm TL.

Ammodytidae: Ammodytes hexapterus, Pacific sandlance.

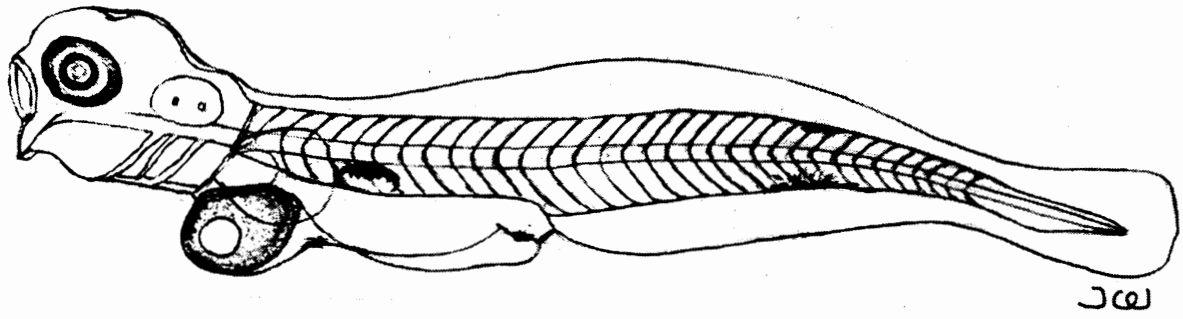


Figure 34-1. Prolarva, 5.5 mm TL.

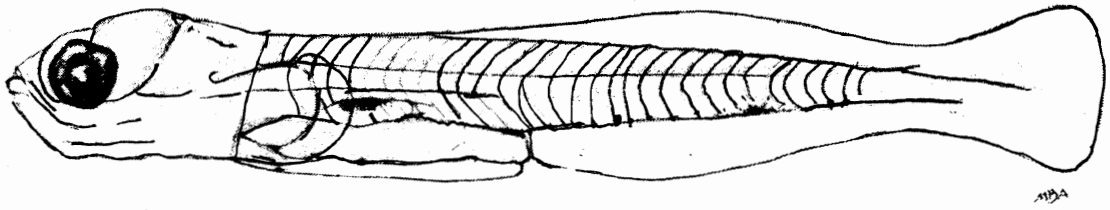


Figure 34-2. Postlarva, 6.8 mm TL.

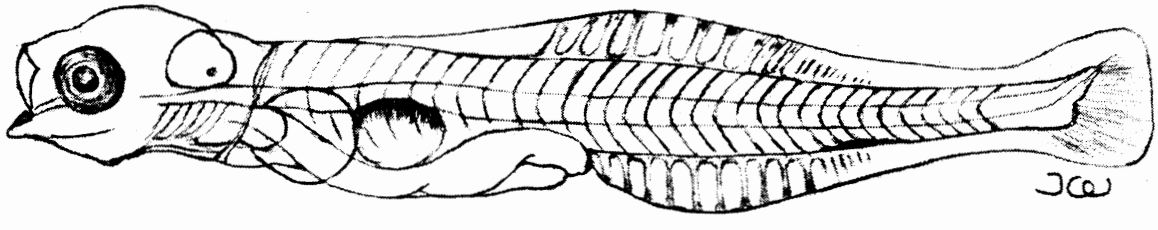


Figure 34-3. Postlarva, 8 mm TL.

Gobiidae: Acanthogobius flavimanus, yellowfin goby.

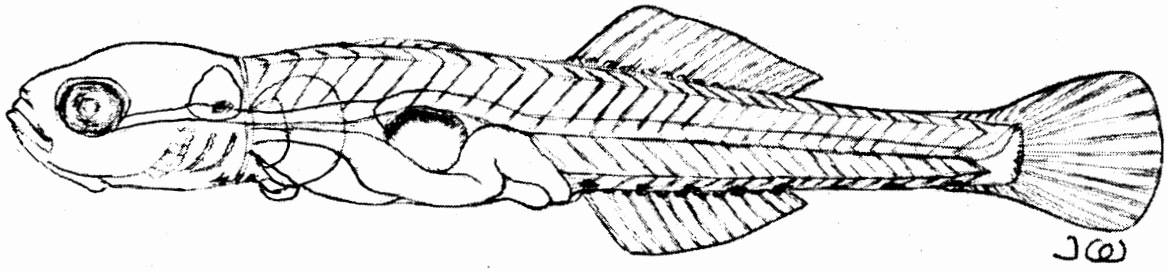


Figure 34-4. Postlarva, 23.2 mm TL.

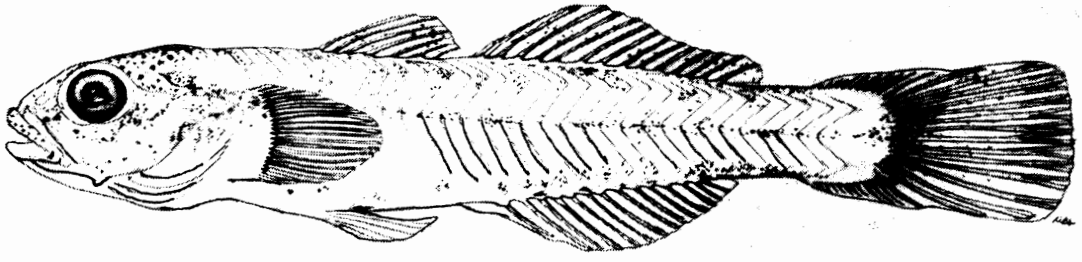


Figure 34-5. Juvenile, 22.3 mm TL.

Gobiidae: Acanthogobius flavimanus, yellowfin goby.

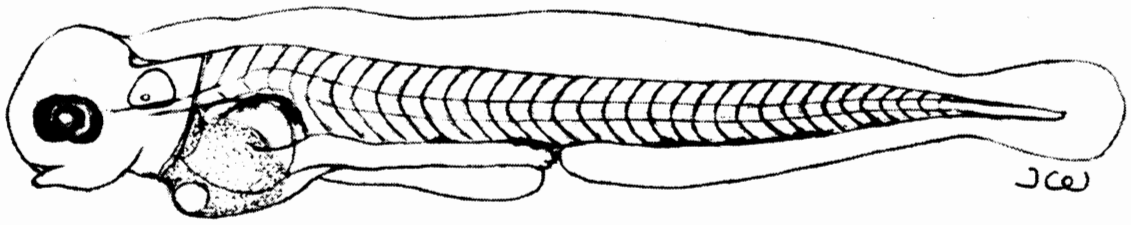


Figure 34-6. Prolarva, 3.1 mm TL.

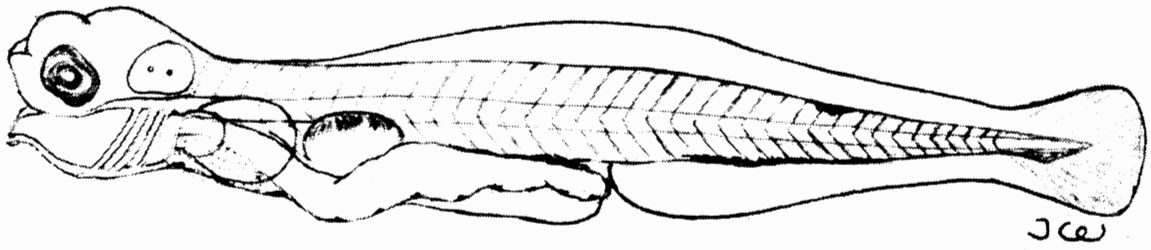


Figure 34-7. Postlarva, 4.8 mm TL.

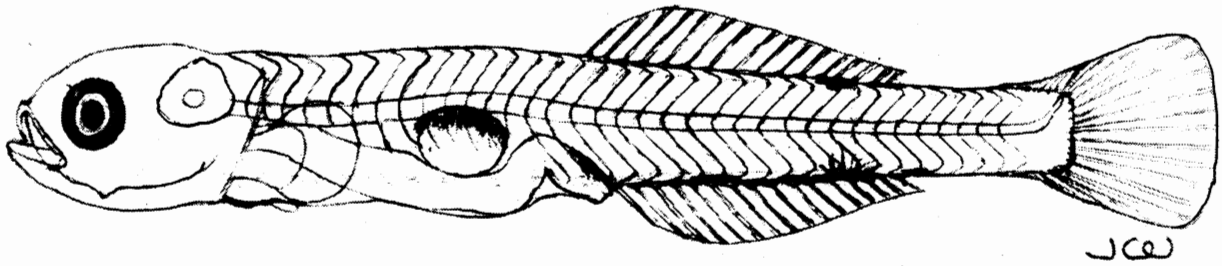


Figure 34-8. Postlarva, 11.5 mm TL.

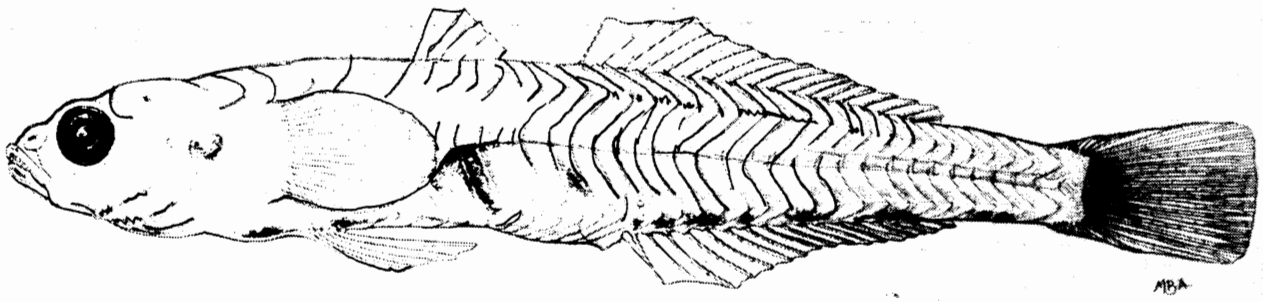


Figure 34-9. Juvenile, 21.5 mm TL.

Gobiidae: Clevelandia ios, arrow goby.

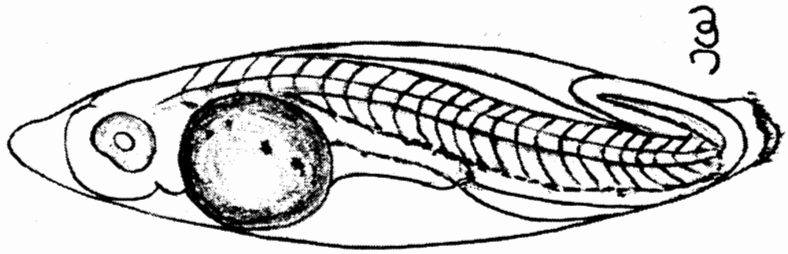


Figure 34-10. Egg, late embryo, 2.2 mm diameter long axis, 1.2 mm short axis.

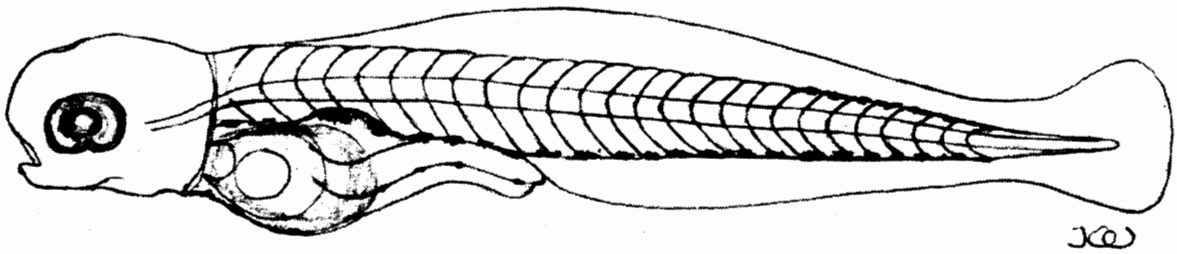


Figure 34-11. Prolarva, 2.2 mm TL.

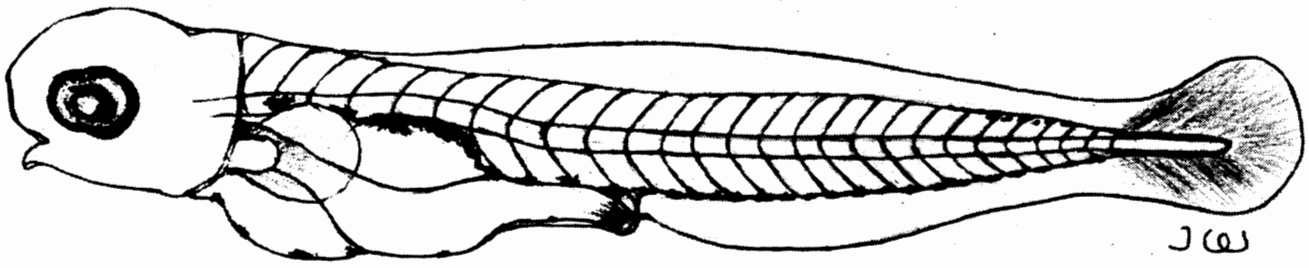


Figure 34-12. Postlarva, 3.4 mm TL.

Gobiidae: Coryphopterus nicholsi, blackeye goby.

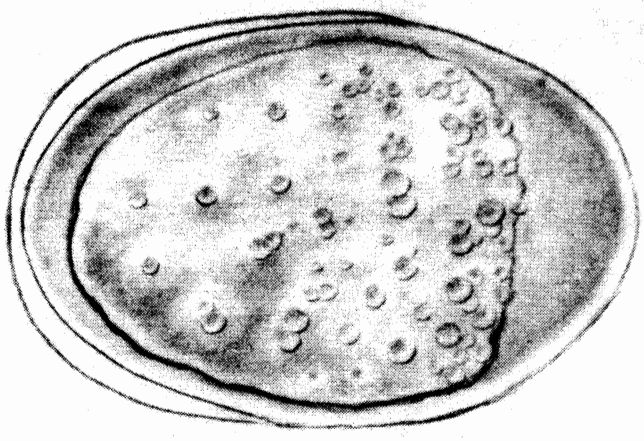


Figure 34-13. Unfertilized egg. 1.8 mm diameter long axis. 0.8 mm short axis.

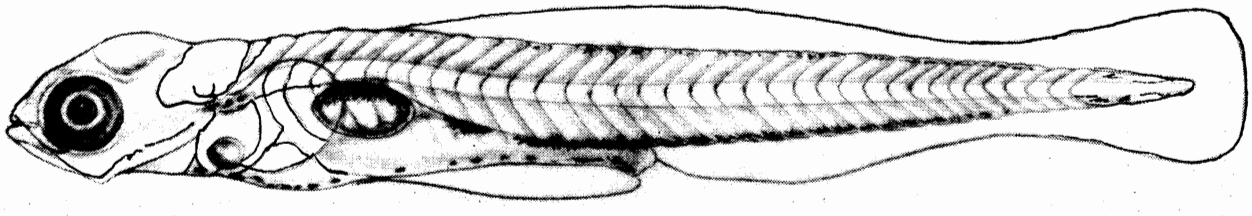


Figure 34-14. Prolarva, 5.1 mm TL.

Gobiidae: Eucyclogobius newberryi, tidewater goby.

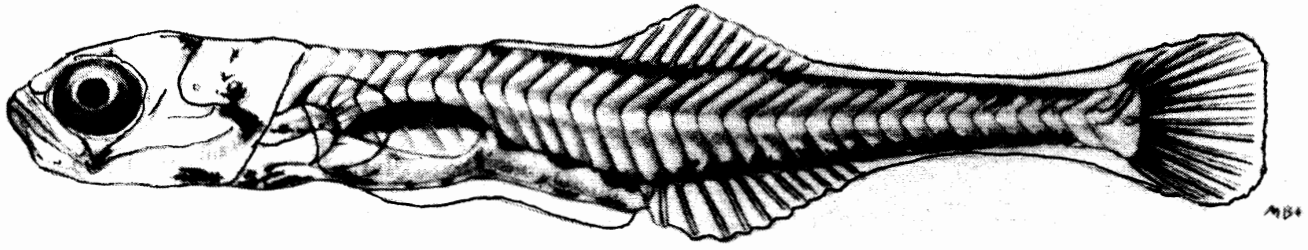


Figure 34-15. Postlarva, 8.6 mm TL.

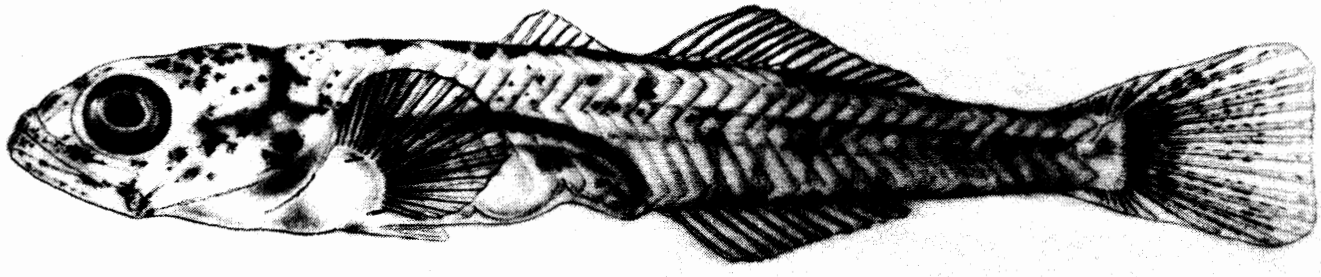


Figure 34-16. Juvenile, 15 mm TL.

Gobiidae: Eucyclogobius newberryi, tidewater goby.

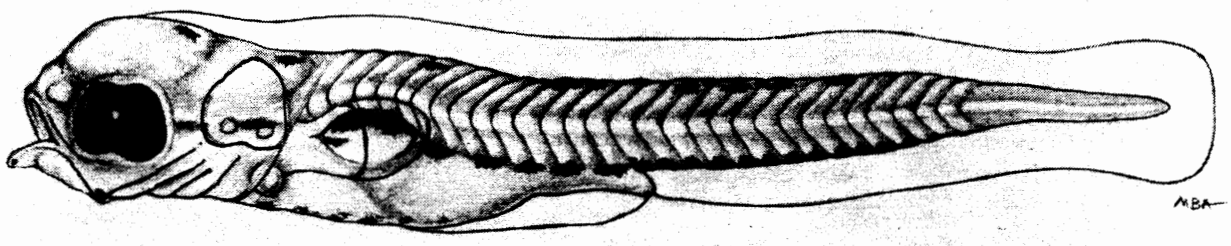


Figure 34-17. Postlarva, 3.5 mm TL.

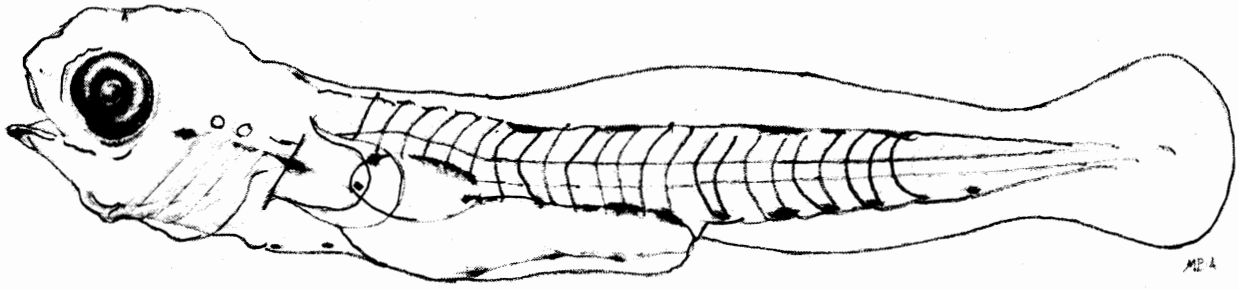


Figure 34-18. Postlarva, 4.5 mm TL.

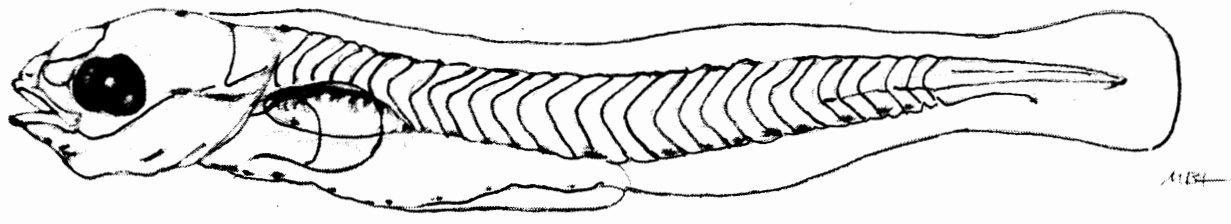


Figure 34-19. Postlarva, 5.2 mm TL.

Gobiidae: Gillichthys mirabilis, longjaw mudsucker.

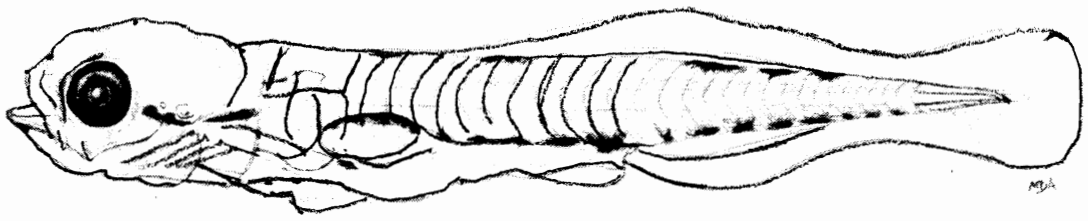


Figure 34-20. Postlarva, 6.2 mm TL.

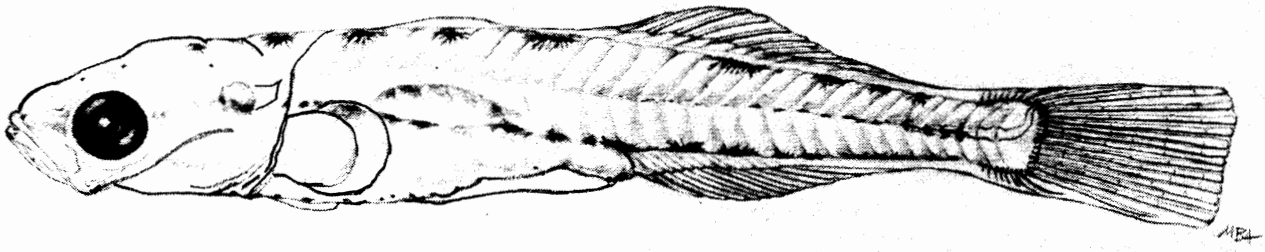


Figure 34-21. Postlarva, 10.5 mm TL.

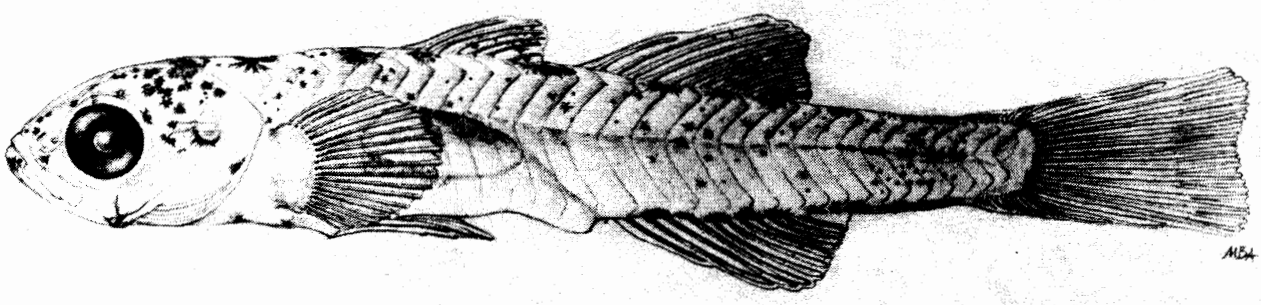


Figure 34-22. Juvenile, 15 mm TL.

Gobiidae: Gillichthys mirabilis, longjaw mudsucker.

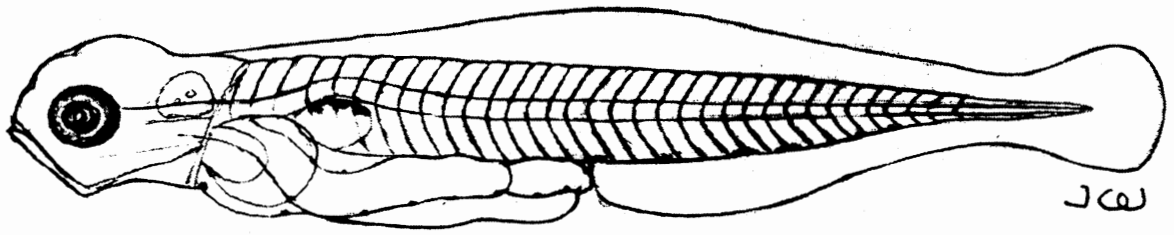


Figure 34-23. Postlarva, 4.9 mm TL.

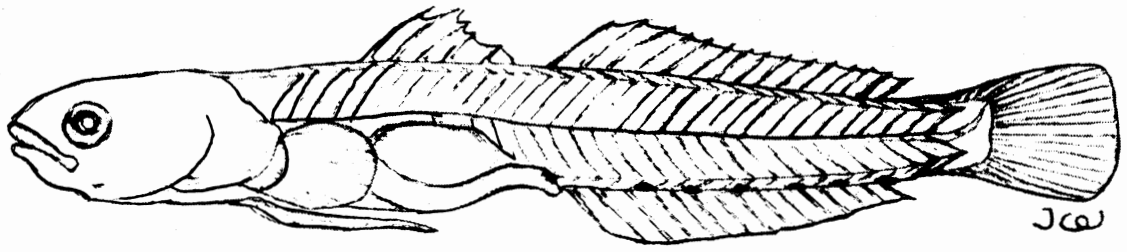


Figure 34-24. Juvenile, 14.8 mm TL.

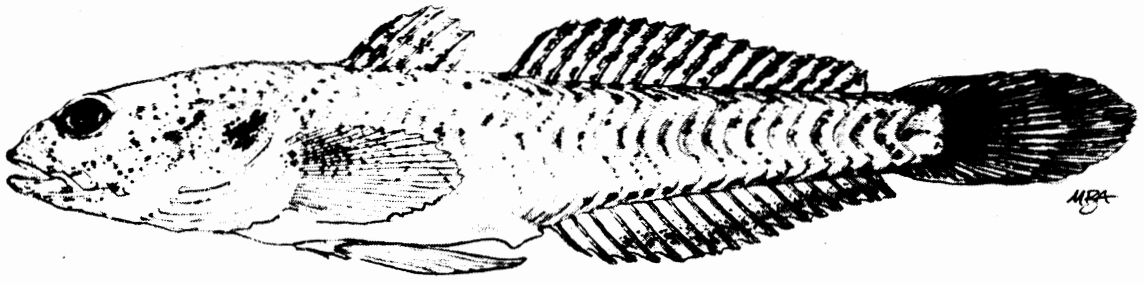


Figure 34-25. Juvenile, 32 mm TL.

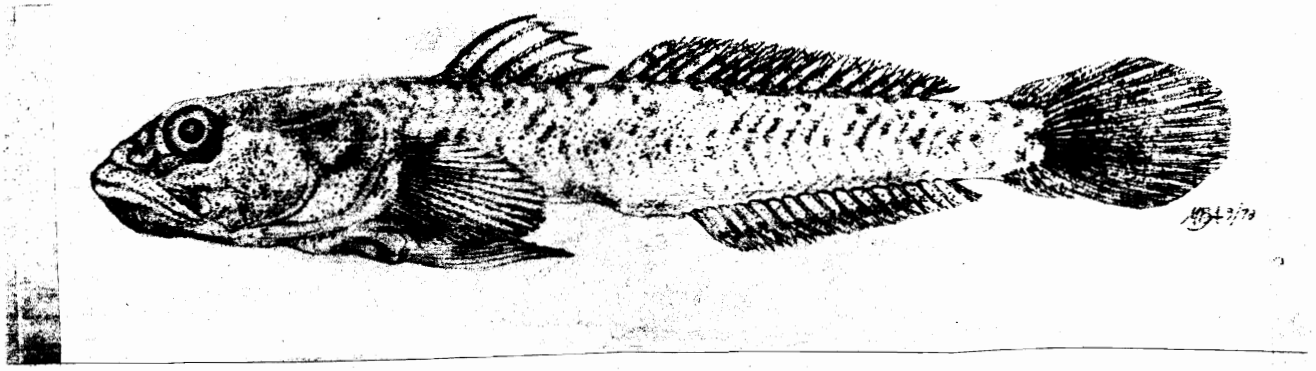


Figure 34-26. Juvenile, 45 mm TL.

Gobiidae: <u>Ilypnus</u> <u>gilberti</u>, cheekspot goby.

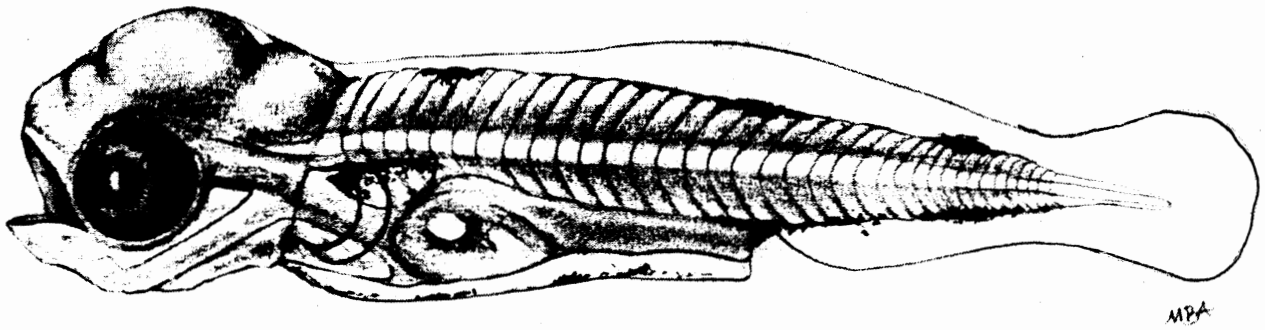


Figure 34-27. Prolarva, 3.2 mm TL.

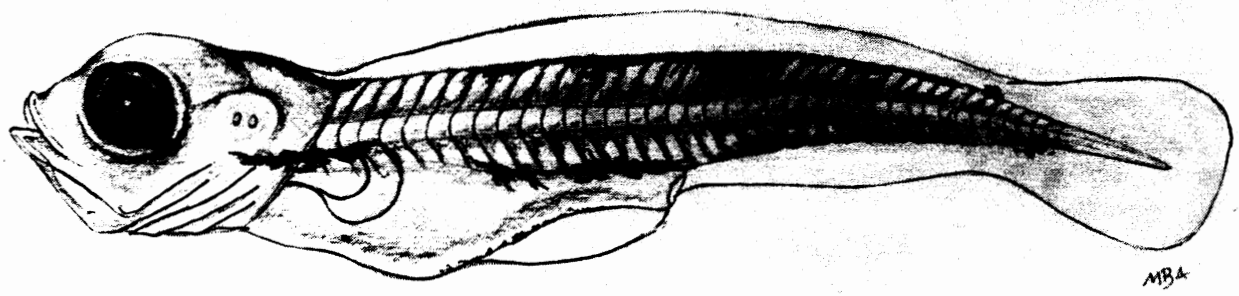


Figure 34-28. Prolarva, 3.6 mm TL.

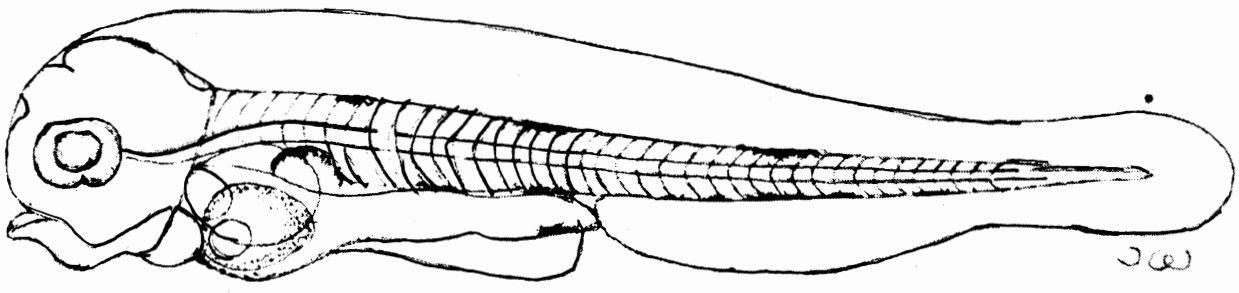


Figure 34-29. Prolarva, 3.7 mm TL.

Gobiidae: Lepidogobius lepidus, bay goby.

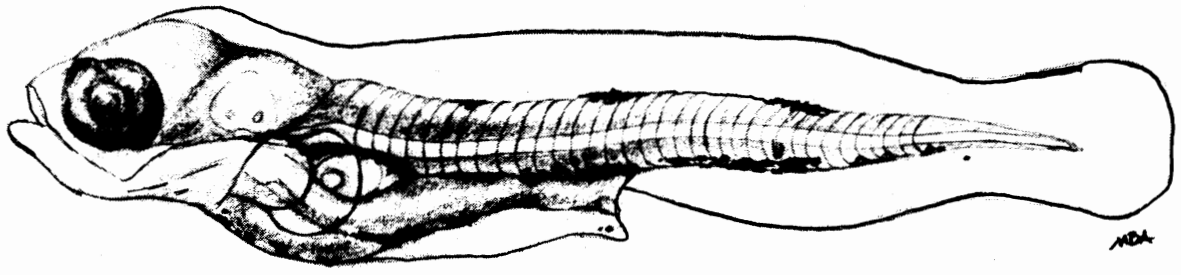


Figure 34-30. Prolarva, 3.7 mm TL.

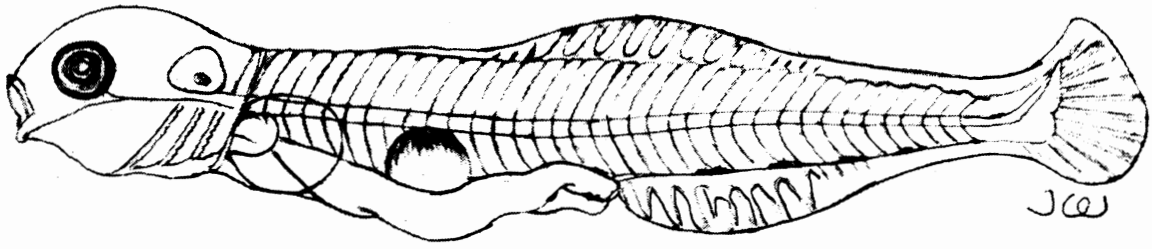


Figure 34-31. Postlarva, 6.9 mm TL.

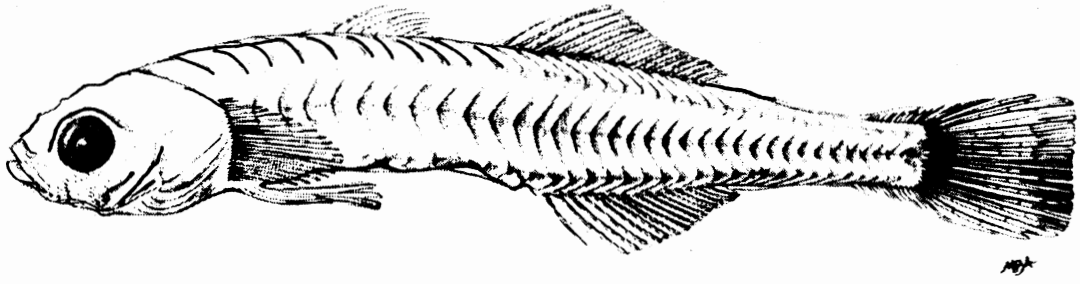


Figure 34-32. Juvenile, 28 mm TL.

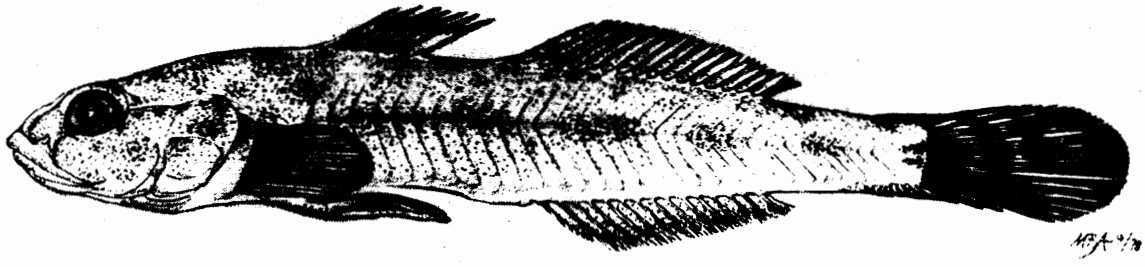


Figure 34-33. Juvenile, 57 mm TL.

Gobiidae: Lepidogobius lepidus, bay goby.

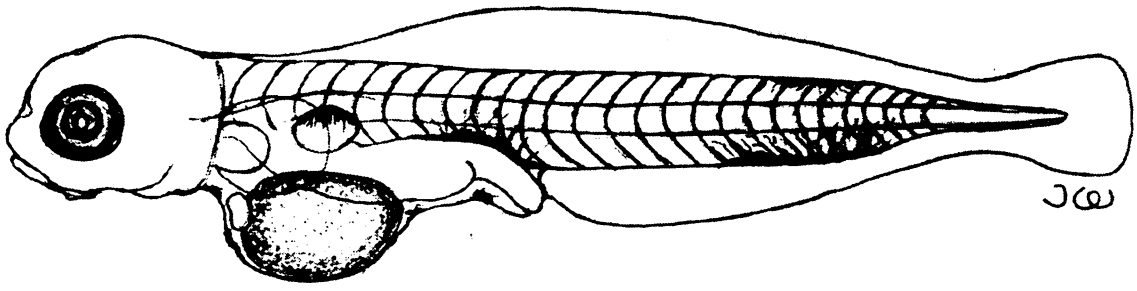


Figure 34-34. Prolarva, 2.5 mm TL.

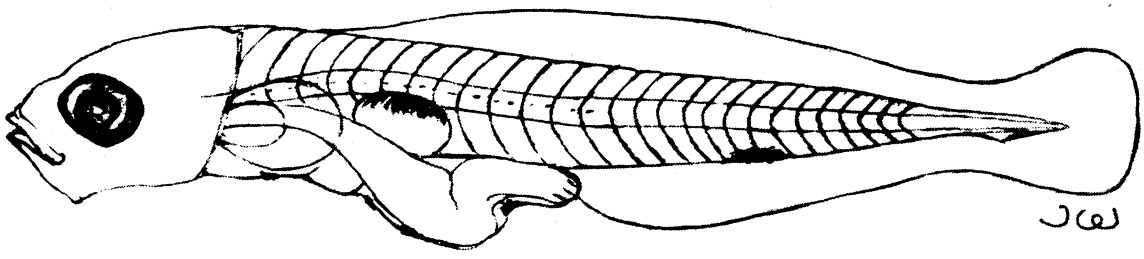


Figure 34-35. Postlarva, 4.2 mm TL.

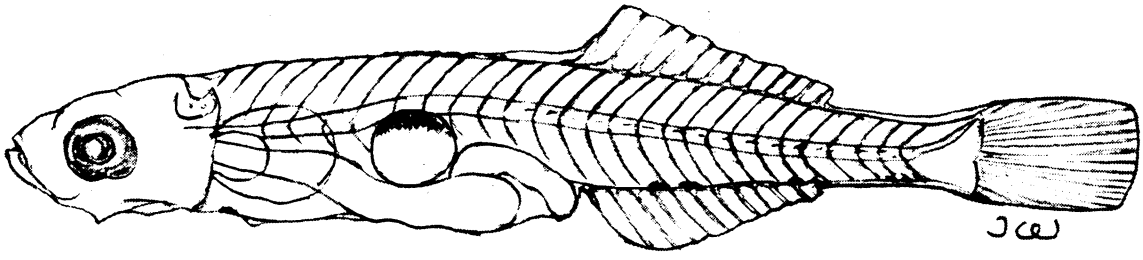


Figure 34-36. Postlarva, 6.8 mm TL.

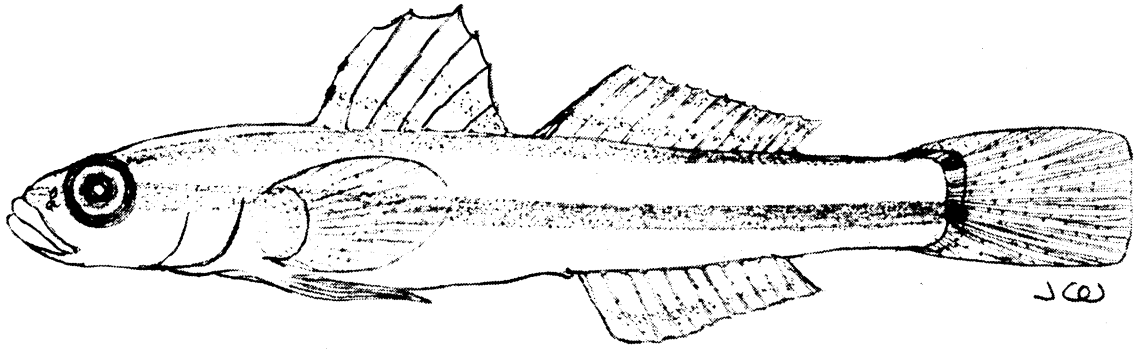


Figure 34-37. Juvenile, 23.2 mm TL.

Gobiidae: Tridentiger trigonocephalus, chameleon goby.

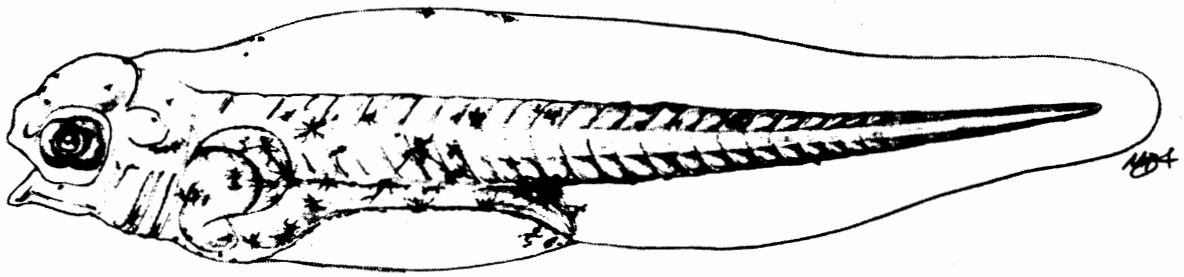


Figure 35-1. Prolarva, 2.5 mm TL.

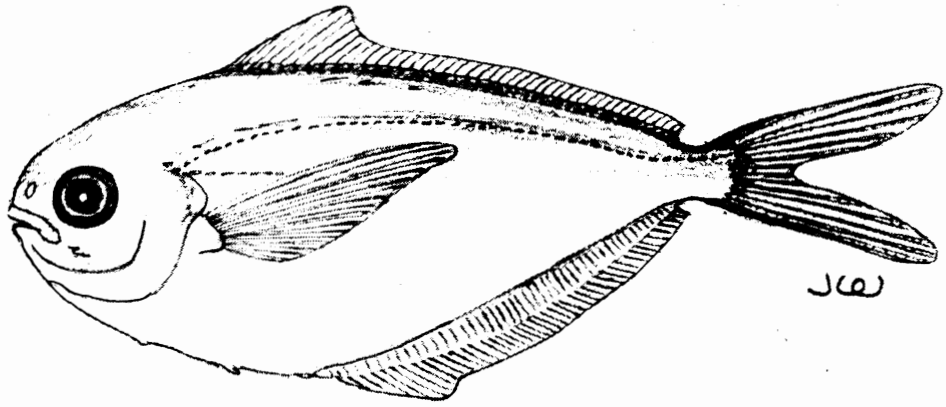


Figure 35-2. Juvenile, 107 mm TL.

Stromateidae: Peprilus simillimus, Pacific pompano.

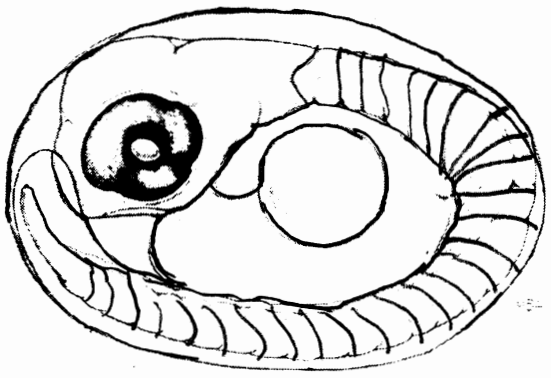


Figure 36-1. Late embyro dissected from adult, 1.8 mm diameter long axis, 1.1 mm short axis.

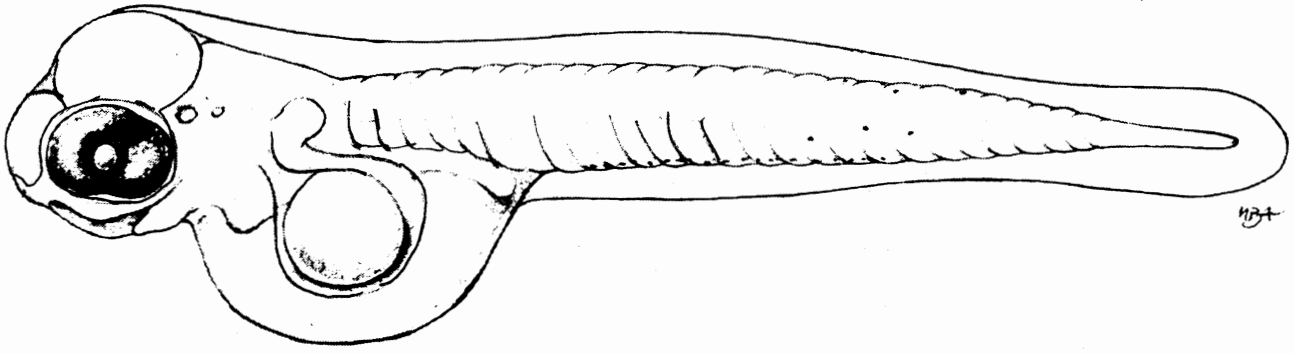


Figure 36-2 Prolarva dissected from adult, 4.5 mm TL.

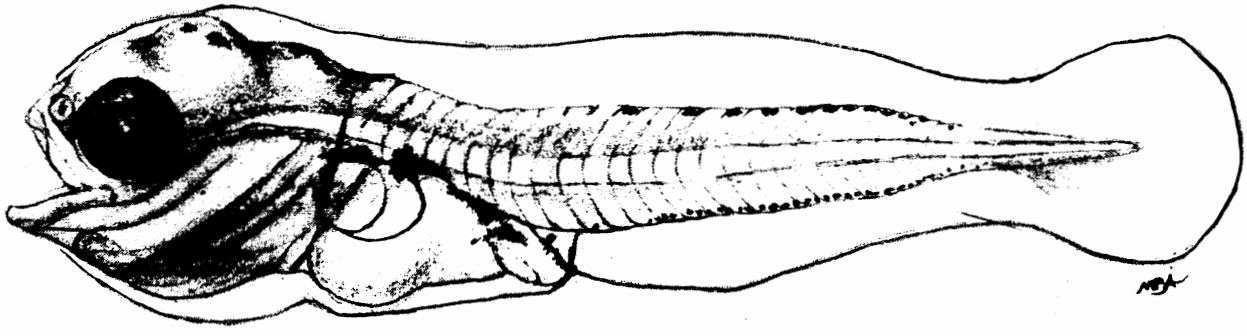


Figure 36-3. Postlarva, 5.3 mm TL.

Scorpaenidae: Sebastes auriculatus, brown rockfish.

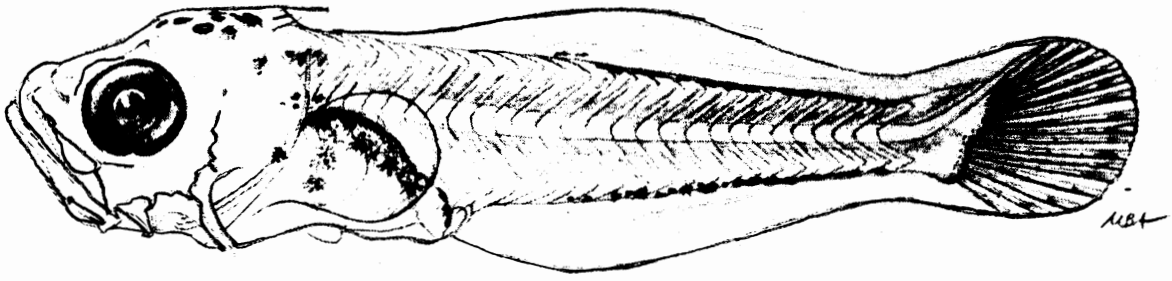


Figure 36-4. Postlarva, 10.1 mm TL.

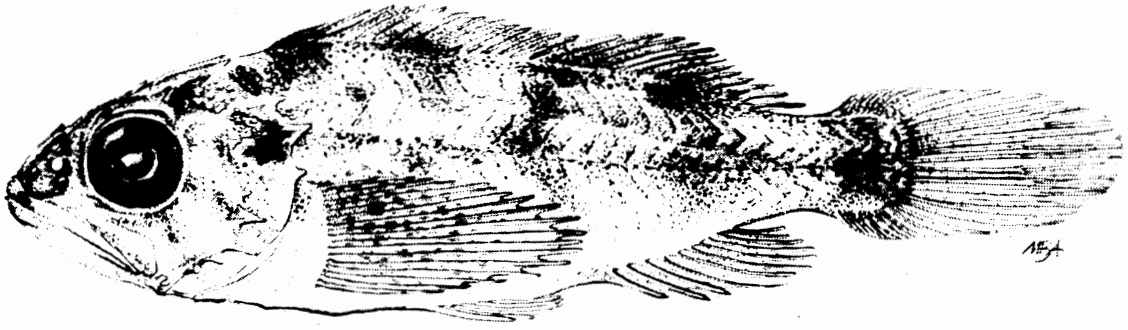


Figure 36-5. Juvenile, 36.8 mm TL.

Scorpaenidae: Sebastes auriculatus, brown rockfish.

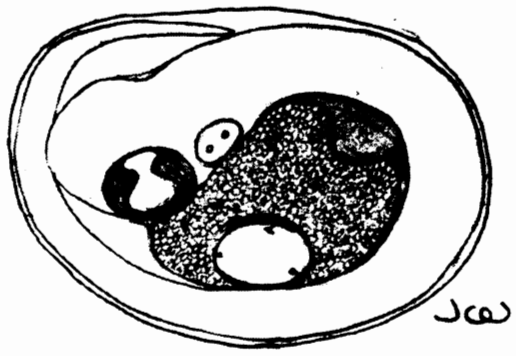


Figure 36-6. Late embryo dissected from adult, 1.7 mm long axis, 1.2 mm short axis diameter.

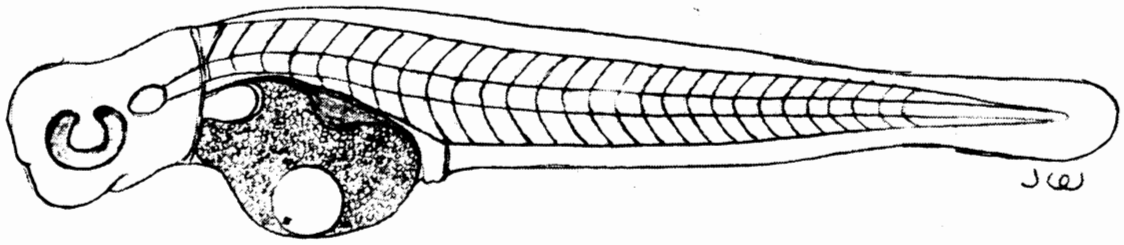


Figure 36-7. Prolarva dissected from adult, 3.4 mm TL.

Scorpaenidae: Sebastes chlorostictus, greenspotted rockfish.

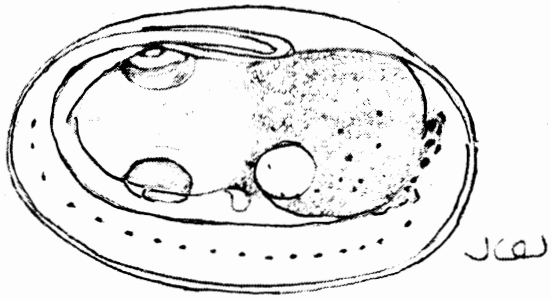


Figure 36-8. Late embryo dissected from adult, 1.6 mm long axis, 0.9 mm short axis diameter.

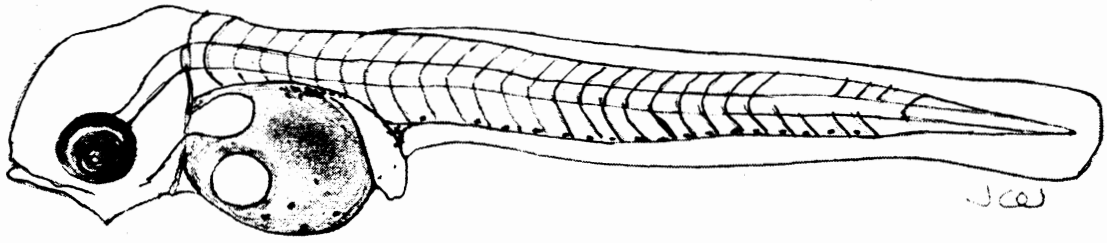


Figure 36-9. Prolarva dissected from adult, 4.0 mm TL.

Scorpaenidae: Sebastes elongatus, greenstriped rockfish.

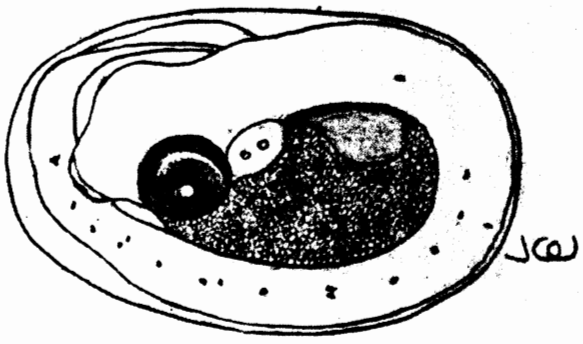


Figure 36-10. Late embryo dissected from adult, 1.5 mm long axis, 1.1 mm short axis diameter.

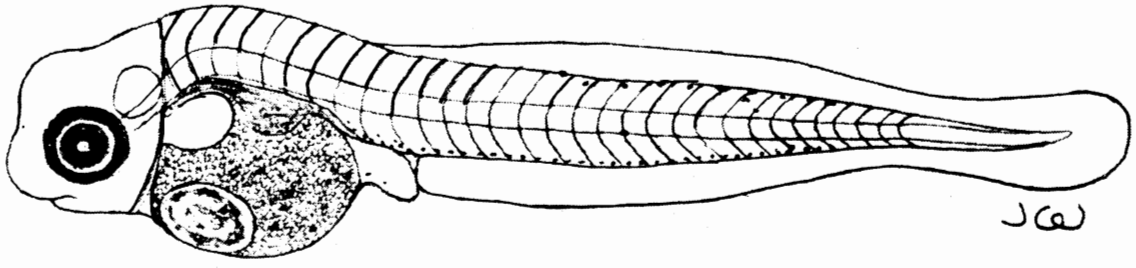


Figure 36-11. Prolarva dissected from adult, 4.1 mm TL.

Scorpaenidae: Sebastes maliger, quillback rockfish.

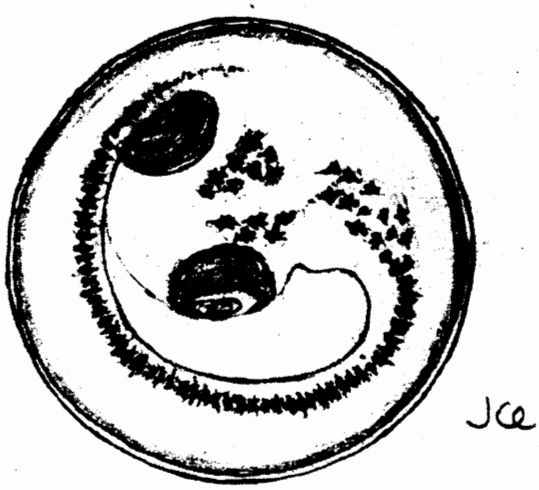


Figure 37-1. Egg, late embryo, 2.3 mm diameter.

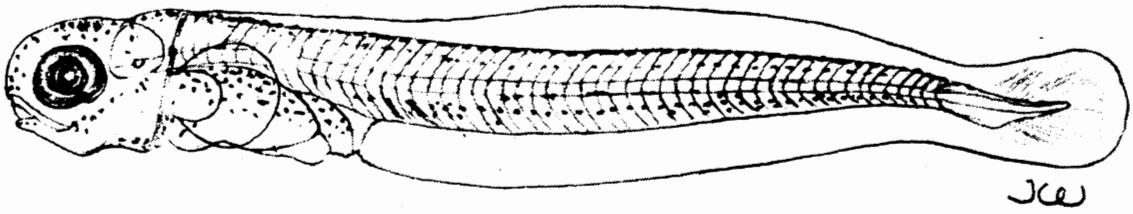


Figure 37-2. Postlarva, 11 mm TL.

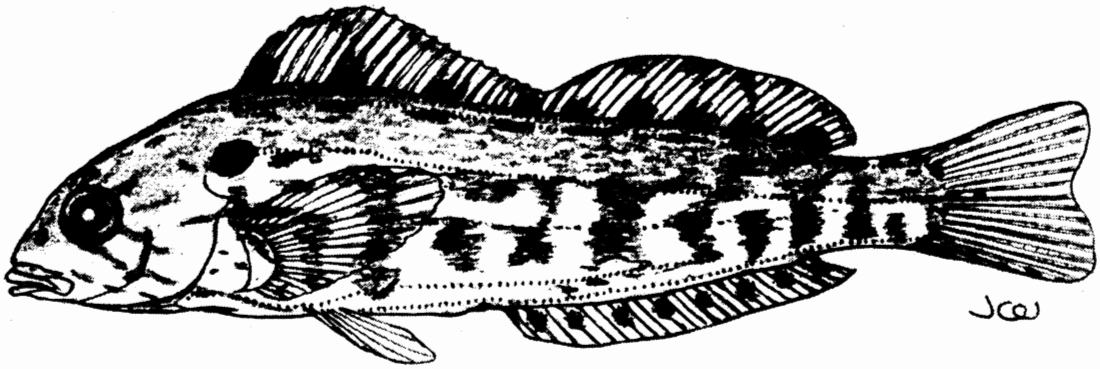


Figure 37-3. Juvenile, 71.5 mm TL.

Hexagrammidae: Hexagrammos decagrammus, kelp greenling.

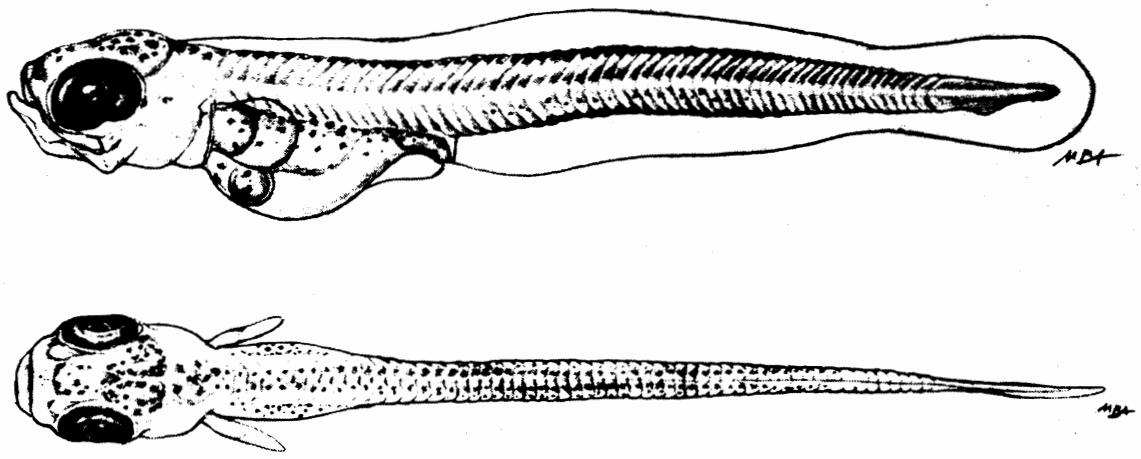


Figure 37-4, 37-5. Postlarva, lateral and dorsal views, 9 mm TL.

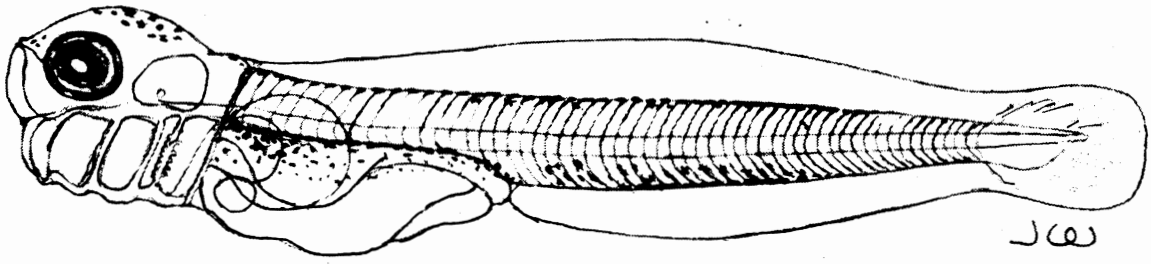


Figure 37-6. Postlarva, 10 mm TL.

Hexagrammidae: Ophiodon elongatus, lingcod.

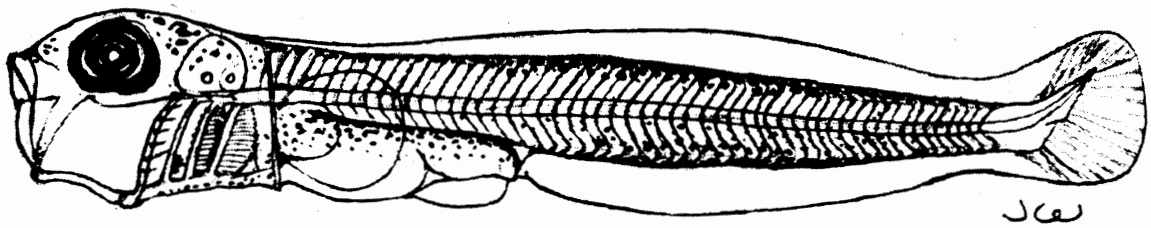


Figure 37-7. Postlarva, 14.9 mm TL.

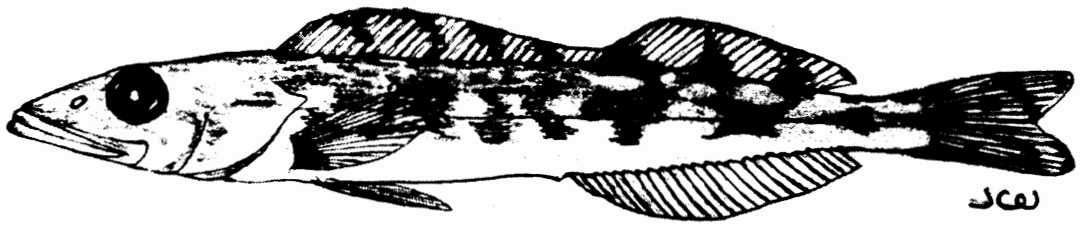


Figure 37-8. Juvenile, 97 mm TL.

Hexagrammidae: Ophiodon elongatus, lingcod.

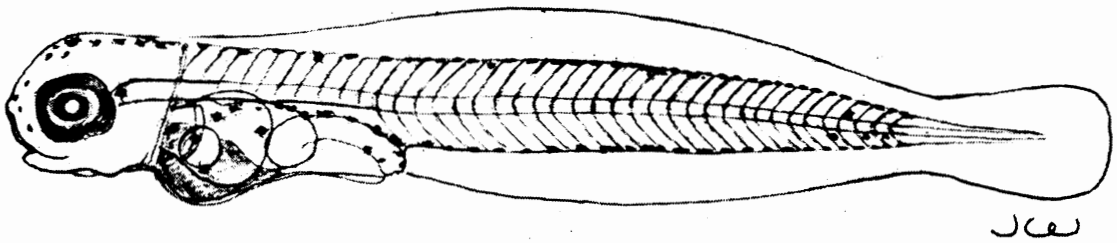


Figure 37-9. Prolarva, 6.2 mm TL.

Figure 37-10. Juvenile, 85 mm TL.

Hexagrammidae: Oxylebius pictus, painted greenling.

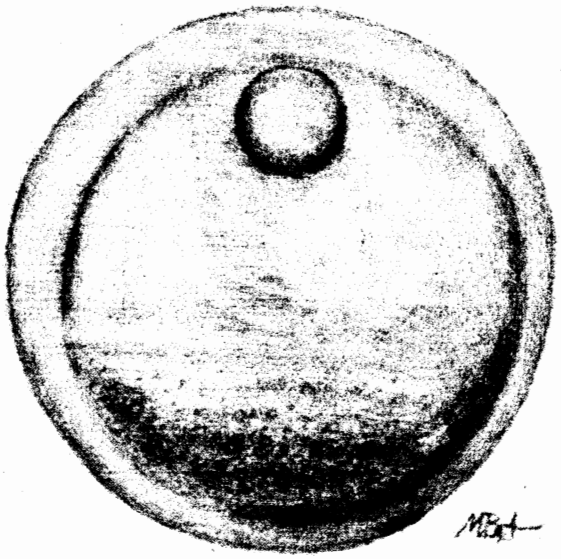


Figure 38-1. Newly fertilized egg, 1.4 mm diameter.

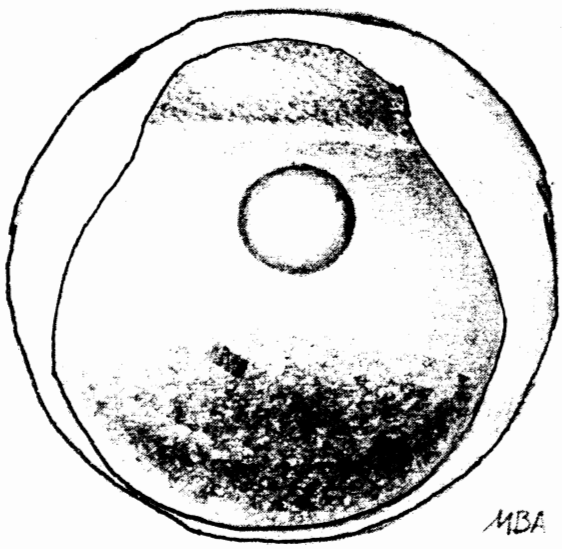


Figure 38-2. Egg, morula, 1.4 mm diameter.

Cottidae: Cottus asper, prickly sculpin.

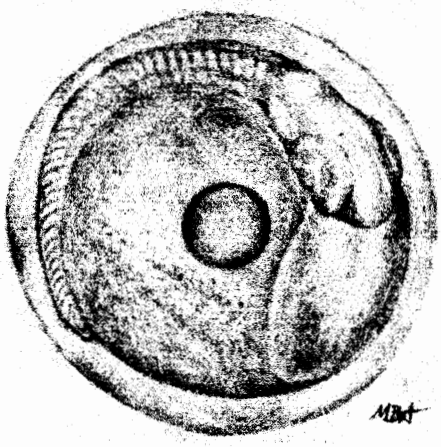


Figure 38-3. Egg, early embryo, 1.5 mm diameter.

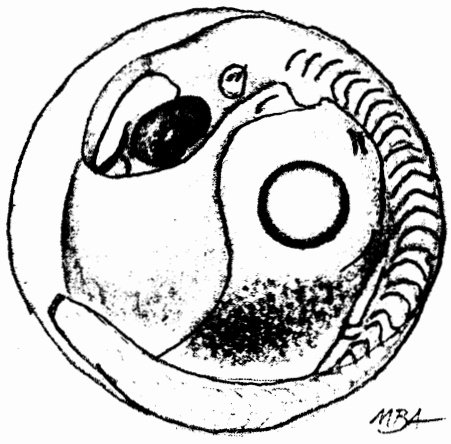


Figure 38-4. Egg, late embryo, 1.5 mm diameter.

Cottidae: Cottus asper, prickly sculpin.

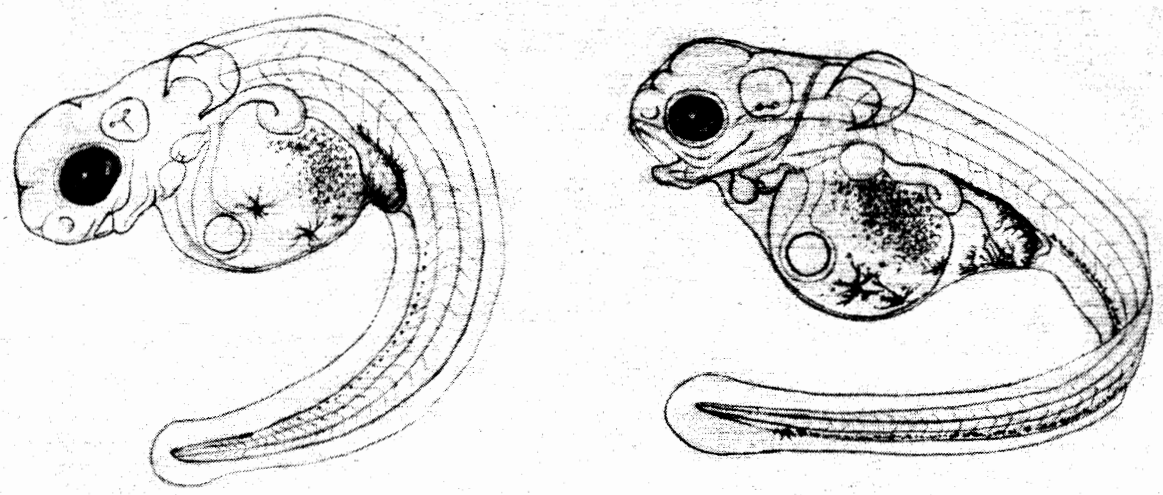


Figure 38-5, 38- 6. Newly hatched prolarva, 4.5 mm TL.

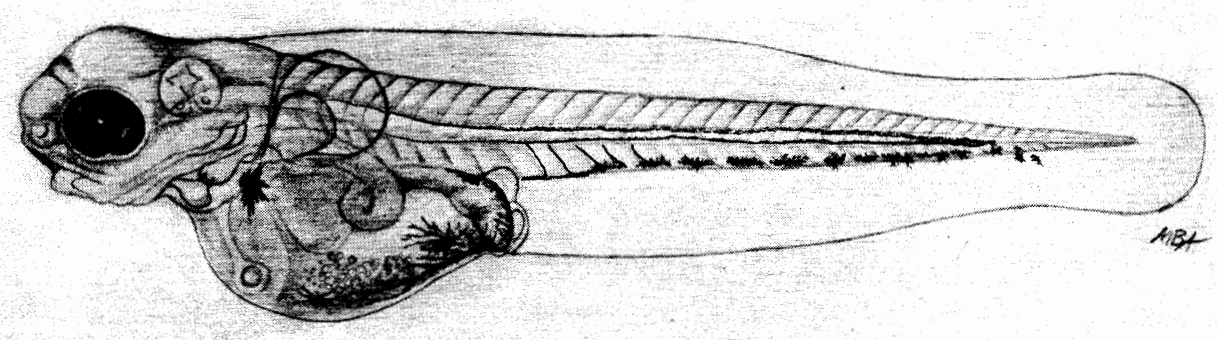


Figure 38-7. Prolarva, 5.5 mm TL.

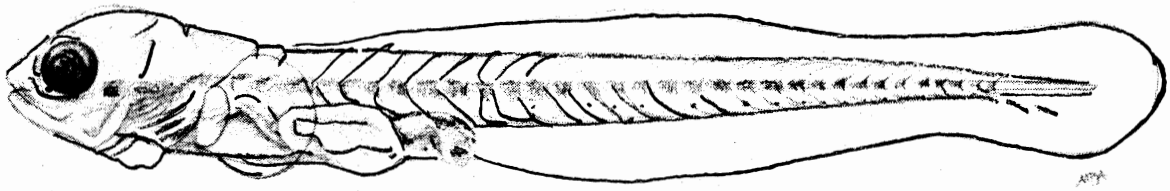


Figure 38-8. Postlarva, 6 mm TL.

Cottidae: Cottus asper, prickly sculpin.

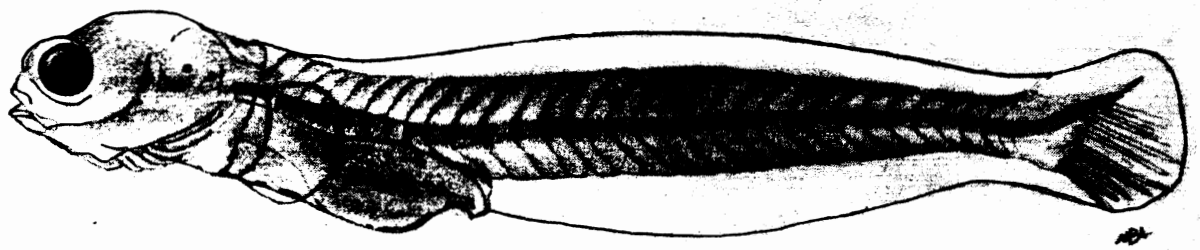


Figure 38-9. Postlarva, 7.4 mm TL.

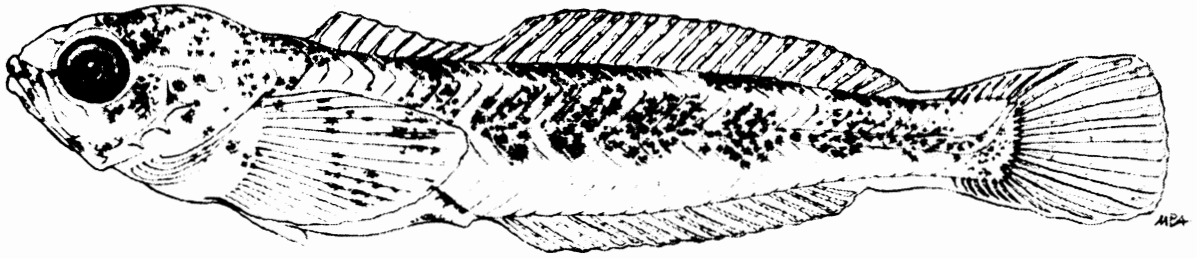


Figure 38-10. Juvenile, 11.4 mm TL.

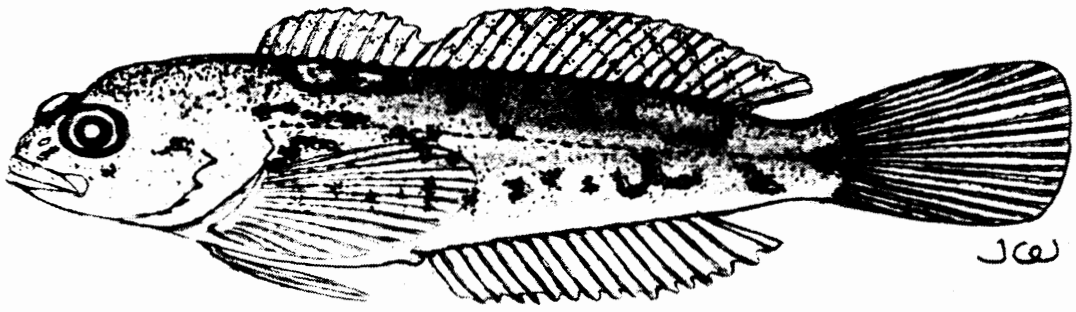


Figure 38-11. Juvenile, 34.5 mm TL.

Cottidae: Cottus asper, prickly sculpin.

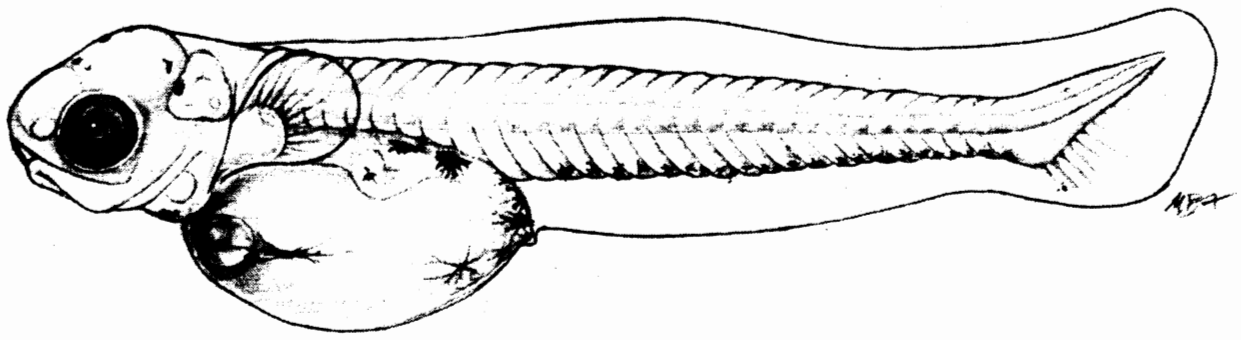


Figure 38-12. Prolarva, 6.5 mm TL.

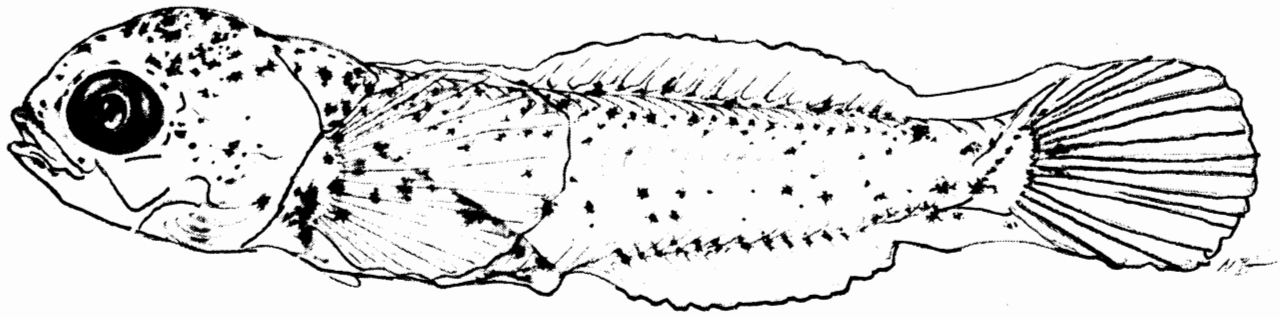


Figure 38-13. Postlarva, 7.2 mm TL.

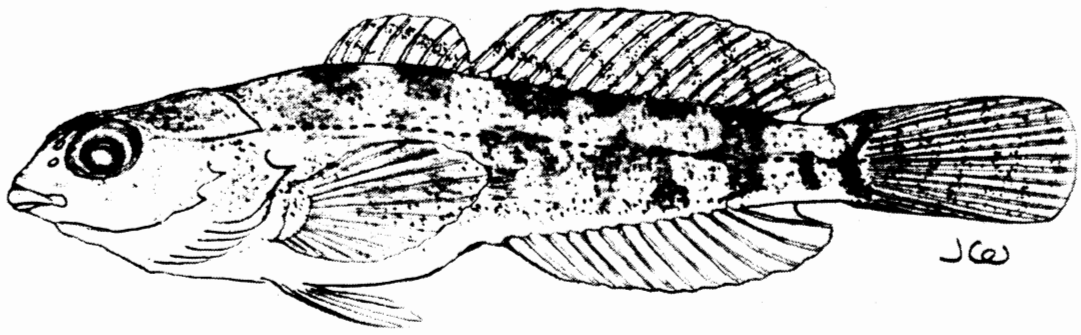


Figure 38-14. Juvenile, 22.7 mm TL.

Cottidae: Cottus gulosus, riffle sculpin.

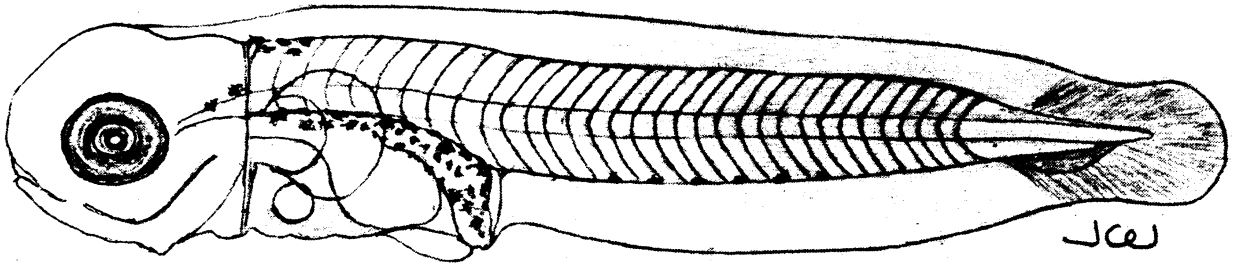


Figure 38-15. Enophrys bison, buffalo sculpin, prolarva, 4.6 mm TL.

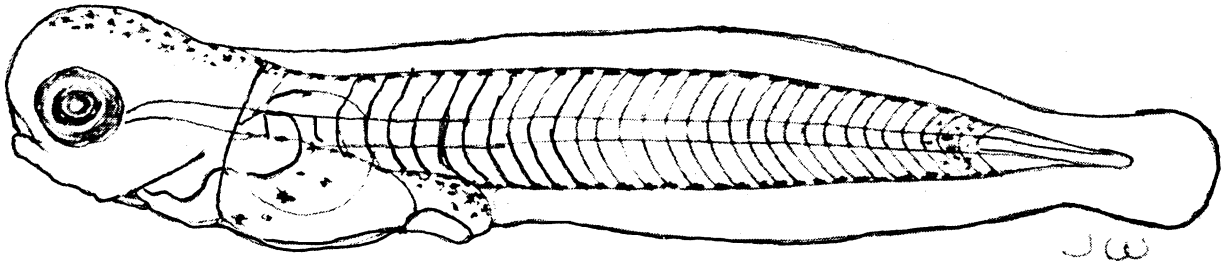


Figure 38-16. Hemilepidotus spinosus, brown Irish lord postlarva, 5.1 mm TL.

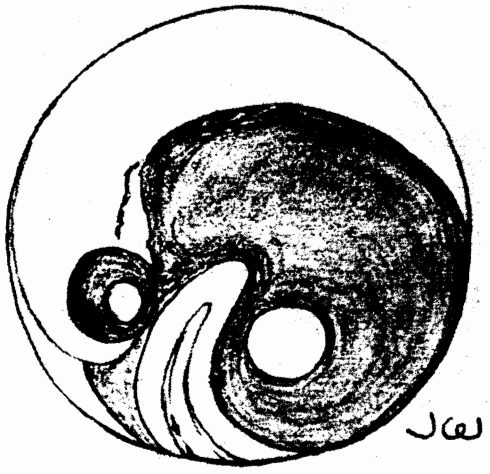


Figure 38-17. Egg, late embryo, 1.4 mm diameter.

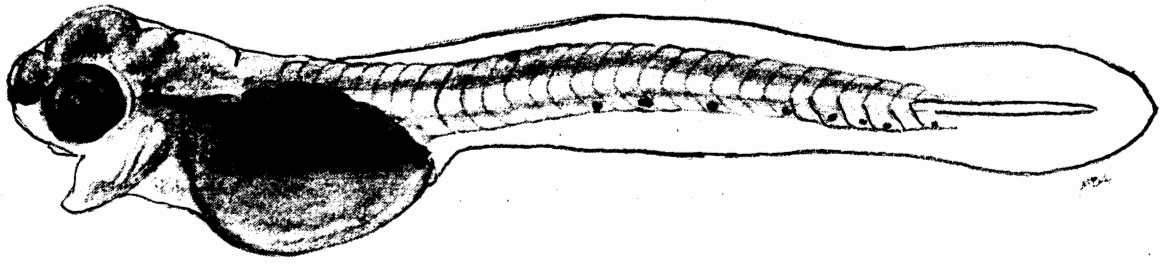


Figure 38-18. Prolarva, 5 mm TL.

Cottidae: Leptocottus armatus, Pacific staghorn sculpin.

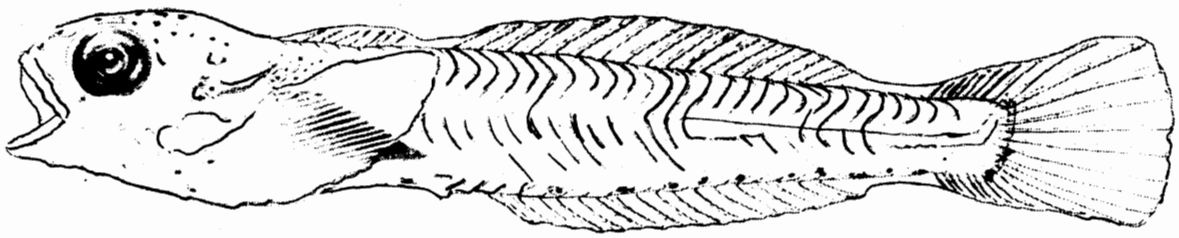


Figure 38-19. Postlarva, 12 mm TL.

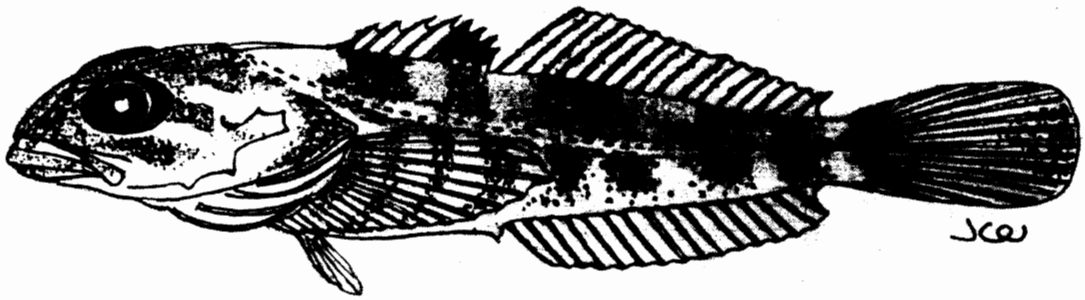


Figure 38-20. Juvenile, 43 mm TL.

Cottidae: Leptocottus armatus, Pacific staghorn sculpin.

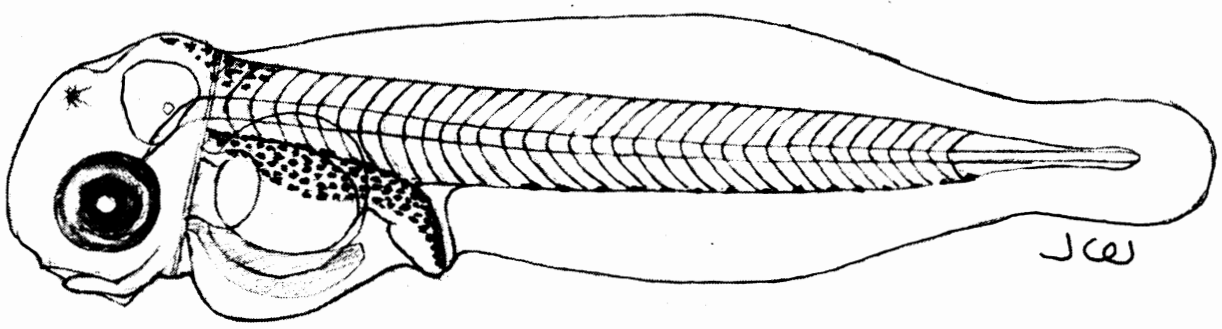


Figure 38-21. Prolarva, 4.1 mm TL.

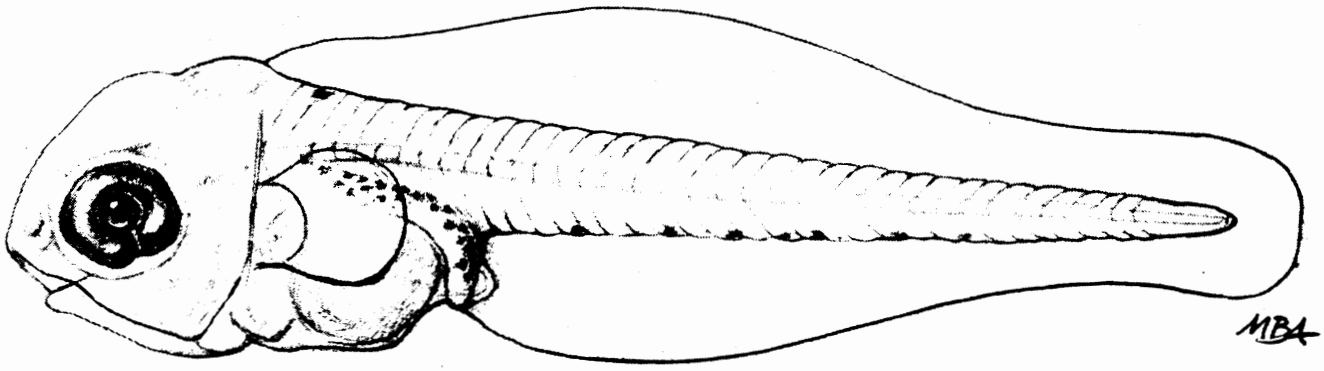


Figure 38-22. Prolarva, 4.5 mm TL.

Cottidae: Oligocottus maculosus, tidepool sculpin.

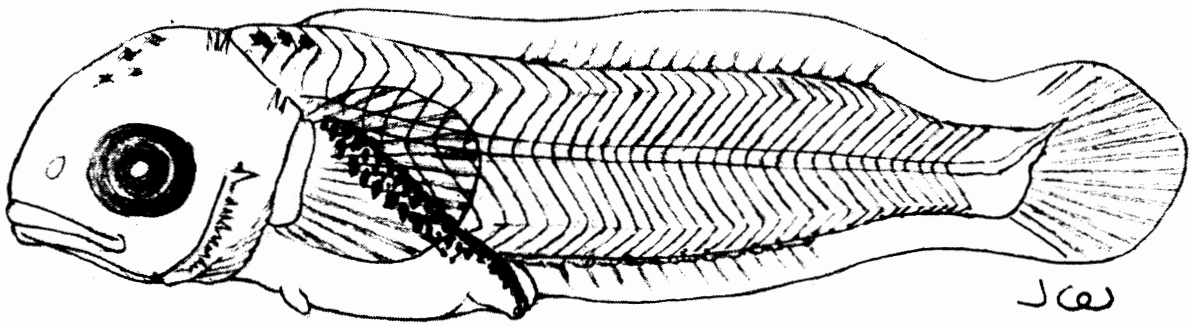


Figure 38-23. Postlarva, 8.4 mm TL.

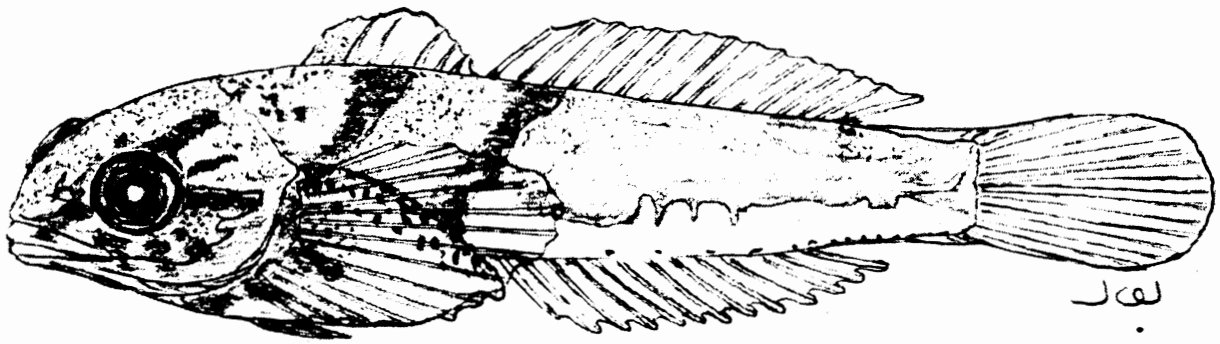


Figure 38-24. Juvenile, 13 mm TL.

Cottidae: Oligocottus maculosus, tidepool sculpin.

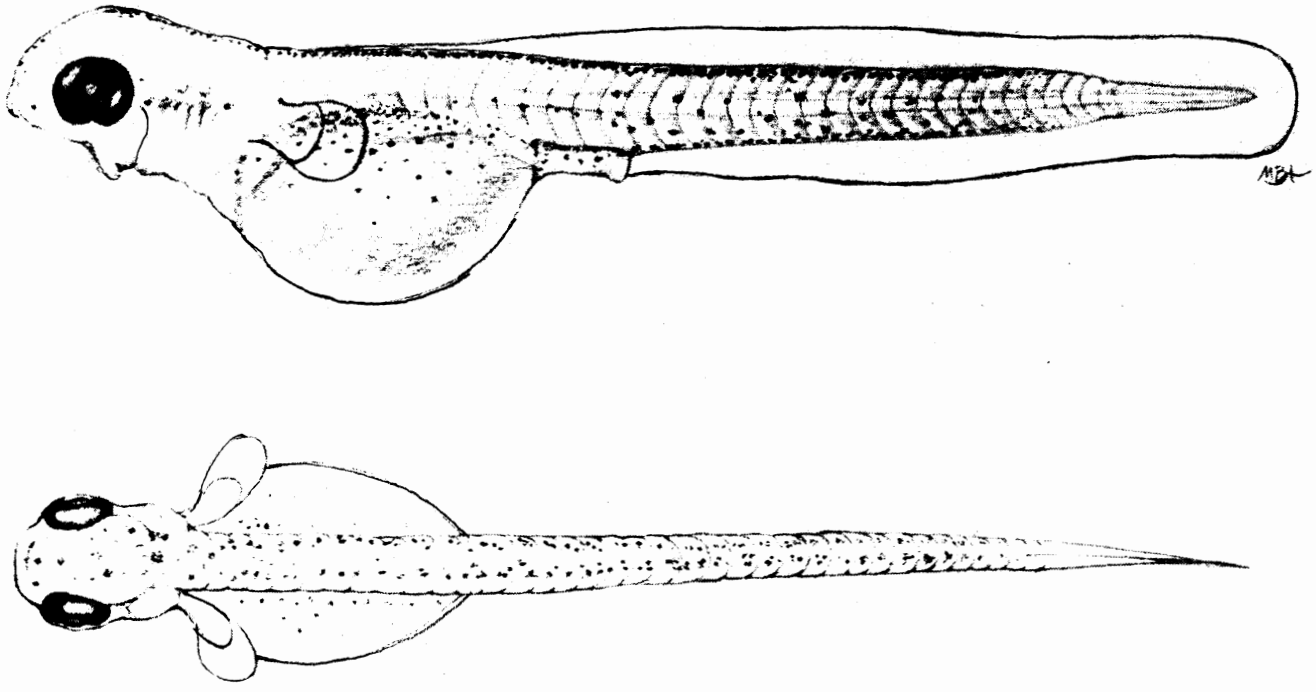


Figure 38-25, 38-26. Prolarva, lateral and dorsal views, 4.8 mm TL.

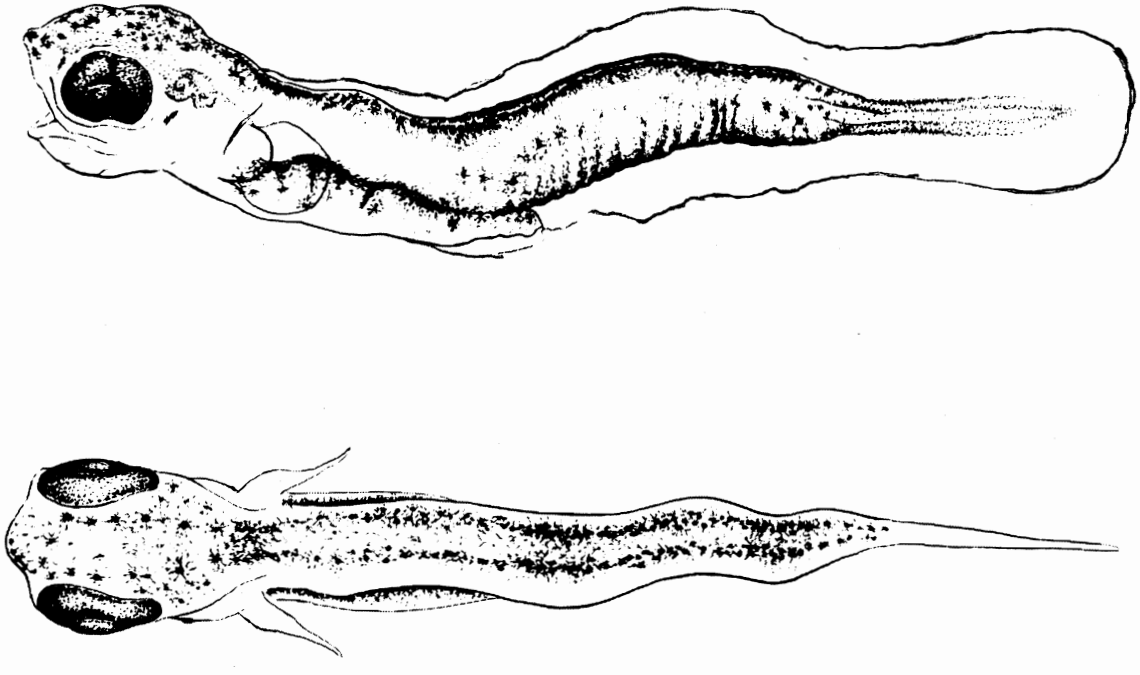


Figure 38-27, 38-28. Postlarva, lateral and dorsal views, 5 mm TL.

Cottidae: Scorpaenichthys marmoratus, cabezon.

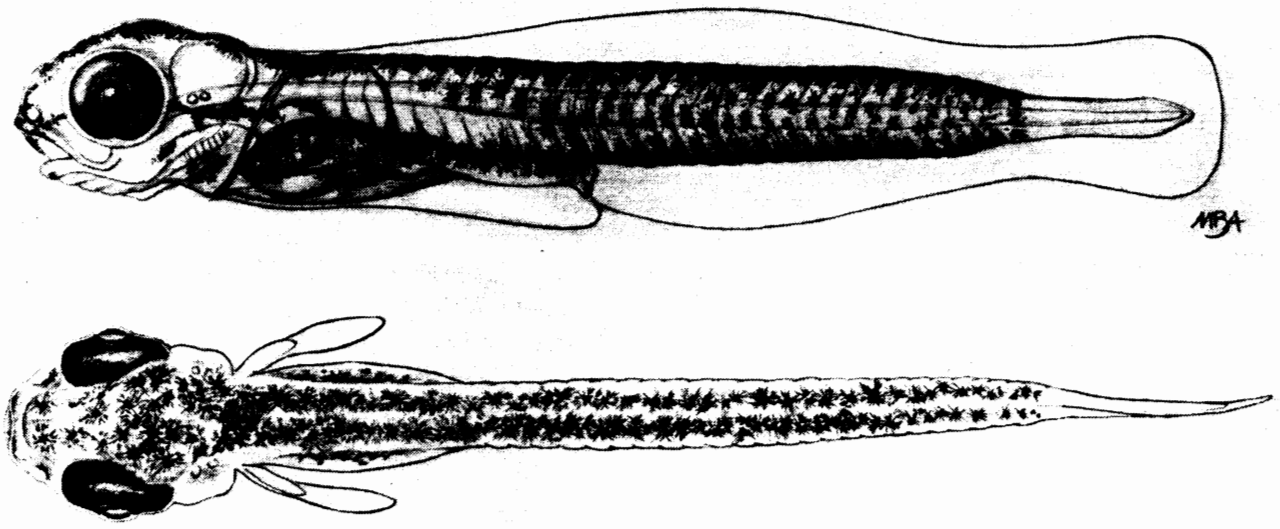


Figure 38-29, 38-30. Postlarva, lateral and dorsal views, 6.3 mm TL.

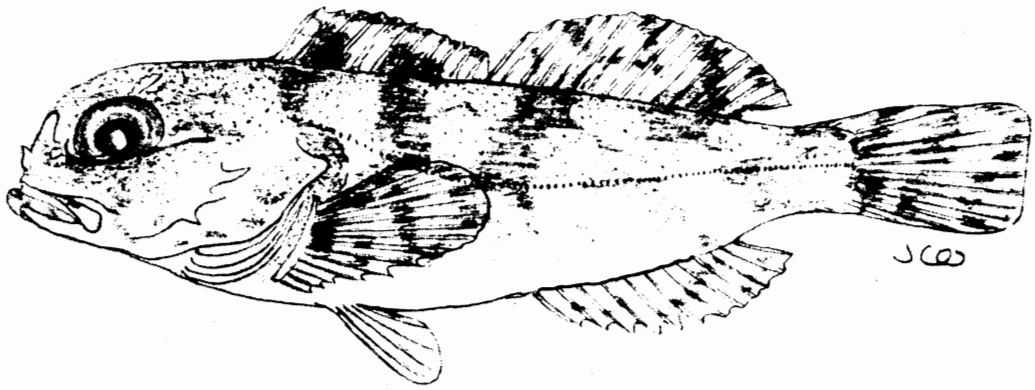


Figure 38-31. Juvenile, 50 mm TL.

Figure 38-32. Juvenile, 83 mm TL.

Cottidae: Scorpaenichthys marmoratus, cabezon.

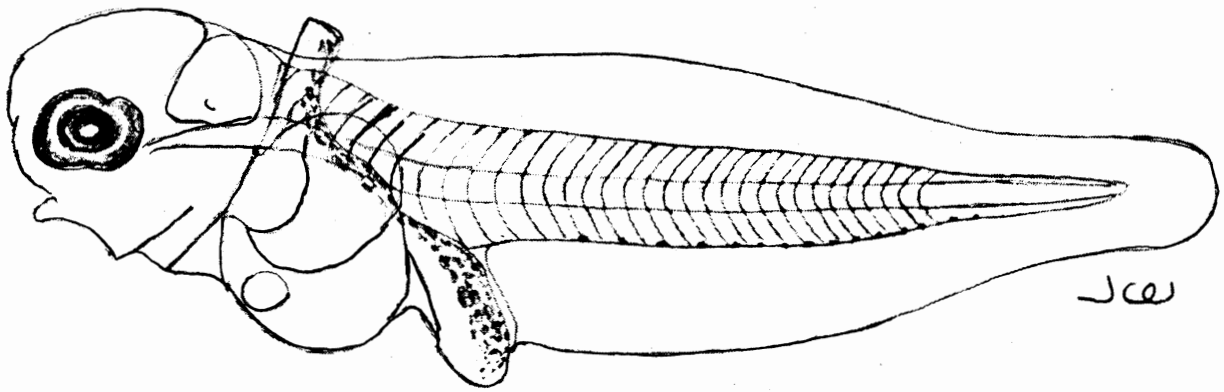


Figure 38-33. Artedius spp. prolarva, 3.2 mm TL (may be Artedius notospilotus, bonehead sculpin).

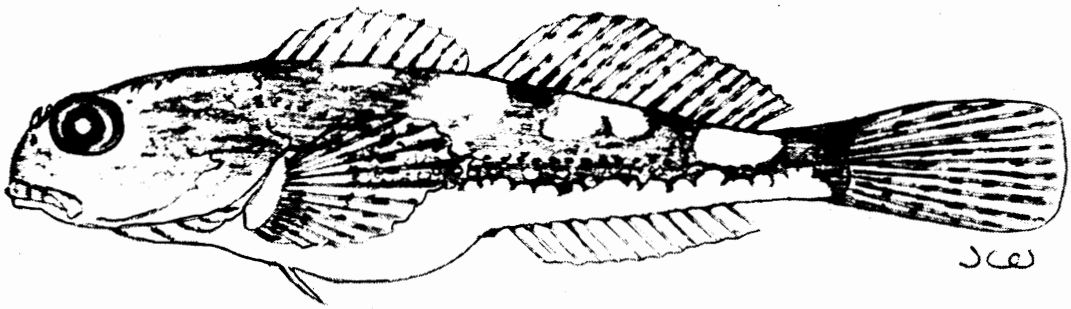


Figure 38-34. Artedius notospilotus, bonehead sculpin juvenile, 58 mm TL.

Cottidae: Sculpins.

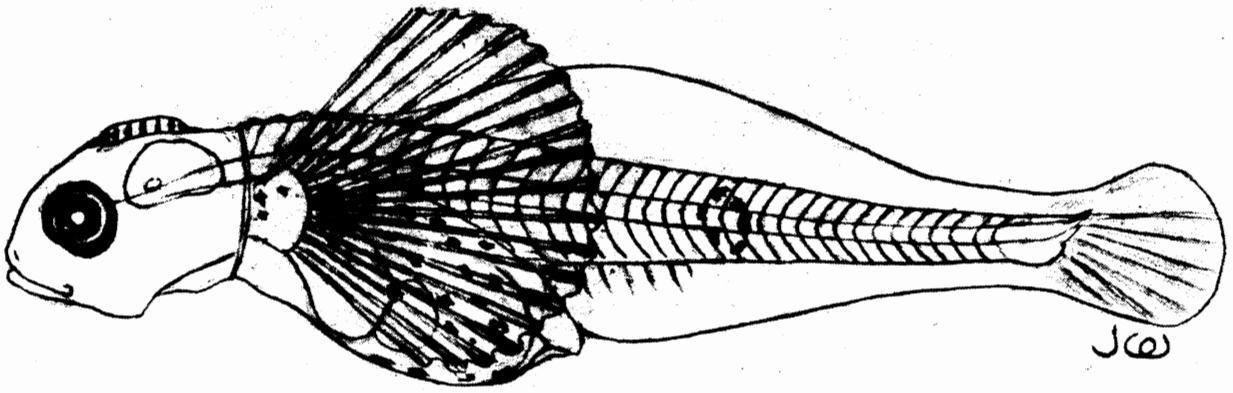


Figure 39-1. Postlarva, 6.1 mm TL.

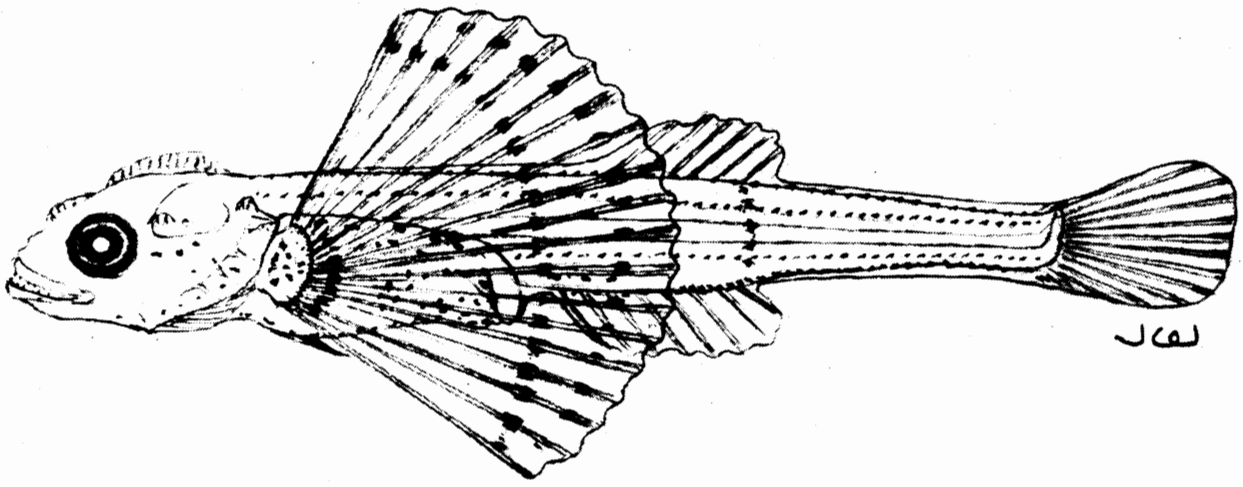


Figure 39-2. Juvenile, 9.4 mm TL.

Agonidae: Stellerina xyosterna, pricklebreast poacher.

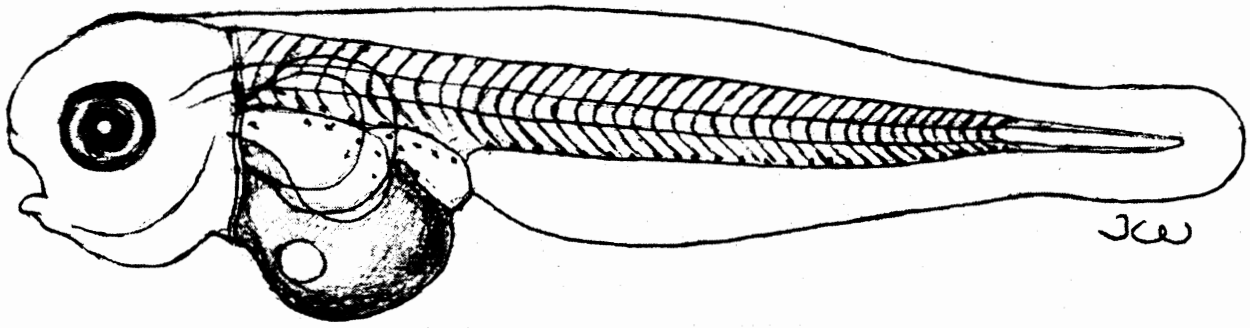


Figure 40-1. Prolarva, 3.2 mm TL.

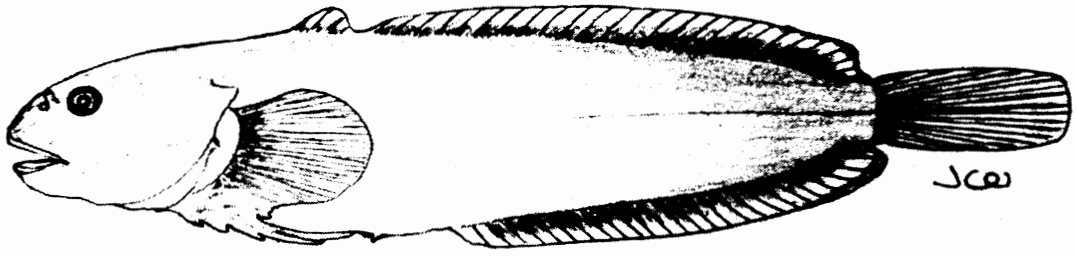


Figure 40-2. Juvenile, 82 mm TL.

Cyclopteridae: Liparis fucensis, slipskin snailfish.

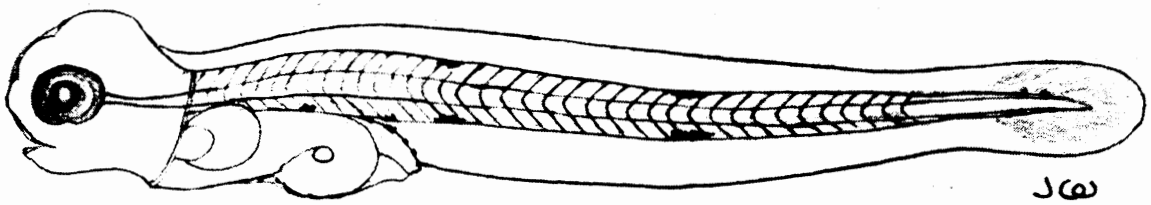


Figure 41-1. Postlarva, 3.4 mm TL.

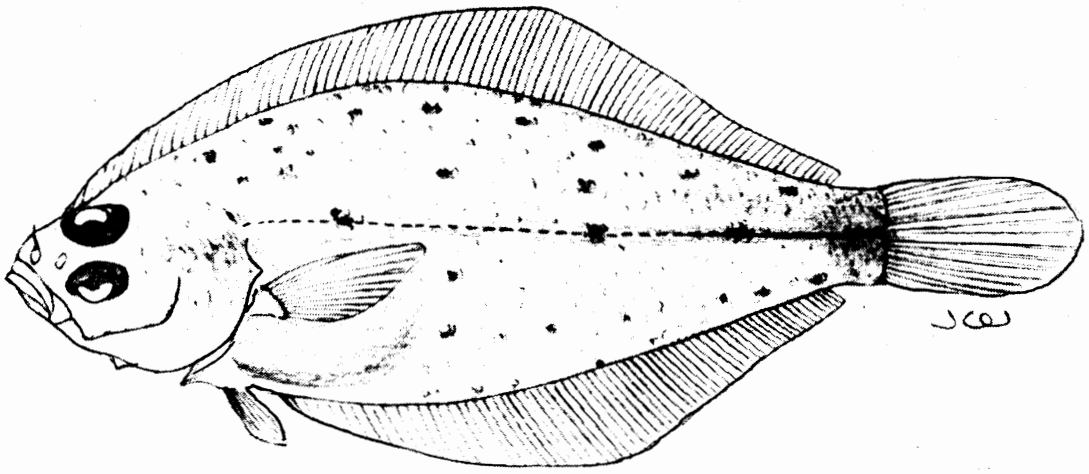


Figure 41-2. Juvenile, 52 mm TL.

Bothidae: Citharichthys stigmaeus, speckled sanddab.

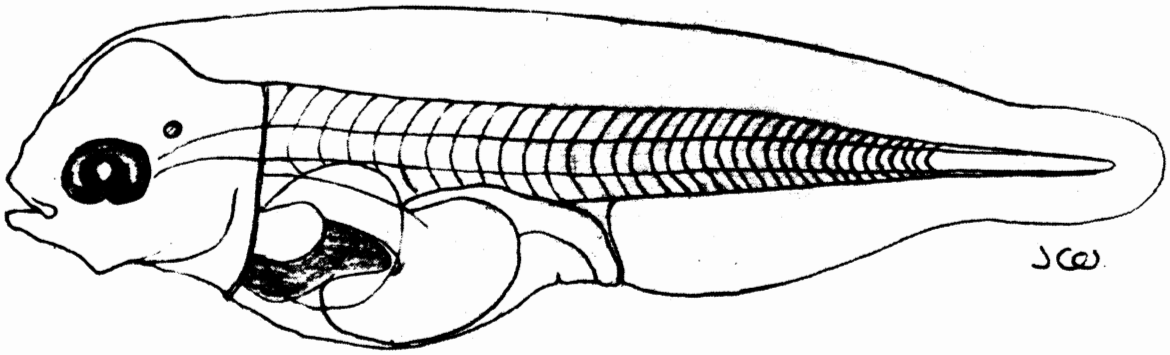


Figure 41-3. Postlarva, 3.2 mm TL.

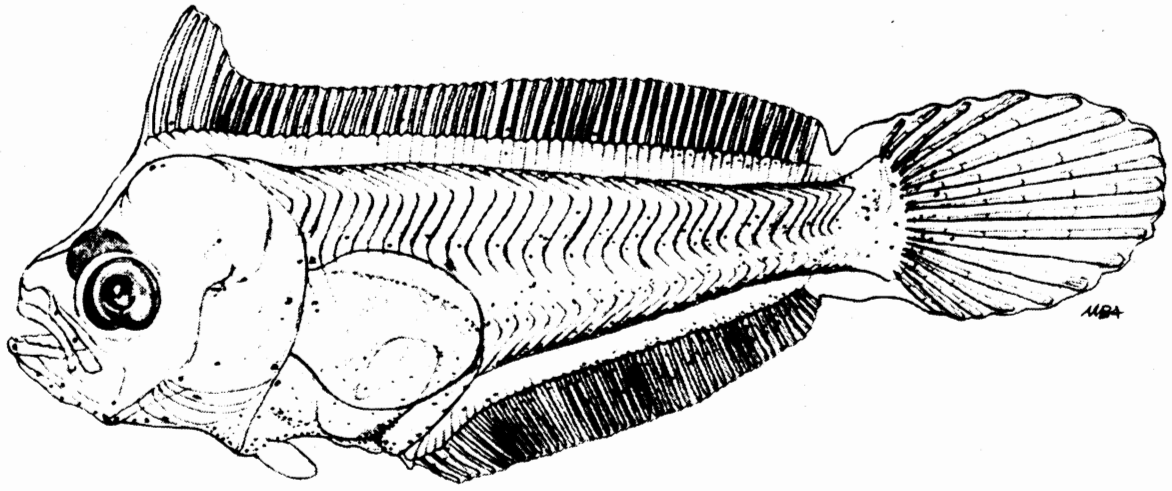


Figure 41-4. Postlarva, 8.4 mm TL.

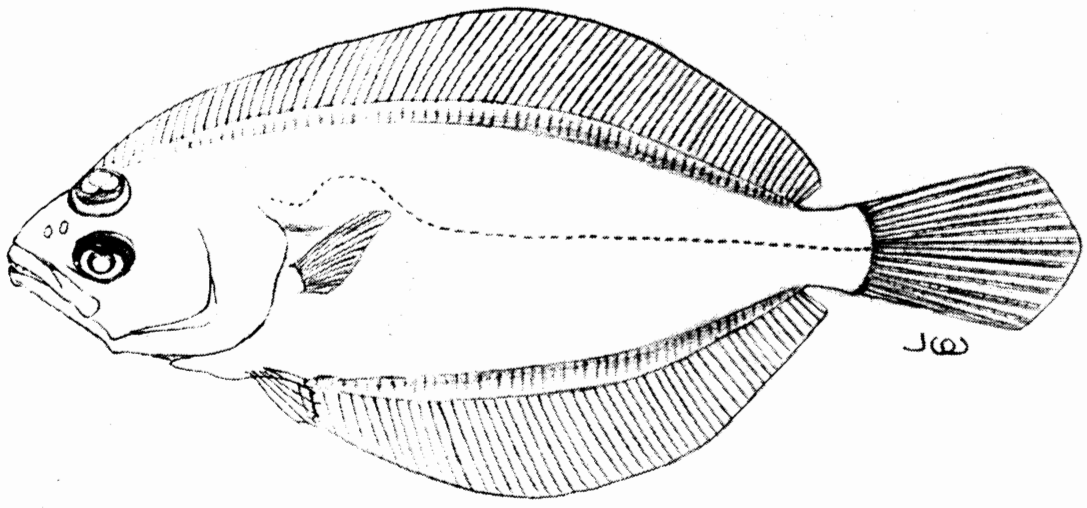


Figure 41-5. Juvenile, 42.5 mm TL.

Bothidae: Paralichthys californicus, California halibut.

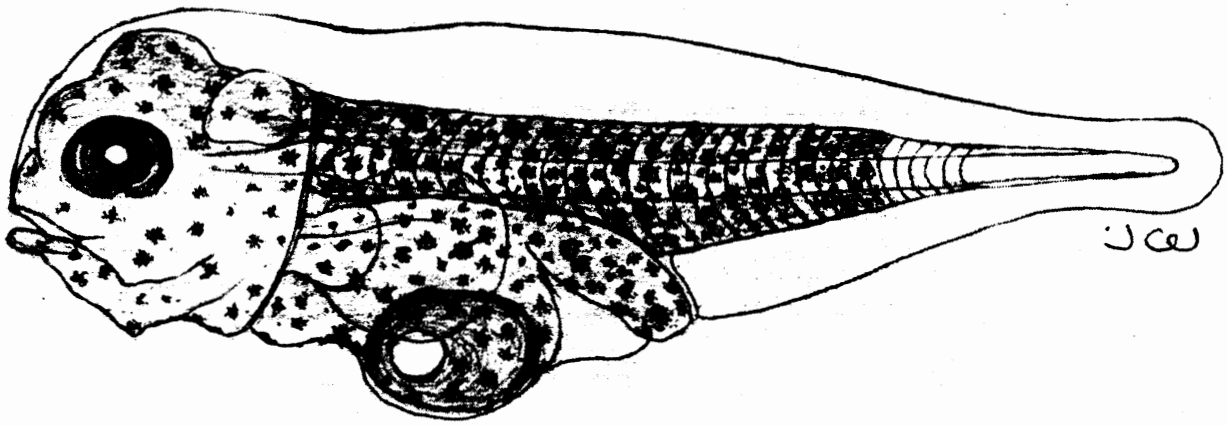


Figure 42-1. Prolarva, 2.5 mm TL.

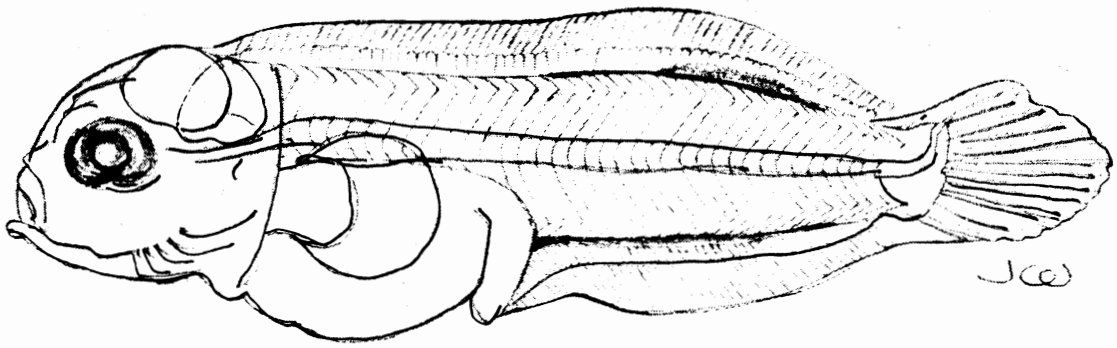


Figure 42-2. Postlarva, 5.9 mm TL.

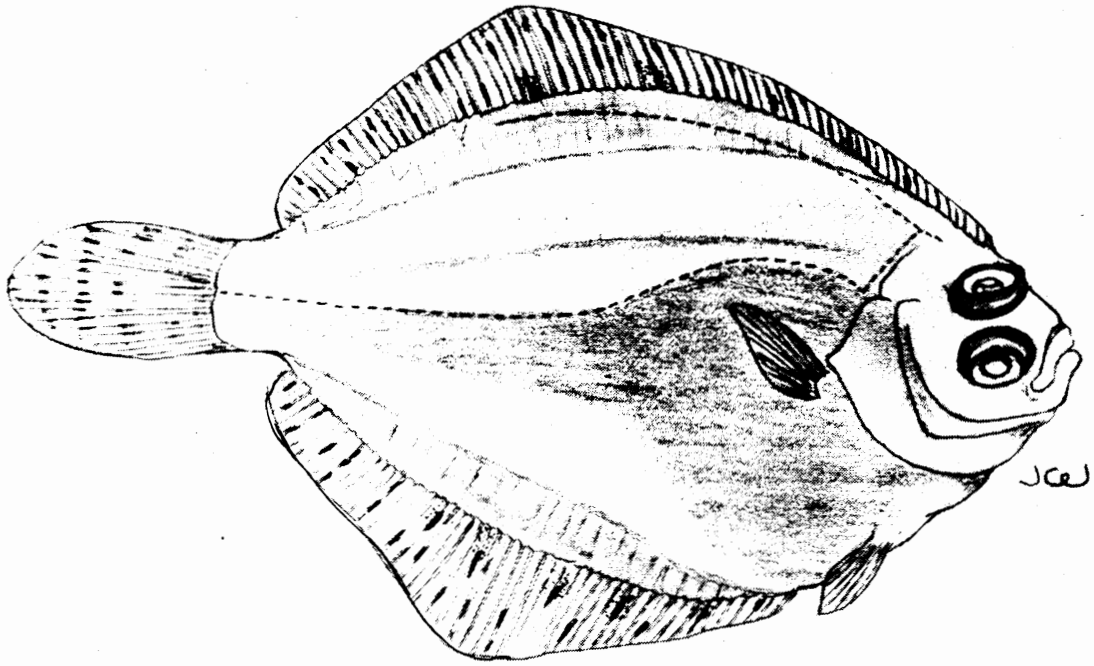


Figure 42-3. Juvenile, 32 mm TL.

Pleuronectidae: Hypsopsetta guttulata, diamond turbot.

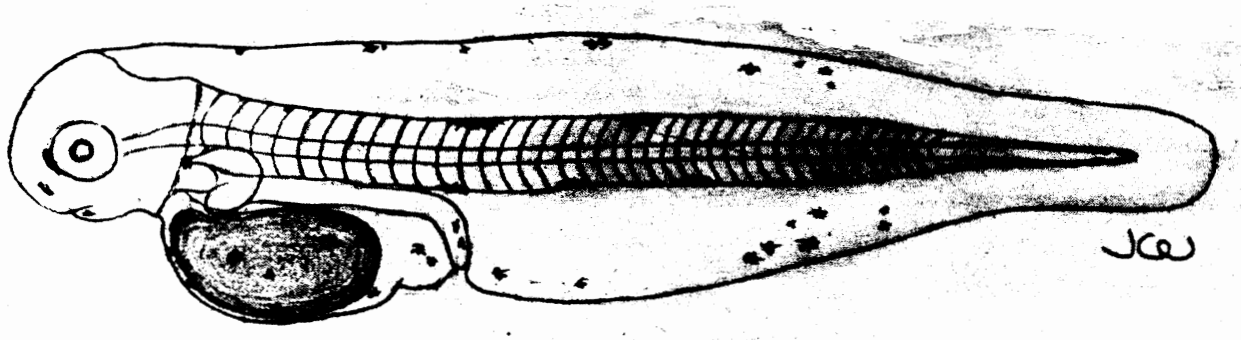


Figure 42-4. Prolarva 3 mm TL.

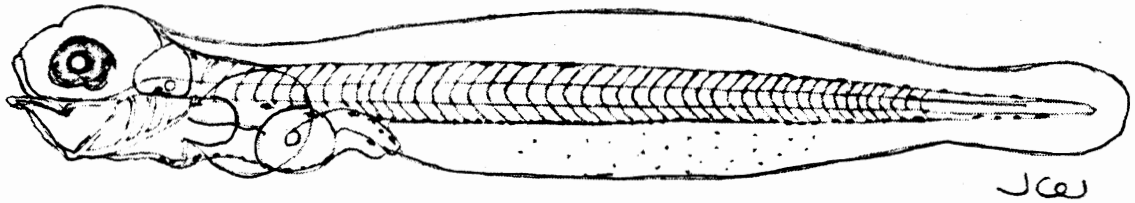


Figure 42-5. Postlarva, 8.8 mm TL.

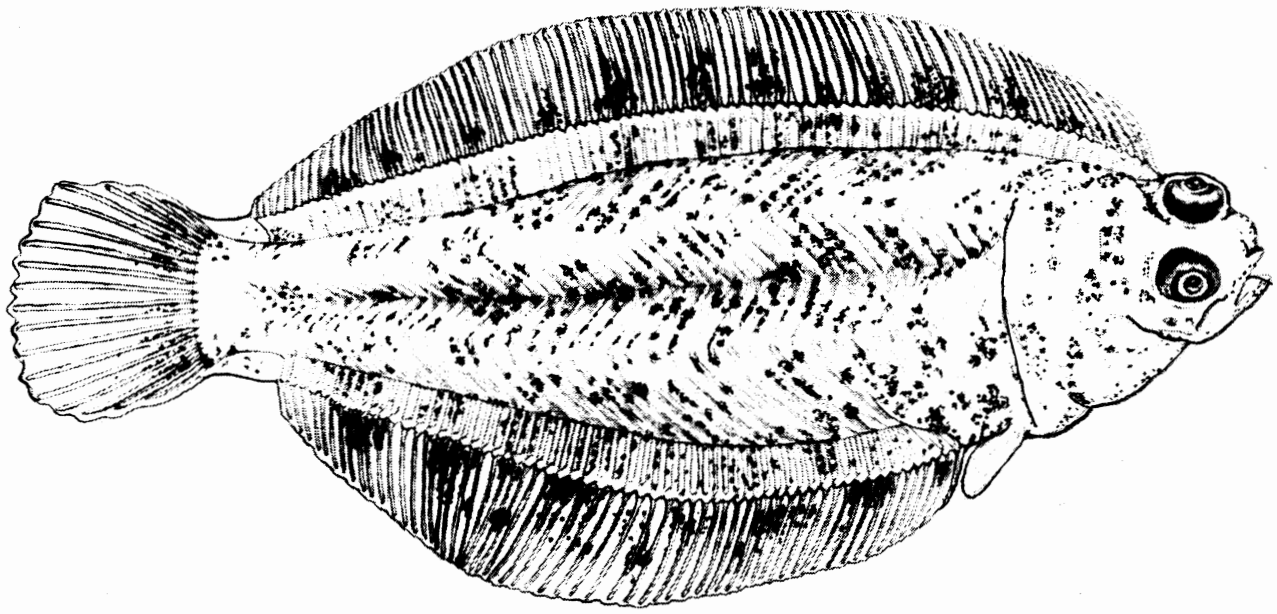


Figure 42-6. Juvenile, 23.3 mm TL.

Pleuronectidae: Parophrys vetulus, English sole.

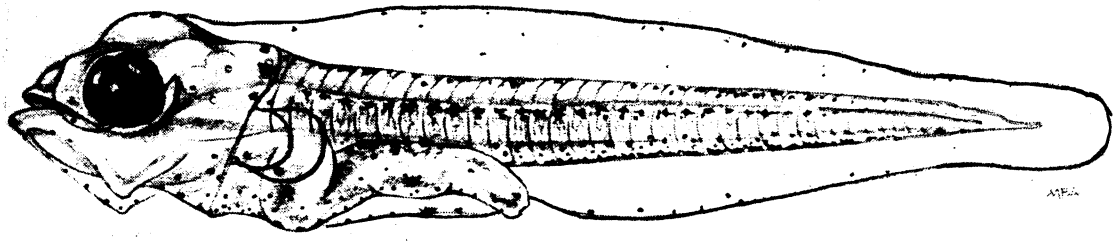


Figure 42-7. Postlarva, 3.7 mm TL.

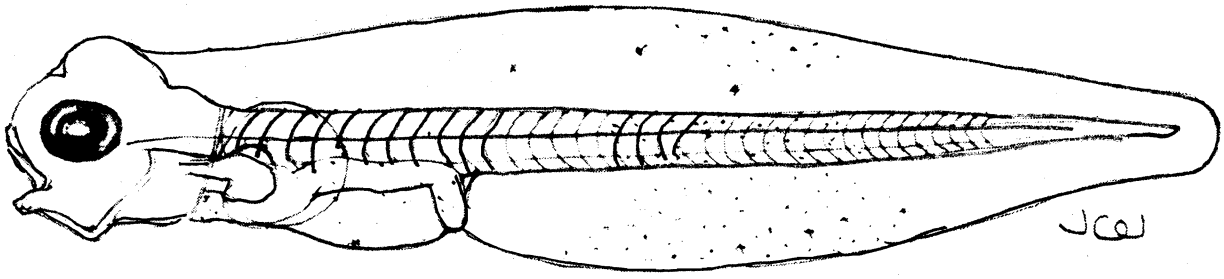


Figure 42-8. Postlarva, 3.9 mm TL.

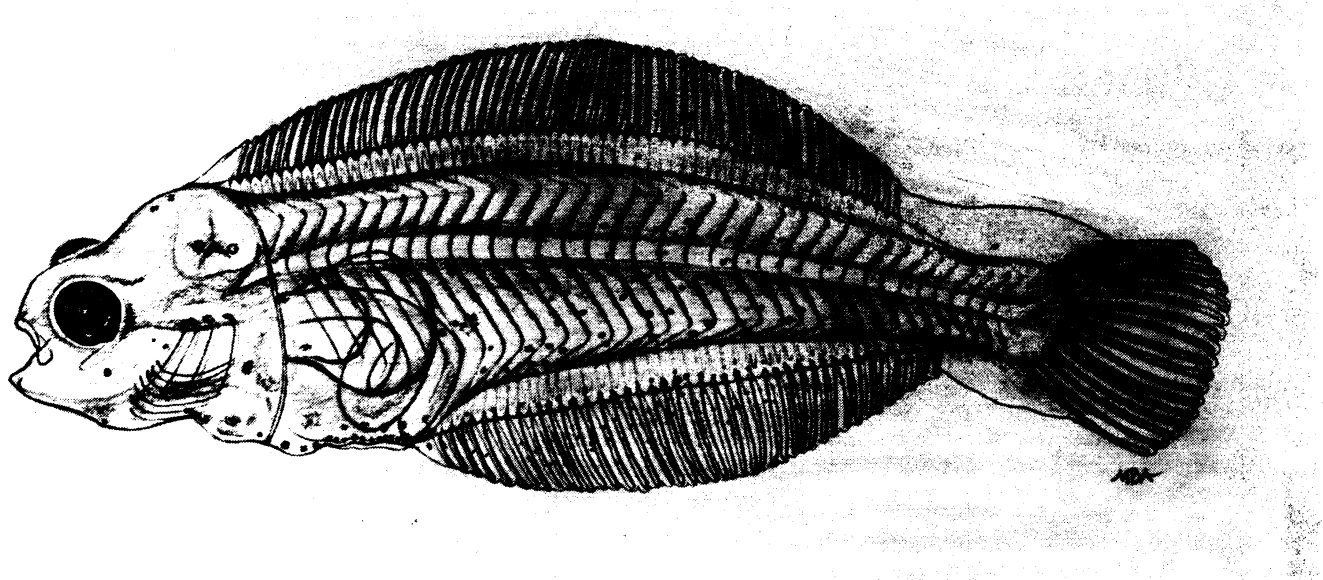


Figure 42-9. Postlarva, 8.5 mm TL.

Pleuronectidae: Platichthys stellatus, starry flounder.

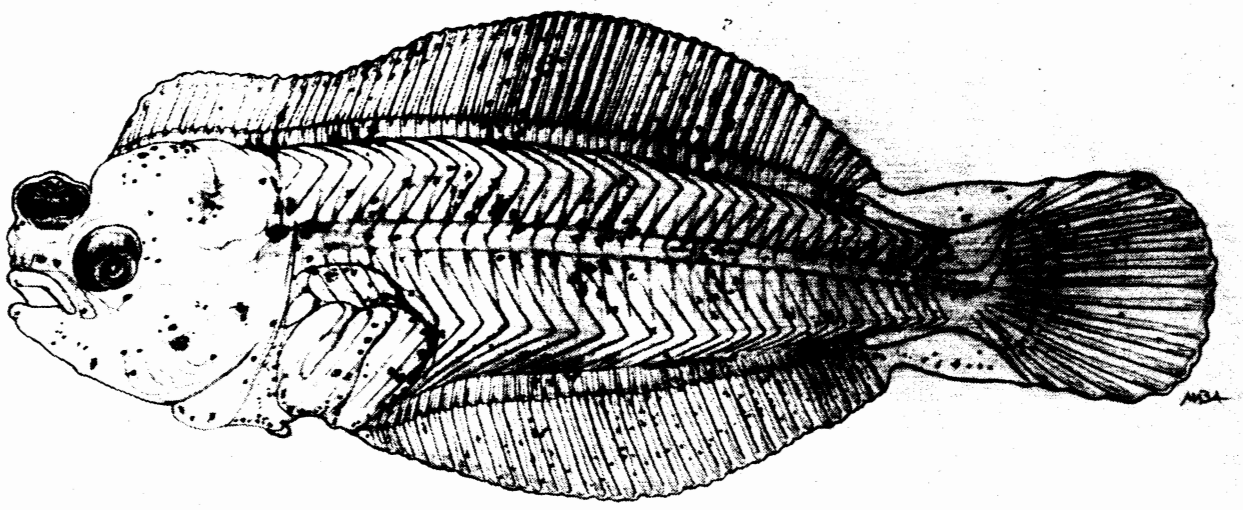


Figure 42-10. Platichthys stellatus, starry flounder postlarva, 8.5 mm TL.

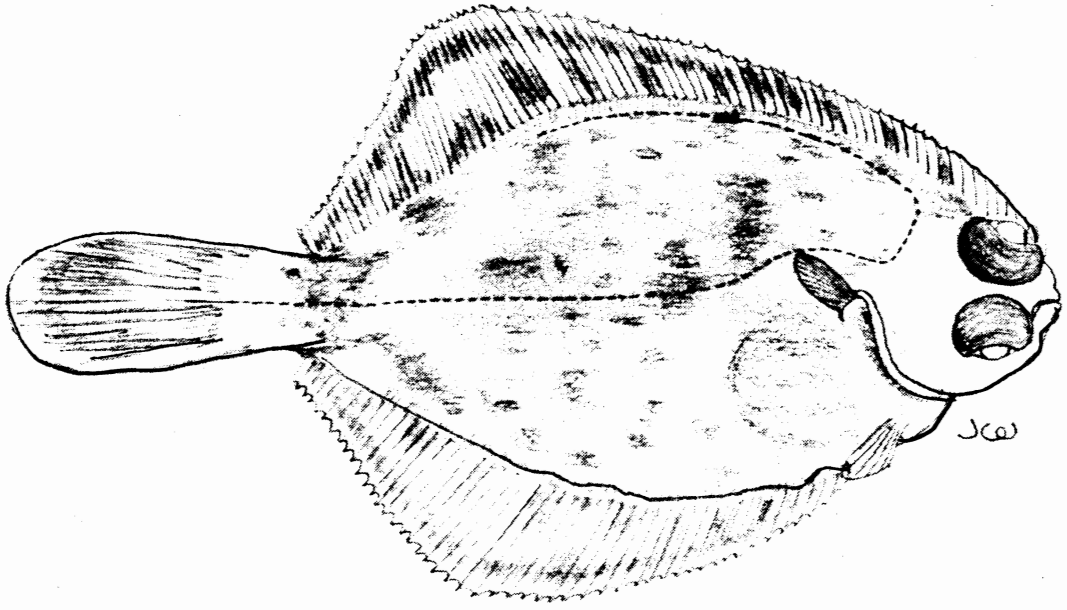


Figure 42-11. Pleuronichthys decurrens, curlfin sole juvenile, 68 mm TL.

Pleuronectidae: Righteye Flounders.

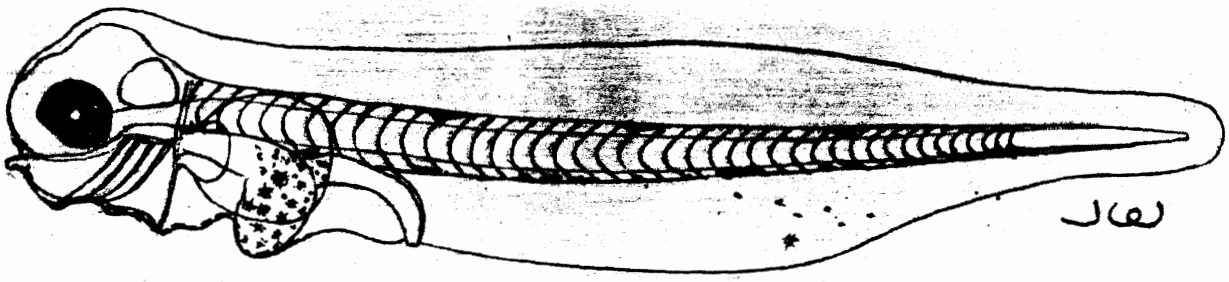


Figure 42-12. Postlarva, 4.3 mm TL.

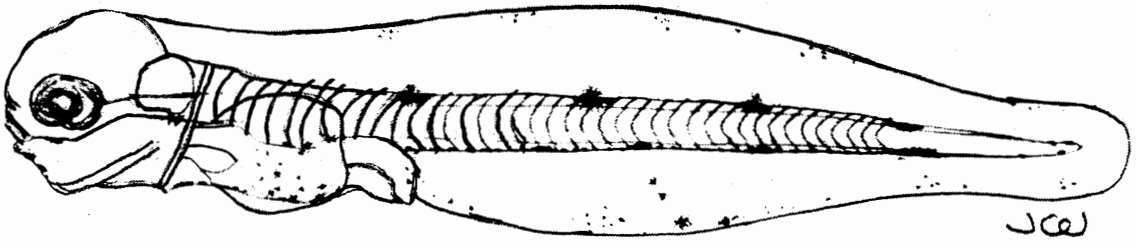


Figure 42-13. Postlarva, 5.2 mm TL.

Pleuronectidae: Psettichthys melanostictus, sand sole.

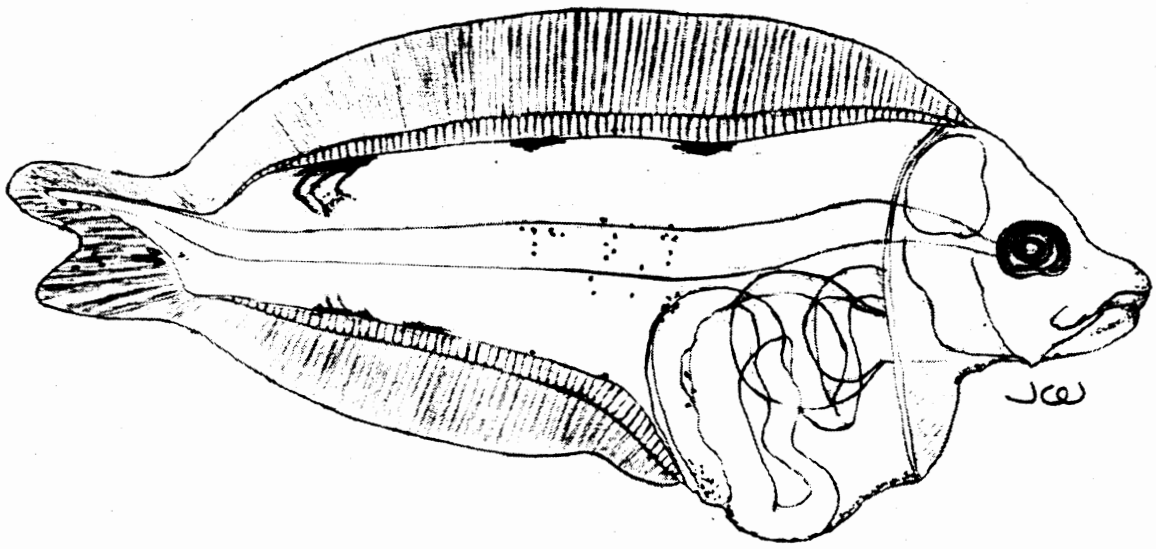


Figure 42-14. Postlarva, 7.5 mm TL.

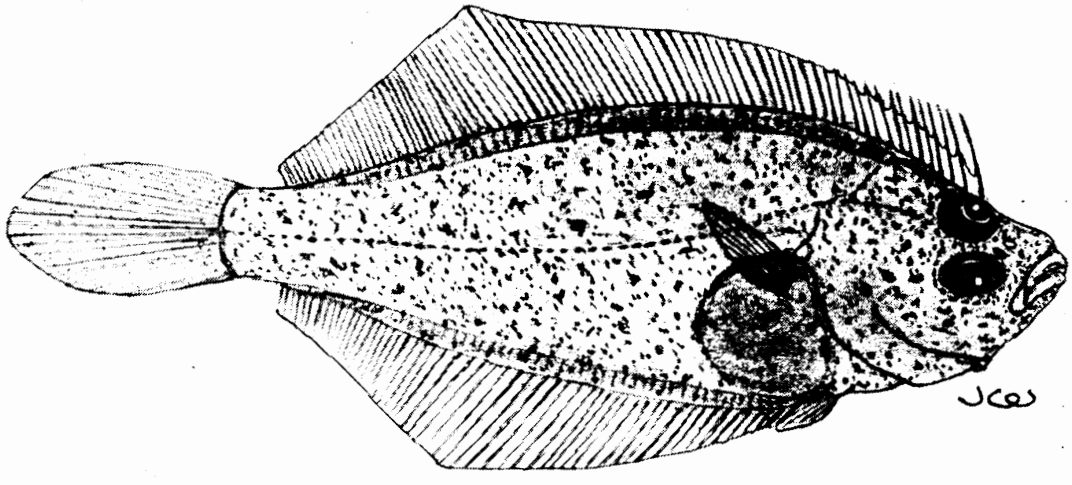


Figure 42-15. Juvenile, 79 mm TL.

Pleuronectidae: Psettichthys melanostictus, sand sole.

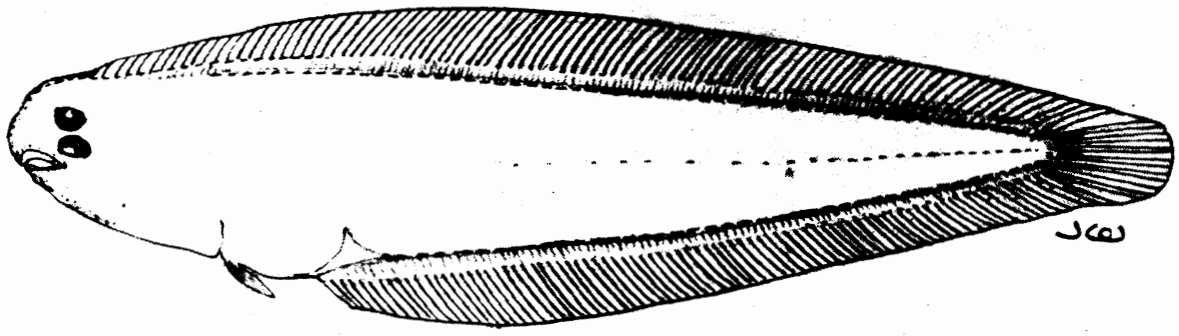
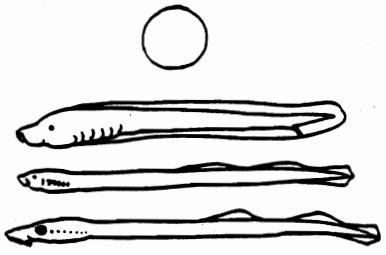


Figure 43-1. Juvenile, 25 mm TL.

Cynoglossidae: Symphurus atricauda, California tonguefish.

GENERAL CHARACTERISTICS OF THE EARLY LIFE
STAGES OF FISH FAMILIES

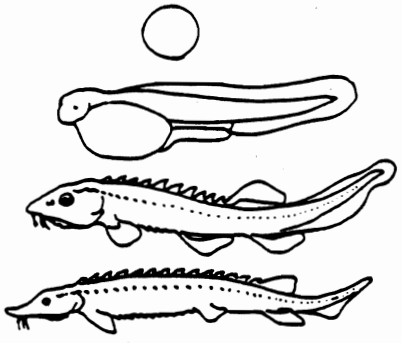
1. PETROMYZONTIDAE
Lampreys



Eggs
- Slightly elliptical to irregular.
- Cream to pale green.
- Holoblastic cleavage.
- Demersal, adhesive

Larvae/Juveniles (Ammocoetes)
- Body elongate, laterally compressed.
- Anus very posterior, near caudal region.
- Jawless, mouth inferior, eyes small and underdeveloped.
- Tail myotomes congested.

2. ACIPENSERIDAE
Sturgeons

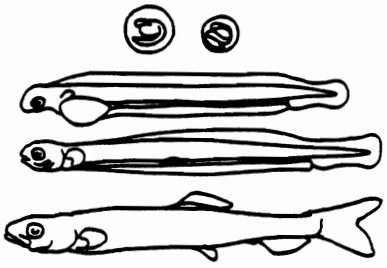


Eggs
- Spherical, very large.
- Opaque, gray to black.
- Modified holoblastic cleavage.
- Demersal, adhesive.

Larvae
- Body gray, chunky, large size at hatching.
- Large yolk sac.
- Anus slightly posterior.
- Eyes small, underdeveloped.
- Caudal fin becoming asymmetrical.

Juveniles
- Body shape similar to sharks.
- Elongate snout, inferior mouth, barbels present.
- Bony plates.

3. CLUPEIDAE
Herrings

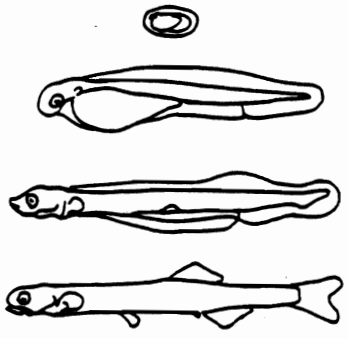


Eggs
- Spherical.
- Yolk yellowish to whitish, usually granular.
- Meroblastic cleavage.
- Demersal to semidemersal.

Larvae
- Body thin, very elongate.
- Yolk sac small, thoracic.
- Anus near caudal region.
- Dashed melanophores along thoracic and midventral regions.

Juveniles
- Body elongate, highly compressed laterally.
- Origin of anal fin very posterior to insertion of dorsal fin.
- Deeply forked caudal fin.
- Large cycloid scales.

4. ENGRAULIDAE
Anchovies

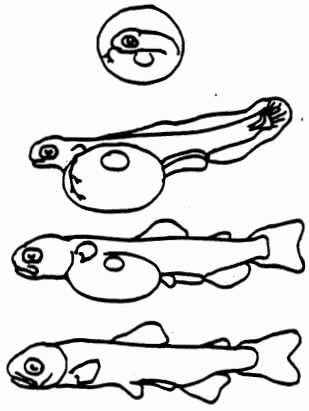


Eggs
- Elliptical.
- Yolk granular, yellowish-whitish
- Meroblastic cleavage.
- Pelagic in coastal waters.

Larvae
- Body elongate with finfolds.
- Thoracic yolk sac.
- Anus posterior (but not as far as clupeids).
- Dashed melanophores in thoracic and midventral regions.

Juveniles
- Body elongate, laterally compressed.
- Snout pointed, mouth inferior, maxillary extends past eye.
- Origin of anal fin overlaps insertion of dorsal fin.

5. SALMONIDAE
Trouts

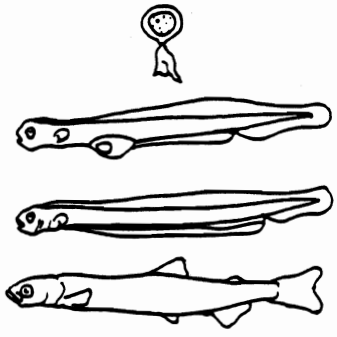


Eggs
- Spherical, very large (4 mm in diameter).
- Yolk yellowish-orange, with many oil globules.
- Meroblastic cleavage.
- Demersal, adhesive.

Larvae
- Newly hatched larvae have extremely large yolk sac with single oil globule.
- Anus posterior.
- Adipose fin.

Juveniles
- Body elongate but chunky.
- Parr marks on sides of body.
- Adipose fin.

6. OSMERIDAE
Smelts

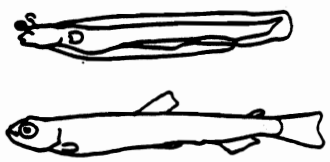


Eggs
- Spherical.
- Yolk yellowish-whitish, granular, with many oil globules.
- Meroblastic cleavage.
- Demersal.
- Outer layer of chorion forms attachment to substrate.

Larvae
- Body thin, elongate.
- Yolk sac small; posterior to thoracic region, with single oil globule.
- Single row of dashed melanophores along midventral region.

Juveniles
- Body elongate, laterally compressed.
- Origin of anal fin very posterior to insertion of dorsal fin.
- Adipose fin.

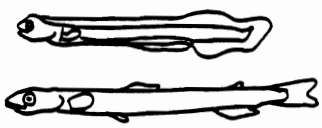
7. BATHYLAGIDAE
Deepsea Smelts



Larvae
- Body elongate.
- Anus near caudal region.
- Elongate eye stalk.

Juveniles
- Body elongate.
- Eye large, may be on stalk.
- Two branchiostegal rays.
- Adipose fin.
- Bathypelagic.

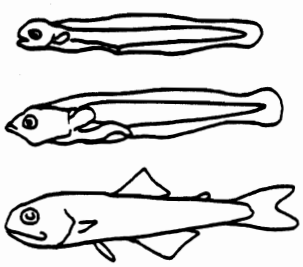
8. SYNODONTIDAE
Lizardfishes



Larvae
- Body elongate, laterally compressed.
- Anus posterior.
- Paired dark blotches spaces equally along entire length of gut.

Juveniles
- Body cylindrical, elongate, with dark blotches embedded in skin.
- Snout pointed, mouth large.
- Adipose fin.

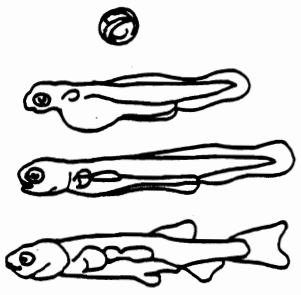
9. MYCTOPHIDAE
Lanternfishes



Larvae
- Body elongate.
- Anus anterior.
- May have vertically narrow eyes.

Juveniles
- Body short, compressed.
- Large head and mouth.
- Photophores present, mostly below lateral line.
- Adipose fin.

10. CYPRINIDAE
Minnows and Carps

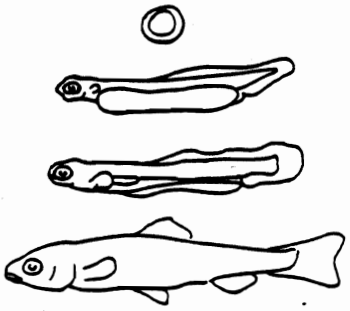


Eggs
- Spherical.
- Yolk yellowish. Generally no oil globules.
- Meroblastic cleavage.
- Dermersal and adhesive (with exception of hitch eggs).

Larvae
- Body elongate, heavy pigmentation.
- Yolk-sac elongate, tear-drop shape.
- Anus posterior (but less than 70 percent of total length).

Juveniles
- Body elongate, heavy pigmentation.
- Mouth terminal.
- Single dorsal fin.
- Anal fin ray count less than 15.

11. CATOSTOMIDAE
Suckers

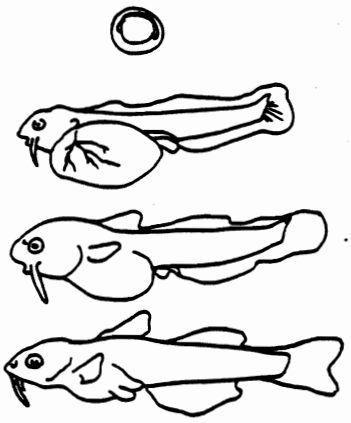


Eggs
- Spherical, large (ca. 3 mm in diameter).
- Yolk yellowish, granular.
- Meroblastic cleavage.
- Demersal, adhesive.

Larvae
- Body elongate, heavy pigmentation.
- Yolk sac very elongate, forms three segments.
- Anus near caudal region (greater than 70 percent of total length).

Juveniles
- Body elongate.
- Mouth inferior.
- Air bladder has two chambers.

12. ICTALURIDAE
Catfishes



Eggs

Spherical, large, (ca. 3 mm in diameter).
Yolk yellowish, granular, no oil globules.
Meroblastic cleavage.
Demersal, highly adhesive, forms clusters.

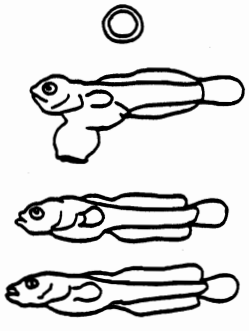
Larvae

Newly hatched larvae large, chunky.
Anus midway or slightly anterior.
Yolk sac yellowish, very large.
Barbels.

Juveniles

Body cylindrical, large head.
Four pairs of barbels: two on maxillary, two on lower chin.
Dorsal and pectoral fins with spines.

13. BATRACHOIDIDAE
Toadfishes



Eggs

Spherical, very large (4 mm in diameter).
Yolk bright yellow to pinkish-yellow, hard.
Chorion thick, eggs change shape during incubation.
Meroblastic cleavage.
Demersal and adhesive.

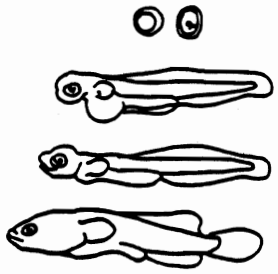
Larvae

Body short and chunky.
Anus near thoracic region.
Yolk-sac larval stage attached to substrate.

Juveniles

Body elongate, trunk and tail taper off.
Head large, flat.
Dorsal and anal fins elongate.
Photophores on head and body.

14. GOBIESOCIDAE
Clingfishes

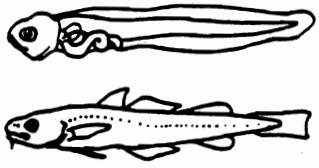


Eggs
- Elliptical.
- Oil globules.
- Meroblastic cleavage.
- Demersal and attached to substrate.

Larvae
- Body short and stubby.
- Anus midway of total length.
- Large stellate melanophores cover trunk.

Juveniles
- Body robust, tapers off.
- Head big and flat.
- Lips thick and fleshy.
- Single dorsal fin near caudal region.
- Pelvic fin modified into sucking disc.

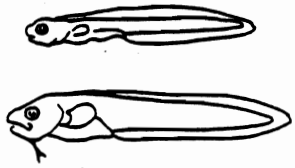
15. GADIDAE
Codfishes



Larvae
- Body elongate, laterally compressed
- Anus slightly anterior.
- Matching pigmentation pattern in tail region.

Juveniles
- Body elongate, laterally compressed.
- Dorsal fin, 2-3; anal fin, 1-2. No spines in fins.

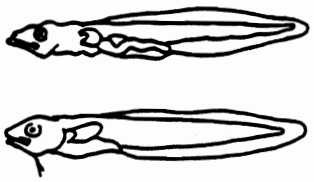
16. OPHIDIIDAE
Cusk-eels



Larvae
- Body elongate, laterally compressed.
- Anus anterior
- Melanophores concentrate mostly along postanal region in early postlarvae.

Juveniles
- Body elongate, laterally compressed.
- Pelvic fins modified into filamentous structure in jugular area.
- Dorsal and anal fins elongate.

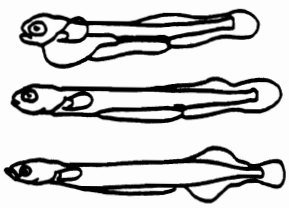
17. BYTHITIDAE
Viviparous Brotulas



Larvae (embedded in ovaries of females).
- Body elongate.
- Anus midway or slightly anterior.
- Melanophores along dorsal and postanal regions in alternate pattern.

Juveniles
- Body elongate, cylindrical (similar to eels).
- Pelvic fin modified into filamentour structure in jugular region.
- Dorsal and anal fins elongate.

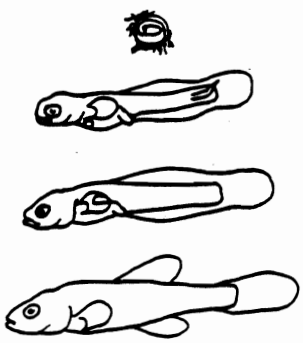
18. SCOMBERESOCIDAE
Sauries



Larvae
- Body elongate, laterally compressed, heavily pigmented.
- Anus posterior.
- Eyes large.

Juveniles
- Body very slender.
- Snout pointed, upper jaw short.
- Dorsal and anal fins very posterior on body, both followed by a few finlets.

19. CYPRINODONTIDAE
Killifishes



Eggs
- Spherical.
- Yolk yellowish with oil globules.
- Fine filaments cover chorion.
- Meroblastic cleavage.
- Demersal, but suspended on substrate.

Larvae
- Body short, stubby, generally heavily pigmented.
- Anus slightly anterior.
- Caudal rays visible in newly hatched larvae.

Juveniles
- Body short, stubby, tapers off, heavily pigmented.
- Head large and flat.
- Mouth superior.
- Dorsal fin anterior to anal fin.
- Tail round.

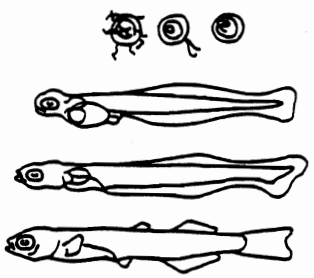
20. POECILIIDAE
Livebearers

Eggs (embedded in ovaries of females).
- Spherical.
- Yolk bright yellow, with many oil globules.
- Meroblastic cleavage.

Larvae (embedded in ovaries of females).
- Body curled, pigmented.
- Anus in thoracic position.
- Scales developed.

Juveniles
- Body short, stubby, fully scaled.
- Head flat.
- Mouth superior.
- Origin of dorsal fin posterior to origin of anal fin.

21. ATHERINIDAE
Silversides

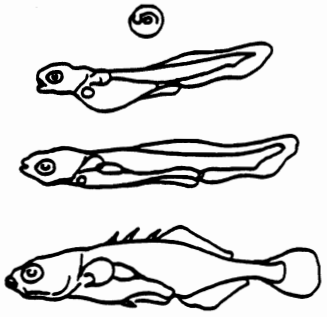


Eggs
- Spherical.
- Yolk yellowish, granular, with one or more oil globules.
- Various elongate chorion filaments.
- Meroblastic cleavage.
- Demersal, nonadhesive, suspended on substrate.

Larvae
- Body thin, elongate, with single oil globule.
- Anus thoracic.
- Long tail.
- Large stellate melanophores cover top of head, dashed melanophores along lateral line.

Juveniles
- Body elongate.
- Head and snout relatively flat.
- Two dorsal fins, well separated.
- Anus shifts to posterior.

22. GASTEROSTEIDAE
Sticklebacks

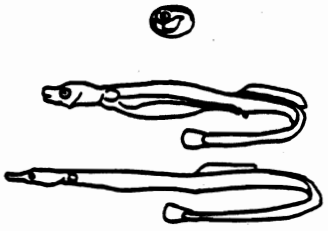


Eggs
- Spherical.
- Yolk yellowish, clear, with oil globules.
- Meroblastic cleavage.
- Demersal, adhesive, clustered.

Larvae
- Body short and stubby, heavily pigmented.
- Anus midway.
- Elongate yolk sac, with single oil globule.

Juveniles
- Body short, narrow caudal peduncle.
- First spiny dorsal fin develops into spearate spines.
- Bony plates develop on sides of body.

23. SYNGNATHIDAE
Pipefishes and Seahorses

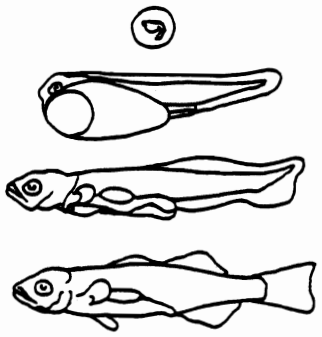


Eggs (embedded in males' pouches).
- Spherical to oval.
- Yolk bright yellow to orange, with many oil globules.
- Meroblastic cleavage.
- Demersal and clustered.

Larvae (embedded in males' pouches).
- Body curled.
- Yoik sac large, spherical, thoracic.
- Anus anterior.

Juveniles
- Body elongate, covered with bony rings.
- Mouth tubular, small.
- Head bony.

24. PERCICHTHYIDAE
Temperate Basses



Eggs

- Spherical, large (3 mm in diameter).
- Yolk yellowish, with single oil globule.
- Large perivitelline space.
- Meroblastic cleavage.
- Semidemersal.

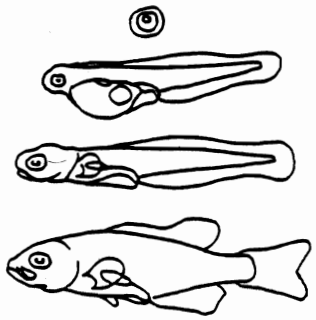
Larvae

- Body elongate, chunky.
- Yolk sac large, oval, with a single oil globule.
- Anus midway.
- Sharp teeth.
- Low myomere count (ca. 25).

Juveniles

- Body elongate.
- Mouth terminal and large, teeth sharp.
- Gut straight.
- Two dorsal fins.

25. CENTRARCHIDAE
Sunfishes



Eggs

- Spherical.
- Yolk yellowish, granular, with single large oil globule.
- Meroblastic cleavage.
- Demersal, highly adhesive.

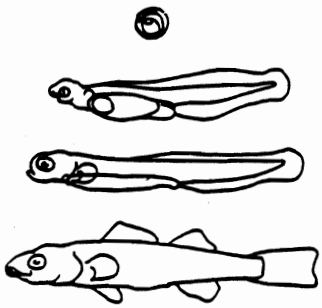
Larvae

- Body elongate.
- Thoracic yolk sac, with single oil globule.
- Anus slightly anterior.
- Gut coiled or twisted, air bladder distinctive.

Juveniles

- Body deep to elongate, laterally compressed.
- Anus midway.
- Two connected dorsal fins.

26. PERCIDAE
Perches

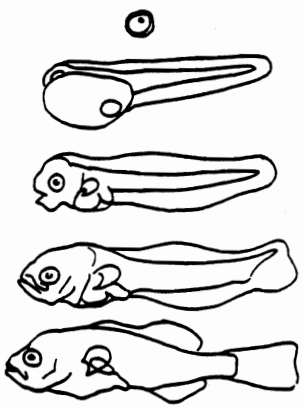


Eggs
- Spherical.
- Yolk yellowish, clear, with single oil globule.
- Demersal, adhesive.

Larvae
- Body elongate.
- Yolk sac elongate, thoracic, with single oil globule.
- Anus slightly posterior.
- Gut elongate, straight.
- High myomere count (ca. 40).

Juveniles
- Body elongate, cylindrical.
- Two separated dorsal fins.

27. SCIAENIDAE
Drums

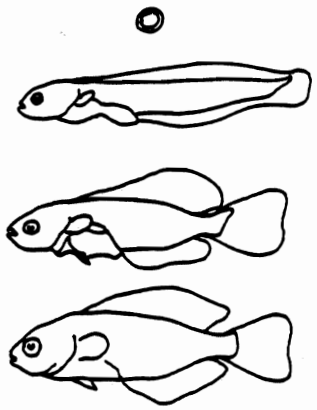


Eggs
- Spherical, small (ca. 1 mm in diameter).
- Yolk yellowish-whitish, clear, with single oil globule.
- Meroblastic cleavage.
- Pelagic in coastal waters.

Larvae
- Body short, high finfolds.
- Head large, body tapers off.
- Anus thoracic
- Teeth sharp.

Juveniles
- Body deep.
- Caudal fin pointed.

28. EMBIOTOCIDAE
Surfperches

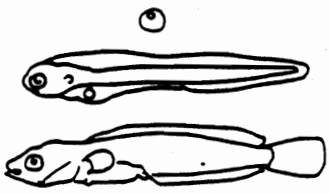


Eggs (embedded in ovaries of females).
- Spherical, small.
- An oil globule may be present.
- Modified holoblastic or meroblastic cleavage.

Larvae (embedded in ovaries of females).
- Body elongate (similar to tadpoles), with elongate unpaired fin rays.
- Anus midway or anterior.
- Large hind gut.

Juveniles
- Body deep, elongate unpaired fin rays.
- Two connected dorsal fins.
- Body with sparse or no pigmentation.

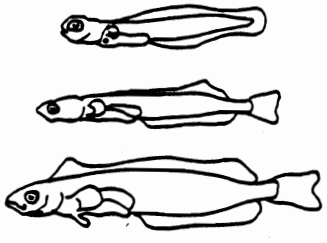
29. LABRIDAE
Wrasses



Larvae
- Body elongate.
- Anus midway.

Juveniles
- Body elongate.
- Snout pointed, teeth modified into buck-teeth.
- Spiny and soft dorsal fins elongate and continuous.

30. CLINIDAE
Clinids

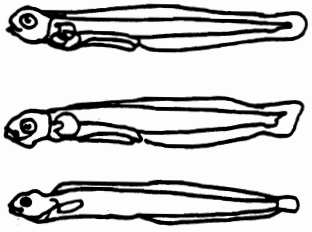


Eggs
- Spherical.
- Yolk yellowish, with single oil globule.
- Chorion attached to substrate by filaments.
- Meroblastic cleavage.
- Demersal, clustered.

Larvae
- Body very elongate.
- Anus anterior.
- Series of melanophores along postanal region.
- High myomere count (ca. 46-58).

Juveniles
- Body elongate, compressed, leaf-like.
- Snout pointed.
- Pelvics in jugular region.
- Dorsal and anal fin elongate.

31. STICHAEIDAE
Pricklebacks

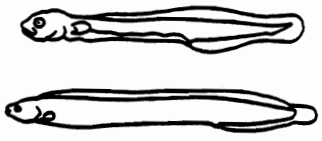


Eggs
- Spherical.
- Yolk mostly white, yellow to gray, with single oil globule.
- Meroblastic cleavage.
- Clustered, demersal.

Larvae
- Body elongate.
- Anus slightly anterior.
- Melanophores mostly along midventral and postanal regions.
- High myomere count (ca. 40-80).

Juveniles
- Body elongate, laterally compressed.
- Dorsal fin, all spines.
- Anal fin elongate, with sharp spine.

32. PHOLIDAE
Gunnels

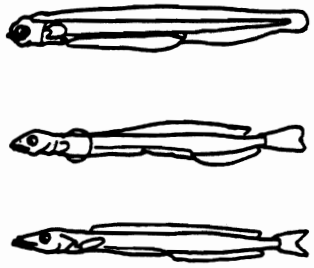


Eggs
- Spherical.
- Yolk whitish, granular.
- Meroblastic cleavage.
- Demersal, clustered.

Larvae
- Body elongate.
- Anus slightly posterior.
- Series of melanophores along postanal region.
- Very high myomere count (ca. 80-110).

Juveniles
- Body elongate, leaf-like.
- Pelvic fin absent or with one spine and one ray.
- Dorsal fin extends from head to tail, entirely spiny.
- Anal fin elongate, with sharp spine.

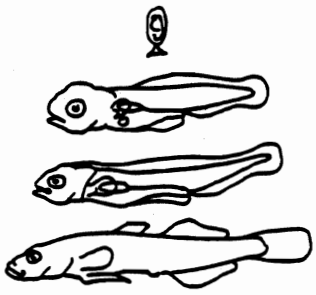
33. AMMODYTIDAE
Sand Lances



Larvae
- Body very elongate, with high finfolds.
- Anus slightly posterior.
- Melanophores along dorsal surface of gut and postanal regions.

Juveniles
- Body elongate, stick-like.
- Snout pointed, and lower jaw projected.
- Dorsal fin elongate, spines absent.
- No pelvic fin.

34. GOBIIDAE
Gobies

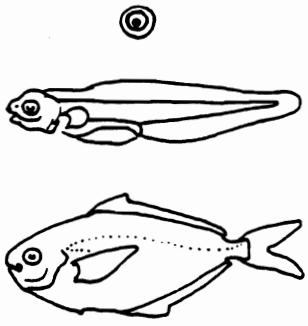


Eggs
- Elliptical or tear-drop shape.
- Yolk yellowish, granular, with oil globules.
- Meroblastic cleavage.
- Demersal and attached to roof of underground burrow.

Larvae
- Body short.
- Spherical, thoracic yolk sac, with single oil globule.
- Anus midway.
- Melanophores along postanal region.
- Mostly pelagic.

Juveniles
- Body elongate, cylindrical.
- Pelvics modified into sucking disc.
- Two separated dorsal fins.
- Mostly benthic.

35. STROMATEIDAE
Butterfishes

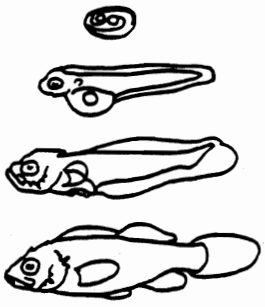


Eggs
- Spherical.
- Yolk yellowish.
- Meroblastic cleavage.

Larvae
- Body elongate, with high finfolds.
- Anus slightly anterior.
- Lower myomere count (ca. 29-31).

Juveniles
- Body deep.
- Dorsal and anal fins elongate.
- Pelvic fins absent.

36. SCORPAENIDAE
Scorpionfishes

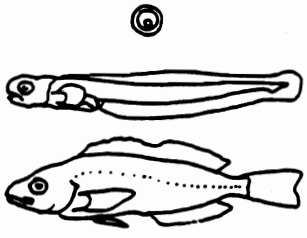


Eggs (embedded in ovaries of females).
- Spherical to elliptical.
- Yolk yellowish, with single oil globule.
- Meroblastic cleavage.

Larvae (partial development in ovaries of *Sebastes* spp. females).
- Body elongate, with high finfolds.
- Spherical, thoracic yolk sac, with single large oil globule.
- Anus near thoracic region.
- Low myomere count (ca. 26-30).

Juveniles
- Body deep.
- Eye and head large, numerous spines on head.
- Two connected dorsal fins.

37. HEXAGRAMMIDAE
Greenlings

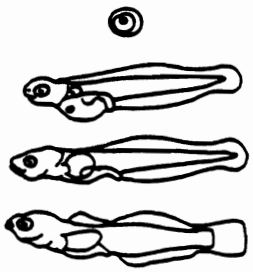


Eggs
- Spherical, large (ca. 2.0 mm in diameter).
- Chorion very thick.
- Meroblastic cleavage.
- Clustered, demersal.

Larvae
- Body elongate.
- Yolk, yellow to green to blue with single oil globule.
- Anus anterior.
- Pigmentations heavy, particularly along middorsum.

Juveniles
- Body elongate to deep, heavily pigmented.
- Snout pointed.
- Single to multiple lateral line systems.

38. COTTIDAE
Sculpins

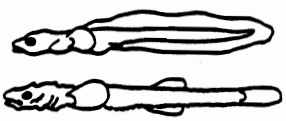


Eggs
- Spherical, large (1.5 mm in diameter).
- Yolk yellow to greenish to various colors, with single oil globule.
- Meroblastic cleavage.
- Demersal and clustered.

Larvae
- Body elongate.
- Large thoracic yolk sac.
- Anus in thoracic region.
- Long tail.
- Gut coiled, air bladder absent.

Juveniles
- Body elongate, cylindrical, tapers off.
- Head large.
- Pelvic fins never form disc.
- Two connected dorsal fins.

39. AGONIDAE
Poachers



Eggs
- Spherical.
- Chorion very thick.
- Meroblastic cleavage.
- Demersal.
- Prolonged incubation period.

Larvae
- Body thin, slender, heavily pigmented.
- Anus anterior.
- Very large pigmented pectorals.

Juveniles
- Body elongate, covered with bony plates which do not overlap (resemble alligators).
- Snout protrudes.
- Two separated dorsal fins.

40. CYCLOPTERIDAE
Snailfishes

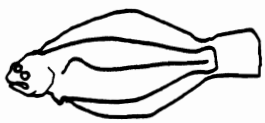
Larvae

Body short and deep.
Large pectoral fin bud.
Anus anterior.
Scattered melanophores on body, and a series melanophores along postanal region.

Juveniles

Body short, stubby, and cylindrical.
Pelvic fins modified into an adhering disc.
Pectoral fin wide and large.
Scaleless.

41. BOTHIDAE
Lefteye Flounders



Eggs

Spherical.
Oil globule present or absent.
Meroblastic cleavage.
Pelagic or demersal.

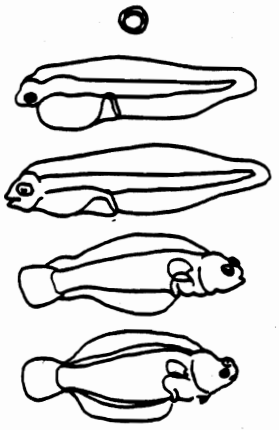
Larvae

Both thin, slender, bilaterally symmetrical, high finfolds.
Anus near thoracic region.
Long tail.
Gut coiled.

Juveniles

Body deep, flat, asymmetrical.
Eyes usually on left side.
Very elongate dorsal and anal fins, separated from caudal fin.

42. PLEURONECTIDAE
Righteye Flounders

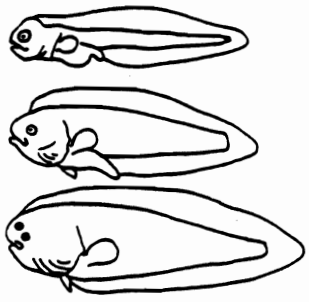


Eggs
- Spherical.
- Oil globule may be present.
- Meroblastic cleavage.
- Pelagic or demersal.

Larvae
- Body elongate, bilaterally symmetrical, high finfolds, pigmentation on body and finfolds.
- Anus midway or thoracic.
- Gut coiled.

Juveniles
- Body deep, flat, asymmetrical.
- Eyes usually on right side.
- Dorsal and anal fins elongated, separated from caudal fin.

43. CYNOGLOSSIDAE
Tonguefishes



Larvae
- Body thin, slender, high finfolds, pigmentation.
- Anus anterior or thoracic.
- Gut coiled.

Juveniles
- Body deep, flat, asymmetrical.
- Eyes on left side.
- Dorsal, caudal, and anal fins connected as one continuous fin.
- Gut elongated in early juveniles.
- Pectoral fin degenerate.