

Continued.



Smartweeds, Water Pepper (*Polygonum*) Plants inhabiting the shallow water of a pond, with lance-shaped, alternate leaves. At the base of each leaf is a sheath going around the stem and topped with long, fine hairs. The flowers are pink, white, or greenish and found in terminal spikes or on short, lateral spikes originating between the leaf and the stem. The seed is either triangular or lens-shaped in cross-section. These seeds are a choice food for ducks.

Lizardstail (*Saururus*)
Succulent herbs with jointed stems and alternate drooping heart-shaped leaves, found along the edges of the water. The long, nodding, white-flowered spike is present during the summer and easily distinguishes this plant.

Cattail (*Typha*)
Long, narrow, veinless, bluish-green leaves, sheathing at the base of the plant, and the familiar seed head are enough to identify this plant.

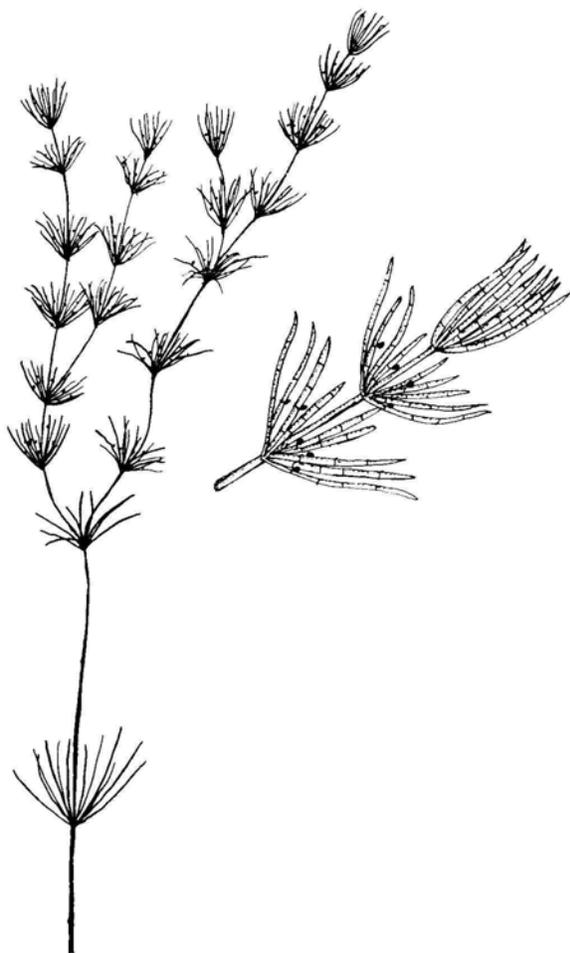
Arrow-arum (*Peltandra*) - Upper Left
The leaves are shaped like a barbed arrowhead and are borne on thick fleshy stems. The yellow "flowers" are enclosed in a green, partly opened, sac-like structure which terminates in a wrinkled tip. The skin of the fruit is green, purplish, or brown, and the seeds are enclosed in a gelatinous mass within the fruit.

Arrowhead (*Sagittaria*) - Upper Right
The leaves are highly variable, but are generally arrowhead-shaped, though the "barbs" may or may not be present, according to the species and water depth. The small white flowers are in whorls of three along the main stalk.

Pickerelweed (*Pontederia*) - Lower Left
The leaves are heart-shaped and are borne on thick stems. The flowers are bluish and found in a terminal spike.

Note: In the case where the flowers are absent, these plants may be differentiated by the veination of the leaves. See the illustration.

Figure B-7



Stoneworts Muskgrass (*Chara*)

Actually a higher form of perennial algae. The 6-12 leaves are cylindrical and arranged in whorls around the stems and branches. Stems, branches, and leaves are very brittle, and when crushed, emit a strong musk-like or "skunky" odor. The "fruit" or *oogonium* appears as small black dots scattered over the leaves of the plant. Variable in height but generally not reaching the surface of the water. All parts of the plant are eaten by waterfowl.

Simple assessment of bottom-dwelling insects (ref. A-2).

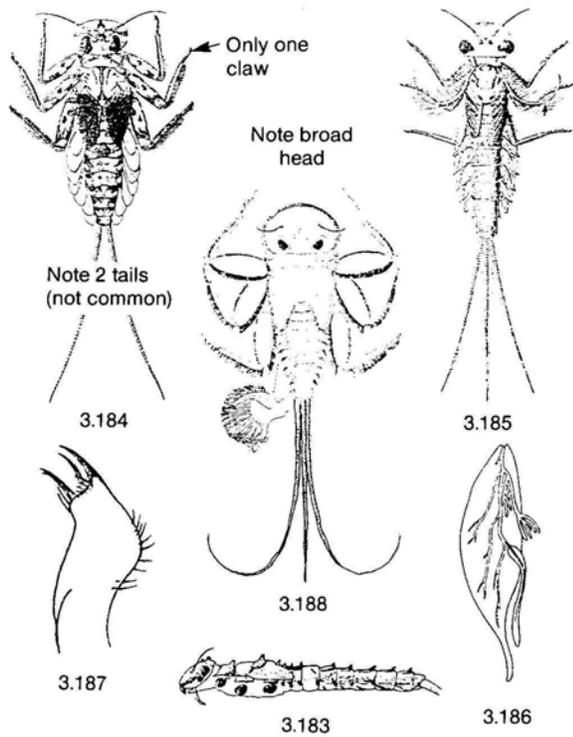
Immature forms of bottom-dwelling stream insects live primarily in riffles—shallow, swift-flowing portions of a watercourse. Two major groups of aquatic insects should be present in the upper watercourse reaches of all unpolluted waterways: mayflies (fig. B-8) and caddisflies (fig. B-9). Mayflies have a roachlike body, a thin hairlike tail, and six jointed legs. Caddisflies have a maggotlike body, no tail, and six jointed legs.

To sample these insects, use the following simple technique. Remove three stones from a shallow, swift-flowing portion of the watercourse. Each stone should be about six inches in diameter. Place the stones in a bucket filled with stream water. Brush the entire surface of each stone with your hands. If after carefully examining the surface of each, you are satisfied that no insects remain, then discard the stone. Pour the contents of the bucket through a white handkerchief. Count the number of mayflies and caddisflies. Using the following illustrations, identify and count the number of insects belonging to the various groups.

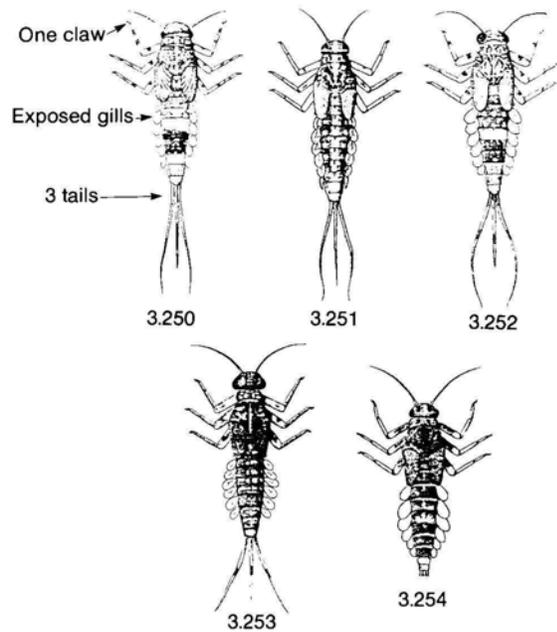
If both mayflies and caddisflies are absent from the watercourse, then the watercourse is severely polluted. If only mayflies *or* caddisflies are present, then the watercourse is probably moderately polluted. If both mayflies and caddisflies are present, along with stoneflies (fig. B-10), then the stream is probably in good-to-excellent condition. Stoneflies resemble mayflies in having a roachlike body, tail, and six jointed legs. Mayfly legs come to a fine point at the tips, whereas stonefly legs are tipped with two hooks or claws.

Insect larvae, which are tolerant of pollution and might be found in either clean or moderately polluted water, are blackflies, bloodworm midges (chironomids), rat-tailed maggots, and others. See also fig. A-4.

Mayflies (*Ephemeroptea*).



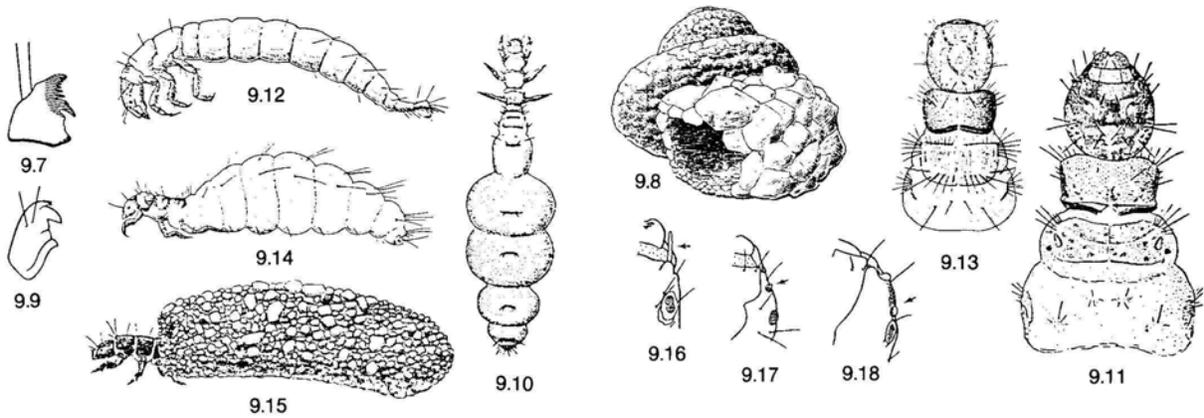
Figures 3.183 through 3.188. *Heptageniidae*. 3.183 *Spinadis*, lateral aspect (shown without legs and gills); nymph, dorsal aspect: 3.184 *Epeorus*, 3.185 *Arthroplea bipunctata*; 3.186 *Pseudiron*, gill of 3rd abdominal segment; *Anepeorus*: 3.187 mandible, 3.188 dorsal aspect and left abdominal gill (3.183 after Flowers and Hilsenhoff 1975; 3.184 through 3.186, 3.188, Illinois Natural History Survey, (INHS)).



Figures 3.250 through 3.254. *Baetidae*. *Baetis* nymph, dorsal aspect: 3.250 *B. macdunnoughi*, 3.251 *B. pygmaeus*, 3.252 *B. intercalaris*, 3.253 *B. propinquus*, 3.254 *B. tricaudatus* (all after Morihiro and McCafferty, 1979).

Figure B-9

Caddisflies (Tricoptera).

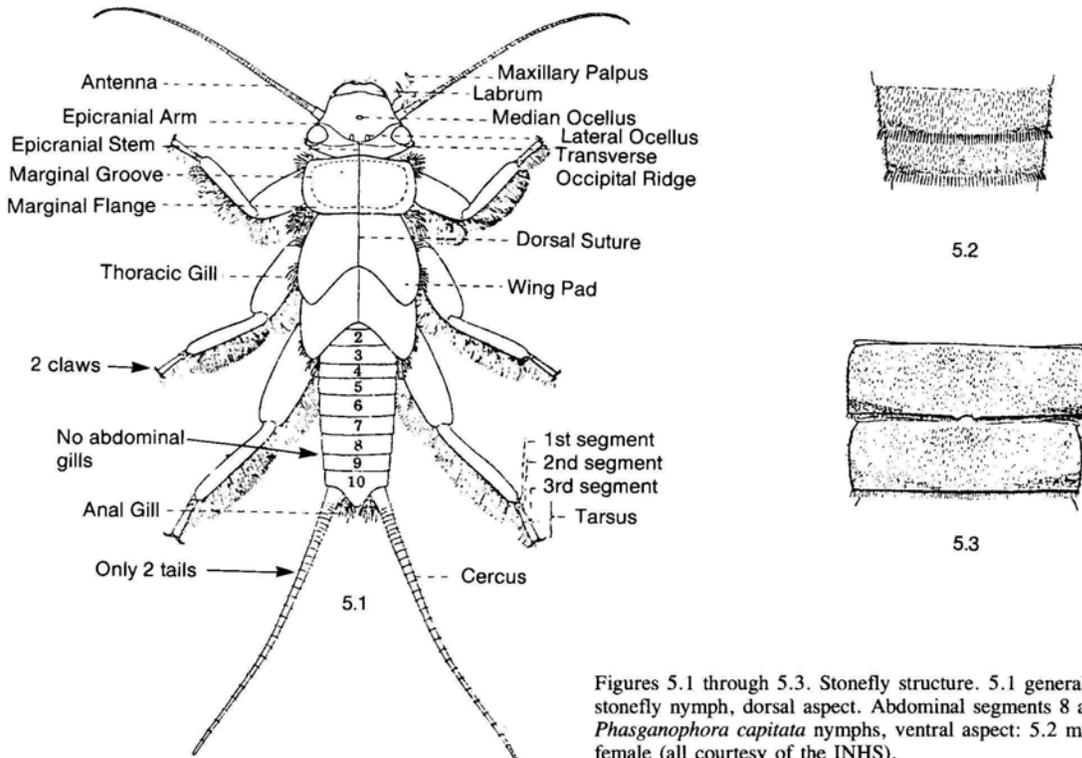


Figures 9.7 through 9.18. Family characters. *Helicopsyche borealis* larva: 9.7 anal claw, lateral aspect, 9.8 larval case; 9.9 *Brachycentrus*, anal claw of larva, lateral aspect; 9.10 *Leucotrichia pictipes* larva, dorsal aspect; 9.11 *Limnephilus submonilifer*, head and thorax of larva, dorsal aspect; 9.12

Polycentropus larva, lateral aspect; 9.13 *Lepidostoma*, head and thorax of larva, dorsal aspect; 9.14 *Hydroptila* larva, lateral aspect; 9.15 *Ochrotrichia* larva in purse case, lateral aspect; larval head, dorsal aspect: 9.16 *Leptoceris americanus*, 9.17 *Limnephilus*, 9.18 *Lepidostoma* (all INHS).

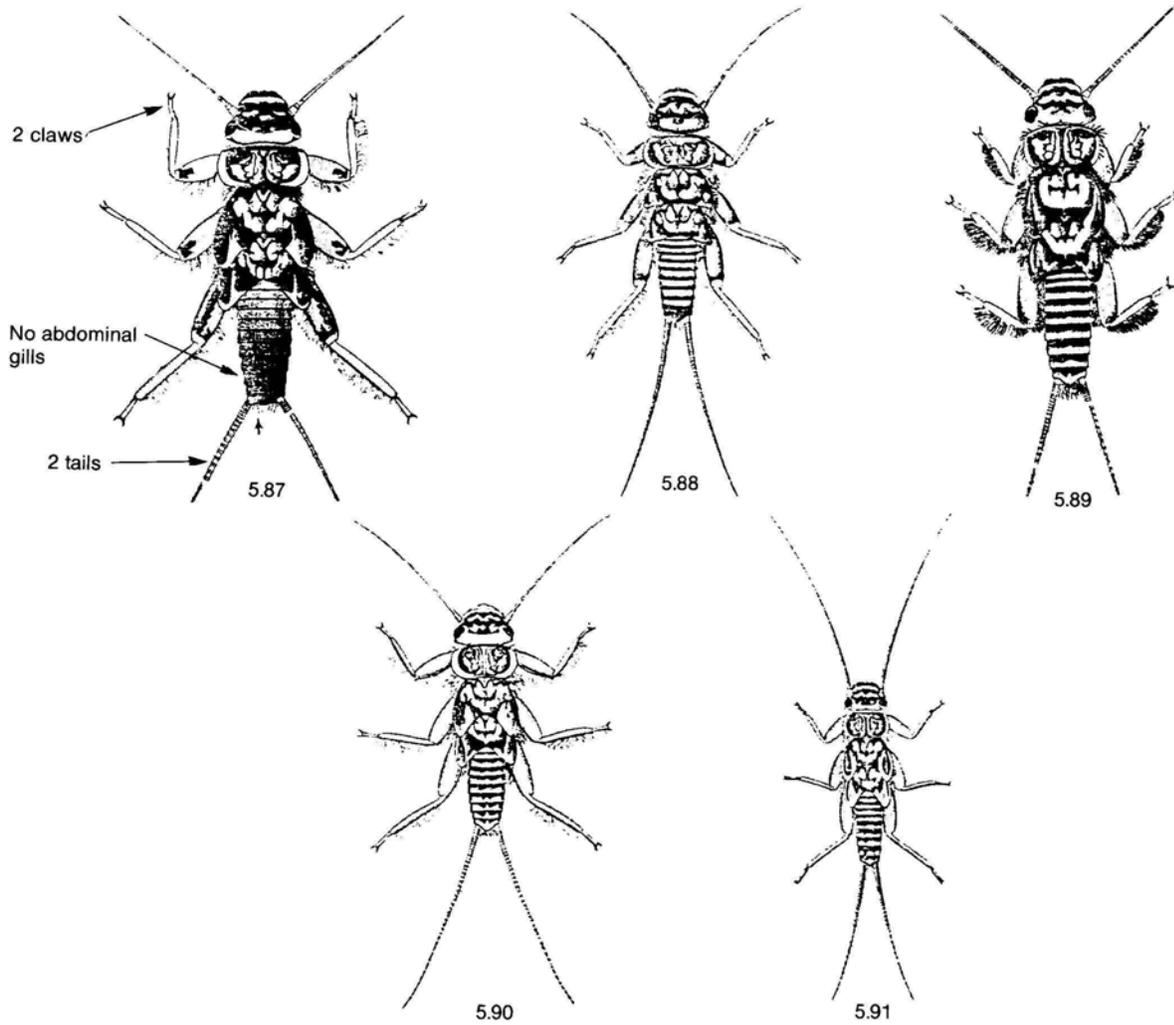
Figure B-10

Stoneflies (Plecoptera).



Figures 5.1 through 5.3. Stonefly structure. 5.1 generalized stonefly nymph, dorsal aspect. Abdominal segments 8 and 9 of *Phasganophora capitata* nymphs, ventral aspect: 5.2 male, 5.3 female (all courtesy of the INHS).

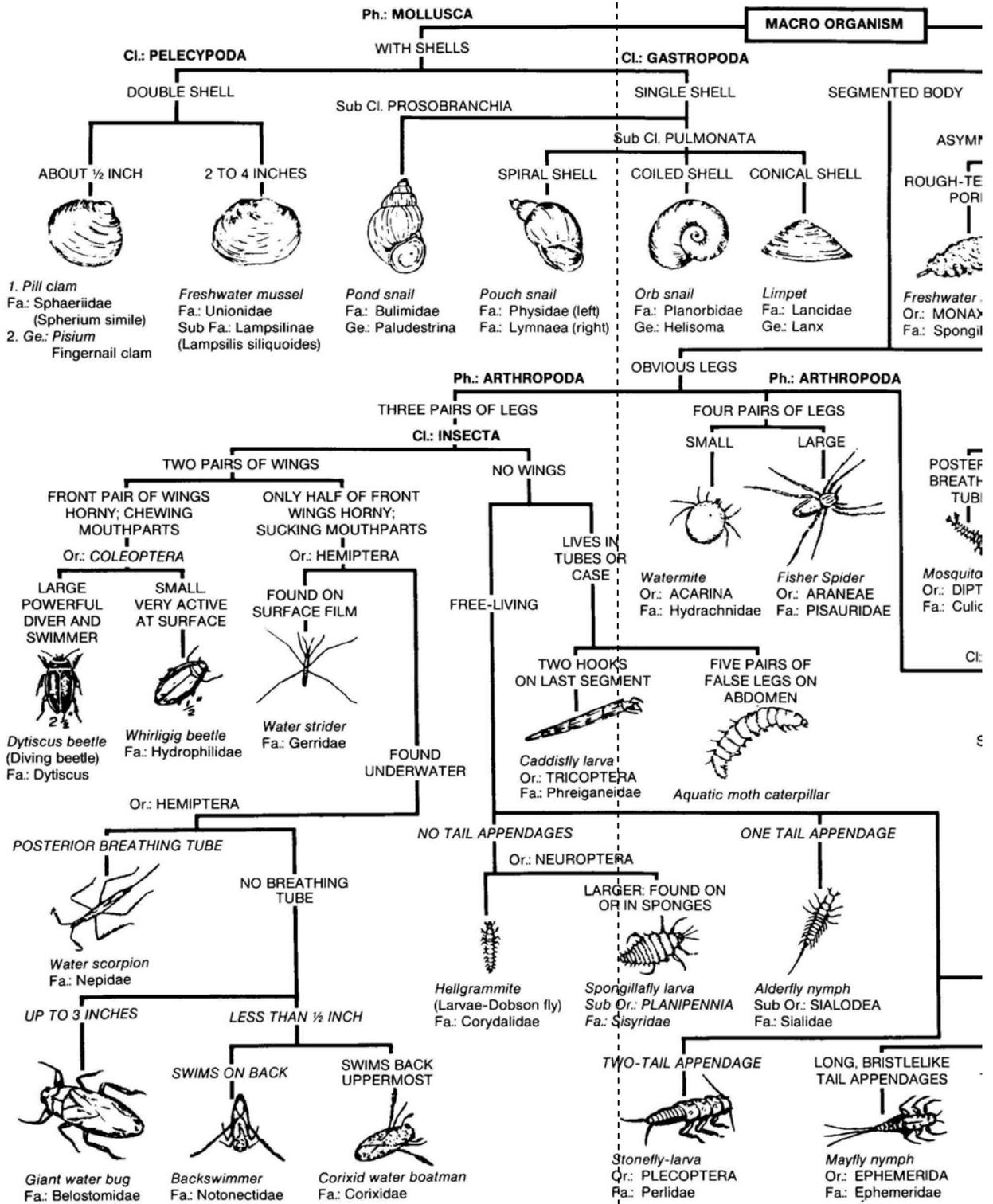
Stoneflies, continued.

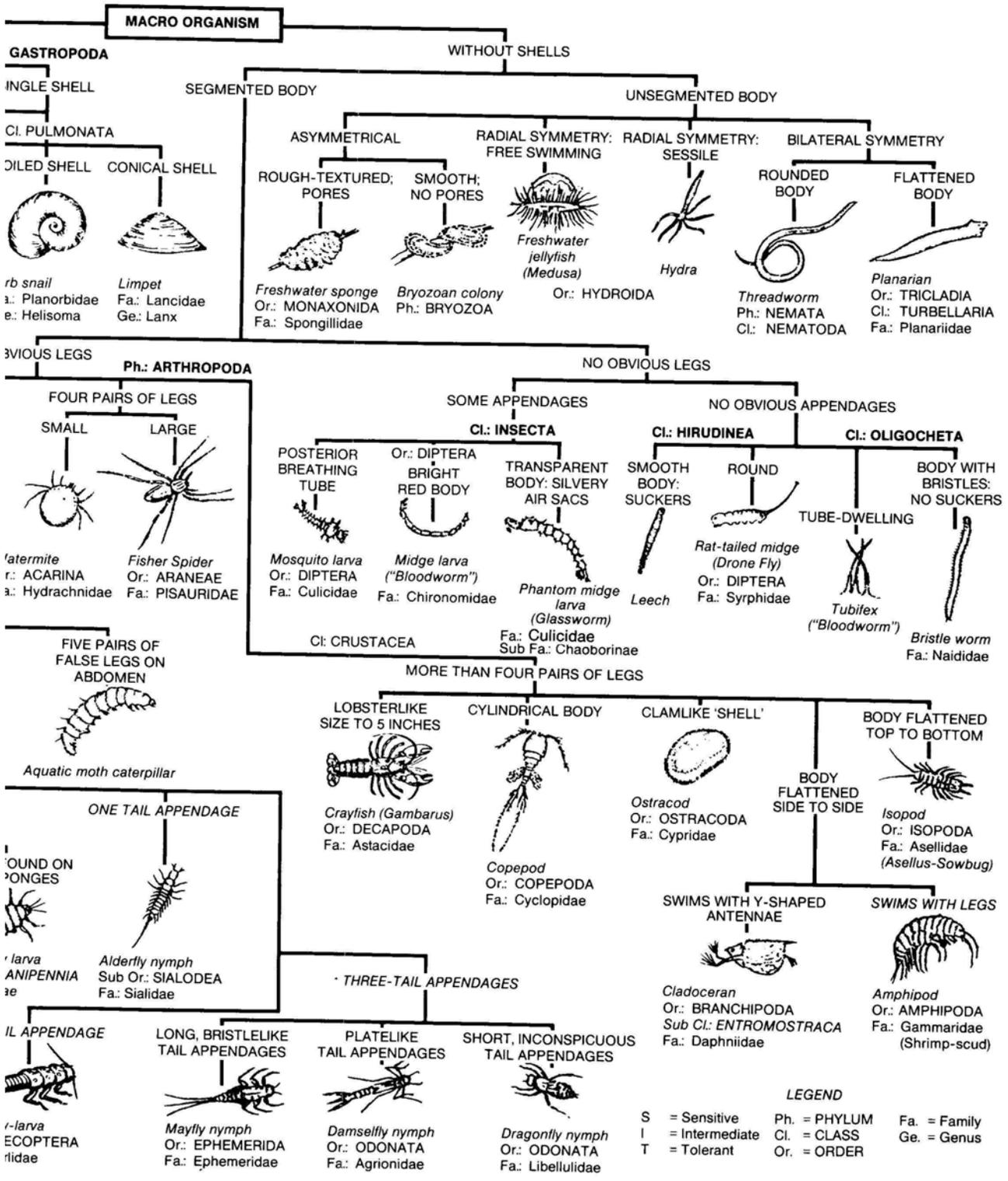


Figures 5.87 through 5.91. *Perlidae*. *Acroneuria* nymph, dorsal aspect: 5.87 *A. mela*, 5.88 *A. lycorias*, 5.89 *A. evoluta*, 5.90 *A. perplexa*, 5.91 *A. filicis* (all INHS).

Figure B-11

Key to the Major Invertebrate Species of Stream Zones.





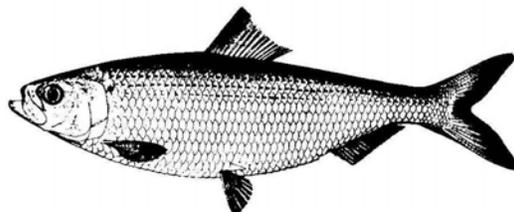
Some Common Freshwater Fishes (Ref. B-4).

***Alosa aestivalis* (Mitchill)**
Blueback herring

TYPE LOCALITY: New York (Mitchill 1815. Trans. Lit. Philos. Soc. N.Y. 1:355-492).

SYSTEMATICS: Formerly placed in *Pomolobus*, synonymized most recently under *Alosa* by Svetovidov (1964. Copeia: 118-30). Often confused with *A. pseudoharengus*.

Order Clupeiformes
Family Clupeidae



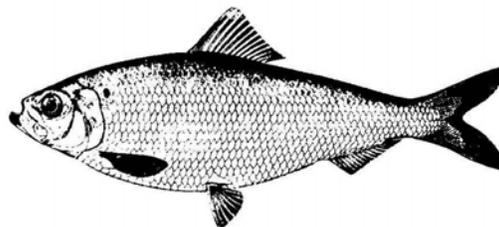
Washington, D.C., market ca. 23 cm SL (Jordan and Evermann 1900).

***Alosa pseudoharengus* (Wilson)**
Alewife

TYPE LOCALITY: Probably Delaware River at Philadelphia, Philadelphia Co., PA (Wilson ca. 1811 in *Rees' New Cyclopaedia* 9: no pagination).

SYSTEMATICS: Formerly placed in *Pomolobus*, most recently synonymized with *Alosa* (Svetovidov 1964. Copeia: 118-30). Often confused with *A. aestivalis*.

Order Clupeiformes
Family Clupeidae



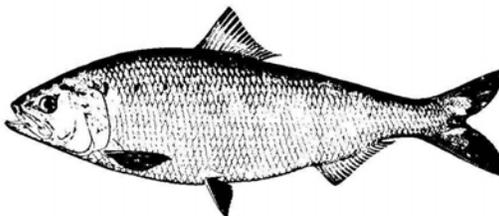
Washington, D.C., market ca. 26 cm SL (Jordan and Evermann 1900).

***Alosa sapidissima* (Wilson)**
American shad

TYPE LOCALITY: Probably Delaware River at Philadelphia, Philadelphia Co., PA (Wilson ca. 1811. in *Rees' New Cyclopaedia* 9: no pagination).

SYSTEMATICS: Forms geographically disjunct species pair with *A. alabamae* (Berry 1964. Copeia: 720-30). Meristic differences seen between spawning populations inhabiting various river systems (and their tributaries) along Atlantic coast (Carscadden and Leggett 1975. J. Fish. Res. Board Can. 32:653-60 and included references).

Order Clupeiformes
Family Clupeidae



VA: Norfolk, ca. 43 cm SL (Jordan and Evermann 1900).

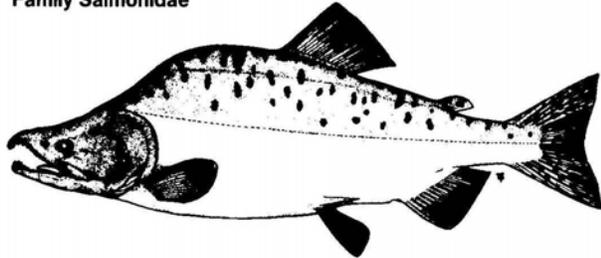
Continued.

***Oncorhynchus gorbuscha* (Walbaum)**
Pink salmon

TYPE LOCALITY: Rivers of Kamchatka, USSR (Walbaum in Artedi 1772. *Genera Piscium* 3:4-723).

SYSTEMATICS: Essentially unstudied, apart from Rounsefell's (1962. Fishery Bull. 62:237-70) work on relationships between *Oncorhynchus* species. Vladykov (1962. Bull. Fish. Res. Board Can. 136:1-172) compared pyloric caeca in specimens from North America and Japan. Taxonomic comparisons between even and odd year stocks seem warranted.

Order Salmoniformes
Family Salmonidae



ca. 53 cm SL (NMC).

***Oncorhynchus tshawytscha* (Walbaum)**
Chinook salmon

TYPE LOCALITY: Rivers of Kamchatka, USSR (Walbaum in Artedi 1792. *Genera Piscium* 3:4-723).

SYSTEMATICS: Broad meristic variation within species, but individual stocks usually uniform. Scott and Crossman (1973. *Freshwater Fishes of Canada*) provided comparison of variation between Pacific and introduced Lake Ontario populations.

Order Salmoniformes
Family Salmonidae



CA: Sacramento Co., American River, male, 64 cm SL (Moyle 1976).

***Salmo gairdneri* Richardson**
Rainbow trout

TYPE LOCALITY: Mouth of Columbia River at Fort Vancouver, WA (Richardson 1836. *Fauna Boreali-Americana*).

SYSTEMATICS: The "rainbow trout" is comprised of two major groups, coastal rainbow trouts and redband trouts. The redband trout, native to headwaters of McCloud River, CA, is closely related to the golden trout of Kern River drainage, CA, *S. aguabonita*. Oldest name for any member of redband trout group is *S. newberryi*. Oldest name applied to any member of either group is *S. mykiss*, proposed by Walbaum in 1792 for the Kamchakan trout. Many practical difficulties are involved if *gairdneri* becomes synonym of *mykiss*.

Order Salmoniformes
Family Salmonidae



(N.C. Wildl. Resour. Comm. and NCSM)

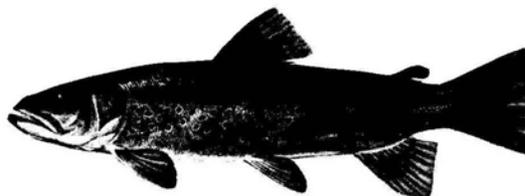
***Salmo trutta* Linnaeus**
Brown trout

TYPE LOCALITY: "Europe" (Linnaeus 1758. *Systema naturae*, Laurentii Salvii, Holmiae, 10th ed., 1:1-824).

SYSTEMATICS: Subgenus *Salmo*. Rather variable within native range and number of subspecies recognized. Hybridizes with *Salvelinus fontinalis* in nature (hybrids called "tiger trout") and artificially hybridized with other salmonids (Scott and Crossman 1973. *Freshwater Fishes of Canada*; Buss and Wright 1958. *Trans. Am. Fish. Soc.* [1957] 87:172-81).

Order Salmoniformes
Family Salmonidae

EXOTIC



(N.C. Wildl. Resour. Comm. and NCSM)

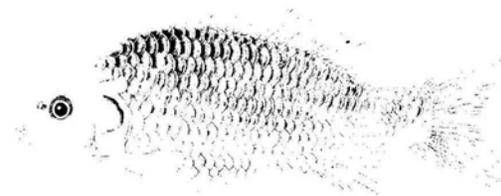
***Cyprinus carpio* Linnaeus**
Common carp

TYPE LOCALITY: Europe (Linnaeus 1758. *Systema naturae*, Laurentii Salvii, Holmiae 10th ed., 1:1-824).

SYSTEMATICS: Subfamily Cyprininae, which does not include native North American cyprinids. Hybridizes with goldfish, *Carassius auratus*, another exotic cyprinine (Scott and Crossman 1973. *Freshwater Fishes of Canada*). Hubbs (*in Blair* [ed.] 1961. *Vertebrate Speciation: A Symposium*.) discussed Asiatic genus *Carassiops*, possibly of ancient hybrid origin between *C. carpio* and *C. auratus*.

Order Cypriniformes
Family Cyprinidae

EXOTIC



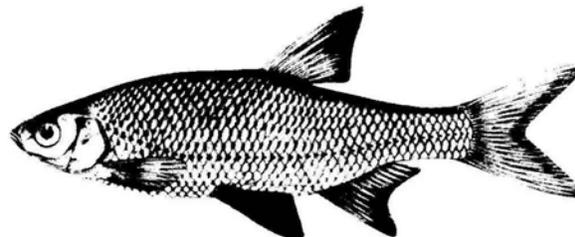
MD: Charles Co., Community Lake, 151 mm SL (NCSM).

***Notemigonus crysoleucas* (Mitchill)**
Golden shiner

TYPE LOCALITY: New York (Mitchill 1814. *Rept. on Fishes of New York*: 1-30).

SYSTEMATICS: Possibly more closely related to certain Eurasian cyprinids than to any North American group (Gosline 1974. *Jap. J. Ichthyol.* 21: 9-15). Three subspecies have been recognized—*N. c. crysoleucas* in northeast, and *N. c. auratus* and *N. c. bosci* in south—but recent authors have not considered these valid. Variation in anal fin ray count appears to be influenced by water temperature during development (Hubbs 1921. *Trans. Ill. State Acad. Sci.* 11: 147-51; Schultz 1927. *Pap. Mich. Acad. Sci. Arts Letts.* [1926] 7:417-32). Scott and Crossman (1973. *Freshwater Fishes of Canada*) discussed and provided additional data on geographic variation in this character.

Order Cypriniformes
Family Cyprinidae



MD: Anne Arundel Co., Lake Waterford, 101 mm SL (NCSM).

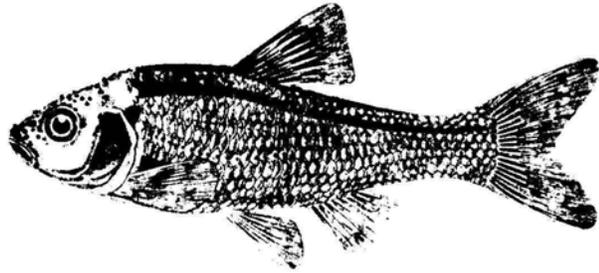
Continued.

***Notropis cornutus* (Mitchill)
Common shiner**

TYPE LOCALITY: Wallkill River, 4.8 km sw of New Paltz, Ulster Co., NY (Mitchill 1817. Am. Mon. Mag. Crit. Rev. 1:289-90).

SYSTEMATICS: Subgenus *Luxilus*, Gilbert (1964. Bull. Fla. State Mus. Biol. Sci. 8:95-194) reviewed systematics of species. Hybridizes extensively with *N. chrysocephalus* (Gilbert 1961. Copeia:181-92). Based on blood protein patterns Menzel (1976. Biochem. Syst. Ecol. 4:281-93) considered *N. cornutus* and *N. chrysocephalus* as subspecies. *N. albeolus* is also closely related to *N. cornutus* and replaces it on middle Atlantic coast.

**Order Cypriniformes
Family Cyprinidae**



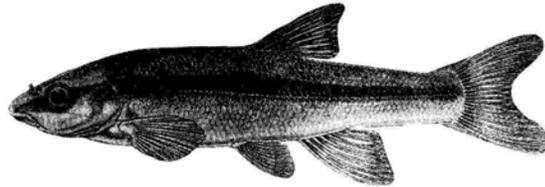
MD: Harford Co., Swan Creek, male, 88 mm SL (NCSM).

***Rhinichthys atratulus* (Hermann)
Blacknose dace**

TYPE LOCALITY: "North America" (Hermann 1804. Observations Zoologicae, quibus novae complures, aliaeque anamaliium species descibuntur et illustrantur 31:1-332).

SYSTEMATICS: Three subspecies distributed about as follows: *R. a. atratulus* on Atlantic slope; *R. a. meleagris* in central and northern interior; and *R. a. obtusus* (including nominal form *simus*) from lower Ohio basin to upper Mobile drainage (Hubbs 1936. Copeia: 124-25; Matthews et al. ms). Matthews et al. (1979. Abstr. 59th Ann. ASIH meetings) discussed intergradation between *R. a. atratulus* and *R. a. obtusus* in James River drainage, VA.

**Order Cypriniformes
Family Cyprinidae**



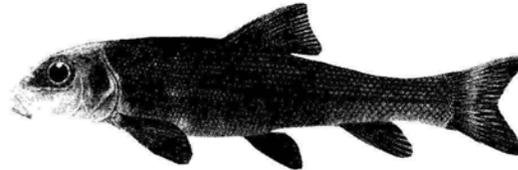
MD: Charles Co., Zekiah Swamp, 51 mm SL (NCSM).

***Catostomus commersoni* (Lacepede)
White sucker**

TYPE LOCALITY: None given (Lacepede 1803. *Histoire Naturelle Poissons* 5:1-803).

SYSTEMATICS: No comprehensive analysis of systematics over entire range published, although numerous dwarf populations have received individual recognition (McPhail and Lindsey 1970. *Freshwater Fishes of Northwestern Canada and Alaska*). Beamish and Crossman (1971. J. Fish. Res. Board Can. 34:371-78) concluded dwarf form *C. commersonii utawana* not valid subspecies. Metcalf (1966. Univ. Kans. Publ. Mus. Nat. Hist. 17:23-189) suggested that three geographical forms from eastern, Plains, and Hudson Bay drainages existed in past.

**Order Cypriniformes
Family Catostomidae**



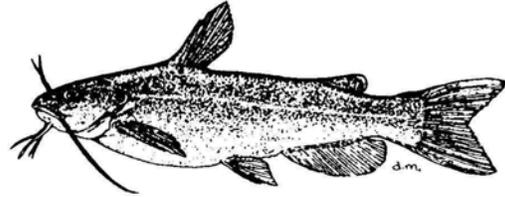
MD: Frederick Co., Glade Creek, 96 mm SL (NCSM).

***Ictalurus catus* (Linnaeus)**
White catfish

TYPE LOCALITY: "Northern part of America" (Linnaeus 1758. *Systema naturae* Laurentii Salvii, Holmiae, 10 ed., 1:1-824).

SYSTEMATICS: No definitive study; no subspecies recognized. Phylogenetic relationships to other ictalurids presented by Taylor (1969. U.S. Natl. Mus. Bull. 282:1-315).

Order Siluriformes
Family Ictaluridae



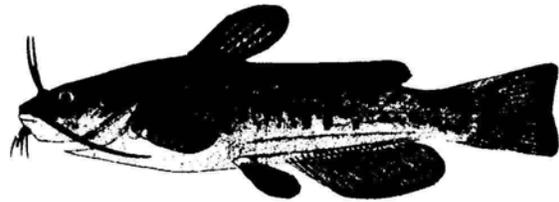
CA: Lake Co., Clear Lake, 11 cm SL (Moyle 1976).

***Ictalurus melas* (Rafinesque)**
Black bullhead

TYPE LOCALITY: "Ohio River" (Rafinesque 1820. Q. J. Sci. Lit. Arts 9:48-55).

SYSTEMATICS: Two subspecies sometimes recognized: *I. melas catus* from Gulf coast states and northern Mexico, and *I. m. melas* from farther north (Smith 1979. *The Fishes of Illinois*; Scott and Crossman 1973. *Freshwater Fishes of Canada*). List of synonyms provided by Scott and Crossman (1973). Phylogenetic relationships with other ictalurids presented by Taylor (1969. U.S. Natl. Mus. Bull. 282:1-315), and Lundberg (1975. Univ. Mich. Mus. Zool. Pap. Paleo. 11).

Order Siluriformes
Family Ictaluridae



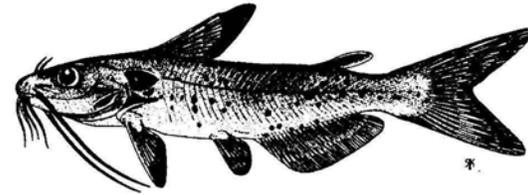
MD: Anne Arundel Co., Annapolis Reservoir, 99 mm SL (NCSM).

***Ictalurus punctatus* (Rafinesque)**
Channel catfish

TYPE LOCALITY: "Ohio River" (Rafinesque 1818. Am. Mon. Mag. Crit. Rev. 3:354-56).

SYSTEMATICS: Bailey et al. (1954. Proc. Acad. Nat. Sci. Phila. 106:109-64) discussed geographic and clinical variation but did not recognize subspecies. Possibly name-worthy forms were originally present, but situation has become greatly (perhaps hopelessly) confused by extensive introductions within and outside original range. Several closely related Mexican species, but precise relationships yet to be delineated. Most closely related United States species is *I. lupus* of TX and Mexico. Phylogenetic relationship to other ictalurids presented by Taylor (1969. U.S. Nat. Mus. Bull. 282:1-315).

Order Siluriformes
Family Ictaluridae



MD: Cecil Co., Susquehanna River, 127 mm SL (NCSM).

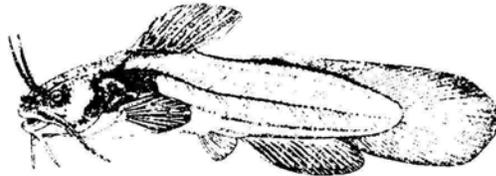
Continued.

***Noturus gyrinus* (Mitchill)**
Tadpole madtom

TYPE LOCALITY: Wallkill River, NY (Mitchill 1817. *Am. Monthly Mag. Crit. Rev.* 1:289-90).

SYSTEMATICS: Subgenus *Schilbeodes*. Appears to be most closely related to *N. lachneri* (Taylor 1969. *U.S. Natl. Mus. Bull.* 282:1-315).

Order Siluriformes
Family Ictaluridae



MD: St. Mary's Co., St. Mary's River (NCSM)

***Morone saxatilis* (Walbaum)**
Striped bass

TYPE LOCALITY: "New York" (Walbaum in Artedi 1792. *Genera Piscium* 3:4-723).

SYSTEMATICS: Appears in earlier literature as *Roccus lineatus*. Whitehead and Wheeler (1966. *Ann. Mus. Civ. Stor. Nat. Genova* 76:23-41) showed that *Morone* has priority over *Roccus*.

Order Perciformes
Family Percichthyidae



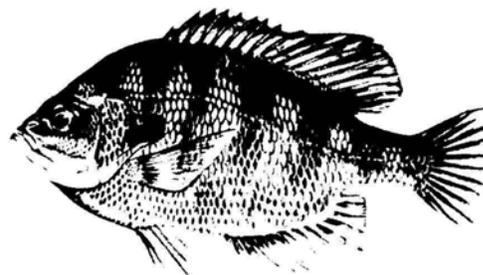
(N.C. Wildl. Resour. Comm. and NCSM)

***Lepomis macrochirus* Rafinesque**
Bluegill

TYPE LOCALITY: "Ohio River" (Rafinesque 1819. *J. Physique* 88:417-29).

SYSTEMATICS: Three subspecies are recognized. *Lepomis m. macrochirus* occurs in the Great Lakes and north Mississippi basin, *L.m. speciosus* in TX and Mexico and *L.m. purpurescens* on the Atlantic slope from coastal VA to FL (Hubbs and Lagler 1964. *Fishes of the Great Lakes Region*). Widespread introductions have resulted in extensive mixing of these gene pools. Avise and Smith (1974. *Evolution* 28:42-56) studied geographic variation and subspecific intergradation, and Avise and Smith (1977. *Syst. Zool.* 26:319-35) studied relationships to other centrarchid species using electrophoretic data. Commonly hybridizes with several other species of *Lepomis*, particularly in areas of ecological disturbance. Considered to be most closely related to *L. humilis* (Branson and Moore 1962. *Copeia*:1-108).

Order Perciformes
Family Centrarchidae



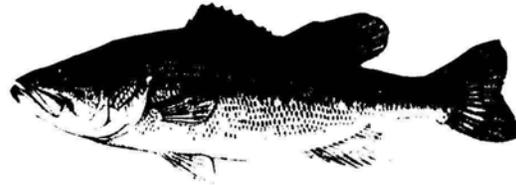
(N.C. Wildl. Resour. Comm. and NCSM)

***Micropterus salmoides* (Lacepede)
Largemouth bass**

TYPE LOCALITY: "les rivieras de le carolina"; Charleston, SC, regarded as probable type locality (Lacepede 1802. *Histoire Naturelle des Poissons* 4:1-728).

SYSTEMATICS: Subfamily Lepominae, tribe Micropterini. Formerly placed in monotypic genus *Huro* (Hubbs 1926. Misc. Publ. Mus. Zool. Univ. Mich. 15:1-77; Hubbs and Bailey 1940. Misc. Publ. Mus. Zool. Univ. Mich. 48:1-51). Hubbs and Bailey (1940) reviewed systematics, and Bailey and Hubbs (1949. Occas Pap. Mus. Zool. Univ. Mich. 516:1-40) defined and mapped distinctive subspecies, *M. s. floridanus*, endemic to peninsular FL.

Order Perciformes
Family Centrarchidae



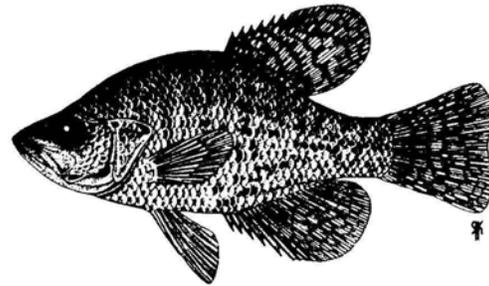
(N.C. Wildl. Resour. Comm. and NCSM)

***Pomoxis annularis* Rafinesque
White crappie**

TYPE LOCALITY: "Ohio River" (Rafinesque 1818. Am. Mon. Mag. Crit. Rev. 4:39-42).

SYSTEMATICS: Subfamily Centrarchinae, tribe Centrarchini. Branson and Moore (1962. Copeia: 1-108) studied morphology of acoustic-lateralis system and determined closest generic relationships to be with *Centrarchus*. Avise et al. (1977. Copeia: 250-58), based on electrophoretic data, suggested relationships might be closer to *Lepomis* and *Micropterus*, subfamily Lepominae. Bailey (1938. Ph.D. diss., Univ. Michigan) reviewed systematics. Known to hybridize naturally with *P. nigromaculatus*; artificially crossed with other genera (Schwartz 1972. Publ. Gulf Coast Res. Lab. Mus. 3:1-328).

Order Perciformes
Family Centrarchidae



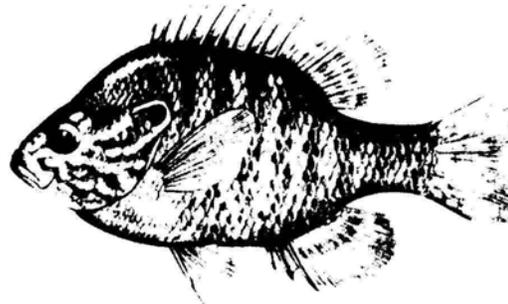
MD: Garrett Co., Piney Creek, 165 mm SL (NCSM).

***Lepomis megalotis* (Rafinesque)
Longear sunfish**

TYPE LOCALITY: Kentucky, Licking, and Sandy rivers, KY (Rafinesque 1820. *Ichthyologia Ohiensis*).

SYSTEMATICS: Closest relative *L. marginatus*, these two species comprising subgenus *Ichthelis*. Hybridizes extensively with other *Lepomis*. Most polytypic member of family Centrarchidae, consisting of from four to six subspecies. Presently under study by compiler.

Order Perciformes
Family Centrarchidae



(NMC)

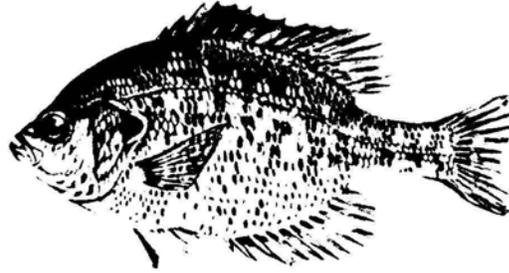
Continued.

***Lepomis microlophus* (Günther)**
Redear sunfish

TYPE LOCALITY: St. Johns River, FL (Günther 1859. *Catalogue of the Fishes in the British Museum* 1:1-524).

SYSTEMATICS: Bailey (1938. Ph.D. diss., Univ. Michigan) concluded that *L. microlophus* comprises two distinct subspecies. Extensive introductions of stocks into ranges of each other have obscured natural relationships. Avise and Smith (1977. *Syst. Zool.* 26:319-35) on basis of electrophoretic data determined that most closely related species of *Lepomis* likely are *L. megalotis* and *L. marginatus*.

Order Perciformes
Family Centrarchidae



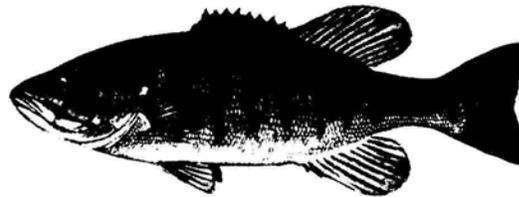
(N.C. Wildl. Resour. Comm. and NCSM)

***Micropterus dolomieu* Lacepede**
Smallmouth bass

TYPE LOCALITY: None given (Lacepede 1802. *Histoire Naturelle des Poissons* 4:1-728).

SYSTEMATICS: Hubbs and Bailey (1940. *Misc. Publ. Mus. Zool. Univ. Mich.* 48:1-51) recognized two subspecies: *M. d. dolomieu* east of Mississippi River and from central MO north; and *M. d. velox* from middle Arkansas River drainage. Intergrades identified from White and Black river drainages, AR and MO, and Ouachita River system, AR. Widely introduced and genetic integrity of original stocks may no longer be valid. Summary of nomenclature in Scott and Crossman (1973. *Freshwater Fishes of Canada*).

Order Perciformes
Family Centrarchidae



(N.C. Wildl. Resour. Comm. and NCSM)

***Pomoxis nigromaculatus* (Lesueur)**
Black crappie

TYPE LOCALITY: Wabash River, OH (Lesueur in Cuvier and Valenciennes 1829. *Histoire Naturelle des Poissons* 3:1-500).

SYSTEMATICS: Subfamily Centrarchinae, tribe Centrarchini. Branson and Moore (1962. *Copeia*:1-108) studied morphology of acoustico-lateralis system and determined closest generic relationships to be with *Centrarchus*. Avise et al. (1977. *Copeia*: 250-58), based on electrophoretic data, suggested relationships might be closer to *Lepomis* and *Micropterus*, subfamily Lepominae. Bailey (1938. Ph.D. diss., Univ. Michigan) reviewed systematics. Known to hybridize naturally with *P. annularis*; artificially crossed with other genera (Schwartz 1972. *Publ. Gulf Coast Res. Lab. Mus.* 3:1-328).

Order Perciformes
Family Centrarchidae



(N.C. Wildl. Resour. Comm. and NCSM)

Figure B-12

***Cottus bairdi* Girard**
Mottled sculpin

TYPE LOCALITY: Mahoning River, OH (Girard 1850. Proc. Am. Assoc. Adv. Sci. [1849]:409-11).

SYSTEMATICS: Bailey and Bond (1963. Occas. Pap. Mus. Zool. 634:1-27) presented summary of species included in *C. bairdi* group. Considerable geographic variation throughout wide range of species, and overall systematic picture unresolved. Some populations classified as *C. bairdi* may be distinct species. Scott and Crossman (1973. *Freshwater Fishes of Canada*) noted that Canadian populations have received insufficient attention for subspecific recognition. Robins (1954. Ph.D. diss., Cornell Univ.) studied systematics in eastern United States. McAllister (1964. J. Fish. Res. Board Can. 21:1339-42) discussed separation of *C. bairdi* from *C. cognatus*.

Order Perciformes
Family Cottidae



(NCSM)

Detection of *Escherichia coli* in water samples. The presence of *E. coli* is detected by the following procedure:

A water sample is collected in a sterile bottle and poured into a filtering apparatus. When water is drawn through a sterile filter, the bacterial contaminants are left behind on a piece of filter paper. This filter paper is placed in a sterile Petri plate containing a nutrient broth, which the bacteria will use to grow. The plate is incubated at 35 degrees C for 24 hours. Portable incubators are available that run off a car's cigarette lighter and can be used until a source of electricity is available. By the end of this 24-hour period, individual *E. coli* organisms have divided to produce metallic-green colonies visible to the naked eye. The log, or geometric mean of 200 fecal coliform colonies per five 100 ml samples collected over 30 days, is the allowable limit for fresh waters used for swimming. See *Standard Methods for the Examination of Water and Wastewater* (1985) for details (ref. B-5).