

Artificial Key to the Families of Fishes in Minnesota

Adapted from

Eddy, Samuel and James C. Underhill. 1974. Northern Fishes. University of Minnesota Press, Minneapolis.

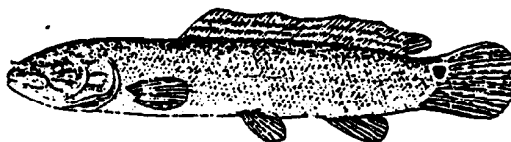
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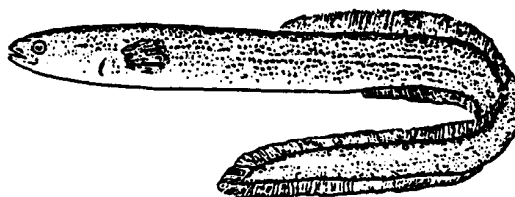
- 1a. Mouth a sucker-like disk without jaws; paired fins absent; single, median nostril; 7 distinct gill openings on each side of head **I. Petromyzontidae**
- b. Mouth with jaws; at least one set of paired fins present; paired nostrils on snout; single gill opening on each side of head 2
- (1b.) 2a. Tail heterocercal or modified heterocercal 3
- b. Tail homocercal 6
- (2a.) 3a. Tail heterocercal, the dorsal and ventral lobes of the caudal fin clearly distinguishable from one another; mouth subterminal; body lacking a complete covering of scales 4
- b. Tail modified heterocercal, the caudal fin appearing more or less as one rounded fin; mouth terminal; body fully covered in scales 5
- (3a.) 4a. Long paddle-like snout, with two small barbels anterior to mouth; gill covers long and pointed posteriorly; body naked except for a few scales on tail **Polyodontidae--paddlefish, *Polyodon spathula* (Walbaum)**



- b. Rounded or scoop-shaped snout, with four large barbels anterior to mouth; gill covers rounded posteriorly; body with several rows of bony plates **II. Acipenseridae**
- (3b.) 5a. Jaws very long and beak-like; no large bony plate (gular bone) on ventral surface of head between lower jaw bones; dorsal fin base shorter than height of fin; scales rhombic ganoid **III. Lepisosteidae**
- b. Jaws normal; large bony plate (gular bone) on ventral surface of head between lower jaw bones; dorsal fin base many times longer than height of fin; scales cycloid **Amiidae--bowfin, *Amia calva* Linnaeus**

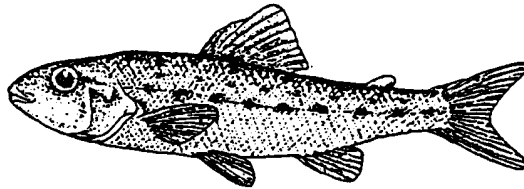


- (2b.) 6a. Pelvic fins absent; dorsal, caudal, and anal fins continuous **Anguillidae--American eel, *Anguilla rostrata* (Lesueur)**

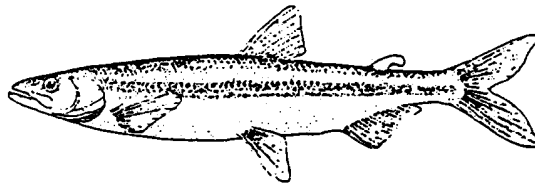


- b. Pelvic fins present; dorsal, caudal, and anal fins never continuous 7

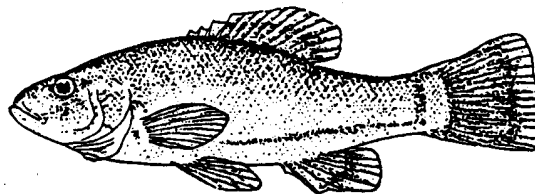
- (6b.) 7a. Adipose fin present 8
 b. Adipose fin absent 11
- (7a.) 8a. Several barbels present around mouth; stout spines present on pectoral fins VIII. Ictaluridae
 b. Barbels absent around mouth, although single barbel may be present on chin;
 stout spines not present on pectoral fins..... 9
- (8b.) 9a. Pelvic axillary process present X. Salmonidae
 b. Pelvic axillary process absent 10
- (9a.) 10a. Scales ctenoid (feel rough when rubbed from tail to head); anterior base of pelvic
 fin below middle of pectoral fin
 Percopsidae--trout perch, *Percopsis omiscomaycus* (Walbaum)



- b. Scales cycloid (feel smooth when rubbed from tail to head); anterior base of pelvic
 fin entirely behind pectoral fin
 Osmeridae--rainbow smelt, *Osmerus mordax* (Mitchill)

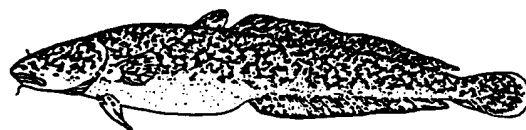


- (10b.) 11a. Anus in adult anterior to the pectoral fins, between pelvic fins in juveniles
 Aphredoderidae--pirate perch, *Aphredoderus sayanus* (Gilliams)



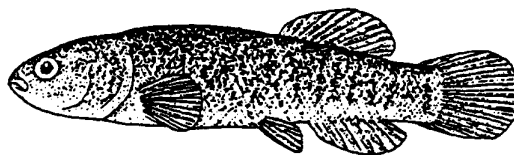
- b. Anus directly anterior to the anal fin 12

- (11b.) 12a. Single barbel under chin; dorsal and anal fins extending over nearly half of the
 body length Lotidae--burbot, *Lota lota* (Linnaeus)

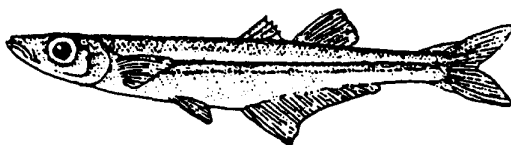


- b. No barbel under chin; dorsal and anal fins not extending over nearly half of the
 body length 13

- (12b.) 13a. Body appears scaleless, although some tiny spines or prickles may be present 14
 b. Body with scales clearly visible..... 15
- (13a.) 14a. Dorsal spines separate, not connected to each other by a membrane; no prickles
 on body XII. Gasterosteidae
 b. Dorsal connected by a memberane; prickles on body XVI. Cottidae
- (13b.) 15a. Dorsal fin single, without spines or with 1 saw-toothed hard ray 16
 b. Dorsal either divided into two parts or, if single, with 4 or more sharp spines ... 23
- (15a.) 16a. Caudal fin rounded 17
 b. Caudal fin indented or forked 18
- (16a) 17a. Premaxillaries nonprotractile; origin of dorsal fin slightly posterior to the pelvic
 fin base..... Umbridae--central mudminnow, *Umbra limi* (Kirtland)

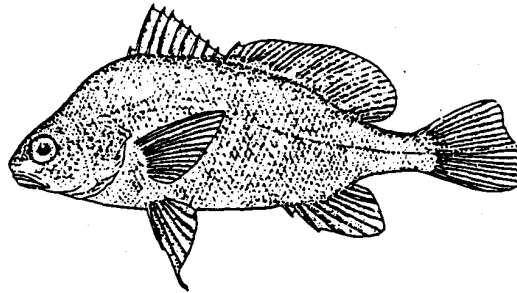


- b. Premaxillaries protractile; origin of dorsal fin near or behind the margins of the
 pelvic fins XI. Fundulidae
- (16b.) 18a. Gill membranes free from the isthmus (may have a flap of skin over them but not
 attached to them) and extending forward to or in front of the eye 19
 b. Gill membranes attached to the isthmus distinctly behind the eye 21
- (18a.) 19a. Jaws elongated, shaped like a duck's bill; scales on opercle; pelvic axillary process
 absent IX. Esocidae
 b. Jaws not elongated; scales absent from opercle; pelvic axillary process present ... 20
- (19b.) 20a. Lateral line present; part of belly sharp but without sawtoothed margin
 IV. Hiodontidae
 b. Lateral line absent; belly with sawtoothed margin V. Clupeidae
- (16b.) 21a. Single dorsal fin with 1 stout, hard rayVI. Cyprinidae, in part
 b. Single dorsal fin without a hard ray 22
- (21b.) 22a. Principal dorsal rays 8-9; depressed anal fin does not reach to base of caudal fin;
 pharyngeal teeth in 1 or 2 rows with 6 or fewer in primary row
 VI. Cyprinidae
 b. Principal dorsal rays 10 or more; depressed anal fin reaches to base of caudal fin
 or beyond; pharyngeal teeth in 1 row with 20 or more teeth.. VII. Catostomidae
- (15b.) 23a. Anal soft rays 20 or more; dorsal fin divided into two distinctly separate parts,
 first is small with 3 to 8 flexible spines, second is much larger with soft
 rays only ..Atherinidae--brook silverside, *Labidesthes sicculus* (Cope)



- b. Anal soft rays 18 or fewer; dorsal fin single, notched or barely separated in to
 two parts 24

- (23b.) 24a. Anal spines, 2 or fewer 25
 b. Anal spines, 3 or more, first spine sometimes rudimentary 26
- (24a) 25a. Spinous and soft-rayed portions of dorsal fin distinctly divided; soft dorsal fin with fewer than 22 rays; lateral line does not extend onto caudal fin XV. Percidae
 b. Spinous and soft-rayed portions of dorsal fin confluent; soft dorsal fin with 24 or more rays; lateral line extends onto caudal fin
 Sciaenidae--freshwater drum, *Aplodinotus grunniens* Rafinesque



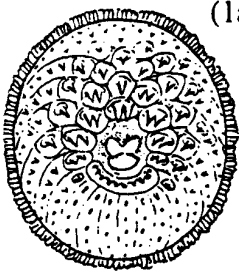
- (24b.) 26a. Without longitudinal dark stripes on side of body or with only one stripe; posterior edge of operculum lacks sharp spine XIV. Centrarchidae
 b. With 5 or more dark longitudinal stripes, usually distinct, on side of body; operculum terminates with a sharp spine XIII. Moronidae

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I. Key to the Species of Petromyzontidae

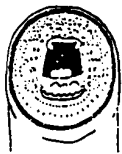
- 1a. Dorsal fin separated into two distinct lobes, either completely divided or notched to the body musculature (Fig. 1) 2
 b. Dorsal fin continuous, not separated (Fig.2) 3



- (1a.) 2a. Oral disk with three radiating rows of well-developed teeth; supraoral teeth not widely separated (Fig. 3a) sea lamprey, *Petromyzon marinus* Linnaeus



- b. Oral disk with only teeth scattered and most poorly developed; supraoral teeth widely separated (Fig. 4a)
 American brook lamprey, *Lampetra appendix* (DeKay)

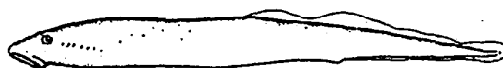


- (1b.) 3a. Posterior portion of oral disk with well-developed teeth (Fig. 3b, c) 4
 b. Posterior portion of oral disk with poorly developed teeth (Fig. 4b, c) 5

- (3a.) 4a. Most circumoral teeth with 2 large, pointed cusps (Fig. 3b)
 chestnut lamprey, *Ichthyomyzon castaneus* Girard



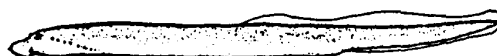
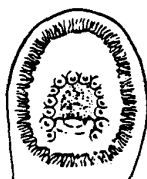
- b. All circumoral teeth with only 1 pointed cusp (Fig. 3c)
 silver lamprey, *Ichthyomyzon unicuspis* Hubbs & Trautman



- (3b.) 5a. Circumoral teeth moderately developed with 1 or 2 pointed cusps (Fig. 4b)
 southern brook lamprey, *Ichthyomyzon gagei* Hubbs & Trautman



- b. All disk teeth poorly developed; circumorals with one low, blunt cusp (Fig. 4c)
 northern brook lamprey, *Ichthyomyzon fossor* Reighard & Cummins



II. Key to the Species of Acipenseridae

- 1a. Small spiracle between eye and upper corner of opercle (Fig. 5a); caudal peduncle deep and not enclosed in bony plates; lower lip with two papillose lobes (Fig. 5b) lake sturgeon, *Acipenser fulvescens* Rafinesque



- b. No spiracle between eye and upper corner of opercle (Fig. 6a); caudal peduncle slender and completely enclosed in bony plates; lower lip with four papillose lobes (Fig. 6b)
 shovelnose sturgeon, *Scaphirhynchus platorynchus* (Rafinesque)



III. Key to the Species of Lepisosteidae

- 1a. Beaklike snout long and slender, its length about 20 times its width
..... longnose gar, *Lepisosteus osseus* (Linnaeus)

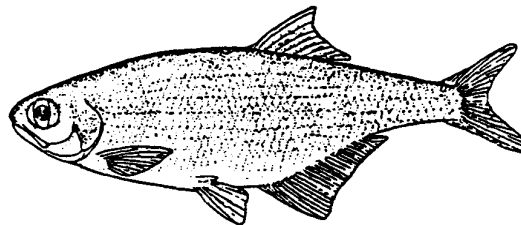


- b. Beaklike snout short and broad, its length about 6 times or less its width
..... shortnose gar, *Lepisosteus platostomus* Rafinesque

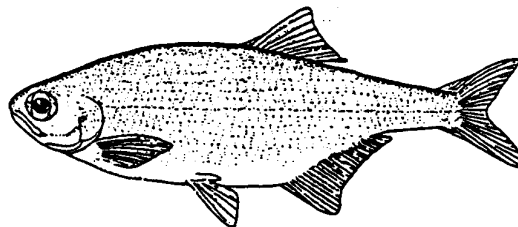


IV. Key to the Species of Hiodontidae

- 1a. Anterior margin of dorsal fin inserted just above or slightly behind anal fin; dorsal fin with 9 developed rays; belly keeled anterior and posterior to pelvic fins (Fig. 10);
..... goldeye, *Hiodon alosoides* (Rafinesque)

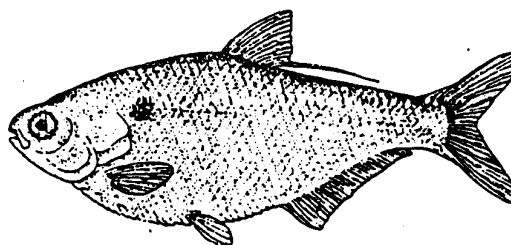


- b. Anterior margin of dorsal fin inserted in front of anal fin; dorsal fin with 11-12 developed rays; belly scarcely keeled anterior to pelvic fins (Fig. 11);
..... mooneye, *Hiodon tergisus* LeSueur



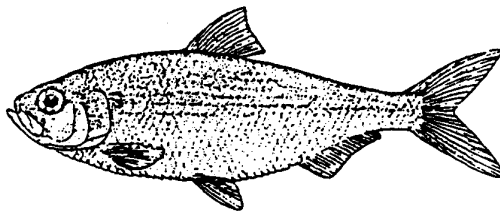
V. Key to the Species of Clupeidae

- 1a. Last dorsal ray greatly elongated; snout blunt; lower jaw not projecting; predorsal midline naked (Fig. 8); .gizzard shad, *Dorosoma cepedianum* (LeSueur)

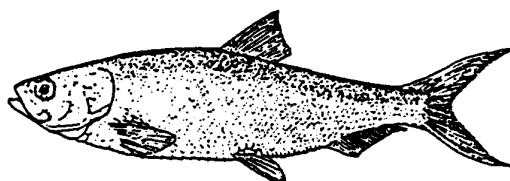


- b. Last dorsal ray not elongated; snout sharp; lower jaw projecting; predorsal
midline scaled; 2

- (1b.) 2a. Spot on side behind opercle; upper jaw without teeth on rim; gill rakers long
..... alewife, *Alosa pseudoharengus* (Wilson)



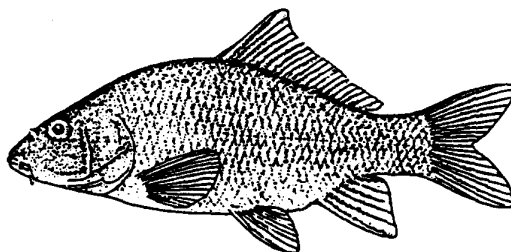
- b. No spot on side behind opercle; upper jaw with teeth on rim; gill rakers short
..... skipjack, *Also chrysochloris* (Rafinesque)



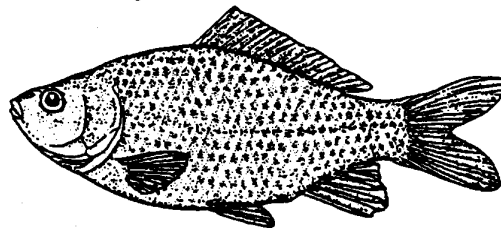
VI. Key to the Species of Cyprinidae

- 1a. Dorsal fin with more than 11 soft rays; dorsal and anal fins with stout, hard
spine-like first ray 2
b. Dorsal fin with fewer than 10 soft rays; no spine-like rays present 3

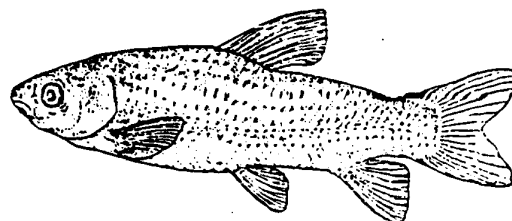
- (1a.) 2a. Barbels present on upper jaw carp, *Cyprinus carpio* Linnaeus



- b. Barbels absent on lower jaw goldfish, *Carassius auratus* (Linnaeus)

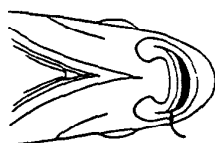


- (1b.) 3a. Distance from the pelvic fin base to anal fin origin equal to distance from anal
fin origin to caudal fin base (end of hypural plate)
..... grass carp, *Ctenopharyngodon idella* (Valenciennes)



- b. Distance from the pelvic fin base to anal fin origin $1/2$ to $3/4$ the distance from anal fin origin to caudal fin base (end of hypural plate) 4

- (3b.) 4a. Lower jaw with a hard, cartilaginous shelf projecting anteriorly beyond the tip of the flesh of the lower jaw (touch with your finger) 5



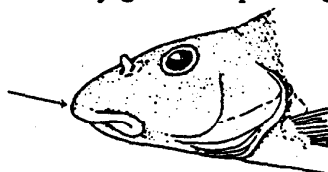
- b. Lower jaw lacking the cartilaginous shelf 6

- (4a.) 5a. Scale rows around body just in front of dorsal fin usually 31-36; lateral line scales 43-47; least width of skull between eyes about equal to distance from back of eye to dorsal end of gill opening largescale stoneroller, *Campostoma oligolepis* Hubbs and Greene

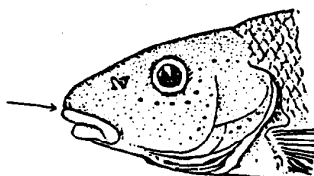
- a. Scale rows around body just in front of dorsal fin usually 39-46; lateral line scales 49-55; least width of skull between eyes usually less than distance from back of eye to dorsal end of gill opening central stoneroller, *Campostoma anomalum* (Rafinesque)



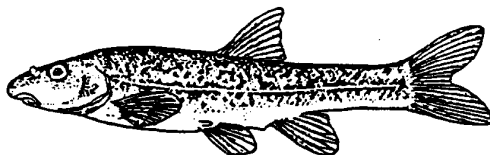
- (4b.) 6a. Premaxillaries nonprotractile, attached to the snout with skin so that there is not a continuous premaxillary groove separating them from the snout 7



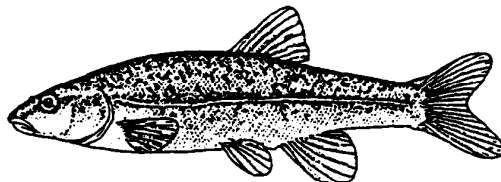
- b. Premaxillaries protractile, separated from the snout by a continuous premaxillary groove 8



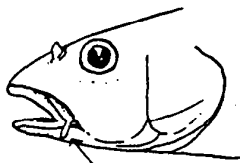
- (6a.) 7a. Snout projects far beyond the horizontal mouth; eye diameter is less than or equal to the distance from the tip of the snout to the anterior tip of the lower jaw **longnose dace, *Rhinichthys cataractae*** (Valenciennes)



- b. Snout scarcely projecting beyond the somewhat oblique mouth; eye diameter is greater than the distance from the tip of the snout to the anterior tip of the lower jaw **blacknose dace, *Rhinichthys atratulus*** (Hermann)

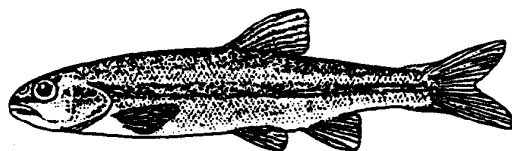


- (6b.) 8a. Barbel present at the posterior tip of the maxillary (not hidden in maxillary groove) 9



- b. Barbel not present at the posterior tip of the maxillary (may be in maxillary groove) 15

- (8a.) 9a. Lateral line scales more than 55
..... **lake chub, *Couesius plumbeus*** (Agassiz)



- b. Lateral line scales less than 45 10

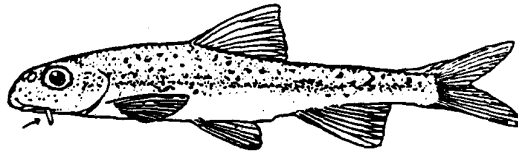
- (9b.) 10a. Blotches present on sides along the lateral band 11



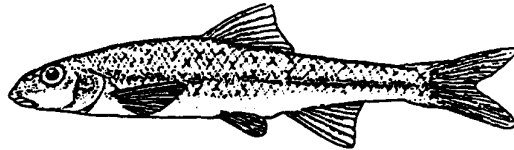
- b. Blotches not present on sides along the lateral band 12



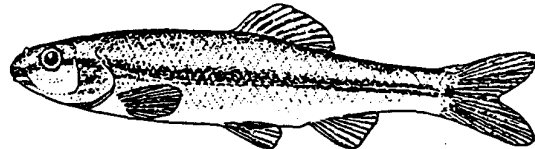
- (10a.) 11a. Barbel as long or longer than diameter of pupil of eye; sides of the body rather heavily sprinkled with black dots
 **speckled chub, *Macrhybopsis aestivalis* (Girard)**



- b. Barbel shorter than diameter of pupil of eye; sides and back marked with scattered X-shaped marks
 **gravel chub, *Erimystax x-punctata* (Hubbs and Crowe)**

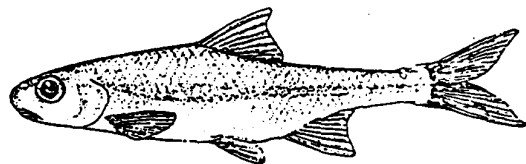


- (10b.) 12a. Dark pigmentation prevalent in interradiar membranes of first 4 dorsal rays; snout with 3 horizontal rows of breeding tubercles (breeding male)
 **bluntnose minnow, *Pimephales notatus* (Rafinesque)**



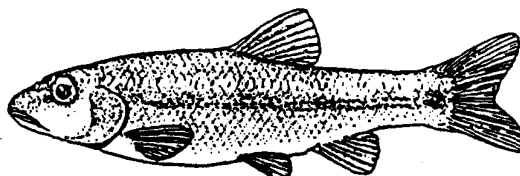
- b. Pigmentation in dorsal fin membranes scattered or absent; breeding tubercles not as above or absent 13

- (12b.) 13a. Diameter of orbit equal to or greater than distance from its posterior margin to the dorsal end of gill opening.....
 **silver chub, *Macrhybopsis storeriana* (Kirtland)**

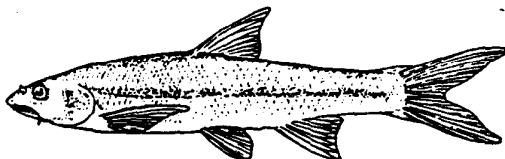


- b. Diameter of orbit equal noticeably less than distance from its posterior margin to the dorsal end of gill opening 14

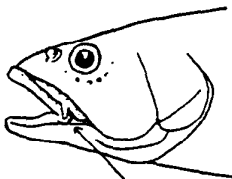
- (13b.) 14a. Mouth somewhat oblique and slightly inferior, upper lip scarcely overhung by snout; dorsal and anal fins rounded; blackish spot at caudal base; caudal fin red to orange in life...**hornyhead chub, *Nocomis biguttatus* (Kirtland)**



- b. Mouth horizontal and strictly inferior, upper lip considerably overhung by snout; dorsal and anal fins pointed; no caudal spot; caudal fin without red or orange color..... **flathead chub, *Platygobio gracilis*** (Richardson)

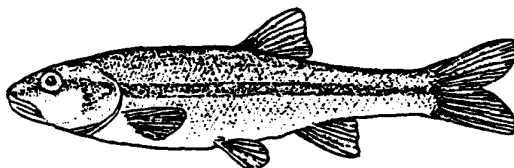


- (8b.) 15a. Small barbel (may be more like a slight blip) within the maxillary groove 16

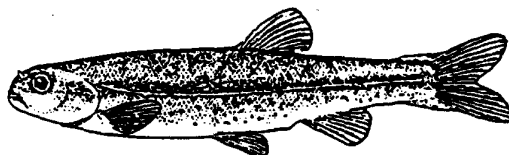


- b. No barbel or any kind present within the maxillary groove 17

- (15a.) 16a. Mouth large, maxillary extending beyond front of eye; black spot at anterior dorsal fin base in adults; lateral line scales 60 or fewer
..... **creek chub, *Semotilus atromaculatus*** (Mitchill)

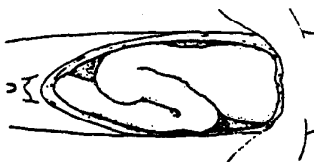


- b. Mouth small, maxillary not extending to front of eye; no black spot anterior dorsal fin base in adults; lateral line scales 65-75
..... **pearl dace, *Margariscus margarita*** (Cope)

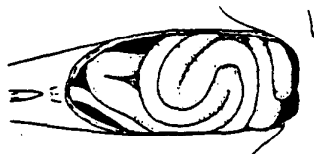


- (15b.) 17a. Lateral line scales 62 or more 18
b. Lateral line scales 60 or fewer 23

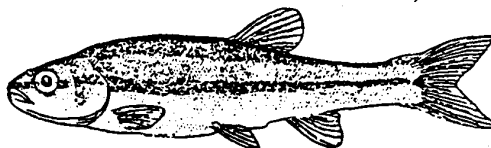
- (17a.) 18a. Intestine short, with a single main loop less than twice as long as body; single dusky lateral band present 19



- b. Intestine long, with two crosswise coils in addition to primary loops making it more than twice as long as body; two black lateral bands present 22



- (18a.) 19a. Lining of abdominal cavity black; lateral line incomplete; scales minute, more than 80 in lateral line **finescale dace, *Phoxinus neogaeus* (Cope)**

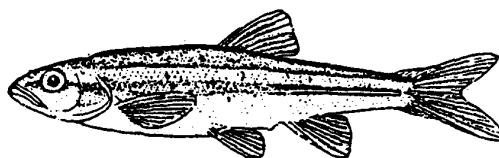


- b. Lining of abdominal cavity pale; lateral line complete with fewer than 80 scales 20

- (19b.) 20a. Mouth small, maxillary not extending beyond front of eye
..... **pearl dace, *Margariscus margarita* (Cope)**
see couplet 16

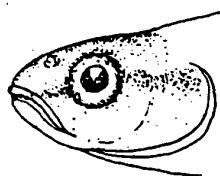
- b. Mouth large, maxillary extending beyond front of eye 21

- (20b.) 21a. Narrow head with very large mouth extending beyond middle of eye; snout sharp; no evidence of black spot at anterior dorsal fin base.....
..... **redside dace, *Clinostomus elongatus* (Kirtland)**

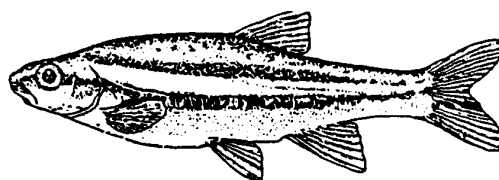
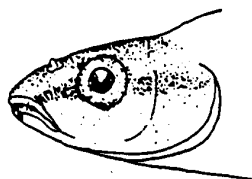


- b. Medium-width head with a smaller mouth extending beyond anterior margin of eye but not beyond middle; snout round; black spot at anterior dorsal fin base in adults.....
see couplet 16 **creek chub, *Semotilus atromaculatus* (Mitchill)**

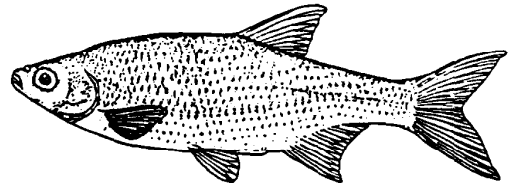
- (18b.) 22a. Mouth sharply oblique (usually 45° or more) and curved; chin slightly anterior to upper lip; length of upper jaw less than 1/4 the head length; distance from tip of snout to back of eye usually about equal to rest of head
..... **northern redbelly dace, *Phoxinus eos* (Cope)**



- b. Mouth slightly oblique (usually less than 45°) and less curved; chin and upper lip about equal or the upper lip protruding slightly; length of upper jaw more than 1/4 the head length; distance from tip of snout to back of eye distinctly longer than rest of head
..... **southern redbelly dace, *Phoxinus erythrogaster* (Rafinesque)**



- (17b.) 23a. Abdomen posterior to the pelvic fins with a fleshy, scaleless keel; lateral line strongly curved downward in middle portion of body golden shiner, *Notemigonus crysoleucas* (Mitchill)

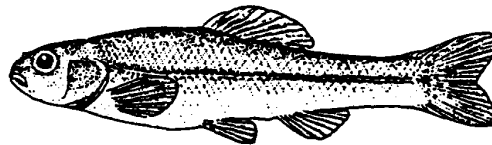


- b. Abdomen posterior to the pelvic fins lacking a fleshy, scaleless keel; lateral line not curved or only slightly curved downward in middle portion of body... 24

- (23b.) 24a. Predorsal area broad and flattened, with mid dorsal scales smaller than those of upper sides; predorsal scales irregularly arranged and crowded; often the first dorsal ray is short and separated from other dorsal rays by an interradi al membrane 25

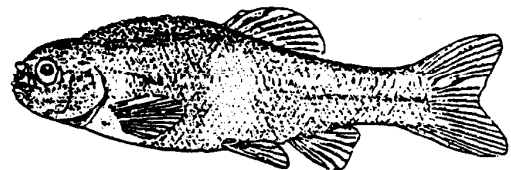
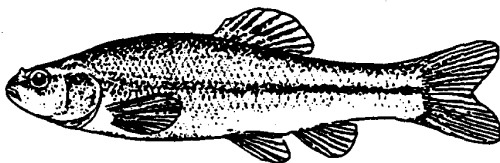
- b. Predorsal rounded or sloping, with mid dorsal scales roughly the same size as those of upper sides; predorsal scales regularly arranged and not crowded; the first dorsal ray is thin and bound to the first principal ray 27

- (24a.) 25a. Lining of body cavity silvery with black flecks; intestine short, with a single S-shaped loop *See Couplet 18a.* bullhead minnow, *Pimephales vigilax* (Baird and Girard)



- b. Lining of body cavity black; intestine long, with at least one extra coil 26

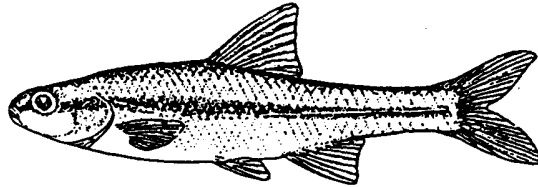
- (25b.) 26a. Mouth terminal and oblique, not overhung by snout; dusky lateral band with indistinct caudal spot; lateral line incomplete (not extending to hypural plate) fathead minnow, *Pimephales promelas* Rafinesque



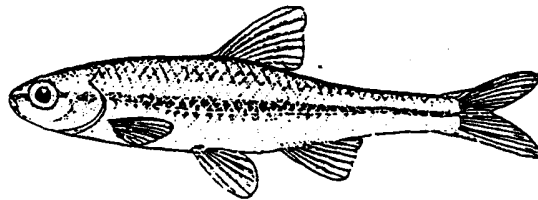
- b. Mouth inferior and nearly horizontal, overhung by snout; dark lateral band with distinct caudal spot; lateral line complete (extending to hypural plate)
..... **bluntnose minnow, *Pimephales notatus* Rafinesque**
see couplet 12

- (24b.) 27a. Mouth extremely small and nearly vertical (80° or more from horizontal), upper jaw extending only to below anterior nostril 28
b. Mouth large and oblique (60° or less) to horizontal, upper jaw extending to below posterior nostril 29

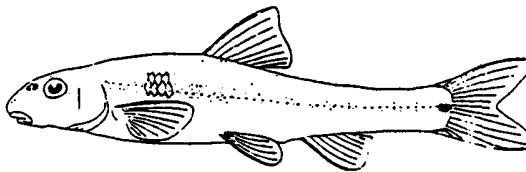
- (27a.) 28a. Principal rays of dorsal fin typically 9; small melanophores line the edges of all rays except 5 and 6; lining of body cavity speckled
..... **pugnose minnow, *Opsopoeodus emiliae* Hay**



- b. Principal rays of dorsal fin typically 8; dorsal rays not lined with melanophores; lining of body cavity brown to black
..... **pugnose shiner, *Notropis anogenus* Forbés**



- (27b.) 29a. Mouth inferior with upper lip thickened and plicate, lower lip with thickened lateral lobes giving the mouth a scroll-like or fiddlehead appearance
suckermouth minnow, *Phenacobius mirabilis* (Girard)

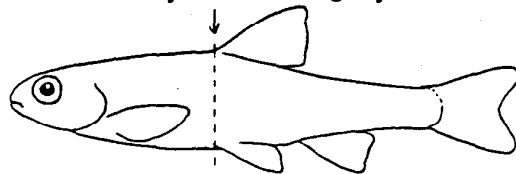


- b. Mouth not as above 30

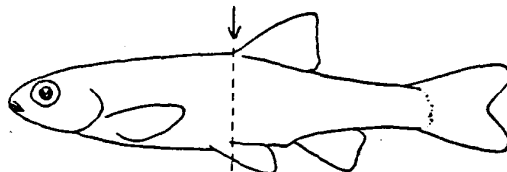
- (29b.) 30a. Anal fin with 9-13 rays 31

- b. Anal fin usually with 7 or 8 rays (so be careful with counts of 9, don't force the key) 35

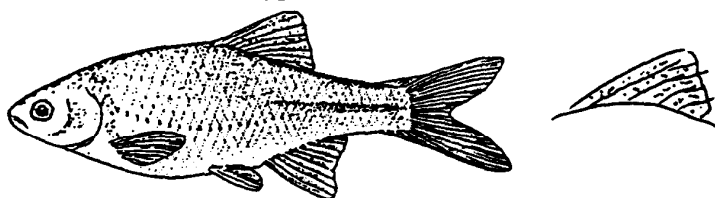
- (30a.) 31a. Origin of dorsal fin directly above or slightly anterior to pelvic fin base 32



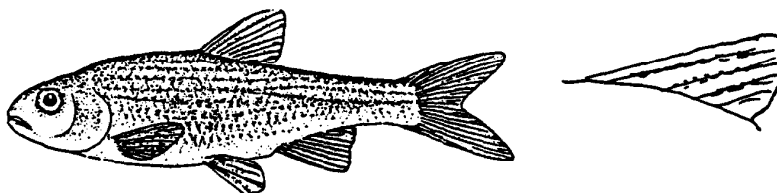
- b. Origin of dorsal fin distinctly posterior to pelvic fin base 33



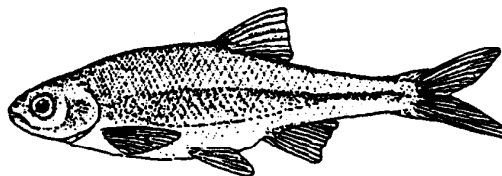
- (31a.) 32a. Interradial membranes of dorsal fin moderately and evenly pigmented
 **red shiner, *Cyprinella lutrensis*** (Baird and Girard)



- b. Interradial membranes of dorsal fin without pigment
 **common shiner *Luxilus cornutus*** (Mitchill)

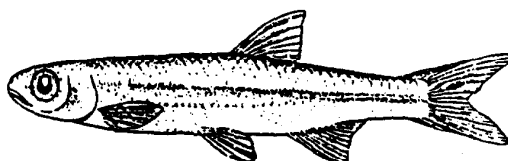


- (31b.) 33a. Body deep, its greatest depth typically exceeds head length in adults or is equal to head length in juveniles; collection of black pigment at the anterior base of the dorsal fin **redfin shiner, *Lythrurus umbratilis*** (Girard)

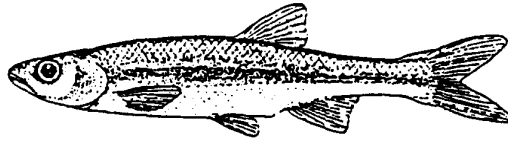


- b. Body more slender, its greatest depth much less than head length; dorsal fin lacks collection of black pigment 34

- (33b.) 34a. Snout short and rounded when looking down on top of head; chin melanophores present midventrally as well as along lip margins; anal fin margin k-shaped when expanded; lateral band pale and diffuse anterior to dorsal fin, consisting of loosely scattered small melanophores
 **emerald shiner, *Notropis atherinoides*** Rafinesque



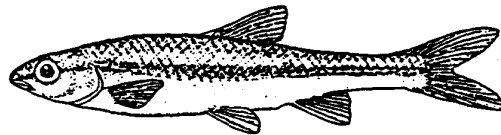
- b. Snout produced and sharp when looking down on top of head; chin melanophores small and present only along lip margins; anal fin margin straight or slightly concave when expanded; lateral band anterior to dorsal fin, consisting of larger, more tightly spaced melanophores, giving the band a more definitive look rosyface shiner, *Notropis rubellus* (Agassiz)



- (30b.) 35a. Intestine greatly elongated, twice or more as long as body; lining of the abdominal cavity black 36

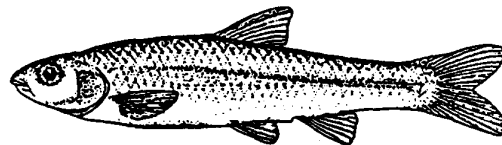
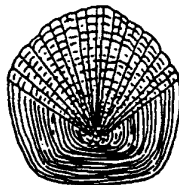
- b. Intestine short, S-shaped and much less than twice as long as body; lining of the abdominal cavity silvery, or pale with black flecks..... 38
see couplet 18a.

- (35a.) 36a. Body with prominent lateral band from caudal base forward around the snout; origin of dorsal fin even with pelvic fin bases; mouth U-shaped
..... Ozark minnow, *Notropis nubilus* (Forbes)

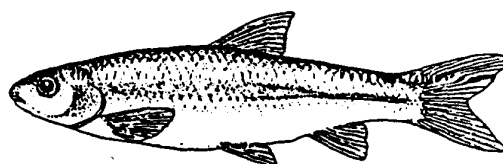
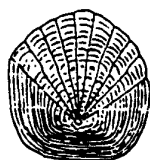


- b. Body at most with a indistinct lateral band not extending even to the head; origin of dorsal fin anterior to pelvic fin bases; mouth not U-shaped 37

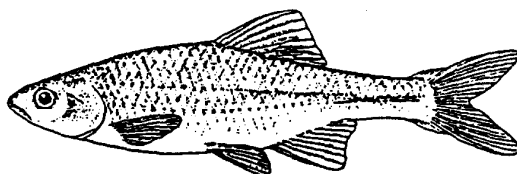
- (36b.) 37a. Dorsal fin more or less round, the first principal ray shorter than the second and third; anterior field of scales with closer to 20 radii; body color yellowish to brassybrassy minnow, *Hybognathus hankinsoni* Hubbs



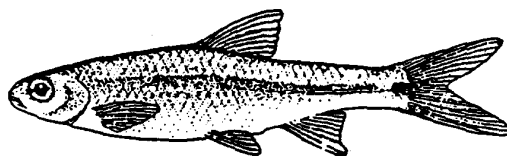
- b. Dorsal fin more or less pointed, the first principal ray as long or longer than the second and third; anterior field of scales with closer to 10 radii; body color silvery.....
..... Mississippi silvery minnow, *Hybognathus nuchalis* Agassiz



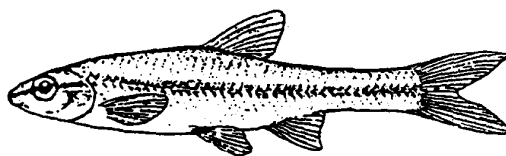
- (35b.) 38a. Dorsal fin with many melanophores present in the interradi-
 al membranes of at least the last 4 principal rays 39
 b. Dorsal fin with few to no melanophores present in the interradi-
 al membranes.. 40
 (38a.) 39a. Dorsal fin with melanophores forming dark spot in the interradi-
 al membranes of last 4 principal rays;
 **spotfin shiner, *Cyprinella spiloptera* (Cope)**



- b. Dorsal fin with melanophores more or less evenly distributed throughout all
 interradi- al membranes
 **red shiner, *Cyprinella lutrensis* (Baird and Girard)**
 see couplet 32a.
 (38b.) 40a. Large, solid black spot at base of caudal fin, about same size as pupil of the eye
 **spottail shiner, *Notropis hudsonius* (Clinton)**

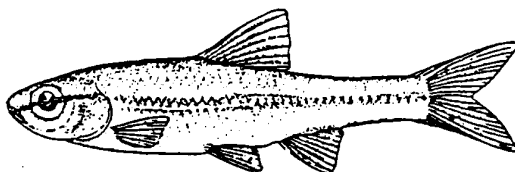


- b. Black spot at base of caudal fin noticeably smaller than pupil of eye, diffuse,
 or absent 41
 (40b.) 41a. Lateral line incomplete 42
 41b. Lateral line complete 44
 (41a) 42a. Lateral band continued through eye and around snout and premaxillaries, but
 not ventrally onto chin; fairly distinct crescent-shaped marks in lateral
 band at least on the anterior half of the body (trunk)
 **blacknose shiner, *Notropis heterolepis* Eigenmann and Eigenmann**

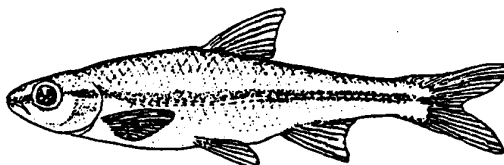


- b. Lateral band continued through eye and onto premaxillaries and chin, but not
 dorsally around snout; distinct crescent-shaped marks not present in
 lateral band 43

- (42b.) 43a. Anal fin rays almost always 8; breast scaled; snout rather sharp
 **blackchin shiner, *Notropis heterodon* (Cope)**

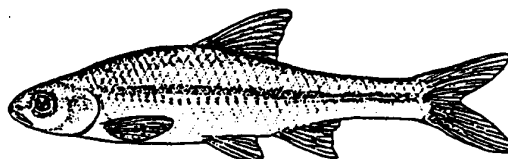


- b. Anal fin rays almost always 7; breast naked; snout rather blunt
 **weed shiner, *Notropis texanus* (Girard)**



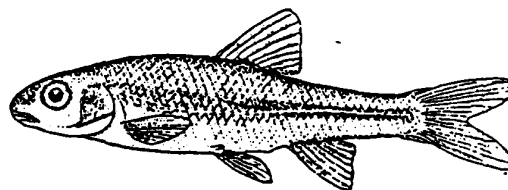
- (41b.) 44a. Anal fin rays 7 45
 b. Anal fin rays 8 47

- (44a) 45a. Lateral band distinctly extending from caudal base forward onto opercle; distance from tip of snout to origin of dorsal fin less than distance from dorsal fin origin to end of vertebral column
 **Topeka shiner, *Notropis tristis* (Girard)**

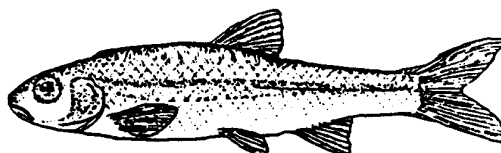


- b. Lateral band not extending forward onto opercle; distance from tip of snout to origin of dorsal fin equal to distance from dorsal fin origin to end of vertebral column 46

- (45b.) 46a. Thin predorsal stripe abruptly becomes as wide as dorsal fin base just anterior to dorsal fin origin; predorsal scales very darkly outlined with pigment; upper jaw length less than eye diameter
 **sand shiner, *Notropis lundibundus* (Girard)**



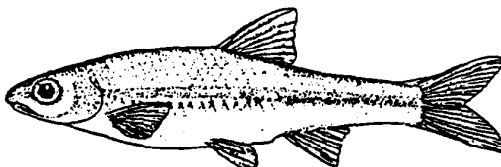
- b. Predorsal stripe roughly the same width as the dorsal fin base throughout its length, not expanding abruptly just anterior to the dorsal fin base; predorsal scales weakly outlined with pigment; upper jaw length greater than eye diameter; found in large rivers. **river shiner, *Notropis blennioides* (Girard)**



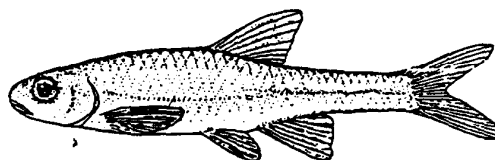
- (44b.) 47a. Length of the upper jaw greater than the eye diameter 48
 b. Length of the upper jaw less than the eye diameter 49

(47a.) 48a. Lateral line scales 47 or more; mouth oblique; black spot at anterior dorsal fin base in adults..... creek chub, *Semotilus atromaculatus* (Mitchill)
 see couplet 16

- b. Lateral line scales fewer than 40; mouth horizontal; no black spot at anterior dorsal fin base in adults..bigmouth shiner, *Hybopsis dorsalis* Agassiz

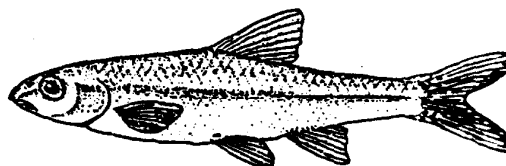


- (47b.) 49a. Body pale, pigment confined to dorsal scales, lateral band on caudal the peduncle and some anterior lateral line scales; infraorbital canal incomplete; pelvic fin margins reach to the anal fin origin ghost shiner, *Notropis buechanani* Meek



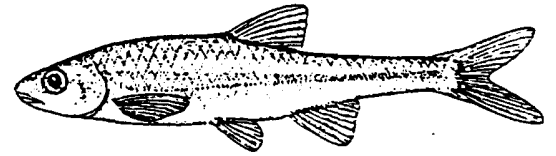
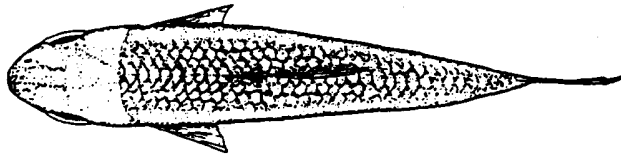
- b. Body pigment considerable; anterior lateral band distinct and/or pigment darkly outlining anterior scales above and 1-2 rows below the lateral line; infraorbital canal incomplete; pelvic fin margins do not reach anal fin origin 50

- (49b.) 50a. Snout projecting distinctly beyond upper lip; mouth small, the upper jaw falling well-short of anterior margin of eye; lateral band fairly distinct and extending very obviously around the snout pallid shiner, *Notropis amnis* Hubbs and Greene

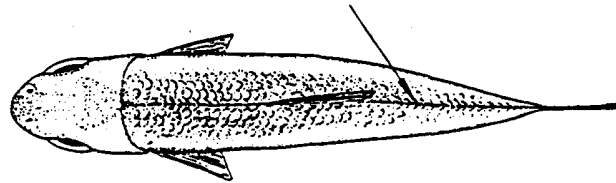


- b. Snout not projecting distinctly beyond upper lip; mouth larger, upper jaw extending almost to anterior margin of eye; lateral band very diffuse anteriorly and not extending very obviously around the snout 51

- (50b.) 51a. Post dorsal dark streak absent or nearly so; breast with some scales posteriad; body depth usually contained more than 4.5 times in standard length; body width usually more than 1.7 times in depth; depth of caudal peduncle usually contained more than 2.5 times in head length; anterior lateral scales usually about 3.0 times as wide **mimic shiner, *Notropis volucellus* (Cope)**

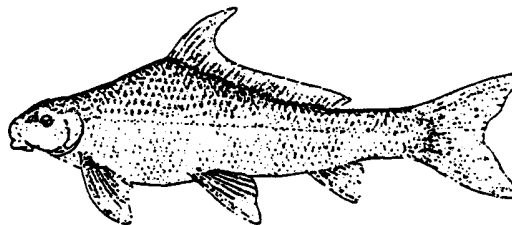


- b. Post dorsal dark streak dark and continuous; breast and anterior belly naked; body depth usually contained less than 4.5 times in standard length; body width usually less than 1.7 times in depth; depth of caudal peduncle usually contained less than 2.5 times in head length; anterior lateral scales usually about 2.5 times as wide; restricted to Mississippi River below St. Anthony Falls **channel shiner, *Notropis wickliffi* Trautman**

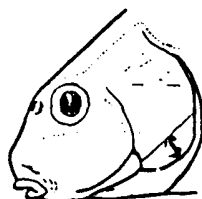


VII. Key to the Species of Catostomidae

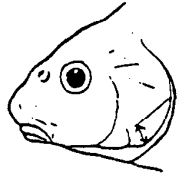
- 1a. Dorsal fin with more than 20 rays..... 2
 b. Dorsal fin with fewer than 20 rays..... 8
 (1a.) 2a. Lateral line scales more than 50; body elongate, standard length more than 4 times the body depth; body color bluish or blue-gray in adults
 **blue sucker, *Cycleptus elongatus* (Lesueur)**



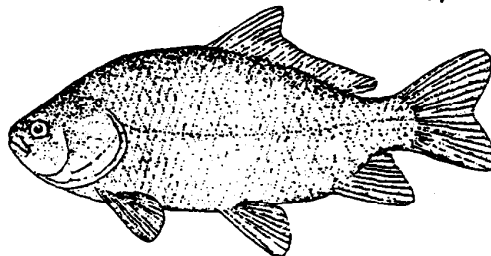
- b. Lateral line scales fewer than 45; body deep and laterally compressed, standard length less than 4 times the body depth; body color silvery or dusky gray in adults 3
 (2b.) 3a. Suboperculum symmetrical, broadest in the middle; distance from back of eye to posteroventral angle of preoperculum about 3/4 the distance from back of eye to dorsal end of gill opening; body usually dusky gray; pelvic fins with dense dark pigment; intestines in longitudinal loops 4



- b. Suboperculum asymmetrical, broadest below the middle; distance from back of eye to posteroventral angle of preoperculum about equal to the distance from back of eye to dorsal end of gill opening; body usually silvery; pelvic fins with little or no pigment; intestines in circular coils 6



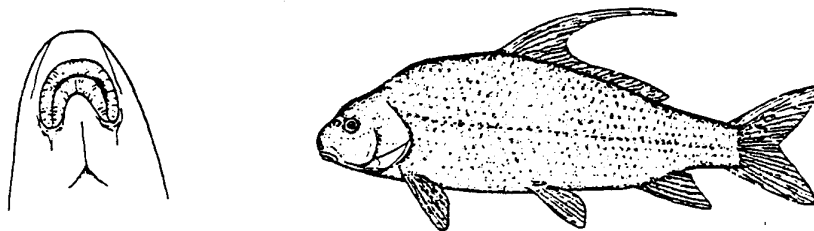
- (3a.) 4a. Mouth terminal, oblique and large; anterior tip of upper lip nearly level with lower margin of eye; gill rakers ϕ 40 in juveniles to about 60 in adults
..... **bigmouth buffalo, *Ictiobus cyprinellus* (Valenciennes)**



- b. Mouth subterminal, nearly horizontal; anterior tip of upper lip far below lower margin of eye; gill rakers 135 5
see couplet 5 below
- (4b.) 5a. Standard length 2.2-2.8 times the body depth; back strongly arched and sharply ridge-like anterior to dorsal fin; distance from front of mandibles to posterior tip of maxilla less than diameter of eye in young, about equal to diameter of eye in adults..... **smallmouth buffalo, *Ictiobus bubalus* (Rafinesque)**

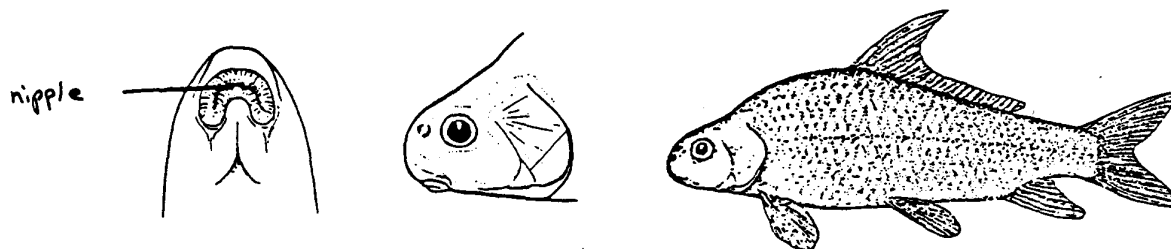
- b. Standard length 2.6-3.2 times the body depth; back rounded anterior to dorsal fin; distance from front of mandibles to posterior tip of maxilla about equal to diameter of eye in young, about twice diameter of eye in adults
..... **black buffalo, *Ictiobus niger* (Rafinesque)**

- (3b.) 6a. Lateral line scales normally 36-38 (extremes 35-39); nostrils in subadults and adults posterior to middle of mouth; snout relatively long in subadults and adults, contained 3.5 times or less in head length; no nipple-like project in middle of lower lip..... **quillback, *Carpiodes cyprinus* (Lesueur)**

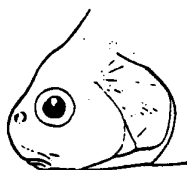


- b. Lateral line scales normally 34-35 (extremes 33-37); nostrils anterior to middle of mouth; snout relatively blunt throughout life, contained 3.5 times or more in head length; nipple-like projection usually present in middle of lower lip .. 7
see couplet 7a.

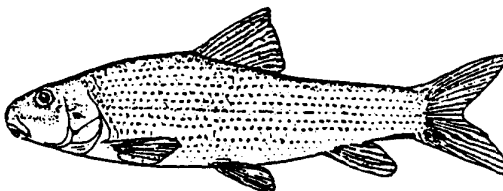
- (6b.) 7a. Anterior dorsal fin rays short throughout life, the longest ray typically less than 2/3 the length of dorsal fin base; standard length in adults typically ≤ 2.6 times body depth ... **river carpsucker, *Carpiodes carpio* (Rafinesque)**



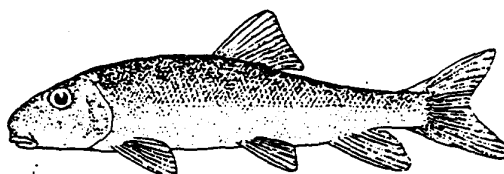
- b. Unbroken anterior dorsal fin rays in adults longer than dorsal fin base; standard length in adults typically < 2.6 times body depth; not easily distinguished from *C. carpio* when under 100 mm TL
..... **highfin carpsucker, *Carpiodes velifer* (Rafinesque)**



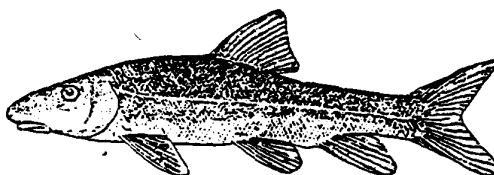
- (1b.) 8a. Lateral line absent or poorly developed, or, if well developed, body has 8 or more dark, dashed, parallel lines formed by series of large black dots at the bases of the scales
..... **spotted sucker, *Minytrema melanops* (Rafinesque)**



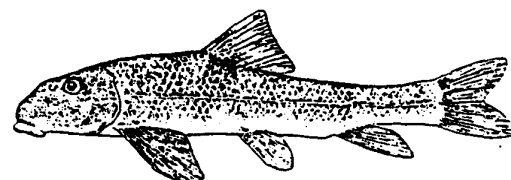
- b. Lateral line complete and well developed; no dark, dashed, parallel lines formed by series of large black dots at the bases of the scales 9
- (8b.) 9a. Lateral line scales ≥ 55 ; anterior scales smaller and more crowded than those on posterior half of body 10
- b. Lateral line scales < 55 ; anterior scales not small and crowded than those on posterior half of body 11
- (9a.) 10a. Lateral line scales < 75
 white sucker, *Catostomus commersoni* (Lacépède)



- b. Lateral line scales > 90
 longnose sucker, *Catostomus catostomus* (Forster)



- (9b.) 11a. Head depressed between the eyes; lips entirely covered with elevated, pimplelike structures (papillae) (papillose lips); body with 4-6 distinct dark saddles; swim bladder divided into 2 parts
 northern hogsucker, *Hypentilium nigricans* (LeSueur)

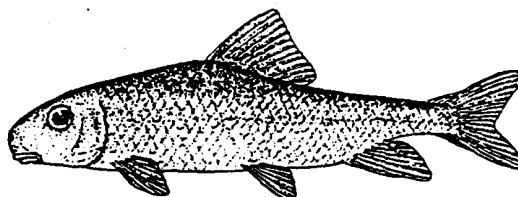


- b. Head convex between the eyes; lips not as above; body without distinct dark saddles; swim bladder divided into 3 parts 12

- (11b.) 12a. Scale rows around the narrowest portion of the caudal peduncle 16; dark spots at bases of dorsolateral scales; lower lip with longitudinal grooves forming plicae and a few non-elevated papilla-like elements in the corners only (subplicate lips) greater redhorse, *Moxostoma valenciennesi* Jordan

- b. Scale rows around the narrowest portion of the caudal peduncle 12-15, rarely 16; dark spots at bases of dorsolateral scales present or absent; lower lip with plicae only (plicate lips), or with subplicate lips but papilla-like elements occur all across lip, or with semipapillose lips where nearly all plicae are subdivided into non-elevated papillose-like elements 13
see figures of lips in couplets 13, 15 and 16 below

- (12b.) 13a. Upper and lower lip semipapillose, with irregularly sized papilla-like elements covering entire lower lip; two halves of lower lip meet at an acute angle forming a sharp V-shape; dorsal rays typically 15 (extremes 14-16)
..... **silver redhorse, *Moxostoma anisurum* (Rafinesque)**

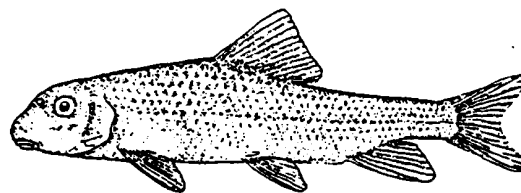
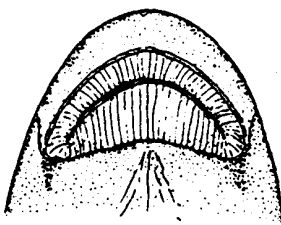


- b. Upper lip plicate, lower lip plicate or subplicate; two halves of lower lip meet at broader angle (80°-almost 180°); dorsal rays typically 12-14 14
see figures of lips in couplets 15 and 16 below

- (13b.) 14a. Scales, especially above the lateral line, moderately to strongly darker at their bases than in their central portions and distal margins; caudal fin reddish in life 15

- b. Scales about as dark at their bases as at their margins and only slightly darker than in their central portions; caudal fin dusky in life 16

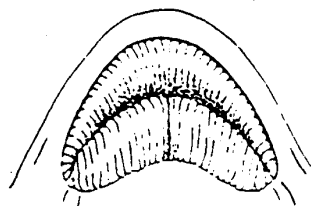
- (14a.) 15a. Margin of dorsal fin very concave when extended; lower lip subplicate; head small and short, <22.5% of standard length in adults; pharyngeal arch moderate thickness with thin, comblike teeth
..... **shorthead redhorse, *Moxostoma macrolepidotum* (Lesueur)**



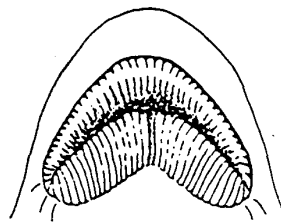
- b. Margin of dorsal fin straight or very slightly concave when extended; head moderate to large and longer, >24% of standard length in specimens >150 mm; pharyngeal arch thick with large, molariform teeth
..... **river redhorse, *Moxostoma carinatum* (Cope)**



- (13b.) 16a. Lateral line scales 39-42 (extremes 38-44); pelvic fin rays usually 9, rarely 10; caudal peduncle deep, about 9.5-11.5% of standard length; breast scales of adults well exposed and not abruptly smaller than adjacent body scales; bases and margins of anterior dorsolateral scales considerably darker than central portions **golden redhorse, *Moxostoma erythrurum* (Rafinesque)**

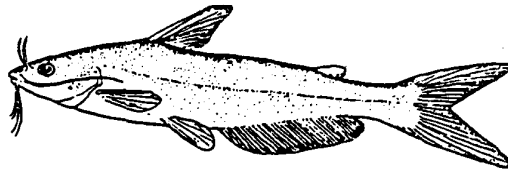


- b. Lateral line scales 44-48 (extremes 42-49); pelvic fin rays frequently 10; caudal peduncle more shallow, about 8.5-10% of standard length; breast scales of adults partially embedded and abruptly smaller than adjacent body scales; bases and margins of anterior dorsolateral scales only slightly darker than central portions, giving the scale a noticeably more uniform appearance
..... **black redhorse, *Moxostoma duquesnei* (Lesueur)**

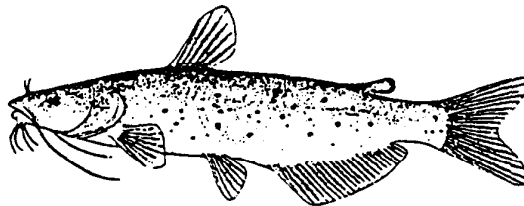


VIII. Key to the Species of Ictaluridae

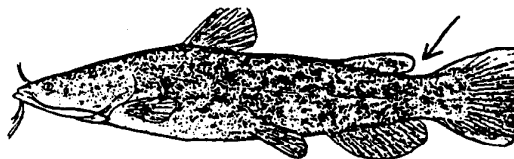
- 1a. Caudal fin deeply forked..... 2
 b. Caudal fin rounded, truncate, or slightly indented..... 3
- (1a.) 2a. Margin of anal fin straight when fully erected; principal plus rudimentary anal fin ray count ≥ 30 ; no dark spots on sides of any size specimen (introduced to Lake St. Croix in 1977 and 1979, but probably not extant at present; still, be on the lookout!).....
 **blue catfish, *Ictalurus furcatus* (Lesueur)**



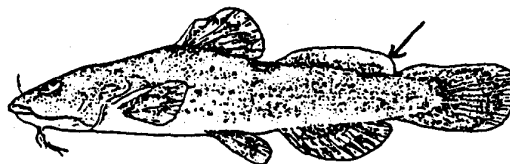
- b. Margin of anal fin rounded when fully erected; principal plus rudimentary anal fin ray count 24-27; dark spots on sides of juvenile and young adult specimens.....**channel catfish, *Ictalurus punctatus* (Rafinesque)**



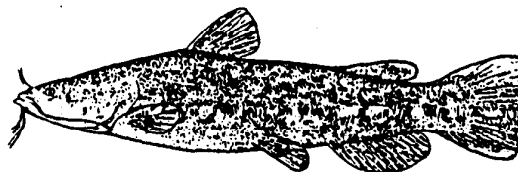
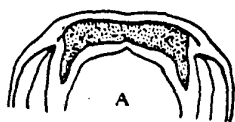
- (1b.) 3a. Adipose fin distinctly free from caudal fin..... 4



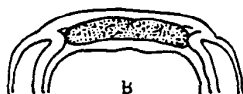
- b. Adipose fin connected or partly connected to caudal fin..... 7



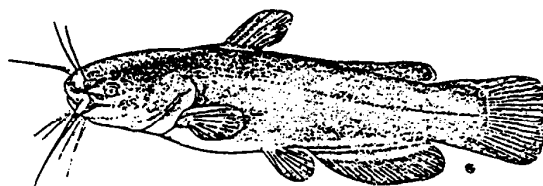
- 4a. Principal plus rudimentary anal fin ray count < 16 , typically 13; tooth patch of lower jaw with posterior extensions at the lateral margins; caudal fin may have a pale or whitish dorsal tip.....
**flathead catfish, *Pylodictis olivaris* (Rafinesque)**



- b. Principal plus rudimentary anal fin ray count typically ≥ 17 ; tooth patch of upper-lower jaw without posterior extensions at the lateral margins; caudal fin does not have a pale or whitish dorsal tip..... 5

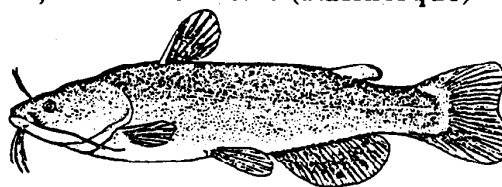


- 5a. Chin barbels whitish; principal plus rudimentary anal fin ray count typically 24-25 (extremes 23-27); fully rounded caudal fin.....
.....yellow bullhead, *Ameiurus natalis* (Lesueur)

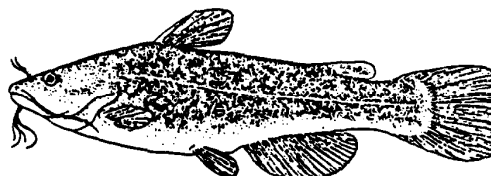
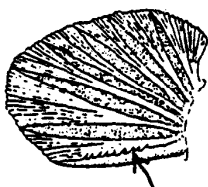


- b. Chin barbels grayish to black; principal plus rudimentary anal fin ray count typically 17-24; caudal fin truncate to slightly indented..... 6

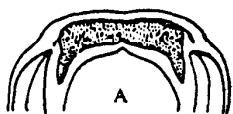
- 6a. Principal plus rudimentary anal fin ray count 17-21, interradial membranes jet black, sharply contrasting with the lighter fin rays; posterior edge of pectoral spines with weakly developed barbs (few if any are sharply pointed); sides not mottled and belly whitish in adults.....
.....black bullhead, *Ameiurus melas* (Rafinesque)



- b. Principal plus rudimentary anal fin ray count 21-24, interradial membranes and fin rays various shades of gray; posterior edge of pectoral spines with strongly developed barbs (all sharply pointed); sides often mottled and belly yellowish in adults.....
.....brown bullhead, *Ameiurus nebulosus* (Lesueur)



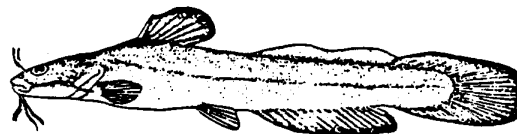
- 7a. Premaxillary tooth patch with posterior extensions at the lateral margins; large, pale patch between head and dorsal fin and a smaller pale patch at posterior end of dorsal fin..... stonecat, *Noturus flavus* Rafinesque



- b. Premaxillary tooth patch without posterior extensions at the lateral margins;
pale patches on back absent or occurring as transverse bands

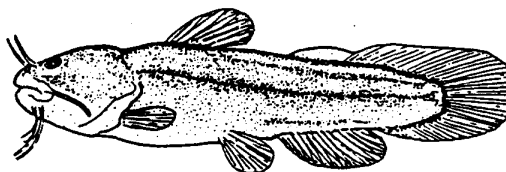
8

- 8a. Body long and slender, predorsal depth about equal to caudal peduncle depth;
posterior edge of pectoral spines strongly barbed; light-colored transverse
bands behind head and dorsal fin.....
.....**slender madtom, *Noturus exilis* Nelson**



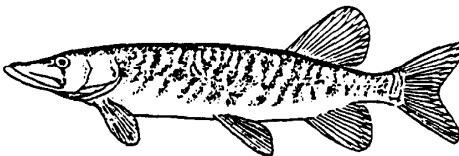
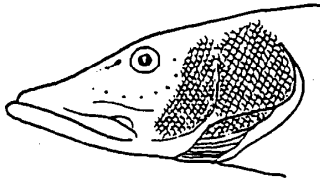
- b. Body short and stout, predorsal depth noticeably greater than caudal peduncle
depth; posterior edge of pectoral spines weakly or not barbed; no light-
colored transverse bands behind head and dorsal fin

tadpole madtom, *Noturus gyrinus* (Mitchill)

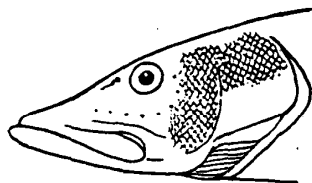


IX. Key to the Species of Esocidae

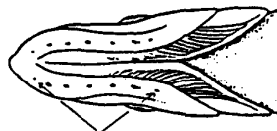
- 1a. Operculum fully scaled; total number of pores on ventral surface of lower jaws ≤ 8 ; branchiostegal rays usually 12 on each side (extremes 10-14);
Mississippi River in Wisconsin.....
.....grass pickerel, *Esox americanus* LeSueur



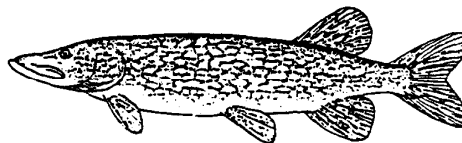
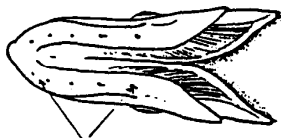
- b. Operculum with scales on upper half only; total number of pores on ventral surface of lower jaws ≥ 8 (count both sides); branchiostegal rays ≥ 14 on each side..... 2



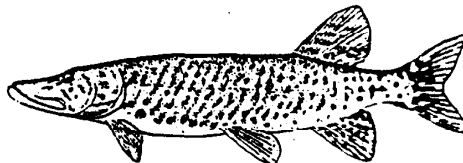
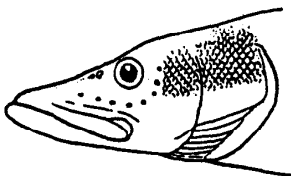
northern pike



- (1b.) 2a. Cheeks fully or almost fully scaled; total number of pores on ventral surface of lower jaws 8-10; branchiostegal rays 14-16 on each side; body with light spots on dark background in adults.....
.....northern pike, *Esox lucius* Linnaeus



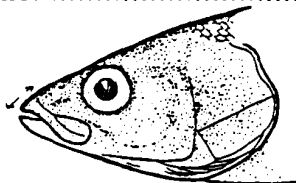
- b. Cheeks scaled only on the upper portion not extending to the level of the mandible; total number of pores on ventral surface of lower jaws 12-17; branchiostegal rays 16-19 on each side; body with dark spots or verticle bars on light background in adults.....
.....muskellunge, *Esox masquinony* Mitchill



X. Key to the Species of Salmonidae

- 1a. Mouth large, maxilla extends beyond the center of eye; teeth well developed all along both jaws; scales small. ≥ 20 rows above lateral line.....**Salmoninae** 2

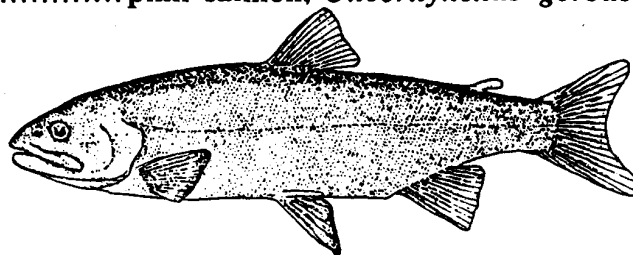
- b. Mouth small, maxilla does not extend beyond center of eye; teeth poorly developed and absent from lateral portions of jaws; scales large, ≤ 10 rows above lateral line.....**Coregoninae** 18



- (1a.) 2a. Specimen without parr marks (a series of oval to elongate vertical markings centered on the sides of the fish) and >130 mm SL **post parr Salmoninae** 3
b. Specimen with parr marks and/or <130 mm SL.....**parr Salmoninae** 11

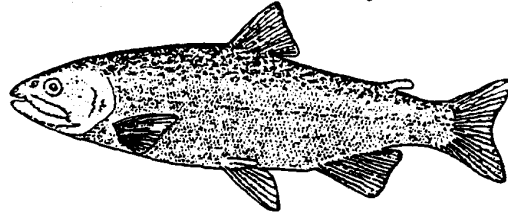
- (2a.) 3a. Back, upper sides and caudal fin without light-colored spots or vermiform markings, instead dark spots are present at least on back and upper sides..... 4
b. Back and upper sides with many light-colored spots and/or vermiform markings, which may or may not be visible on the caudal fin..... 9
(3a.) 4a. Principal anal fin ray count 13-19 (rarely 12); lower jaws dark gray or black..... 5 (see figures under couplet 6a and 6b)
b. Principal anal fin ray count 8-12; lower jaws whitish, without gray or black..... 7

- (4a.) 5a. Large, oblong dark spots on back and caudal fin, the largest $\geq$ eye diameter; breeding males with large, predorsal hump.....
.....**pink salmon, *Oncorhynchus gorbuscha* (Walbaum)**

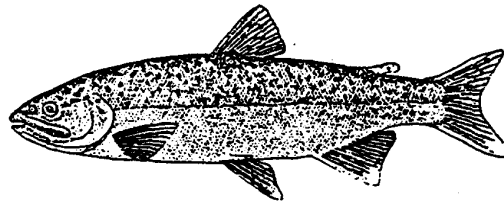


- b. Dark spots on back and caudal fin small and irregular, the largest much smaller than eye diameter; breeding males without large, predorsal hump..... 6

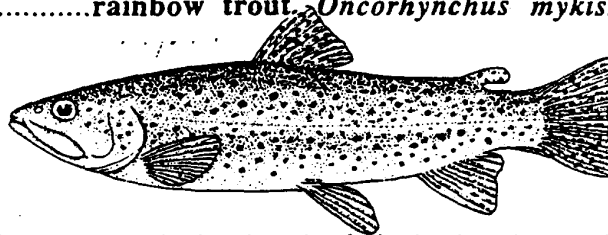
- (5b.) 6a. Small black spots on both lobes of caudal fin; lower jaw with dark pigment surrounding teeth; principal anal fin ray count 15-19 (sometimes 14).....
..... chinook salmon, *Oncorhynchus tshawytscha* (Walbaum)



- b. Black caudal spots, if present, restricted to dorsal lobe; lower jaw with dark pigment on both sides of teeth but not between them; principal anal fin ray count typically 13-15 (extremes 12-15).....
..... coho salmon, *Oncorhynchus kisutch* (Walbaum)

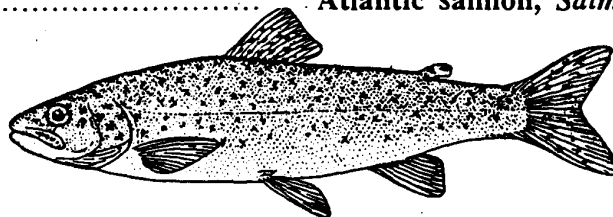


- (4b.) 7a. Well-defined black spots throughout the caudal fin; broad pink to rose stripe may be present along side of body.....
..... rainbow trout, *Oncorhynchus mykiss* (Walbaum)

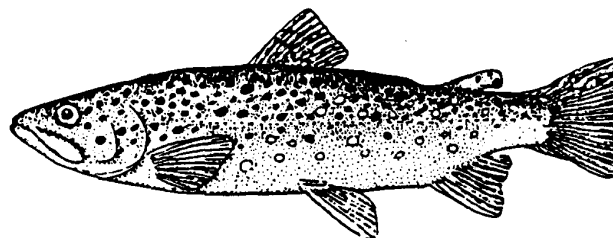


- b. Black spots absent, or poorly developed only in the dorsal lobe of caudal fin; no pink to rose stripe on sides..... 8

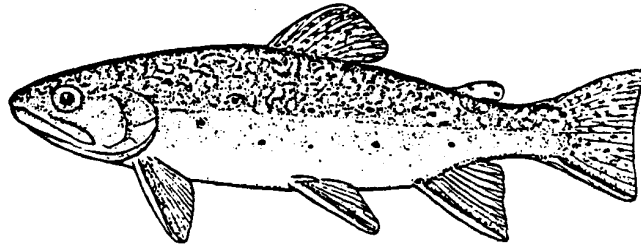
- (7b.) 8a. Anal fin rays usually 9, sometimes 10; teeth on the shaft of the vomer few, scattered and poorly developed; branchiostegal rays usually 11 or 12; lateral line scales 109-121; some body spots may take the form of small, thin X's; no red-orange color on body or adipose fin.....
..... Atlantic salmon, *Salmo salar* Linnaeus



- b. Anal fin rays usually 10-12; teeth on the shaft of the vomer strongly developed and in either a single zigzag row or in two rows; branchiostegal rays usually 10; lateral line scales 120-130; if X's are present on body they are thick; red-orange color may be present on body or adipose fin.....
..... brown trout, *Salmo trutta* Linnaeus

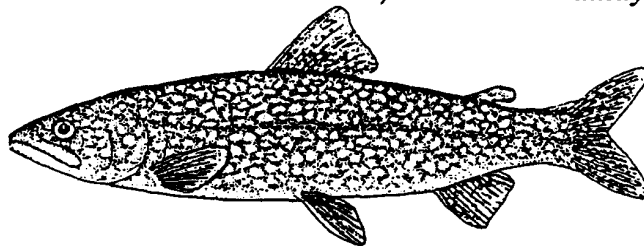


- 9a. Caudal fin indented but not deeply forked; pectoral, pelvic and anal fins with a distinct light-colored margin, followed by a dark stipe; red spots may be present on sides; gill rakers 9-12; pores on undersides of mandibles usually 7-8 on each side.....brook trout, *Salvelinus fontinalis* (Mitchill)

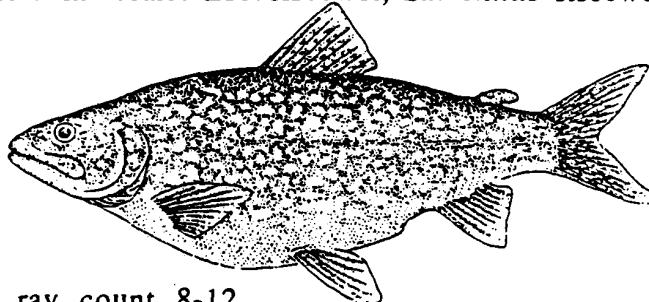


- b. Caudal fin deeply forked; pectoral, pelvic and anal fins without distinct marginal markings; no red spots anywhere on body; gill rakers 12-14; pores on undersides of mandibles usually 9-10 on each side..... 10

- 10a. Body depth 4.1-4.8 into standard length; top of head forming a fairly straight line from nape to snout; lateral line scales ≥ 195 lake trout, *Salvelinus namaycush* (Walbaum)



- b. Body depth 3.1-3.8 into standard length; top of head forming small hump over the eye; lateral line scales ≤ 183siscowet, *Salvelinus siscowet* (Agassiz)



- 11a. Principal anal ray count 8-12..... 12
b. Principal anal ray count ≥ 13 (rarely 12)..... 16

- 12a. Dorsal fin lacking distinct black spots, first dorsal ray not black..... lake trout, *Salvelinus namaycush* (Walbaum)

- b. Dorsal fin with distinct black spots or the first dorsal ray is black..... 13

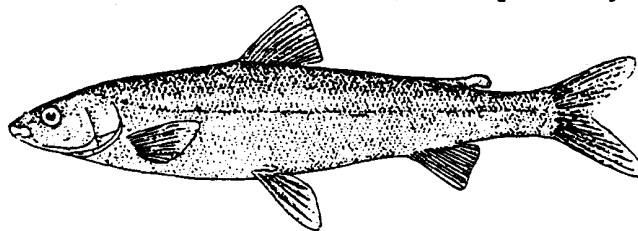
- 13a. Combined width of parr marks along lateral line less than the combined width of the light intervening areas; no red or yellow spots on or between the parr marks in fresh wild specimens.....rainbow trout, *Oncorhynchus mykiss* (Walbaum)

- b. Combined width of parr marks along lateral line equal to or greater than the combined width of the light intervening areas; red or yellow spots on or between the parr marks in fresh wild specimens..... 14
- 14a. Pectoral fins as long as depressed dorsal fin; caudal fin deeply formed, the center rays about half the length of the longest rays.....
 **Atlantic salmon, *Salmo salar* Linnaeus**
- b. Pectoral fins shorter than depressed dorsal fin; caudal fin not deeply formed, the center rays definitely more than half the length of the longest rays..... 15
- 15a. Black spots about the size of the eye pupil present below the lateral line anterior to the anal fin; parr marks usually 10 or 11, none as wide as eye diameter.....
 **brown trout, *Salmo trutta* Linnaeus**
- b. No black spots the size of the eye pupil present below the lateral line anterior to the anal fin (tiny melanophores are numerous, however); 8 or 9 wide parr marks, the widest about equal to eye diameter.....
 **brook trout, *Salvelinus fontinalis* (Mitchill)**
- 16a. No parr marks of any size present.....
 **pink salmon, *Oncorhynchus gorbuscha* (Walbaum)**
- b. Parr marks present..... 17
- 17a. Adipose fin uniformly pigmented; first anal ray elongate, making the anal fin margin appear quite concave when extended; anal fin usually with some dark pigment behind the white leading edge; usually 45-50 pyloric caeca.....
 **coho salmon, *Oncorhynchus kisutch* (Walbaum)**
- b. Adipose fin with an unpigmented central area; first anal ray not elongate; anal fin usually without dark pigment behind the white leading edge; usually 135-185 pyloric caeca.....
 **chinook salmon, *Oncorhynchus tshawytscha* (Walbaum)**

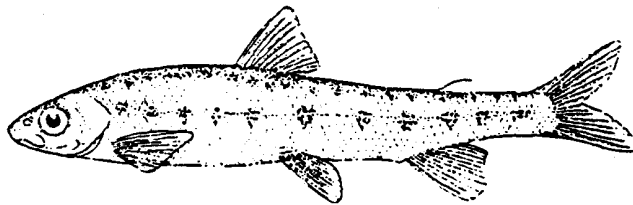
18a. Single flap of skin between anterior and posterior nostrils; gill rakers <22 19

b. Double flap of skin between anterior and posterior nostrils; gill rakers >22 20

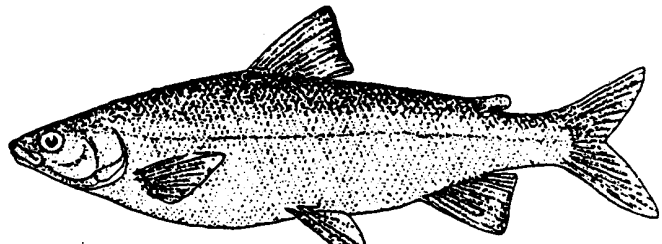
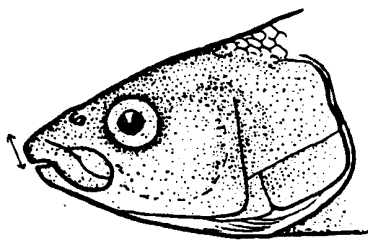
19a. Lateral line scales 80-100; pyloric caeca 87-117
round whitefish, *Prosopium cylindraceum* (Pallas)



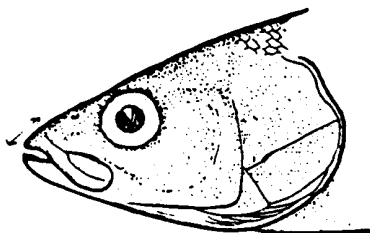
b. Lateral line scales 55-70; pyloric caeca 15-23 Wisconsin waters of Lake Superior only
pigmy whitefish, *Prosopium coulteri* (Pallas)



20a. Snout rounded with premaxillaries oriented backward; premaxillary wider than long; gill rakers short and <32
lake whitefish, *Coregonus clupeaformis* (Mitchill)



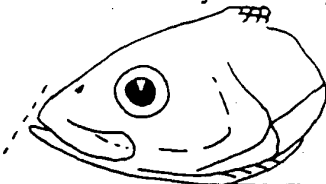
b. Snout pointed with premaxillaries oriented forward; premaxillary longer than wide; gill rakers short or long and >32 21



CAUTION: THE SPECIES BELOW ARE EXTREMELY PHENOTYPICALLY PLASTIC AND ARE VERY DIFFICULT TO IDENTIFY WITH 100% CERTAINTY; CONSIDER ALL IDENTIFICATIONS TENTATIVE!

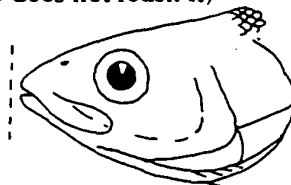
21a. Anterior tip of mandible extends beyond the tip of premaxillaries

22



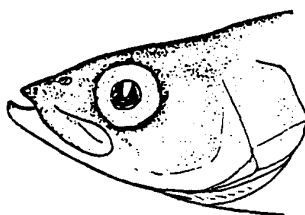
b. Anterior tip of mandible does not extend beyond tip of premaxillaries (it either extends to it or does not reach it)

23



22a. Gill rakers about the length of the gill filaments and usually fewer than 41; distance from origin of pectoral fin to origin of pelvic fin less than distance from pelvic fin origin to anal fin insertion; pelvic fins reaching to anus or beyond; eye diameter equal or almost equal to snout length

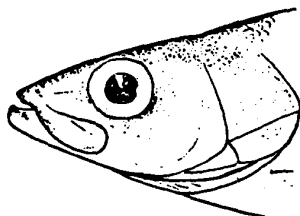
kiyi, *Coregonus kiyi* (Koelz)



also see next page for morphometrics

b. Gill rakers longer than the length of the longest gill filaments and usually more than 41; distance from origin of pectoral fin to origin of pelvic fin greater than distance from pelvic fin origin to anal fin insertion; pelvic fins barely reaching anus or short of it; eye diameter smaller than snout length

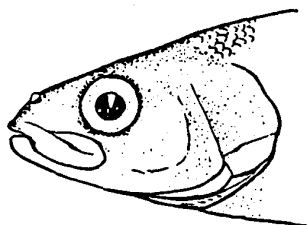
bloater, *Coregonus hoyi* (Gill)



also see next page for morphometrics

23a. Tip of the premaxillary projects beyond the tip of the mandible; posterior margin of premaxillary reaches or surpasses center of the eye; distance from origin of pectoral fin to origin of pelvic fin greater than distance from pelvic fin origin to anal fin insertion

shortjaw cisco, *Coregonus zenithicus* (Jordan and Evermann)



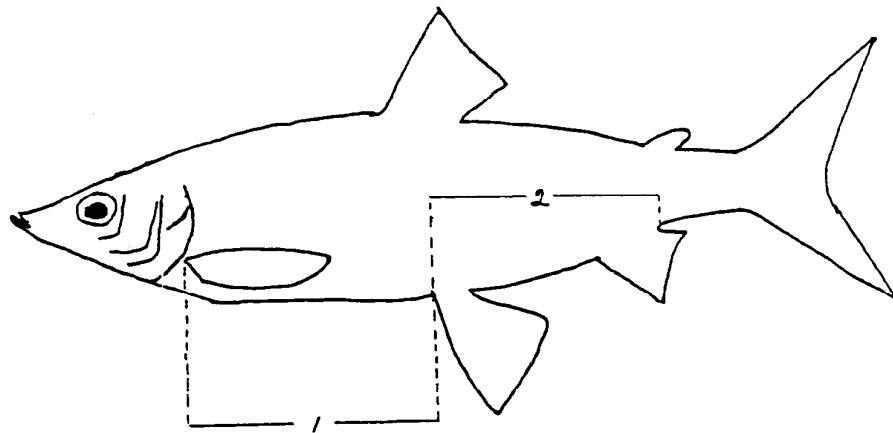
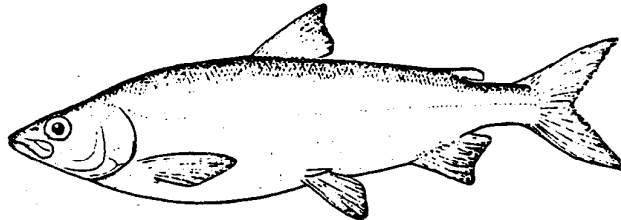
also see next page for morphometrics

- b. Tip of the mandible extends just to tip of the premaxillary; posterior margin of premaxillary not reaching center of the eye; distance from origin of pectoral fin to origin of pelvic fin less than distance from pelvic fin origin to anal fin insertion.....
cisco or lake herring, *Coregonus artedii* Lesueur

Further Caution: there may also be two other species in the state; their validity as species is being debated: *they would key here w/ 12 cisco*

blackfin cisco, *Coregonus nigripinnis* (Gill)

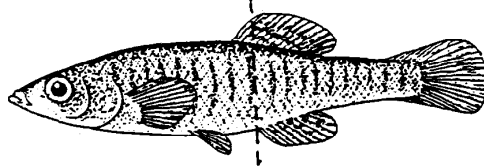
Nipigon cisco, *Coregonus nipigon* (Koelz)



morphometric comparisons
for ciscoes

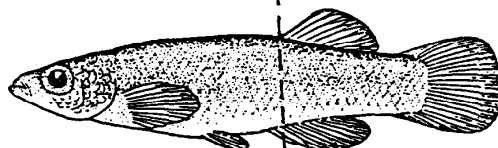
XI. Key to the Species of Fundulidae

- 1a. Origin of dorsal fin anterior to origin of anal fin; no dark teardrop under eye and sides of body with thin verticle bands spaced from pectoral fin origin to caudal peduncle.....banded killifish, *Fundulus diaphanus* (Lesueur)

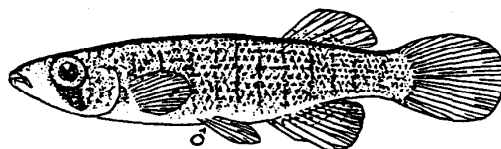


- b. Origin of dorsal fin posterior to origin of anal fin; sides of body either plain and without a dark teardrop under eye or with a teardrop and side markings..... 2

- 2a. No teardrop beneath eye and sides of body plain; anal fin rays usually 12-14; dorsal fin rays usually 10-11....plains topminnow, *Fundulus sciadicus* Cope

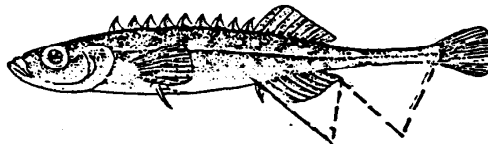


- b. Teardrop beneath eye and sides of body with dotted horizontal lines (females) or with dotted horizontal lines combined with dark vertical bands (males); anal fin rays usually 11; dorsal fin rays usually 8-9 (Mississippi R. below L. Pepin).....southern starhead topminnow, *Fundulus notti* (Agassiz)



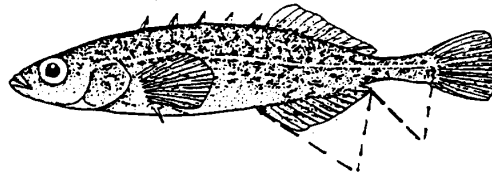
XII. Key to the Species of Gasterosteidae

- 1a. Eight or more isolated dorsal spines; distance from base of first anal soft ray to posterior margin of anal fin about equal to distance from posterior margin of anal fin to end of vertebral column.....ninespine stickleback, *Pungitius pungitius* (Linnaeus)



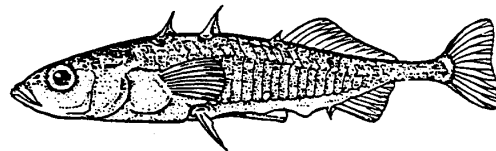
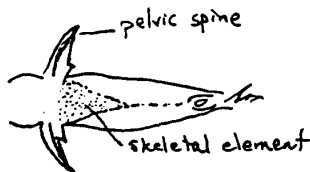
- b. Six or fewer isolated dorsal spines; distance from base of first anal soft ray to posterior margin of anal fin greater than distance from posterior margin of anal fin to end of vertebral column..... 2
(see couplet 2a)

- 2a. Base of the dorsal fin under the soft rays shorter than base of the anal fin under the soft rays; 4-6 fairly evenly spaced spines of approximately equal height; no trace of lateral keel on caudal peduncle.....
brook stickleback, *Culaea inconstans* (Kirtland)

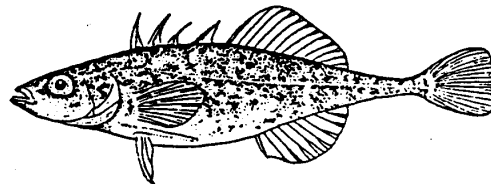
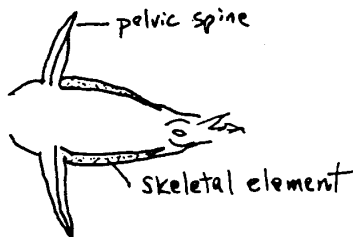


- b. Base of the dorsal fin under the soft rays longer than base of the anal fin under the soft rays; 2-4 isolated dorsal spines of unequal height separated asymmetrically from a short spine that just precedes the soft dorsal rays; may have lateral keel on peduncle..... 3

- 3a. A single, elongated, triangular skeletal element projecting mesially and posteriorly from middle of pelvic fin bases; caudal fin margin straight to slightly indented; lateral line obvious and complete; caudal peduncle usually with lateral keels; sides of body often with several vertically oblong bony plates; usually 3 (rarely 2 or 4) total dorsal spines (**recent introduction to Lake Superior**).....
 threespine stickleback, *Gasterosteus aculeatus* Linnaeus



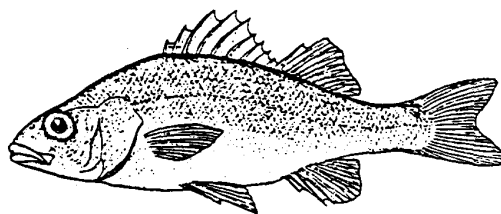
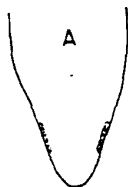
- b. A lateral skeletal element projecting posteriorly from each pelvic fin base; caudal fin margin rounded; lateral line present but inconspicuous and often incomplete; caudal peduncle never with lateral keels; sides of body never with several vertically oblong bony plates; usually 4 (rarely 5) total dorsal spines (**recent introduction to Lake Superior**).....
fourspine stickleback, *Apeltes quadracus* (Mitchill)



XIII. Key to the Species of Moronidae

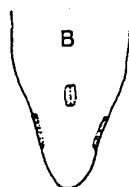
- 1a. Tooth patch in center of tongue absent (tongue teeth in two narrow strips along lateral margins of tongue only); sides of body plain silvery or with faint, irregular longitudinal stripes

white perch, *Morone americana* (Gmelin)



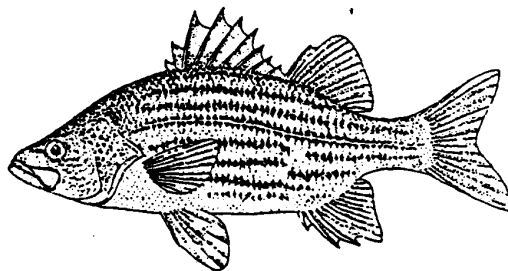
- b. Double row of teeth along center of tongue (teeth also present in two narrow strips along lateral margins of tongue); sides of body with numerous dark, obvious longitudinal stripes

2



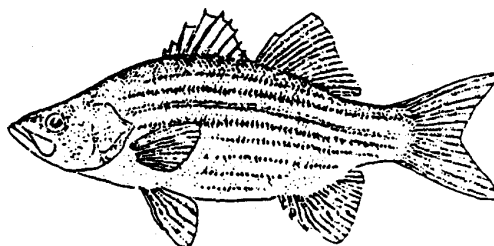
- 2a. Second anal spine 3 times longer than first and almost as long as the third, also thicker than the third anal spine; soft dorsal rays 8-10; at least a slight membranous connection between the two dorsal fins; most longitudinal stripes twice as wide as diameter of dorsal spines

yellow bass, *Morone mississippiensis* Jordan and Eigenmann



- b. Second anal spine 2 times as long as first and 2/3 to 3/4 as long as third, also about same thickness as the third anal spine; soft dorsal rays 12 or 13; no membranous connection whatsoever between the two dorsal fins; most longitudinal stripes as wide as or slightly wider than diameter of dorsal spines

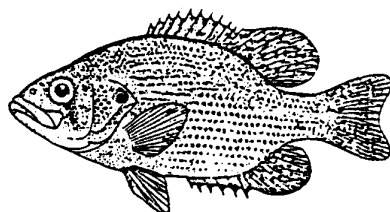
white bass, *Morone chrysops* (Rafinesque)



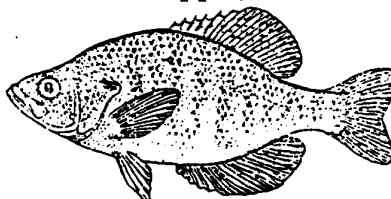
XIV. Key to the Species of Centrarchidae

- 1a. More than 3 spines in anal fin..... 2
- b. Only 3 spines in anal fin..... 4

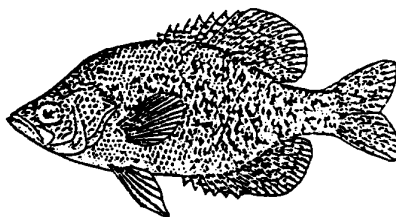
- 2a. Length and area of dorsal fin noticeably greater than length and area of anal fin;
10 or 11 spines in dorsal fin.....
..... **rock bass, *Ambloplites rupestris* (Rafinesque)**



- b. Length and area of dorsal fin and anal fin appearing nearly equal (see couplet 3 illustrations); 6-8 spines in dorsal fin..... 3
- 3a. Length of dorsal fin base less than the distance from dorsal fin origin to posterior margin of eye; usually 5 or 6 spines in dorsal fin.....
..... **white crappie, *Pomoxis annularis* Rafinesque**

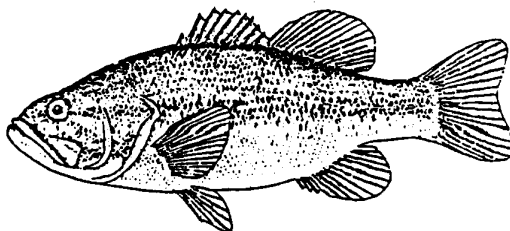


- b. Length of dorsal fin base about equal to the distance from dorsal fin origin to posterior margin of eye; usually 7 or 8 spines in dorsal fin
..... **black crappie, *Pomoxis nigromaculatus* (Lesueur)**



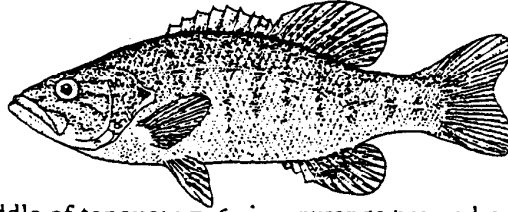
- 4a. Body somewhat elongate, depth contained about 3 times in standard length;
more than 59 scales in lateral line..... 5
- b. Body rounder, depth contained 2.5 times or less in standard length; less than
54 scales in lateral line..... 6

- 5a. Upper jaw extends beyond posterior margin of eye in adults; spinous dorsal fin
arched, shortest of 3 posterior-most spines less than 1/2 length of longest
dorsal spine; scales on cheeks large, in 9-11 rows; wide, dark lateral band
often visible, especially in younger fish; caudal fin of juveniles lacking colorful
pigment..... **largemouth bass, *Micropterus salmoides* (Lacépède)**



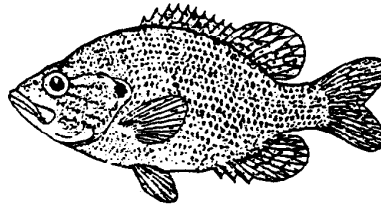
- b. Upper jaw does not extend beyond posterior margin of eye in adults; spinous dorsal fin with low contour, shortest of the 3 posterior-most spines more than 1/2 length of longest dorsal spine; scales on cheeks small, in 15-18 rows; side markings, if present, are verticle bands; caudal fin of juveniles with yellow-orange base and dark, crescent mark through middle

smallmouth bass, *Micropterus dolomieu* (Lacépède)



- 6a. Teeth present in middle of tongue; upper jaw extends beyond middle of eye and a well-developed supramaxillary bone is evident; 3-5 fingerlike marks radiating from eye across operculum (Mississippi River below L. Pepin)

warmouth, *Chaenobryttus gulosus* Cuvier



- b. Teeth absent from middle of tongue; upper jaw does not extend beyond middle of eye and supramaxillary bone is absent or poorly developed; fingerlike marks behind eye absent

7

- 7a. Pectoral fins short and rounded, their length less than 4 times the length of their base

8



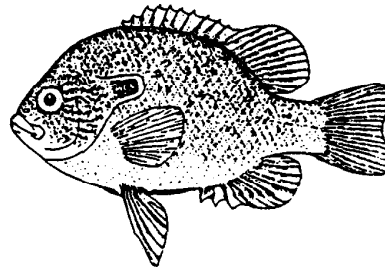
- b. Pectoral fins long and pointed, their length at least 4 times the length of their base

9

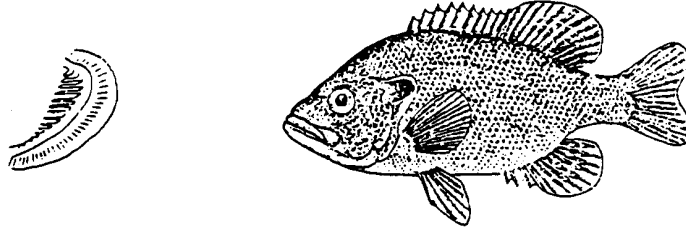


- 8a. Opercular lobe ("earflap") longer than wide; gill rakers short, knoblike and crooked; no dark blotch at posterior base of dorsal fin

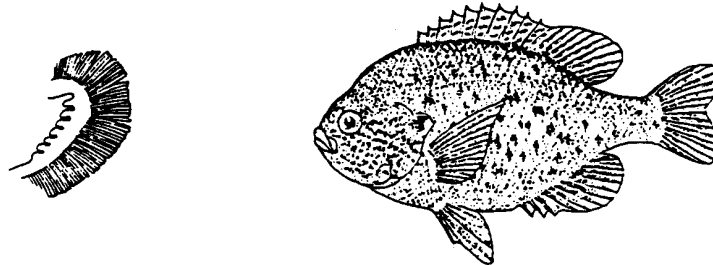
longear sunfish, *Lepomis megalotis* (Rafinesque)



- b. Opercular lobe ("earflap") wider than long; gill rakers long, straight and pointed;
dark blotch at posterior base of dorsal fin usually present
green sunfish, *Lepomis cyanellus* Rafinesque



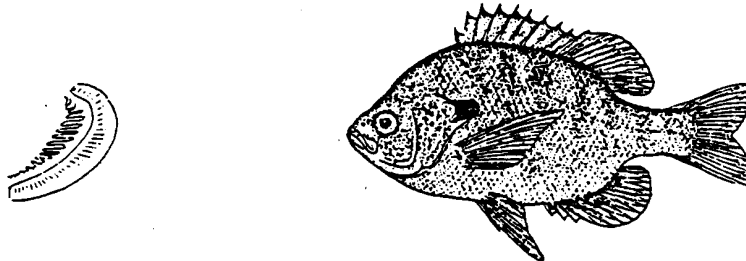
- 9a. Gill rakers short and knoblike, barely longer than wide
pumpkinseed, *Lepomis gibbosus* (Linnaeus)



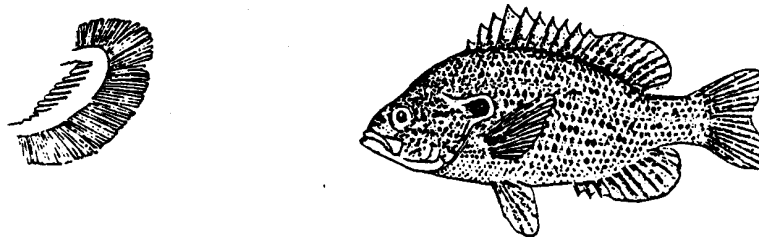
- b. Gill rakers long, at least 2 times longer than wide
(see couplet 10a & b.)

10

- 10a. Gill rakers pointed; opercular lobe ("earflap") without a light margin around
entire edge; distinct dark blotch at posterior base of dorsal fin
bluegill, *Lepomis macrochirus* Rafinesque



- b. Gill rakers blunt; opercular lobe ("earflap") with a distinct light margin around
entire edge; no distinct dark blotch at posterior base of dorsal fin
orangespotted sunfish, *Lepomis humilus* (Girard)



XV. Key to the Species of Percidae

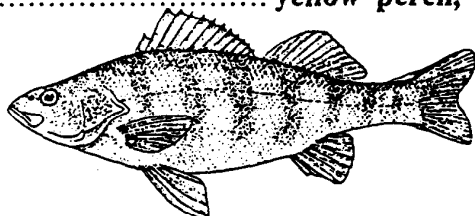
- 1a. Spinous and soft dorsal fins completely confluent; posterior margin of the preopercle bearing spines several stout spines (introduced, St. Louis Estuary and Lake Superior)..... **ruffe, *Gymnocephalus cernua* Linnaeus**

- b. Spinous and soft dorsal fins distinctly separated; posterior margin of the preopercle serrate (tooth-like margin) or entire ("smooth" margin)..... 2
(see couplet 2)

- 2a. Posterior margin of the preopercle serrate (tooth-like margin); branchiostegal rays 7 or 8; tail clearly forked, not just indented; adults large (>160 mm)..... 3

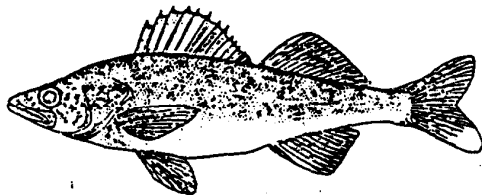
- b. Posterior margin of the preopercle is entire ("smooth" margin); branchiostegal rays 6; tail not forked, indented at most; adults small (<135 mm)..... 5

- 3a. No canine teeth present on jaws and palatine bones.....
..... **yellow perch, *Perca flavescens* (Mitchill)**

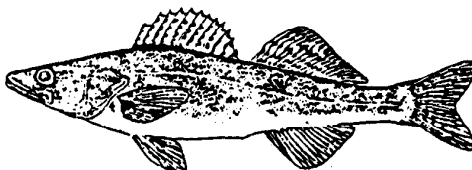


- b. Canine teeth present on jaws and palatine bones..... 4

- 4a. Dorsal fin with about 20 soft rays; large black spot near base of last 3 dorsal spines; tip of lower lobe of caudal fin usually whitish; no black spot at base of pectoral fin; pyloric caeca usually 3 and about same length as stomach
..... **walleye, *Stizostedion vitreum* (Mitchill)**

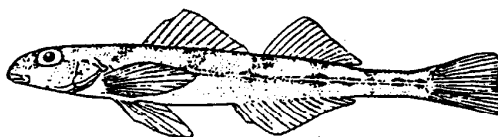


- b. Dorsal fin with about 17 soft rays; series of black spots in membranes between dorsal spines, but no large black spot near base of last 3; tip of lower lobe of caudal fin no whitish; black spot at base of pectoral fin; pyloric caeca usually 4-6 and shorter than stomach... **sauger, *Stizostedion canadense* (Smith)**



- 5a. Body long and slender, its depth contained 7 or more times in length; body color pallid or translucent with dorsal dark pigment faintly developed; anal fin with 1 spine (see couplet 6 figures)..... 6
- b. Body more robust, its depth contained fewer than 7 times in length; dorsal dark pigment usually well developed; anal fin with 1 or 2 spines..... 7

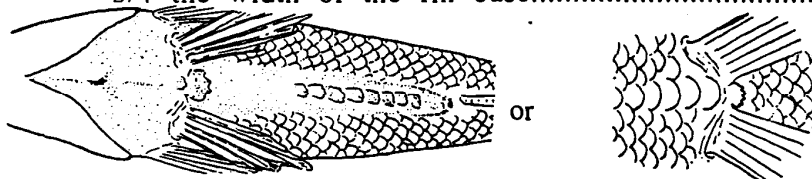
- 6a. Back with 4 faint, broad saddles; 12-16 soft anal rays; more than 89 lateral line scales..... **crystal darter, *Crystallaria asprella* (Jordan)**



- b. Back without saddles; 7-10 soft anal rays; 80 or fewer lateral line scales.....
..... **western sand darter, *Etheostoma clarum* Jordan and Meek**

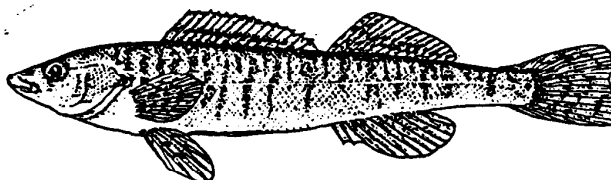


- 7a. Belly and/or area between pelvic fins with 1 or more enlarged scales having strong cteni; pelvic fins widely separated, the space between them at least $\frac{3}{4}$ the width of the fin base..... 8



- b. Belly and area between pelvic fins lacking enlarged scales as above; pelvic fins more narrowly separated, the space between them less than $\frac{3}{4}$ the width of the fin base..... 12

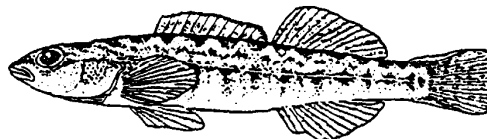
- 8a. Snout conical and "pig-like"; 15 or more narrow saddles across back with similar marks down the sides giving a "tiger" appearance; dorsal rays plus spines >30
..... **logperch, *Percina caprodes* (Rafinesque)**



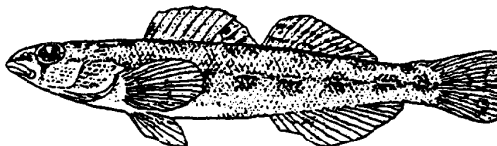
- b. Snout not conical and "pig-like"; saddles across back fewer than 12 or absent, with variable shaped blotches on the sides not mixing with the saddles to give a "tiger" appearance; dorsal rays plus spines <29..... 9

- 9a. Distance from tip of snout to junction of gill membranes greater than the distance from the membrane junction to the insertion of the pelvic fins; distance between eyes when viewed from above less than pupil diameter; suborbital bar absent or indistinct.....
.....slenderhead darter, *Percina phoxocephala* (Nelson)

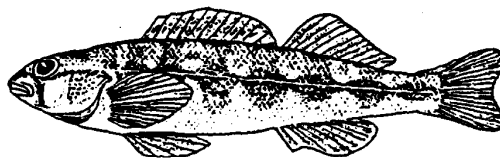
in B



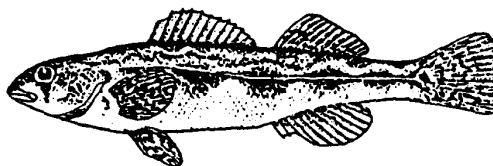
- b. Distance from tip of snout to junction of gill membranes less than the distance from the membrane junction to the insertion of the pelvic fins; distance between eyes when viewed from above greater than pupil diameter; suborbital bar dark and distinct..... 10
- 10a. Spinous dorsal fin with dark marks at the base between the first and second spine and between the last 3 spines; 8-11 dark, lateral blotches higher than wide at the level of the pectoral fin and becoming wider than high on the caudal peduncle.....river darter, *Percina shumardi* (Girard)



- b. Spinous dorsal fin with uniform dark pigment or arranged in a continuous lower band, but not in marks as above; lateral blotches at level of pectoral fin either squarish, rectangular or ovate (as wide as high or wider)..... 11
- 11a. Spinous dorsal fin more or less uniformly pigmented except for the extreme outer margin; back with 5-8 dark saddles, some of which are faintly confluent with the lateral blotches; lateral blotches forward of the soft dorsal basically squarish with noticeable space in between.....
.....gilt darter, *Percina evides* (Jordan and Copeland)



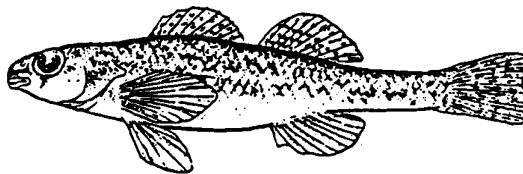
- b. Spinous dorsal fin darkly pigmented in the lower half; back with vermiform or checkerboard marks rather than saddles; lateral blotches forward of the soft dorsal basically rectangular or oval with little if any space between.....
.....blackside darter, *Percina maculata* (Girard)



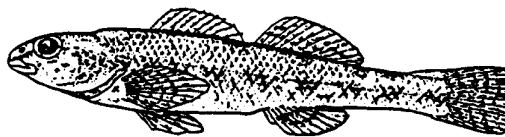
12a. Premaxillaries protractile, separated from snout by a complete groove..... 13

b. Premaxillaries not protractile, a small fleshy area (the frenum) interrupts the maxillary groove in the center of the snout..... 14

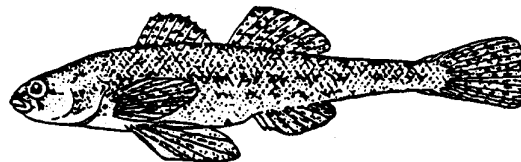
13a. Lateral line incomplete; preorbital bar continuous from eye to eye across snout; breast and cheek fully scaled.....
.....bluntnose darter, *Etheostoma chlorosomum* (Hay)



b. Lateral line complete; preorbital bar broken at center of snout; breast and lower cheeks naked.....johnny darter, *Etheostoma nigrum* Rafinesque

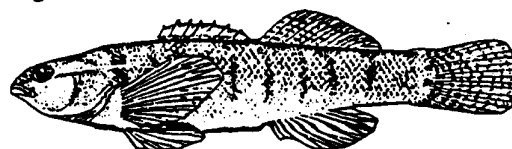


14a. Spinous dorsal with 6 or 7 spines; lateral line with 8 or fewer pored scales; pelvic fins reaching nearly to vent or beyond.....
.....least darter, *Etheostoma microperca* Jordan and Gilbert



b. Spinous dorsal with 8 or more spines; lateral line with 10 or more pored scales; pelvic fins not reaching vent..... 15

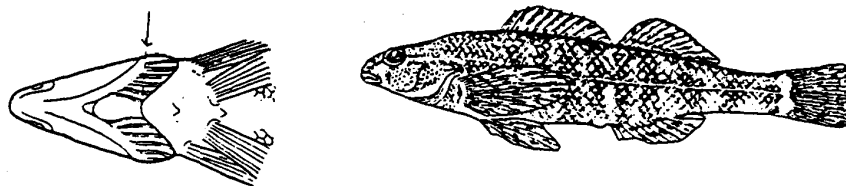
15a. Head completely scaleless; sides of body with many horizontal dashed lines; rounded tail; breeding males with fleshy knobs atop the dorsal spines and lacking bright colors..fantail darter, *Etheostoma flabellare* Rafinesque



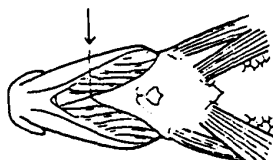
b. Head at least partially scaled; sides of body variously marked, but lacking horizontal dashed lines; breeding males with bright colors and lacking

fleshy knobs atop the dorsal spines..... 16

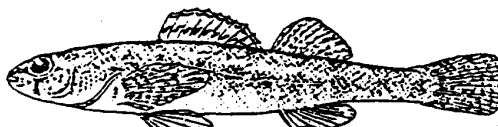
- 16a. Gill membranes very broadly connected and covering the isthmus; predominantly emerald green body color in breeding males and sometimes females.....
..... banded darter, *Etheostoma zonale* (Cope)



- b. Gill membranes narrowly connected forming a 'V' at the isthmus; predominant body colors of breeding males not blue, red or orange, but not green..... 17

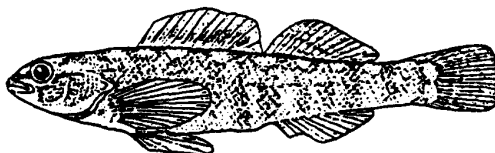


- 17a. Body slender, its depth 4.8-5.5 in standard length; scales in lateral line series 55 or more; gill rakers 7, short and knoblike.....
..... Iowa darter, *Etheostoma exile* (Girard)

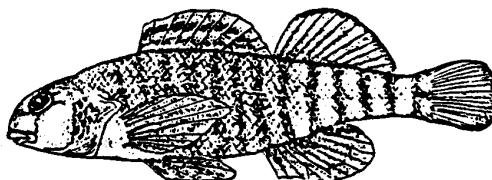


- b. Body deeper, its depth 4.0-5.0 in standard length; scales in lateral lines series 50 or fewer; gill rakers 8, long and stout but may have knobs..... 18

- 18a. Cheeks fully scaled..... mud darter, *Etheostoma aspringene* (Forbes)

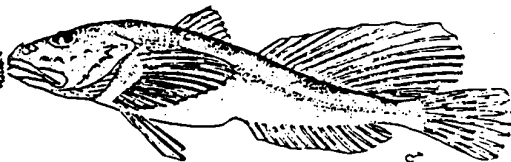
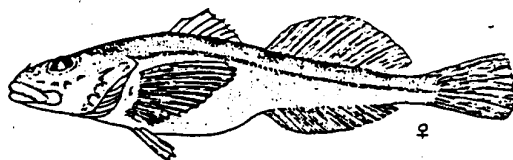
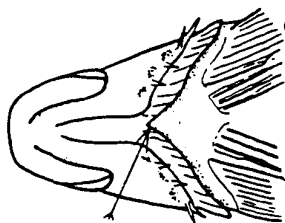


- b. Cheeks naked or with a few embedded posterior to the eye.....
.....rainbow darter, *Etheostoma caeruleum* Storer

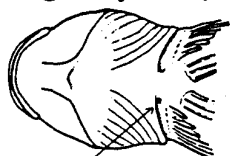


XVI. Key to the Species of Cottidae

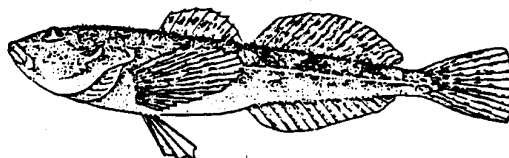
- 1a. Gill membranes free from the isthmus and forming a 'V'; dorsal fins separated by a space about equal to eye diameter; 2-4 large and partially naked spines on preopercle. **deepwater sculpin, *Myoxocephalus thompsoni* (Girard)**



- b. Gill membranes broadly joined to the isthmus; dorsal fins barely separated or touching; only one partially naked spine on preopercle..... 2

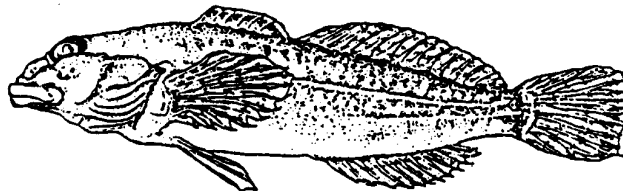


- 2a. Lateral line complete; single pore on the midline of chin.....
.....**spoonhead sculpin, *Cottus ricei* (Nelson)**



- b. Lateral line incomplete; 2 midchin pores, one on either side of midline 3

- 3a. Pelvic rays usually 3, if 4 then the last ray is $\frac{2}{3}$ or less the length of the longest ray; distance from insertion of anal fin to end of vertebrae (caudal peduncle length) is greater than distance from posterior margin of eye to posterior margin of opercle (postorbital distance); last 2 rays of dorsal and anal fins usually arise from separate bases; palatine teeth usually absent.....
.....**slimy sculpin, *Cottus cognatus* Richardson**



- b. Pelvic rays 4, with the last ray usually more than $\frac{2}{3}$ the length of the longest ray; caudal peduncle length is less than postorbital distance; last 2 rays of dorsal and anal fins usually arise from a single base; palatine teeth usually present
.....**mottled sculpin, *Cottus bairdi* Girard**

