

Minnesota Fish Taxonomic Key

2017 Edition



Pictures from – NANFA (2017)



Warren Lamb

Aquatic Biology Program
Bemidji State University
Bemidji, MN 56601

Introduction

Minnesota's landscape is a maze of lakes and rivers that are home to a recorded total of 163 species of fish. This document is a complete and current dichotomous taxonomic key of the Minnesota fishes. This key was based on the 1972 "Northern Fishes" key (Eddy 1972), and updated based on Dr. Jay Hatch's article "Minnesota Fishes: Just How Many Are There?" (Hatch 2016). Any new species or family additions were also referenced to the 7th edition of the American Fisheries Society "Names of North American Fishes" (Page et al. 2013) to assess whether a fish species is currently recognized by the scientific community. Identifying characteristics for new additions were compared to those found in Page and Burr (2011). In total five species and one family have been added to the taxonomic key, while three have been removed since the last publication. Species pictures within the keys have been provided from either Bemidji State University Ichthyology Students or North American Native Fish Association (NANFA). My hope is that this document will offer an accurate and simple key so anyone can identify the fish they may encounter in Minnesota.

Warren Lamb – 2017



Pictures from – NANFA (2017)

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- NANFA (North American Native Fish Association). 2017. North American Native Fish Association: Gallery. Accessed 10 May 2017. <http://forum.nanfa.org/index.php/gallery/>

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Key to the Families of Fishes in Minnesota

Modified from Eddy, Samuel and James C. Underhill. 1974. Northern Fishes.
University of Minnesota Press, Minneapolis. 414pp.

- 1a. Mouth a sucker-like disk without jaws; paired fins absent; single, median nostril; 7 distinct gill openings on each side of the 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 abbreviate heterocercal3
- b. Tail homocercal6
- (2a.) 3a. Tail heterocercal, the dorsal and ventral lobes of the caudal fin clearly distinguishable from one another; mouth sub-terminal; body lacking a complete covering of scales4
- b. Tail abbreviate heterocercal, the caudal fin appearing more or less as one rounded fin; mouth terminal; body fully covered in scales5
- (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



Picture by Will Varela – 2016

- 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**
- (3a.) 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



Picture by Will Varela – 2016

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



Picture by Ryan Henry – 2016

- b. Pelvic fins present; dorsal, caudal, and anal fins never continuous7
- (6b.) 7a. Adipose fin present8
- b. Adipose fin absent11
- (7a.) 8a. Several barbels present around mouth; stout spines present around pectoral fins
VII. Ictaluridae
- b. Barbels absent around mouth, although single barbel may be present on chin; stout spines
not present on pectoral fins9
- (8b.) 9a. Pelvic axillary process present..... **X. Salmonidae**
- b. Pelvic axillary process absent10
- (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)



Picture by Steve Hauschildt – 2016

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



Picture by Will Varela – 2016

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



Picture by Matthew Wang – 2017

- b. Anus directly anterior to the anal fin12
- (11b.) 12a. Single barbel under chin; dorsal and anal fins extending over half of the body length..
Gadidae–Burbot, *Lota lota* (Linnaeus)



Picture by Brad Klingsheim – 2014

- b. No barbel under chin; dorsal and anal fins not extending over nearly half of the body length13
- (12b.) 13a. Body appears scaleless, although some tiny spines or prickles may be present14
- 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 spines connected by a membrane; prickles on body**XVI. Cottidae**
- (13b.) 15a. Dorsal fin single, without spines or with 1 saw-toothed hard ray16
- b. Dorsal either divided into two parts or, if single, with 4 or more sharp spines23
- (15a.) 16a. Caudal fin rounded.....17
- b. Caudal fin indented or forked18
- (16a.) 17a. Premaxillaries nonprotractile; origin of dorsal fin slightly posterior to the pelvic fin base
Esocidae–Central mudminnow, *Umbra limi* (Kirtland)



Picture by Arianne Louwers – 2014

- 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 eye21
- (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 present20
- (19b.) 20a. Lateral line present; part of belly sharp but without sawtoothed margin.. **IV. Hiodontidae**
- b. Lateral line absent; belly with sawtoothed margins..... **V. Clupeidae**
- (16b.) 21a. Single dorsal fin with 1 stout, hard ray **VI. Cyprinidae, in part**
- b. Single dorsal fin without a hard ray22
- (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 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
Atherinopsidae–Brook silverside, *Labidesthes sicculus* (Cope)



Picture by Jonathan Peterson – 2014

- b. Anal soft rays 18 or fewer; dorsal fin single, notched or barely separated into 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 confluent; soft dorsal fin with 24 or more rays; lateral line extends onto caudal fin.....
Sciaenidae–Freshwater drum, *Aplodinotus grunniens* (Rafinesque)



Picture by Christopher Mjones – 2015

- b. Spinous and soft-rayed portions of dorsal fin distinctly divided; soft dorsal fin with fewer than 25 rays; lateral line does not extend onto caudal fin if present**27**
- (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**
- (25a.) 27a. Possess lateral line system; pelvic fins distinctly separated**XV. Percidae**
- b. Lateral line system absent; pelvic fins fused**XVII. Gobiidae**

Key to the Species of Fishes in Minnesota

I. Key to the Species of Petromyzontidae

- 1a. Dorsal fin separated into two distinct lobes, either completely divided or notched to the body musculature**2**



Picture by Steve Hauschildt – 2016

- b. Dorsal fin continuous, not separated.....3



Picture by Steve Hauschildt – 2016

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



Picture by Steve Hauschildt – 2016

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



Picture by Jacob Kaden – 2017

- (1b.) 3a. Posterior portion of oral disk with well–developed teeth4
 b. Posterior portion of oral disk with poorly developed teeth.....5

- (3a.) 4a. Most circumoral teeth with 2 large, pointed cusp
Chestnut lamprey, *Ichthyomyzon castaneus* (Girard)



Picture by Steve Hauschildt – 2016

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



Picture by Steve Hauschildt – 2016

- (3b.) 5a. Circumoral teeth moderately developed with 1 or 2 pointed cusps
Southern brook lamprey, *Ichthyomyzon gagei* (Reighard & Cummins)



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



II. Key to the Species of Acipenseridae

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



Picture by Kayla Morey – 2016

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



Picture by Alexis Jerry – 2016

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)



Picture by Alexis Jerry – 2016

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



Picture by Megan Novy – 2016

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
Goldeye, *Hiodon alosoides* (Rafinesque)



Picture by Jon Brill – 2015

- 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.....

Mooneye, *Hiodon tergisus* (LeSueur)



Picture by Jacob Kaden – 2017

V. Key to the Species of Clupeidae

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



Picture by Cody Dock – 2016

- b. Last dorsal ray not elongated; snout sharp; lower jaw projecting; predorsal midline scaled2

- (1b.) 2a. Spot on side behind opercle; upper jaw without teeth on rim; gill rakers long.....

Alewife, *Alosa pseudoharengus* (Wilson)



Picture by Cody Dock – 2016

- b. No spot on side behind opercle; upper jaw with teeth on rim; gill rakers short

Skipjack, *Alosa chrysochloris* (Rafinesque)

VI. Key to the Species of Cyprinidae

- 1a Diameter of eye is below mouth line2
 b. Diameter of eye is above mouth line.....3

- (1a) 2a. Origin of dorsal fin parallel with pelvic fin origin; keel extending from junction of branchiostegal membrane to anus.....

Silver carp, *Hypophthalmichthys molitrix* (Velenciennes)

- b. Origin of dorsal fin slightly behind pelvic fin origin; keel only present from anus to pelvic fins.....

Bighead carp, *Hypophthalmichthys nobilis* (Richardson)



Picture by Arianne Louwers – 2014

- 3a. Dorsal fin with more than 11 soft rays; dorsal and anal fins with stout, hard spine-like first ray4
- b. Dorsal fin with fewer than 10 soft rays; no spine-like rays present5
- (3a.) 4a. Barbels present on upper jaw **Common carp, *Cyprinus carpio* (Linnaeus)**



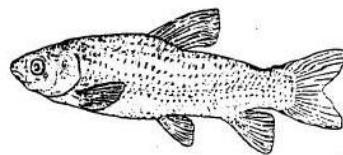
Picture by Jacob Kaden – 2017

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



Picture by Arianne Louwers – 2014

- (3b.) 5a. 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 $\frac{1}{2}$ to $\frac{3}{4}$ the distance from anal fin origin to caudal fin base (end of hypural plate)6
- (5b.) 6a. Lower jaw with a hard, cartilaginous shelf projecting anteriorly beyond the tip of the flesh of the lower jaw (touch with your finger)7



Picture by Steve Hauschildt – 2016

- b. Lower jaw lacking the cartilaginous shelf8

- (6a.) 7a. 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)**



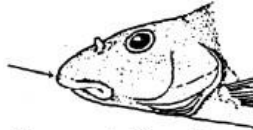
Picture by Kayla Morey – 2016

- b. 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 stone roller, *Campostoma anomalum* (Rafinesque)**

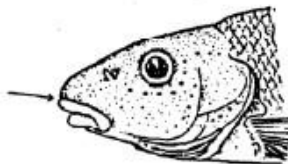


Picture by Niki Carlton – 2014

- (7b.) 8a. Premaxillaries nonprotractile, attached to the snout with skin so that there is not a continuous premaxillary groove separating them from the snout.....9



- b. Premaxillaries protractile, separated from the snout by a continuous premaxillary groove10



- (8a.) 9a. 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)**



Picture by Niki Carlton – 2014

- 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)**



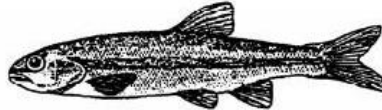
Picture by Maria Berkeland – 2014

(8b.) 10a. Barbel present at the posterior tip of the maxillary (not hidden in maxillary groove)....11



b. Barbel not present at the posterior tip of the maxillary (may be in maxillary groove)...17

(10a.) 11a. Lateral line scales more than 55..... **Lake chub, *Couesius plumbeus* (Agassiz)**



b. Lateral line scales less than 45.....12

(11b.) 12a. Blotches present on sides along the lateral band.....13



b. Blotches not present on sides along the lateral band14



(12a.) 13a. Barbel as long or longer than diameter of pupil of eye; sides of the body rather heavily sprinkled with black dots **Speckled chub, *Marchybopsis aestivalis* (Girard)**



Picture by Kristin Huber – 2015

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



Picture by Niki Carlton – 2014

(12b.) 14a. Dark pigmentation prevalent in interradial membranes of first 4 dorsal rays; snout with 3 horizontal rows of breeding tubercles (breeding male) **Bluntnose minnow, *Pimephales notatus* (Rafinesque)**



Picture by Jonathan Peterson – 2014

- b. Pigmentation in dorsal fin membranes scattered or absent; breeding tubercles not as above or absent 15

- (14b.) 15a. 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)**



Picture by Niki Carlton – 2014

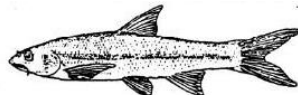
- b. Diameter of orbit noticeably less than distance from its posterior margin to the dorsal end of gill opening 16

- (15b.) 16a. 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)

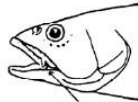


Picture by Niki Carlton – 2014

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



- (10b.) 17a. Small barbel (may be more like a slight blip) within the maxillary groove 18



- b. No barbel or any kind present within the maxillary groove 19

- (17a.) 18a. 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)



Picture by Niki Carlton – 2014

- b. Mouth small, maxillary not extending to front of eye; no black spot anterior dorsal fin base in adults; lateral line scales 60–75
Northern pearl dace, *Margariscus nachtriebi* (Cox)



Picture by Brad Klingsheim – 2014

- (17b.) 19a. Lateral line scales 62 or more20
- b. Lateral line scales 60 or fewer25

- (19a.) 20a. Intestine short, with a single main loop less than twice as long as body; single dusky lateral band present21



- 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.....24



- (20a.) 21a. Lining of abdominal cavity black; lateral line incomplete; scales minute, more than 80 in lateral line **Finescale dace, *Chrosomus neogaeus* (Cope)**



Picture by Arianne Louwers – 2014

- b. Lining of abdominal cavity pale; lateral line complete with fewer than 80 scales22

- (21b.) 22a. Mouth small, maxillary not extending beyond front of eye.....
Northern pearl dace, *Margariscus nachtriebi* (Cox)



Picture by Niki Carlton – 2014

- b. Mouth large, maxillary extending beyond front of eye23

- (22b.) 23a. 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)



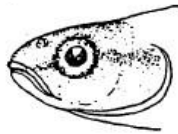
Picture by Jonathan Peterson – 2014

- 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
Creek chub, *Semotilus atromaculatus* (Mitchill)



Picture by Niki Carlton – 2014

- (20b.) 24a. Mouth sharply oblique (usually 45° or more) and curved; chin slightly anterior to upper lip; length of upper jaw less than ¼ the head length; distance from tip of snout to back of eye usually about equal to rest of head
Northern redbelly dace, *Chrosomus eos* (Cope)



Picture by Niki Carlton – 2014

- 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 ¼ the head length; distance from tip of snout to back of eye distinctly longer than rest of head
Southern redbelly dace, *Chrosomus erythrogaster* (Rafinesque)



Picture by Will Varela – 2016

- (19b.) 25a. Abdomen posterior to the pelvic fins with a fleshy, scaleless keel; lateral line strongly curved downward in middle position of body
Golden shiner, *Notemigonus crysoleucas* (Mitchill)

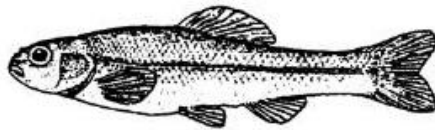


Picture by Niki Carlton – 2014

- 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.....26

- (25b.) 26a. Predorsal area broad and flattened, with middorsal 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 membrane27
- b. Predorsal rounded or sloping, with middorsal 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 ray29

- (26a.) 27a. 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 coil28

- (27b.) 28a. 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)**



Picture by Martin Evans – 2015

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



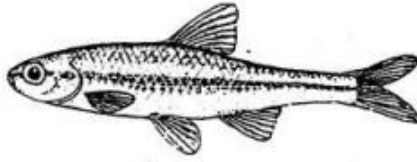
Picture by Jonathan Peterson – 2014

- (26b.) 29a. Mouth extremely small and nearly vertical (80° or more from horizontal), upper jaw extending only to below anterior nostril30
- b. Mouth large and oblique (60° or less) to horizontal, upper jaw extending to below posterior nostril31

- (29a.) 30a. Principal rays of dorsal fin typically 9: small melanophores line the edge 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* (Forbes)**



- (29b.) 31a. 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)**



Picture by Jonathan Peterson – 2014

- b. Mouth not as above.....32

- (31b.) 32a. Anal fin with 9–13 rays33

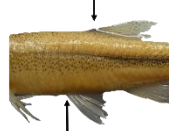
- b. Anal fin usually with 7 or 8 rays (so be careful with counts of 9, don't force the key)..37

- (32a.) 33a. Origin of the dorsal fin directly above or slightly anterior to pelvic fin base34



Picture by Steve Hauschildt – 2016

- b. Origin of dorsal fin distinctly posterior to pelvic fin base35



Picture by Steve Hauschildt – 2016

- (33a.) 34a. Interradial membranes of dorsal fin moderately and evenly pigmented..... **Red shiner, *Cyprinella lutrensis* (Baird and Girard)**



Picture by Kylie St. Peter – 2017

- b. Interradial membrane of dorsal fin without pigment **Common shiner, *Luxilus cornutus* (Mitchill)**



Picture by Niki Carlton – 2014

(33b.) 35a. 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)



Picture by Alexis Jerry – 2016

b. Body more slender, its greatest depth much less than head length; dorsal fin lacks collection of black pigment.....36

(35b.) 36a. 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)**



Picture by Niki Carlton – 2014

b. Snout produced and sharp when looking 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)



Picture by Will Varela – 2016

(32b.) 37a. Intestine greatly elongated, twice or more as long as body; lining of the abdominal cavity black.....38

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; see couplet 18a40

(37a.) 38a. 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 an indistinct lateral band not extending even to the head; origin of dorsal fin anterior to pelvic fin bases; mouth not U-shaped39
- (38b.) 39a. 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 brassy

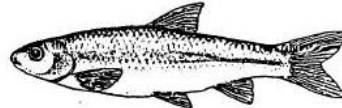
Brassy minnow, *Hybognathus hankinsoni* (Hubbs)



Picture by Maria Berkeland – 2014

- 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)



- (37b.) 40a. Dorsal fin with many melanophores present in the interradial membranes of at least the last 4 principal rays41
- b. Dorsal fin with few to no melanophores present in the interradial membranes.....42

- (40a.) 42a. Dorsal fin with melanophores forming dark spot in the interradial membranes of last 4 principal rays.....**Spotfin shiner, *Cyprinella spiloptera* (Cope)**



Picture by Kristin Huber – 2015

- b. Dorsal fin with melanophores more or less evenly distributed throughout all interradial membranes see couplet 32a **Red shiner, *Cyprinella lutrensis* (Baird and Girard)**

- (40b.) 42a. Large, solid black spot at base of caudal fin, about same size as pupil of the eye.....

Spottail shiner, *Notropis hudsonius* (Clinton)



Picture by Niki Carlton – 2014

- b. Black spot at base of caudal fin noticeably smaller than pupil of eye, diffuse, or absent43

- (42b.) 43a. Lateral line incomplete44
- b. Lateral line complete46

- (43a.) 44a. 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)



Picture by Maria Berkeland – 2014

- 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.....45

- (44b.) 45a. Anal fin rays almost always 8; breast scaled; snout rather sharp.....

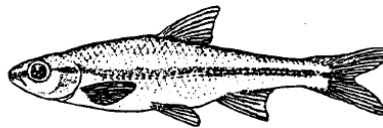
Blackchin shiner, *Notropis heterodon* (Cope)



Picture by Maria Berkeland – 2014

- b. Anal fin rays almost always 7; breast naked; snout rather blunt.....

Weed shiner, *Notropis texanus* (Girard)



- (43b.) 46a. Anal fin rays 7.....47

- b. Anal fin rays 8.....49

- (46a.) 47a. 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 topeka* (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.....48

- (47a.) 48a. 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 stramineus* (Girard)**



Picture by Phillip Oswald – 2015

- 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

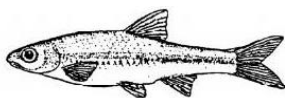
River shiner, *Notropis blennioides* (Girard)



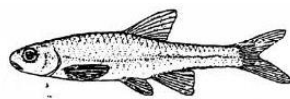
Picture by Jonathan Peterson – 2014

- (46b.) 49a. Length of the upper jaw greater than the eye diameter50
- b. Length of the upper jaw less than the eye diameter51

- (49a.) 50a. Lateral line scales 47 or more; mouth oblique; black spot at anterior dorsal fin base in adults; See couplet 16 **Creek chub, *Semotilus atromaculatus* (Mitchill)**
- b. Lateral line scales fewer than 40; mouth horizontal; no black spot at anterior dorsal fin base in adults..... **Bigmouth shiner, *Notropis dorsalis* (Agassiz)**



- (49b.) 51a. 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 burchanani*) Meek**
(Most likely extinct in Minnesota)



- 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 origin52
- (51b.) 52a. 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, *Hybopsis amnis* (Hubbs and Greene)**



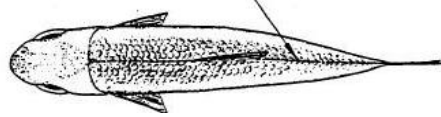
- b. Snout not projecting distinctly beyond upper lip; mouth larger, upper jaw extending almost to anterior margin of eye; lateral band very diffuse anteriorly and not extending very obviously around the snout53
- (52b.) 53a. Post dorsal dark streak absent or nearly so; breast with some scales posteriad; 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)



Picture by Cody Dock – 2016

- 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 **Channel shiner, *Notropis wickliffi* (Trautman)**



VII. Key to the Species of Catostomidae

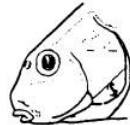
- 1a. Dorsal fin with more than 20 rays.....2
- b. Dorsal fin with fewer than 20 rays.....8
- (1a.) 2a. Lateral line scales more than 50; body elongate, standard length more than 4 times the body depth; body color bluish or grey in adults.....

Blue sucker, *Cycleptus elongatus* (Lesueur)



Picture by Kristin Huber – 2015

- 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 loops4



- 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 40 in juveniles to about 60 in adults

Bigmouth buffalo, *Ictiobus cyprinellus* (Valenciennes)



Picture by Kristin Huber – 2015

- b. Mouth subterminal, nearly horizontal; anterior tip of upper lip far below lower margin of eye; gill rakers 35 or less5

- (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)



Picture by Matthew Wang – 2017

- 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)

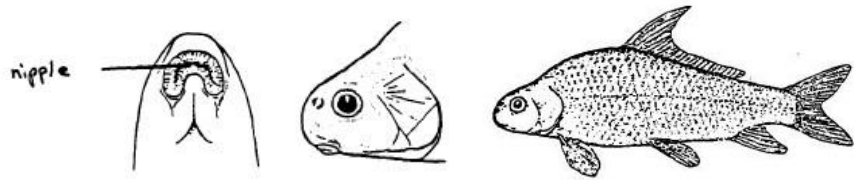


Picture by Jon Brill – 2015

- 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 see couplet 7a.....7

- (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)**



Picture by Matthew Wang – 2017

- (1b.) 8a. Lateral line absent or poorly developed, or, if 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)**



Picture by Arianne Louwers – 2014

- 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 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 commersonii* (Lacepede)**



Picture by Kristin Huber – 2015

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



Picture by Ryan Henry – 2016

- (9b.) 11a. Head depressed between the eyes; lips entirely covered with elevated, pimple like

structures (papillae) (papillose lips); body with 4–6 distinct dark saddles; swim bladder divided into 2 parts **Northern hogsucker, *Hypentelium nigricans* (LeSueur)**



Picture by Kristin Huber – 2015

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 the 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 see figures of lips in couplets 13, 15, and 16 below 13

(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 see figures of lips in couples 15 and 16 below..... 14

(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 base 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)**



Picture by Megan Novy – 2016

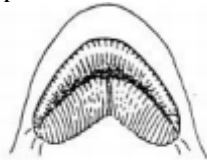
- b. Margin of dorsal fin straight or very slightly concave when extended; head moderate to large and longer, >24% of standard length in specimens >150mm; pharyngeal arch thick with large, molariform teeth **River redhorse, *Moxostoma carinatum* (Cope)**



- (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 no 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 band 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

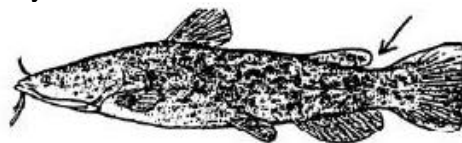
- 1a. Caudal fin deeply forked..... **Channel catfish, *Ictalurus punctatus* (Rafinesque)**



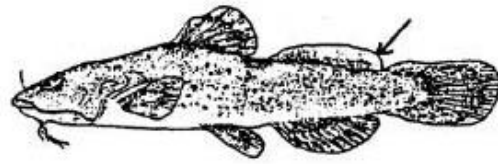
Picture by Arianne Louwers – 2014

- b. Caudal fin rounded, truncate, or slightly indented.....3

- (1b.) 2a. Adipose fin distinctly free from caudal fin3



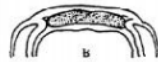
- b. Adipose fin connected or partly connected to caudal fin.....6



(2a.) 3a. Principal plus rudimentary anal fin ray count <16, typically 13; tooth patch of upper jaw with posterior extensions at the lateral margins; caudal fin may have a pale or whitish dorsal tip **Flathead catfish, *Pyloodictis olivaris* (Rafinesque)**



b. Principal plus rudimentary anal fin ray count typical ≥ 17 ; tooth patch of upper jaw without posterior extensions at the lateral margins; caudal fin does not have a pale or whitish dorsal tip.....4



(3b.) 4a. 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)**



Picture by Arianne Louwers – 2014

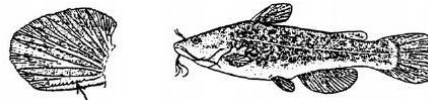
b. Chin barbels grayish to black; principle plus rudimentary anal fin ray count typically 17–24; caudal fin truncate to slightly indented.....5

(4b.) 5a. Principal plus rudimentary anal fin ray count 17–21, interradiial membranes jet black, sharply contrasting with the lighter fin rays; posterior edge of pectoral spines with weakly developed barb (few if any are sharply pointed); sides not mottled and belly whitish in adults..... **Black bullhead, *Ameiurus melas* (Rafinesque)**



Picture by Dominic Metty – 2014

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



- (2b.) 6a. 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)



Picture by Brad Klingsheim – 2014

- b. Premaxillary tooth patch without posterior extensions at the lateral margins; pale patches on back absent or occurring as transverse bands7

- (6b.) 7a. 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)**



Picture by Arianne Louwers – 2014

IX. Key to the Species of Esocidae

- 1a. Long duck bill with caniniform teeth.....2
 b. Short mouth with villiform teeth, dark bar present on caudle base
Central mudminnow, *Umbra limi* (Kirtland)



Picture by Arianne Louwers – 2014

- (1a) 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)**



Picture by Dominic Metty – 2014

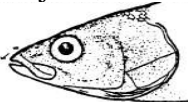
- b. Cheeks scaled only on the upper portion not extending to the level of the mandible; total number of pores on ventral surface of lower jaws 12–17; branchiostegal rays 16–19 on each side; body with dark spots or vertical bars on light background in adults

Muskellunge, *Esox masquinongy* (Mitchill)



Picture by Arianne Louwers – 2014

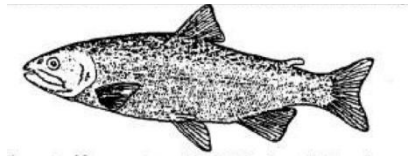
X. Key to the Species of Salmonidae

- 1a. Mouth large, maxilla extends beyond the center of eye; teeth well developed all along both jaws scales small. >20 rows above lateral line2
 - 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 line18
- 
- (1a.) 2a. Specimen without parr marks (a series of oval to elongate vertical markings centered on the sides of the fish) and >130mm SL3
 - b. Specimen with parr marks and/ or <130mm SL 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 sides4
 - b. Back and upper sides with many light-colored spots and/or vermiform markings, which may or may not be visible on the caudal fin9
- (3a.) 4a. Principal anal fin ray count 13–19 (rarely 12); lower jaws dark gray or black (see figures under couplet 6a and 6b).....5
 - 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 ≥ eye diameter; breeding males with large, predorsal hump ...**Pink salmon, *Oncorhynchus gorbuscha* (Walbaum)**

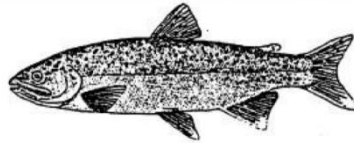


Picture by Jacob Kaden – 2017

- b. Dark spots on back and caudal fin small and irregular, the largest much smaller than eye diameter; breeding males without large, predorsal hump6
- (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 dorsal lobe; lower jaw with dark pigment on both sides of teeth but not between them; principle anal fin ray count typically 13–15 (extremes 12–15) **Coho salmon, *Oncorhynchus kisutch* (Walbaum)**



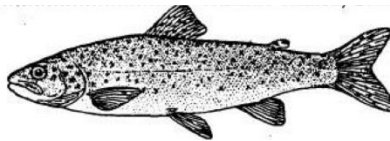
- (4b.) 7a. Well-defined black spots throughout the caudal fin; broad pink to rose stripe may be present along side of body **Rainbow trout, *Oncorhynchus mykiss* (Walbaum)**



Picture by Jon Brill – 2015

- 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 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)**



Picture by Heather Marjamaa – 2016

- (3a.) 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)**



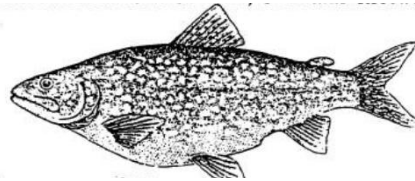
Picture by Jacob Kaden – 2017

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



Picture by Dominic Metty – 2014

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



- (2a.) 11a. Principal anal ray count 8–12 12
- b. Principal anal ray count ≥ 13 (rarely 12) 16
- (11a.) 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
- (12b.) 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
- (13b.) 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 ray..... 15
- (14b.) 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)**



Picture by Heather Marjamaa – 2016

- 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)**



Picture by Maria Berkeland – 2014

- (11b.) 16a. No parr marks of any size present... **Pink salmon, *Oncorhynchus gorbuscha* (Walbaum)**
- b. Parr marks present 17

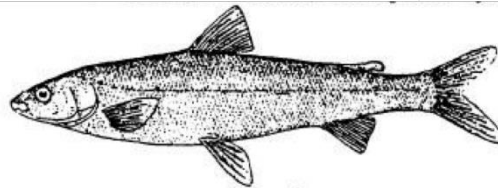
- (16b.) 17a. Adipose fin uniformly pigmented; first anal ray elongate, making the anal fin margin appear quite concave when extended; anal fin usually with some dark pigment behind the white leading edge; usually 45–50 pyloric caeca.....

Coho salmon, *Oncorhynchus kisutch* (Walbaum)

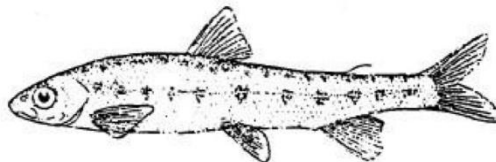
- b. Adipose fin with an unpigmented central area; first anal ray not elongate; anal fin usually without dark pigment behind the white leading edge; usually 135–185 pyloric caeca...
Chinook salmon, *Oncorhynchus tshawytscha* (Walbaum)

- (1b.) 18a. Single flap of skin between anterior and posterior nostrils; gill rakers <2219
- b. Double flap of skin between anterior and posterior nostrils; gill rakers >22.....20

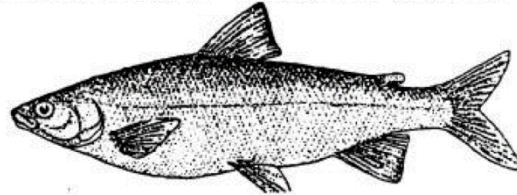
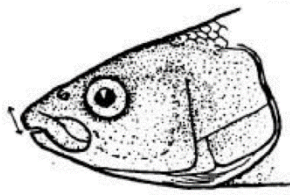
- (18a.) 19a. Lateral line scales 80–100; pyloric caeca 87–117
Round whitefish, *Prosopium cylindraceum* (Pallas)



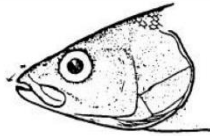
- b. Lateral line scales 55–70; pyloric caeca 15–23 Wisconsin waters of Lake Superior only
Pigmy whitefish, *Prosopium coulteri* (Pallas)



- (18b.) 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 >3221

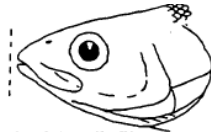


CAUTION: THE SPECIES BELOW ARE EXTREMELY PHENOTYPICALLY PLASTIC AND ARE VERY DIFFICULT TO IDENTIFY WITH 100% CERTAINTY; CONSIDER ALL IDENTIFICATIONS TENTATIVE!

- (20b.) 21a. Anterior tip of mandible extends beyond the tip of premaxillaries22



- b. Anterior tip of mandible does not extend beyond the tip of premaxillaries (it either extends to it or does not reach it)23

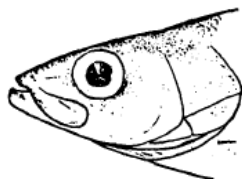


- (21a.) 22a. Gill rakers about the length of the gill filaments and usually fewer than 41; distance from origin of pectoral fin to origin of pelvic fin less than distance from pelvic fin origin to anal fin insertion; pelvic fins reaching to anus or beyond; eye diameter equal or almost equal to snout length **Kiyi, *Coregonus kiyi* (Koelz)**



Picture by Steve Hauschildt – 2016

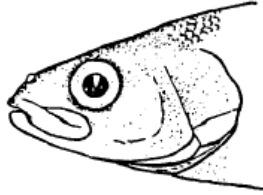
- b. Gill rakers longer than the length of the longest gill filaments and usually more than 41; distance from origin of pectoral fin to origin of pelvic fin greater than distance from pelvic fin origin to anal fin insertion; pelvic fins barely reaching anus or short of it; eye diameter smaller than snout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



also see next page for morphometrics

- (21b.) 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)

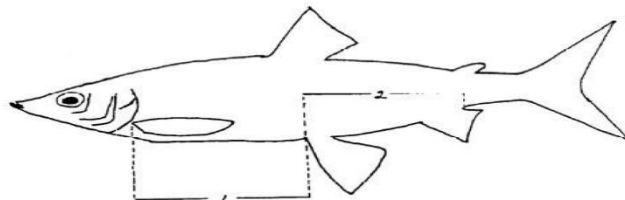
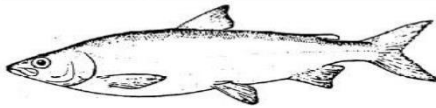


Picture by Heather Marjamaa – 2016

Further caution: there may also be two other species in the same state; validity as species is being debated: *they would key here with 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 the dorsal fin anterior to origin of anal fin; no dark teardrop under eye and sides of body with thin vertical bands spaced from pectoral fin origin to caudal peduncle

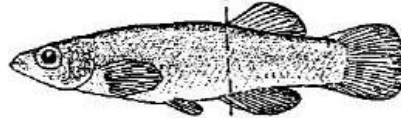
Banded killifish, *Fundulus diaphanus* (LeSueur)



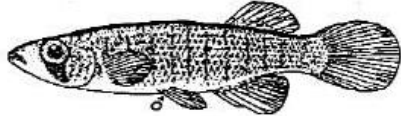
Picture by Jonathan Peterson – 2014

- 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

- (1b.) 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) **Starhead topminnow, *Fundulus dispar* (Agassiz)**



XII. Key to the Species of Gasterosteidae

- 1a. Eight or more isolated dorsal spines; distance from the base of the 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)**



Picture by Jonathan Peterson – 2014

- 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 (see couplet 2a) 2

- (1b.) 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)**

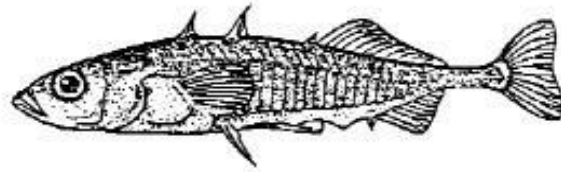
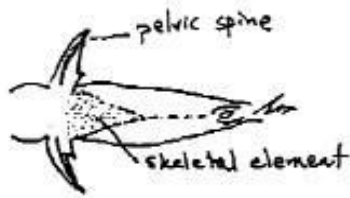


Picture by Jonathan Peterson – 2014

- 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

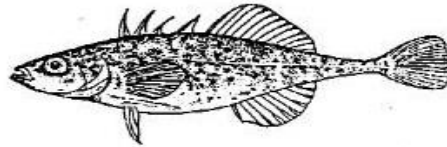
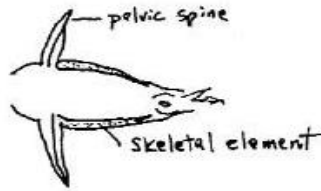
- (2b.) 3a. A single, elongated, triangular skeletal element projecting medially and posteriorly from middle of pelvic fin bases; caudal fin margin straight to slightly indented; lateral line obvious and complete; caudal peduncle usually with lateral keels; sides of body often with several vertically 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)



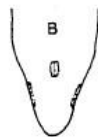
XIII. Key to the Species of Moronidae

- 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)**



Picture by Alexis Jerry – 2016

- 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



- (1b.) 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)**



Picture by Cody Dock – 2016

- b. Second anal spine 2 times as long as first and $\frac{2}{3}$ to $\frac{3}{4}$ 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)**



Picture by Matthew Wang – 2017

XIV. Key to the Species of Centrarchidae

- 1a. More than 3 spines in anal fin.....2
 - b. Only 3 spines in anal fin4
- (1a.) 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)**



Picture by Neil Mourning – 2015

- b. Length and area of dorsal fin and anal fin appearing nearly equal (see couplet 3 illustrations); 6–8 spines in dorsal fin.....3
- (2b.) 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)**



Picture by Brad Klingsheim – 2014

- 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* (Lessueur)**



Picture by Brad Klingsheim – 2014

- (1b.) 4a. Body elongate, depth contained about 3 times standard length, more than 59 scales in lateral line5
- b. Body rounder, depth contained 2.5 times or less in standard length; less than 54 scales in lateral line6
- (4a.) 5a. Upper jaw extends beyond posterior margin of eye in adults; spinous dorsal fin arched, shortest of 3 posterior-most spines less than ½ 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* (Lacepede)



Picture by Neil Mourning – 2015

- 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 ½ length of longest dorsal spine; scales on cheeks small, in 15–18 rows; side markings, if present, are vertical bands; caudal fin of juveniles with yellow–orange base and dark, crescent mark through middle
- Smallmouth bass, *Micropterus dolomieu* (Lacepede)**



Picture by Christopher Mjones – 2015

- (4b.) 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, *Lepomis gulosus* (Cuvier)**



Picture by Martin Evans – 2015

- 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
- (6b.) 7a. Pectoral fins short and rounded, their length less than 4 times the length of their base



b. Pectoral fins long and pointed, their length at least 4 times the length of their base9



(7a.) 8a. Opercular lobe (“earflap”) longer than wide slanted upward; white opercular boarder (red spot may be present); gill rakers short, knoblike and crooked; no dark blotch at posterior bass of dorsal fin **Northern sunfish, *Lepomis peltastes* (Cope)**



Picture by Brad Klingsheim – 2014

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)**



Picture by Neil Mourning – 2015

(7b.) 9a. Gill rakers short and knoblike, barely longer than wide **Pumpkinseed, *Lepomis gibbosus* (Linnaeus)**



Picture by Brad Klingsheim – 2014

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

(9b.) 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)**



Picture by Kevin Longtin – 2014

- 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 humilis* (Girard)

XV. Key to the Species of Percidae

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



Picture by Andrew Schmieg – 2015

- b. Spinous and soft dorsal fins distinctly separated; posterior margin of the preopercle serrate (tooth-like margin) or entire (“smooth” margin).....2
- (1b.) 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 (<135mm)5
- (2a.) 3a. No canine teeth present on jaws and palatine bones
Yellow perch, *Perca flavescens* (Mitchill)



Picture by Brad Klingsheim – 2014

- b. Canine teeth present on jaws and palatine bones4
- (3b.) 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, *Sander vitreus* (Mitchill)**



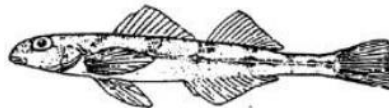
Picture by Brad Klingsheim – 2014

- 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 not whitish; black spot at base of pectoral fin; pyloric caeca usually 4–6 and shorter than stomach **Sauger, *Sander canadensis* (Smith)**



Picture by Brad Klingsheim – 2014

- (2b.) 5a. Body long and slender, its depth contained 7 or more 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
- (5a.) 6a. Back with 4 faint, broad saddles; 12–16 soft anal rays; more than 89 lateral line scales
Crystal darter, *Crystallaria asprella* (Jordan)

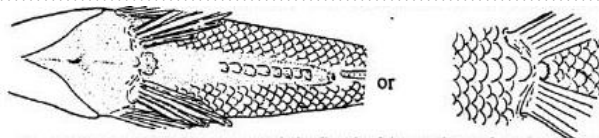


- b. Back without saddles; 7–10 soft anal rays; 80 or fewer lateral line scales
Western sand darter, *Ammocrypta clara* (Jordan and Meek)



Picture by Dominic Metty – 2014

- (5b.) 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 fine 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

- (7a.) 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)



Picture by Phillip Oswald – 2015

- 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 <299

- (8b.) 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

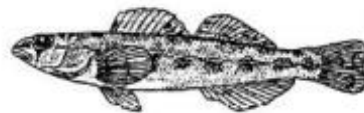
Slenderhead darter, *Percina phoxocephala* (Nelson)



- 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 distinct10

- (9b.) 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 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

- (10b.) 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 connected 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 maculate* (Girard)



Picture by Martin Evans – 2015

- (7b.) 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

- (12a.) 13a. Lateral line incomplete; preorbital bar continuous from eye to eye across snout; Breast and cheek fully scaled..... **Bluntnose darter, *Etheostoma chlorosoma* (Hay)**

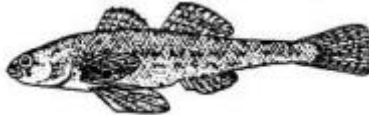


- b. Lateral line complete; preorbital bar broken at center of snout; breast and lower cheeks naked..... **Johnny darter, *Etheostoma nigrum* (Rafinesque)**



Picture by Jonathan Peterson – 2014

- (12b.) 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

- (14b.) 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)**



Picture by Christopher Mjoness – 2015

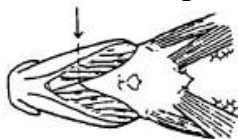
- b. Head at least partially scaled; sides of body variously marked, but lacking horizontal dashed lines; breeding males with bright colors and lacking fleshy knobs atop the dorsal spines 16

- (15b.) 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)**



Picture by Christopher Mjones – 2015

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



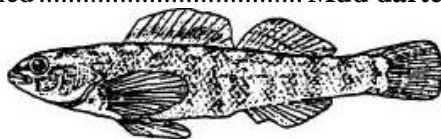
- (16b.) 17a. Body slender, its depth 4.8–5.5 in standard length; scales in lateral line series 55 or more gill rakers 7, short and knoblike..... **Iowa Darter, *Etheostoma exile* (Girard)**



Picture by Alexis Jerry – 2016

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

- (17b.) 18a. Cheeks fully scaled **Mud darter, *Etheostoma asprigene* (Forbes)**



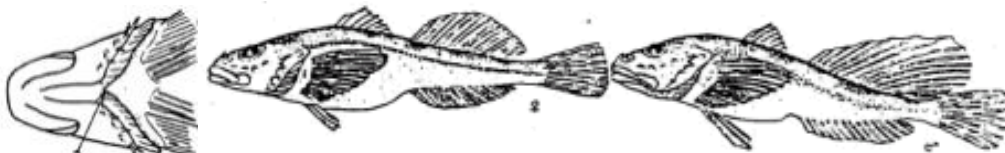
- b. Cheek naked or with a few embedded posterior to the eye **Rainbow darter, *Etheostoma caeruleum* (Storer)**



Picture by Jonathan Peterson – 2014

XVI. Key to the Species of Cottidae

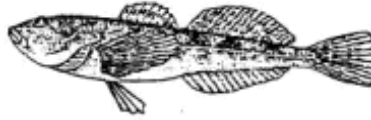
- 1a. Gill membranes free from the isthmus and forming a ‘V’; dorsal fins separated by a space about equal to eye diameter; 2–4 large and partially naked spines on preopercle **Deepwater sculpin, *Myoxocephalus thompsonii* (Girard)**



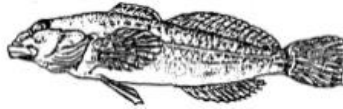
- b. Gill membranes broadly joined to the isthmus; dorsal fins barely separated or touching; only one partially naked spine on preopercle.....2



- (1b.) 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 midline3
- (2b.) 3a. Pelvic rays usually 3, if 4 then the last ray is 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 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 bairdii* (Girard)



Picture by Samuel Peterson – 2015

XVII Key to the species of Gobiidae

- 1a. Short nostril tubercles not extending past upper lip; bold black spot on rear of first dorsal fin; 18-19 pectoral rays **Round goby, *Neogobius melanostomus* (Pallas)**
- b. Long nasal tubercles extending past upper lip; mottled brown with no distinct black spot on rear of first dorsal fin; 14-16 pectoral rays
Tube-nose goby, *Proterorhinus semilunaris* (Heckal)