

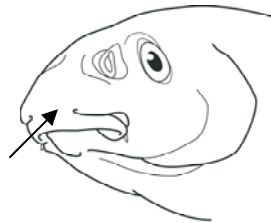
RANDOM ACCESS KEY FOR MINNOWS OF ONTARIO – INSTRUCTIONS  
Erling Holm, Royal Ontario Museum

## INSTRUCTIONS

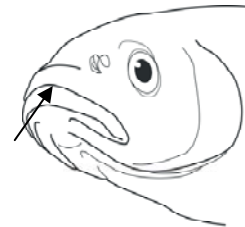
In addition to the program itself (MinnowKey.exe), three files (MinnowChar.txt, MinnowFish.txt, MinnowData.txt) need to be copied together into a separate directory in order for the key to work. Start the key by clicking on MinnowKey.exe in My Computer. You will see a screen with a list of 75 characters (defined below) grouped together into subheadings (e.g., Premaxilla). Select any character possessed by your minnow by clicking on it. Click the character again to de-select it. The number of species that possess the characters you have selected is shown in the “Number of Taxa” box. Click on “Show Fish” to see the species that possess the selected characters. A couple of distinctive characteristics are listed for each species. Some characters are best assessed using magnification, and some internal characters have been included which can only be assessed on preserved specimens. In some cases, more conventional keys and descriptions (see **Literature**) are required to complete the identification, but this key is useful in narrowing down the choice of possible species. An accurately identified reference collection is helpful in making comparisons with unknown species, particularly when the computer key will not be able to narrow the identification down to one species.

## PREMAXILLA

*frenum*: premaxillaries not protractile, a bridge of tissue across groove of upper lip.



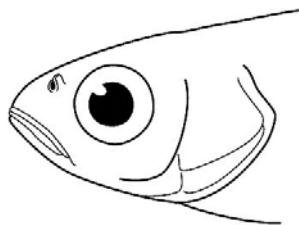
*groove*: premaxillaries protractile, upper lip separated from skin of snout by a groove



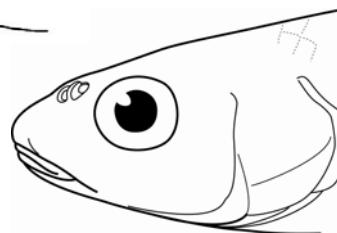
## SNOUT/JAW

The overhang of the snout over the upper jaw can be reliably determined only if mouth is closed

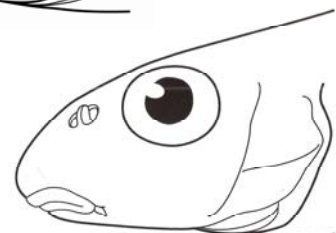
*not protruding.*: snout does not extend past tip of upper jaw



*overhung*: snout extends slightly past tip of upper jaw, gape of mouth lower on head



*obviously overhung.*: snout obviously overhanging jaw, mouth well below eye

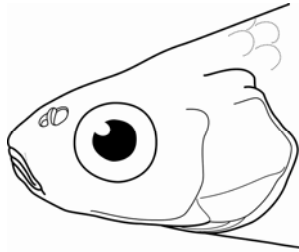


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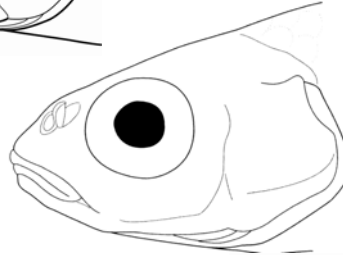
**MOUTH SIZE**

The mouth size can be reliably determined only if mouth is closed.

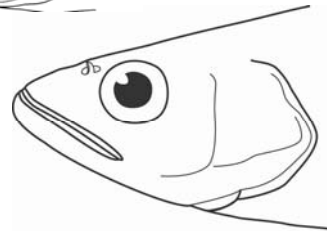
*to nostril*: end of upper jaw extends backwards to below nostril



*to eye*: end of upper jaw extends backwards past the nostril to below the anterior margin of eye



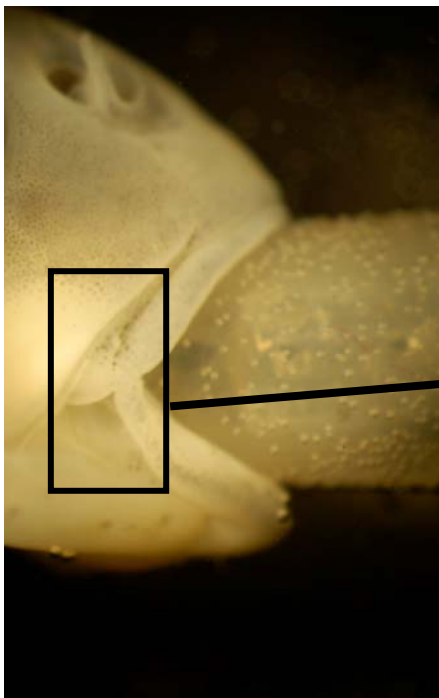
*past eye*: end of upper jaw extends backwards past the anterior margin of eye



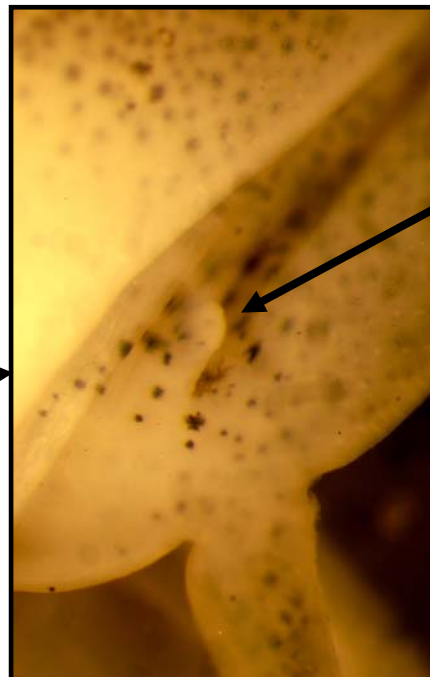
**BARBELS**

*none*: no tiny flaps or hair-like projections around the mouth.

*Hidden in groove*: a very inconspicuous triangular flap or projection sitting in the groove of the upper jaw and anterior to the posterior corner. It is usually necessary to open the mouth and observe it using a microscope.



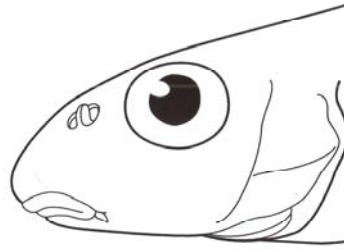
Rick Winterbottom



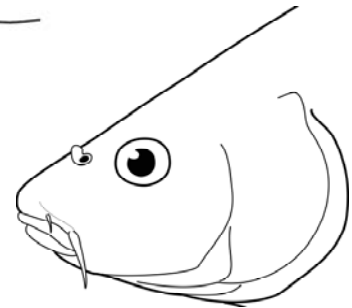
Rick Winterbottom

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*terminal*: hair-like projection of tissue at the posterior corner of the upper jaw.

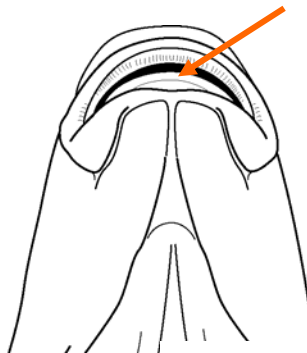


*two pairs*: two pairs of barbels on each side of upper jaw.

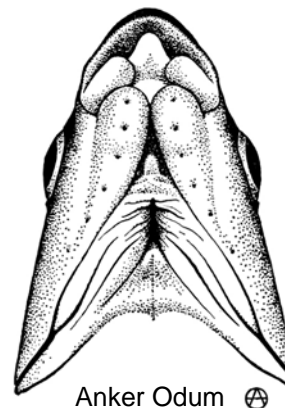


### LOWER LIP

*cartilaginous ridge*: lower jaw with a cartilaginous ridge separated by a definite groove from lower lip.



*trilobed*: lower lip consisting of a bony tongue between two fleshy lobes.



Anker Odum

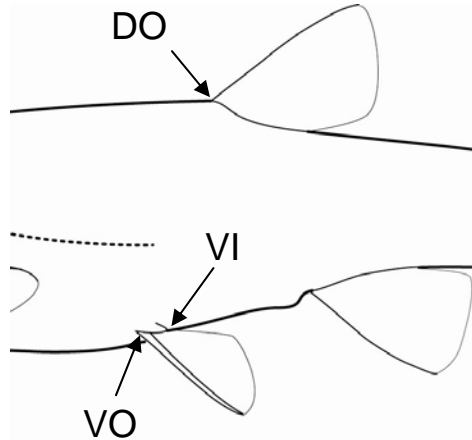
*normal*: lower jaw without cartilaginous ridge or conspicuous lobes



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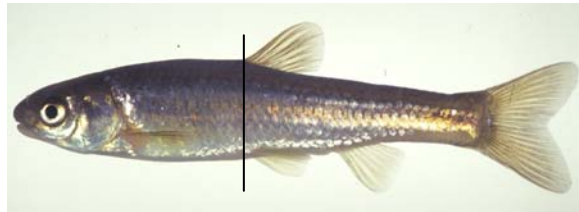
**DORSAL ORIGIN**

To determine location of dorsal fin origin (**DO**) relative to ventral or pelvic fin origin (**VO**) and the posterior insertion of the pelvic fin (**VI**), draw a large cross on a piece of paper making sure that the angle between the vertical and horizontal line is exactly 90°. Place the fish along the horizontal line so that the line passes through the middle of the fish and the vertical line is at the dorsal fin origin.



Determine if the line is:

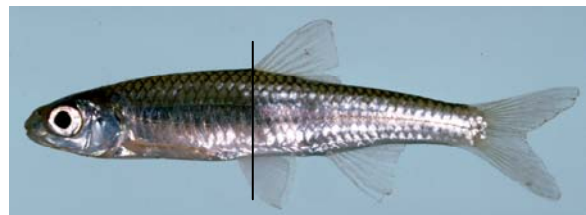
*ahead of VO*: Vertical line through dorsal fin origin is ahead of ventral or pelvic fin origin.



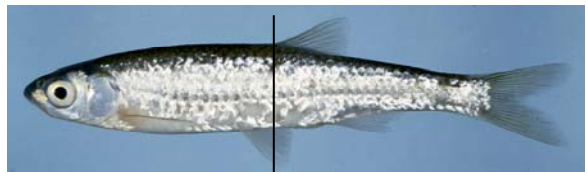
*over VO*: dorsal fin origin is directly above pelvic fin origin



*between VO/VI*: Dorsal fin origin is somewhere between the anterior and posterior end of pelvic fin base



*behind VI*: Vertical line through dorsal fin origin is behind the base of the pelvic fin.



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## FIN RAYS

Count only the large and obvious principal rays (not the smaller rudiments). They almost always comprise the branched rays plus one anterior unbranched ray. The last ray often appears as two unbranched rays close together

*D rays 8:* Eight principal dorsal fin rays

*D rays >8:* Nine or more principal dorsal rays

*A rays 7:* Seven principal anal rays

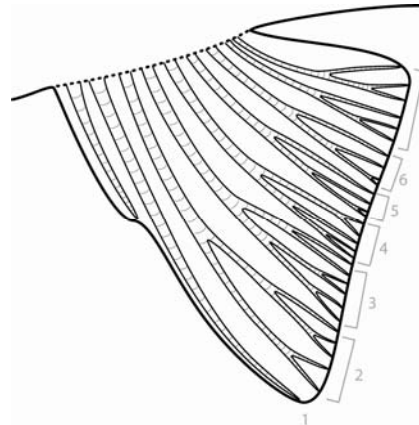
*A rays 8:* Eight principal anal fin rays

*A rays 9:* Nine principal anal rays

*A rays >9:* More than nine principal anal rays

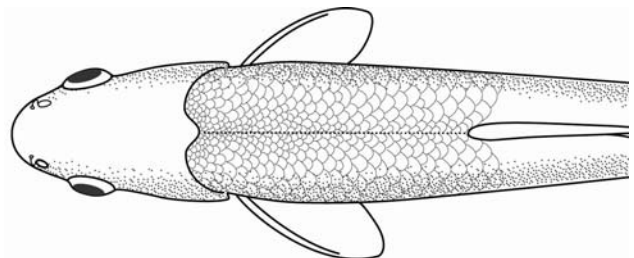
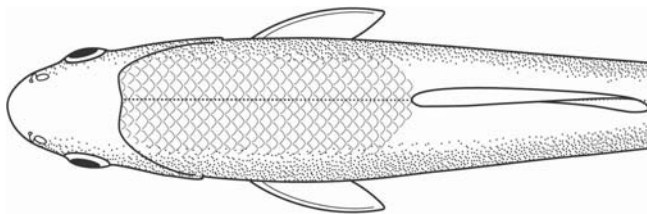
*A rays <7:* Less than seven anal rays

*D rays <8:* Less than eight dorsal rays

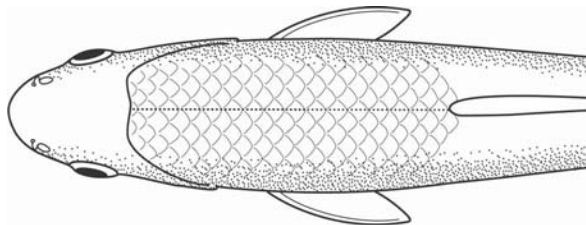


## PREDORSAL

*small crowded:* scales on back before dorsal fin distinctly smaller than scales on the sides of the body

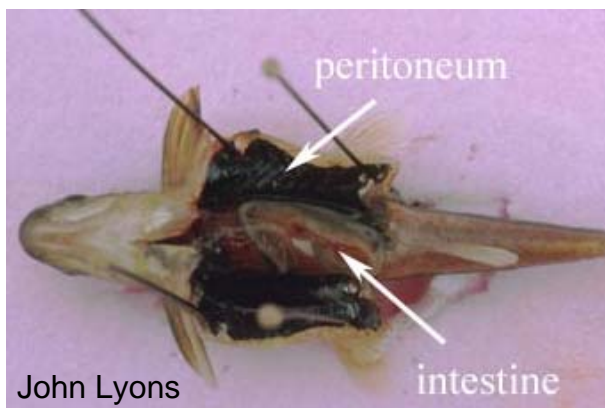


*large regular:* scales on back before dorsal fin approximately the same size as those on sides

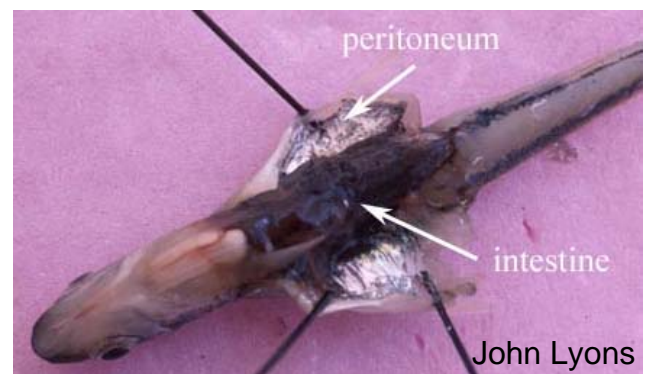


## PERITONEUM

*dark:* internal lining of body cavity dark brown or black



*light:* internal lining of body cavity silvery or speckled lightly with tiny dark spots (melanophores).





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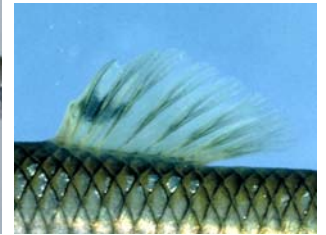
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## PIGMENTATION

*caudal spot*: a prominent dark round caudal spot at base of tail clearly distinct from lateral stripe



*spot at D origin*: black spot or blotch present at the front of the dorsal fin

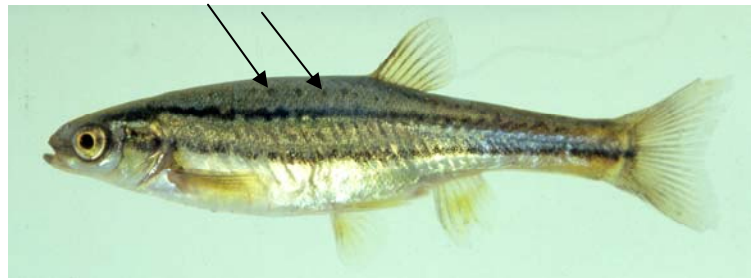


W. C. Carrick

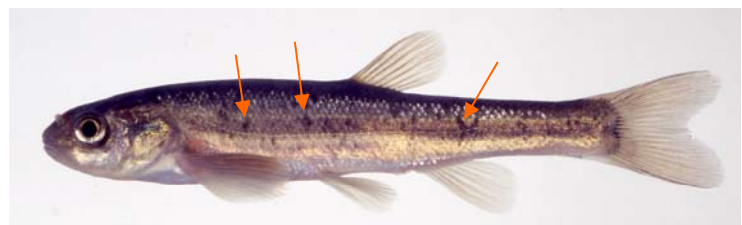
*D fin blotch*: posterior membranes of dorsal fin with distinct black pigment



*back spots*: row of spots on either side of dorsal fin.



*darkened scales*: sides of body with scattered darkened scales. Not to be confused with black spot, a disease manifested by small black cysts on body and fins.



*black crescents*.: anterior lateral stripe with a row of obvious black crescent-shaped markings



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*pigment. → lat. line*: pigmentation on sides stops abruptly at lateral line (best seen in preserved specimens)

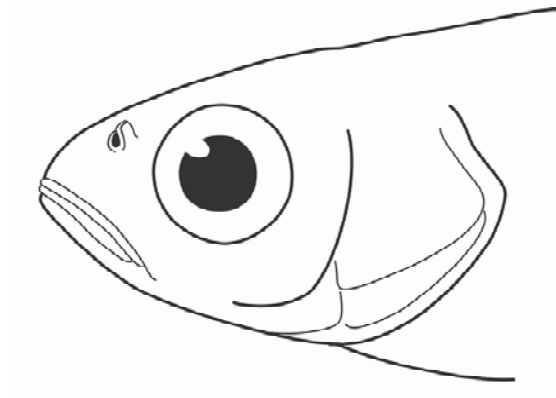


*black chin*: chin with black pigment

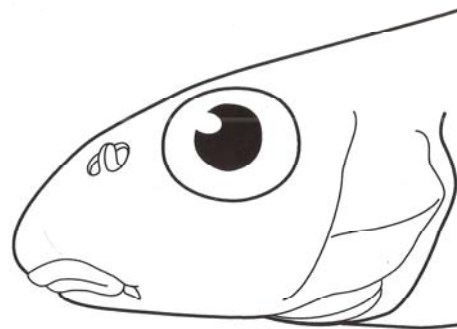
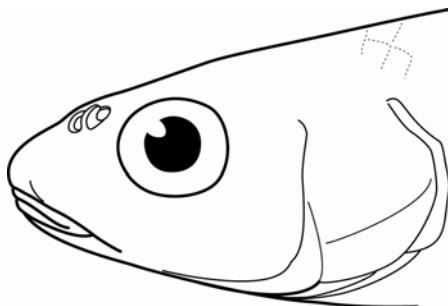


**MOUTH**

*terminal*: tips of the upper and lower jaw forming the most anterior part of the head and gape of mouth about level with middle of eye



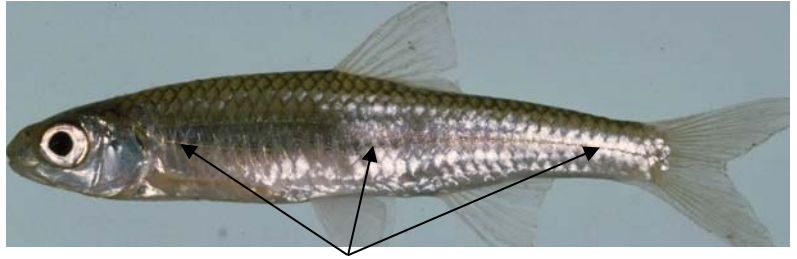
*subterminal*: upper and lower jaws lower on head, usually with snout overhanging mouth



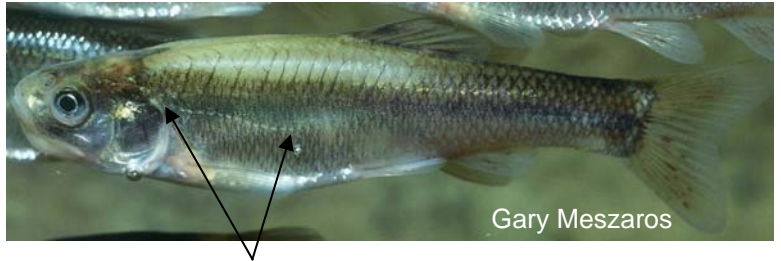
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**LATERAL LINE**

*complete*: Lateral line (tube with series of pores along side of body) extends from head to base of tail



*incomplete*: Lateral line starts at head and terminates before base of tail



*<37 lateral scales*: Number of scales along lateral line less than 37. The count starts at the pectoral girdle and terminates at the end of the vertebral column, or at the crease formed when the caudal fin is bent from side to side. If lateral line is incomplete, count continues to the end of the vertebral column.



*37-43 lateral scales* : Number of scales along lateral line 38-43



*44-49 lateral scales*: Number of scales along lateral line 44-49





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*50-60 lateral scales:* Number of scales along lateral line 50-60



*>60 lateral scales:* Number of scales along lateral line greater than 60



### **LATERAL STRIPE**

*On snout:* midlateral stripe extends onto snout



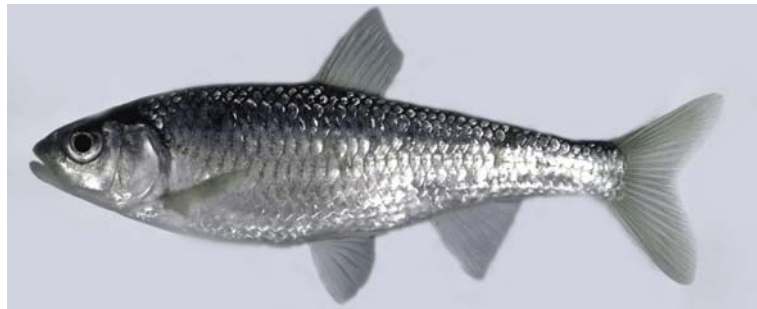
*gill → tail:* lateral stripe extending from head to tail, not on snout



*diffuse:* Lateral stripe poorly defined or faint at front, posterior half usually darker and more conspicuous



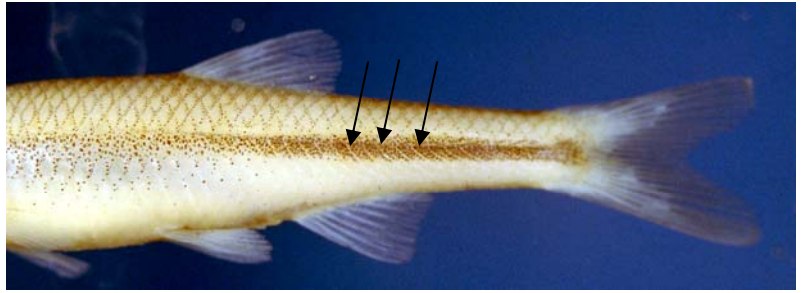
*none:* no lateral stripe evident



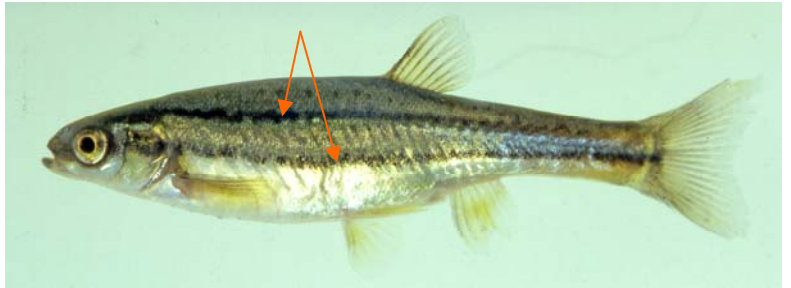
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*white flecks*: a series of fine white curved lines on posterior part of black lateral stripe, often more conspicuous in juveniles and in preserved specimens



*2 lateral stripes*: a black midlateral lateral stripe and a second lateral stripe above it



### INTESTINE

*short*: intestine with a single loop



*long*: intestine long and coiled with one or more loops in addition to the main loop

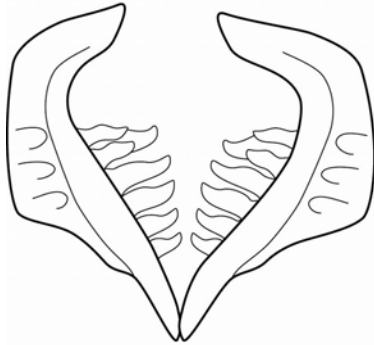


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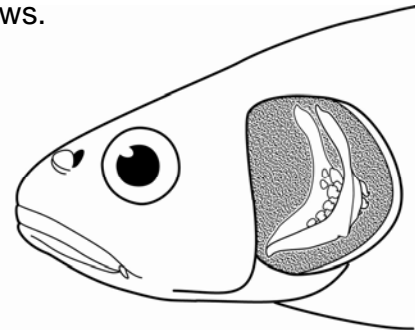
### THROAT TEETH

Throat or pharyngeal teeth are found on a pair of bony arches behind the gills and in front of the pectoral girdle. The arches must be removed very carefully with forceps and scalpel and cleaned in order to count the teeth and determine the number of rows.

Minnows usually have 4-5 large teeth in an inner or main row and many have a second outer row of 1 or 2 teeth. The carp is unique in having 3 rows.



Pharyngeal arch of Creek Chub with 2 rows of pharyngeal teeth and 5 teeth in the main, inner row



*1 row*: usually 4-5 teeth in one row

*>1 row*: 1-3 smaller teeth in addition to the main row of 4-5 teeth

*5 inner*: 5 teeth in the main, inner row

### ABDOM. KEEL

*none*: belly in front of anus rounded and scaled

*fleshy*: a small sometimes inconspicuous keel in front of the anus, part of which is unscaled.

*scaled*: belly in front of anus tapers to a sharp keel which is covered with scales

### DIMENSIONS

*TL>160*: Total length (maximum length from snout to end of tail fin) greater than 160 mm

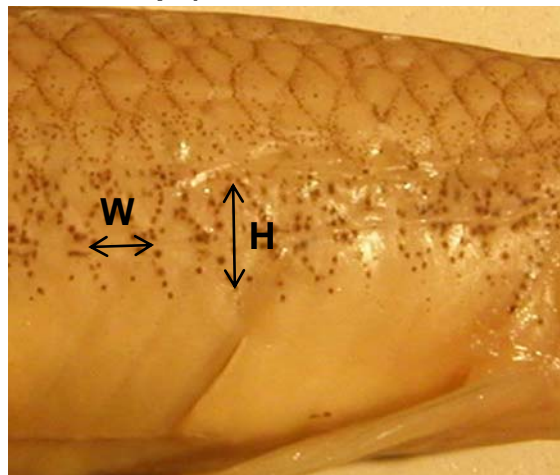
*TL>120*: Total length greater than 120 mm

*Depth>22% TL*: Maximum depth of body greater than 22% of total length

*Depth<17% TL*: Maximum depth of body less than 17% of total length

### L.L. SC. SHAPE (Anterior lateral line scale shape)

This is the ratio of the exposed height (H) over the exposed width (W) of the 6th - 12th lateral line scale

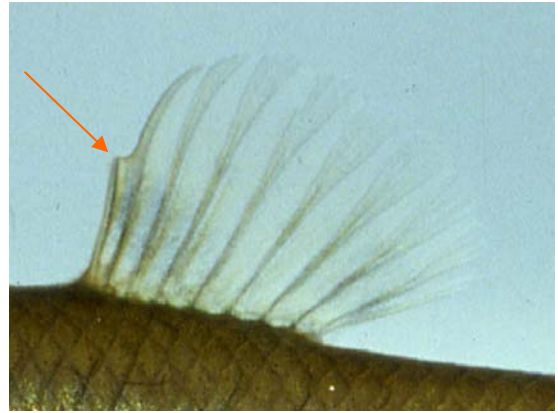




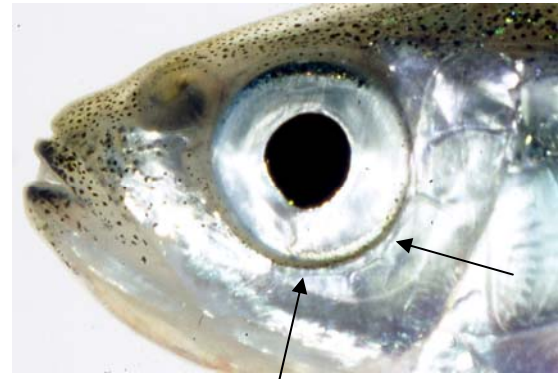
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**OTHER**

*1st D ray detached.*: tip of first obvious dorsal ray not closely attached to first principal ray



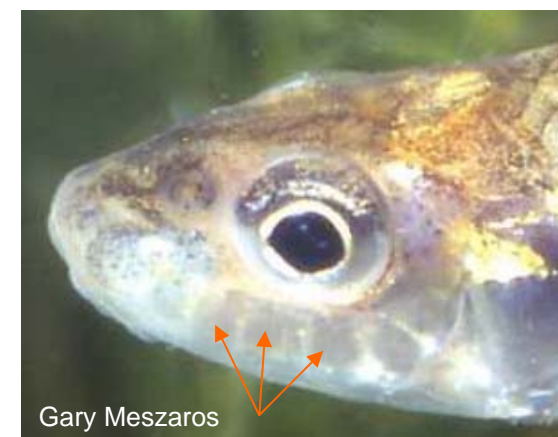
*Infraorbital canal*: infraorbital canal present  
The infraorbital canal is a tube below the eye with a series of pores. It is extremely difficult to see, even with a microscope.



*no IO canal*: infraorbital canal absent  
(IO canal absent only in Ghost Shiner)



*cavernous IO*: bones of the lower surface of the head with large, externally visible, cavernous chambers





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## Acknowledgements

All illustrations © Marianne Collins 2009, except where noted. All images Erling Holm, Royal Ontario Museum, except where noted. Character states have been determined from Becker (1983), Scott and Crossman (1973), and examination of preserved specimens in the fish collection of the Royal Ontario Museum. The Windows version of this key was programmed by Rodney Sullivan in 2004 from a DOS version by Maher and Korda (1993) (see the “About” box in the key).

## Literature

- Bailey, R.M., W. C. Latta and G. R. Smith.** 2004. An atlas of Michigan fishes with keys and illustrations for their identification. Museum of Zoology, University of Michigan, No. 192. Ann Arbor Michigan
- Becker, G. C.** 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison, Wisconsin. (Available at <http://seagrant.wisc.edu/greatlakesfish/becker.html>)
- Bernatchez, L. and M. Giroux.** 2000. Les poissons d'eau douce du Québec et leur répartition dans l'est du Canada. Broquet Inc., Saint-Constant, Québec
- Holm, E., N. E. Mandrak, and M. E. Burrige.** 2009, 2010. The ROM Field Guide to the freshwater fishes of Ontario. Royal Ontario Museum
- Hubbs, C. L., K. F. Lagler and G.R. Smith.** 2004. Fishes of the Great Lakes region, Revised Edition. University of Michigan Press, Ann Arbor Michigan
- Page, L. M., and B. M. Burr.** 2011. A field guide to the freshwater fishes, North America north of Mexico, Second Edition. Houghton Mifflin Company, Boston. (Peterson Field Guide)
- Scott, W. B., and E. J. Crossman.** 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184. Ottawa, Ontario
- Stewart, K.W. and D.A. Watkinson.** 2004. Freshwater Fishes of Manitoba. University of Manitoba Press. Winnipeg
- Trautman, M. B.** 1981. The fishes of Ohio. Ohio State University Press, Columbia, Ohio