

**Developmental stages of bony fish,  
morphological characters useful for  
larval fish identification, and fish taxonomy**

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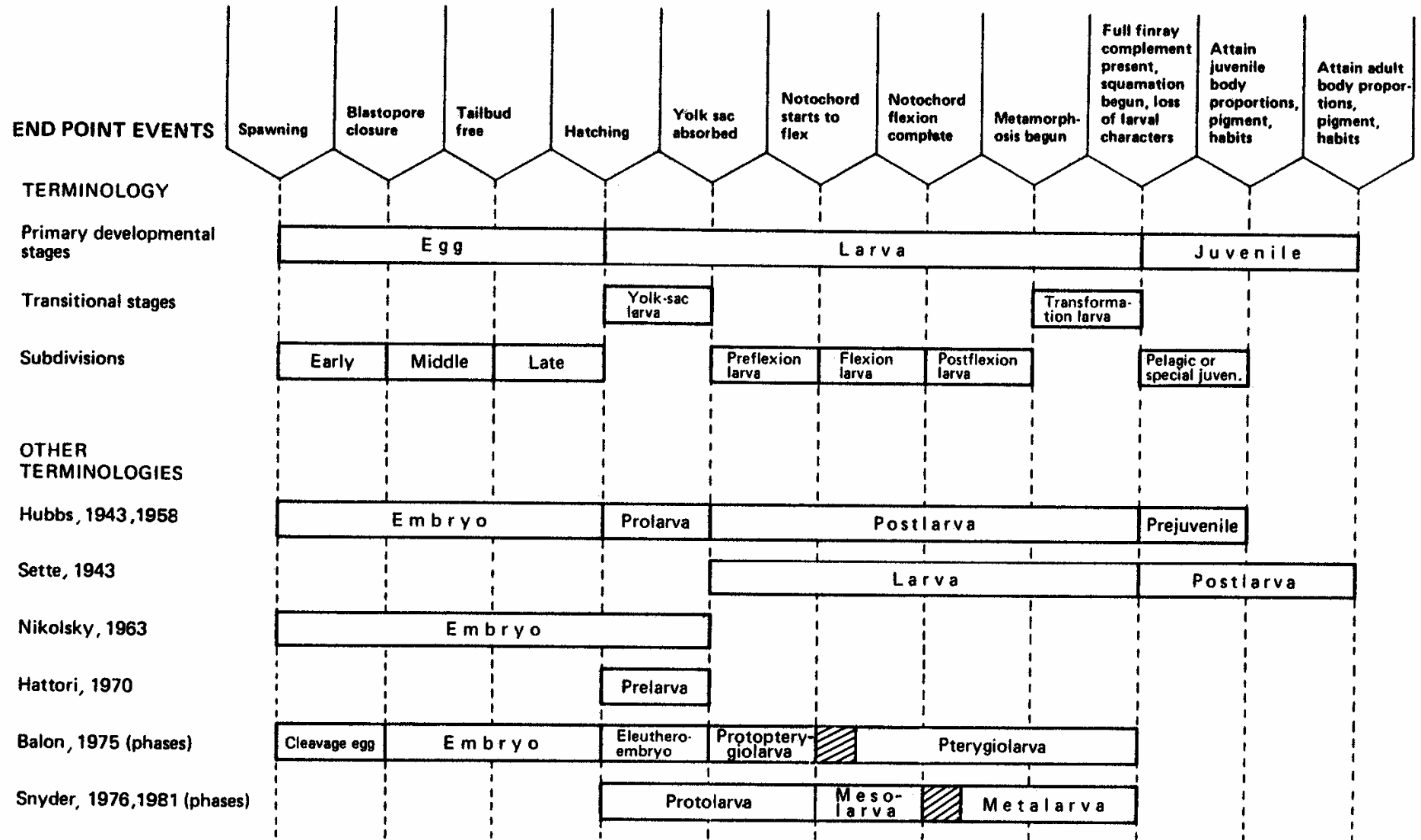
# Developmental stages of bony fish

from Jones et al., 1978

- **Egg**
- **Yolk-sac larva**  
stage between hatching and absorption of yolk
- **Larva**  
stage between absorption of yolk and acquisition of minimum adult fin ray complement
- **Juvenile**  
stage between acquisition of minimum adult fin ray complement and sexual maturity with assumption of adult body form (**prejuvenile**: with assumption of incomplete adult body form)
- **Adult**  
sexually mature

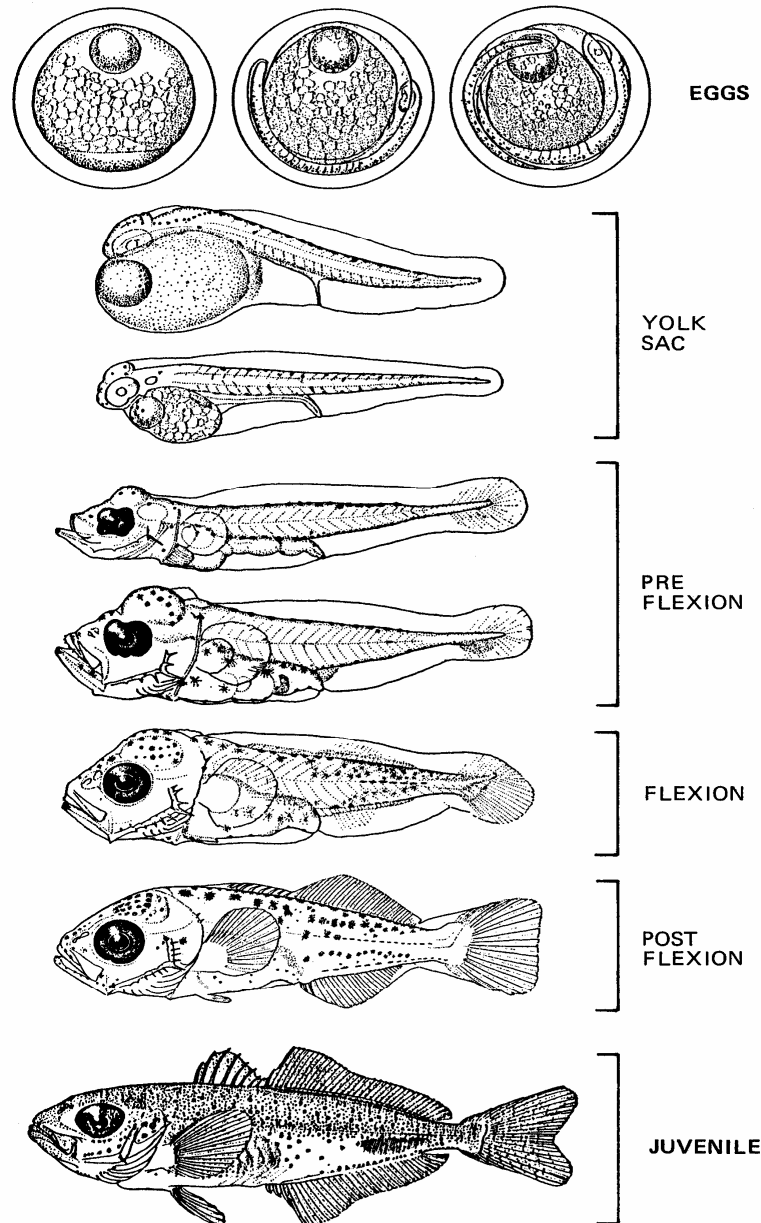
Jones, P. W., Martin, F. D. and Hardy, J. D. Jr. 1978: Development of fishes of the Mid-Atlantic Bight. An atlas of egg, larval and juvenile stages. Volume I Acipenseridae through Ictaluridae. U. S. Dep. Interior, Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/12. 366 pp.

# Terminology of early life history stages



from Kendall et al., 1984

# Early life history stages of *Trachurus symmetricus*

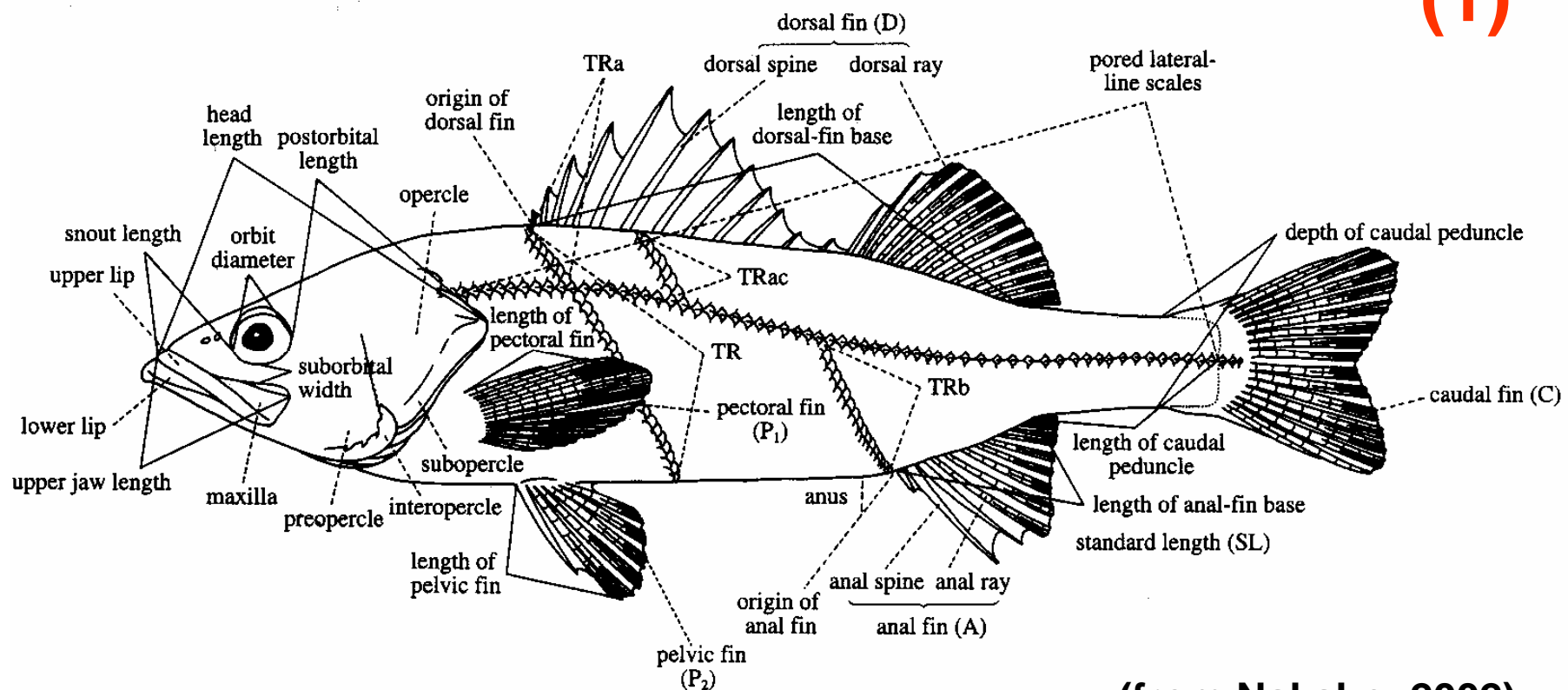


from Kendall et al., 1984  
(originally Ahlstrom and Ball, 1954)

Kendall, A. W. Jr., Ahlstrom, E. H. and Moser, H. G. 1984: Early life history stages of fishes and their characters. Pages 11-22 in Moser, H. G., Richards, W. J., Cohen, D. M., Fahay, M. P., Kendall, A. W. Jr. and Richardson, S. L. (eds.) Ontogeny and systematics of fishes. Am. Soc. Ichthyol. Herpetol. Spec. Publ. 1.

# External characters of bony fish and methods of measuring

(1)

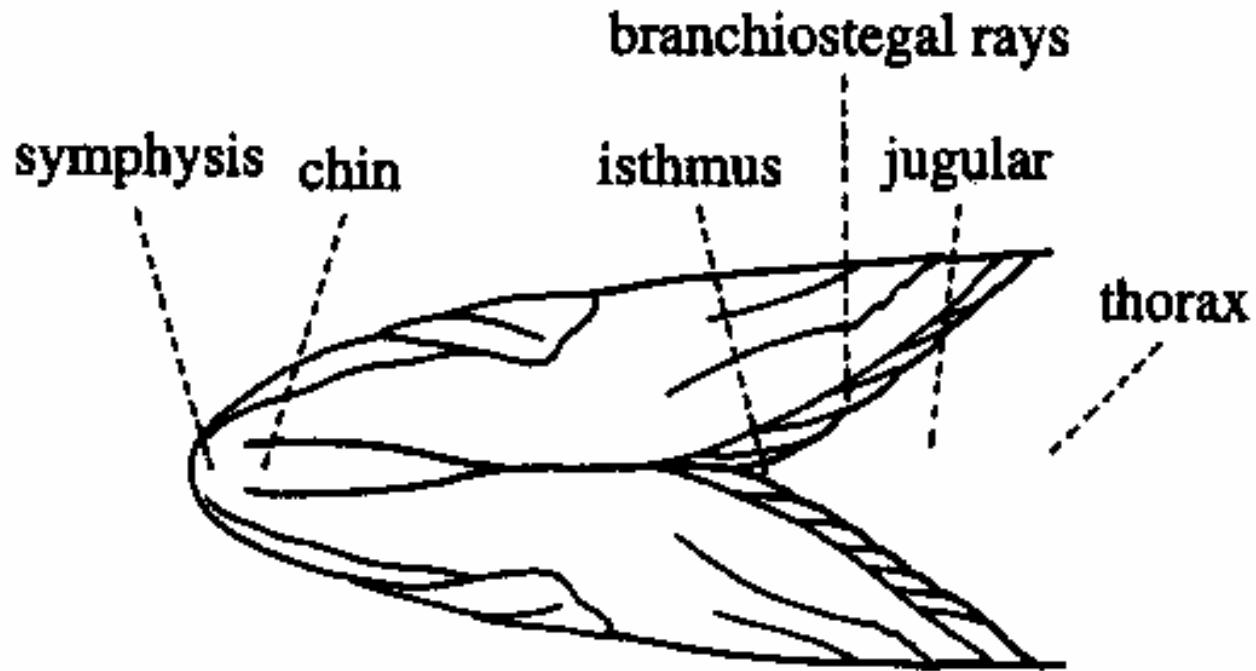


(from Nakabo, 2002)

Nakabo, T. (ed.) 2002: Fishes of Japan with pictorial keys to the species, English edition. Tokai University Press, Tokyo, 1749 pp.

# External characters of bony fish and methods of measuring

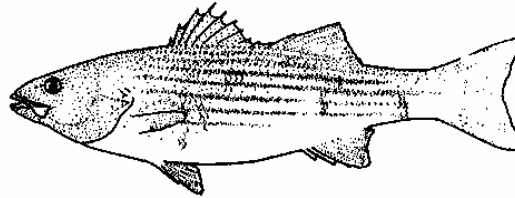
(2)



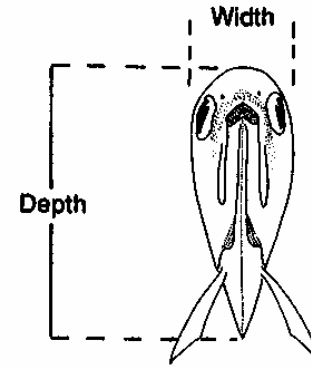
(from Nakabo, 2002)

# Body shapes of bony fish

slender or fusiform



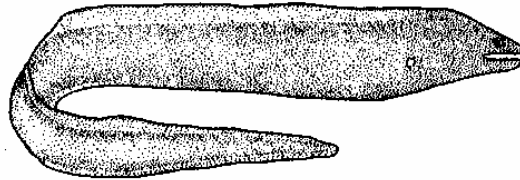
a.



compressed

d.

eel-like or elongate



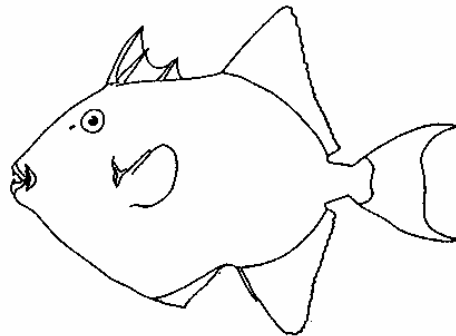
b.



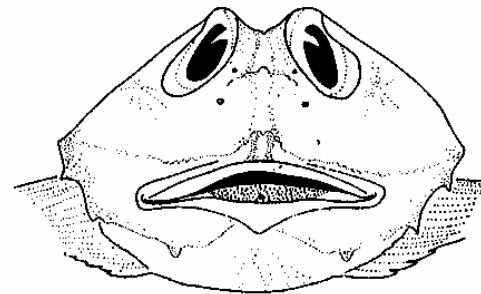
depressed

e.

ovate or truncated



c.



round

f.

(from Cailliet et al., 1986)

Cailliet, G. M., Love, M. S. and Ebeling A. W. 1986: Fishes. Field and laboratory manual on their structure, identification, and natural history. Wadsworth Publishing Company, California, 194 pp.

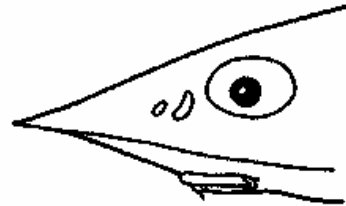
# Position of mouth and pelvic fins



terminal



subterminal



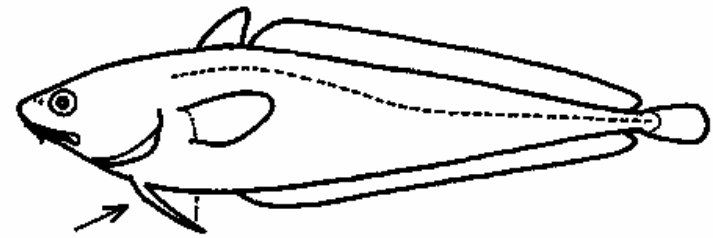
inferior



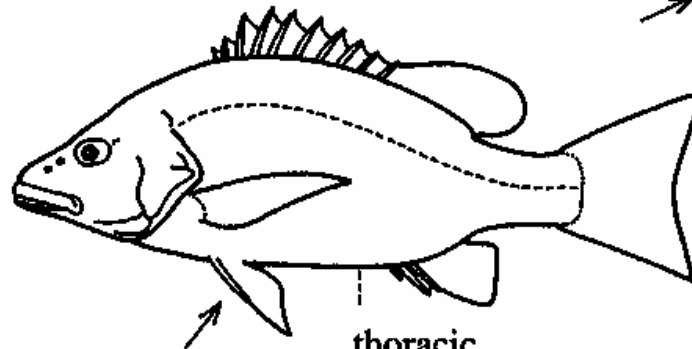
superior



pelvic fin  
abdominal



jugular



thoracic

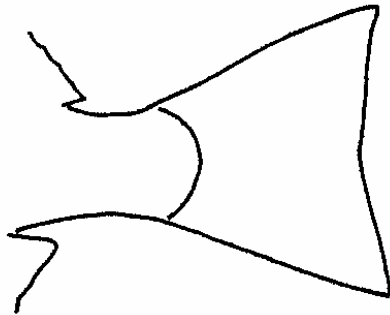
(from Nakabo, 2002)



# Caudal fin forms

emarginate

a.



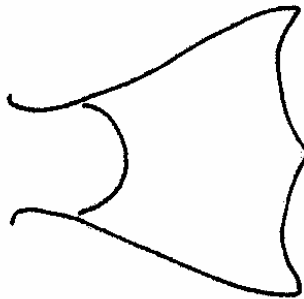
round

b.



double emarginate

c.

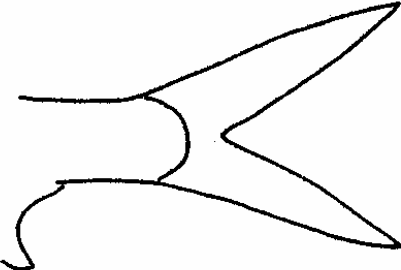


truncate

d.

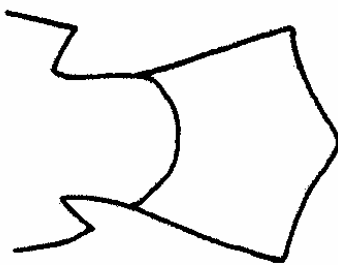


e.



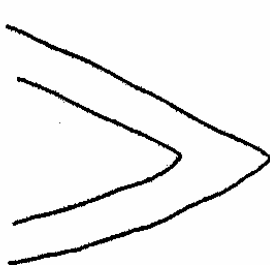
forked

f.



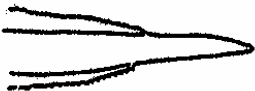
double truncate

g.



pointed

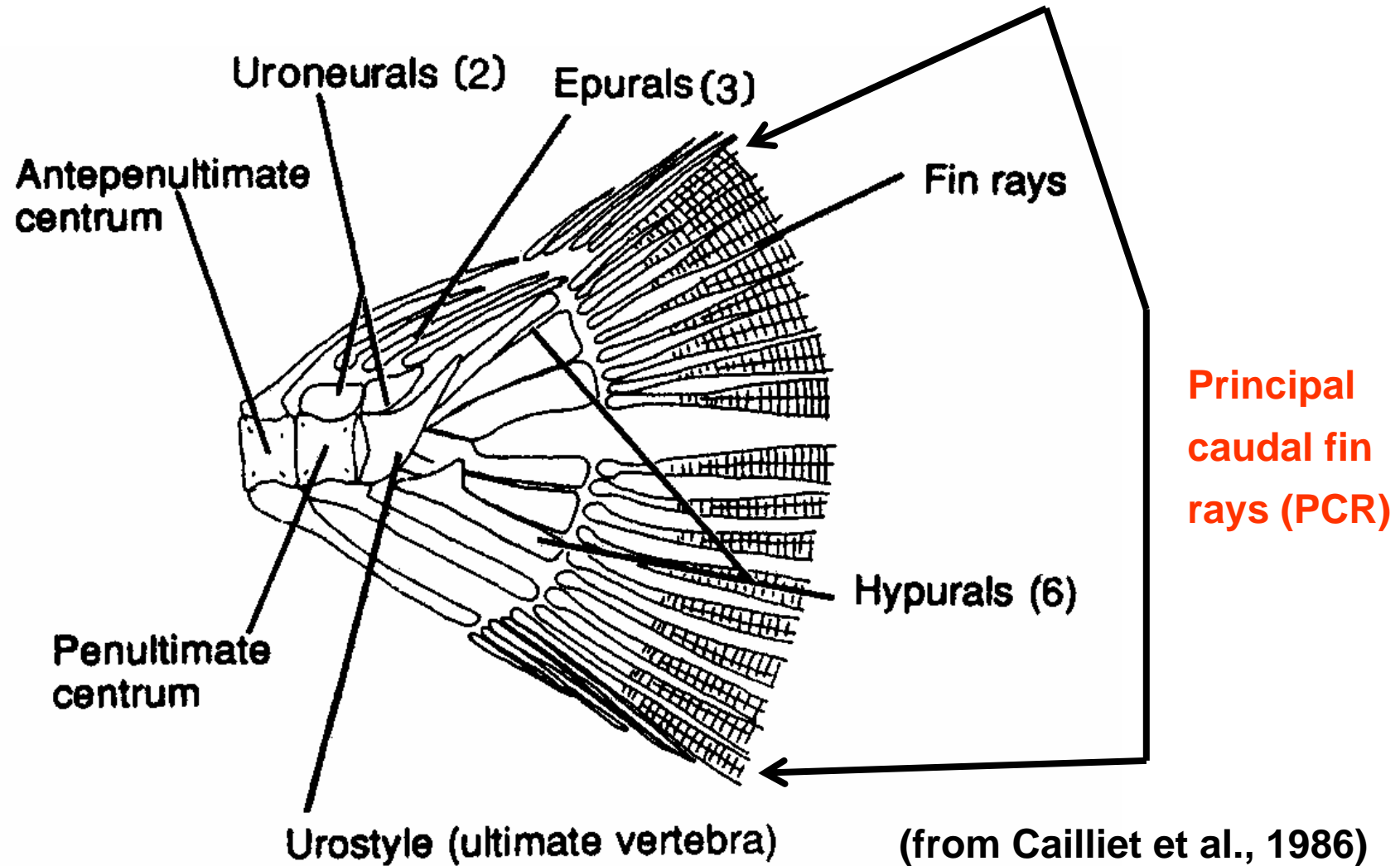
h.



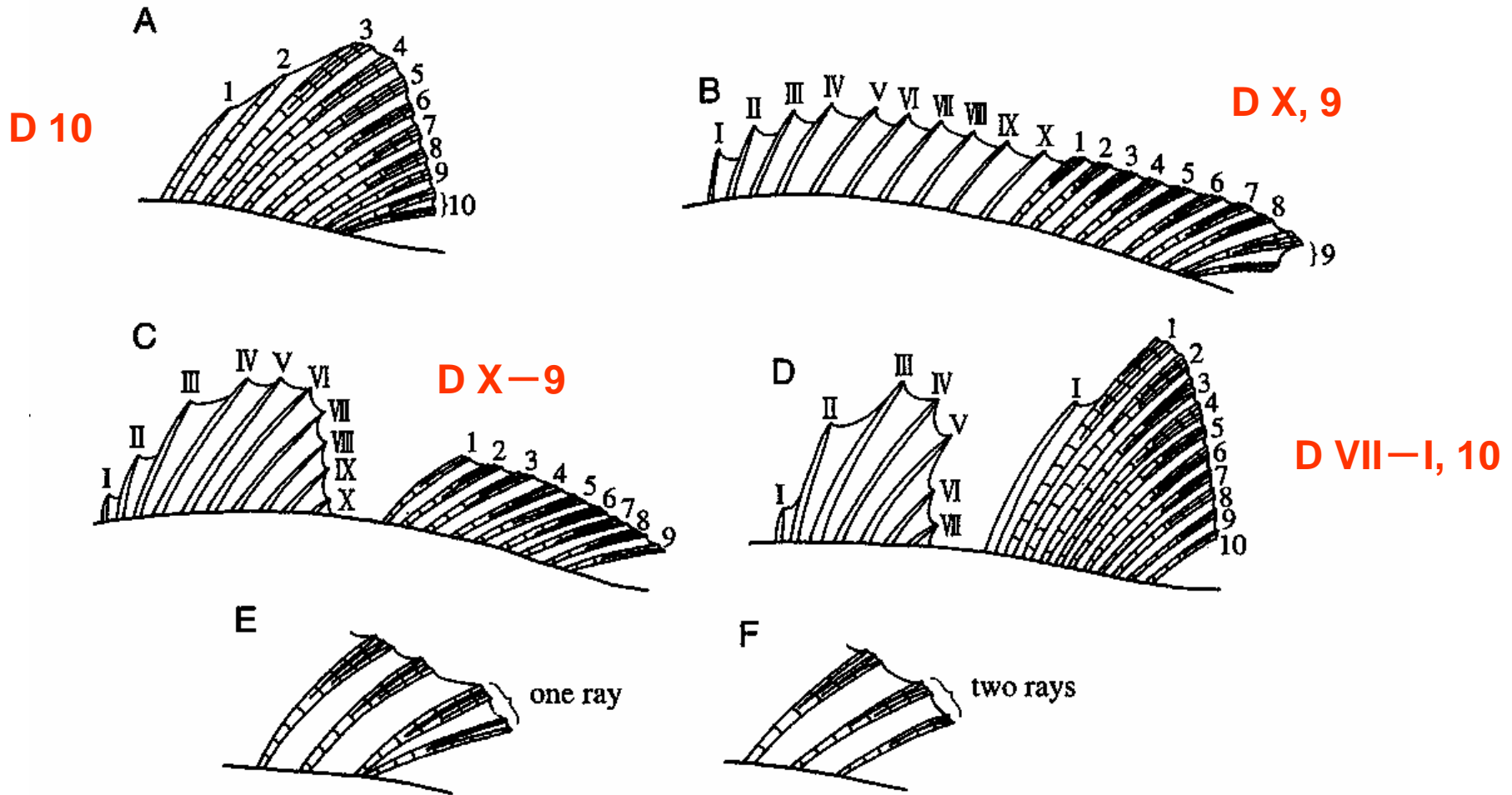
naked

(modified Cailliet et al., 1986)

# Caudal fin support



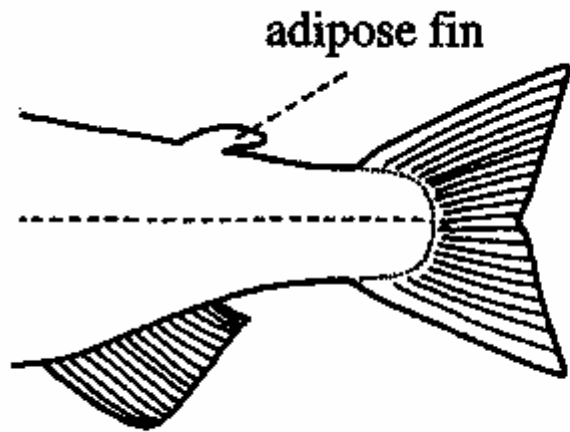
# Typical forms of dorsal fin and counting method for spines and soft rays



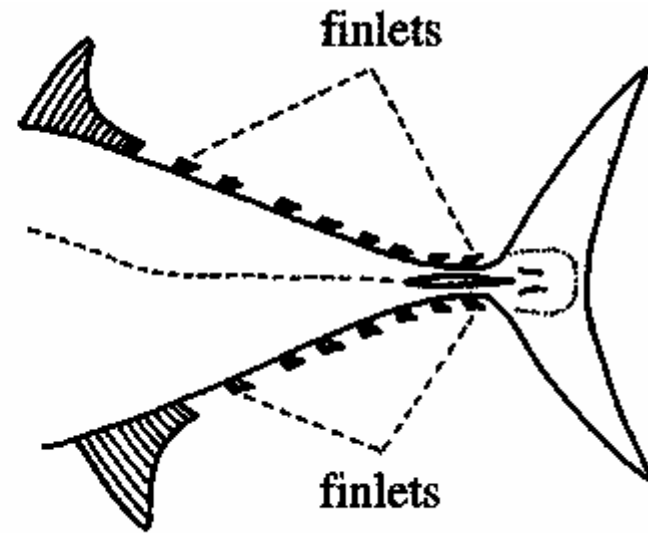
Spines: unpaired, unsegmented and unbranched fin rays  
 Soft rays: paired, segmented, branched fin rays

(from Nakabo, 2002)

# Adipose fin and finlets



**Myctophidae  
Aulopidae etc**



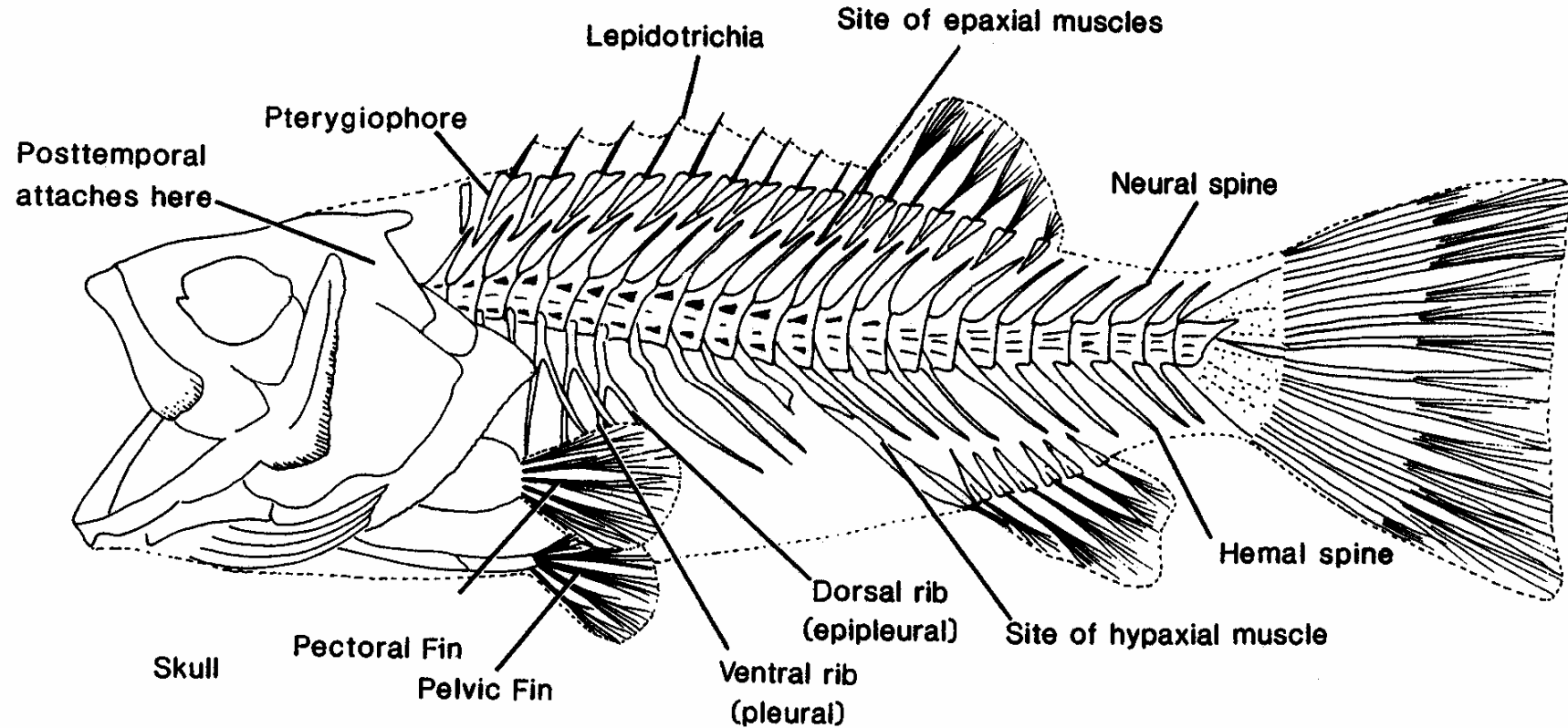
**Scombridae**

Adipose fin is membranous.

Finlet has fin element (like ray).

(from Nakabo, 2002)

# Vertebrae



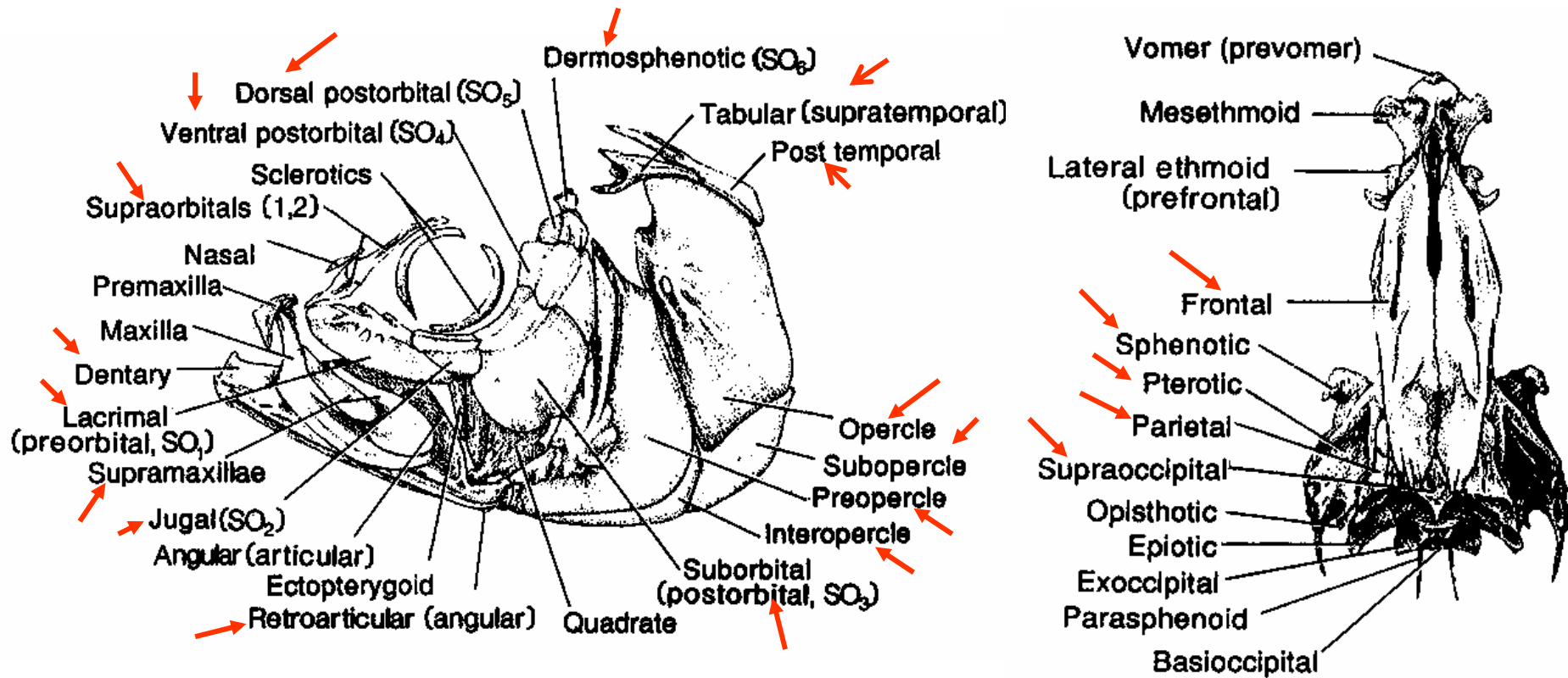
(from Cailliet et al., 1986)

**V (total number of vertebrae) = (precaudal vertebrae) + (caudal vertebrae)**

Precaudal V. bear ribs and neural spines. Caudal V. bear haemal and neural spines.

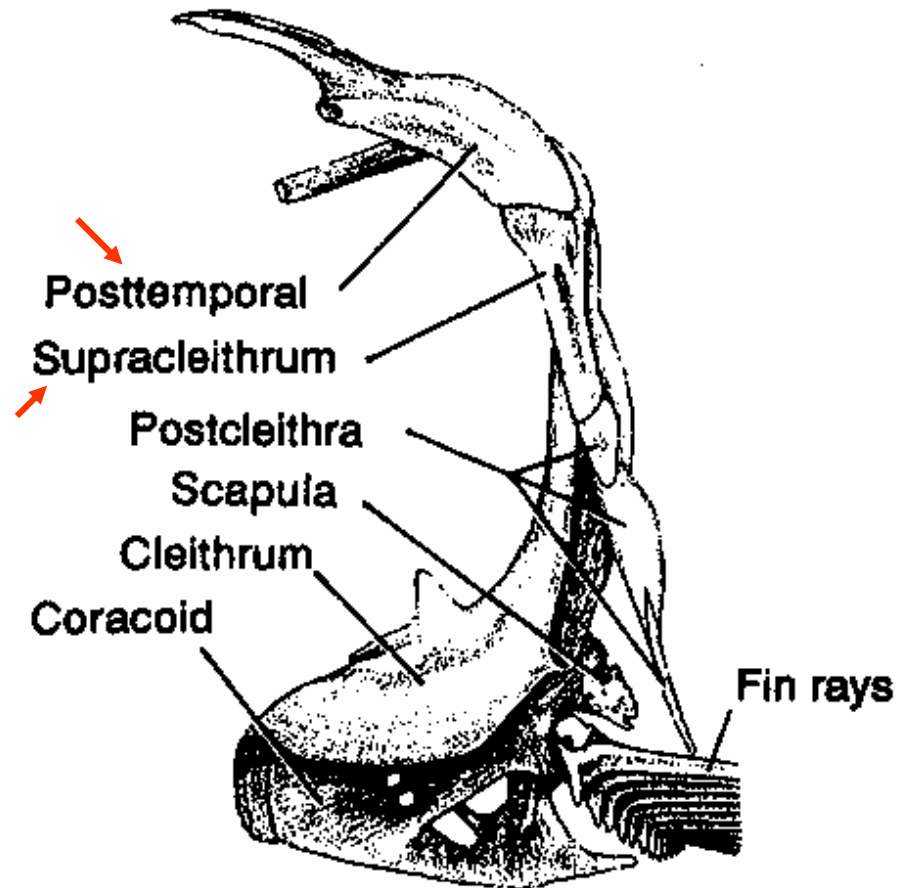
# Head and shoulder girdle bones wearing spination in larval stage for some species

(1)



(from Cailliet et al., 1986)

# Head and shoulder girdle bones wearing spination in larval stage for some species



(from Cailliet et al., 1986)

# Fish taxonomy

See a text