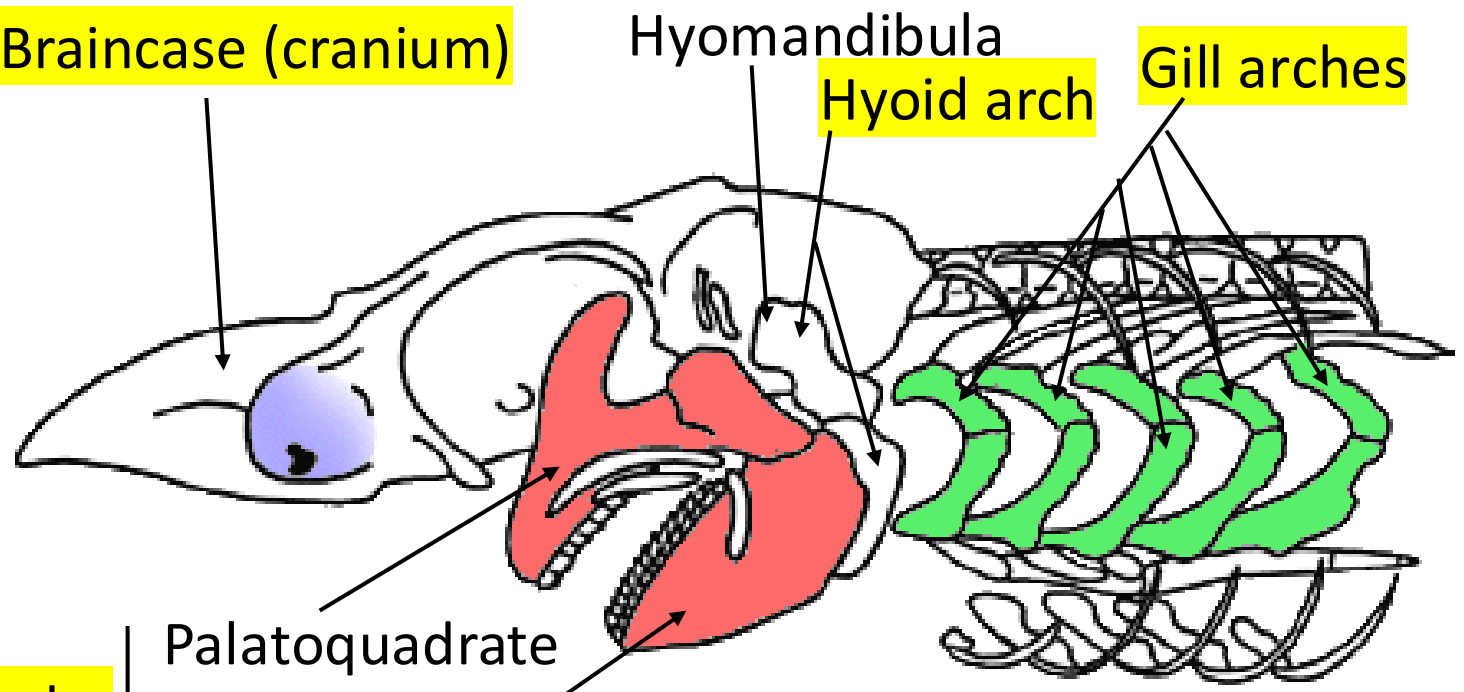
GVZ 2026 10 September

- More on Chondrichthyes
- Actinopterygii
  - Diversity
  - Traits

Characteristics of Chondrichthyes



Braincase: Chondrocranium

Jaws, gill arches: Splanchnocranium

Holostylic
Hyostylic
(Amphistylic)

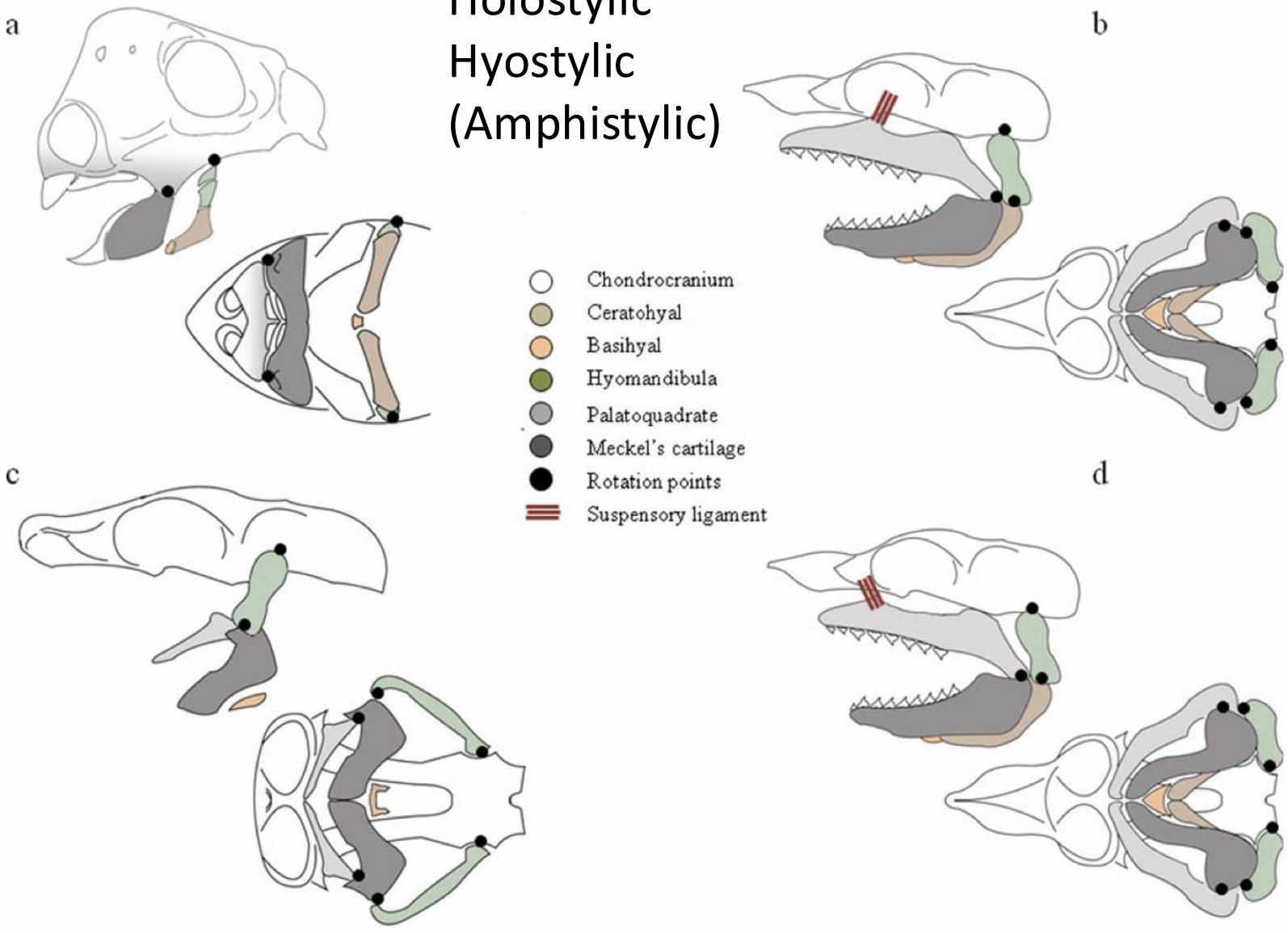
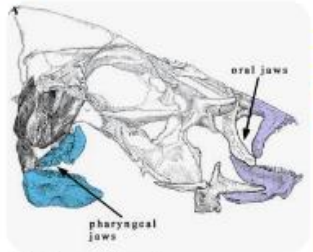


Fig. 1. Methods of jaw suspension in chondrichthyan fishes. (**a**) Holostylic—*Hydrolagus*, (**b**) Orbitostylic—*Squalus*, (**c**) Euhyostylic—*Urobatis*, (**d**) Hyostylic with ethmoid attachments—*Carcharhinus*.

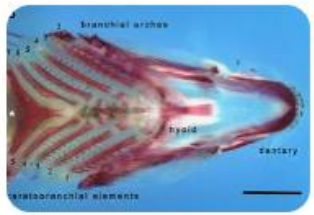
Sign in

Morphoclinal transition predicted...
ResearchGate

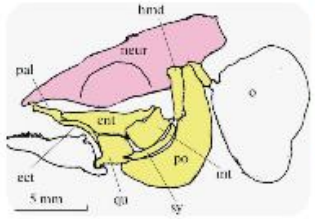
Comparative account of jaw...
Slideshare



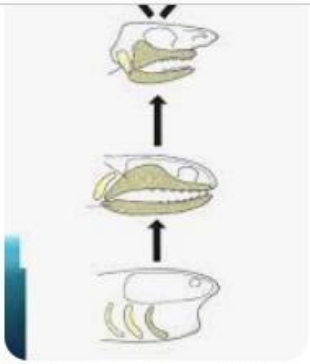
Fish jaw - Wikipedia
Wikipedia



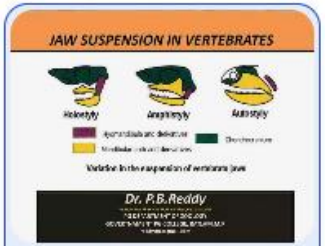
Fish jaw - Wikipedia
Wikipedia



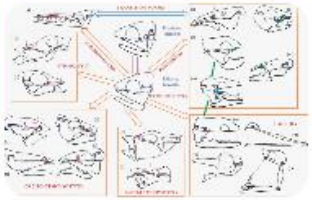
Typology of the Suspensorium...
Springer Nature



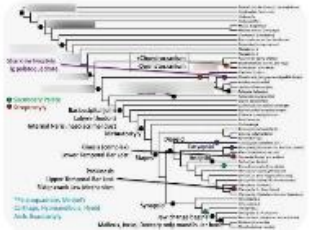
Skull Evolution Diagram | Quizlet
Quizlet

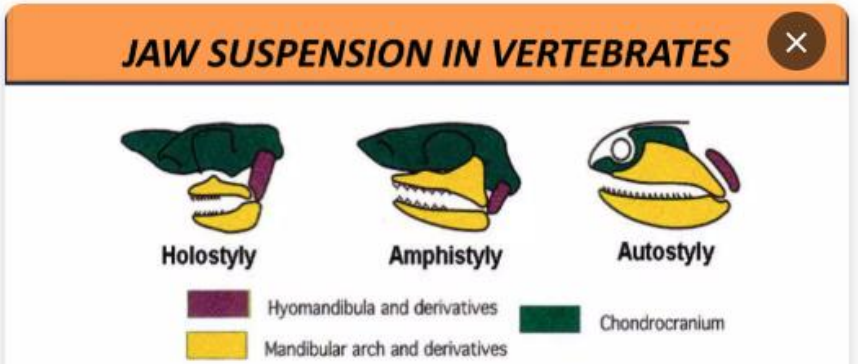


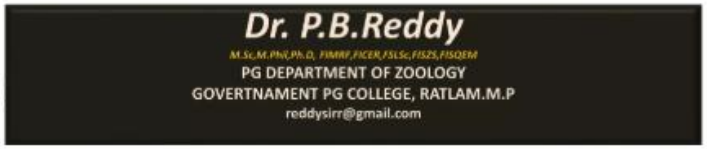
Jaw suspension in vertebrates...
Slideshare



Typology of the Suspensorium...
Springer Nature







Jaw suspension in vertebrates [autosaved] | PPTX

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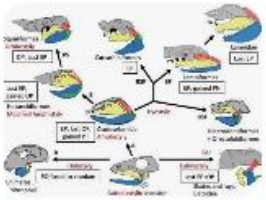
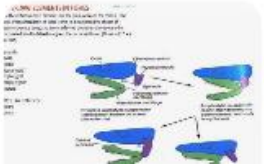
Vertebrate Jaw Types
www.mun.ca

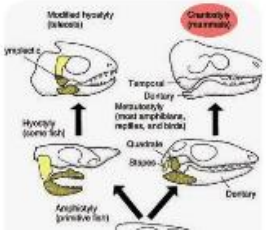


2. Evolution of jaw suspensi...
ResearchGate

2.02 More A and P Flashcard...
Quizlet

Comparative account of jaw...
Slideshare





Paleobiology, 48(4), 2022, pp. 622–654
DOI: 10.1017/pab.2021.47

PALEOBIOLOGY
A PUBLICATION OF THE Paleontological SOCIETY

Article

The chondrichthyan fossil record of the Florida Platform (Eocene–Pleistocene)

Victor J. Perez

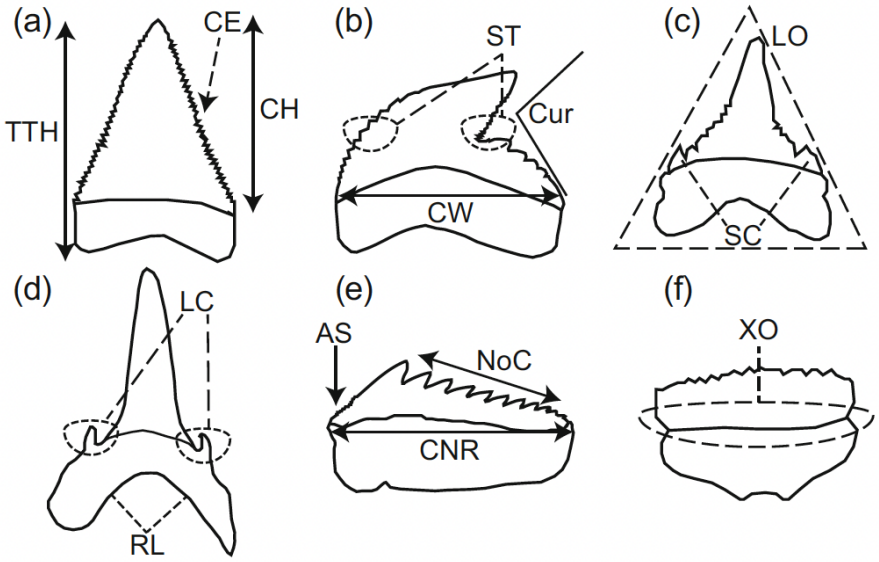
Received: 28 September 2022 | Accepted: 14 January 2023
DOI: 10.1111/jfb.15326

REGULAR PAPER

JOURNAL OF FISH BIOLOGY fsbi

Are shark teeth proxies for functional traits? A framework to infer ecology from the fossil record

Jack A. Cooper[1] | John N. Griffin[1] | René Kindlimann[2] | Catalina Pimier



Body size	Total length in centimetres and categorised in the following classes:
	1 – small (1–200 cm)
	2 – medium (201–400 cm)
	3 – large (401–600 cm)
	4 – giant (>600 cm)
Prey preference	Categories
	1 – plankton
	2 – invertebrates
	3 – fishes
	4 – high vertebrates
Feeding mechanism	Categories
	1 – crushing
	2 – clutching
	3 – grasping
	4 – cutting
	5 – vestigial

Received: 28 September 2022 | Accepted: 14 January 2023
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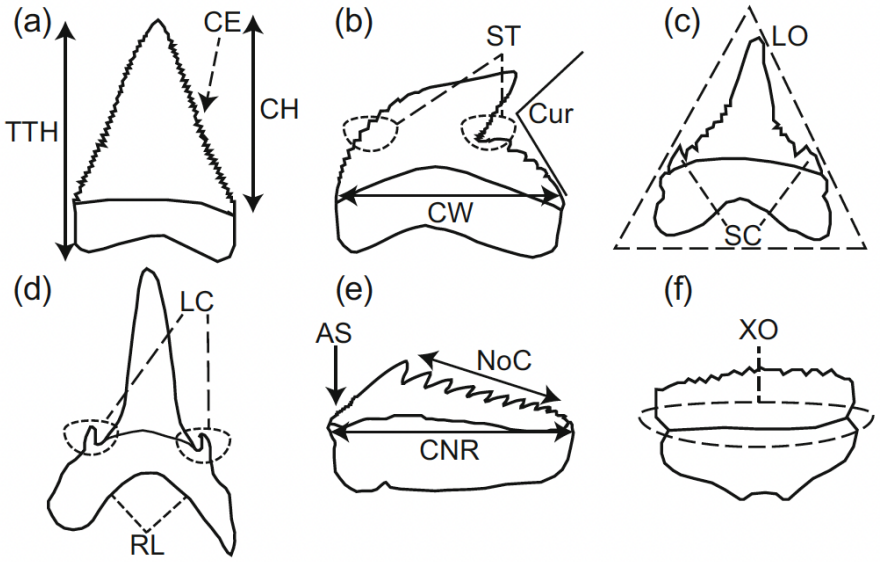

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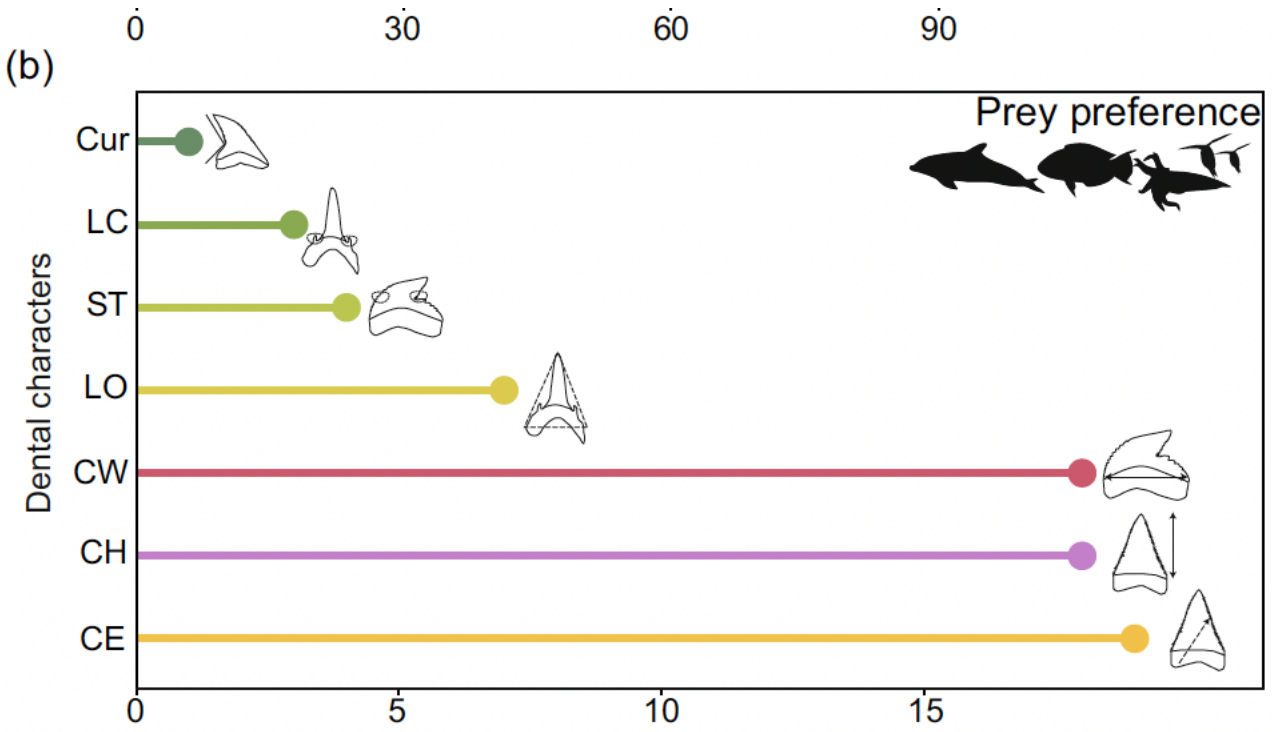
Jack A. Cooper[1] | John N. Griffin[1] | René Kindlimann[2] | Catalina Pimiento[1,3,4]

3.1 | Q1 Which dental characters have been used as proxies for functional traits in sharks?



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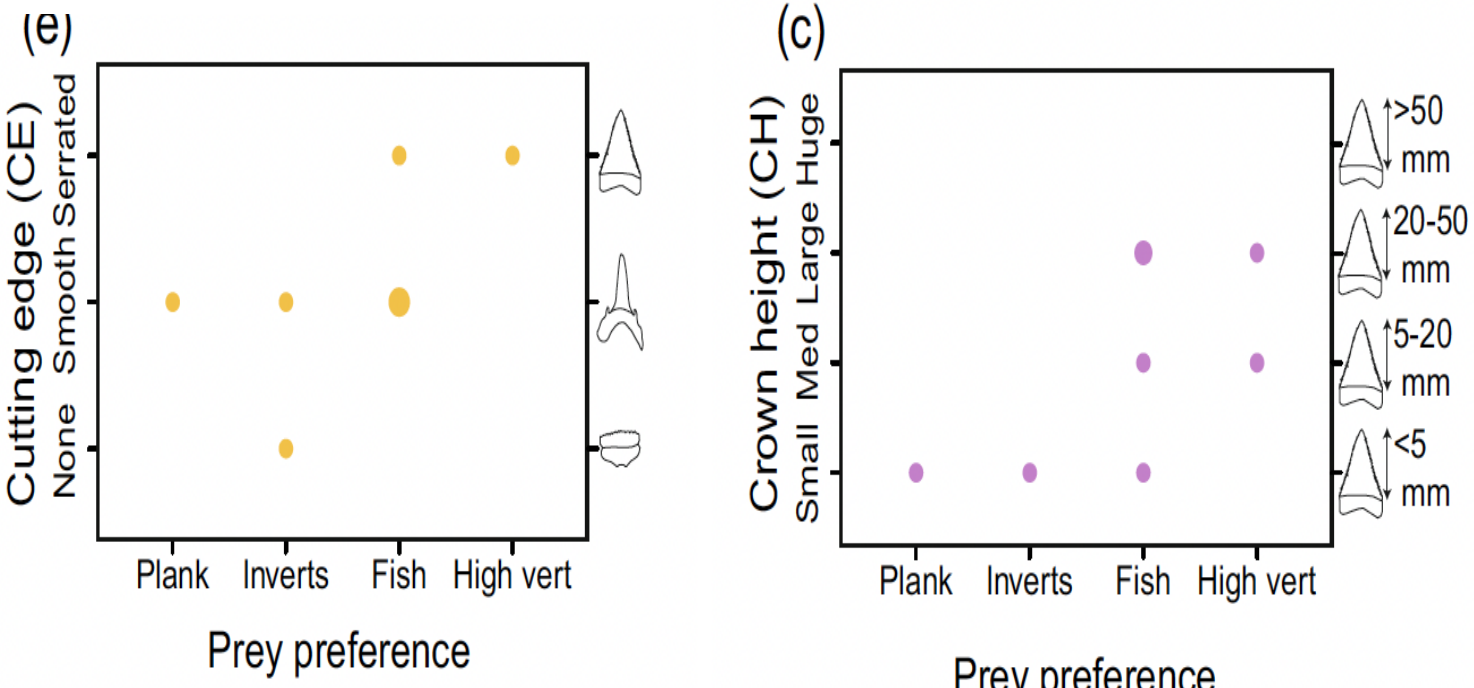

Are shark teeth proxies for functional traits? A framework to infer ecology from the fossil record

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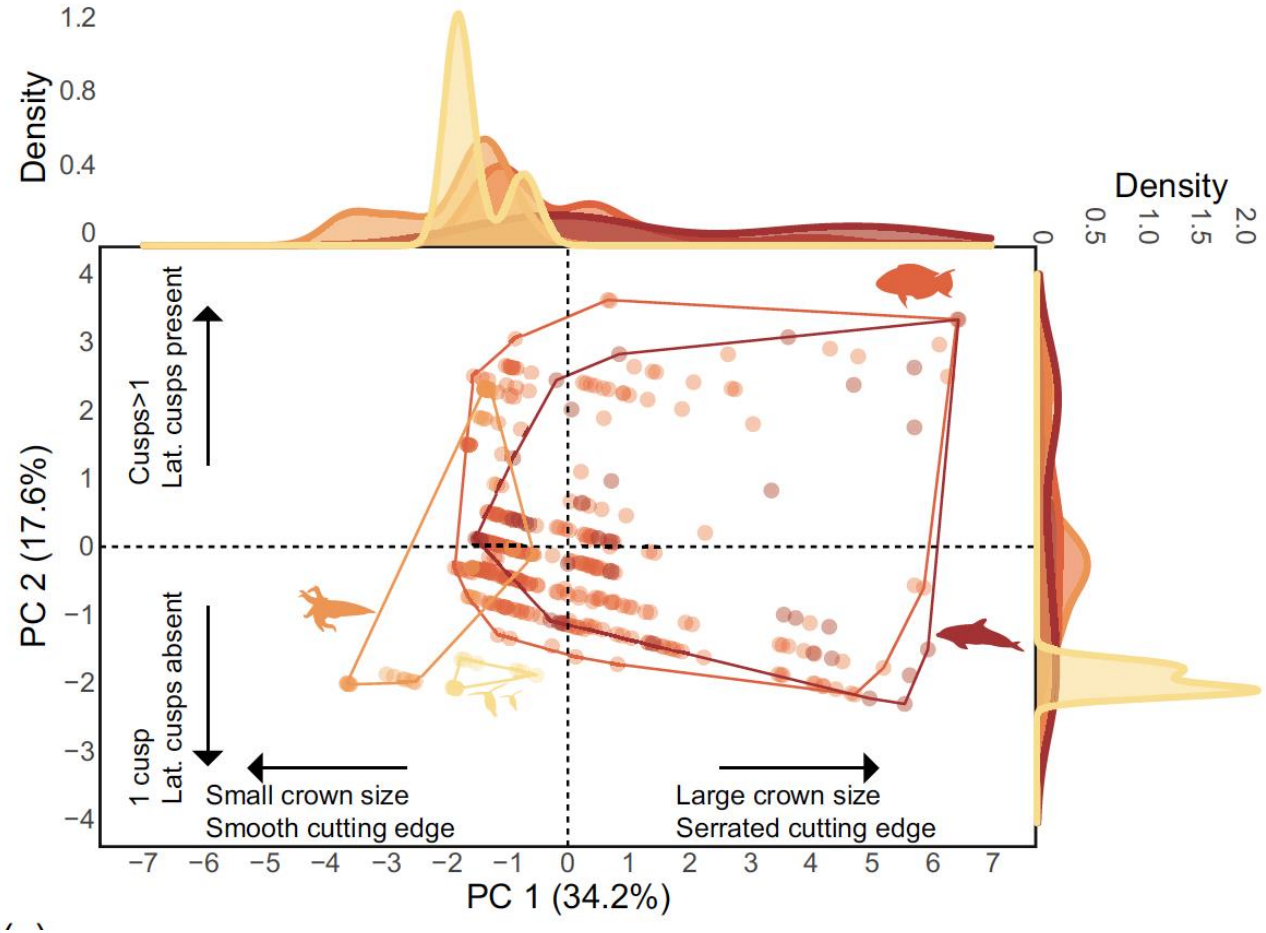

Are shark teeth proxies for functional traits? A framework to infer ecology from the fossil record

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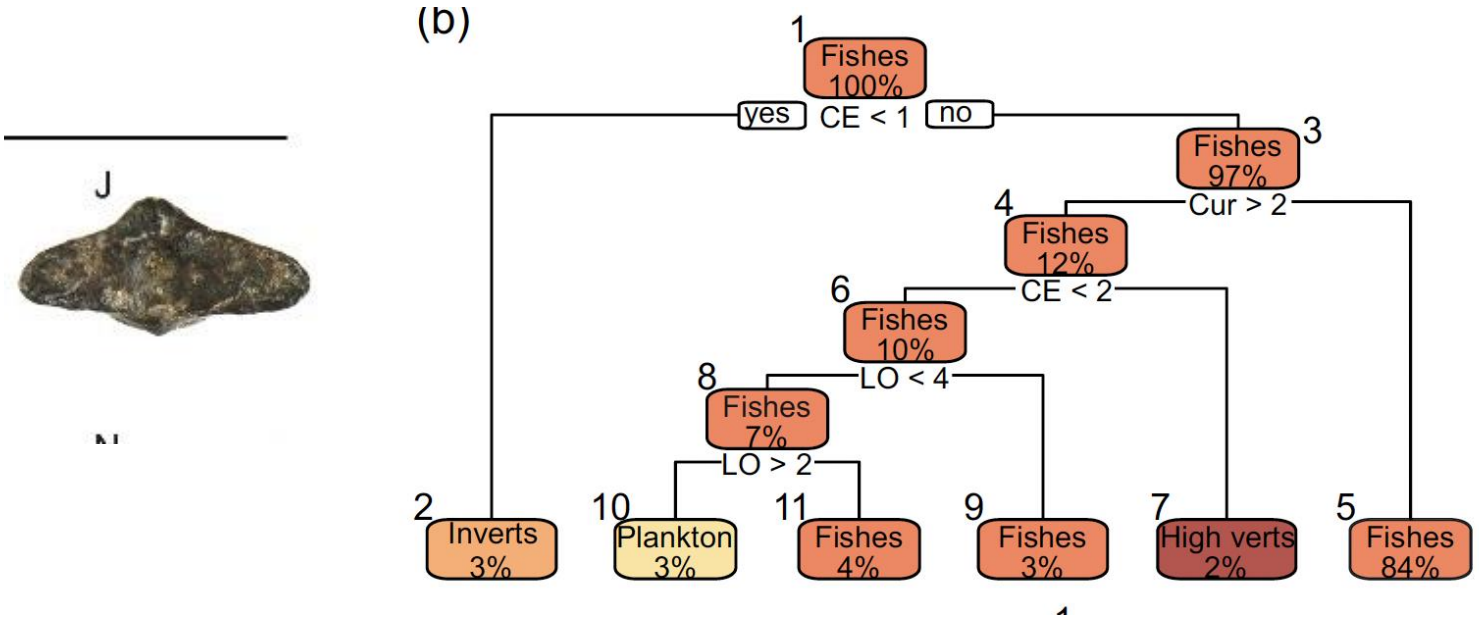
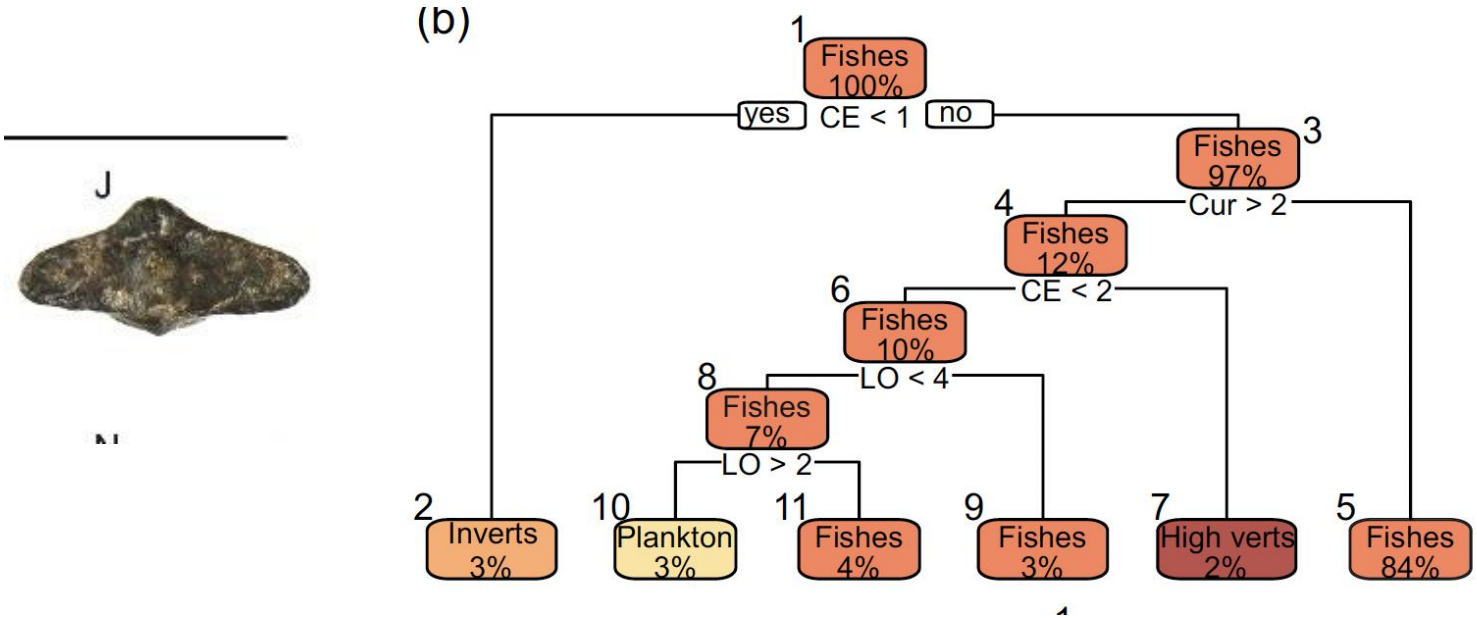


Are shark teeth proxies for functional traits? A framework to infer ecology from the fossil record

Jack A. Cooper[1] | John N. Griffin[1] | René Kindlimann[2] | Catalina Pimiento[1,3,4]

The classification tree analysis revealed cutting edge to be the main predictor of prey preference at the root node (Figure 6b), in line



associated with planktivory (Figure 6b; Table S5). Cross-validation analyses indicated an accuracy of 83.9% on the test set, suggesting that the dental characters used in the tree are strong predictors of prey preference. When only anterior teeth were analysed, cross-

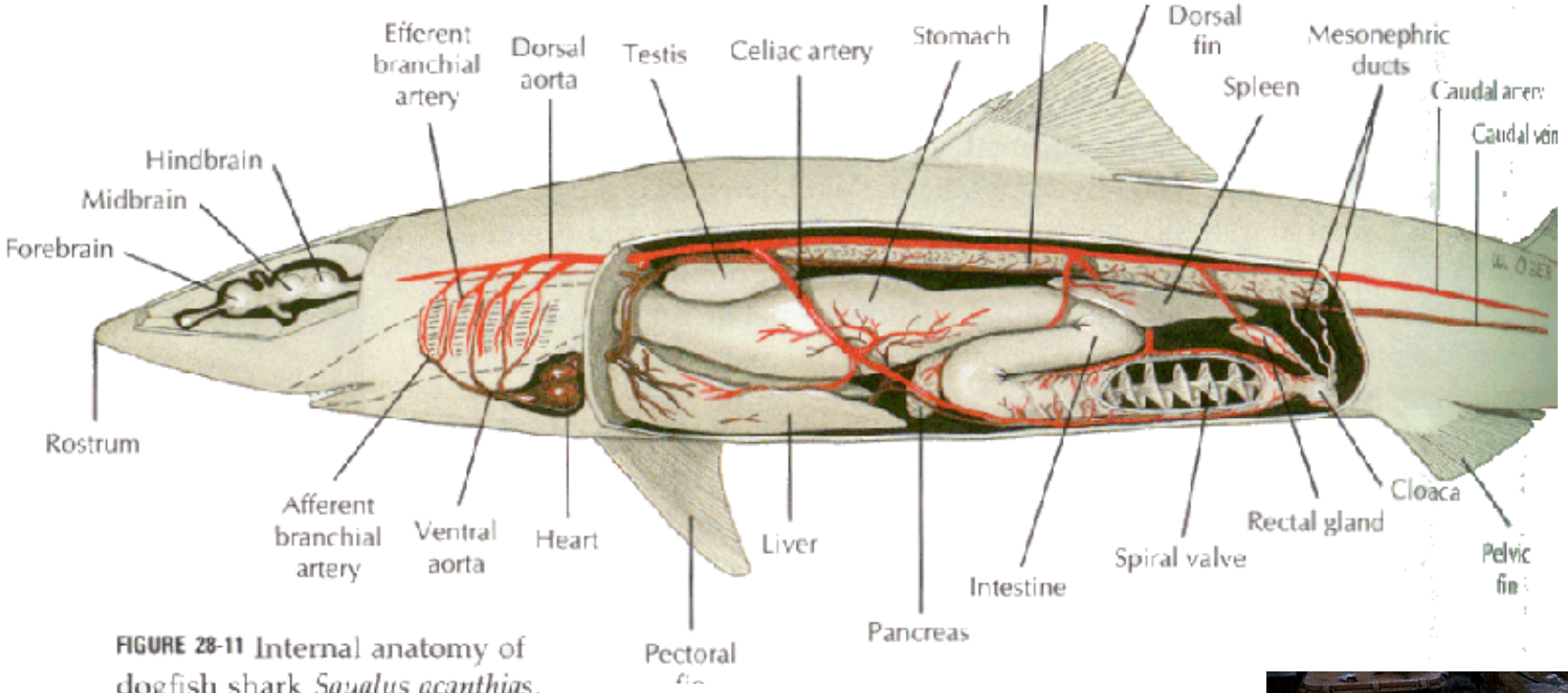
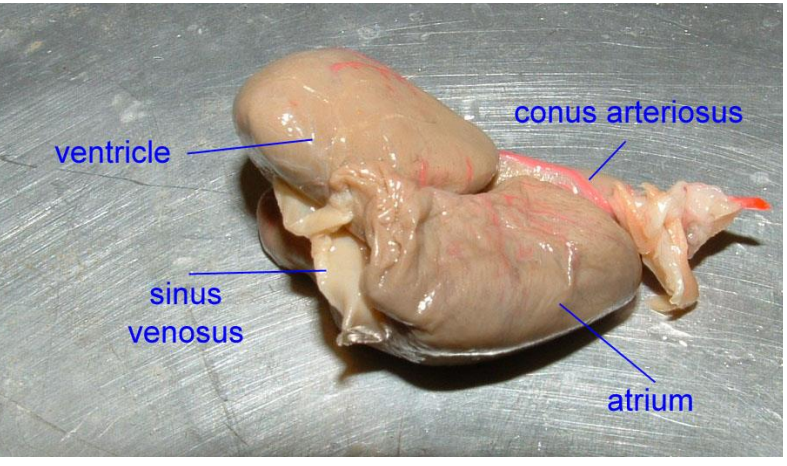
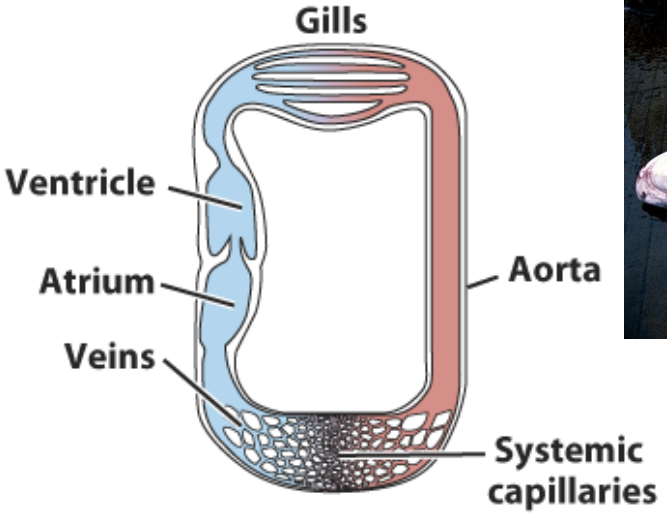
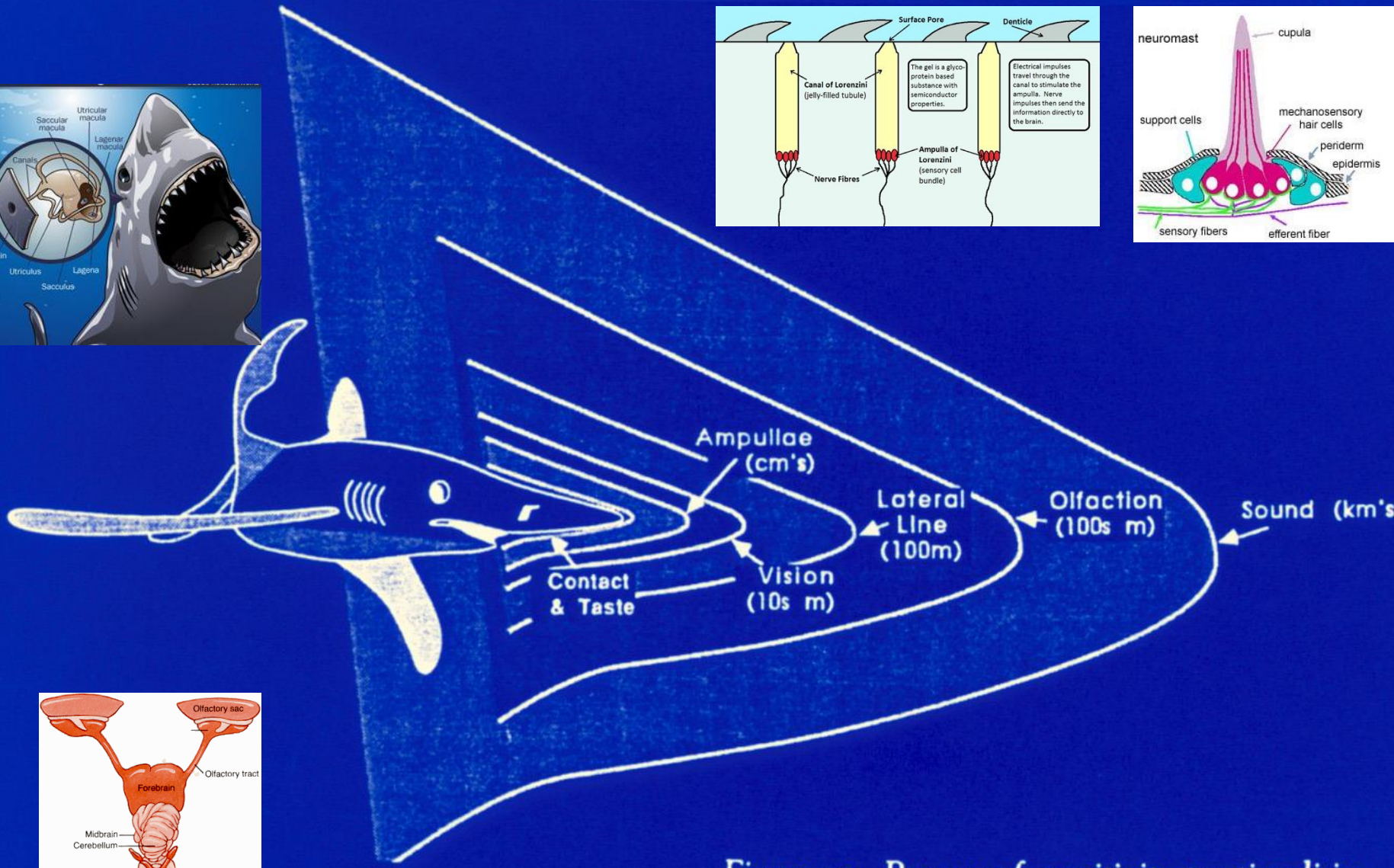


FIGURE 28-11 Internal anatomy of dogfish shark *Squalus acanthias*.







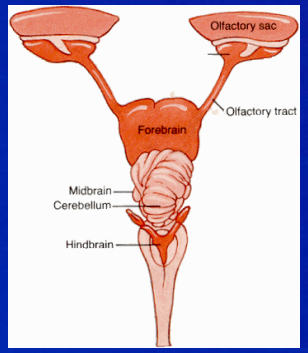
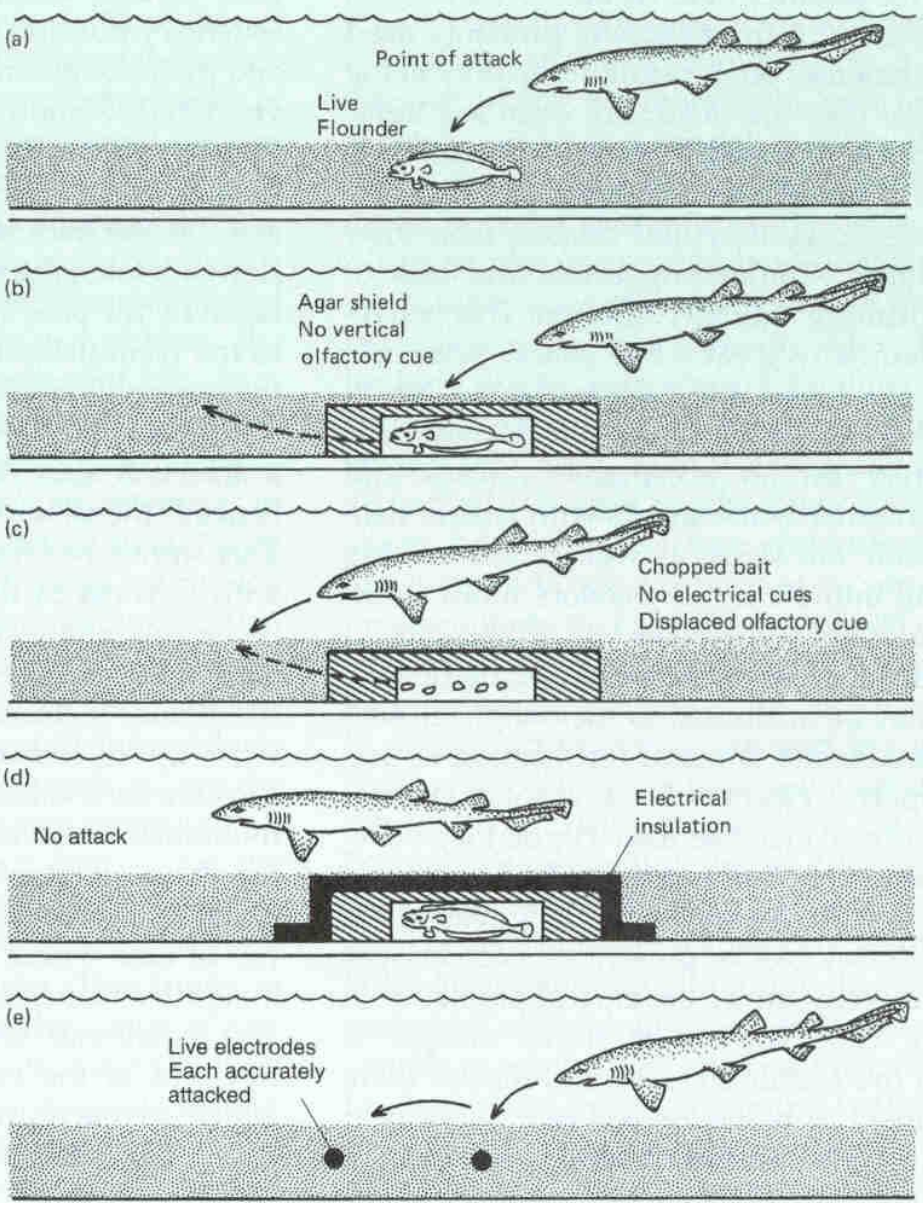


Figure 32. Ranges of sensitivity to stimuli in a shark.

Kalmijn's Experiment

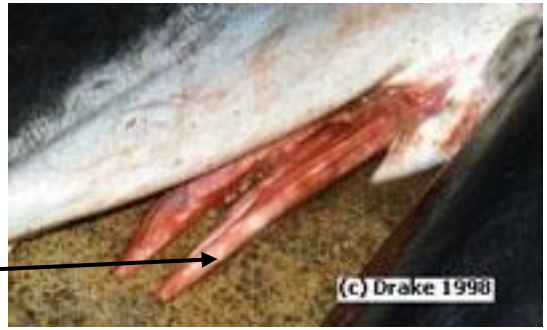
Figure 7–11 Kalmijn's experiments illustrating the electrolocation capacity of elasmobranchs. (Modified from A. J. Kalmijn 1974, *Handbook of Sensory Physicology*, volume 3, part 3, edited by A. Fessard, Springer, New York, NY.)



Chondrichthyes reproduction

- Internal fertilization

claspers



- Oviparous, Ovoviviparous, or viviparous
- 3 to 25 years to reach sexual maturity
- Gestation 6 months to two years
- Multiple modes of embryonic nutrition
- About 2-20 young/litter

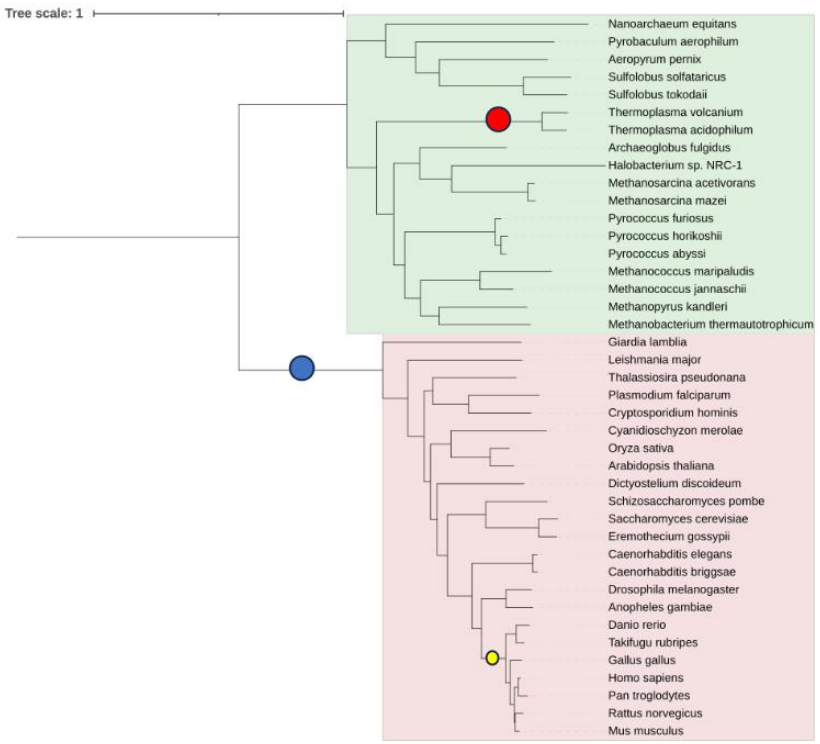
BIOLOGICAL
REVIEWS

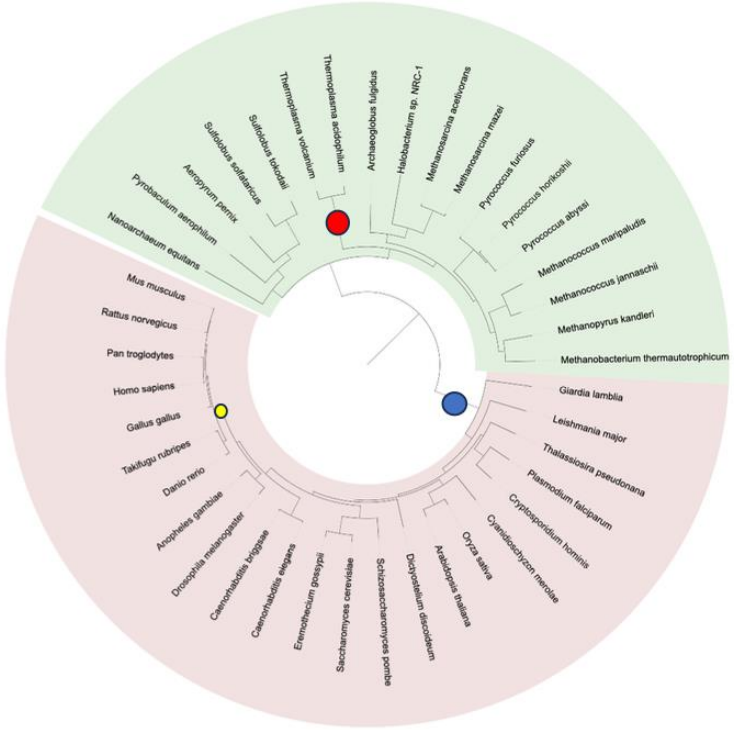
Biol. Rev. (2024), **99**, pp. 1314–1356.
doi: 10.1111/brv.13070

Phylogenetic analysis of viviparity, matrotrophy, and other reproductive patterns in chondrichthyan fishes

Daniel G. Blackburn[1,*] and Daniel F. Hughes[2]

'Circle' trees





BIOLOGICAL
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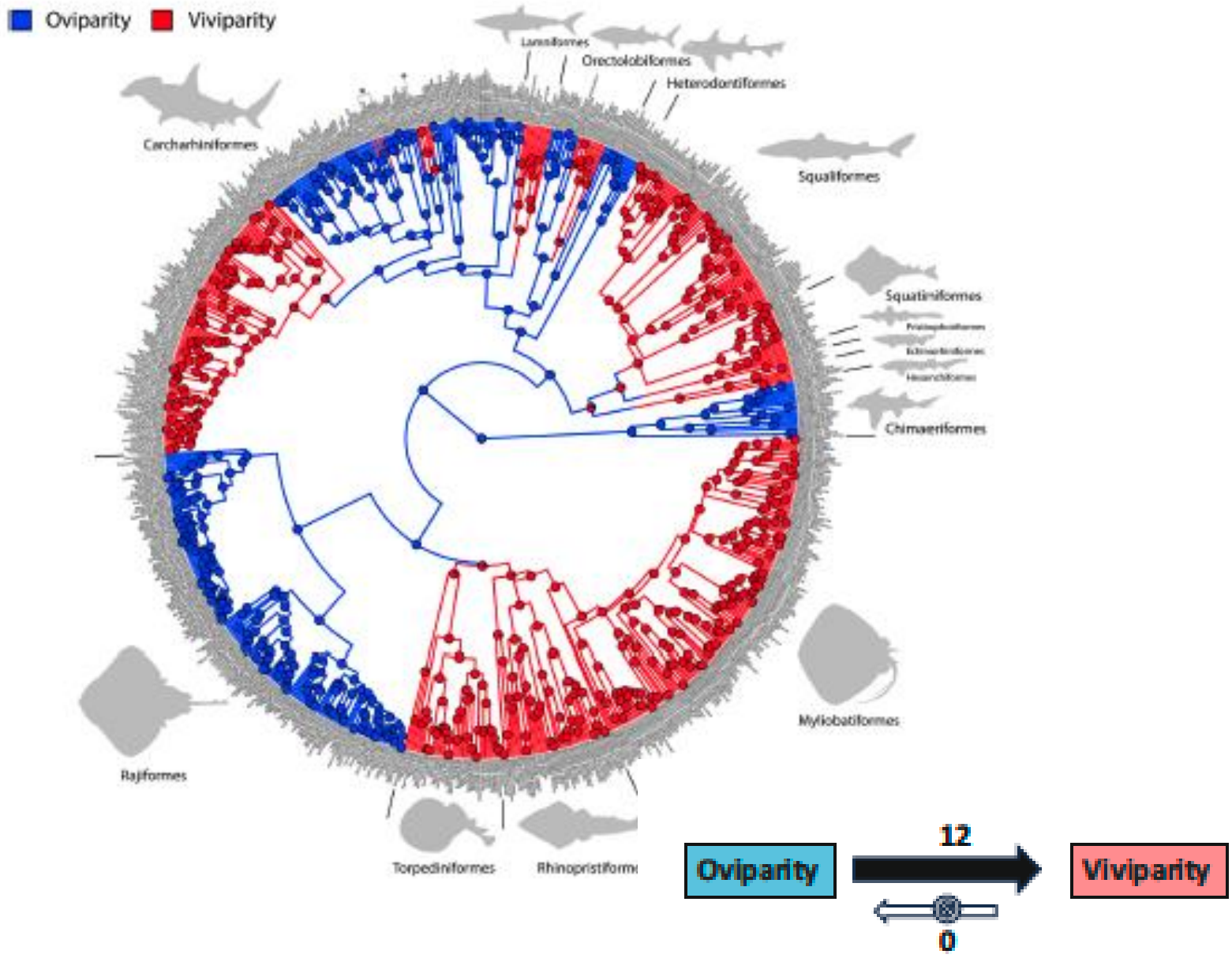
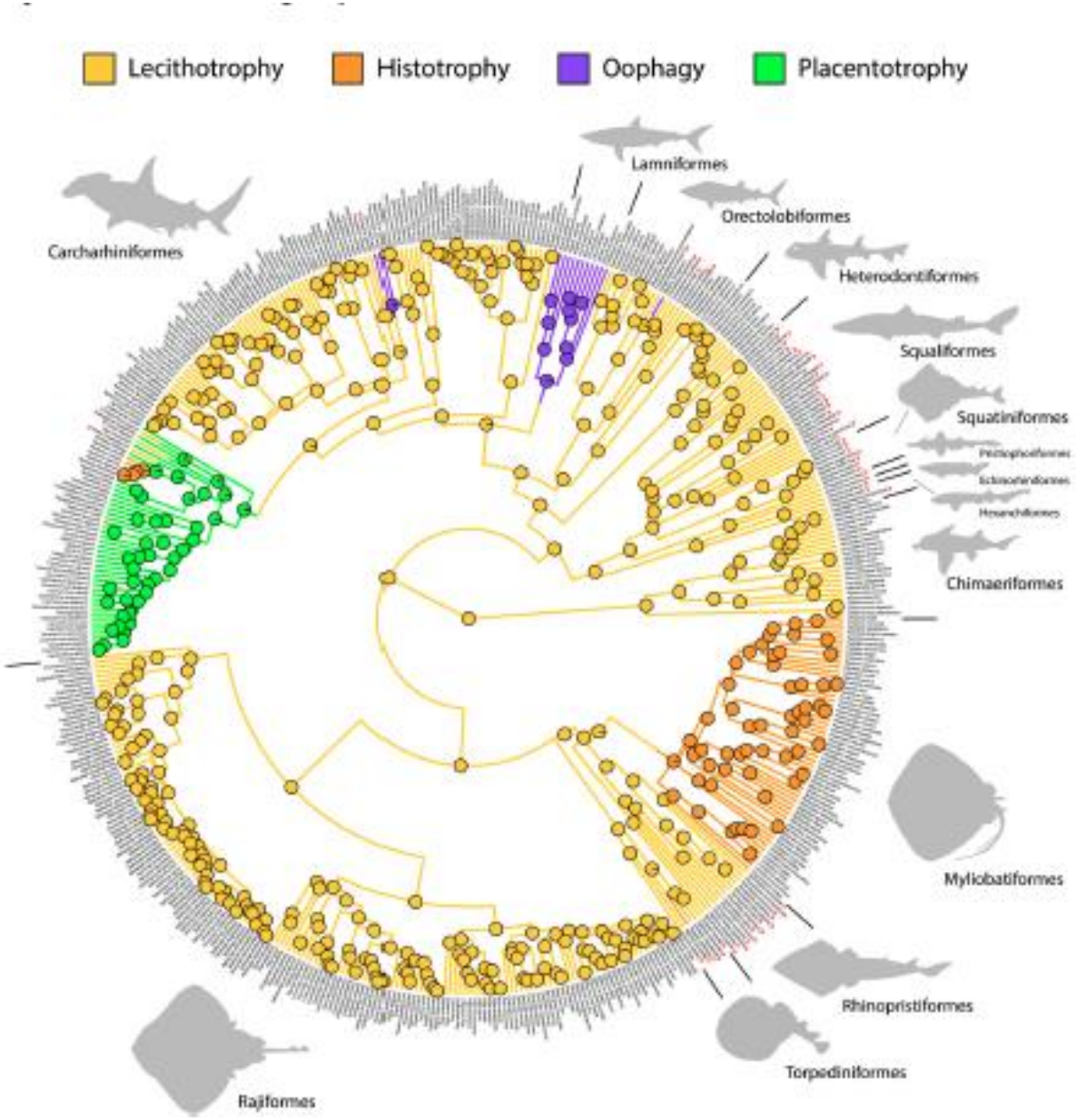
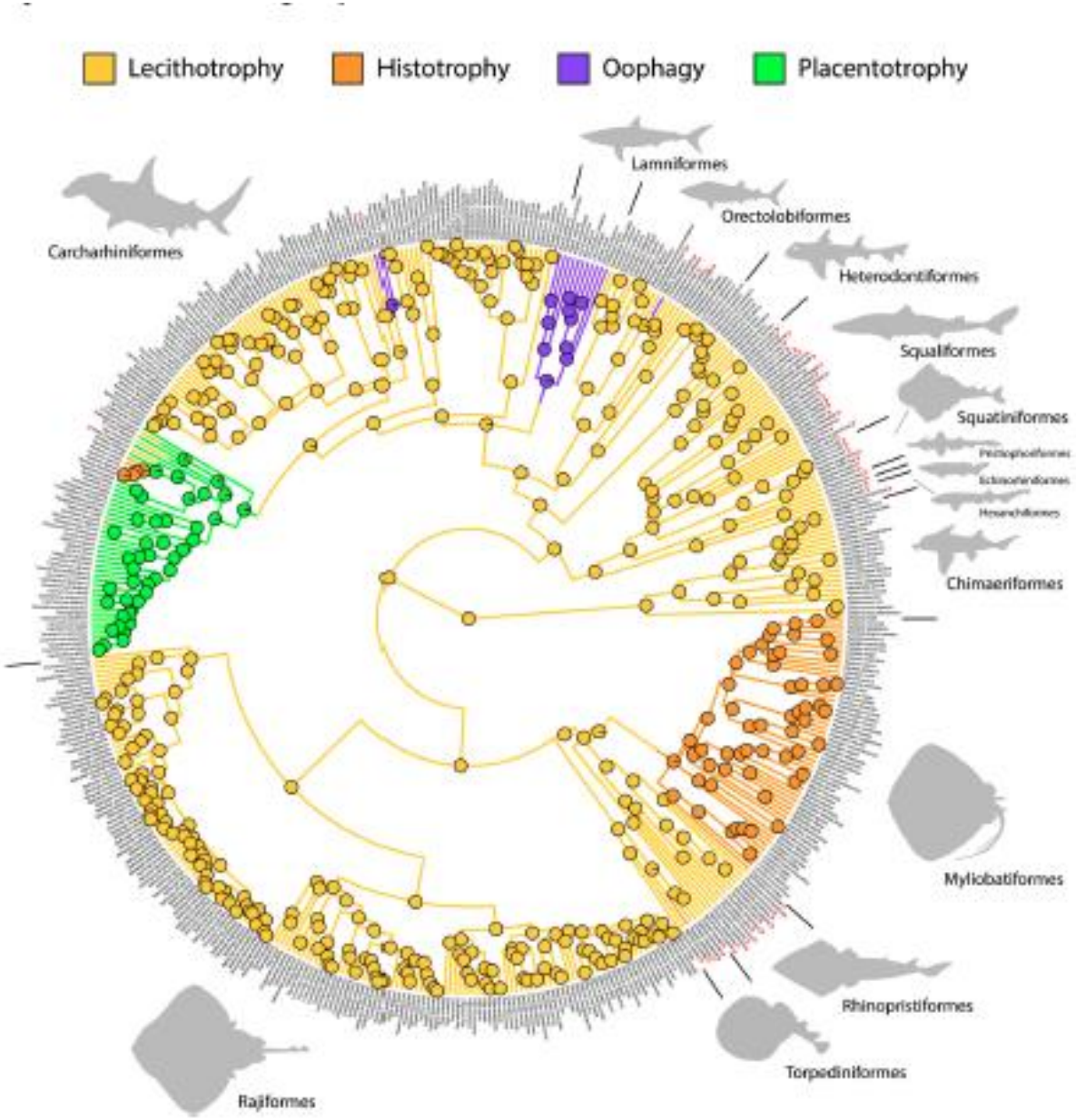
1 Reproductive data for 800 species of Chondrichthyes
2 Phylogenetic estimate for Chondrichthyes
3 Map data, reconstruct ancestral states


Oviparity
Viviparity
Orectolobiformes
Heterodontiformes
Carcharhiniformes
Squaliformes
Squatiniformes
Chimaeriformes
Myliobatiformes
Rajiformes
Torpediniformes
Oviparity
12
0
Viviparity



-troph: nutrition
lecitho- : yolk
matro- : mother
histo- : tissue
placento- : placenta
-phagy : eat
oo- : egg



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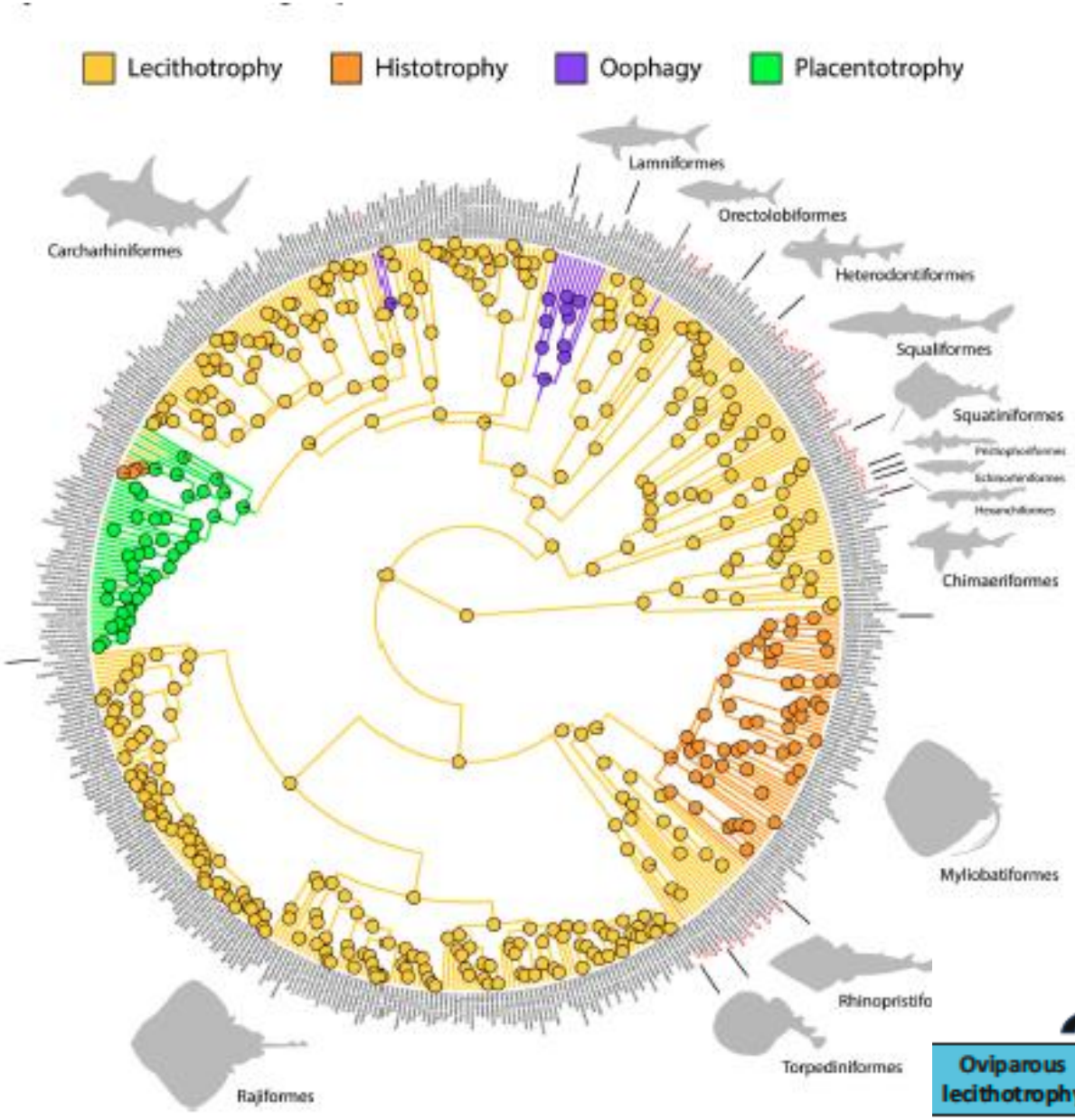
Lecithotrophy
Matrotrophy
- Histotrophy
- Placentotrophy

Oophagy



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Lecithotrophy
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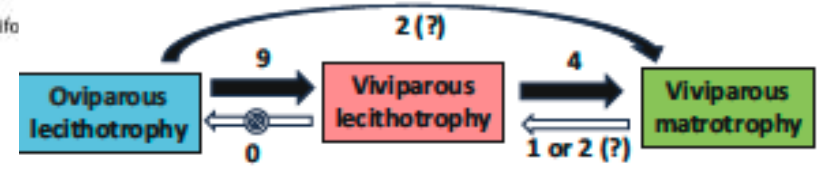
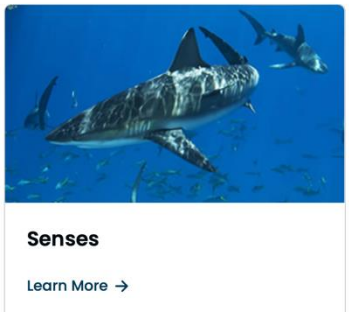
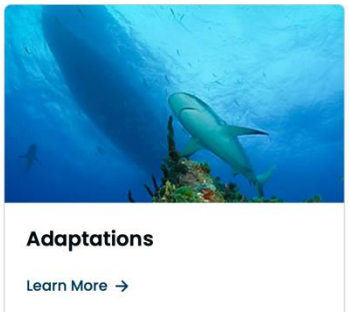
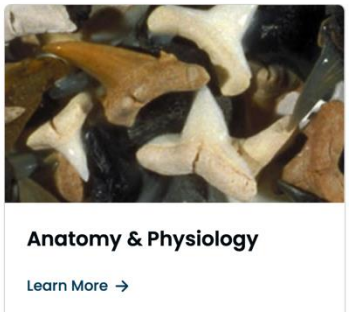


NATURE FOOTAGE

- Reading
  - Fishbase.org
  - Seaworld chondrichthyes research & info
    https://seaworld.org/animals/all-about/sharks-and-rays/
  - Blackburn and Hughes

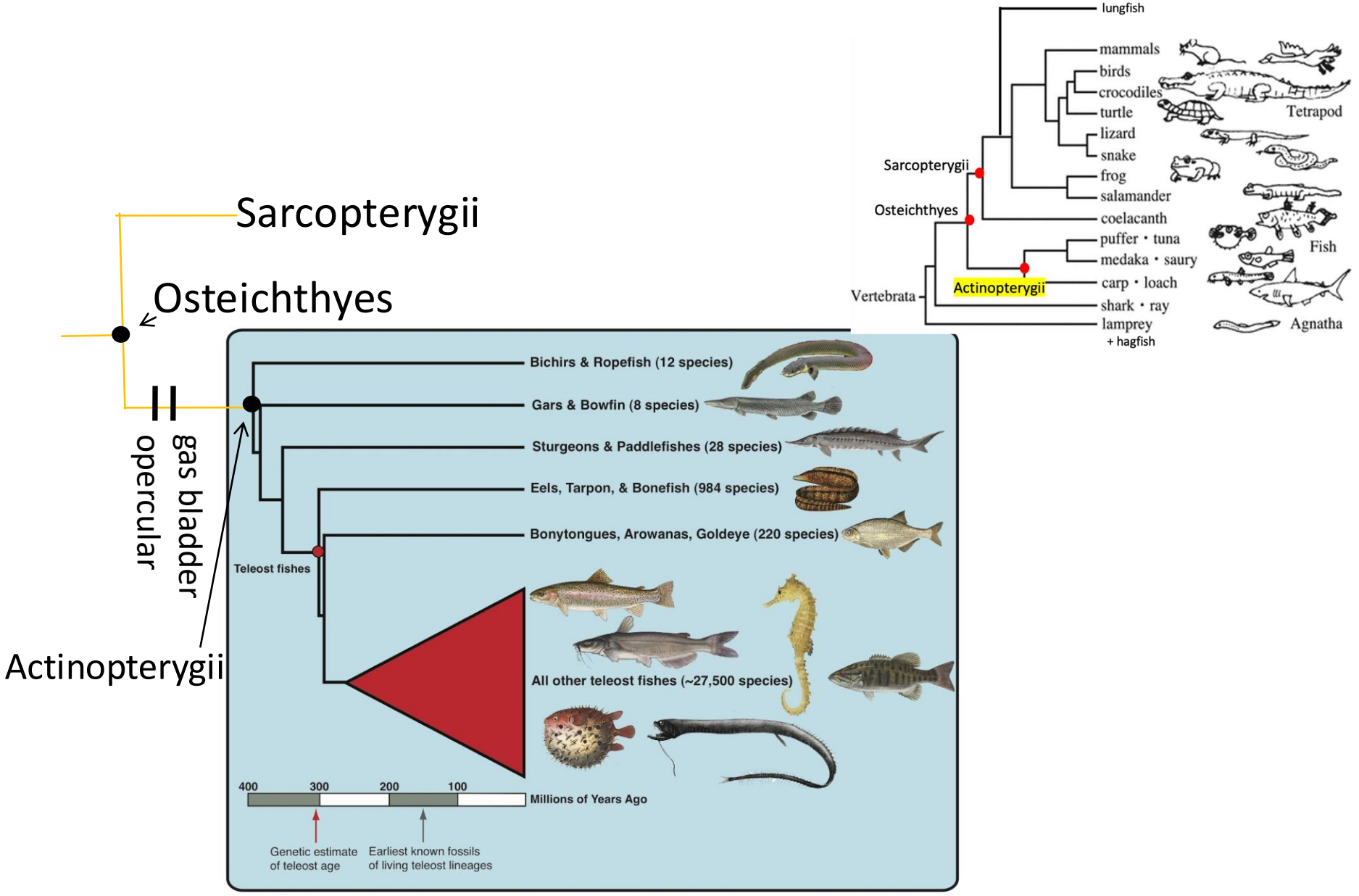


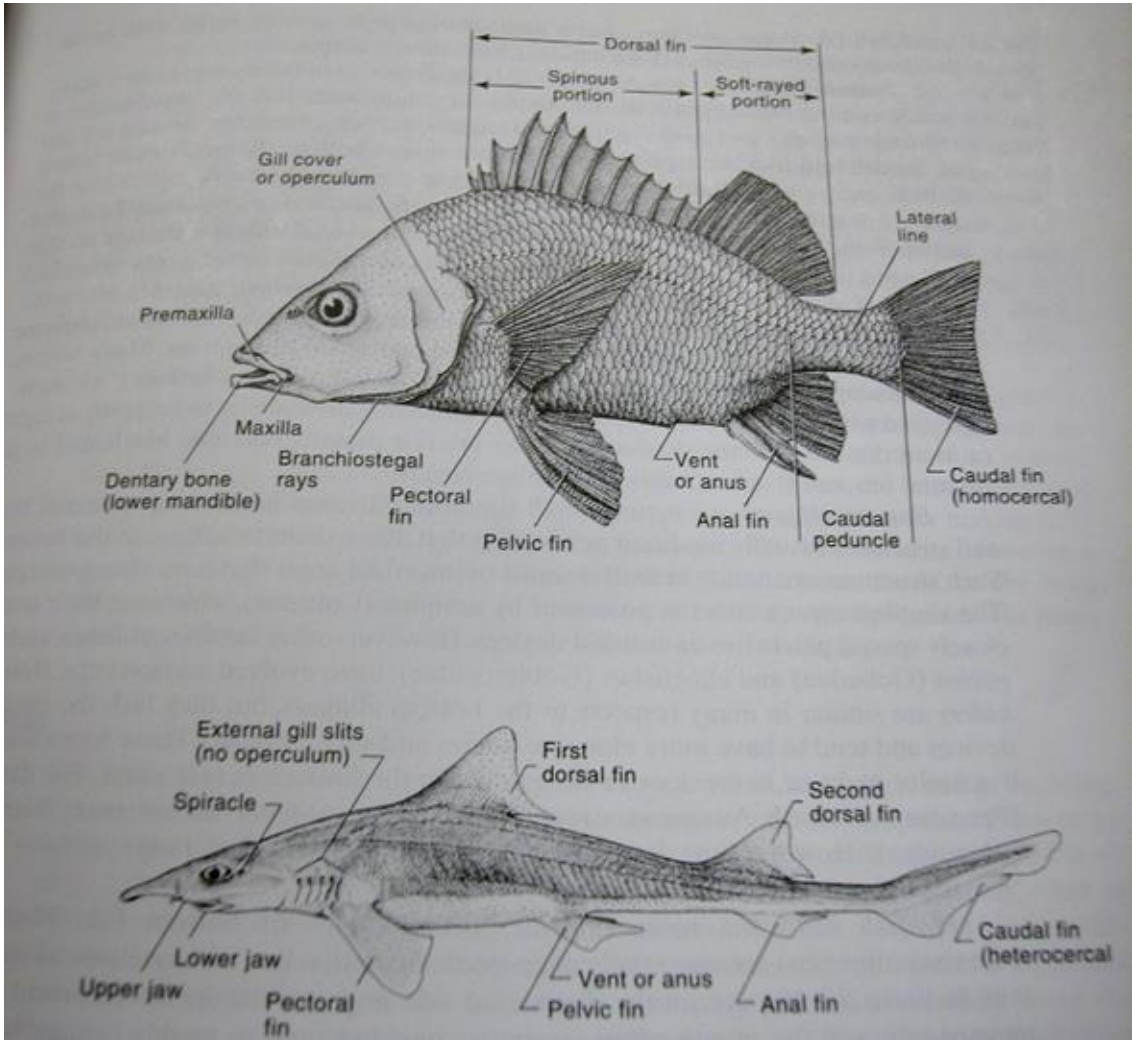


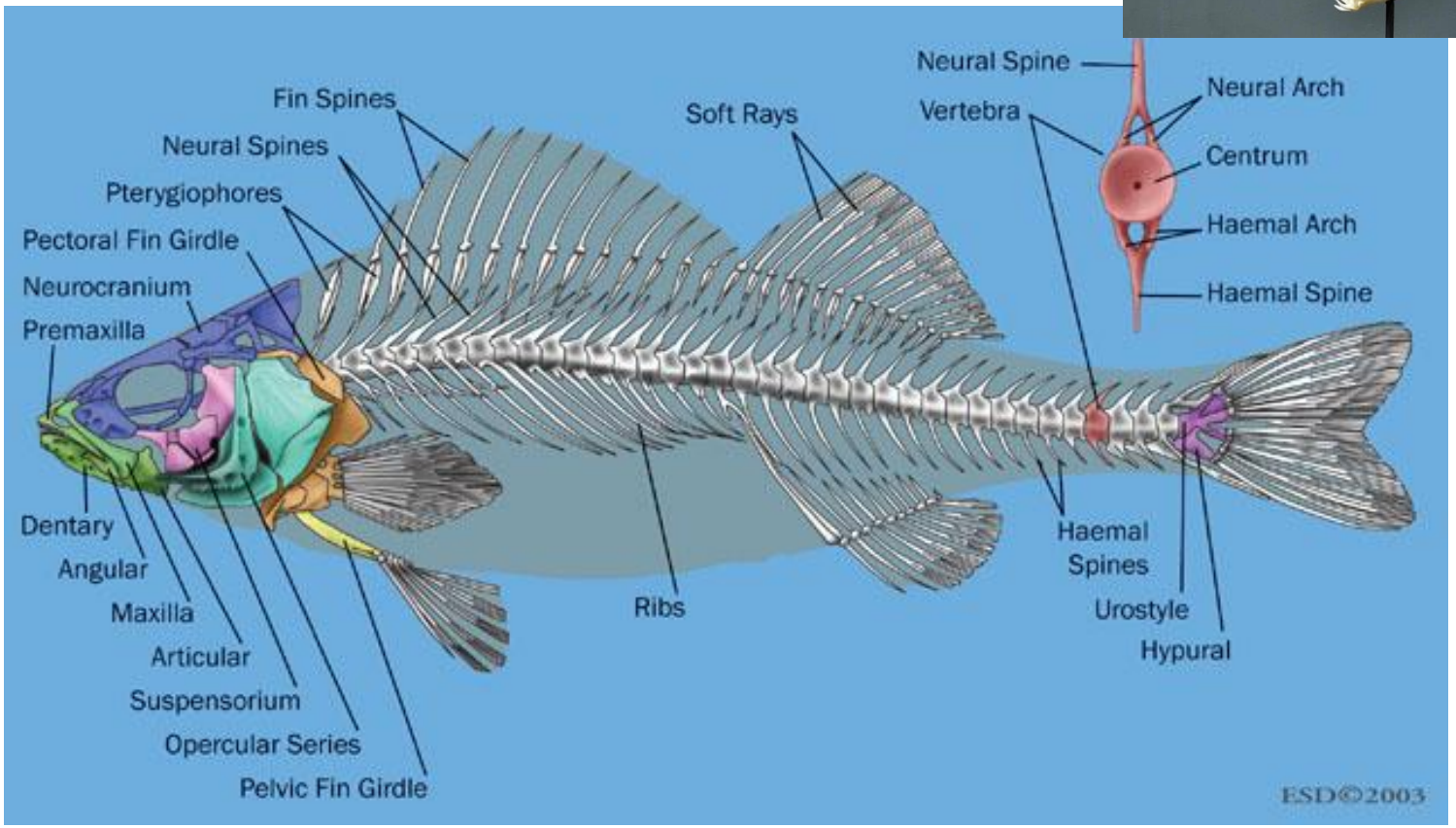


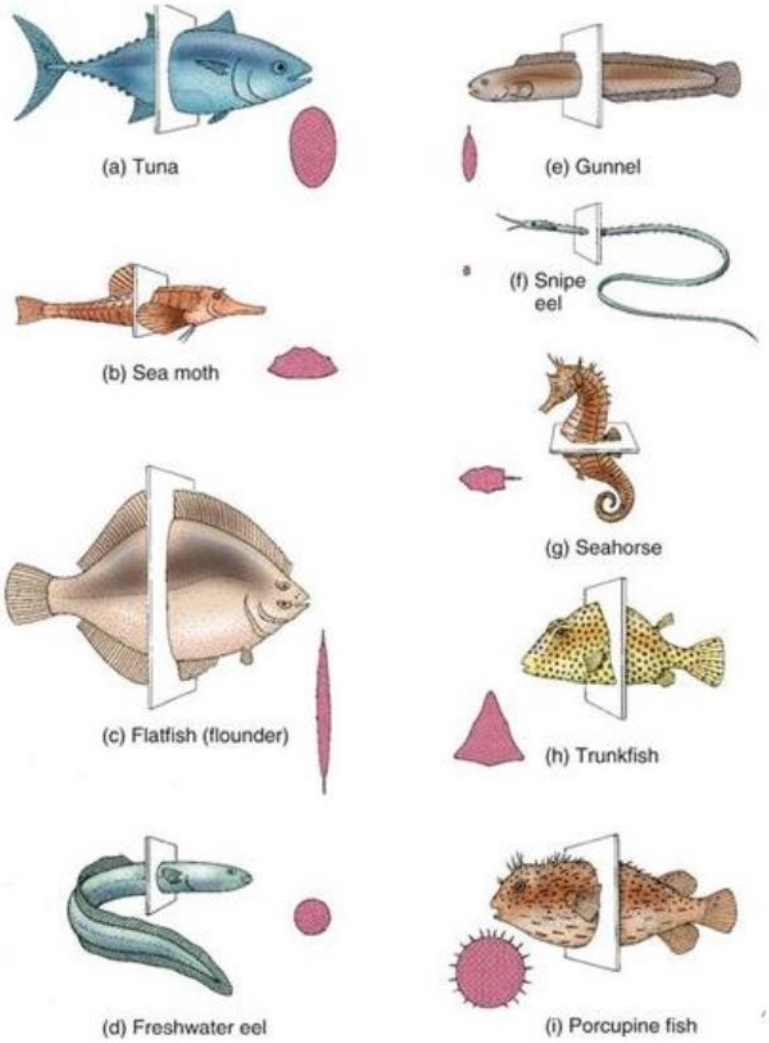
GVZ 2026 10 September

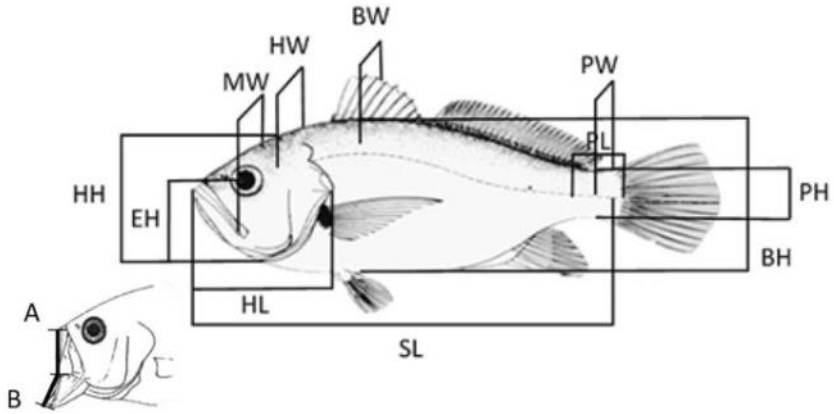
- Diversity of Ray-finned fishes
- Traits of Ray-finned fishes


Sarcopterygii
Osteichthyes
gas bladder
opercular
Actinopterygii
Bichirs & Ropefish (12 species)
Gars & Bowfin (8 species)
Sturgeons & Paddlefishes (28 species)
Eels, Tarpon, & Bonefish (984 species)
Bonytongues, Arowanas, Goldeye (220 species)
Teleost fishes
All other teleost fishes (~27,500 species)
400
300
200
100
Millions of Years Ago
Genetic estimate of teleost age
Earliest known fossils of living teleost lineages
lungfish
mammals
birds
crocodiles
turtle
lizard
snake
frog
salamander
coelacanth
puffer • tuna
medaka • saury
carp • loach
shark • ray
lamprey
+ hagfish
Tetrapod
Fish
Agnatha
Sarcopterygii
Osteichthyes
Actinopterygii
Vertebrata


Dorsal fin
Spinous portion
Soft-rayed portion
Gill cover or operculum
Lateral line
Premaxilla
Maxilla
Dentary bone (lower mandible)
Branchiostegal rays
Pectoral fin
Pelvic fin
Vent or anus
Anal fin
Caudal peduncle
Caudal fin (homocercal)
External gill slits (no operculum)
Spiracle
First dorsal fin
Second dorsal fin
Lower jaw
Upper jaw
Pectoral fin
Vent or anus
Pelvic fin
Anal fin
Caudal fin (heterocercal)


Fin Spines
Neural Spines
Pterygiophores
Pectoral Fin Girdle
Neurocranium
Premaxilla
Soft Rays
Neural Spine
Vertebra
Neural Arch
Centrum
Haemal Arch
Haemal Spine
Dentary
Angular
Maxilla
Articular
Suspensorium
Opercular Series
Pelvic Fin Girdle
Ribs
Haemal Spines
Urostyle
Hypural
ESD©2003


(a) Tuna
(b) Sea moth
(c) Flatfish (flounder)
(d) Freshwater eel
(e) Gunnel
(f) Snipe eel
(g) Seahorse
(h) Trunkfish
(i) Porcupine fish


BW
HW
MW
PW
PL
HH
EH
PH
BH
HL
SL
A
B

Polypteriformes: bichir

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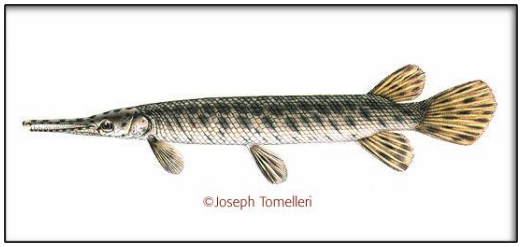
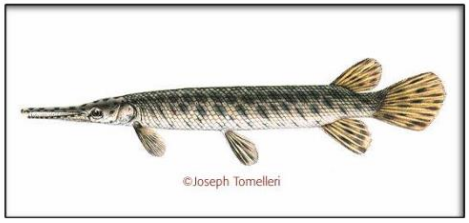
RESEARCH ARTICLE

Behaviour and muscle activity across the aquatic–terrestrial transition in *Polypterus senegalus*

Keegan Lutek[1,*], Kathleen L. Foster[2] and Emily M. Standen[1]

Lepisosteiformes: gar



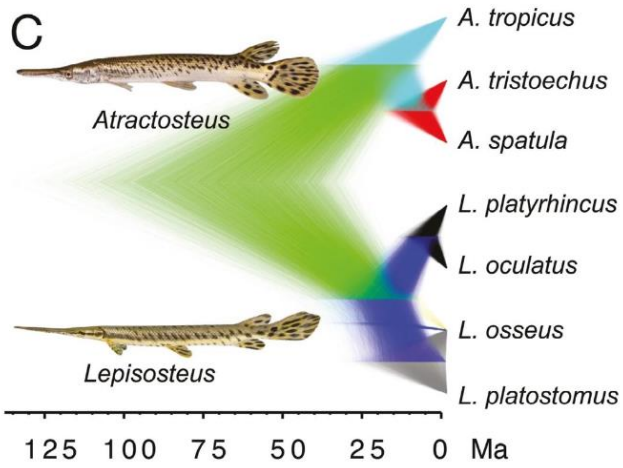


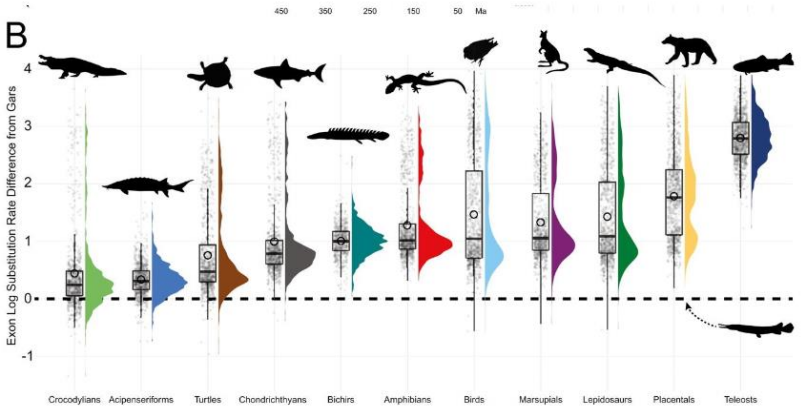
JOURNAL ARTICLE

The genomic signatures of evolutionary stasis

Chase D Brownstein ✉, Daniel J MacGuigan, Daemin Kim, Oliver Orr, Liandong Yang, Solomon R David, Brian Kreiser, Thomas J Near
Author Notes

Evolution, Volume 78, Issue 5, 1 May 2024, Pages 821–834,
https://doi.org/10.1093/evolut/qpae028
Published: 04 March 2024 **Article history** ▾

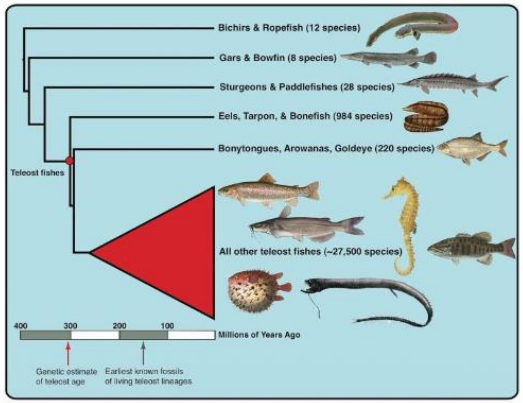




Acipenseriformes:

sturgeon

paddlefish



Acipenseriformes:

sturgeon

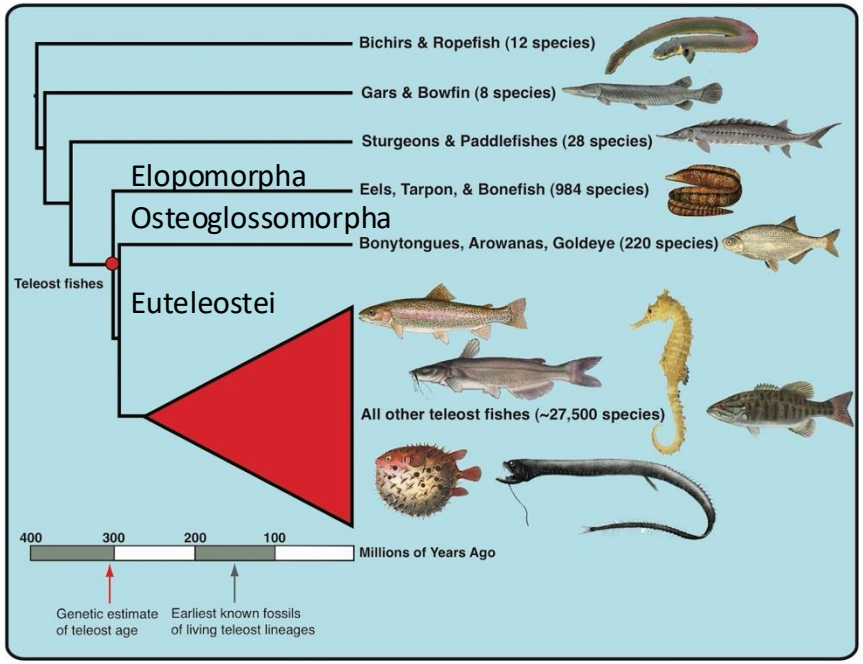
paddlefish

Observation of the Atlantic sturgeon, *Acipenser oxyrhynchus*, in the Rio Grande, Texas and Mexico, with comments on Rio Grande records of *Scaphirhynchus platorynchus*

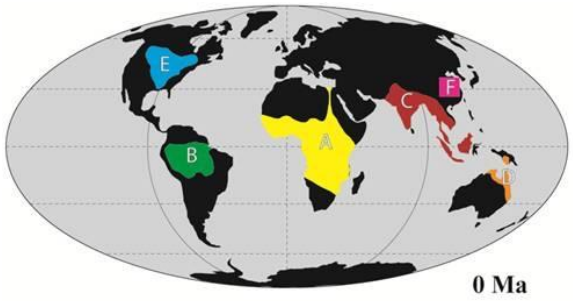
Steven P. Platania, Douglas A. Young, and Brooks M. Burr[1]
Department of Biology, Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM 87131 (SPP, BMB)
U.S. Bureau of Reclamation, P. O. Box 11568, Salt Lake City, UT 84147 (DAY)

Teleost fish

- 27,000+ species
- Very diverse in form, ecology
- Homocercal tail
- Specializations of jaws, fins, gills, skeletal system, swim bladder, reproduction
- Three "main" lineages



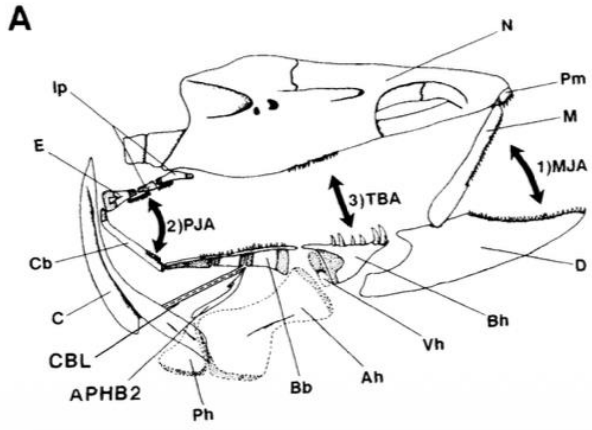
Teleostei: Osteoglossomorpha (bony tongues):

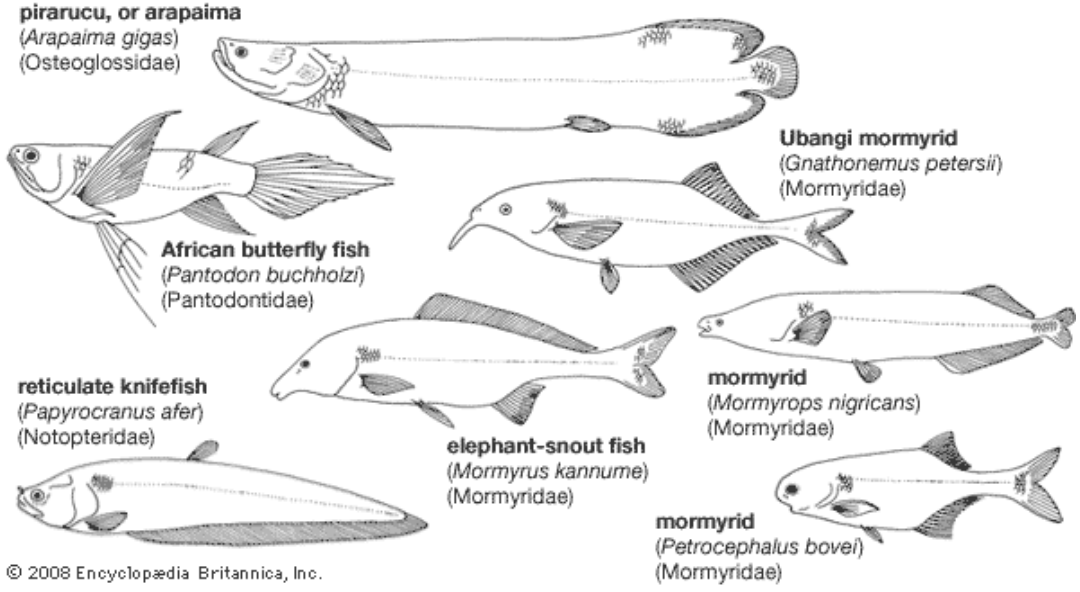


Gulf saratoga

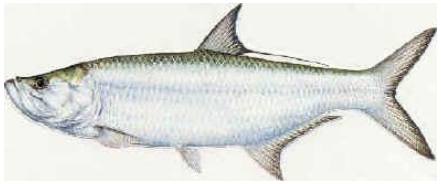
Functional Morphology of the "Tongue-Bite" in the Osteoglossomorph Fish *Notopterus*

CHRISTOPHER P. SANFORD AND GEORGE V. LAUDER
Department of Ecology and Evolutionary Biology, University of California, Irvine, California 92717





Teleostei: Elopomorpha

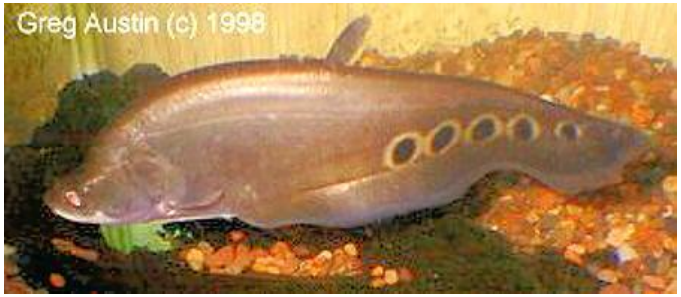


tarpon

Gulper eel

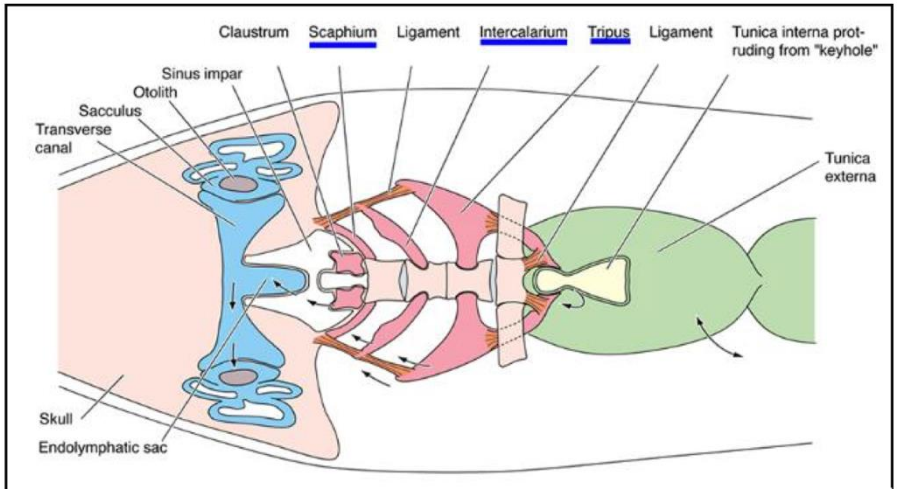
Teleostei: Ostariophysi

knifefish



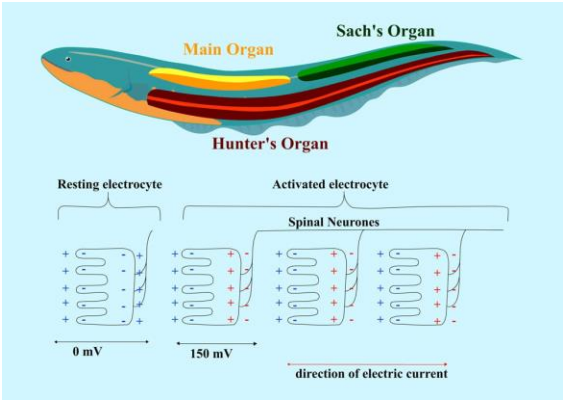
Rio Grande silvery minnow

Channel catfish



Teleostei: Ostariophysi: *Electrophorus*

(Electric "eel")

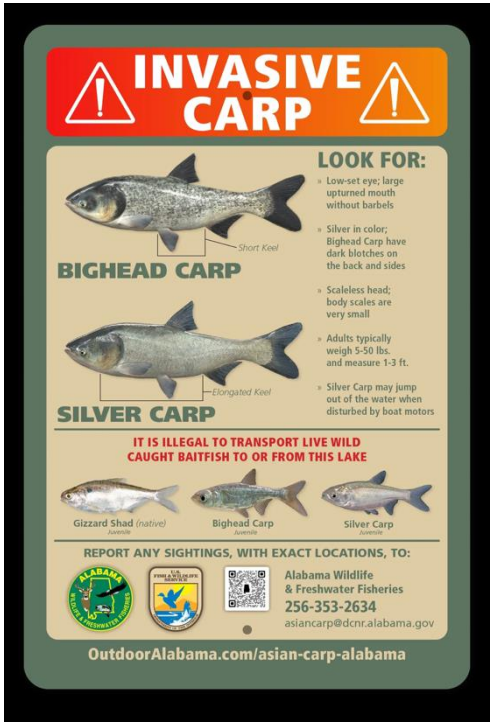


Teleostei: Ostariophysi: *Electrophorus* (Electric "eel")

Teleostei: Ostariophysi: Asian carp

USDA National Invasive Species Information Center
U.S. DEPARTMENT OF AGRICULTURE

The newest invaders, **bighead carp**, **black carp**, **grass carp**, and **silver carp** that originated from Asia are collectively known as invasive carp or Asian carp. These invasive carp species are causing issues in the Mississippi river and surrounding waters. Invasive carp are fast-growing and prolific feeders that out-compete native fish and leave a trail of environmental destruction in their wake.



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THE WATERS OPERATING IN

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