

MorphoBank at twenty years: the importance of discipline- specific repositories



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Stony Brook University

MorphoBank

1. What is MorphoBank?
2. Why MorphoBank?
3. Overview
4. Interactions
5. Summary and plans

1. What is MorphoBank?

Web application and database that allows users, collaborating in real time, to build matrices linked to comparative phenomic data through a web browser interface.

2. Why MorphoBank?

Traditional Software

Project of "Mor" Matrix in file "Morphology matrix Nov 2016.nex"

Project « Matrix Alter Select Display Analysis:Matrix » Window Matrix in file "Morphology matrix Nov 2016.nex"

Taxa (69 taxa) Matrix in file "M"

Taxon \ Character	51	52	53	54	55	56	57	58	59	60	61	62	63
	Anterior ramus of mesal	Dorsal-mesal bulge of	Anterovertebral keel of	Anterovertebral keel of	Notch posterior to the	Longitudinal crest on	Anterior cranial fontanelle	Posterior cranial fontanelle	Posterior cranial fontanelle	Posterior cranial fontanelle	Lateral margin of the	Lateral process of sphenoid	Lateral posterior border
1 <i>Acanthodoras cataphractus</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Undivided&Divided	Close	-	Not reaching the supraoccipital	Smooth&Serrated	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
2 <i>Acanthodoras spinosissimus</i>	Not coalesce	Present	Absent	-	Present	Absent	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
3 <i>Agamyxis albomaculatus</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Divided	Close	-	Not reaching the supraoccipital	Serrated	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
4 <i>Agamyxis pectinifrons</i>	Not coalesce	Absent	Absent	-	Present	Present	Undivided	Close	-	Not reaching the supraoccipital	Serrated	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
5 <i>Ageneiosus inermis/brevifilis</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Divided	Close	-	Not reaching the supraoccipital	Smooth	Present	Distinctly concave, exposing part of the articulation between hyomandibula and sphenotic
6 <i>Ageneiosus ucayalensis</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
7 <i>Amblyodoras affinis</i>	Not coalesce	Absent	Absent	-	Present	Present	Undivided	Close	-	Not reaching the supraoccipital	Serrated	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
8 <i>Amblyodoras nauticus</i>	?	Absent	?	?	Absent	Present	Undivided	Close	-	Not reaching the supraoccipital	Serrated	?	?
9 <i>Anadoras grypus</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Divided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
10 <i>Anadoras weddellii</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
11 <i>Anduzodoras oxyrhynchus</i>	Not coalesce	Absent	Present	Not distinctly developed into a ventral process	Absent	Present	Undivided	Open	Large	Reaching the supraoccipital	Smooth	Present	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
12 <i>Aspredo aspredo</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Undivided	Open	Large	Reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
13 <i>Astrodoras asterinifrons</i>	?	?	?	?	Present	Present	?	?	?	?	?	?	?
14 <i>Auchenipterus nigriripinnis</i>	Not coalesce	Absent	?	?	Absent	Absent	Divided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
15 <i>Bunocephalus werrucosus</i>	Not coalesce	Absent	?	?	Absent	Absent	Undivided	Open	Large	Reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
16 <i>Centrochir crocodilli</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
17 <i>Centrodoras brachiatus</i>	Not coalesce	Absent	Absent	-	Absent	Absent	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
18 <i>Centromochlus heckeli</i>	Not coalesce	Absent	Absent	-	Absent	Present	Divided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
19 <i>Doraops zuolagai</i>	Not coalesce	Absent	Absent	-	Present	Present	Divided	Close	-	Not reaching the supraoccipital	Smooth	Absent	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
20 <i>Doras carinatus</i>	Not coalesce	Absent	Present	Not distinctly developed into a ventral process	Absent	Absent	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Present	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic
21 <i>Doras higuchi</i>	Not coalesce	Absent	Present	Not distinctly developed into a ventral process	Absent	Present	Undivided	Close	-	Not reaching the supraoccipital	Smooth	Present	Slightly concave, not exposing part of the articulation between hyomandibula and sphenotic

Comment

Reference

Image


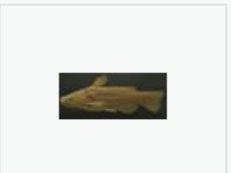
t.1/c.65 charac

2. Why MorphoBank?

- MorphoBank is both a web application and a database
- It is a discipline specific repository where one can build matrices linked to comparative phenomic data.
- Allows real time collaboration, where users can label and score characters and/or media in phylogenetic matrices, specify relationships among characters, download matrices for analysis, and even analyze the data without leaving the interface.
- The data published live must be affiliated with a scientific, peer-reviewed publication.
- The content on MorphoBank can be consumed by scientists and the public alike.

3. Overview

- Phylogenetic matrix
- Media
- Taxa - Specimens
- Bibliography
- Documents

	[43] Posterior cranial fontanelle	[44] Form of the posterior tip of the supraoccipital...	[45] Length of supraoccipital process	[46] Width of the supraoccipital process measured at...	[47] Vertical lamina of the supraoccipital process
[17] <i>Ameiurus platyceph...</i> 	Open anteriorly and almos...	Simple	Intermediate, length of the ...	Broad	Present
[18] <i>Ameiurus natalis</i> 	Almost closed or closed alo...	Simple	Short, length of the process...	Broad	Absent
[19] <i>Ameiurus melas</i> 	Open anteriorly and almos...	Simple	Intermediate, length of the ...	Broad	Present
[20] <i>Ameiurus nebulosus</i> 	Almost closed or closed alo...	Simple	Short, length of the process...	Broad	Present

Phylogenetic Characters

Matrix Character Editor

Character #41 / id: C1805605 Done

Character Media Comments Citations Partitions Change log

Name

Description

Difficulty Beginner

"Task name" for display in TheEvolutionProject.org

"Task info" for display in TheEvolutionProject.org

#	State	TheEvolutionProject.org alternate state name
0	Anteriormost tip of the sphenotic reaches the anterior end of the bar	The anterior end of the sphenotic reaches or extend beyond the anterior end of the bar
1	Anteriormost tip of the sphenotic does not reach the posterior end of the bar	The anterior end of the sphenotic does not reach the anterior end of the bar
2	Anteriormost tip of the sphenotic extends beyond the	

Add State Remove State Unordered Save changes

Phylogenetic Characters

Matrix Character Edit

Character List

Character

Name

Description

Difficulty

"Task name" for

"Task info" for di

#	State
0	Anterior end of the
1	Anterior posterior
2	Anterior

#	Name	States	Media
2	Anterior cranial fontanelle <i>Notes:</i> <i>The anterior cranial fontanelle is a hole in the anterior portion of the skull. Establish if the hole is open or closed. Note that you may not see the whole image as some of the specimens are of fossils that do not preserve all the anatomy. The structure that you are looking for is highlighted in blue in the drawings.</i>	(0) Open (1) Almost completely closed	
3	Length of the muscle crests on frontal <i>Notes:</i> <i>The frontal is a bone located in the middle of the skull surrounding the fontanelles (holes). In these bones there is a ridge where muscles get attached. Establish where the ridge meets the margin of the skull in reference to the bar located between the two holes, the shadows in the picture can help you establish the position of the crests, and the structure that you are looking for is highlighted in blue in the drawings.</i>	(0) Crests meet skull roof margin near level of epiphyseal bar (1) Crests meet skull roof margin anterior to level of epiphyseal bar	
4	Frontal crest reaching lateral ethmoid <i>Notes:</i> <i>The frontals are a pair of bones located in the middle of the skull surrounding the fontanelles (holes). In these bones there is a ridge where muscles get attached. The lateral ethmoid bones are lateral projections near the area where the mouth of the fish is located. Establish if the ridge reaches the lateral ethmoid bones. Note that the shadows in the picture can help you establish the path of the ridge and that the structure that you are looking for is highlighted in blue in the drawings.</i>	(0) Anterior end of the ridge reaching the lateral ethmoid bone (1) Anterior end of the ridge not reaching the lateral ethmoid bone	

Continuous Characters

	[1] Male body length	[2] Female body length	[3] Male head length/body length	[4] Female head length/body length	[5] Male head width/head length	[6] Female head width/head length
[1] <i>Eoneria blanchardi</i>	7.9	6.4 - 7.1	0.187	0.238 - 0.252	?	0.648 - 0.704
[2] <i>Eoneria maldonadoi</i>	7.1 - 8.7	7.3 - 7.4	0.228 - 0.261	0.215 - 0.247	0.697 - 0.722	0.74 - 0.756
[3] <i>Eoloxozus sabroskyi</i>	10.5	5.6	0.222	0.314	0.655	0.705
[4] <i>Antillonarius cinereus</i>	?	6	?	0.257	?	0.649
[5] <i>Longina abdominalis</i>	9.5 - 13.4	13.4	0.225 - 0.242	0.215	0.675 - 0.699	0.757
[6] <i>Longina anguliceps</i>	12.5	14 - 18	?	?	?	?
[7] <i>Longina semialba</i>	9 - 11	13 - 15	?	?	?	?

Character ontologies

Character ontologies as graph



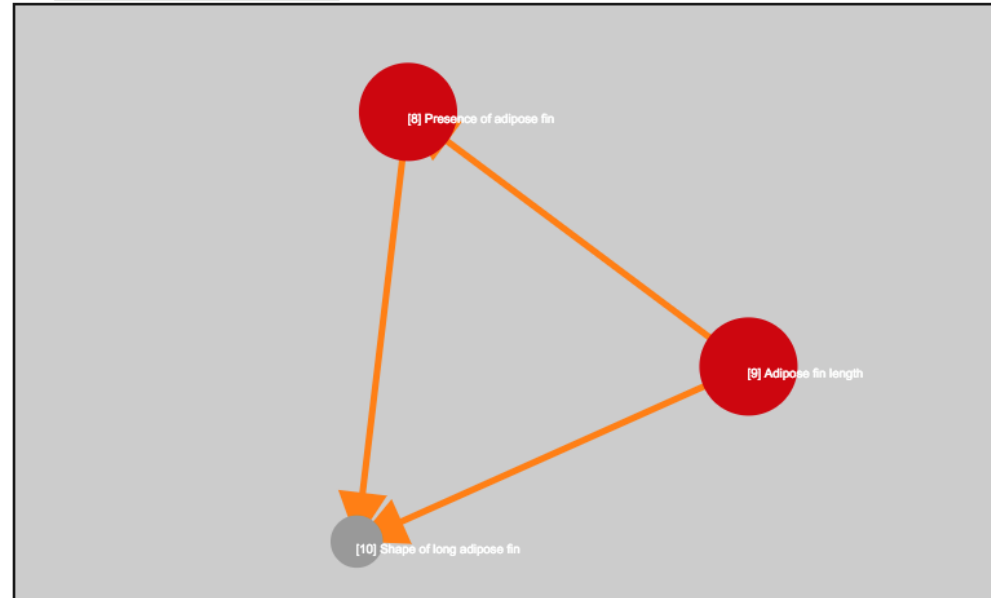
View rules



Character ontologies as graph

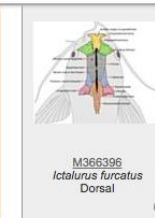
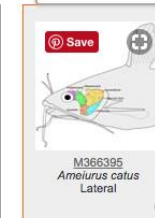
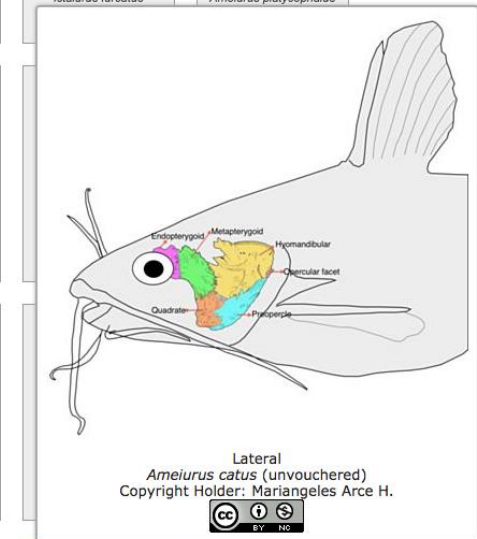
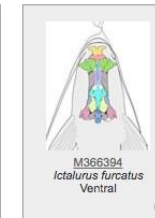
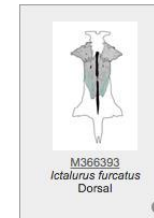
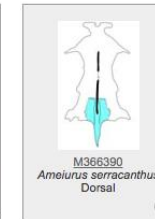
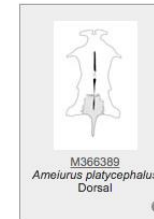
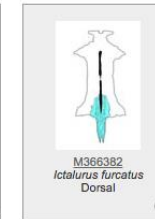
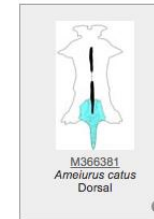


View rules



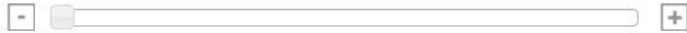
3. Overview

- Phylogenetic Matrix
- Media
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Media

Image Viewer



Media #: M366172

View: Dorsal



Copyright holder: Mariangeles Arce H.

Specimen: *Ictalurus furcatus* (unvouchered)

Character: Mesethmoid cornua Cornua not widely forked, the anterior margin of the skull is narrow 1

Media

Image Viewer



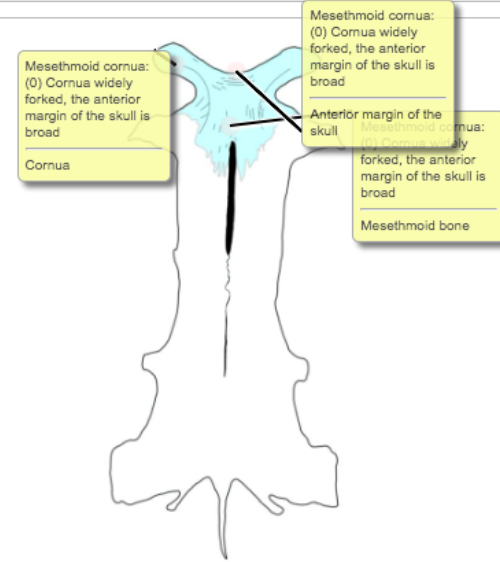
Media #: M366172
View: Dorsal



Copyright holder: Mariangeles Arce H.

Specimen: *Ictalurus furcatus* (unvouchered)
Character: Mesethmoid cornua Cornua not widely forked, the anterior margin of the skull is narrow 1

Image Viewer



Media #: M366257
View: Dorsal



Copyright holder: Mariangeles Arce H.

Specimen: *Pyloodictis olivaris* (UMMZ:169029)
Character: Mesethmoid cornua 0 Cornua widely forked, the anterior margin of the skull is broad

3. Overview

- Phylogenetic Matrix
- Media
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- Bibliography
- Documents

Genus, Subgenus, Species, Subspecies

* indicates that a taxon has not matched to the **NCBI** hierarchy.

† *Ameiurus leidyi*

† *Ameiurus macgrewi*

† *Ameiurus pectinatus*

† *Ameiurus peregrinus*

† *Ameiurus reticulatus*

† *Ameiurus sawrockensis*

† *Ameiurus hazenensis*

† *Ameiurus lavetti*

† *Ameiurus vespertinus*

Ameiurus brunneus

Ameiurus brunneus (unvouchered)

Ameiurus brunneus (DUF:915)

Ameiurus brunneus (ANSP:186638)

Ameiurus brunneus (:UMMZ 186241)

Ameiurus brunneus (UMMZ:186421)

† *Ameiurus vespertinus* (USNMV:167591)

† *Ameiurus vespertinus* (USNM:322249)

† *Ameiurus vespertinus* (USNMV:22348)

Ameiurus natalis (:UMMZ 171788)

Ameiurus natalis (:UMMZ 171789)

3. Overview

- Phylogenetic Matrix
- Media
- Specimens - Taxa
- Bibliography
- Documents

Project 2100: Arce-H., M., Lundberg, J.G., O'Leary, M.A. 2017. Phylogeny of the North American catfish family Ictaluridae (Teleostei: Siluriformes) combining morphology, genes and fossils. *Cladistics*. 33 (to be added):406-428.

This project has 4 bibliographic references.

Display bibliographic references beginning with: **A B E L | ALL**

Arce-H., M., Lundberg. 2017. Phylogeny of the North American catfish family Ictaluridae (Teleostei: Siluriformes) combining morphology, genes and fossils. *Cladistics*. Vol. 33, pp. 406-428.

Baumgartner J. V. 1982. A New Fossil Ictalurid Catfish from the Miocene Middle Member of the Truckee Formation, Nevada. *Copeia*. Vol. 1982(1), pp. 38-46.

EGGE, J. J. D. and SIMONS, A. M. 2009. Molecules, morphology, missing data and the phylogenetic position of a recently extinct madtom catfish (Actinopterygii: Ictaluridae). *Zoological Journal of the Linnean Society*. Vol. 155(1), pp. 60-75.

Lundberg J.G. 1970. The Evolutionary History of North American Catfishes, Family Ictaluridae.

3. Overview

- Phylogenetic Matrix
- Media
- Specimens - Taxa
- Bibliography
- Documents

21 Documents

Complete matrix (Downloaded 3 times )	» View/Download File
Figure 1 (Downloaded 1 time )	» View/Download File
Figure 2	» View/Download File
Figure 3	» View/Download File
Figure 4	» View/Download File
Figure 5	» View/Download File
Figure 6	» View/Download File
Figure 7	» View/Download File
Figure 8	» View/Download File
Figure 9	» View/Download File

4. Interactions



4. Interactions

Ictaluridae+Cranoglanididae

9536 scorings; 71 taxa; 209 characters; 4732 cell images; 0 labels attached to cell images; 291 character images;

Viewed 149 times; Downloaded 27 times; 

Matrix DOI: 10.7934/X23209, <http://dx.doi.org/10.7934/X23209>

Download options:

Download entire matrix as NEXUS w/o notes format

Download Matrix

Download character list (NEXUS
 NeXML
 TNT)



Download character list

» Download ontology »

4. Interactions

Tree-building options

Please try this BETA tool and send any feedback to [Contact Support](#)

Run with Job name:

Notes for run:

The Parsimony Ratchet (Kevin Nixon, 1999) improves the ability to find shortest trees during heuristic searches on large datasets (it is ok to use on small ones too). You can use it to search for a tree or tree(s) based on your MorphoBank matrix. Set your parameters below and click "Run" and MorphoBank will write the commands for you to use the program PAUPRat (Sikes and Lewis, 2001) to execute the Parsimony Ratchet on in PAUP* via CIPRES.

The commands tell PAUP* to do this:

1. Conduct an heuristic search from scratch for a starting tree. This will use the Branch Swapping Algorithm that you select.
2. Perform two tree searches for each Ratchet Iteration, one in which a subset of your characters is assigned a weight of 2, and a second in which all characters are equally weighted. The characters to be weighted are chosen randomly.
3. This repeats for the number of iterations or replicates that you specify.
4. The shortest trees and related files are returned to you from CIPRES here.

You can learn more about the Parsimony Ratchet [here](#) and [here](#)

Two default parameters are set: verbose defaults to "terse" and starting seed to 0.

Number of Iterations:

or % chars to permute:

Branch-swapping algorithm:



Systematic Biology

A QUARTERLY OF THE
Society of Systematic Biologists

O'Leary M. et al, (2018)
Crowds Replicate Performance
of Scientific Experts Scoring
Phylogenetic Matrices of
Phenotypes, Systematic
Biology, Volume 67, Issue 1,
Pages 49-
60, <https://doi.org/10.1093/sysbio/syx052>

EVOLUTION PROJECT

home projects tutorial for scientists about contact sign up | login

Help scientists build the genealogy of all species living and extinct.

Introduction

Building the evolutionary Tree of Life means knowing how all species are related to each other. With the tree we can interpret all sorts of interesting ideas about how, when and why new features, like eyes and flight and flowers evolved.

- STEP 1**
Register
- STEP 2**
Do science
- STEP 3**
Watch your contributions grow

Why Scientists Need You

There may be as many as 10 million living species on Earth and hundreds of thousands of fossil species. We need data from all of them to build the tree - a big job!

1123 Members
35 Scientists
247756 Images Scored

Get Started

The Evolution Project currently has 7 science teams you can join.



Bat skull diversity and evolution

Scientists: Nancy Simmons, Maureen O'Leary, Andrea Cirranello, Paul Velazco, MorphoBank Curator, Maria Passarotti, Seth Kaufman

This project aims to understand the diversity of form in the skulls and teeth of bats -- the only mammals that fly. Different bat species have very different diets. Most feed on insects, but other species eat animals, fish, fruit, nectar, pollen, or even blood (vampires). The shapes of bat skulls and teeth reflect these dietary habits, but also contain information useful for understanding bat evolution. We aim to use details of skull form to build a family tree of bats that can be used to better understand the evolution and diversity of these amazing animals.

6 INTERNS

176 RESEARCH ASSISTANTS

0 LAB ASSISTANTS

GO



That sting thing: the diversity of nematocysts of sea anemones and corals

Scientists: Marymegan Daly, Abigail Reft, Maureen O'Leary, Michael Lam, Jed Irvine

Jellyfish, corals, sea anemones, and their kin capture food and defend themselves against predators using tiny but highly complex stinging capsules called nematocysts. We are exploring the diversity of these microscopic structures using scanning electron microscopy, which reveals that nematocysts vary widely in the shape and arrangement of spines, tubule, and capsule.

1 INTERNS

115 RESEARCH ASSISTANTS

0 LAB ASSISTANTS

GO


2. Anterior cranial fontanelle

Scoring 1 of 16 taxa | Jump to: 1

Next >



Select the category below that best describes the new image above

Click the  to see labels



Would you like to provide a comment with your score? Enter it here before selecting a choice above.

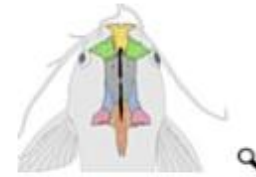
Not sure?

Click here to skip to the next slide

[← BACK TO TASK LIST](#)

PROJECT INFO

TASK INFO



The anterior cranial fontanelle is a hole in the anterior portion of the skull. Establish if the hole is open or closed. Note that you may not see the whole image as some of the specimens are of fossils that do not preserve all the anatomy. The structure that you are looking for is highlighted in blue in the drawings.

COMMUNITY INFO

131 users have scored this slide

TAXON INFO

Ictalurus furcatus



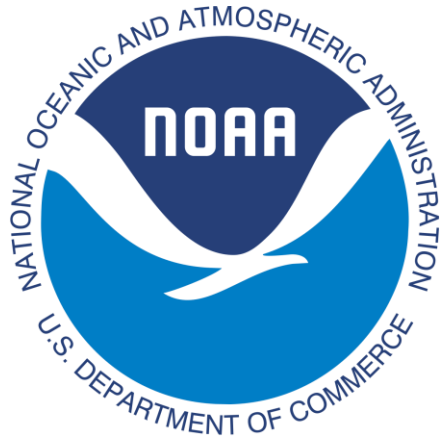
 [SEND FEEDBACK](#)



Summary and future plans

- Data archiving is a key objective of contemporary science and for that discipline-specific databases should be use.
- If phenomic matrix data are stored in MorphoBank, users are guaranteed an executable file and taxa and characters linked in database tables as well as to NCBI Taxonomy, EOL, iDigBio and CIPRES tools.
- Archiving of data in MorphoBank needs to be planned from the start of a project not the end.
- Discussion with Figshare
- Paleobiology Database

Support



founded in 2000 by comparative biologists

Thanks!

Questions?