

# Comparative anatomy of osteocranium in some catfishes (*Clarias macrocephalus*, *Clarias gariepinus* and *Clarias macrocephalus* x *Clarias gariepinus*)

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## Abstract

The morphological structure of the osteocranium in different species of catfishes varies significantly and plays a crucial role in both evolutionary adaptation and species classification. The purpose of this study were to examine and compare the cranial bone of three catfish species *Clarias macrocephalus* (native catfish), *Clarias gariepinus* (African catfish), and their hybrid (*Clarias macrocephalus* x *Clarias gariepinus*). To study in anatomy of the fish skull, the head of a catfish was detached from its body and subsequently processed using a warm water maceration technique. Additionally, the skulls were immersed in a hydrogen peroxide solution for several hours to eliminate soft tissue and bleach the skull. Subsequently, cranial bones were photographed using a digital camera and examine in accordance with established anatomical manuals to identify the corresponding bones accurately. The results revealed significant variations in skull morphology among the three species, particularly the size shape of neurocranium. Notable differences were observed in the frontal bone, sphenotic bone, pterotic bone, supraoccipital bone, occipital bone, and jaw structure. Morphological analysis revealed that *Clarias gariepinus* has the largest and most robust skull, while *Clarias macrocephalus* has a smaller and more delicate cranial structure. The hybrid catfish exhibited intermediate cranial characteristics between its parental species. This study indicates that osteocranium morphology can be an effective taxonomic tool for identifying species within the Clariidae family and contributes to the understanding of phylogenetic relationships and evolutionary studies of catfish.

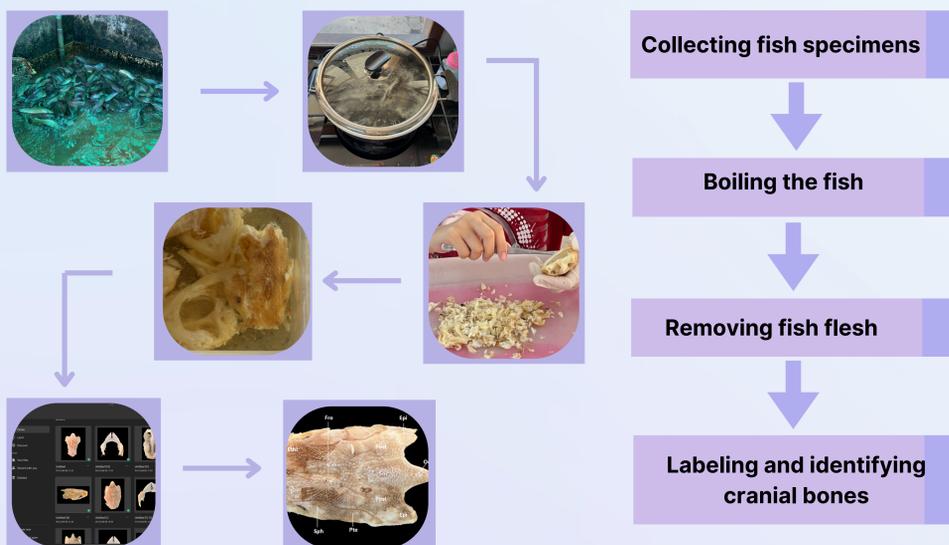
## Introduction

Catfishes (family clariidae) have elongated, scaleless bodies, flattened heads, and four pairs of barbels. They possess an aborescent organ, enabling survival in low-oxygen environments. Their skulls feature the frontal and occipital fontanels, an inferior-positioned mouth, and 48-106 dorsal fin rays. The main farmed species include *Clarias macrocephalus* (stout body, broad head, dark brown to black), *Clarias gariepinus* (longer body, grayish-white, native to Africa), and their hybrid (*C. gariepinus* x *C. macrocephalus*), bred for aquacultural efficiency. Neurocranial morphology, due to its complexity and stability, serves as a reliable taxonomic and evolutionary marker. This study compareal the skull structures of these three species to enhance anatomical and taxonomic understanding of Clariidae.

## Objectives

To identify species of these three catfishes based on the cranial bones and provide a fundamental data about osteocranium of catfish for further researches in taxonomy and morphology.

## Methodology



## Results and Discussion (Cont.)

The study found significant differences in the skull structures of the three catfish species, particularly in the occipital bone, which aid in species identification. *Clarias gariepinus* had the widest and strongest skull, with well-developed frontal, sphenotic, and occipital bones, supporting its predatory behavior. In contrast, *Clarias macrocephalus* had a thinner and narrower skull, especially in the supraoccipital and occipital fontanel, which may relate to different feeding habits. The hybrid catfish showed intermediate skull characteristics, combining traits from both parent species. Additionally, differences in the occipital fontanel's size and shape were linked to brain development and movement control in these catfishes.

## Conclusion

This study confirms distinct differences in the head morphology and skull structure of catfish species, supporting the accurate Clariidae identification. Insights into the neurocranium and occipital fontanel aid in understanding evolutionary adaptation and feeding behavior. These findings benefit species conservation, resource management, and aquacultural development.

## Acknowledgements

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## References

I. Zulfahmi, Y. Akmal, A.I. Burhanuddin, Y. Dhamayanti, E. Paujiah, K.A. Sumon, D.N. Pandit, F.M. Nur, 2022 Osteocranium anatomy of African catfish (*Clarias gariepinus* Burchell 1822) from cultured pond in Aceh, Indonesia.

## Results and Discussion

Bone Name	<i>Clarias gariepinus</i> (African catfish)	<i>Clarias macrocephalus</i> (Native catfish)	<i>Clarias macrocephalus</i> x <i>Clarias gariepinus</i> (Hybrid catfish)
Frontals	Broad and long	Narrow and short	Intermediate between parents
Sphenotic	Large protuberance	Small and flat	Medium protuberance
Pterotic	Long and thick	Short and flat	Intermediate between parents
Supraoccipital	Tall and wide	Short and flat	Intermediate between parents
Occipital bone	Largest, widest, and thickest	Smallest, narrowest, and thinnest structure	Intermediate between parents
Occipital fontanel	Longer and wider	Short and narrow	Medium height

**Abbreviations:** Sphenotic (Sph), Pterotic (Pte), Supraoccipital (So), Occipital (Oc), Epioticum (Epi), Posttemporale (Post), Supraoccipitale (Soc), Mesethmoidale (Mes), Epioccipitale (Epc), Extrascapulare (Exs), Prooticum (Pro), Parasphenoidale (Psp), Orbitosphenoidale (Obs), Basioccipital (Bac), Exoccipital (Exc), Maxillary (Max), Ethmoidale (Ethl).

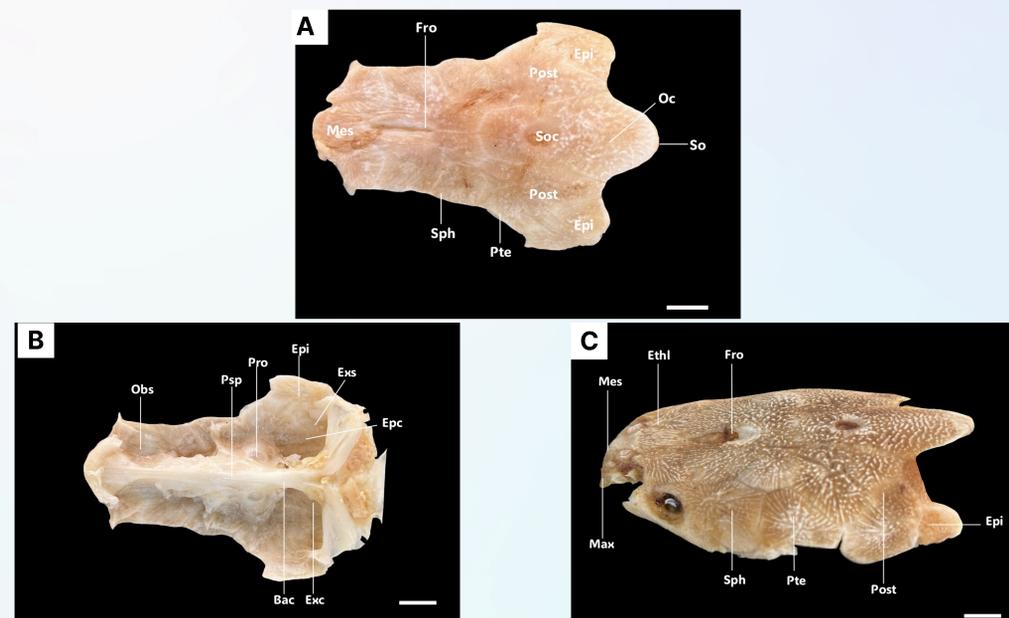


Figure 1 Dorsal view (A), ventral view (B), lateral view (C) of the osteocranium of *C. macrocephalus* Scale bar = 1 cm.

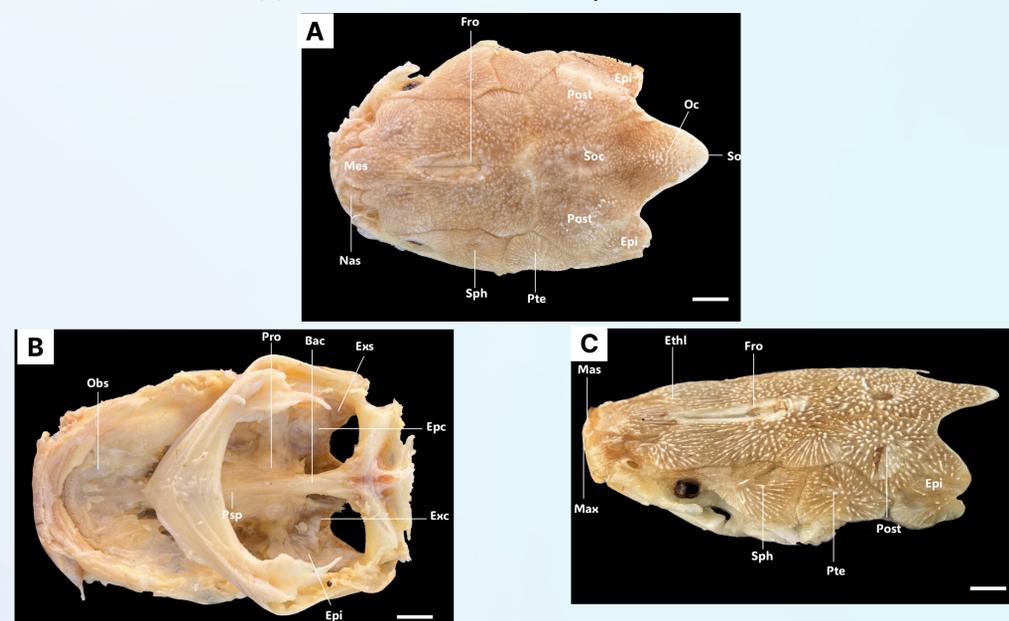


Figure 2 Dorsal view (A), ventral view (B), lateral view (C) of the osteocranium of *C. gariepinus* Scale bar = 1 cm.

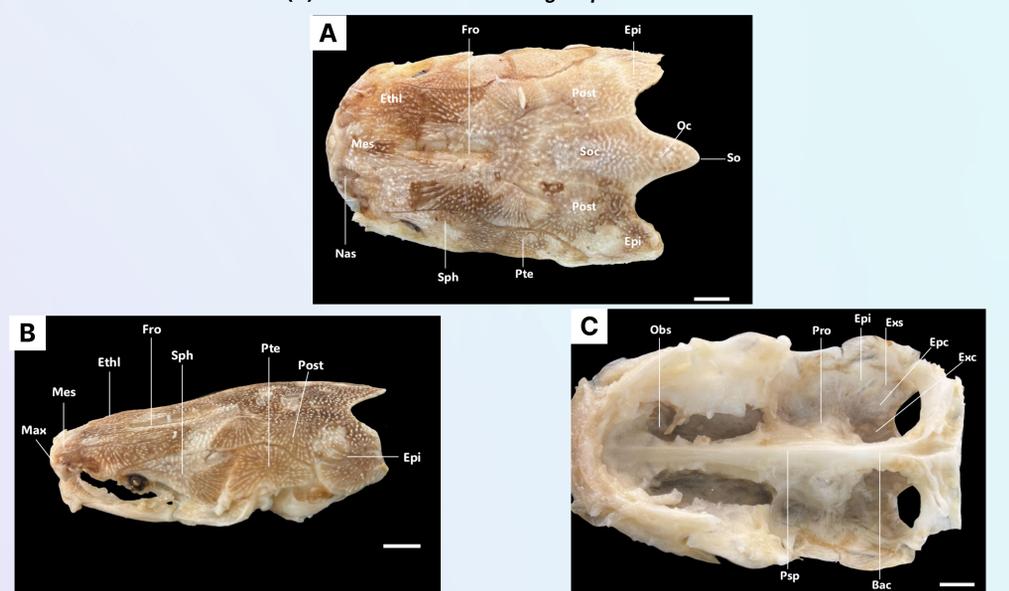


Figure 3 Dorsal view (A), ventral view (B), lateral view (C) of the osteocranium of *C. macrocephalus* x *C. gariepinus* Scale bar = 1 cm.