Natural History Collections—Summer Research Scholarship 2018

Final Report

Title: A Review of the Anatomy of Polypteriformes (Vertebrata: Cladistii)

Student: Pedro Pereira Rizzato, MSc. Graduate Program in Comparative Biology, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto da Universidade de São Paulo (FFCLRP-USP)

PhD advisor: Dr. Flávio A. Bockmann, Laboratório de Ictiologia, FFCLRP-USP

Co-advisor: Dr. Eric J. Hilton, Virginia Institute of Marine Sciences, College of William & Mary

Faculty Advisor at UMass, Amherst: Dr. Cristina Cox Fernandes, Biology Department (UMAss) and Instituto Nacional de Pesquisas da Amazônia (INPA)

The aim of my PhD research is to review the anatomy of Polypteridae (Actinopterygii: Cladistii), a group of freshwater fishes including 14 species exclusive of Africa. The group is of great interest because of its phylogenetic position as sister group to all the remaining extant ray-finned fishes (Fig. 1). Understanding their anatomy will help provide a more complete picture of the anatomy of the common ancestor of bony fishes and of the evolution and morphological diversity among the main clades of Vertebrata.

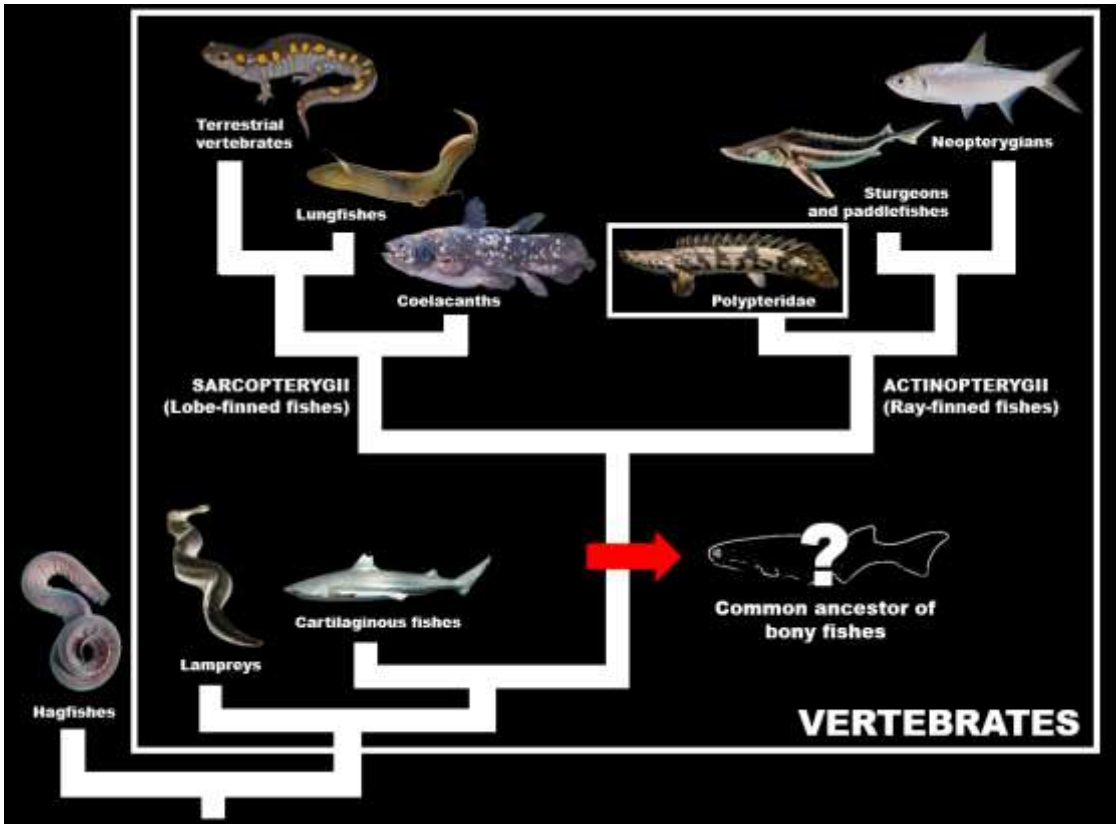

Fig. 1. Phylogenetic relationships between main clades of living vertebrates (according to Nelson, 2006). Polypterids highlighted in white box.

During the period at the Natural History Collection (NHC) of the University of Massachussets, Amherst, from July 11 to August 3, I was able to analyze all specimens of polypterids housed in the collection (Tab 6). New identifications were provided for some of the specimens. Morphometric and meristic data was collected for each specimen, including ethanol preserved specimens and dry skeletons. In addition, material of closely-related taxa, especially dry-skeletons, was also analyzed. Kate Doyle, Collection Manager of the NHC, helped me accessing the collection.

Tab. 6. Material of polypterids housed at the Natural History Collection of the University of Massachussets, Amherst.

Species	**Catalog Number**	**Number of specimens**	**Locality**
Calamoichthys calabaricus	UMAF00097	1	No data
	UMAF20002-02-598	1	No data
	UMAF20006-04-011	1	Aquarium
	UMAF20007-04-012	1	No data
	UMAF20008-04-013	1	No data
	UMAF20009-04-014	1	No data
	UMAF20010-04-015	1	Aquarium
Polypterus bichir	UMAF11341	1	No data
P. mokelembembe	UMAF11354	2	No data
P. ornatipinnis	UMAF20791-03-044	1	No data
P. polli	UMAFunid.	1	No data
	UMAFunid.	2	No data
P. senegalus	UMAF11442	1	No data
	UMAF20343	1	No data
	UMAF20600	2	No data
	UMAF20792-03-092	1	No data
	UMAFunid.	1	Aquarium
Total	17	20	3 aquarium, 14 no data

One of the polypterid characters of interest for my research is the dorsal fin. Polypterids have a unique dorsal fin structure, unlike any other living or fossil fish. The dorsal fin of polypterids extends through the dorsal midline of the trunk until the tip of the caudal peduncle. It is possible to divide the dorsal fin of polypterids in two portions, an anterior one formed by flag-like, spinous finlets (Fig. 2), and a posterior one formed by non-spinous rays and continuous posteroventrally with the caudal fin.

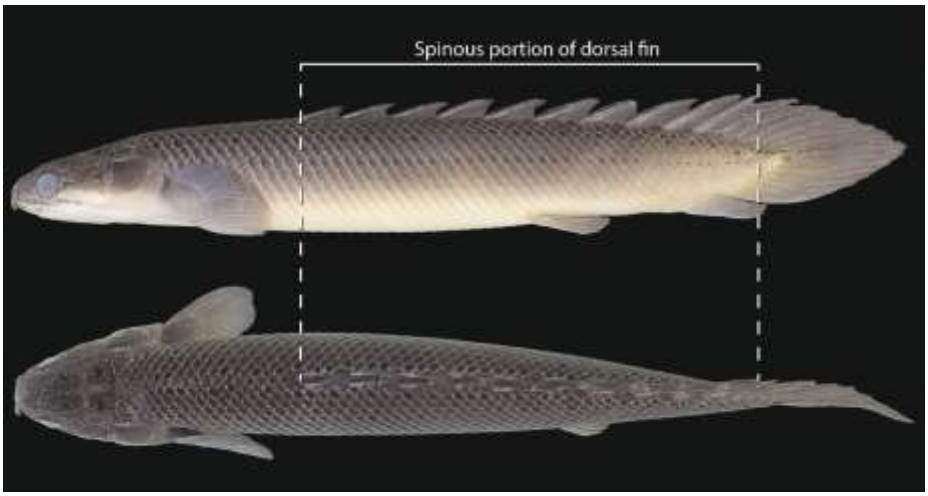

Fig. 2. Left lateral and dorsal views of a specimen of *Polypterus senegalus*, with spinous portion of dorsal fin indicated.

The number of dorsal-fin rays varies among polypterids, including both the number of spinous dorsal finlets and of non-spinous dorsal-fin rays, and the variation is very useful to distinguish not only species, but also clades inside the family. With basis on the meristic data collected during my study, including the meristic data collected from the specimens housed at the Natural History Collection of the UMass, we were able to analyze the variation in the number of dorsal fin spines among polypterids (Fig. 3).

Arranged from the lowest to the highest number of spinous dorsal finlets, the different species seem to form a continuous, ranging from six to seven rays in *P. mokelembembe* to 13 to 18 in *P. bichir*. However, the number of spinous dorsal finlets varies intraspecifically from one to five, modally two, unities. Furthermore, the majority of the specimens usually have one or two well-defined modal counts that, combined with other characters, allow for the distinction among species. Remarkably, the number of spinous dorsal finlets among the lower-jaw bichirs is higher, usually higher than 12, except for *P. endlicherii* in which some specimens may have 11 spinous dorsal finlets. Among the upper-jaw bichirs, only some specimens of *P. delhezi* and *C. calabaricus* present 12 or 13 spinous dorsal finlets.

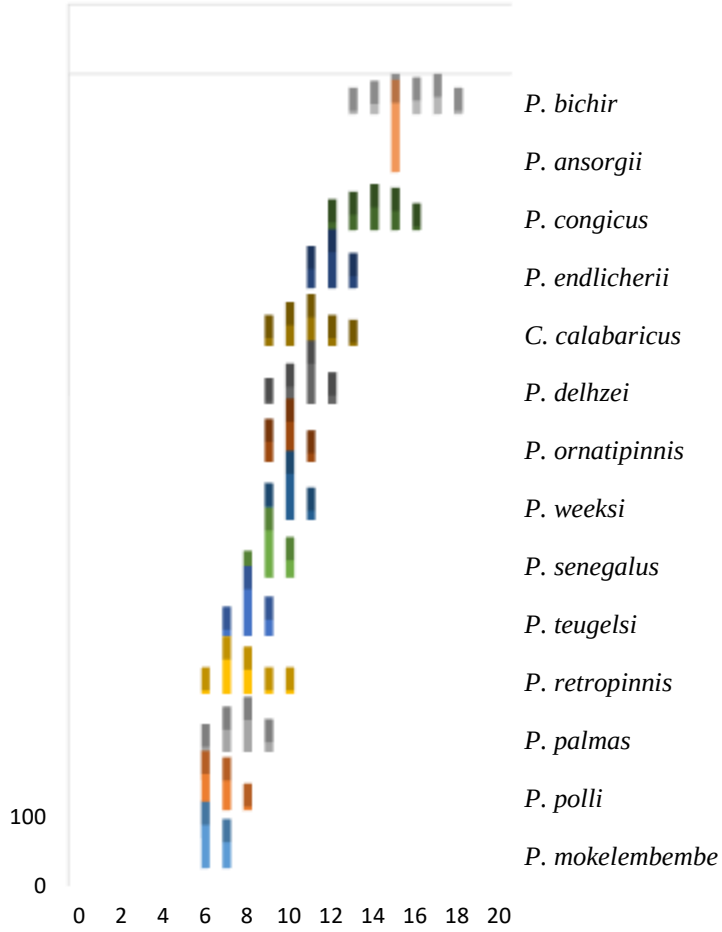

Fig. 3 Frequency of dorsal-spine count among polypterids.

With this and other analyses based on morphometric and meristic data collected during the course of my study, I hope to provide a better understanding of the polypterid anatomy, not only to help unraveling the taxonomy and evolutionary relationships between the species, but also to fill gaps in our understanding of the morphological diversity among the main clades of Vertebrata.

In addition, during my time at the NHC, I analyzed some material of Neotropical electric kinfefishes (Ostariophysii: Gymnotiformes), studying the lateral line system of representatives of the group. The material was previously prepared by Dr. Cristina Cox Fernandes. Part of the material was examined at Dr. Craig Albertson's lab. He and his student, Chaise Gilbert, kindly helped me analyzing the specimens and taking some photographs under the stereomicroscope. After these analyses, we will be able to describe in details for the first time the distribution of lateral line cephalic canals and their association to bones in representatives of gymnotiforms (Fig. 4), as an aid for systematic studies of the group.

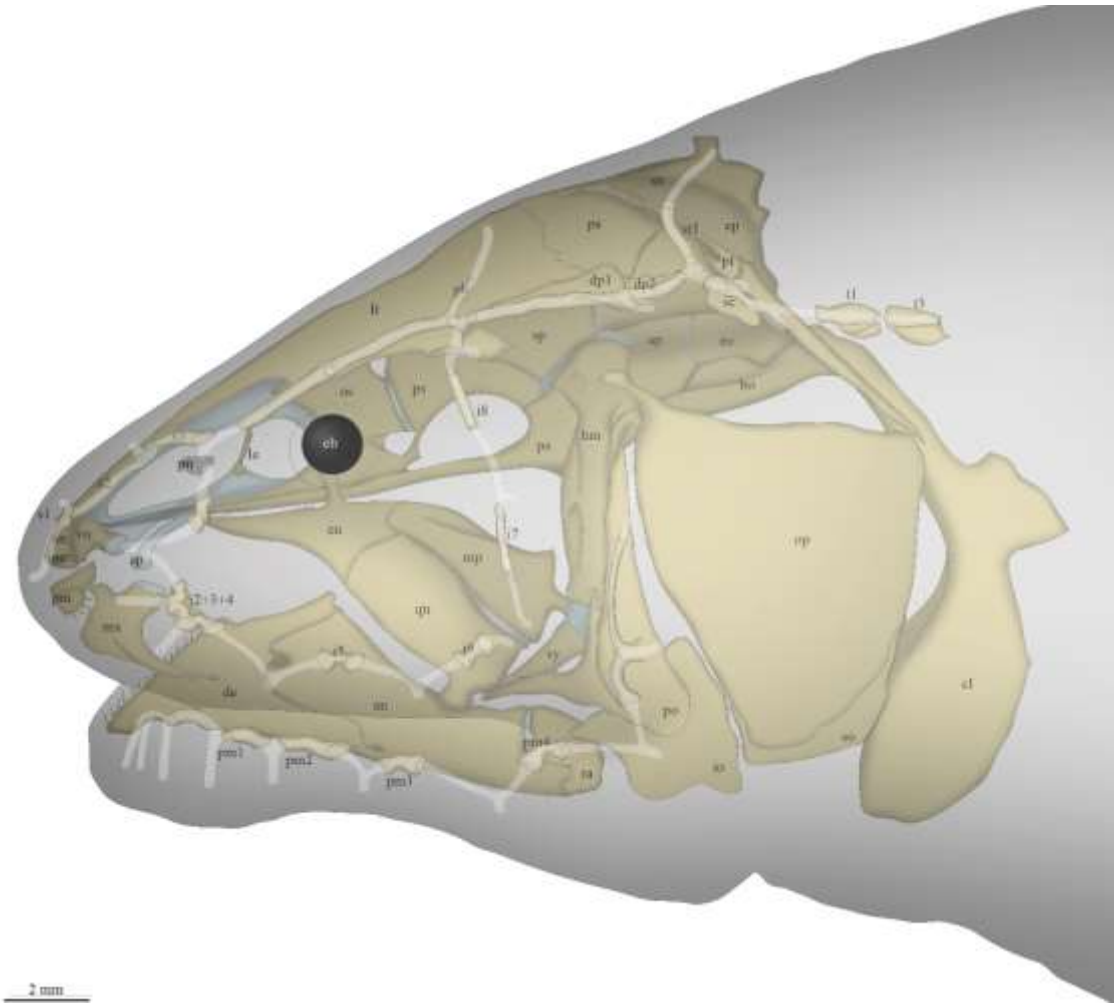

Fig. 4. Left lateral view of the skull of *Apteronotus bonapartii*, with lateral line canals highlighted in white.

I would like to thank all the people with whom I interacted during my period at the UMass for their patience, attention and kindness, especially Dr. Cristina Cox Fernandes, Dr. Jeff Podos, Dr. Craig Albertson, Kate Doyle, Sally Klingener, and Chaise Gilbert.