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Brachyplatystoma rousseauxii (CASTELNAU, 1855) AND *Brachyplatystoma vaillantii* (VALENCIENNES, 1840) IN THE AMAZON BASIN: INTEGRATIVE REVIEW ON ECOLOGY, TAXONOMY, AND CONSERVATION STRATEGIES

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Abstract

The aquatic biodiversity of the Amazon basin is heavily influenced by environmental factors, such as altitude, rainfall cycles, and dry seasons. These factors impact the water's physical and chemical parameters, consequently affecting the distribution and diversity of fish. The order Siluriformes Cuvier, 1817, particularly the family Pimelodidae Bonaparte, 1835, is ecologically and economically significant due to its migratory behavior and dependence on the region's water variability. The genus *Brachyplatystoma* Bleeker, 1862 includes species of high commercial value, such as "dourada" *Brachyplatystoma rousseauxii* (Castelnau, 1855) and "piramutaba" *Brachyplatystoma vaillantii* (Valenciennes, 1840) and is fundamental to fishing in the Amazon. This study provides a thorough review of the taxonomy, ecology, migration, and genetic diversity of species in this genus. Information was collected from scientific articles, theses, and books using databases such as Scholar Google, SciELO, Scopus, Web of Science, WoRMS, Consensus, and INPA databases. The results underscore the significance of morphological and ecological adaptations in response to the seasonal dynamics of Amazonian rivers. Additionally, eco-morphological analyses reveal essential information about habitat use, resource sharing, and evolutionary patterns shaped by environmental pressures and phylogenetic constraints. These data are essential for developing sustainable fisheries management strategies and conserving aquatic biodiversity in the Amazon.

Keywords: Fish. Pimelodidae. Morphology. Taxonomy.

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1 Introduction

The aquatic biodiversity of the Amazon basin has a variety of species depending on environmental factors. Among these aspects, altitude, the rain cycle, periods of drought, and dry spells affect the physical and chemical parameters of the water, such as temperature, and vegetation cover directly influences the distribution and biological biodiversity of Amazonian fish (RÍOS-VILLAMIZAR et al., 2020). As a result, environmental variations have developed different life cycles (REIS et al., 2016). The order Siluriformes Cuvier, 1817—known as catfish—corresponds to one of the most populous and diverse groups of freshwater fish (VAN DER LAAN; ESCHMEYER; FRICKE, 2014). The ichthyofauna of the family Pimelodidae Bonaparte, 1835, belonging to the order Siluriformes, is of high ecological and commercial relevance in the Amazon region (FORMIGA; BATISTA; ALVES-GOMES, 2021). They are migratory, depending on the seasonality of the region, occupying the vast expanse of the Amazon River, which is essential for reproduction, feeding, and growth, highlighting their dependence on water variability and the completeness of Amazonian aquatic ecosystems (RUFFINO; ISAAC, 1995).

The genus *Brachyplatystoma* Bleeker, 1862 comprises seven current species: *Brachyplatystoma capapretum* Lundberg & Akama, 2005; *Brachyplatystoma filamentosum* (Lichtenstein 1819); *Brachyplatystoma juruense* (Boulenger 1898); *Brachyplatystoma platynema* Boulenger 1898; *Brachyplatystoma rousseauxii* (Castelnau 1855); *Brachyplatystoma tigrinum* (Britski 1981); *Brachyplatystoma vaillantii* (Valenciennes 1840) (FRICKE; ESCHMEYER; VAN DER LAAN, 2025); and one fossil species — *Brachyplatystoma promagdalena* Lundberg, 2005 (LUNDBERG, 2005). Among the species of the genus, *B. rousseauxii, B. vaillantii,* and *B. filamentosum* stand out as being of high interest for fishing in the Amazon and, consequently, of economic value associated with the fish (IBAMA, 2005; 2007; BRASIL, 2012).

Taking into account the available socioeconomic, biological, and ecological relevance, it is essential to obtain data that assist in defining management policies aimed at the sustainability of fishing activities and the conservation of fishery resources. In this context, molecular biology represents a means of scientific relevance, contributing to the understanding of aspects related to phylogeny, population genetics, and phylogeography of organisms (FORMIGA; BATISTA; ALVES-GOMES, 2021). Research on the relationship between morphological variations among species can reflect changes in the different environmental and/or biological variables to which organisms are subjected (CASATTI et al., 2006). Such differences can be investigated through the application of morphological and biometric (ecomorphological) indices. Reflecting the aspects of the individual in relation to the environment, acting as indicators of habits and occupation of different habitats of the species (GATZ Jr., 1979a).

The Amazonian ichthyofauna of the genus *Brachyplatystoma* Bleeker, 1862, of the Pimelodidae family is made up of migratory species of ecological and economic importance to fisheries, such as *B. rousseauxii* and *B. vaillantii*. The seasonal environmental and hydrological aspects influence the habitat, life cycle, and morphology of the fish, so developing sustainable and ecological management studies and genetic and morphological studies are fundamental for understanding the adaptations, biodiversity, and identification of the species of *Brachyplatystoma*.

The aim of this literature review was therefore to survey the genus *Brachyplatystoma* in the Amazon Basin. In order to observe the adaptive and evolutionary processes, as well as the differentiation between species from a morphological, ecological, biological, and genetic point of view of the “piramutaba” *B. vaillantii* and “dourada” *B. rousseauxii* species and their ecological and commercial importance in the Amazon.

2 Material and Methods

This explanatory literature review gathered and analysed scientific research on the migration, sustainable fishing, ecology, and genetics of Amazonian species of the genus *Brachyplatystoma*. References were searched for in Scholar Google, SciELO, Scopus, Web of Science, WoRMS, Consensus, and INPA databases, without a defined time period to provide an overview of the subject through available literature. Keywords such as "Brachyplatystoma," "fish migration Amazon," "sustainable fishing," and "population genetics" were used. Articles, theses, dissertations, and book chapters discussing ecological, genetic, and biological aspects related to the management of *Brachyplatystoma* species, including *B. rousseauxii* and *B. vaillantii*, were included. The preferred method was to read the titles and abstracts to qualitatively verify the main findings and existing gaps.

3 Results and Discussion

Taxonomic Review

Teleost fishes represent the largest and most diverse group of vertebrates, comprising approximately 27,000 species that exhibit remarkable morphological, behavioural and ecological diversity (RAVI; VENKATESH, 2008; NELSON; GRANDE; WILSON, 2016).

Within this class, the superorder Ostariophysi stands out as the second largest teleost group, including 102 families, 1,372 genera, and 11,883 species, representing approximately 30% of all known fish species and 70 % of freshwater taxa (OLIVEIRA, 2025).

Among the Ostariophysi, the order Siluriformes is particularly diverse with wide geographical distribution (NELSON, 1994; DE PINNA et al., 2025), adaptive potential, and ecological importance for aquatic ecosystems, such as in tropical regions in the Amazon basin, where many fish perform essential functions in the arrangement and roles of aquatic communities (GRANDE; EASTMAN, 1986; NELSON; GRANDE; WILSON, 2016). This fish order — commonly known as catfishes — inhabit primarily freshwater environment, although some families, such as Ariidae and Plotosidae, have adapted to marine and estuarine habitats (BURGESS, 1989; DAGOSTA; DE PINNA, 2019). There are around 3,600 species of Siluriformes, but around 30% of catfish species are still to be discovered (OTA et al., 2015).

The family Pimelodidae Swainson, 1838 (long-whiskered catfishes — order Siluriformes, superfamily Pimelodoidea) includes 30 genera containing more than 110 species (SILVA et al., 2024), typical from the Neotropical region (MEES, 1974).

Based on molecular analyses, Silva et al. (2024) propose that Pimelodidae is divided into four major clades: (1) *Steindachneridion* clade, (2) *Leiarius* + *Phractocephalus* clade, (3) Sorubiminae, and (4) Pimelodinae, and in addition, supporting the monophyly of this family (SILVA et al., 2024). In this way, this hypothesis leads to solve previous phylogeny-based-only on morphological characters, such as Lundberg et al. (1991) and De Pinna, 1998.

These catfishes are medium to large in size, most of them are predators (LUNDBERG et al., 1988; LUNDBERG; MAGO-LECCIA; NASS, 1991). This has sparked interest in conservation and fisheries management studies of the genus *Brachyplatystoma* Bleeker, 1862, which is distributed in Brasil, eastern Colombia, Venezuela, the Guianas, Peru, and Bolivia (BURGESS, 1989), including the Amazonian commercially important species targeted in this study — the “piramutaba” *Brachyplatystoma vaillantii* (Valenciennes, 1840) and the “dourada” *Brachyplatystoma rousseauxii* (Castelnau, 1855).

Fishing and economic importance

The “piramutaba” (*Brachyplatystoma vaillantii*) and the “dourada” (*Brachyplatystoma rousseauxii*) are freshwater catfish, known as large migratory catfish, because they travel great distances from the estuary to the source of the Amazon River near the Andes for spawning (BARTHEM; GOULDING, 1997).

The fishing fleet is made up of artisanal and industrial vessels (BARTHEM, 1990a, b). Artisanal fishing is limited to continental and estuarine areas, with both species targeted (BARTHEM; PETRERE Jr., 1995). The industrial fleet operates exclusively in Amazonian estuarine areas, with the target species being the “piramutaba” (BARTHEM, 2000). In the 1990s, the fishing stocks investigated, covering the years 1984 and 1985 for “piramutada” in the Amazon estuarine region, were found to be at risk of overfishing, i.e., the fishing effort was high (BARTHEM; PETRERE Jr., 1995). For the sea bream fishery, overfishing occurred in 2002 (ALONSO, 2002). As a result of the recent exploitation of these two fishery resources, they were included in the National List of Species of Aquatic Invertebrates and Fish Overexploited or Threatened with Overexploitation in Appendix II (MINISTÉRIO DO MEIO AMBIENTE, 2004).

Ecology and morphology

The main morphological characteristics present are the presence of three pairs of barbels (one maxillary pair and two mentonian pairs); a naked body, i.e., free of plates; a robust adipose fin; a furred caudal fin; widely separated nostrils absent of barbels; and aculei on the pectoral and dorsal fins, which may be present or absent; when present, they are rigid (BURGESS, 1989; LUNDBERG; LITTMANN, 2003).

The ichthyofauna of the Neotropical groups of the Siluriformes order has an evolutionary history associated with the watercourse (CASTRO, 2021). For this reason, Amazonian streams have morphological characteristics such as current speed, water volume, and suspended particulate matter, among others (UIEDA; CASTRO, 1999), and physiological characteristics adapted to the seasonal water variation of floods and droughts, allowing the ichthyofauna to take advantage of the resources available for reproduction, migration, feeding, and other activities (TAYLOR, 1996). This complexity allows for simultaneity so that each individual takes advantage of the habitat and microhabitat with competitive advantages (WILLIS; WINEMILLER; LOPEZ-FERNANDEZ, 2005).

The evolutionary relationship and adaptive effect of morphology and ecological factors through individuals, populations, and communities is called ecomorphology (PERES-NETO, 1999). It is based on the concept that morphological heterogeneity between species is associated with different biological and/or environmental aspects (CASATTI; CASTRO, 2006). These differences can be studied through the use of morphological and biometric indices as patterns expressed by the organism when associated with the environment and are capable of being indicators of the habits or adaptations of species to the appropriation of different habitats (GATZ Jr., 1979a).

However, this correlation can occur through phylogenetic induction, indicating that genetically close species exhibit morphological and ecological similarities (PERES-NETO, 1999). This is because the same morphological attributes used to link with ecology are used to group individuals from phylogenetically close species (DOUGLAS; MATTHEWS, 1992).

It is therefore necessary to check morphological characters together with the phylogenetic proximity between species, providing ecomorphological inferences, especially of adaptive convergence and divergence. This tool analyses the arrangement and organisation of communities, competition, resource use, ecological niches, and taxon diversity (GATZ Jr., 1979b; WATSON; BALON, 1984; WIKRAMANAYAKE, 1990; WINEMILLER, 1991; DOUGLAS; MATTHEWS, 1992; SCHLUTER, 1993; WINEMILLER; KELSO-WINEMILLER; BRENKERT, 1995; PIET, 1998; CHUANG; LIN; LIANG, 2006; KERFOOT Jr.; SCHAEFER, 2006; HOAGSTROM; BERRY, 2008).

In this way, biological analyses such as growth, ecological niche, habitats, and fishing dynamics are fundamental for the sustainable management and conservation of species such as "piramutaba" and "dourada." In the case of bony fish, otoliths (rigid parts found in the inner ear) (LAGLER; BARDACH; MILLER, 1963) are commonly used for ecobiological studies (MORALES-NIN, 2000), such as age and growth (CHILTON; BEAMISH, 1982; CASSELMAN, 1983; McFARLANE; BEAMISH, 1987; HAUSER et al., 2018), which are important for determining the reproductive period. Species identification (SCHMIDT, 1969); systematics and taxonomy (AKKIRAN, 1984; 1985; NOLF, 1985; KINACIGİL et al., 2000); phylogeny (LOMBARTE; CASTELLÓN, 1991); genetics (GAEMERS, 1976); and microchemistry (THRESHER, 1999; SANBORN; TELMER, 2003), among others.

Most studies on teleost species using otoliths are carried out with the pair called sagitta, as it is the largest for determining age and growth (SECOR; DEAN; LABAN, 1992). However, for fish of the Ostariophysi superorder, to which the "piramutaba" and the gilthead seabream belong, the otoliths are modified and have a pair of sagitta otoliths, which are small and delicate, making it difficult to carry out studies (LAGLER; BARDACH; MILLER, 1963).

The otoliths most commonly used for analysis are lapillus otoliths in terms of shape and measurements to define growth over the ontogenetic growth period (RÊGO; FABRÉ; LOZÁNO, 1998; PIRKER, 2001; ALONSO, 2002). The literature on otolith morphology and morphometry presents few studies, e.g. Rêgo, Fabré and Lozáno (1998) that described the lapillus otolith of the gilthead seabream (*B. rousseauxii*) through morphometric analysis.

Nevertheless, the morphological definition of otoliths in conjunction with morphometrics is still lacking for catfish species belonging to the superorder Ostariophysi, including the "dourada" (*B. rousseauxii*) and the "piramutaba" (*B. vaillantii*) (VILLACORTA CORREA, 1997). The morphological characterisation of otoliths shows important structures for the description or identification of a species or genus, especially in trophic chain studies (FITCH; BROWNELL Jr., 1968; FROST; LOWRY, 1981; GRANADEIRO; SILVA, 2000; WAESSLE; LASTA; FAVERO, 2003). In fish from tropical environments, the constitution of growth rings is affected by various conditions such as food availability, seasonality, and salinity, among others (SPARRE; VENEMA, 1998). In view of this, the identification of the first growth rings is difficult to determine due to the consequence of growth (CHILTON; BEAMISH, 1982). However, according to Alonso (2002), the first growth marks on the otoliths of the "piramutaba" sea bream are not considered because the individual does not follow a growth pattern, since throughout their life cycle, they inhabit the estuary, which is a transnational environment influenced by rainfall and tides.

However, the first growth marks are formed on the otoliths of sea bream and "piramutaba" during the period in which these species inhabit the Amazon estuary, which is a very peculiar and unique environment directly influenced by local rainfall (EGLER; SCHWASSMANN, 1964; SCHWASSMANN; BARTHEM; CARVALHO, 1989), in addition to other factors that may be considerably influencing the pattern of marking the growth rings of the fish that live there (EGLER; SCHWASSMANN, 1964; SCHWASSMANN; BARTHEM; CARVALHO, 1989). Causing changes in the ecology of the species, such as intensified predation and competition for food and habitat, among other reasons (BARTHEM; GOULDING, 1997).

Evolutionary connections and physical characteristics within the genus *Brachyplatystoma*

The genus *Brachyplatystoma* is strongly recognised as a single lineage based on phylogenetic studies that yielded six equally plausible trees (65 steps; consistency index = 0.60; retention index = 0.81) according to Lundberg and Akama (2005). This evolutionary understanding sheds light on the connections within the genus and its nearest relatives. A significant shared morphological trait of *Brachyplatystoma*, which it has in common with the closely related genus *Platynematichthys* Bleeker 1858, is the existence of a distinctly specialised bipartite gas bladder. This two-sectioned organ is distinct among catfishes, differing from the single-chambered, thin-walled gas bladder regarded as the ancestral form within Pimelodidae and the majority of other Siluriformes. Another notable feature is the ventral crest present on the cleithrum, creating a slender ridge positioned between the pectoral spine's joint and the rear process.

This crest can be found in all species except *B. tigrinum*, where it is significantly diminished. This characteristic is not found in other catfish groups. The structure of the caudal fin also serves as an important taxonomic indicator. Juvenile and subadult fish display elongated upper and lower filaments of the caudal fin, which consist of a single, unbranched main ray (LUNDBERG; AKAMA, 2005; LUNDBERG; MAGO-LECCIA; NASS, 1991). In *B. juruense*, *B. platynemum*, and *B. tigrinum*, these filaments continue into their adult stage, whereas in *B. rousseauxii*, *B. vaillantii*, *B. filamentosum*, and *B. capapretum*, they are progressively diminished or absent due to negative allometry or physical injury. Phylogenetic studies indicate a significant clade that includes *B. capapretum*, *B. filamentosum*, *B. rousseauxii*, *B. juruense*, *B. platynemum*, and *B. tigrinum*, which is closely related to *B. vaillantii*. Four critical morphological synapomorphies characterise this clade.

All species of the genus *Brachyplatystoma* are South American riverine catfishes (family Pimelodidae), distributed primarily in the Amazon Basin, with several occurrences in the Orinoco and Guianas rivers.

In this study, the main focus is on *Brachyplatystoma rousseauxii* ("dourada") and *Brachyplatystoma vaillantii* ("piramutaba"), two of the most abundant and economically important migratory catfishes in the Amazon region.

The identification key developed here is a compilation adapted from De Queiroz et al. (2013) — **Peixes do Rio Madeira** VOLUME III — which can be consulted below, solely for the purpose of assisting in the identification of these siluriform fish species:

Updated taxonomic key for Order Siluriformes in Amazon (based on DE QUEIROZ et al., 2013):

1' Reniform plate located before the dorsal fin resembles a kidney or bean shape.........*Phractocephalus hemioliopterus*
1" A small anterior dorsal plate, varying in form but never kidney-shaped..........2
2' Body is distinctly compressed laterally; it possesses a very extended anal fin that takes up more than half the body length; gill openings are significantly wide, reaching nearly to the joining point of the dentaries ("chin"); numerous long gill rakers: Genus *Hypophthalmus* (3 species)..........3
2" The body is slightly compressed laterally to somewhat flattened; anal fin is short, making up around a quarter or less of the body length; gill openings are brief, covering at most half of the ventral side of the head; gill rakers are typically short and limited in number (exception: *Sorubim maniradii*)..........5
3' Very broad maxillary and mental barbels, each adorned with a black membranous flap that flares towards the tip of the barbel..........*Hypophthalmus fimbriatus*
3" Narrow maxillary and mental barbels lacking any noticeable membranous flap..........4
4' The head is short, with its length only slightly exceeding its width; the lower lobe of the caudal fin is rounded..........*Hypophthalmus edentatus*
4" The head is elongated, with its length significantly greater than its width; the lobes of the caudal fin are pointed and symmetrical..........*Hypophthalmus marginatus*
5' The dorsal fin contains 9 to 11 branched rays: Genus *Leiarius* (2 species)..........6
5" The dorsal fin has 6 or 7 branched rays..........7
6' The dorsal fin is disproportionately tall (roughly double the body height); the body is dark with two light, curved longitudinal stripes along the sides..........*Leiarius pictus*
6" The dorsal fin is lower (matching the body height); the body is light with dark polygonal spots interspersed with light wavy lines..........*Leiarius marmoratus*
7' The premaxilla extends like a rostrum, leaving the plate of villiform teeth visible ventrally..........8
7" Premaxilla slightly larger than the dentary (sometimes revealing a small segment of the villiform tooth band)......11
8' Stout body , almost circular in cross-section; coloration is characterized by black spots and small, dark, elongated blotches, especially prominent on the head; median rays of the caudal fin are light..........*Sorubimichthys planiceps*
8" The body is slightly compressed laterally towards the back; its coloration features a central longitudinal black stripe that runs along the body and extends onto the median caudal rays: Genus *Sorubim* (3 species)..........9
9' The gill rakers are long and plentiful (31 to 37)..........*Sorubim maniradii*
9" The gill rakers are relatively brief and few in number (13 to 23)..........10
10' The pectoral fin has 9 branched rays; the head is relatively broad; the underside of the rostrum is uniformly clear, lacking melanophores..........*Sorubim lima*
10" The pectoral fin consists of 8 branched rays; the head is narrow; the underside of the rostrum displays a light median section and a dark border, with melanophores particularly noticeable at the tip..........*Sorubim elongatus*
11' The mandible is prognathous, with the dentary notably longer than the premaxilla......*Hemisorubim platyrhynchos*
11" The premaxilla is longer than the dentary, with the mouth positioned subterminally..........12

12' Pectoral fins lack spines, featuring a flexible main ray……13
12" The pectoral fin has its main ray evolved into a stinging spine……20
13' The premaxilla possesses a primary row of capitate teeth (enlarged at the distal end), forming a sharp edge……*Calophysus macropterus*
13" The premaxilla contains a band of villiform teeth of varying widths……14
14' Slim, tapering snout, with the mouth positioned clearly below the tip; body is gray with yellowish pectoral and pelvic fins; has a muscular, gizzard-like stomach……*Pimelodina flavipinnis*
14" Wide snout, with mouth positioned at the tip or slightly below; body is uniformly gray or pale brown; fins are light to clear, sometimes featuring dark spots……15
15' Mouth positioned nearly at the tip; premaxilla displays a central dip in the frontal view, creating an upward-pointing "v"; adipose fin is exceptionally long, with a gap between it and the dorsal fin that is less than the dorsal fin's base……*Pinirampus pirinampu*
15" Mouth located subterminally; premaxilla lacks a central dip, appearing as a consistent arch in the frontal view; shorter adipose fin, with a space from the dorsal that matches the length of the dorsal base……16
16' Slender upper lip; features two slender, dark spots (in the shape of commas) at the base of the caudal lobes (may only be visible at the upper lobe's base)……Genus *Megalonema* (3 species)
16" Wide and fleshy upper lip; no dark spots present at the base of the caudal lobes……19
17' Extended pelvic fin with a broadened, flat end……*Megalonema amaxanthum*
17" Short, triangular pelvic fin with no extension at the end……18
18' Long supraoccipital process, nearly reaching the predorsal plate; large eye, around 5 times the head length……*Megalonema platanum*
18" Short supraoccipital process, distanced from the predorsal plate by approximately the eye's size; small eye, about 8 times the head length……*Megalonema platycephalum*
19' Gray body with large round or oval dark spots (similar to eye size); large eye, roughly 8% of head length; somewhat narrow mouth, about 37–45% of head length……*Aguarunichthys torosus*
19" A light-colored body featuring small dark spots that are less than the size of the eye; a small eye accounting for around 6% of the head's length; a broad mouth that makes up 55% of the head's length; there is a light stripe without spots that slopes between the dorsal fin's base and the pelvic fin's base……*Aguarunichthys inpai*
20' A slender mouth located on the underside, with fleshy lips and a fold of skin at the mouth's corners resembling a pocket; a delicate, relatively bendable pectoral spine……Genus *Cheirocerus* (2 species)……21
20" A broad and terminally positioned mouth; lips that are narrow and lack noticeable skin folds at the mouth's edges; a sturdy, wide pectoral spine that is well-ossified……22
21' A dark saddle-shaped mark appears on the back just in front of the dorsal fin; has 17 to 21 gill rakers on the first gill arch……*Cheirocerus eques*
21" A dark triangular or crescent-shaped mark is located on the back immediately ahead of the dorsal fin; it shows 23 to 27 gill rakers on the first gill arch……*Cheirocerus goeldii*
22' A short pectoral spine measuring two-thirds the length of the subsequent branched ray; vomer tooth plates meet at the midline of the palate……*Duopalatinus peruanus*
22" A lengthy pectoral spine that is either equal to or slightly smaller than the next branched ray; vomer tooth plates, when present, are separated from each other along the midline of the palate……23
23' Premaxillary teeth are comparatively large and conical, arranged in 2 to 3 rows; the adipose fin is very long, spanning almost the full distance between the dorsal fin and the caudal fin's base……24
23" Premaxillary teeth arranged in multiple rows of slender conical teeth; the adipose fin is relatively short, distinctly separated from the back portion of the dorsal fin……29
24' A small eye, more than 5 times the length of the head; a low dorsal fin almost as high as the front section of the adipose fin, accompanied by a short spine……*Exallodontus aguanai*
24" A relatively large eye, less than 5 times the head's length; a high dorsal fin clearly above the adipose fin, with a long spine……Genus *Propimelodus* (5 species)……25
25' A lobe is found on the initial rays of the anal fin ("anal with lobe")……*Propimelodus* sp.
25" The anal fin has no lobe……26'
26' A long adipose fin measuring 2.3 to 2.6 times in CP; the head is 4.6 to 5.3 times in CP; eye diameter ranges from 14.5 to 21.1% of head length and 31 to 44% of snout length; the premaxilla has 4 to 5 rows of teeth, with 20 to 23 gill rakers……*Propimelodus caesius*
26" A short adipose fin measuring 2.4 to 3.0 times in the CP……27'
27' A short maxillary barbel that extends no further than the end of the adipose fin; the body is uniformly low, with a gently rising predorsal profile; the adipose fin is low, with its maximum height matching that of the caudal peduncle; the supraoccipital process has a relatively uniform width throughout its length……*Pimelodidae* sp.

27" A long maxillary barbel that reaches or exceeds the caudal fin; the body is relatively tall, featuring a gently rising predorsal profile; the adipose fin is high, with its maximum height surpassing that of the caudal peduncle; the supraoccipital process has a broad base……………………28'
28' The barbels are comparatively short, with the maxillary barbel reaching the caudal fin but not surpassing it; the external mental barbel does not extend to the first pelvic ray; the internal mental barbels meet but do not go beyond the pectoral fin; The adipose fin is present 2.9 to 3.0 times in CP; the premaxillary tooth plate features numerous rows of fine teeth and has a lateral posterior projection; the head is contained 4.2 times in CP…………*Propimelodus* sp.
28" The barbels are lengthy, as the maxillary barbel goes beyond the caudal fin; the external mental barbel reaches the first pelvic ray; the internal mental barbel extends to the pectoral fin; the adipose fin is 2.4 to 2.9 times present in CP; the premaxillary tooth plate consists of 4 to 6 uneven rows of robust conical teeth, lacking a lateral posterior projection; and the head is 3.9 to 4.3 times contained in CP ("BCD - short adipose")……………………*Propimelodus* sp.
29' The maxillary barbel is extremely long and has a rigid, ossified base; the coloration consists of two or more round black spots on the front side of the flanks; a prominent black stripe stretches from the lower part of the caudal peduncle to the fin's tip……………………30'
29" The length of the maxillary barbel varies but features a flexible base without any ossification; the color differs from the previously mentioned shade……………………31'
30' The snout has a rounded to trapezoidal end, slightly extending ahead of where the maxillary barbels connect; the premaxillary tooth plate is partially visible from a ventral perspective……………………*Platysilurus mucosus*
30" The snout is triangular with a pointed tip; the premaxillary tooth plate is fully exposed, creating a large triangular view from below; a very long snout resembles a rostrum, significantly extending in front of the maxillary barbel insertion point……………………*Platystomatichthys sturio*
31' The caudal fin is emarginate; the head is short and broad, featuring small eyes and a wide, flat space between the eyes; the palatal tooth plate appears as a narrow transverse band, with tips curving backward into points; the overall body color ranges from gray to yellowish, with many darker spots……………………*Zungaro zungaro*
31" The caudal fin is forked; the head is relatively long; the interorbital space varies, as does the eye size; the palatal teeth do not create a transverse band; the color pattern is variable but never matches the one described above……32'
32' The color pattern is characterized by alternating dark and light vertical bands, which may be either separate or interconnected……………………33'
32" A uniform gray color scheme is present, with a lighter belly area that may or may not have several round dark spots……………………36'
33' The caudal fin is deeply forked with pointed lobes, occasionally elongated into a filament……………………35'
33" The caudal fin exhibits a mild fork to emarginate, with rounded lobes and is never extended into a filament……34'
34' The coloration consists of a grayish or olive base with narrow black vertical stripes that alternate with very thin white ones; there are black spots on the head and lower part of the flanks; the sides of the head display a straight outline; shallow fontanelle……………………*Pseudoplatystoma punctifer*
34" The coloration consists of a light gray background featuring irregular, networked black stripes, creating various patterns along the sides; the snout has a central narrowing and is slightly broader at its tip compared to the middle section; clearly defined fontanelle……………………*Pseudoplatystoma tigrinum*
35' The appearance is characterized by slender black stripes that run diagonally across the body, lacking any connections; the tail fin displays slender vertical black stripes; the snout is long and flattened; the base of the adipose fin is longer than that of the anal fin……………………*Brachyplatystoma tigrinum*
35" The coloration includes broad, nearly vertical dark bands that are interconnected on the body, with no connections; the tail fin has irregular dark blotches, never forming narrow vertical lines; the snout is comparatively short and elevated; and the base of the adipose fin is roughly the same size as that of the anal fin……………………*Brachyplatystoma juruense*
36' The maxillary and mental barbels are broad and flat, shaped like ribbons……………………37'
36" The maxillary and mental barbels are thin and rounded, never resembling ribbons……………………38'
37' The head and snout are short; the maxillary barbels are also short, not reaching the pelvic fin origins; the dorsal fin features an extended first ray turning into a filament; the body is marked by numerous dark spots on a gray background; the tail fin has blackened median rays and part of the lower lobe……………………*Platynematichthys notatus*
37" The head and snout are elongated; maxillary barbels are long, reaching or exceeding the pelvic fin origins; the dorsal fin lacks a filament; the body is uniformly gray with a lighter underbelly; the tail fin is a consistent light gray……………………*Brachyplatystoma platynemum*
38' The supraoccipital process is robust, clearly visible, and touches the predorsal plate……………………40'
38" The supraoccipital process is short and slender, barely noticeable, with its end separated from the predorsal plate by a small area of skin……………………39'
39' The adipose fin is long, with its base larger than that of the anal fin……………………***Brachyplatystoma vaillantii***

40' The body is gray and becomes progressively lighter (whitish) on the belly; the premaxilla has a series of larger, flattened teeth at the back; the tail fin is rounded with lobes that are rounded............*Brachyplatystoma filamentosum*
40" The body is uniformly silvery-white or faintly and gradually shaded; the back is light to medium gray; it has no spots or stripes, and the premaxillary tooth band features uniformly slightly flattened teeth; the tail fin has pointed lobes with short barbels, which do not reach the end of the dorsal fin and are often slightly shorter than the head..***Brachyplatystoma rousseauxii***

4 Conclusions

Phylogenetic and morphological analyses provide a strong basis for understanding the evolution and taxonomy of *Brachyplatystoma*. Proposing a *B. vaillantii* and *B. rousseauxii* taxonomical key is crucial for many purposes, like genetic studies, which can reveal cryptic diversity and population structure. An integrative approach combining molecular and morphological data is essential to accurately define species boundaries and guide effective conservation. This is vital for managing these important migratory catfish, being critical to the Amazon's ecology and fisheries. Further research is needed to refine the taxonomy of the genus *Brachyplatystoma*.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

K.M.C. and U.S. contributed equally to all aspects of this study, including conceptualisation, methodology, data acquisition, writing, proofreading, and validation.

DECLARATION OF INTEREST

The authors disclose that they have no known competing financial interests or personal relationships that could have appeared to influence this study.

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The authors who carried out this research declare the use of an AI-based tool to promote improvements in the writing of this manuscript.

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