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**Inventory**

# The ichthyofauna of streams from the Purus-Madeira interfluve: composition, new records, and conservation status for the south of the Amazon

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***Abstract:*** This study presents a survey of small-stream fish species from the Purus-Madeira interfluve, collected in four streams near Humaitá on the highway BR-319. The results reveal a rich and diversified ichthyofauna with 3016 collected individuals distributed in 84 species, six orders, 25 families, and 60 genera. Of all the specimens collected, the Characiformes was the most representative, with eight families, 26 genera, and 42 species, followed Siluriformes, with nine families, 20 genera, and 23 species. In terms of families, Characidae had the highest number of species (25), followed by Loricariidae (9), and Cichlidae (8). Among the 95 captured species,s 11 are the first records for the region, evidencing a high diversity in these environments. Of the 84 species recorded in this study, 15 have not been assessed by the IUCN, while the remaining 62 include 23 listed as Least Concern (LC), three as data deficient (DD), and one as Near Threatened (NT). The southeastern Amazon region still has few fish surveys, especially in the region comprising the Purus-Madeira Interfluve, which highlights the importance of surveys to fill gaps and understand the biodiversity distribution patterns in the region.
***Keywords:*** *Checklist; fishes; BR-319; Amazonian; biodiversity; conservation.*

## A ictiofauna de igarapés do interflúvio Purus-Madeira: composição, novos registros de ocorrência e estado atual de conservação no sul do Amazonas

***Resumo:*** Este estudo apresenta um levantamento das espécies de peixes de pequenos riachos do interflúvio Purus-Madeira, coletadas em quatro riachos perto de Huimaitá na rodovia BR-319. Os resultados revelam uma ictiofauna rica e diversificada com 3016 indivíduos distribuídos em 84 espécies, seis ordens, 25 famílias e 60 gêneros. De todos os espécimes coletados, Characiformes foi a mais representativa, com oito famílias, 26 gêneros e 42 espécies, seguida da Siluriformes, com 9 famílias, 20 gêneros e 23 espécies. Em termos de famílias, Characidae apresentou o maior número de espécies (25), seguida de Loricariidae (9) e Cichlidae (8). Dentre as espécies capturadas, do total de 84 espécies, 11 são o primeiro registro da região, evidenciando uma alta diversidade nesses ambientes. Das 84 espécies registradas neste trabalho, 15 não foram avaliadas pela IUCN, 63 listadas como Menos Preocupante (LC), quatro como Deficientes em Dados (DD) e uma como Quase Ameaçada (NT). A região sudoeste da Amazônia ainda conta com poucos levantamentos de peixes, principalmente na região que compreende o Interflúvio Purus-Madeira, por isso é importante realizar levantamentos para preencher lacunas de coletas e compreender padrões de distribuição da biodiversidade da região.
***Palavras-chave:*** *Lista de espécies; peixes; BR-319; Amazônia; conservação; biodiversidade.*

## Introduction

Studies of small Amazonian streams have increased in the last two decades (Mendonça et al., 2005; Barros et al., 2011; Benone et al., 2017; Leitão et al., 2018; Stegmann et al., 2019; Benone et al., 2020), and show that the ichthyofauna in these environments is composed by at least 50% of medium to small-sized individuals (up to 150 mm length), and with high indices of endemism (Castro, 2021).

Small streams in forest areas are particularly vulnerable to human occupation (e.g. Dias et al., 2009), especially considering the high endemic-species diversity in this type of environment (Albert et al., 2011). However, studies of the composition and distribution of fish assemblages of small streams in the region affected by the Álvaro Maia Federal Highway (BR-319) are restricted to a few stretches of the interfluve or in streams close to big rivers (Barros et al., 2011; Queiroz et al., 2013b; Vieira et al., 2016; Stegmann et al., 2019). The lack of governance along the BR-319, a road that connects the city of Manaus, in Amazonas state, to the city of Porto Velho, in Rondônia state, is responsible for several socioenvironmental impacts (Fearnside et al., 2009; Andrade et al., 2021).

Located in the Purus-Madeira interfluve, its connection to the deforestation arch has generated opportunities for people to illegally occupy, deforest, and offer land for sale, including environmental protection areas (EPAs) and indigenous lands (Fearnside & Graça, 2009; Anjos et al., 2019; Ferrante et al., 2020; Ferrante et al., 2021). These protected areas are critical to biodiversity because they promote the conservation of the forest cover, a crucial factor in the ichthyological diversity (Castello et al., 2013; Lobón-Cerviá et al., 2015; Arantes et al., 2017; Frederico et al., 2018; Barros et al., 2020).

Small streams can be altered by anthropogenic impacts across watersheds (Leal et al., 2016) and must be monitored frequently, especially when considering the occupational processes occurring in the interfluve region. Also, fishes are bioindicators that can provide excellent ecological answers since they are relatively easier to identify (at least as morphospecies) than other groups, have life cycles long enough to allow temporal comparisons, and are dependent on numerous biotic and abiotic factors (Mendonça et al., 2005). Here, we present a list of fish species recorded from small streams along the Purus-Madeira interfluve to identify new occurrences and complement the assessments already undertaken along the interfluve, including new surveys near the southern extremity of the BR 319 highway.

## Material and Methods

### 1. Study area

The interfluve region of the Purus and Madeira Rivers, both tributaries of the Amazon River, is part of the Içá formation, which is constituted by tabular formations with wide fluvial terraces and weak draining incision, and probably originated in the Pleistocene (CPRM, 1997). The Purus-Madeira interfluve is approximately 800 km long and 150 km wide and holds a wide variety of habitats, including natural grasslands, upland and flooded forests (Rapp Py-Daniel et al., 2007; Campos, 2011).

Original data was collected in PPBio modules 12 and 13 near Humaitá, Amazonas. Module 13 is located 10 km from the Humaitá township, and module 12 is located 40 km away (Table 1), adjoining the BR-319 – and inside a military area (Figure 1).

**Table 1.** Coordinates of streams where the specimens were collected.

| Streams | Collection coordinates |
|---|---|
| Stream 1 (Module 12) | 7°27'42.88"S 63°13'19.94"W |
| Stream 2 (Module 12) | 7°27'51.60"S 63°13'41.40"W |
| Stream 3 (Module 13) | 7°33'32.30"S 63° 6'40.50"W |
| Stream 4 (Module 13) | 7°34'13.20"S 63° 6'51.10"W |

### 2. Data collection

Specimens were collected under the SISBIO permanent license Nº 29476-4, following the methodology proposed by Mendonça et al. (2005), which consists of the active sampling of 50 m of a delimited part of the stream using fishnets with <3 mm mesh, and with an effort of 4 persons during one hour.

Seven collections were carried out over a period of three years in four small-streams from a Madeira River micro-basin. Four collections were made between 2018 and 2019 (Module 13), and three between 2019 and 2020 (Module 12). Initially, it was planned to have four collections in Module 12 as well. However, the COVID-19 pandemic made it impossible to carry out the fourth collection.

The collected individuals were euthanized with Eugenol, fixed in 10% formaldehyde, and stored in flasks with 70% ethanol. All captured specimens are deposited in the Laboratório de Ictiologia e Ordenamento Pesqueiro do Vale do Rio Madeira – LIOP, of the Universidade Federal do Amazonas – UFAM, Instituto de Educação, Agricultura e Ambiente – IEAA, in Humaitá, Amazonas State. The species' threatened status was derived from the IUCN Red List of Threatened Species (IUCN, 2024), criteria available in https://www.iucnredlist.org/.

### 3. Taxonomic identification

We separated, counted and identified the captured individuals to the lowest possible taxonomic level, using taxonomic keys and specialized literature (Weitzman 1960; 1978; Rosen & Rumney, 1978; Géry 1977; 1993; Kullander 1986; 1989; 1995; Vari and Ortega 1986; Weitzman and Vari 1987; Burgess 1989; Kullander and Ferreira 1991; Huber 1992; Vari 1992; Buckup 1993; Mago-Leccia 1994; Reis 1997; Schaefer 1997; Zarske and Géry 1997; Römer 2002; Crampton et al., 2003; Crampton and Albert 2003; Armbruster, 2004; Crampton et al., 2004; Crampton and Albert 2004; Crampton et al., 2005; Lundberg 2005; Reis et al., 2005; Sousa and Py-Daniel 2005; Zarske and Géry 2006; Rocha et al., 2008; Sarmento-Soares and Martins-Pinheiro 2008; Oyakawa and Mattox 2009; Marinho and Langeani 2010; Queiroz et al., 2013a; Zuanon et al., 2015; Crampton et al., 2016).

## Results

We captured 3016 individuals, distributed in six orders, 25 families, 60 genera, and 84 species (Table 2). Characiformes had the most species, totalizing 42 species distributed in eight families and 26 genera, mostly in the Characidae, which had 25 species. Siluriformes was the second most captured order, with 23 species distributed in nine families, and 20 genera, followed by Cichliformes, with nine species, and the Gymnotiformes, with eight species. Beloniformes and

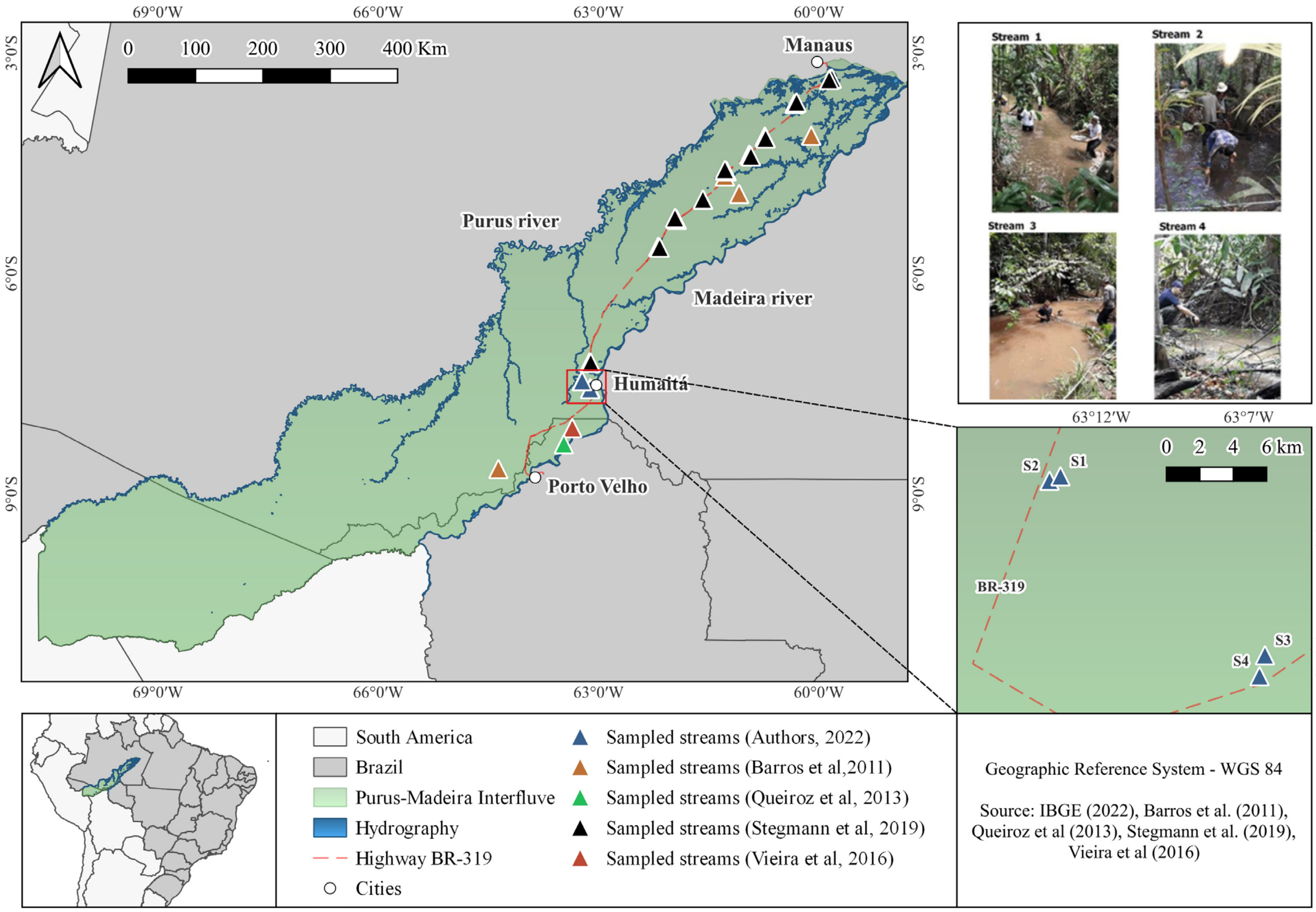


**Figure 1.** Location of the Purus-Madeira interfluve showing sites investigated for the first time in this study and location of the other assessments made using the standardized methods given in Mendonça et al. (2005).

Synbranchiformes were the least captured orders with the lower species richness (Figure 2A).

In the module 13, Stream 4 had the highest species richness, with a total of 53 fish species recorded, followed by Stream 3, with 45 species. Fewer species were captured in module 12, , with 15 species in Stream 1 and 17 in Stream 2 (Figure 2B,C). *Apistogramma agassizii*, *Gladioglanis conquistador*, *Hemigrammus ocellifer* and *Nannostomus eques* were recorded in all the streams of this study.

Of the 84 captured species, 11 are the first record of occurrence (Figure 3**)** in the Purus-Madeira interfluve area for assessments made following the Mendonça et al. (2005) method (Barros et al., 2011; Queiroz et al., 2013a,b; Vieira et al., 2016; Stegmann et al., 2019). Of the species recorded in this study, 15 have not been assessed by the IUCN, and 63 of the remaining 68 are listed as Least Concern (LC), four as Data Deficient (DD), and one as Near Threatened species (NT) (Table 2).

## Discussion

In accordance with other studies conducted in the Purus-Madeira interfluve (Barros et al., 2011; Queiroz et al., 2013a,b; Vieira et al., 2016; Stegmann et al., 2019), there was a dominance of Characiformes, followed by the Siluriformes, Cichliformes, and Gymnotiformes. The Amazon basin hosts a remarkably diverse ichthyofauna, comprising lineages from the basin and ancient continental connections, including Osteoglossiformes, Characiformes, Siluriformes, and Dipnoi. The basin also has dozens of species derived from ancestral marine species that invaded freshwater ecosystems. Notably, more than 80% of the species are Characiformes, Siluriformes, or Gymnotiformes (Dagosta & De Pinna, 2018; 2019).

*Apistogramma agassizii, Gladioglanis conquistador, Hemigrammus ocellifer* and *Nannostomus eques* were widely distributed in streams in the two studied modules. These species were also captured by Barros et al. (2011), Queiroz et al. (2013a), Vieira et al. (2016), and Stegmann et al. (2019), suggesting that they are commonly found in small streams along the Purus-Madeira interfluve. Addionally, the species identified as “cf,” “aff,” and “sp” are probably related to new species, such as *Characidium* sp. ‘mancha pedúnculo,’ and little-known taxonomic groups, such as *Hemigrammus* cf *bellottii*.

The elevated diversity found in this stretch of the Purus-Madeira interfluve highlights a rich ichthyofaunal diversity, also shown in other studies conducted in this region (see Barros et al., 2011; Queiroz et al., 2013a,b; Vieira et al., 2016; Stegmann et al., 2019). The Madeira

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**Table 2.** Annotated list of species of fishes captured in small streams of the South Amazonas' Long-Term Ecological Research modules 12 (Stream 1 – S1; Stream 2 – S2) and 13 (Stream 3 – S3; Stream 4 – S4), Brazil. LC (Least Concern); DD (Deficient data); NE (Not Evaluated) NT (Near Threatened).

| Taxon | IUCN | S1 | S2 | S3 | S4 | Vouchers (LIOP-UFAM) |
|---|---|---|---|---|---|---|
| **BELONIFORMES** | | | | | | |
| **Belonidae** | | | | | | |
| *Potamorrhaphis guianensis* Jardine, 1843 | LC | | | | X | 1594 |
| **CHARACIFORMES** | | | | | | |
| **Acestrorhynchidae** | | | | | | |
| *Gnathocharax steindachneri* Fowler, 1913 | LC | | | | X | 1497 |
| **Curimatidae** | | | | | | |
| *Cyphocharax spiluropsis* (Eigenmann & Eigenmann, 1889) | NE | | | | X | 1603 |
| *Cyphocharax spilurus* (Günther, 1864) | NE | | | | X | 1524 |
| *Steindachnerina fasciata* (Vari & Géry, 1985) | LC | | | | X | 1533 |
| **Characidae** | | | | | | |
| *Amazonspinther dalmata* Bührnheim, Carvalho, Malabarba & Weitzman, 2008 | LC | X | X | | X | 1532, 1644, 1650, 1659 |
| *Astyanax* cf. *bimaculatus* (Linnaeus, 1758) | LC | | | X | | 15 |
| *Axelrodia stigmatias* (Fowler, 1913) | LC | X | | | X | 1496, 1629, 2046, 2047 |
| *Bario steindachneri* (Eigenmann, 1893) | LC | | X | X | | 1474, 1504, 1668 |
| *Bryconella pallidifrons* (Fowler, 1946) | LC | | | | X | 1694 |
| *Chrysobrycon hesperus* (Böhlke, 1958) | LC | | | X | X | 1473, 1492, 1511, 1549, 1589, 1624 |
| *Hemigrammus bellottii* (Steindachner, 1882) | NE | | X | | | 1578, 1580, 1663, |
| *Hemigrammus* cf. *bellottii* (Steindachner, 1882) | | X | X | X | X | 1472, 1513, 1520, 1536, 1628, 1654, 1643, 1669 |
| *Hemigrammus coeruleus* Durbin, 1908 | NE | X | | | | 2050 |
| *Hemigrammus* cf. *geisleri* Zarske & Géry, 2007 | | | | X | X | 1618 |
| *Hemigrammus hyanuari* | NE | | X | | | 2052 |
| *Hemigrammus geisleri* Zarske & Géry, 2007 | NE | | | X | | 1477, 1550 |
| *Hemigrammus ocellifer* (Steindachner, 1882) | NE | X | X | X | X | 1514, 1527, 1648, 1666 |
| *Hemigrammus* sp. | – | X | | | | 1652 |
| *Hemigrammus vorderwinkleri* Géry, 1963 | NE | | | X | | 1479 |
| *Hyphessobrycon agulha* Fowler, 1913 | LC | | | X | | 1558, 1574, 2051 |
| *Hyphessobrycon bentosi* Durbin, 1908 | LC | | X | X | X | 1481, 1500, 1535, 1563, 1662, 2049 |
| *Hyphessobrycon ericae* Moreira & Lima, 2017 | NE | | | | X | 1519 |
| *Hyphessobrycon hasemani* Fowler, 1913 | DD | | | | X | 1528, 1598 |
| *Hyphessobrycon wosiackii* Moreira & Lima, 2017 | NE | | X | | | 2045 |
| *Microschemobrycon geisleri* Géry, 1973 | LC | | | X | X | 1499, 1534, 1559, 1599 |
| *Moenkhausia melogramma* Eigenmann, 1908 | LC | | | X | X | 1484, 1508, 1553 |
| *Moenkhausia bonita* Benine, Castro & Sabino, 2004 | LC | | | | X | 1601 |
| *Moenkhausia comma* Eigenmann, 1908 | LC | X | | X | | 1471, 1635 |
| *Moenkhausia oligolepis* (Günther, 1864) | LC | | | | X | 1595 |
| *Moenkhausia* sp. | – | | | X | | 1475 |
| *Phenacogaster* cf. *beni* Eigenmann, 1911 | LC | | | X | X | 1537, 1557, 1600 |
| *Phenacogaster* cf. *pectinatus* (Cope, 1870) | LC | | | X | | 1494, 1626 |
| *Tyttocharax madeira* Fowler, 1913 | LC | | | X | X | 1478, 1493, 1530, 1579, 2048 |
| **Chilodontidae** | | | | | | |
| *Chilodus punctatus* Müller & Troschel, 1844 | LC | | | X | | 1585 |
| **Crenuchidae** | | | | | | |
| *Ammocryptocharax elegans* Weitzman & Kanazawa, 1976 | LC | | | | X | 1495 |
| *Characidium* aff. *etheostoma* Cope, 1872 | LC | X | X | | | 1651 |
| *Characidium pteroides* Eigenmann, 1909 | LC | | | X | X | 1488, 1507, 1521, 1552, 1564 |
| *Characidium* cf *pteroides* Eigenmann, 1909 | | | | | X | 1592 |
| *Characidium* sp. 'mancha pendúculo' | | | | X | X | 1581, 1607 |
| *Crenuchus spilurus* Günther, 1863 | LC | X | X | | X | 1625, 1638, 1653, 1667 |

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| Taxon | IUCN | S1 | S2 | S3 | S4 | Vouchers (LIOP-UFAM) |
|---|---|---|---|---|---|---|
| *Elachocharax pulcher* Myers, 1927 | LC | | | X | X | 1510, 1523, 1555, 1583 |
| **Erythrinidae** | | | | | | |
| *Hoplias malabaricus* Bloch, 1794 | LC | X | | | | 1639 |
| **Gasteropelecidae** | | | | | | |
| *Carnegiella strigata* (Günther, 1864) | LC | X | | X | X | 1476, 1482, 1512, 1516, 1546, 1562, 1614, 1637 |
| *Gasteropelecus sternicla* (Linnaeus, 1758) | LC | | | | X | 1051, 1115, 1615 |
| **Lebiasinidae** | | | | | | |
| *Copella callolepis* (Regan, 1912) | LC | X | | | | 1636, 1640 |
| *Nannostomus eques* Steindachner, 1876 | LC | X | X | X | X | 1515, 1538, 1606, 1658 |
| *Pyrrhulina obermulleri* | DD | | X | | X | 1531, 1627, 1632, 1641 |
| **CICHLIFORMES** | | | | | | |
| **Cichlidae** | | | | | | |
| *Aequidens tetramerus* (Heckel, 1840) | LC | | X | | | 1661 |
| *Apistogramma agassizii* (Steindachner, 1875) | NE | X | X | X | X | 1517, 1556, 1582, 1602, 1633, 1642, 1649, 1655, 1665 |
| *Apistogramma resticulosa* Kullander, 1980 | NE | | | X | | 1470, 1506 |
| *Bujurquina cordemadi* Kullander, 1986 | LC | | | | X | 1485,1621 |
| *Crenicichla regani* Ploeg, 1989 | LC | | | | X | 1518 |
| *Crenicichla semicincta* Steindachner, 1892 | LC | | | X | | 1566, 1620 |
| *Laetacara thayeri* (Steindachner, 1875) | LC | | | | X | 1610 |
| *Satanoperca acuticeps* (Heckel, 1840) | LC | | | X | | 1554 |
| **Polycentridae** | | | | | | |
| *Monocirrhus polyacanthus* Heckel, 1840 | LC | X | | | X | 1611, 1631 |
| **GYMNOTIFORMES** | | | | | | |
| **Gymnotidae** | | | | | | |
| *Gymnotus coatesi* La Monte, 1935 | LC | | | X | | 1547, 1587 |
| *Gymnotus coropinae* Hoedeman, 1962 | LC | X | X | | | 1630, 1646, 1656 |
| **Hypopomidae** | | | | | | |
| *Brachyhypopomus regani* Crampton, de Santana, Waddell & Lovejoy, 2016 | LC | | | X | | 1544 |
| *Brachyhypopomus sullivani* Crampton, de Santana, Waddell & Lovejoy, 2016 | LC | | | X | X | 1502, 1588, 1597 |
| *Brachyhypopomus walteri* Sullivan, Zuanon & Cox Fernandes, 2013 | LC | | X | X | | 1569, 1670 |
| *Hypopygus lepturus* Hoedeman, 1962 | NE | | | X | | 1467, 1551, 1573 |
| **Rhamphichthyidae** | | | | | | |
| *Gymnorhamphichthys rondoni* (Miranda Ribeiro, 1920) | LC | | X | X | X | 1480, 1540, 1572, 1593, 1660 |
| **Sternopygidae** | | | | | | |
| *Eigenmannia* gr. *trilineata* | NE | | | X | | 1466 |
| **SILURIFORMES** | | | | | | |
| **Aspredinidae** | | | | | | |
| *Bunocephalus coracoideus* (Cope, 1874) | LC | | | X | X | 1543, 1575, 1612 |
| **Auchenipteridae** | | | | | | |
| *Tatia gyrina* (Eigenmann & Allen, 1942) | LC | | | X | X | 1522, 1586 |
| **Callichthyidae** | | | | | | |
| *Corydoras narcissus* Nijssen & Isbrücker, 1980 | DD | | | | X | 1608 |
| *Corydoras urucu* Britto, Wosiacki & Montag, 2009 | LC | | | | X | 1486 |
| **Cetopsidae** | | | | | | |
| *Helogenes marmoratus* Günther, 1893 | LC | | | X | | 1469 |
| **Doradidae** | | | | | | |
| *Physopyxis lyra* Cope, 1871 | LC | | | X | | 1570 |

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| Taxon | IUCN | S1 | S2 | S3 | S4 | Vouchers (LIOP-UFAM) |
|---|---|---|---|---|---|---|
| **Heptapteridae** | | | | | | |
| *Gladioglanis conquistador* Lundberg, Bornbusch & Mago-Leccia, 1991 | LC | X | X | X | X | 1491, 1545, 1568, 1591, 1634, 1645, 1657, 1664 |
| *Imparfinis cochabambae* (Fowler, 1940) | NT | | | X | | 1619 |
| *Mastiglanis asopos* Bockmann, 1994 | LC | | | | X | 1498 |
| *Pimelodella howesi* Fowler, 1940 | LC | | | | X | 1483 |
| **Loricariidae** | | | | | | |
| *Ancistrusdubius* Eigenmann & Eigenmann, 1889 | LC | | | X | | 1565 |
| *Oxyropsis carinata* Steindachner, 1879 | LC | | | | X | 1529 |
| *Oxyropsis wrightiana* Eigenmann & Eigenmann, 1889 | LC | | | | X | 1609 |
| *Otocinclus mangaba* Lehmann A., Mayer & Reis, 2010 | DD | | | X | X | 1487, 1501, 1519, 1560, 1623 |
| *Otocinclus mura* Schaefer, 1997 | LC | | | X | X | 1577, 1616 |
| *Hypoptopoma thoracatum* Günther, 1868 | LC | | | X | X | 1468, 1509, 1541, 1576, 1613 |
| *Hypoptopoma* cf. *thoracatum* Günther, 1868 | – | | X | | | 1489 |
| *Farlowella amazonum* (Günther, 1864) | LC | | | X | | 1505, 1571, 1590 |
| *Rineloricaria* cf. *lanceolata* (Günther, 1868) | LC | | | | X | 1490 |
| *Hemiodontichthys acipenserinus* (Kner, 1853) | LC | | | | X | 1622 |
| **Pseudopimelodidae** | | | | | | |
| *Microglanis poecilus* Eigenmann, 1912 | LC | | | X | X | 1542, 1548, 1567, 1617 |
| **Trichomycteridae** | | | | | | |
| *Ituglanis gracilior* (Eigenmann, 1912) | NE | | | X | X | 1526, 1539, 1561 |
| *Ituglanis* cf. *amazonicus* (Steindachner, 1882) | LC | | | | X | 1647 |
| *Ochmacanthus reinhardtii* (Steindachner, 1882) | LC | | | | X | 1596 |
| **SYNBRANCHIFORMES** | | | | | | |
| **Synbranchidae** | | | | | | |
| *Synbranchus* gr. *madeirae* Rosen & Rumney, 1972 | LC | | | X | | 1503 |

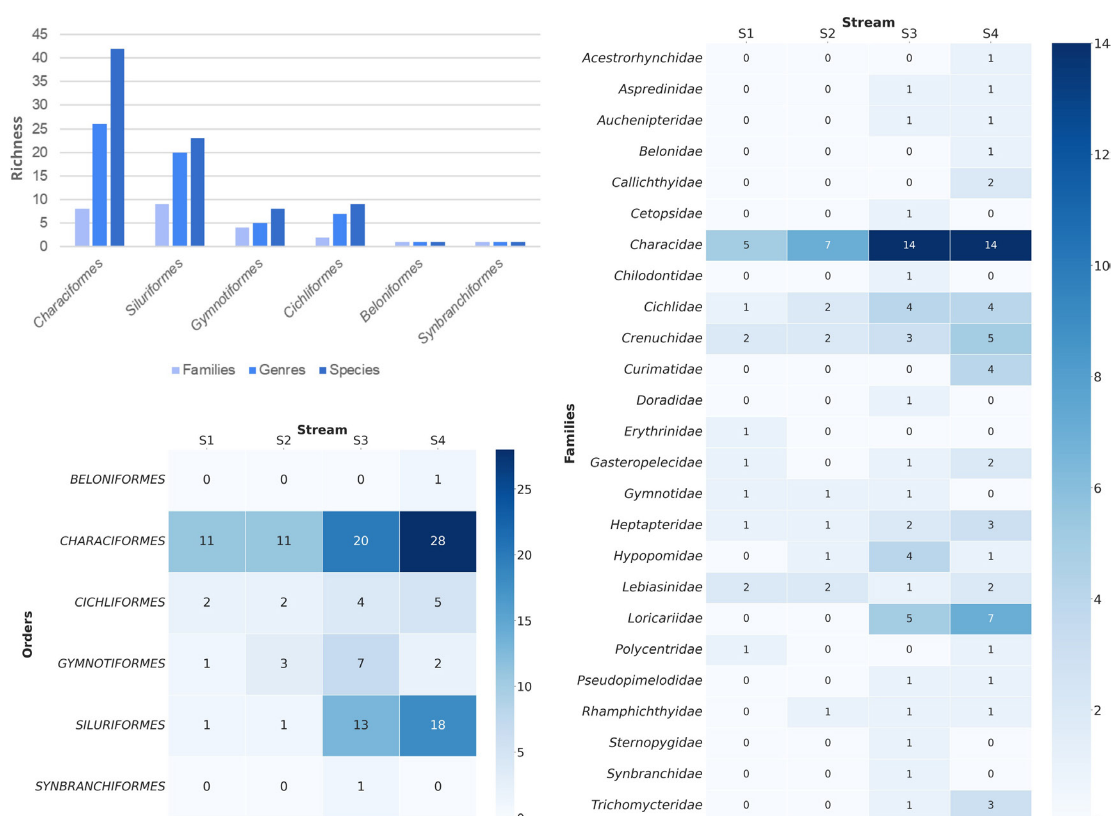


**Figure 2.** (A) Number of fish families, genera and species by order; (B) Number of species by order and locality; (C) number of species by family and locality.


**Figure 3.** Species with new occurrences for the region (1-*Brachyhypopomus regani*; 2-*Corydoras narcissus;* 3-*Corydoras urucu*; 4-*Cyphocharax spilurus;* 5-*Hyphessobrycon hasemani*; 6-*Hyphessobrycon wosiackii;* 7-*Microglanis poecilus*; 8-*Moenkhausia melogramma*; 9-*Otocinclus mangaba*; 10-*Oxyropsis carinata*; 11-*Steindachnerina fasciata*.) White bar equals 1 cm.

River is one of the most biodiverse Amazon-River tributaries, with over 1000 documented species (Ohara et al., 2015). It is situated in the Amazonian lowlands, and its tributaries originate from the Andean Mountains and Brazilian Shield, which are regions that host a many endemic species (Dagosta & De Pinna, 2019). One of the factors that may explain this elevated fish diversity in our study is the proximity of these areas to large rivers, such as the Madeira River (Stegmann et al., 2019), which allows an interchange of fish species during the flood period, when the refugia are amplified (Zuanon et al., 2015; Rapp Py-Daniel et al., 2017). Another fact to consider is that in the study conducted by Queiroz et al. (2013b), the fish were collected from streams that connect to Lake Cuniã and this in turn, connects to the Madeira River, providing a wide variety of environments and consequently, a greater diversity of fish.

Even though studies of stream fish have advanced (Castro et al., 2021), the basic biology of the ichthyofauna in the Purus-Madeira interfluve is still largely unknown. Though 68 species are on the IUCN red list (IUCN, 2024), other authors, such as Ayla et al. (2021), only found 22 species listed in the IUCN red list of the 164 collected on the lower reaches of the Ucayalli River, Peru. This lack of information impairs assertive evaluations of conservation status, and it is related to the difficulty of access to many areas, which generates information gaps in the Amazon's most remote regions (Carvalho et al., 2023). Biological surveys are needed to provide data about species richness and distribution, guiding the path to the delimitation of priority areas for conservation and the development of public policies.

We captured less species than previous studies in the region, but Queiroz et al. (2013b) used other sampling methods in addition to those used in this study, such as seine nets, gill nets and hand nets, and collected other environments, such as lakes and their tributaries, collecting 25 samples over two years, resulting in a total of 133 species. Vieira et al. (2016), also collected over two years and used complementary methods, such as fyke nets.

Another factor that also contributes to the high diversity records is the proximity of the sampled areas to the military area of the 54th Jungle Infantry Battalion. The four sampled streams in this study are inside military areas and have restricted access, which can indirectly promote the conservation of the vegetation cover – extremally important for the maintenance of fish populations (Castello et al., 2013; Lobón-Cerviá et al., 2015; Arantes et al., 2017).

The presence of the military base increases the value of these areas as potential biodiversity refugees, especially for the the streams S3 and S4 (Figure 1), which are located only a few kilometers from the military headquarters. Two results stand out regarding the surveys carried out in this study. The first concerns the 11 new species-occurrence records showing the enormous gaps in knowledge of biodiversity, and the need for better-informed public policies to guide territorial management along the Purus-Madeira interfluve. The second result is related to the many of the species collected that could not be identified at the lowest taxonomic level, which indicates the need for further taxonomic studies.

As pointed by Espírito-Santo et al. (2009), changes in the fish-assemblages composition along the year must be evaluated carefully so as not to be confused with anthropic impacts, especially when considering the inundation pulses, which can cause serious limitations for the methodology proposed by Mendonça et al. (2005), and consequently, over management alternatives and conservation efforts, especially considering periods when the streams were too full to apply the method. In these regions with extreme seasonal differences in stream width and depth, complementary sampling methods (e. g., the use of stationary nets/non active assessments) are necessary to document the fish diversity.

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## Conflicts of Interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

## Ethics

Authors have complied with the guidelines established by the ethics committees of their respective research institutions.

## Data Availability

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