

# Updated checklist of the freshwater and estuarine fishes of French Guiana

by

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**ABSTRACT.** - The fish fauna of French Guiana is among the best known of South America. Various fieldwork campaigns have been conducted since the publication of the “Atlas des poissons d’eau douce” de Guyane, particularly in poorly surveyed areas, leading to the discovery of new taxa, and numerous scientific publications have provided new insights concerning this fauna. An updated checklist of the fishes of French Guiana, including all of this new information, is therefore desirable. The list contains 416 species, 367 of which are strictly freshwater. Fish diversity is strongly correlated with catchment size and is, on average, higher in French Guiana than in Suriname. The largest groups are the Characiformes (41%), Siluriformes (33%) and Perciformes (13%). The relative abundance of taxonomic groups differs between catchments, probably reflecting the ecological character of the rivers. Eighty seven species, around a quarter of the ichthyofauna, are listed as endemic, but this may be an underestimate because a rather strict definition of endemism is used. The rate of endemism is strongly correlated with catchment size, with some families showing higher than average rates. Comparison of the number of species shared by the different catchments suggests a highly complex pattern of dispersal as a function of the catchment size, topography, and species. The Oyapock River seems to belong to a relatively distinct biogeographic zone influenced by the Amazon basin, but it is not possible to show a broader trend. These results provide an additional tool for environmental managers and decision makers.

**RÉSUMÉ.** - Liste actualisée des poissons d’eau douce et d’estuaire de Guyane française.

L’ichtyofaune de Guyane française est probablement parmi les mieux connues d’Amérique du Sud. Depuis la publication de “l’Atlas des poissons d’eau douce de Guyane”, différentes campagnes de récoltes ont été menées, en particulier dans les régions encore peu explorées, amenant à la découverte de nouveaux taxa, et de nombreuses publications scientifiques ont fourni de nouvelles données sur cette faune. L’établissement d’une checklist des poissons de Guyane française prenant en compte ces nouveaux éléments était ainsi devenue nécessaire. Cette liste contient 416 espèces, dont 367 sont strictement dulçaquicoles. La diversité des poissons est fortement corrélée avec la taille du bassin et est en moyenne plus élevée pour la Guyane française que pour le Suriname. Les plus grands groupes sont les Characiformes (41%), les Siluriformes (33%) et les Perciformes (13%). L’abondance relative des groupes taxonomiques diffère entre bassins, reflétant probablement la spécificité écologique des rivières. Quarante-sept espèces, environ le quart de l’ichtyofaune, sont considérées endémiques. Ce chiffre pourrait néanmoins représenter une sous-estimation du taux effectif liée à l’utilisation d’une mesure stricte du taux d’endémisme. Il apparaît fortement corrélé à la taille des bassins et certaines familles présentent un taux plus élevé que la moyenne. La comparaison du nombre d’espèces partagées entre les différents bassins suggère un patron de dispersion très complexe qui serait fonction de la taille du bassin, de la topographie et des espèces. Si aucune tendance générale n’a pu être mise en évidence, l’Oyapock semble appartenir à une zone biogéographique distincte influencée par le bassin de l’Amazonie. Ces résultats fournissent un outil additionnel aux gestionnaires de l’environnement et aux décideurs.

Key words. - Ichthyofauna - Guiana Shield - Distribution - Diversity - Neotropics - Conservation.

Although the ichthyofauna of Guyana had already been extensively studied (Schomburgk, 1841; Eigenmann, 1912, 1917), our knowledge of the freshwater species of French Guiana remained fragmentary until the appearance of Puyo’s

monograph (1949), which listed 76 freshwater species in French Guiana. Before him, Geay (1899) had referred to various species as being from “French Guiana”, including the Pirarucu (*Arapaima gigas*), but these were collec-

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ted when French Guiana extended south as far as the Araguari River and west as far as the Branco River, along the southern edge of the Guiana Shield. Ichthyological surveys only really got underway in the late 1950s (for more details see Planquette *et al.*, 1996). These collecting expeditions involved many research organisations, including the Institut français d’Amérique tropicale (IFAT), which later became the Office de la recherche scientifique et technique outre-mer (ORSTOM) and then the Institut de recherche pour le développement (IRD), the Institut royal des Sciences naturelles de Belgique (IRsNB), the Muséum national d’Histoire naturelle (MNHN) and the Institut national de la Recherche agronomique (INRA). Based on the information acquired, a highly comprehensive three-volume atlas was published, describing around 480 fresh and brackish water species (Planquette *et al.*, 1996; Keith *et al.*, 2000; Le Bail *et al.*, 2000), which has remained the standard reference, even

though the taxonomic status of many taxa was uncertain or the species undescribed.

Since then, further surveys have been carried out by these organisations and by others such as the Muséum d’histoire naturelle de la Ville de Genève (MHNG). Moreover, the information about fish diversity made available to consulting firms such as Hydréco and Ecobios by the “Atlas des poissons d’eau douce de Guyane” has facilitated the development of human impact studies and surveys, providing additional information on species distribution. The list of fish species has thus evolved, with the appearance of 36 publications dealing with new taxa (for references, see the recently described species in Tab. I), modifications and revisions of the taxonomic status of existing species (for references, see “Notes accompanying the Checklist of freshwater fishes from French Guiana”), and phylogenetic, ecological and biogeographical issues (e.g., Albert, 2001; de Mérona, 2005;

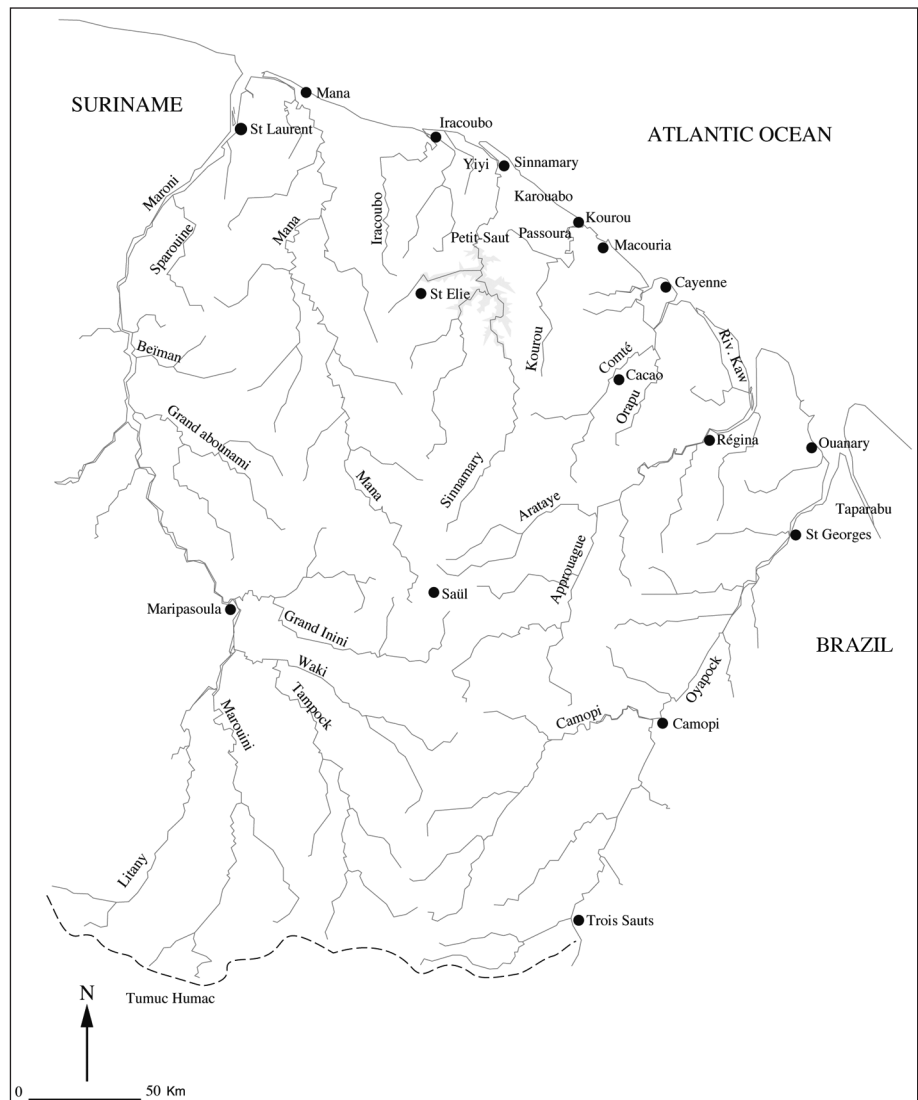


Figure 1. - Map of French Guiana showing the main rivers and places mentioned in the list of estuarine and freshwater fish.

Reis *et al.*, 2005; Vigouroux *et al.*, 2005; Covain *et al.*, 2006; Mol *et al.*, 2007; Cardoso and Montoya-Burgos, 2009; Lucena and Malabarba, 2010; de Santana and Vari, 2010; Meunier *et al.*, 2011). Since 2000, 60 new taxa have been identified from French Guiana, with 26 species new to science and only recently described. It therefore became essential to update the current body of knowledge about fish diversity in French Guiana to improve the tools available to Government authorities for the management of freshwater ecosystems. Since checklists are not only aids for the identification and correct naming of species, but also serve as essential resources for biodiversity estimates, and when reviewed by specialists often represent the most advanced state of knowledge available in the field (Funk and Kelloff, *in* Vari *et al.*, 2009), we propose here an updated and annotated checklist of the freshwater and estuarine fishes of French Guiana.

## MATERIAL AND METHODS

The checklist (Tab. I) basically follows the classification adopted by Reis *et al.* (2003) in CLOFFSCA, while also taking into account Eschmeyer and Fricke (2011), and recent publications. It completes the list given in the “Atlas des poissons d’eau douce de Guyane” (Planquette *et al.*, 1996; Keith *et al.*, 2000; Le Bail *et al.*, 2000) (hereafter the Atlas), and that more recently published by Vari *et al.* (2009), by adding observations not previously published by the authors, species whose taxonomic status is undecided (sp., cf., aff.) and their distribution in the largest river basins. The data on geographical distribution are updated based on authors’ own data, recent fieldwork, and collection database information (MNHN, MHNG, IRD, INRA, Hydréco). Species present in the frontier basins (Maroni and Oyapock), except for the highly endemic *Harttiella crassicauda* (Boeseman, 1953) (see Covain *et al.*, 2012), have been included even if they have not been formally collected in French Guiana, as they are considered potentially present on both banks of the river. Fish do not observe administrative boundaries, but it is worth noting that certain Amazonian species present in Brazil in the swamps on the right bank of the lower Oyapock (Taparabu, Jumina) have not been found in the swamps on the opposite bank in French Guiana (Jégu and Keith, 1999). Uncertain locality information for some species has not been given in the current list. For the species living in brackish water, only those that have clearly been collected in the estuaries have been included, though we recognise the arbitrary nature of this choice. We have not, therefore, systematically included the species indicated from brackish water in French Guiana by the FAO (1978), as was done for the Atlas. The presence of species of marine origin in the list is therefore minimised.

The Checklist (Tab. I) is an updated list of species present

in the large rivers of French Guiana (Fig. 1). It is presented in a table containing eight columns referring to the eight principal rivers of French Guiana, from west to east: Maroni, Mana, Iracoubo, Sinnamary, Kourou, Comté-Orapu basins, Approuague, and Oyapock (see de Mérona *et al.*, 2012). A final column indicates whether the species are also present on the coast. When the presence of a species is particularly linked to swamp zones or other precise localities (Fig. 1) these have been indicated in the column of their nearest catchment (Yiyi: pripri Yiyi and Trou poisson; Renner: Crique Renner near Sinnamary; Karouabo: crique Karouabo; Passoura: crique Passoura; Macouria: crique Macouria; Cayenne: lac des Américains at Cayenne or uncertain locality given by Valenciennes; Kaw: Kaw Swamp and River; Taparabu: Taparabu Swamp downstream on the Brazilian bank of the Oyapock; Tumuc-Humac: Tumuc-Humac Mountains, considered part of the Maroni catchment, though this is uncertain). Data concerning the area of the catchments and length of the rivers are taken from the Atlas des “Départements d’Outre-Mer” (Boyé *et al.*, 1979).

Species with a distribution area less than or equal to three adjacent catchments have been considered endemic (indicated in table I). Thus, for the Maroni these are species present in the Maroni, but whose distribution area extends no further than the Suriname River to the west and the Mana to the east. For the Oyapock, since we do not have a list of fish species from the adjacent rivers (e.g., the Uaçá) or other information, we have taken the distribution area known for each species at the time of their description. This method of calculation makes it easier to see changes in the number of endemic species in French Guiana, and highlights the national importance of species with distribution areas that are restricted but larger than a single catchment. The latter point is particularly important for the implementation of a policy to protect species limited to a small area of French Guiana.

A number of species cited by other authors have not been included in the Checklist. These are species placed in synonymy, or whose presence seems doubtful and has not been confirmed during the last 30 years of investigation by research organisations in French Guiana. Non-native species (marked with a triple asterisk in table I) were included when they were thought to be established in natural habitats (Cambou and Thonnel, 2010) and observed by the authors. Other species have changed status with respect to the list drawn up for the Atlas, in particular species that were not then formally described. New taxa have also been added, which had not yet been found when the Atlas was published. The main changes between the Checklist and the Atlas, excluding new discoveries, are indicated by an asterisk in table I and summarised in the section “Notes accompanying the Checklist of freshwater fishes from French Guiana.” Newly discovered species are also marked by a double asterisk in table I.

Table I. - Updated checklist of fish species found in estuaries and fresh water in French Guiana, arranged by main river basin. An asterisk (\*) indicates a change of name since the “Atlas des poissons d’eau douce de Guyane”, a double asterisk (\*\*) indicates a new record since the same work, and a triple asterisk (\*\*\*) indicates non native species. (+) indicates the presence of the species in the corresponding catchment. (locality name) indicates that the species was not found in the main watercourse but in adjacent rivers or aquatic zones, whose names are given in brackets. (T) indicates that the type specimen was captured in the corresponding catchment.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<b>Pristidae</b>												
<i>Pristis perotteti</i> Müller & Henle, 1841	+											+
<b>Order: Myliobatiformes</b>												
<b>Potamotrygonidae</b>												
<i>Potamotrygon marinae</i> Deynat, 2006*	T							Taparabu				
<i>Potamotrygon orbignyi</i> (Castelnau, 1855)**								+				
<i>Potamotrygon lysteri</i> (Müller & Henle, 1841)		+						+	Kaw			
<b>Order: Osteoglossiformes</b>												
<b>Osteoglossidae</b>												
<i>Osteoglossum bicirrhosum</i> (Cuvier, 1829)											+	
<b>Order: Elopiformes</b>												
<b>Megalopidae</b>												
<i>Megalops atlanticus</i> Valenciennes, 1847	+	+			+				+			+
<b>Order: Clupeiformes</b>												
<b>Clupeidae</b>												
<i>Odontognathus mucronatus</i> (Lacepède, 1800)	+									CayenneT	+	+
<b>Engraulidae</b>												
<i>Anchoa spinifer</i> (Valenciennes, 1848)	+										+	+
<i>Anchovia clupeoides</i> (Swainson, 1939)	+										+	+
<i>Anchovia surinamensis</i> (Bleeker, 1866)	+				+						+	+
<i>Anchoviella cayennensis</i> (Puyo, 1946)	+									T	+	+
<i>Anchoviella guianensis</i> (Eigenmann, 1912)					+						+	+
<i>Anchoviella lepidostole</i> (Fowler, 1911)											+	+
<i>Lycengraulis batesii</i> (Günther, 1868)	+				+						+	+
<i>Lycengraulis grossidens</i> (Agassiz, 1829)	+				+						+	+
<i>Pterengraulis atherinoides</i> (Linnaeus, 1766)	+				+						+	+
<b>Pristigasteridae</b>												
<i>Pellona flavipinnis</i> (Valenciennes, 1836)											+	+
<b>Order: Characiformes</b>												
<b>Parodontidae</b>												
<i>Parodon guyanensis</i> Géry, 1959	+	T			+						+	
<b>Curimatidae</b>												
<i>Curimata cyprinoides</i> (Linnaeus, 1766)	+	+			+						+	+
<i>Curimatopsis crypticus</i> Vari, 1982	+		Yiyi		+						+	+
<i>Cyphocharax biocellatus</i> Vari, Sidlauskas & Le Bail, 2012***	T	+			+						+	+

Table I. - Continued.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<i>Cyphocharax helleri</i> (Steindachner, 1876)	+	+		+	+	+	+	+				
<i>Cyphocharax gouldingi</i> Vari, 1992*	+											+
<i>Cyphocharax microcephalus</i> (Eigenmann & Eigenmann, 1889)**	T											+
<i>Cyphocharax punctatus</i> (Vari & Nijssen, 1986)	+											
<i>Cyphocharax spilurus</i> (Günther, 1864)	+											
<i>Cyphocharax</i> aff. <i>spilurus</i>			Yiyi									
<i>Steindachnerina varii</i> Géry, Planquette & Le Bail, 1991	T	+		+								+
<b>Prochilodontidae</b>												
<i>Prochilodus rubrotaeniatus</i> Jardine, 1841	+	+										
<i>Semaprochilodus varii</i> Castro, 1988	T											+
<b>Anostomidae</b>												
<i>Anostomus brevior</i> Géry, 1963	+	+		+								T
<i>Anostomus ternetzi</i> Fernández-Yépez, 1949	+											
<i>Hypomasticus despaixi</i> (Puyo, 1943)*	T	+		+								+
<i>Leporinus acutidens</i> (Valenciennes, 1837)*												+
<i>Leporinus fasciatus</i> (Bloch, 1794)	+	+		+								
<i>Leporinus friderici</i> (Bloch, 1794)*	+	+		+								
<i>Leporinus gossei</i> Géry, Planquette & Le Bail, 1991	T	+		+								+
<i>Leporinus granti</i> Eigenmann, 1912	+	+		+								
<i>Leporinus lebailli</i> Géry & Planquette, 1983	T	+		+								
<i>Leporinus maculatus</i> Müller & Troschel, 1844*	+	+		+								
<i>Leporinus melanostictus</i> Norman, 1926												
<i>Leporinus nijsseni</i> Garavello, 1990												
<i>Leporinus pellegrini</i> Steindachner, 1910*												
<i>Schizodon fasciatus</i> Spix & Agassiz, 1829	+	+		+								+
<b>Chilodontidae</b>												
<i>Caenotropus maculosus</i> (Eigenmann, 1912)	+											
<i>Chilodus zunevei</i> Puyo, 1946	T		+	+								+
<b>Crenuchidae</b>												
<i>Characidium pellucidum</i> Eigenmann, 1909	+											
<i>Characidium zebra</i> Eigenmann, 1909*	+	+		+								+
<i>Characidium</i> sp. 1*												
<i>Characidium</i> sp. 2**	+											
<i>Crenuchus spilurus</i> Günther, 1863	+											+
<i>Melanocharacidium bleennioides</i> (Eigenmann, 1909)*	+											+
<i>Melanocharacidium dispilomma</i> Buckup, 1993	+	+		+								+
<i>Microcharacidium eleotrioides</i> (Géry, 1960)	+	T		+								+

Table I. - Continued.

Taxa	River catchments and localities									Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock			
<b>Hemiodontidae</b>											
<i>Argonectes longiceps</i> (Kner, 1858)	+										
<i>Bivibranchia bimaculata</i> Vari, 1985	+	+		+		+	+				
<i>Bivibranchia simulata</i> Géry, Planquette & Le Bail, 1991	T	+		+		+	+				T
<i>Hemiodus huraulti</i> (Géry, 1964)											
<i>Hemiodus quadrimaculatus</i> Pellegrin, 1909		+		+		+	+				T
<i>Hemiodus unimaculatus</i> (Bloch, 1794)	+	+		+		+	+				+
<i>Hemiodus</i> aff. <i>unimaculatus</i>											
<b>Gasteropelecidae</b>											
<i>Carnegiella strigata</i> (Günther, 1864)	+										
<i>Gasteropelecus sternicla</i> (Linnaeus, 1758)	+	+		+		+	+				
<b>Characidae</b>											
<b>Taxa incertae sedis</b>											
<i>Aphyocharacidium melandettum</i> (Eigenmann, 1912)	+										
<i>Asyanax bimaculatus</i> (Linnaeus, 1758)	+	+		+		+	+				+
<i>Asyanax leopoldi</i> Géry, Planquette & Le Bail, 1988											T
<i>Asyanax validus</i> Géry, Planquette & Le Bail, 1991	+	+		+		+	+				+
<i>Bryconamericus guyanensis</i> Zarske, Le Bail & Géry, 2010*	+	T		+		+	+				+
<i>Bryconamericus heterosthes</i> Eigenmann, 1908*	+										
<i>Bryconamericus</i> aff. <i>hyphesson</i> Eigenmann, 1909*	+										
<i>Bryconops affinis</i> (Günther, 1864)	+	+		+		+	+				+
<i>Bryconops</i> aff. <i>affinis</i> **	+										
<i>Bryconops caudomaculatus</i> (Günther, 1864)	+	+		+		+	+				+
<i>Bryconops</i> aff. <i>caudomaculatus</i>											
<i>Bryconops cyrtogaster</i> (Norman, 1926)											
<i>Bryconops melanurus</i> (Bloch, 1794)	+	+		+		+	+				+
<i>Chalceus macrolepidotus</i> Cuvier, 1818	+										
<i>Creagrutus melanzoni</i> Eigenmann, 1909	+										
<i>Creagrutus planquettei</i> Géry & Renno, 1989	+										T
<i>Ctenobrycon spilurus</i> (Valenciennes, 1850)		+									
<i>Hemibrycon surinamensis</i> Géry, 1962		+									
<i>Hemigrammus aereus</i> Géry, 1959**		+									
<i>Hemigrammus bellottii</i> (Steindachner, 1882)	+										
<i>Hemigrammus boesemani</i> Géry, 1959	+										
<i>Hemigrammus guyanensis</i> Géry, 1959	+	T		+		+	+				+
<i>Hemigrammus</i> aff. <i>marginatus</i> (Ellis, 1911)**	+										
<i>Hemigrammus ocellifer</i> (Steindachner, 1882)	+										
<i>Hemigrammus ora</i> Zarske, Le Bail & Géry, 2006*	+	+	Yiyi T	+		+	+				+

Table I. - Continued.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<i>Hemigrammus rodwayi</i> Durbin, 1909	+	+	+	+	+	+	+	+	+			
<i>Hemigrammus unilineatus</i> Gill, 1858*	+	+	+	+	+	+	+	+	+			
<i>Hyphessobrycon borealis</i> Zarske, Le Bail & Géry, 2006*	+	T	+		+	+	+	+	+			
<i>Hyphessobrycon copelandi</i> Durbin, 1908		+										
<i>Hyphessobrycon eques</i> (Steindachner, 1882)*/**	T											
<i>Hyphessobrycon roseus</i> (Géry, 1960)*	+	+	+	+	T				+			
<i>Hyphessobrycon simulatus</i> (Géry, 1960)*	+		+						+			
<i>Hyphessobrycon takasei</i> Géry, 1964	+								+			
<i>Jupiaba abramoides</i> (Eigenmann, 1909)*	+	+		+					+			
<i>Jupiaba keithi</i> (Géry, Planquette & Le Bail, 1996)*	T	+		+					+			
<i>Jupiaba maroniensis</i> (Géry, Planquette & Le Bail, 1996)*	T	+		+					T			
<i>Jupiaba meunieri</i> (Géry, Planquette & Le Bail, 1996)*	+	+		+								
<i>Jupiaba ocellata</i> (Géry, Planquette & Le Bail, 1996)*	+	+		+								
<i>Moenkhausia chrysargyrea</i> (Günther, 1864)	+	+	+	+	+	+	+	+	+			
<i>Moenkhausia collettii</i> (Steindachner, 1882)	+	+	+	+	+	+	+	+	+			
<i>Moenkhausia georgiae</i> Géry, 1965	+	T		+					+			
<i>Moenkhausia grandisquamis</i> (Müller & Troschel, 1845)	+	+		+					+			
<i>Moenkhausia</i> aff. <i>grandisquamis</i>	+	+		+					+			
<i>Moenkhausia hemigrammoides</i> Géry, 1965	+	+		+					Kaw			
<i>Moenkhausia inrai</i> Géry, 1992	+	+		+					T			
<i>Moenkhausia</i> aff. <i>intermedia</i> Eigenmann, 1908	+	+		+					+			
<i>Moenkhausia lata</i> Eigenmann, 1908*	+	+		+					+			
<i>Moenkhausia moisae</i> Géry, Planquette & Le Bail, 1995	T	+		+								
<i>Moenkhausia oligolepis</i> (Günther, 1864)	+	+	+	+	+	+	+	+	+			
<i>Moenkhausia surinamensis</i> Géry, 1965	+	+	+	+	+	+	+	+	+			
<i>Pristella maxillaris</i> (Ulrey 1894)	+	+	+	+	+	+	+	+	+			
<i>Pristella</i> aff. <i>maxillaris</i>	+	+	+	+	+	+	+	+	Kaw			
<i>Roebioxodon guyanensis</i> (Puyo, 1948)	T	+		+					+			
<i>Thayeria ifaiti</i> Géry, 1959	T	+		+					+			
<i>Triportheus brachipomus</i> (Valenciennes, 1850)*	+	T		+	+	+	+	+	+			
<b>Iguanodectinae</b>												
<i>Iguanodectes</i> aff. <i>purusii</i> (Steindachner, 1908)**	+	+		+					+			
<i>Piabucus dentatus</i> (Koelreuter, 1763)	+	+	+	+	+	+	+	+	+			
<b>Bryconinae</b>												
<i>Brycon falcatus</i> Müller & Troschel, 1844	+	+		+					+			
<i>Brycon pesu</i> Müller & Troschel, 1845	+	+		+					+			
<b>Serrasalminae</b>												
<i>Acnodon oligacanthus</i> (Müller & Troschel, 1844)	+	+		+					+			





Table I. - Continued.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<b>Erythrinidae</b>												
<i>Erythrinus erythrinus</i> (Bloch & Schneider, 1801)	+	+	+	+	+	+	+	+	+			
<i>Hoplerythrinus unitaeniatus</i> (Spix & Agassiz, 1829)	+	+	+	+	+	+	+	+	+			
<i>Hoplias aimara</i> (Valenciennes, 1847)	+	+	+	+	+	+	+	+	+			
<i>Hoplias malabaricus</i> (Bloch, 1794)	+	+	+	+	+	+	+	+	+			
<b>Lebiasinidae</b>												
<i>Copella arnoldi</i> (Regan, 1912)*	+	+	+	+	+	+	+	+	+			
<i>Copella</i> aff. <i>arnoldi</i> *	+	+	+	+	+	+	+	+	+			
<i>Nannostomus beckfordi</i> Günther, 1872	+	+	+	+	+	+	+	+	+			
<i>Nannostomus bifasciatus</i> Hoedeman, 1954	+	+	+	+	+	+	+	+	+			
<i>Pyrhulina</i> cf. <i>brevis</i> Steindachner, 1876**	+	+	+	+	+	+	+	+	+			
<i>Pyrhulina filamentosa</i> Valenciennes, 1847	+	+	+	+	+	+	+	+	+			
<i>Pyrhulina stoli</i> Boeseman, 1953**	T											
<b>Ctenopomidae</b>												
<i>Boulengerella cuvieri</i> (Spix & Agassiz, 1829)												+
<b>Order: Siluriformes</b>												
<b>Cetopsidae</b>												
<i>Cetopsidium orientale</i> (Vairi, Ferraris & Keith, 2003)*	+	+	+	+	+	+	+	+	+			
<i>Helogenes marmoratus</i> Günther, 1863	+	+	Yiyi	+	+	+	+	+	+			
<b>Aspredinidae</b>												
<i>Aspredinichthys filamentosus</i> (Valenciennes, 1840)	+	+	+	+	+	+	+	+	+			+
<i>Aspredinichthys tibicen</i> (Valenciennes, 1840)	+	+	+	+	+	+	+	+	+			+
<i>Aspredo aspredo</i> (Linnaeus, 1758)	+	+	+	+	+	+	+	+	+			+
<i>Bunocephalus aloi</i> (Hoedeman, 1961)*	T	+	+	+	+	+	+	+	+			
<i>Bunocephalus coracoides</i> (Cope, 1874)*		+	+	+	+	+	+	+	+			
<i>Bunocephalus verrucosus</i> (Walbaum, 1792)*		+	+	+	+	+	+	+	+			
<i>Platyistius cotylephorus</i> Bloch, 1794*	+	+	+	+	+	+	+	+	+			+
<b>Trichomycteridae</b>												
<i>Inglanis amazonicus</i> (Steindachner, 1882)	+	+	+	+	+	+	+	+	+			
<i>Inglanis nebulosus</i> de Pinna & Keith, 2003*	+	+	+	+	+	+	+	+	+			
<i>Ochmacanthus</i> cf. <i>alternus</i> Myers, 1927	+		+									
<i>Ochmacanthus reinhardtii</i> (Steindachner, 1882)	+											
<b>Callichthyidae</b>												
<b>Callichthyinae</b>												
<i>Callichthys callichthys</i> (Linnaeus, 1758)	+	+	Yiyi	+	+	+	+	+	+			+
<i>Hoplosternum littorale</i> (Hancock, 1828)	+											+
<i>Megalechis thoracata</i> (Valenciennes, 1840)	+	T	Yiyi	+	+	+	+	+	+			+

Table I. - Continued.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<b>Corydoradinae</b>												
<i>Corydoras aeneus</i> (Gill, 1858)	+			+		+	+					
<i>Corydoras amapaensis</i> Nijssen, 1972					+		+					+
<i>Corydoras approuaguensis</i> Nijssen & Isbrücker, 1983	+						T					
<i>Corydoras baderi</i> Geisler, 1969	+											
<i>Corydoras aff. brezi</i> Isbrücker & Nijssen, 1992*	+											
<i>Corydoras cf. brevivostriis</i> Fraser-Brunner, 1947	+											
<i>Corydoras condiscipulus</i> Nijssen & Isbrücker, 1980	+	+					+					T
<i>Corydoras geoffroy</i> Lacepède, 1803	+	+					+					
<i>Corydoras guianensis</i> Nijssen, 1970	+	+					+					
<i>Corydoras nanus</i> Nijssen & Isbrücker, 1967	+		+									
<i>Corydoras oiapoquensis</i> Nijssen, 1972	+											T
<i>Corydoras punctatus</i> (Bloch, 1794)			+									
<i>Corydoras sipaliwini</i> Hoedeman, 1965												
<i>Corydoras solox</i> Nijssen & Isbrücker, 1983	+				+							T
<i>Corydoras</i> sp. 1**												
<i>Corydoras</i> sp. 2**												
<i>Corydoras</i> sp. 3**												
<i>Corydoras</i> sp. 4**												
<i>Corydoras spilurus</i> Norman, 1926												
<b>Loricariidae</b>												
<b>Hypoptopomatinae</b>												
Gen. nov. aff. <i>Parotocinclus</i>	+											
<i>Otocinclus mariae</i> Fowler, 1940	+											+
<b>Loricariinae</b>												
<i>Cteniloricaria platystoma</i> (Günther, 1868)*	+	+										
<i>Farlowella reticulata</i> Boeseaman, 1971	T	+										+
<i>Farlowella rugosa</i> Boeseaman, 1971	T											
<i>Harttia fowleri</i> (Pellegriin, 1908)*												T
<i>Harttia guianensis</i> Rapp Py-Daniel & Oliveira, 2001*	+	+										
<i>Harttiella intermedia</i> Covain & Fisch-Muller, 2012**												
<i>Harttiella jannoli</i> Covain & Fisch-Muller, 2012**	T											
<i>Harttiella longicauda</i> Covain & Fisch-Muller, 2012**		T										
<i>Harttiella lucifer</i> Covain & Fisch-Muller, 2012**	+	T										
<i>Harttiella parva</i> Covain & Fisch-Muller, 2012**	T											
<i>Harttiella pilosa</i> Covain & Fisch-Muller, 2012**												
<i>Hemiodontichthys acipenserinus</i> (Kner, 1853)												
<i>Loricaria cataphracta</i> Linnaeus, 1758	T	+	+		+							+

Table I. - Continued.

Taxa	River catchments and localities										Coastline			
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock						
<i>Loricaria nickeriensis</i> Isbrücker, 1979	+			+										
<i>Loricaria</i> aff. <i>paralythabae</i> Steindachner, 1907	T			+								+		
<i>Metaloricaria paucidens</i> Isbrücker, 1975				+								+		
<i>Rineloricaria platyura</i> (Müller & Troschel, 1849)*				+								+		
<i>Rineloricaria</i> aff. <i>stewarti</i> (Eigenmann, 1909)*	+	+	+	+	+							+		
<b>Hypostominae</b>														
<i>Ancistrus</i> aff. <i>hoplogerys</i> (Günther, 1864)	+	+	+	+	+							+		
<i>Ancistrus</i> cf. <i>leucostictus</i> (Günther, 1864)	+	+		+	+							+		
<i>Ancistrus temminckii</i> (Valenciennes, 1840)	+											+		
<i>Ancistrus</i> aff. <i>temminckii</i>	+			+								+		
<i>Guyanancistrus brevispinis</i> (Heitmans, Nijssen & Isbrücker, 1983)*				+								+		
<i>Guyanancistrus longispinis</i> (Heitmans, Nijssen & Isbrücker, 1983)*				+								+		
<i>Guyanancistrus niger</i> (Norman, 1926)*				+								+		
<i>Hemiancistrus medians</i> (Kner, 1854)	T?											+		
<i>Hypostomus gymnorhynchus</i> (Norman, 1926)	+	+	+	+	+							+		
<i>Hypostomus nematopterus</i> Isbrücker & Nijssen, 1984	+	+	+	+	+							+		
<i>Hypostomus plecostomus</i> (Linnaeus, 1758)*	+	+	+	+	+							+		
<i>Hypostomus watwata</i> Hancock, 1828	+	+	+	+	+							+		
<i>Lithoxus boujardi</i> Muller & Isbrücker, 1993	+	+	+	+	+							+		
<i>Lithoxus planquettei</i> Boeseman, 1982	T	+	+	+	+							+		
<i>Lithoxus stocki</i> Nijssen & Isbrücker, 1990	T	+	+	+	+							+		
<i>Panaqolus kobo</i> Fisch-Muller & Covain, 2012*	T	+	+	+	+							+		
<i>Peckoltia otali</i> Fisch-Muller & Covain, 2012*	T											+		
<i>Peckoltia capitulata</i> Fisch-Muller & Covain, 2012**												+		
<i>Peckoltia simulata</i> Fisch-Muller & Covain, 2012**												+		
<i>Pseudacanthicus serratus</i> (Valenciennes, 1840)	+	+	+	+	+							+		
<i>Pseudancistrus barbatus</i> (Valenciennes, 1840)	+	T										+		
<b>Pseudopimelodidae</b>														
<i>Batrochoglanis raninus</i> (Valenciennes, 1840)*	+	T?	+	+	+							+		
<i>Batrochoglanis villosus</i> (Eigenmann, 1912)**	+											+		
<i>Cephalosilurus nigricaudus</i> (Mees, 1974)*	+	+										+		
<i>Microglanis poecilus</i> Eigenmann, 1912	+											+		
<i>Microglanis secundus</i> Mees, 1974	+											+		
<i>Pseudopimelodus bufonius</i> (Valenciennes, 1840)	+	+		+								+		
<b>Heptapteridae</b>														
<i>Chasmocranus brevior</i> Eigenmann, 1912*	+	+										+		
<i>Chasmocranus longior</i> Eigenmann, 1912*	+	+										+		
<i>Heptapterus bleekeri</i> Boeseman, 1953	T											+		

Table I. - Continued.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<i>Heppterus tapanahoniensis</i> Mees, 1967	T	+		+				+				
<i>Imparfinis piperi</i> (Hoedeman, 1961)*	+	+		+								
<i>Mastiglanis</i> aff. <i>asopos</i> Bockmann, 1994*	+			+								
<i>Phenacorhamdia tenuis</i> (Mees, 1986)*	T	+		+				+				
<i>Pinelodella cristata</i> (Müller & Troschel, 1849)	+	+	+	+								
<i>Pinelodella geryi</i> Hoedeman, 1961	T	+	+	+								
<i>Pinelodella leptosoma</i> (Fowler, 1914)*	+	+		+								
<i>Pinelodella macturki</i> Eigenmann, 1912	+	+		+								
<i>Pinelodella megalops</i> Eigenmann, 1912	+	+		+								
<i>Pinelodella procera</i> Mees, 1983	T	+		+								
<i>Rhamdia quelen</i> (Quoy & Gaimard, 1824)	+	+		+								
<b>Pimelodidae</b>												
<i>Brachyplatystoma filamentosum</i> (Lichtenstein, 1819)												
<i>Brachyplatystoma rousseauxii</i> (Castelnau, 1855)*												
<i>Brachyplatystoma vaillantii</i> (Valenciennes, 1840)												
<i>Hemisorubim platyrhynchos</i> (Valenciennes, 1840)	+	+		+								
<i>Hypophthalmus marginatus</i> Valenciennes, 1840*	+	+		+								
<i>Pimelabditus moli</i> Parisi & Lundberg, 2009*	T	+		+								
<i>Pimelodus blochii</i> Valenciennes, 1840*	+	+		+								
<i>Pimelodus ornatus</i> Kner, 1858	+	+		+								
<i>Propimelodus eigenmanni</i> (Van der Stigchel, 1946)*	+	+		+								
<i>Pseudoplatystoma fasciatum</i> (Linnaeus, 1766)	+	+		+								
<i>Pseudoplatystoma tigrinum</i> (Valenciennes, 1840)	+	+		+								
<b>Ariidae</b>												
<i>Amphiliarius phrygiatus</i> (Valenciennes, 1840)*	+											
<i>Amphiliarius rugispinis</i> (Valenciennes, 1840) *	+											
<i>Aspistor quadriscutis</i> (Valenciennes, 1840)*	+											
<i>Bagre bagre</i> (Linnaeus, 1766)	+											
<i>Cathorops arenatus</i> (Valenciennes, 1840)*	+											
<i>Cathorops spixii</i> (Agassiz, 1829)	+											
<i>Notarius grandicassis</i> (Valenciennes, 1840)*	+											
<i>Sciades couma</i> (Valenciennes, 1840)*	+											
<i>Sciades herzbregii</i> (Bloch, 1794)*	+											
<i>Sciades parkeri</i> (Traill, 1832)*	+											
<i>Sciades passany</i> (Valenciennes, 1840)*	+											
<i>Sciades proops</i> (Valenciennes, 1840)*	+											
<b>Doradidae</b>												
<i>Acanthodoras cataphractus</i> (Linnaeus, 1758)												

Table I. - Continued.

Taxa	River catchments and localities								Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock		
<i>Anadoras weddellii</i> Castelnau, 1855*										
<i>Doras carinatus</i> (Linnaeus, 1766)	T	+	+	+		+	+	+	+	
<i>Doras micropoeus</i> (Eigenmann, 1912)*	+	+							+	
<i>Lithodoras dorsalis</i> (Valenciennes, 1840)										+
<i>Platydoras costatus</i> (Linnaeus, 1758)	+									
<i>Platydoras</i> sp.*	+									
<b>Auchenipteridae</b>										
<i>Ageneiosus inermis</i> (Linnaeus, 1766)*	+	+				+	+	+	+	
<i>Ageneiosus ucayalensis</i> Castelnau, 1855*						+	+	+	+	
<i>Auchenipterus dentatus</i> Valenciennes, 1840				+		+	+	+	+	
<i>Auchenipterus nuchalis</i> (Spix & Agassiz, 1829)	+					+	+	+	+	
<i>Glanidium leopardium</i> (Hoedeman, 1961)*	T	+								
<i>Pseudauchenipterus nodosus</i> (Bloch, 1794)	+	+			+					
<i>Tattia brunnea</i> Mees, 1974	+									
<i>Tattia intermedia</i> (Steindachner, 1877)*		+			+					
<i>Trachelyopterus coriaceus</i> Valenciennes, 1840					+					
<i>Trachelyopterus galeatus</i> (Linnaeus, 1766)*	+	+			+					
<b>Order: Gymnotiformes</b>										
<b>Gymnotidae</b>										
<i>Electrophorus electricus</i> (Linnaeus, 1766)	+	+			+				+	
<i>Gymnotus carapo</i> Linnaeus, 1758	+	+			+				+	
<i>Gymnotus coropinae</i> Hoedeman, 1962	+	+			+				+	
<i>Gymnotus</i> sp.										
<b>Sternopygidae</b>										
<i>Archolaemus blax</i> Korringa, 1970	+								+	
<i>Distocyclus</i> sp.**	+									
<i>Japigny kirschbaum</i> Meunier, Jégu & Keith, 2011*	+	T								
<i>Eigenmannia virescens</i> (Valenciennes, 1836)	+	+			+				+	
<i>Rhabdolichops jegui</i> Keith & Meunier, 2000**	T	+								
<i>Sternopygus macurus</i> (Bloch & Schneider, 1801)	+	+			+				+	
<b>Rhamphichthyidae</b>										
<i>Rhamphichthys rostratus</i> (Linnaeus, 1766)	+	+								+
<b>Hypopomidae</b>										
<i>Brachyhypopomus beebei</i> (Schultz, 1944)	+	+			+				+	
<i>Brachyhypopomus brevis</i> (Steindachner, 1868)									+	
<i>Brachyhypopomus pinnicaudatus</i> (Hopkins, 1991)					T					
<i>Hypopomus arredi</i> (Kaup, 1856)	+									+
<i>Hypopygus lepturus</i> Hoedeman, 1962	T	+								+

Table I. - Continued.

Taxa	River catchments and localities								Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock		
<b>Apteronoftidae</b>										
<i>Apteronotus albifrons</i> (Linnaeus, 1766)	+	+			+		+			
<i>Apteronotus</i> aff. <i>albifrons</i>										
<i>Porotergus gymnotus</i> Ellis, 1912	+	+								
<i>Sternarchorhynchus galibi</i> (de Santana & Vari, 2010)**	T									
<i>Sternarchorhynchus</i> aff. <i>oxyrhynchus</i> (Müller & Troschel, 1849)*										
<b>Ordre des Batrachoïdiformes</b>										
<b>Batrachoididae</b>										
<i>Batrachoides surinamensis</i> (Bloch & Schneider, 1801)	+			+			+			+
<b>Order: Mugiliformes</b>										
<b>Mugilidae</b>										
<i>Mugil cephalus</i> Linnaeus, 1758	+						+			+
<i>Mugil incilis</i> Hancock, 1830	+			+			+			+
<i>Mugil liza</i> Valenciennes, 1836	+			+			+			+
<b>Order: Cyprinodontiformes</b>										
<b>Rivulidae</b>										
<i>Kryptolebias marmoratus</i> (Poey, 1880)*	+				+					+
<i>Kryptolebias septia</i> Vermeulen & Hrbek, 2005**	T									
<i>Rivulus agilae</i> Hoedeman, 1954	+		+		+		+			+
<i>Rivulus cladophorus</i> Huber, 1991				T						
<i>Rivulus gaucheri</i> Keith, Nandrin & Le Bail, 2006**	T									
<i>Rivulus geayi</i> Vaillant, 1899	+						+			+
<i>Rivulus holmiae</i> Eigenmann, 1909	+									
<i>Rivulus igneus</i> Huber, 1991	+		+	+			+			+
<i>Rivulus lungi</i> Berkenkamp, 1984	+		+	+			+			+
<i>Rivulus xiphidius</i> Huber, 1979	+		+	+			+			T
<b>Poeciliidae</b>										
<i>Fluviophylax patikar</i> Costa & Le Bail, 1999										
<i>Micropoecilia bifurca</i> (Eigenmann, 1909)				+	+					
<i>Micropoecilia</i> cf. <i>picta</i> (Regan, 1913)				+	+					
<i>Micropoecilia parva</i> (Eigenmann, 1894)				+	+					
<i>Poecilia reticulata</i> Peters, 1859**/**				+	+					
<i>Poecilia vivipara</i> Bloch & Schneider, 1801	+			+	+					
<i>Toneurus gracilis</i> Eigenmann, 1909				+	+					
<b>Anablepidae</b>										
<i>Anableps anableps</i> (Linnaeus, 1758)	+				+		+			+
<i>Anableps microlepis</i> Müller & Troschel, 1844					+		+			+

Table I. - Continued.

Taxa	River catchments and localities										Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock				
<b>Belontiidae</b>												
<i>Potamorhaphis guianensis</i> (Jardine, 1843)	+	+	+	+								+
<i>Pseudotilosturus microps</i> (Günther, 1866)**	+	+				+						+
<b>Order: Gasterosteiformes</b>												
<b>Syngnathidae</b>												
<i>Microphis lineatus</i> (Bleeker, 1853)**					+							
<b>Order: Synbranchiiformes</b>												
<b>Synbranchidae</b>												
<i>Synbranchus marmoratus</i> Bloch, 1795	+	+	+	+	+							+
<b>Order: Perciformes</b>												
<b>Centropomidae</b>												
<i>Centropomus parallelus</i> Poey, 1860	+			+	+							+
<i>Centropomus undecimalis</i> (Bloch, 1792)	+			+	+							+
<b>Serranidae</b>												
<i>Epinephelus itajara</i> (Lichtenstein, 1822)	+											+
<b>Carangidae</b>												
<i>Caranx hippos</i> (Linnaeus, 1766)	+			+								+
<i>Caranx latus</i> Agassiz, 1831	+			+								+
<i>Oligoplites saliens</i> (Bloch, 1793)	+			+								+
<i>Trachinotus cayennensis</i> Cuvier, 1832	+			+								+
<i>Trachinotus falcatus</i> (Linnaeus, 1758)	+			+								+
<b>Lutjanidae</b>												
<i>Lutjanus joca</i> (Bloch & Schneider, 1801)				+								+
<b>Sciaenidae</b>												
<i>Cynoscion acoupa</i> (Lacepède, 1801)				+								+
<i>Macrondon ancylodon</i> (Bloch & Schneider, 1801)				+								+
<i>Nebris microps</i> Cuvier, 1830					+							+
<i>Pachypops fourcroyi</i> (Lacepède, 1802)	+											+
<i>Plagioscion auratus</i> (Castelnau, 1855)		+										+
<i>Plagioscion squamosissimus</i> (Heckel, 1840)*	+	+	+	+	+							+
<b>Polycentridae</b>												
<i>Polycentrus schomburgkii</i> Müller & Troschel, 1849*	+	+	+	+	+							+
<b>Cichlidae</b>												
<i>Acaronia nassa</i> (Heckel, 1840)												+
<i>Aequidens palaoeuenensis</i> Kullander & Nijssen, 1989	T											+
<i>Aequidens tetramerus</i> (Heckel, 1840)	+	+	+	+	+							+
<i>Apistogramma gosseii</i> Kullander, 1982					+							T

Table I. - Continued.

Taxa	River catchments and localities								Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock		
<i>Astronotus ocellatus</i> (Agassiz, 1831)						+	+	+	Taparabu	
<i>Chaetobranchopsis australis</i> Eigenmann & Ward, 1907				+	+				Taparabu	
<i>Chaetobranchius flavescens</i> Heckel, 1840					+				Taparabu	
<i>Cichla monocultus</i> Spix & Agassiz, 1831									Taparabu	
<i>Cichla ocellaris</i> Bloch & Schneider, 1801									Taparabu	
<i>Cichlasoma anazonarum</i> Kullander, 1983	+								+	
<i>Cichlasoma bimaculatum</i> (Linnaeus, 1758)	+	+	+	+	+	+			Kaw	
<i>Cleithracara maronii</i> (Steindachner, 1881)	T	+	+	+	+	+			+	
<i>Crenicichla albopunctata</i> Pellegrin, 1904	T	+	+	+	+	+			+	
<i>Crenicichla alta</i> Eigenmann, 1912		T								
<i>Crenicichla johanna</i> Heckel, 1840		+							+	
<i>Crenicichla multispinosa</i> Pellegrin, 1903	T	+							+	
<i>Crenicichla saxatilis</i> (Linnaeus, 1758)	+	+	+	+	+	+			+	
<i>Crenicichla ternetzi</i> Norman, 1926									T	
<i>Geophagus camopiensis</i> Pellegrin, 1903									+	
<i>Geophagus harreri</i> Gosse, 1976	T								+	
<i>Geophagus surinamensis</i> (Bloch, 1791)	+	+							Kaw	
<i>Guianacara geayi</i> (Pellegrin, 1902)	+								+	
<i>Guianacara oelemariensis</i> Kullander & Nijssen, 1989	T									
<i>Guianacara owroewefi</i> Kullander & Nijssen, 1989	T	+								
<i>Heros efasciatus</i> Heckel, 1840										
<i>Hypselecara temporalis</i> (Günther, 1862)										
<i>Kribia</i> aff. <i>guyanensis</i> sp. 1		+	Yiyi	+	+	+			Kaw	+
<i>Kribia</i> aff. <i>guyanensis</i> sp. 2		+	Yiyi	+	+	+				+
<i>Kribia itanyi</i> (Puyo, 1943)	T	+								
<i>Laetacara</i> cf. <i>curviceps</i> (Ahl, 1923)										
<i>Mesonauta guyanae</i> Schindler, 1998										
<i>Nannacara anomala</i> Regan, 1905	+									
<i>Nannacara aureocephalus</i> Allgayer, 1983		T								
<i>Nannacara</i> sp.										
<i>Pterophyllum scalare</i> (Schultze, 1823)										
<i>Retroculis septentrionalis</i> Gosse, 1971										
<i>Satanoperca jurupari</i> (Heckel, 1840)										
<i>Satanoperca rhychiitis</i> Kullander, 2012*										
<b>Eleotridae</b>										
<i>Dormitator maculatus</i> (Bloch, 1792)										
<i>Eleotris amblyopsis</i> (Cope, 1871)**		+								+
<i>Eleotris pisonis</i> (Gmelin, 1789)	+	+	Yiyi	+	+	+			Kaw	+



RESULTS AND DISCUSSION

Biodiversity

The checklist (Tab. I) contains 416 species, of which 367 are strictly freshwater (Tab. II). The total number of species is therefore lower than the 480 given by Keith *et al.* (2000), mainly because the more restrictive definition used in this list (see “Notes accompanying the Checklist of freshwater fishes from French Guiana”) means that fewer brackish water species are included. The number of freshwater species is slightly lower in French Guiana than in Suriname (367 vs. 394; Mol *et al.*, 2012), although Suriname is much larger (84,000 vs. 163,820 km<sup>2</sup>), giving an appreciably higher diversity for French Guiana (4.1 vs. 2.4 species/1000 km<sup>2</sup>). This difference can be at least partly explained by the different topographical structure of the two regions. The coastal plain savannahs are much more extensive in Suriname than in French Guiana, where the Guiana Shield is increasingly close to the coast the nearer one gets to Cayenne. The estuarine zone of Suriname’s rivers is therefore much larger on average, reducing the area of rheophile habitats. These habitats host a particularly diversified and sometimes very specialized fauna, and regularly reveal new taxa (see, e.g., Covain *et al.*, 2012; Fisch-Muller *et al.*, 2012; Lundberg *et al.*, 2012). Conversely, the savannah zone almost certainly encourages the exchange of non-territorial, biologically adaptable species between catchment areas, reducing the likelihood of endemic forms emerging. Furthermore, the Amazonian fauna of the Oyapock helps increase the species richness of French Guiana in comparison with Suriname.

A catchment by catchment analysis (Tab. II) underlines the relative importance of different rivers in terms of species richness and contribution to the overall freshwater ichthyofauna of French Guiana. The Maroni River basin undoubtedly has largest number of strictly freshwater species (n = 242), two thirds (66%) of those known from French Guiana. This is largely explained by the size of its catchment area (65,830 km<sup>2</sup>), which is over twice that of the Oyapock (26,820 km<sup>2</sup>), the second largest river in this territory. The latter, like the Mana, contains just under half the species (46% and 47%), though the catchment of one is twice the size of the other (26,820 as against 12,090 km<sup>2</sup>). A third group of rivers, comprising the Approuague, the Sinnamary and the Comté-Orapu, supports around 40% of the species (40%, 37% and 39%, respectively) with catchment areas varying up to a factor of three

Table I. - End.

Taxa	River catchments and localities								Coastline	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock		
<b>Gobiidae</b>										
<i>Awatous flavus</i> (Valenciennes, 1837)**	+									
<i>Awatous tajasica</i> (Lichtenstein, 1822)**	+									
<i>Ctenogobius phenacus</i> (Pezold & Lasala, 1987)**					+	T				
<b>Ephippidae</b>										
<i>Chaetodipterus faber</i> (Broussonet, 1782)								+		+
<b>Order: Pleuronectiformes</b>										
<b>Paralichthyidae</b>										
<i>Syacium gunteri</i> Ginsburg, 1933	+			+						+
<b>Achiridae</b>										
<i>Achirus achirus</i> (Linnaeus, 1758)	+							+		+
<b>Cynoglossidae</b>										
<i>Symphurus plagusia</i> (Bloch & Schneider, 1801)	+							+		+
<b>Order: Tetraodontiformes</b>										
<b>Tetraodontidae</b>										
<i>Colomesus psittacus</i> (Bloch & Schneider, 1801)	+							+		+
<i>Sphoeroides testudineus</i> (Linnaeus, 1758)								+		+
<b>Order: Lepidosireniformes</b>										
<b>Lepidosirenidae</b>										
<i>Lepidosiren paradoxa</i> Fitzinger, 1837						Macouria			Kaw	

Table II. - Species richness and diversity in French Guiana, arranged by river basin. Species are regarded as strictly freshwater if the entire life cycle takes place in fresh water. Diversity is expressed as the number of species per 1000 km<sup>2</sup>.

	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté-Orapu	Approuague	Oyapock	French Guiana
Total number of species	279	176	78	156	108	160	188	204	416
Number of marine cycle species	37	5	2	19	14	17	39	34	50
Number of strictly freshwater species	242	170	76	137	94	143	149	170	366
Percentage of strictly freshwater species	66	47	21	37	26	39	40	46	100
Catchment area (km <sup>2</sup> )	65,830	12,090	1,470	6,565	2,000	3,255	10,250	26,820	84,000
Number of freshwater species per 1000 km <sup>2</sup>	3.68	14.06	51.70	20.87	47.00	43.93	14.54	6.34	4.07

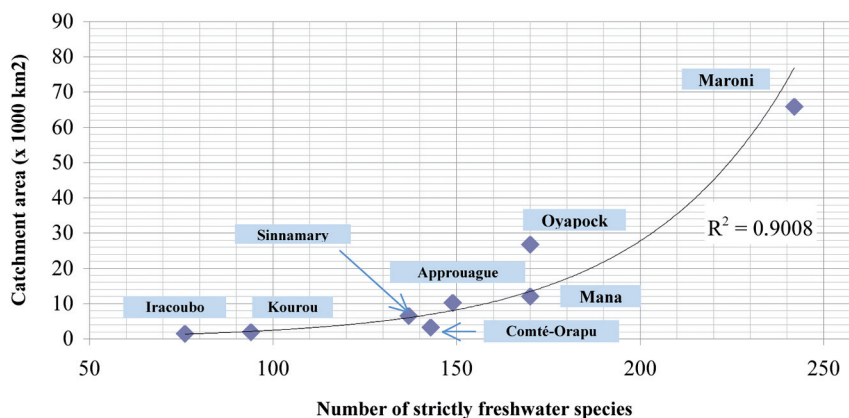


Figure 2. - Relationship between the number of strictly freshwater fish in each catchment and the size of the catchment area. The number of species per site includes those of the main basin (e.g., the Approuague) and those of nearest sites (e.g., the Kaw River and Swamp).

(10,250, 6,565 and 3,255 km<sup>2</sup> respectively). The final group comprises the two smallest rivers, the Kourou and the Iracoubo, and contains about a quarter of the species (26% and 21% respectively) for similar catchment areas (2,000 and 1,470 km<sup>2</sup> respectively). Analysis of diversity (number of species for a given area) in the different catchments shows a classic reduction in species richness as a function of the size of the catchment area (Tab. II), with values (51.7 and 3.7 species per 1000 km<sup>2</sup> for the Iracoubo and the Maroni respectively) that are globally lower but of the same order of magnitude as those previously published (Meunier *et al.*, 1998). The relationship between the area of the rivers and the number of strictly freshwater species they support is given in figure 2. As expected (Albert *et al.*, 2011), most of the rivers lie on an exponential regression curve ( $R^2 = 0.90$ ). In the Maroni, the slightly higher than expected number of species may indicate a zone of more marked exchanges between basins. The other two exceptions are the Comté-Orapu and the Oyapock. The higher than expected species richness of the Comté-Orapu can be explained partly by its connection with the Gabrielle Savannah, a large species-rich swamp zone, and partly by its position on the boundary between the Amazonian influence to the east and that of the Guiana Shield to the west. Conversely, the lower than expected number of species as a function of catchment area found in the Oyapock may be explained by the fact that certain biotopes have not been surveyed or sampled. These include wetland habitats such as swamp, pripi and flooded savannah, which contain many species distinct from those of

the main watercourses. By incorporating the 15 species from the Taparabu Flooded Savannah (as yet poorly sampled), situated on the Brazilian bank of the Oyapock and connected in the estuarine zone, one can partially correct for the deviation with respect to the curve, but the fact remains that the Oyapock has not been explored to the same extent as other large rivers in French Guiana.

Analysis of the relative importance of the large taxonomic groups (> 10 species) present in French Guiana (Tab. III) shows, as expected, that the two best represented taxonomic groups among the freshwater species are the Characiformes (n = 151, i.e., 41%, with the Characidae alone comprising 23%) and the Siluriformes (n = 120, i.e., 33%, with the Loricariidae alone comprising 11%). With the Perciformes, which represent 13% of the total number of species (10% being Cichlidae), these three groups account for almost 90% of the fish diversity of French Guiana. The Characiformes are almost as well represented as they are among the freshwater ichthyofauna of Suriname (n = 145, i.e., 37.1%), though the Siluriformes seem slightly more important in Suriname (n = 170, of which 157 are freshwater, i.e., 40.2%; Mol *et al.*, 2012). These results corroborate the finding of Vari and Ferraris (2009) for the Guiana Shield (Characiformes: 41%, Siluriformes: 36%, and Perciformes: 11%).

It may be observed that the relative abundance of each taxonomic group in the different river basins (to which have been added species from the same geographical zone, see table III) is not always proportional to the total number of species present in the catchment area. The Maroni is the most

Table III. - Relative abundance of the principal strictly freshwater taxonomic groups (> 10 species) in the catchments of French Guiana. The relative abundance of each taxonomic group (orders and large families) in each catchment is expressed as a percentage of the total number of species of the same group for the whole of French Guiana. The number of species per site includes those of the main basin (e.g. the Approuague) and those of nearest sites (e.g., the Kaw River and Swamp). The comparisons are based on the number of strictly freshwater species present in French Guiana.

Taxa	Catchments + surrounding areas								French Guiana	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté-Orapu	Approuague	Oyapock	Species number	% of total number of species
<b>Characiformes</b>	<b>73.5</b>	<b>54.3</b>	<b>25.8</b>	<b>39.1</b>	<b>24.5</b>	<b>40.4</b>	<b>58.9</b>	<b>47.7</b>	<b>151</b>	<b>41.1</b>
Characidae	72.1	54.7	26.7	34.9	20.9	39.5	52.3	47.7	86	23.4
Anostomidae	71.4	64.3	14.3	50.0	14.3	21.4	35.7	50.0	14	3.8
Curimatidae	80.0	60.0	30.0	30.0	30.0	40.0	50.0	40.0	10	2.7
<b>Siluriformes</b>	<b>61.7</b>	<b>40.8</b>	<b>20.8</b>	<b>34.2</b>	<b>21.7</b>	<b>32.5</b>	<b>46.7</b>	<b>46.7</b>	<b>120</b>	<b>32.7</b>
Loricariidae	66.7	40.5	14.3	35.7	14.3	26.2	35.7	47.6	42	11.4
Callichthyidae	45.5	18.2	22.7	18.2	18.2	31.8	45.5	31.8	22	6.0
Heptapteridae	92.9	71.4	21.4	50.0	21.4	35.7	71.4	50.0	14	3.8
Pimelodidae	60.0	40.0	10.0	40.0	30.0	30.0	60.0	80.0	10	2.7
Auchenipteridae	60.0	60.0	20.0	50.0	70.0	60.0	80.0	70.0	10	2.7
<b>Gymnotiformes</b>	<b>76.2</b>	<b>61.9</b>	<b>23.8</b>	<b>28.6</b>	<b>38.1</b>	<b>33.3</b>	<b>61.9</b>	<b>52.4</b>	<b>21</b>	<b>5.7</b>
<b>Cyprinodontiformes</b>	<b>58.8</b>	<b>35.3</b>	<b>23.5</b>	<b>58.8</b>	<b>64.7</b>	<b>64.7</b>	<b>47.1</b>	<b>29.4</b>	<b>17</b>	<b>4.6</b>
Rivulidae	90.0	30.0	40.0	50.0	60.0	60.0	50.0	50.0	10	2.7
<b>Perciformes</b>	<b>42.9</b>	<b>32.7</b>	<b>22.4</b>	<b>30.6</b>	<b>34.7</b>	<b>34.7</b>	<b>38.8</b>	<b>59.2</b>	<b>49</b>	<b>13.4</b>
Cichlidae	36.8	34.2	21.1	28.9	23.7	36.8	47.4	65.8	38	10.4
<b>Others</b>	<b>44.4</b>	<b>44.4</b>	<b>22.2</b>	<b>33.3</b>	<b>22.2</b>	<b>44.4</b>	<b>44.4</b>	<b>66.7</b>	<b>9</b>	<b>2.5</b>
<b>Total</b>	<b>64.3</b>	<b>46.3</b>	<b>23.4</b>	<b>36.5</b>	<b>27.5</b>	<b>37.9</b>	<b>51.5</b>	<b>48.8</b>	<b>367</b>	<b>100.0</b>

speciose river basin, supporting 64% of the total number of Guianese species. In the Maroni, the Characiformes (representing 74% of the total number of Characiformes species in the whole French Guiana, and in particular the Curimatidae at 80%), the Gymnotiformes (76%), the Heptapteridae (93%) and the Rivulidae (90%) are over-represented. Conversely, the Callichthyidae (45%) and the Cichlidae (37%) are under-represented. The same general trend is observed in the Mana, which connects with the Maroni in the coastal zone. In the small rivers (the Iracoubo, the Kourou and the Comté-Orapu) to which one can add the Approuague, which shows the same trend, the Anostomidae and the Loricariidae are under-represented, while the Auchenipteridae are over-represented. This no doubt reflects the character of these rivers, which are predominantly lentic. The Oyapock (49% of the ichthyofauna of French Guiana) and the Sinnamary (37%) show a shortfall in the Callichthyidae (32% and 18%, respectively) and over-representation of the Auchenipteridae (70% and 50%, respectively). The over-representation of the Pimelodidae (80%) in the Oyapock may be partly explained by the presence of large representatives (*Brachyplatystoma*, *Pseudoplatystoma*) that one mainly finds in this river. Without reading too much into these findings, particularly where there are only a few species in the group, one observes an over-representation of the Cyprinodontiformes in the zone between the Iracoubo and the Comté-Orapu. This may be an artefact linked to better knowledge of biotopes favouring the

Rivulidae in this zone where the human population is much denser than elsewhere. The lack of biotopes suitable for the Poeciliidae in the costal zone of large rivers like the Mana, the Approuague and the Oyapock is another plausible explanation.

#### Rates of endemism

Most of the species without settled taxonomic status ( $n = 33$ ) following initial morphological examination have been considered species new to science and included when calculating the rates of endemism. It is possible that cryptic species remain to be discovered, which could alter the number of endemic species and the analysis of their biogeographical distribution. The absolute value for the rate of endemism should therefore be treated with caution pending formal descriptions. There are 87 endemic species, giving French Guiana a rate of endemism of around 24% for the strictly freshwater species. This result is directly comparable to the rate obtained for Suriname (22.6%; Mol *et al.*, 2012). Interestingly, both estimates are significantly lower than the one provided for the Eastern Guiana ecoregion corresponding to Suriname and French Guiana (38%; Albert *et al.*, 2001). Only species with a geographical distribution less than or equal to three adjacent catchments have been considered endemic. However, there are species with larger distribution areas that are present only in French Guiana or only in the catchments adjacent to French Guiana (*Astyanax vali-*

Table IV. - Rates of endemism in the principal strictly freshwater taxonomic groups (> 10 species) in the catchments of French Guiana. Species with a distribution less than or equal to three adjacent catchments are considered as endemic. Results are expressed as number of species, unless otherwise stated. The number of species per site includes those of the main basin (e.g. the Approuague) and those of nearest sites (e.g. the Kaw River and Swamp). The comparisons are based on the number of strictly freshwater species present in French Guiana.

Taxa	Number of endemic species per catchment + surrounding areas								French Guiana	
	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock	Number of endemic species	% of total number of species in taxa
<b>Characiformes</b>	<b>18</b>	<b>10</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>9</b>	<b>12</b>	<b>39</b>	<b>25.8</b>
Characidae	12	6	2	1	1	4	7	9	27	31.4
Anostomidae	1	1	0	0	0	0	0	2	3	21.4
Curimatidae	2	2	1	0	0	0	1	0	3	30.0
<b>Siluriformes</b>	<b>13</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>10</b>	<b>29</b>	<b>24.2</b>
Loricariidae	10	2	0	1	0	2	3	7	20	47.6
Callichthyidae	0	0	0	0	0	2	2	3	7	31.8
Heptapteridae	1	0	0	0	0	0	0	0	1	7.1
Pimelodidae	1	0	0	0	0	0	0	0	1	10.0
Auchenipteridae	0	0	0	0	0	0	0	0	0	0.0
<b>Gymnotiformes</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>19.0</b>
<b>Cyprinodontiformes</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>23.5</b>
Rivulidae	2	0	0	1	1	1	0	0	3	30.0
<b>Perciformes</b>	<b>6</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>11</b>	<b>22.4</b>
Cichlidae	6	3	0	0	0	0	3	5	11	28.9
<b>Others</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.0</b>
<b>Total number per catchment</b>	<b>40</b>	<b>16</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>10</b>	<b>19</b>	<b>30</b>	<b>87</b>	<b>23.7</b>
<b>% of the total number per catchment</b>	<b>16.9</b>	<b>9.4</b>	<b>3.5</b>	<b>2.2</b>	<b>4.0</b>	<b>7.2</b>	<b>10.1</b>	<b>16.8</b>	<b>23.7</b>	

us, *Hemigrammus guianensis*, *Hyphessobrycon borealis*, *Moenkhausia inrai*, etc.). Our calculation method, therefore, markedly reduces the rate of endemism for French Guiana as a whole.

Catchment by catchment analysis (Tab. IV) indicates that the rates of endemism are strongly correlated with catchment size ( $r = 0.82$ ;  $p = 0.013$ ). Thus, the rate of endemism is highest, almost 17%, in the two largest basins, the Maroni and the Oyapock, while the lowest rate (2.2%) is found in the Sinnamary. If we consider the distribution of endemic species within their respective taxonomic groups we see that for the best represented orders (Characiformes, Siluriformes, Gymnotiformes, Cyprinodontiformes and Perciformes) there is little difference between their rates of endemism (25.8%, 24.2%, 19%, 23.5% and 22.4%, respectively) and that calculated for French Guiana as a whole (23.7%). However, the rates of endemism within families are much more variable. Rates of endemism among the Loricariidae (47.6%), the Characidae, the Curimatidae, the Callichthyidae, the Rivulidae and the Cichlidae (around 30%) are appreciably higher than the average value for French Guiana. Most of the species in these families are rheophile species inhabiting the upper sections of rivers, and/or territorial species that tend not to migrate. Conversely, the rates of endemism

for the Heptapteridae (7.1%) and the Pimelodidae (10%) are considerably lower than the value for French Guiana. These families, especially the Heptapteridae, comprise numerous small and poorly known species, and this low value could be the outcome of our poor knowledge of these taxa. The Heptapteridae, includes many small species that occupy microhabitats such as holes in submerged trunks which are difficult to sample, and could therefore represent an important hidden diversity (e.g. cryptic species).

#### Biogeographic relationships between the rivers

The table V shows the number of species shared between the different catchments of French Guiana. After standardization of the data (relating them to the total surface of the two catchments compared following the method used in Albert *et al.*, 2011) three trends are revealed:

From a strictly quantitative point of view (i.e., without considering the species independently), all rivers display a regular pattern showing a decrease in the number of species shared with their successive neighbouring catchments. For example, taking the Maroni as the reference point, we see that the proportion of species shared between it and the other rivers follows a steadily declining gradient as far as the Oyapock (around 8.5 for the Mana, 6.0 for the Sinnamary,

Table V. - Number of species common to the different catchments and adjacent areas. The figures below the diagonal line represent the number of species shared between the catchments and adjacent areas, taken in pairs (see legend in table III). The figures above the diagonal line represent the standardized number of species shared between the catchments and adjacent areas using the equation:  $C = S_C/A^b$  where  $S_C$  represent the number of common species between pairwise compared rivers, A represents the sum of surfaces of the pairwise compared rivers, and b represents the species-area scaling exponent; b is obtained by the slope of the log-log species-area regression (see Fig. 2).

	Maroni	Mana	Iracoubo	Sinnamary	Kourou	Comté Orapu	Approuague	Oyapock
Maroni	-	8.5	4.1	6.0	4.1	5.7	6.6	5.4
Mana	158	-	6.0	8.4	5.7	8.0	8.2	6.2
Iracoubo	74	71	-	6.9	7.5	8.3	6.2	4.7
Sinnamary	109	108	71	-	7.5	9.4	8.8	6.4
Kourou	73	68	62	79	-	9.2	6.9	4.9
Comté-Orapu	103	98	75	102	85	-	9.8	6.7
Approuague	123	111	71	110	80	116	-	7.8
Oyapock	105	96	67	96	71	97	119	-

6.6 for the Approuague and 5.4 for the Oyapock).

Larger rivers share more common species with more numerous and distant drainages than smaller rivers (mostly the rivers of central French Guiana: Iracoubo, Sinnamary, Kourou, Comté-Orapu).

Using a Mantel test to relate the number of shared species to the distance between basins (using distances between river mouths to estimate the between-river distances) revealed no correlation (Mantel = 0.2715;  $p = 0.095$ ).

These observations reveal a highly complex pattern of faunal exchanges between basins, with numerous alternative pathways used according to the species. For example, the small coastal rivers share a relatively similar ichthyofauna, probably due to easier exchanges in the coastal swamps and seasonally flooded savannahs. Exchanges *via* headwaters were also highlighted in a species of *Guyanancistrus* (Cardoso and Montoya-Burgos, 2009) and could concern other species from headwaters. The Oyapock seems to belong to a relatively distinct biogeographic zone of French Guiana, strongly influenced by the Amazon basin, as may be seen from the species found in the Taparabu savannahs (*Pygocentrus nattereri*, *Serrasalmus maculatus*, *Anadoras regani*, *Cichla monoculus*, *Hypselecar temporalis*, *Pterophyllum scalare*, etc.) or caught by American Indians living in the swamps (*Arapaima gigas*). The zone between the Oyapock and the Approuague seems to act as a biogeographical barrier for lowland species (but see also Kullander, 2012) due to the lack of exchange zones (freshwater swamps, flooded savannahs), resulting from the palaeographic history of this landscape (Jégu and Keith, 1999). Nevertheless, due to the high complexity of the distribution patterns observed within French Guiana, additional investigation of species using different dispersal strategies is required for a better understanding of the different dispersion processes.

## Outlook

The results obtained during this revision of the check-

list of freshwater fish of French Guiana show that considerable progress has been made over recent years in our knowledge of fish diversity in this region. They also show the gaps that need to be filled if we are to have a global vision of the diversity and distribution of fish in French Guiana. First of all, it is necessary to clarify the taxonomic position of species whose status remains uncertain and, in the case of new species, to describe them. This would allow legal protection of these often rare taxa. We

also need to improve our knowledge about biodiversity by exploring zones that are difficult to access, little visited or poorly surveyed. Efforts over recent years to study the upper catchment areas have revealed the presence of taxa that had never been found in French Guiana, for example representatives of the genus *Harttiella*, with the discovery of no fewer than six new species (Covain *et al.*, 2012). Investigations must be pursued in these areas, but also in the interior lentic zones, particularly of the Oyapock, which seems poorly surveyed, and in the Tumuc-Humac region, which is still little known.

At the request of the Direction régionale de l'environnement (DIREN) of French Guiana, a short report on introduced and potentially invasive species was produced (Cambou and Thonnel, 2010). This cites two activities as the cause of fish introductions. Since 1970, various attempts to develop pisciculture have led to the importation of exotic species such as *Ctenopharyngodon idella* (grass carp), *Cyprinus carpio* (common carp) and tilapia. The latter is most probably *Oreochromis mossambicus*, illegally imported from Suriname, where it is commercially produced and is present in natural habitats (Kullander and Nijssen, 1989; Fitzsimmons, 2000). These species, whose naturalisation in tropical habitats is well attested, are liable to have a negative impact on the native species (Lever, 1996). It is very likely that fish have escaped in French Guiana, in the Comté and Kourou rivers, but recent investigations have not found evidence of established populations. Guianese aquaria catering for amateur fishkeeping import numerous tropical species, some of them from other parts of South America. When amateur aquarists leave the area they prefer to release the species they have raised into the wild rather than killing them. Cambou and Thonnel (2010) report that *Corydoras* sp., *Poecilia reticulata* (guppies) and *Hyphessobrycon eques* (serpae tetras) may be present in natural habitats. Only the two last named species have been observed by the current authors. The status of the cichlid *Heros efasciatus* is ambiguous. Keith *et al.*

(2000) report its possible exotic origin following a release into the Kourou zone by an amateur aquarist in 1980-82. But since then the species has been reported from pripi Yiyi as far as the Kaw Swamp, with captures in the estuarine zones, showing its alarming capacity to extend its range. It cannot, therefore, be ruled out that the native population present in the Taparabu (a catchment east of the Oyapock; Jégu and Keith, 1999) is the source of the current extension in French Guiana. Genetic analysis of the populations in the different catchments should settle this question.

Climate change has already been suggested as the cause of biodiversity changes in French Guiana. Over the last 50 years a rise of around 2°C in the average annual temperature has been observed in some zones, which may be the cause of deterioration in plant biodiversity (Fonty *et al.*, 2009). This warming could alter the flow rates and vegetation cover of the rivers. It could also have biological implications for some species, for example, altering the sex ratio of *Hoplosternum littorale* (Hostache *et al.*, 1995), with the risk of disrupting population dynamics. It is important to extend genetic studies of populations of species common to different rivers, such as the work carried out on *Guyanancistrus brevispinis* by Cardoso and Montoya-Burgos (2009), in order to better understand the gene flow and identify the exchange zones. The information gained from these various measures will enable us to better understand the potential risks to fish diversity and, where appropriate, take action to limit their impact. These approaches must be coupled with biological and ecological studies of the species. Tejerina-Garro *et al.* (2006) developed a river quality index based on species assemblages to help the monitoring of French Guiana rivers to meet the European Water Framework Directive recommendations (see de Mérona *et al.*, 2012). These complementary studies and tools will help to highlight vulnerable stages of species life cycle and allow better management of the anthropic pressures (fishing by local populations, agriculture, urbanism, etc) in sensitive zones, and priority protection measures in the case of gold mining activities (Mol and Outbater, 2004; Mol *et al.*, 2012) particularly for the most vulnerable species (Jégu and Keith, 2005; Covain *et al.*, 2012; Mol *et al.*, 2012). This will facilitate the implementation of sustainable exploitation of the fish stocks (Jégu *et al.*, 2003; de Figueiredo Silva *et al.*, 2012). The first phases of this programme should, as a priority, be implemented in protected zones such as the Parc amazonien de Guyane and the regional reserves.

#### NOTES ACCOMPANYING THE CHECKLIST OF FRESHWATER FISHES OF FRENCH GUIANA

The main differences between the “Atlas des poissons d’eau douce de Guyane” (Planquette *et al.*, 1996; Keith *et al.*, 2000; Le Bail *et al.*, 2000) and the present checklist

(Tab. I, species names marked with an asterisk), excluding new discoveries and records (see Tab. I, species names marked with a double asterisk), are listed below. These notes also cover species cited for French Guiana but not included in the Checklist.

#### Potamotrygonidae

Some specimens previously identified as *Potamotrygon hystrix* correspond to the recent description of *P. marinae* and have therefore been placed under the latter name. Other specimens have been retained under the name *P. hystrix* pending clarification of the taxonomic status of *Potamotrygon* in French Guiana.

#### Parodontidae

*Apareiodon gransabana* Starnes & Schindler, 1993, cited by Pavanelli (*in Vari et al.*, 2009), has not been observed in French Guiana during the last 30 years and has been excluded from the list pending more concrete data.

#### Curimatidae

*Cyphocharax* cf. *gouldingi* becomes *Cyphocharax gouldingi*.

#### Anostomidae

The presence of *Leporinus arcus* Eigenmann, 1912 in French Guiana is considered doubtful as it has not been confirmed during the last 30 years (see also species distribution in Sidlauskas and Vari, 2012).

*Leporinus despaxi* becomes *Hypomasticus despaxi* (Sidlauskas & Vari, 2008).

The two subspecies *Leporinus friderici acutidens* and *L. f. friderici* were raised to species level.

The two subspecies *Leporinus maculatus maculatus* and *L. m. pellegrini* were raised to species level.

*Leporinus badueli* Puyo, 1948, listed for French Guiana by Vari (*in Vari et al.*, 2009), was considered synonymous with *L. granti* by Géry *et al.* (1991). A detailed comparison of material from across the Guianas is needed before considering the species valid (B. Sidlauskas, pers. comm.).

*Leporinus leschenaulti* Valenciennes, 1850 was considered synonymous with *L. friderici* by Géry and Planquette (1983), and *Leporinus spilopleura* Norman, 1926 was considered synonymous with *L. acutidens* by Géry *et al.* (1991). Both species, cited by Vari (*in Vari et al.*, 2009), are very similar to *L. friderici* and their validity needs to be confirmed (B. Sidlauskas, pers. comm.).

#### Crenuchidae

*Characidium fasciadorsale* is a junior synonym of *C. zebra* (Buckup, 1992).

*Characidium* n. sp. becomes *Characidium* sp. 1.

*Melanocharacidium* cf. *blennioides* is here *M. blennioides*.

### Characidae

*Bryconamericus* sp. 1 aff. *stramineus* is replaced by the recently described *B. guyanensis*.

*Knodus heteresthes* reverts back to *Bryconamericus heteresthes* (Román-Valencia, 2002).

*Bryconamericus* sp. 1 aff. *hyphesson* is replaced by *Bryconamericus* aff. *hyphesson*.

*Hemigrammus* aff. *schmardae* has been described as *H. ora*.

*Hemigrammus unilineatus cayennensis* is *H. unilineatus*.

*Hyphessobrycon* aff. *sovichthys* has been described as *H. borealis*.

*Hyphessobrycon callistus* is a junior synonym of *H. eques* (Weitzman and Palmer, 1997).

*Megalampodus roseus* becomes *Hyphessobrycon roseus* (Weitzman and Palmer, 1997).

*Pseudopristella simulata* becomes *Hyphessobrycon simulatus* (Weitzman and Palmer, 1997).

*Astyanax abramoides*, *A. keithi*, *A. maroniensis*, *A. meunieri* and *A. ocellatus* become *Jupiaba abramoides*, *J. keithi*, *J. maroniensis*, *J. meunieri* and *J. ocellata* (Zanata, 1997).

*Moenkhausia* cf. *lata* is reidentified as *M. lata*.

*Moenkhausia megalops* (Eigenmann, 1907) cited by Lima (in Vari *et al.*, 2009) has never been confirmed in French Guiana and is excluded from the current checklist.

*Moenkhausia* aff. *simulata*, described as *M. rara*, was changed to *Tetragonopterus rarus* (Melo *et al.*, 2011).

*Triportheus brachipomus* formerly placed in synonymy with *T. rodontatus* is a valid species (Malabarba, 2004).

*Metynniscus* cf. *lippincottianus* is confirmed as *M. lippincottianus*.

*Myleus rhomboidalis*, *Me. rubripinnis* and *Me. ternetzi* become *Myloplus rhomboidalis*, *Mo. rubripinnis* and *Mo. ternetzi* (Orti *et al.*, 2008).

*Serrasalmus humeralis* becomes *Pristobrycon eigenmanni* (Meunier *et al.*, 2004).

*Serrasalmus striolatus* becomes *Pristobrycon striolatus* (Jégu in Reis *et al.*, 2003).

*Serrasalmus denticulatus* becomes *Pygopristis denticulata* (Jégu in Reis *et al.*, 2003).

*Mylesinus* ? sp. 1 has been described as *Tometes lebaili*.

*Myleus pacu* was replaced by *Tometes trilobatus* (Jégu *et al.*, 2002).

*Charax pauciradiatus* is replaced partly by *C. niger* and partly by *C. aff. pauciradiatus*.

*Phenacogaster* aff. *megalostictus* is replaced partly by *P. aff. pectinatus*, and partly by the two recently described *P. wayampi* and *P. wayana*.

*Roeboides thurni* Eigenmann, 1912, considered a junior synonym of *R. affinis* (Günther, 1868) by Lucena (2007),

was cited from French Guiana by Menezes and Lucena (in Vari *et al.*, 2009). It has not been observed in French Guiana by the authors and is therefore not included in the current list.

*Odontostilbe gracilis gracilis* and *O. g. littoris* become *Odontostilbe gracilis* and *O. littoris*.

### Acestrorhynchidae

*Acestrorhynchus guianensis* is a junior synonym of *A. microlepis* (Toledo-Piza and Menezes, 1996).

### Erythrinidae

*Hoplerythrinus gronovii* (Valenciennes, 1847), the provenance of which is uncertain, is probably a synonym of *H. unitaeniatus*, to which the material we have collected in French Guiana is referable. Despite its citation for French Guiana (Oyakawa, in Reis *et al.*, 2003), we have excluded *H. gronovii* from the current list pending more detailed studies.

*Hoplias macrophthalmus* (Pellegrin, 1907) cited by Oyakawa (in Reis *et al.*, 2003) is a junior synonym of *H. aimara* (Mattox *et al.*, 2006).

*Hoplias patana* (Valenciennes, 1847), the provenance of which is uncertain, is probably synonymous with *H. malabaricus*, to which the material we have collected in French Guiana is referable. Despite its citation for French Guiana (Oyakawa, in Reis *et al.*, 2003), we have excluded *H. patana* from the current list pending more detailed studies.

### Lebiasinidae

*Copella* cf. *arnoldi* becomes *Copella* aff. *arnoldi*.

*Copella carsevennensis* is considered a junior synonym of *C. arnoldi* (M. Marinho, pers. comm.).

### Cetopsidae

*Pseudocetopsis* cf. *minutus* has been described as *Cetopsidium orientale*.

### Aspredinidae

*Dysichthys coracoideus* is replaced partly by *Bunocephalus coracoideus*, partly by *B. aloikae* and partly by *B. verrucosus* (A. Cardoso, pers. comm.).

*Aspredo cotylephorus* reverts back to *Platystacus cotylephorus* (Friel in Reis *et al.*, 2003).

### Trichomycteridae

*Ituglanis* sp. has been described as *I. nebulosus*.

### Callichthyidae

*Corydoras heteromorphus* is replaced by *C. aff. breiei*.

**Loricariidae**

*Cteniloricaria maculata* is considered a junior synonym of *C. platystoma* (Covain *et al.*, 2012).

*Cteniloricaria fowleri* becomes *Harttia fowleri* following Rapp Py-Daniel and Oliveira (2001).

*Harttia surinamensis* is replaced by *H. guianensis*.

*Loricaria parnahybae* becomes *L. aff. parnahybae*.

*Rineloricaria cf. platyura* becomes *R. platyura*.

*Rineloricaria stewarti* becomes *R. aff. stewarti*.

*Hypostomus tapahoniensis* Boeseman, 1969 is a junior synonym of *H. gymnorhynchus* (Weber *et al.*, 2012).

*Hypostomus ventromaculatus* Boeseman, 1968 is a junior synonym of *H. plecostomus* (Weber *et al.*, 2012).

*Lasiancistrus brevispinis*, *L. longispinis* and *L. niger* become *Guyanancistrus brevipinis*, *G. longispinis* and *G. niger* (Covain and Fisch-Muller, 2012).

*Panaque cf. dentex* is described in this volume as *Panaqolus koko*.

*Hemiancistrus aff. braueri* is described in this volume as *Peckoltia otali*.

**Pseudopimelodidae**

*Pseudopimelodus raninus raninus* becomes *Batrochoglanis raninus* (Shibatta *in Reis et al.*, 2003).

*Pseudopimelodus nigricauda* becomes *Cephalosilurus nigricaudus* (Shibatta *in Reis et al.*, 2003).

**Heptapteridae**

*Heptapterus brevior* and *H. longior* reverts back to *Chasmodranus brevior* and *C. longior* (Bockmann and Guazzelli *in Reis et al.*, 2003).

*Imparfinis minutus* is replaced by *I. pijpersi*.

*Megalonema cf. platycephalum* is replaced by *Mastiglanis aff. asopos*.

*Heptapterus tenuis* becomes *Phenacorhamdia tenuis* (Donascimento and Milani, 2008).

*Rhamdella cf. leptosoma* becomes *Pimelodella leptosoma* (Bockmann & Miquelarena, 2008).

**Pimelodidae**

*Brachyplatystoma flavicans* was reidentified as *B. rousseauxii* (J. Lundberg, pers. comm.).

*Hypophthalmus edentatus* is replaced by *H. marginatus*. It is placed in Pimelodidae based on unpublished molecular evidence (J. Lundberg, pers. comm.).

*Cheirocerus sp.* has been described as *Pimelabditus moli*.

*Pimelodus cf. blochii* is confirmed as *P. blochii*.

*Pimelodus eigenmanni* becomes *Propimelodus eigenmanni* (Lundberg and Littmann *in Reis et al.*, 2003).

**Ariidae**

*Arius phrygiatus* and *R. rugispinis* become *Amphiarius phrygiatus* and *A. rugispinis* (Marceniuk and Menezes, 2007).

*Arius quadriscutis* becomes *Apistor quadriscutis* (Marceniuk and Ferraris, *in Reis et al.*, 2003).

*Cathorops fissus* is a synonym of *C. arenatus* (Marceniuk and Ferraris *in Reis et al.*, 2003).

*Arius grandicassis* becomes *Notarius grandicassis* (Marceniuk and Menezes, 2007).

*Arius couma*, *A. herzbergii*, *A. parkeri*, *A. passany*, and *A. proops* become *Sciades couma*, *S. herzbergii*, *S. parkeri*, *S. passany*, and *S. proops* (Marceniuk and Menezes, 2007).

**Doradidae**

*Amblydoras hancockii* is replaced by *Anadoras weddellii* (M. Sabaj Pérez, pers. comm.).

*Doras cf. micropoeus* becomes *D. micropoeus*.

*Platydoras dentatus* is reidentified as *Platydoras sp.* (Mark Sabaj, pers. comm.; see also Mol *et al.*, 2012).

**Auchenipteridae**

*Ageneiosus brevifilis* is a junior synonym of *A. inermis* (Ferraris *in Reis et al.*, 2003).

*Ageneiosus dentatus* is a junior synonym of *A. ucayalensis* (Ferraris *in Reis et al.*, 2003).

*Tatia cf. intermedia* becomes *Tatia intermedia*.

*Parauchenipterus galeatus* becomes *Trachelyopterus galeatus* (Ferraris *in Reis et al.*, 2003).

**Gymnotidae**

*Gymnotus anguillaris*, known only from type specimens, is replaced by *G. coropinae* (W. Crampton and J. Mol, pers. comm.).

**Sternopygidae**

*Eigenmannia* n. sp. was recently described as *Japigny kirschbaum*.

**Apteronotidae**

*Sternarchorhynchus oxyrhynchus*, for which the taxonomic status of the Oyapock material remains to be clarified, is temporarily called *S. aff. oxyrhynchus*.

**Rivulidae**

*Rivulus ocellatus* is replaced by *Kryptolebias marmoratus* (see Costa, 2006).

**Syngnathidae**

The possible presence of a *Pseudophallus* species is reported from the Approuague River basin (Mol, 2012), but not included in the present list.



**Sciaenidae**

*Plagioscion surinamensis* is considered a junior synonym of *P. squamosissimus* (Casatti, 2005).

**Polycentridae**

*Polycentrus punctatus* is replaced by *P. schomburgkii* (Britz and Kullander in Reis et al., 2003).

**Cichlidae**

*Satanoperca* aff. *jurupari* is described in this volume as *S. rhynchitis*.

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