ISSN 0123 - 3068 bol.cient.mus.hist.nat. 14 (2): 129 - 138

BOLETÍN CIENTÍFICO
CENTRO DE MUSEOS
MUSEO DE HISTORIA NATURAL

PECES DEL RÍO SAN JUAN DE URABÁ, COSTA CARIBE, COLOMBIA, SUR AMÉRICA*

Henry D. Agudelo-Zamora[1], *Juan G. Ospina-Pabón* [1, 2] *y Luz F. Jiménez-Segura*[1]

Resumen

En este artículo se revisan los ejemplares del río San Juan de Urabá depositados en museos nacionales e internacionales y, con base en esta revisión y otros estudios publicados, se documenta el primer listado de los peces del río San Juan de Urabá. Hasta la fecha, el conocimiento científico de la fauna íctica de esta región sigue siendo muy pobre. El único estudio sobre el río fue publicado en 1992 y sólo se enfocó en la zona costera donde encontraron 40 especies. Basado en nuestra revisión de especímenes de museos, se identificaron 38 especies en la cuenca, 15 de éstos fueron Perciformes y el orden más abundante. Las cuencas aisladas actúan como sistemas individuales que pueden contener biotas únicas, además son de alta importancia en un contexto biogeográfico, porque ellas actúan como sistemas particulares.

Palabras clave: actinopterygii, diversidad, estuario, Antioquia, Mar Caribe.

SAN JUAN DE URABÁ RIVER FISH, CARIBBEAN COAST, COLOMBIA, SOUTH AMERICA

Abstract

In this article fish samples from the San Juan de Urabá River deposited in national and international museums are reviewed, and based on this review and other published studies, the first list of San Juan de Urabá River fish is documented. To date the scientific knowledge of the ichthyofauna of this region continues to be very poor. The only study about the river was published in 1992 and was only focused on the coastal zone where 40 species were found. Bases in our revision of museum specimens, 38 species were identified in the basin, 15 from which were Perciformes, the most abundant order. The isolated basins act as individual systems that may contain unique biotas and also they are of great importance in a biogeographical context because they act as independent systems.

Key words: actinopterygii, diversity, estuary, Antioquia, Caribbean Sea.

* FR: 3-X-2010. FA: 22-X-2010

[1] Universidad de Antioquia, Calle 67 No. 53-108, Bloque 7 - 309, Medellín, Colombia. E-mail: hdagudelo@gmail.com; ljimenez@matematicas.udea.edu.co

[2] Grupo de Limnología y Recursos Hídricos, Universidad Católica de Oriente. Sector 3, Cra. 46 No. 40B-50, Rionegro, Colombia. E-mail: juangiopez@gmail.com

INTRODUCTION

The fish of the rivers of northwestern Colombia are poorly sampled and knowledge regarding the icthyofauna remains scarce (DAHL, 1955; ROMÁN-VALENCIA & ACERO, 1992; HAROLD & VARI, 1994). A few articles provide detailed information on fishes in the northern portion of Antioquia (EIGENMANN, 1912, 1920c AND 1922; FOWLER, 1944; DAHL, 1960; ACERO & GARZÓN, 1987; ROMÁN-VALENCIA, 1990). Because the northern areas of Colombia connect Central and South America, they are of special interest to the study of the evolution and biogeography of freshwater fishes (DAHL, 1971; RODRÍGUEZ-OLARTE et al., 2009).

Recently, descriptions of new Colombian freshwater species have appeared regularly (MALDONADO-OCAMPO et al., 2008). MALDONADO-OCAMPO et al. (2005) indicated that knowledge of Colombia's fish fauna is based principally on surveys of the main rivers of the northern Andes (Magdalena and Cauca basins, Figure 1) and of the highlands of Cundinamarca and Boyacá. As the fish fauna of the small streams in these basins are poorly known, research efforts have begun to focus on these smaller streams and have resulted in the discovery to science of new species (DE SANTANA et al., 2004; MALDONADO-OCAMPO et al., 2004; WIJKMARK, 2007; BERTACO, 2008).

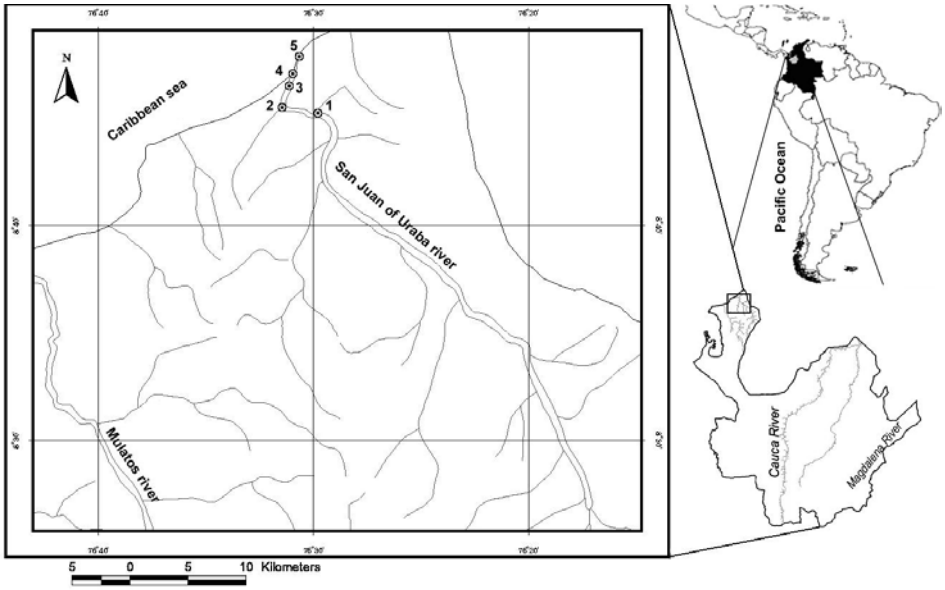

Figure 1. Location of the San Juan de Urabá river basin. 1: El Coco. 2: El Paso. 3: Main cannel. 4: Mouth (Estuary zone). 5: Coastal.

The San Juan de Urabá River originates in the Quimarí Peaks (670 m.a.s.l.) of the Abibe Mountains and drains into the Caribbean Sea. The river drains a basin of

some 1395 km^2 (Figure 1), and its total length is approximately 183 km (RUIZ & CEBALLOS, 2005). Some of its principal tributaries are: the San Juancito and Aguas Claras Rivers, and the El Caimán, El Piritu, Caño del Medio, Molenillo, Zapindonga, El Coco, El Paso, and Honda Streams. The basin's rainfall increases from northeast to southwest, varying from 1500 to 2750 mm/year (LARA-MEJÍA, 2004). These tributaries flow through the San Pedro de Urabá, Arboletes, and San Juan de Urabá municipalities, which form part of the northern region of Antioquia or "Urabá Antioqueño" (RUIZ & CEBALLOS, 2005).

The objective of this paper is to identify the ichthyofauna found in the region of San Juan de Urabá River because of its zoogeographic importance and the fact that it has not been well sampled by modern ichthyologists.

MATERIALS AND METHODS

We reviewed database records from national (**CP-UCO**, **IAvH-P**, **ICNMHN**, **IMCN**, **IUQ**, **INVEMAR-P**, **CSJ**, **MLS**) and internactional museums (**NRM**, **USNM**, **BMNH**, **AMNH**, **CAS**, **SU**, **ANSP**, **MCZ**, **MNHN**, **FLMNH**) for specimens from the lower San Juan de Urabá River or the San Juan de Urabá Basin. In addition, we conducted direct sampling of the depositional zone of the Basin.

The only previous records for the area are cited in ROMÁN-VALENCIA & ACERO (1992) (specimens deposited in **ICNMHN**) (see *Abbreviations*). We directly sampled the depositional zone of the basin. Fish species were identified based on REIS et al. (2003) and MALDONADO-OCAMPO et al. (2005) for freshwater fishes and ESCHMEYER (1998) for marine species. Families are presented in systematic order, but genera and species are in alphabetic order. Species are listed in the column 1 of Table 1. The letters in column 2 indicate the material registered from these collections. The references listed in column 3 are the authors who cited the species from Colombia or boundary rivers (Table 2).

Table 1. Number of families and species for each fish order from de San Juan de Urabá River.

Order	Family		Species	
	No.	(%)	No.	(%)
Carcharhiniformes	1	4	2	5
Scorpaeniformes	1	4	1	3
Elopiformes	1	4	1	3
Clupeiformes	1	4	1	3
Cyprinodontiformes	1	4	1	3
Characiformes	3	13	9	24
Siluriformes	4	17	5	13
Syngnathiformes	1	4	1	3

Order	Family		Species	
	No.	(%)	No.	(%)
Batrachoidiformes	1	4	1	3
Perciformes	9	38	15	39
Pleuronectiformes	1	4	1	3
Total	**24**	**100**	**38**	**100**

Source of specimens

The specimens used were collected by the third author (L. F. J.-S.). Collecting sites were chosen for convenience, i.e. those easily accessed by boat and/or streams near roads. Collecting sites are indicated by numbers on the map (Figure 1). The material examined is deposited in **CIUA**. *Abbreviations*: Institutional abbreviations follow LEVITON et al. (1985) and SABAJ PÉREZ, (2010) except for: **CIUA:** Colección Ictiologia Universidad de Antioquia, Medellin, Antioquia – Colombia. **CP-UCO:** Colección Peces, Universidad Católica de Oriente, Rionegro, Antioquia – Colombia. **IAvH-P:** Colección de Peces dulceacuícolas, Instituto Alexander von Humbolt, Villa de Leyva, Boyacá – Colombia. **IMCN:** Colección ictiológica de referencia Museo de Ciencias Naturales Federico Carlos Lehmann Valencia. Colección Zoológica de Referencia Científica "IMCN" Instituto para la Investigación y Preservación del Patrimonio Cultural y Natural del Valle del Cauca –INCIVA–. **IUQ:** Colección de Ictiología Universidad del Quindío, Armenia, Quindío – Colombia. **INVEMAR-P:** Museo de Historia Natural Marina de Colombia, Santa Marta – Colombia.

Table 2. Fish species recorded from the lower San Juan de Urabá River. (Collection: see Abbreviations).

Taxon	Collection	References
Carcharhiniformes		
Carcharhinidae		
Carcharhinus porosus (Ranzani, 1839)	CIUA 7	FAO, 2002; FROESE & PAULY, 2008.
Rhizoprionodon porosus (Poey, 1861)	CIUA 9	ACEVEDO et al., 2007; FROESE & PAULY, 2008.
Scorpaeniformes		
Triglidae		
Prionotus punctatus (Bloch, 1793)	CIUA 18	RICHARDS, 2002.
Elopiformes		
Megalopidae		

Tarpon atlanticus (Valenciennes, 1847)	ICNMHN 3149	ROMÁN-VALENCIA & ACERO, 1992; DAHL ,1971.
Clupeiformes		
Clupeidae		

Taxon	Collection	References
Opisthonema oglinum (Lesueur, 1818)	CIUA 21	ROMÁN-VALENCIA & ACERO, 1992.
Engraulidae		
Anchoa lyolepis (Evermann & Marsh, 1900)	CIUA 22	DAHL, 1971; FROESE & PAULY, 2008.
Cyprinodontiformes		
Poeciliidae		
Poecilia sphenops (Valenciennes, 1846)	CIUA 287	DAHL ,1971; REID et al., 2003.
Characiformes		
Curimatidae		
Cyphocharax magdalenae (Steindachner, 1878)	CIUA 290, 276	EIGENMANN, 1922; ROMÁN-VALENCIA & ACERO, 1992; MALDONADO-OCAMPO et al., 2005; VILLA-NAVARRO et al., 2006; MOJICA et al., 2006.
Erythrinidae		
Hoplias malabaricus (Bloch, 1794)	CIUA 788	DAHL, 1971, ROMÁN-VALENCIA & ACERO, 1992; MALDONADO-OCAMPO et al., 2005; VILLA-NAVARRO et al., 2006; MOJICA et al., 2006.
Characidae		
Roeboides dayi (Steindachner, 1878)	CIUA 27, 277, 293, 322, 789	LUCENA, 2000; MALDONADO-OCAMPO et al., 2006.
Creagrutus affinis (Steindachner, 1880)	CIUA 280	EIGENMANN, 1920b; HAROLD & VARI, 1994; REID et al., 2003.
Brycon henni (Eigenmann, 1913)	CIUA 281	DAHL, 1971; LIMA, 2003; MONTOYA-LÓPEZ et al., 2006.
Astyanax fasciatus (Cuvier, 1819)	CIUA 285	EIGENMANN, 1922; DAHL, 1971; HAROLD & VARI, 1992; ROMÁN-VALENCIA & ACERO, 1992, MALDONADO-OCAMPO et al., 2005; VILLA-NAVARRO et al., 2006; MOJICA et al., 2006.
Saccoderma hastata (Eigenmann, 1913)	CIUA 291	DAHL, 1971; ROMÁN-VALENCIA & ACERO, 1992; MOJICA et al. 2006.
Hyphessobrycon proteus (Eigenmann, 1913)	CIUA 295, 296	FROESE & PAULY, 2008; GARCÍA-ALZATE et al., 2008, in this paper.

Bryconamericus emperador (Eigenmann y Ogle, 1907)	CIUA 321	MOJICA, 1999; ROMÁN-VALENCIA, 2000, 2003; REID et al., 2003; LIMA et al., 2003; MALDONADO et al., 2005.

Taxon	Collection	References
Siluriformes		
Ariidae		
Notarius grandicassis (Valenciennes, 1840)	CIUA 11	LASSO et al., 2004.
Sciades herzbergii (Bloch, 1794)	CIUA 12, 909	ACERO, 2002.
Heptapteridae		
Rhamdia quelen (Quoy & Gaimard, 1824)	CIUA 278, 332	MALDONADO-OCAMPO et al., 2006; VILLA-NAVARRO et al., 2006; MOJICA et al., 2006.
Callichthyidae		
Hoplosternum punctatum (Meek & Hildebrand, 1916)	CIUA 282	ROMÁN-VALENCIA & ACERO, 1992; MALDONADO-OCAMPO et al., 2006.
Syngnathiformes		
Syngnathidae		
Syngnathus pelagicus (Linnaeus, 1758)	CIUA 279, 288	FROESE & PAULY, 2008.
Batrachoidiformes		
Batrachoididae		
Batrachoides surinamensis (Bloch & Schneider, 1801)	CIUA 20	FROESE & PAULY, 2008.
Perciformes		
Centropomidae		
Centropomus parallelus (Poey, 1860)	CIUA 284	ROMÁN-VALENCIA & ACERO, 1992.
Centropomus pectinatus (Poey, 1860)	CIUA 13	ROMÁN-VALENCIA & ACERO, 1992.
Centropomus undecimalis (Bloch, 1792)	CIUA 292	EIGENMANN, 1920a; ROMÁN-VALENCIA & ACERO, 1992.
Serranidae		
Epinephelus itajara (Lichtenstein, 1822)	CIUA 14	ROMÁN-VALENCIA & ACERO, 1992; FROESE & PAULY, 2008.
Carangidae		
Oligoplites saurus (Bloch & Schneider, 1801)	CIUA 15	ROMÁN-VALENCIA & ACERO, 1992.
Chloroscombrus chrysurus (Linnaeus, 1766)	CIUA 16	FROESE & PAULY, 2008.
Sciaenidae		

Stellifer microps (Steindachner, 1864)	CIUA 30	FROESE & PAULY, 2008, in this paper.
Isopisthus parvipinnis (Cuvier, 1830)	CIUA 17, 4	FROESE & PAULY, 2008.

Taxon	Collection	References
*Nebris microps (*Cuvier, 1830)	CIUA 6	CERVIGON et al., 1992; FROESE & PAULY, 2008.
Trichiuridae		
Trichiurus lepturus (Linnaeus, 1758)	CIUA 10	DAHL, 1971.
Scombridae		
Scomberomorus cavalla (Cuvier, 1829)	CIUA 19	DAHL, 1971.

Taxon	Collection	References
Mugilidae		
Mugil curema (Valenciennes, 1836)	CIUA 28	ROMÁN-VALENCIA & ACERO, 1992.
Agonostomus monticola (Bancroft, 1834)	ICNMHN 3029	ROMÁN-VALENCIA & ACERO, 1992.
Eleotridae		
Eleotris pisonis (Gmelin, 1789)	CIUA 286, 333	EIGENMANN, 1920b.
Cichlidae		
Andinoacara sp. Atrato (Wijkmark, 2007)	CIUA 283	WIJKMARK, 2007, in this paper.
Caquetaia kraussii (Steindachner, 1879*)*	CIUA 289, 319, 331	MALDONADO-OCAMPO et al., 2005.
Pleuronectiformes		
Paralichthyidae		
Citharichthys spilopterus (Günther, 1862)	CIUA 294; ICNMHN 3144	ROMÁN-VALENCIA & ACERO, 1992.

RESULTS

Table 2 records the list of fish species sampled from the lower San Juan de Urabá river basin. We found a total of 38 species in 10 orders and 24 families. The orders with the most species are Perciforms (15), Characiforms (9), and Siluriforms (5). We found two species of Carcharhiniforms and all the others orders had just one species (Table 1).

DISCUSION

Review of San Juan de Urabá River

With the aim of inspiring further research on the fisheries of the San Juan de Urabá River, we offer some preliminary considerations regarding the ichthyofauna of the lower sections of this river. In the past, from Eigenmann (1912 to1923) forward, most researchers sampling fishes in northern Colombia have "jumped" from the Atrato to the Sinú River or San Jorge Drainages, leaving a gap in the coverage (see EIGENMANN, 1912 and Plate I; EIGENMANN, 1920c, 1921). Because the San Juan de Urabá basin apparently includes species from Panama as well as from adjacent basins, we believe it's important to correctly identify the species of these basins (Atrato, Sinú, and Magdalena). This is the first listing of species from the San Juan de Urabá River Basin and furthers zoogeographic understanding of the region. Since the fish of the region were poorly known, previous studies of regional ichthyofaunas constructed zoogeographic provinces without taking the San Juan de Urabá and the Mulatos River Basins into account, thus excluding an important section of northern Colombia (RODRÍGUEZ-OLARTE et al., 2009).

The region has been geologically molded by the events of formation the Isthmus of Panamá, that occurred between the late Miocene and Pliocene, and also by the formation of mountain ranges of Colombia (DUQUE-CARO, 1990). The formation of the Isthmus led to the great faunal exchange between North and South America (BERMINGHAM & MARTIN, 1998). The closure of the ocean waters by the uplifting of Panamá's isthmus did, however, caused the loss the exchange of other fauna in the area (WEBB, 1985; PORTA, 2003; RODRÍGUEZ-OLARTE et al., 2009).

Although we present a checklist for fishes of San Juan River, we understand there continues to be a gap in scientific knowledge for Colombian fish species. We encourage fish researchers to carry out sampling programs throughout this and other basins so as, to determine the total number of species present and their importance to our national biodiversity and to the biogeographic patterns for South American freshwater fishes.

ACKNOWLEDGMENTS

We would like to thank Donald Taphorn, Nancy Dammann and the evaluator for their comments on the final manuscript. We would also like to thank the Curators of the museums that allowed us access to their collections for the study zone. This paper is the partial result of the Antioquia Expedition Project. Thank you as well to Ricardo Callejas Posada for making the ichthyology component part of the Antioquia Expedition Project.

BIBLIOGRAPHY

ACERO, A., 2002.- Order SILURIFORMES: ARIIDAE: 831-858 (in) CARPENTER, K. *The living marine resources of the Western Central Atlantic. Volume 2: Bony fishes part 1 (Acipenseridae to Grammatidae).* FAO Species Identification Guide for Fishery Purposes and American Society of Ichthyologists and Herpetologists Special Publication No. 5. FAO, Rome. p. 601-1374.

ACERO, A. & J. GARZÓN-FERREIRA, 1987.- Los peces marinos hallados durante la expedición Urabá II al Caribe chocoano (Colombia). *An. Inst. Invest. Mar. Punta Bull.*, 17: 113-136.

ACEVEDO, K.; BOHÓRQUEZ-HERRERA, J.; MORENO, F.; MORENO, C.; MOLINA, E.; GRIJALBA-BENDECK &. GÓMEZ-CANCHONG, P., 2007.- Tiburones y Rayas (Subclase Elasmobranchii) Descarados por la Flota de arrastre camaronero en el Caribe de Colombia. *Acta biológica Colombiana*, 12 (2): 69-80.

BERMINGHAN, E. & P. MARTIN, 1998.- Comparative mtDNA phylogeography of neotropical freshwater fishes: testing share history to infer the evolutionary landscape of lower Central America. *Molecular Ecology*, 7: 499-517.

BERTACO, V., 2008.- Taxonomy and Phylogeny of the Neotropical fish genus *Hemibrycon* Günther, 1864 (Ostariophysi: Characiformes: Characidae). [PhD Thesis]. [Porto Alegre (BR)]: Pontificia Universidade Catolica do Rio Grande do Sul.

CERVIGÓN, F.; R. CIPRIANI; W. FISCHER; L. GARIBALDI; M. HENDRICKX; A.J. LEMUS; R. MÁRQUEZ; J.M. POUTIERS; G. ROBAINA & B. RODRÍGUEZ, 1992.- Fichas FAO de identificación de especies para los fines de la pesca. Guía de campo de las especies comerciales marinas y de aquas salobres de la costa septentrional de Sur América. FAO, Rome. 513p. Preparado con el financiamiento de la Comisión de Comunidades Europeas y de NORAD.

DAHL, G., 1955.- An ichthyological reconnaissance of the Sinú River. *Revista Linneana*, 1: 11-19.

_____., 1960.- New Fresh-Water fishes from Western Colombia. *Caldasia*, 8 (39): 451-484.

_____., 1971.- *Los Peces del Norte de Colombia.* INDERENA, Bogotá. 391p.

DE SANTANA, C.D.; J.A., MALDONADO-OCAMPO; W., SEVERI & G.N., MENDES, 2004.- *Apteronotus eschmeyeri,* a new species of ghost knifefish from the Magdalena Basin, Colombia (Gymnotiformes: Apteronotidae). *Zootaxa*, 410: 1-11.

DUQUE-CARO, H., 1990.- Major Neocene events in Panamic South America: 101-113 (in) TSUCHI, R. (ed.) *Pacific Neogene Events: Tokyo.* Univ. of Tokyo Press.

EIGENMANN, C., 1912.- Some results from an ichthyological reconnaissance of Colombia, South America. Part I. *Contrib. Zool. Lab. Ind. Univ.*, 127. *Ind. Univ. Studies*, 16 (8): 1-27.

_____., 1920a.- The Magdalena Basin and the Horizontal and Vertical Distributions of Its Fishes. *Contribution from the Zoological Laboratory of Indiana University*, 177: 21-34.

_____., 1920b.- South America West of the Maracaibo, Orinoco, Amazon, and Titicaca Basins, and the Horizontal Distribution of its Fresh-Water Fishes. *Indiana University Studies*, 45. Vol. VII. 24p.

_____., 1920c.- Fishes of the rivers draining the western slope of the Cordillera of Colombia, Ríos Atrato, San Juan, Dagua and Patía. *Indiana University Studies*, 7 (46): 1-19.

_____., 1921.- The Magdalena Basin and the horizontal and vertical distribution of its fishes. *Indiana University Studies*, 47 (B): 20-34.

_____., 1922.- The fishes of Wester South America, Part I. The fresh-water fishes of Northwestern South America, Including Colombia, Panamá, and the Pacific Slopes of Ecuador and Perú, together with an Appendix Upon the fishes of the Río Meta in Colombia. *Memoirs of the Carnegie Museum*, 9 (1): 1-346.

EIGENMANN, C.H. & R.S. EIGENMANN, 1891.- A catalogue of freshwater fishes of South America. *Proceedings of United States National Museum*, 14 (842): 1-81.

ESCHMEYER, W., 1998.- Newsletter of Systematic Ichthyology. Number Twenty. [Internet] American Society of Ichthyologists and Herpetologists. [cited 2008 jul 13]. Available from: http://research.calacademy.org/research/ichthyology/NLSI/newsletter_pdfs/NLSI_98.pdf

FOWLER, H., 1944.- Fresh-Water Fishes from Northwestern Colombia. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 96: 227- 248.

FROESE, R. & D. PAULY, 2008.- FishBase [Internet] [cited 2008 jul 13]. Available from: http://www.fishbase.org/

GARCÍA-ALZATE, C.A. & C. ROMÁN-VALENCIA, 2008.- *Hyphessobrycon ocasoensis* sp. n. (Teleostei, Characidae) una nueva especie para el Alto Cauca, Colombia. *Animal Biodiversity and Conservation*, 31 (2): 11-23.

HAROLD, A. & R. VARI, 1994.- Systematics of the Trans-Andean Species of *Creagrutus* (Ostariophysi: Characiformes: Characidae). *Smithsonian Contributions to Zoology*, 551. 40 p.

LARA-MEJÍA, P., 2004.- El Muelle de "El Waffe", Turbo, Antioquia, Colombia. On the Waterfront. Universitat de Barcelona. 6: 137-150. ISSN 1139-7365.

LEVITON, A.E.; E. HEAL & C.E. DAWSON, 1985.- Standards in herpetology and ichthyology: part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia,* 1985: 802-832.

MALDONADO-OCAMPO, J.A. & J.S. ALBERT, 2004.- *Gymnotus ardilai:* a new species of Neotropical electric fish (Ostariophysi: Gymnotidae) from the Río Magdalena Basin of Colombia. *Zootaxa*, 759: 1-10.

MALDONADO-OCAMPO, J.A.; A. ORTEGA-LARA; J.S. USMA; G. GALVIS; F.A. VILLA-NAVARRO; L. VÁSQUEZ; S. PRADA-PEDREROS & C. ARDILA, 2005.- *Peces de los Andes de Colombia: guía de campo.* 1. ed. Bogotá, D.C. 346p.

MALDONADO-OCAMPO, J.A.; F.A. VILLA-NAVARRO; A. ORTEGA-LARA; S. PRADA-PEDREROS; U. JARAMILLO-VILLA; A. CLARO; J.S. USMA; T.S. RIVAS; W. CHAVERRA; J.F. CUESTA & J.E. GARCÍA-MELO, 2006.- Peces del río Atrato, Zona hidrográfica del Caribe, Colombia. *Biota Colombiana*, 7 (1): 143-154.

MALDONADO-OCAMPO, J.A.; R.P. VARI & J.S. USMA, 2008.- Checklist of the Freshwater Fishes of Colombia. *Biota Colombiana*, 9 (2): 143-237.

MOJICA, J.I.; G. GALVIS; P. SÁNCHEZ-DUARTE; C. CASTELLANOS & F.A. VILLA-NAVARRO, 2006.- Peces del valle medio del río Magdalena, Colombia. *Biota Colombiana,* 7 (1): 23-38.

PORTA DE J., 2003.- La formación del istmo de Panamá. Su Incidencia en Colombia. *Rev. Academia Colombiana Ciencias,* 27 (103): 191-216.

REIS R.E.; S.O. KULLANDER & C.J. FERRARIS, (Organizadores), 2003.- Check List of the Freshwater Fishes of South and Central America. EDIPUCRS, Porto Alegre, Brasil. 742p.

RICHARDS, W.J., 2002.- Triglidae (in) CARPENTER, K.E. (ed.) *The living marine resources of the Western Central Atlantic. Volume 2: Bony fishes part 1 (Acipenseridae to Grammatidae).* FAO Species Identification Guide for Fishery Purposes and American Society of Ichthyologists and Herpetologists Special Publication No. 5. FAO, Rome, FAO. p. 601-1374.

RODRÍGUEZ-OLARTE, D.; D.C. TAPHORN & J. LOBÓN-CERVIÁ, 2009.- Patterns of freshwater fishes of the Caribbean versant of Venezuela. *International Review of Hydrobiology,* 94 (1): 67-90.

ROMÁN-VALENCIA, C., 1990.- Listado y distribución de Peces en la Cuenca Media del Río Atrato, Chocó Colombia. *Caldasia*, 16 (77): 201-208.

ROMÁN-VALENCIA, C. & A. ACERO, 1992.- Notas sobre las comunidades de peces del norte de Antioquia (Colombia). *Anales del Instituto de investigaciones marinas Punta de Betín*, 21: 117-125.

RUIZ, E.C & D. CEBALLOS, 2005.- *Cuenta física del agua para la ordenación de una cuenca en un Bosque Seco Tropical (San Juan de Urabá).* Trabajo de grado. Facultad de Ciencias Agropecuarias, Universidad Nacional de Colombia, Sede Medellín. 56p.

SABAJ PÉREZ, M.H. (editor). 2010. Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an Online Reference. Verson 1.5 (4 Oct 2010). [Internet]. Available from: http://www.asih.org/, American Society of Ichthyologists and Herpetologists, Washington, DC.

VILLA-NAVARRO, F.A.; P.T. ZUÑIGA-UPEGUI; D. CASTRO-ROA; J.E. GARCÍA-MELO; L.J. GARCÍA-MELO & M.E. HERRADA-YARA, 2006.- Peces del alto Magdalena, Cuenca del río Magdalena, Colombia. *Biota Colombiana*, 7(1): 3-22.

WEBB, S.D., 1985.- Main pathways of mammalian diversification in North America: 201-217 (in) STEHLI F.G., WEBB S.D. (eds.) *The Great American Biotic Interchange.* Plenum Press, New York.

WIJKMARK. N., 2007.- Species Composition, Phylogeny and Historical Biogeography of the '*Aequidens' pulcher* and '*Aequidens' rivulatus* Species Groups (Teleostei: Cichlidae). [Degree Proyect]. [Swedish Museum of Natural History].