

The Magdalena Basin and the Horizontal and Vertical Distribution of Its Fishes

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THE Magdalena basin lies in western Colombia and drains the entire area of Colombia between the Cordillera of Bogota, also called Oriental, and the Cordillera Occidental except a small corner south of Popayan. Its western boundary consists of the oldest (Occidental) Cordillera which extends from Cartagena the entire length of the continent to Cape Horn. Nowhere in Colombia does it reach the height attained by it south of Colombia. Its eastern boundary consists of the much higher eastern crests of the Cordillera of Bogota. The Cordillera Central separates the Magdalena valley proper from the Cauca valley. The Cordillera Central is older than the Cordillera of Bogota, hence the Cauca flowing between the oldest chains in Colombia must be the oldest part of the Magdalena basin.

The Magdalena basin is surrounded by high mountain barriers except in the northwest where low areas separate it from the basins of the Sinu and of the Atrato beyond. It is the reservoir from which the Atrato and thru the Atrato the San Juan to the south and the Tuyra, Chepo, and Chagres to the west and north, got part of the ancestors of their present fresh-water fish fauna. Where did the Magdalena get its fishes?

Physical Features of the Magdalena Basin. The Magdalena basin may conveniently be divided into five sections: (1) the Andean torrents flowing from the heights to the valleys; (2) the Upper Cauca; (3) the Upper Magdalena; (4) the Lower Magdalena; and (5) the Cesar.

The Cauca and the Magdalena rise near the second degree of North latitude. They unite near 9° 30' North latitude and empty near 11° north into the Caribbean Sea.

Veatch (*Quito to Bogota*, 1917) says of the Cauca:

The three great physiographic provinces between the Cordillera del Choco (Occidental) and the Cordillera del Quindío (Central) are thus:

First—The inter-mountain plains of the present Departments of Cauca and Valle del Cauca which occupy the first 250 miles of the depression.

Second—The region of hills and valleys which lie between the two chains along the Cauca River in the Departments of Caldas and Antioquia. The Cauca River, after traversing a portion of the southern plains, flows in this second division of the inter-mountain depression through a series of gorges.

Third—The river-plain of the lower Cauca, in north-central Antioquia and southern Bolivar, which, bounded by the gradually disappearing spurs of the mountains, soon amalgamates with the great low plain of the Magdalena River.

The southern plains (part first, above) area of this inter-mountain depression is divided into three parts: the Plain of the Patia, the Plain of Popayan, and the Plain of Cali. The Plain of the Patia occupies the southern quarter of this area, the Plain of Popayan the next quarter and the Plain of Cali the northern half. The last is thus about 125 miles long and 15 miles wide.

Of these, the plain of Popayan, with a mean elevation of about 6,000 feet, is the highest, and contains the divide between the waters of the Atlantic and the Pacific. However, there is no marked hill mass between the two drainage basins, such as we had inferred from published maps and accounts, and one of the surprises of the journey was to find that in the Plain of Popayan we had crossed from the tributaries of the Rio Patia, which flows into the Pacific thru a great gorge in the Western Andes at the very southern end of the Plain of the Patia, to the tributaries of the Rio Cauca, which flows into the Atlantic by way of the hill country of Antioquia, without having appreciated that we had passed across the hydrographic divide between the two oceans. One would naturally expect in the Andes of South America that the divide between two great river systems, tributary to different oceans, would be a marked mountain crest, and it is perhaps this wholly natural preconception which has led to the showing on a number of maps of such a mountain range across this plain between the head-waters of the two streams and has caused rather misleading statements in many geographic descriptions.

We found the divide to occur here in a rolling plain where the low elevation between the two river systems is of less topographic importance than the elevations between certain tributaries of either river. Looking across the plain from either of the mountain slopes, it would be impossible to say with certainty, in many cases, which little tributary belongs to the Cauca and which to the Patia. The line of this inter-oceanic divide crosses the plain of Popayan in an east-west direction. On the west it mounts to the summit of the Western Andes and then turning abruptly northward, follows it very closely on the western side of the plains area; while to the east it climbs the other chain, and turning abruptly south, follows the summit of the mountains on the east side of the Popayan and Patia Plains.

There is in this general plains-region the suggestion of a remnant of a cross-range, but it does not lie between the Cauca and Patia drainages, but near the northern end of the Plain of Popayan, and a number of miles north of the head-waters of the northward flowing Cauca. It is somewhat near the boundary between the Plains of Cali and Popayan, but the separation of these into distinct units rests on a marked difference in elevation rather than on this feature. Perhaps at one time in the geologic past this remnant of a

cross-range was an important feature in the drainage systems of this region, and while it is certainly not so to-day, its presence adds but another feature to the physiographic history of the Cauca River, which will some day be unravelled.

The Plains of Cali and Patia lie some 3,000 feet below the Plain of **Popayan**, and the latter is therefore deeply trenched towards its northern and southern borders by the streams which cross it on their way to these lower levels. The Plain of Cali has suffered very little erosion. It is slightly concave, sloping up to the mountains on either side, and between its southern end, thirty miles south of Cali, and its northern limit, near Cartago, it has a slope of about four feet per mile, and may be regarded as a plain between 3,000 and 3,500 feet above sea-level. The Cauca River flows through the Cali Plain from end to end, and the levelness of the land, together with the gentle rainfall and the healthy warm character of the region, have all combined to cause it to be regarded as one of the garden spots of Colombia.

North of Cartago the Cauca flows thru the knot formed by the union of the Western and Central **Cordilleras**. In 110 miles, between Cartago and Boca de Nechi it drops from an elevation of 3,000 to 500 feet and forms, with the lower Magdalena, No. 4 of the above regions.

The Magdalena descends rapidly from its sources to Neiva, which has an elevation of 1,442 feet. From Neiva near 3° North it descends more gradually to Girardot, at 1,056 feet, and Beltran or Ambalema, 774 feet near 5° North. Between Beltran, Honda, and La Dorada there are rapids where the river cuts its way out from a trough in the Cordilleras of Bogota to the plain between the Central Cordilleras and the Cordilleras of Bogota. This lower Magdalena (below 600 feet) with the Cauca below Boca de Nechi forms No. 4 in the present classification. No. 5, the Rio Cesar, rises in the southeastern part of the Sierra Nevada de Santa Marta, flows a little west of south and empties into the Magdalena at El Banco. It is the only stream in Colombia with a southward flow that finally enters the Atlantic.

The Fishes of the Magdalena Basin. In the lower Magdalena (No. 4), collections have been made in the Ciénega near the mouth of the Magdalena, at Caceres on the Cauca, and at Bodega Central for Steindachner and at Soplaviento, Calamar, and at various places to Honda during my reconnaissance of Colombia. It is from this part of the river that Humboldt probably got his notes of the fishes mentioned in *Recueil d'Observation de Zoologie et Anatomie*. Nothing is known from the Rio Cesar. In the Upper Magdalena the only collection was made at **Girardot**. In the Upper Cauca I collected in the **Plains of**

Several genera pertain to the Andes and may be autochthonous or may have come from the south. *Astroblepus* is a high Andean genus forming the family *Astroblepidæ* found in Venezuela, Colombia, Ecuador, and Peru, possibly also parts of Bolivia. Several species are found in the Magdalena basin. The genera *Lasiancistrus*, *Pseudancistrus*, and *Chaetostomus* of the *Loricariidæ* or mailed catfishes have nearly the same distribution as *Astroblepus* but do not reach such great altitudes. One species of each genus is found in the Magdalena basin. The genus *Pygidium* is a swift-water mountain genus distributed from southern Panama to Guiana and south to Rio Grande do Sul and Patagonia wherever high altitudes or swift water form a suitable environment for it. Several species are found in different parts of the Andes within the Magdalena basin.

Fifty-odd genera in the Magdalena basin, 76 per cent, are also found east of the easternmost Cordilleras.

The rest are either peculiar to the Magdalena basin or to the Magdalena-Atrato-Chagres-San Juan. These are in detail:

Xyliphius confined to the upper Magdalena is an offshoot of *Bunocephalus*, a genus widely distributed from the Atrato to Paraguay but not yet caught in the Magdalena. *Cetopsorhamdia* and *Nannorhamdia* are catfishes derived from *Pimelodella*—like *Pimelodina*, which are found abundantly in our area as well as east of the Andes.

Eremophilus, confined to the plain of Bogota, is an offshoot from *Pygidium*. It is a *Pygidium* without ventrals.

Grundulus, also confined to the plain of Bogota, is a member of the *Cheirodontinæ* abundantly distributed in western Colombia as well as all thru the east.

Genycharax of the Cauca is either a derivative of *Charax* or of *Astyanax*, both of which have a universal distribution in tropical America.

Microgenes and *Argopleura* are derivatives of *Bryconamericus*, the latter found also in the Atrato and San Juan.

Acestrocephalus replaces *Acestrorhamphus* of the east. *Ctenolucinus* replaces *Xyphostomus*.

Gilbertolus is an offshoot from *Charax*.

Othonophanes is derived from *Brycon* if distinct.

There are no genera in all of these peculiar to the Magdalena which might not equally well have developed anywhere east of the Andes. *Genycharax* and *Gilbertolus* offer the greatest difficulty. While some of them are highly interesting, even thrilling

to the naturalist, none of them are out of the ordinary evolution of genera elsewhere in tropical South America.

This brings us to the genera also found east of the Andes. A few of these belong primarily to Venezuela and the Guianas. They are:

Creagrutus, found along the eastern base of the Andes from the Rio Beni to Lake Valencia and even British Guiana.

Gephyrocharax but recently discovered about Lake Valencia. Its place of greatest abundance is western Colombia.

Hemibrycon is found as far as Trinidad.

Panaque and *Hemicetopsis* are also found in the Amazon. All of the rest of the numerous genera enjoy a universal distribution east of the Andes.

It would scarcely be possible to isolate any place as large as the Magdalena basin anywhere east of the Andes and north of the La Plata that would not contain all of the rest of the genera.

The question arises whether isolation by the formation of a barrier is not the natural, most probable explanation of the present Magdalena fauna.

It is quite out of the question to transport all of these genera over the present barrier formed by the Cordilleras of Bogota, especially if we consider that the Cauca has not been able to contribute anything to the Dagua or Patia over a divide much lower. Either the Cordillera of Bogota is younger than the Magdalena and its growth cut off the Magdalena area with its fauna from a general lowland mass extending eastward from the Cordillera Central or there has existed a possible route of migration perhaps via Lake Maracaibo. The segregation could not have taken place very recently, for in most cases the species are distinct on the two sides of the Cordilleras. The segregation took place before the lifetime of most of the present species. It is, nevertheless, startling that about 20 per cent of the species of the Magdalena are also found east of the Andes.

The species found on both sides of the Cordilleras of Bogota follow. Those marked with a star were taken between Bogota and Barrigon.

Pseudopimelodus zungaro (H.)

**Rhamdia sebae* C. O O O V.

**Pimelodus clarias* (Bl.)

**Pimelodella chagresi* (S.)

Pseudoplatystoma fasciatum (L.)

Sorubim O O O (Bl. O O O Schl.)

- Ageneiosus dentatus (K.)
 Astroblepus cyclopus (H.)
 *Astroblepus grixalvii H.
 *Astroblepus longifilis (St.)
 *Corydoras melanotarnia R.
 *Pseudancistrus daguae (E.)
 ?Pseudancistrus pediculatus (E.)
 ?Sturisoma aurea St.
 *Sturisoma leightoni (R.)
 Curimatus magdalene St In Maracaibo only east of the Cordilleras.
 Parodon suborbitalis C. and V. In Maracaibo.
 ?Abramites eques (St.)
 Leporinus striatus K.
 Characidium fasciatum R.
 Pyrrhulina semifasciata R.
 Hypheobrycon inconstans (E. and O.)
 Astyanax fasciatus (C.)
 *Creagrutus beni E.
~~Reboides~~ Reboides dayi St.
 ?Ctenolucinus ~~insculptus~~ St. In Lake Maracaibo?
 *Hoplias malabaricus (Bl.)
 *Gymnotus carapo L.
 *Sternopygus macrurus (Bl and Sch.)
 Eigenmannia virescens (V.)
 Hypopomus brevirostris St.
 Synbranchus marmoratus Bl.
 Tarpon atlanticus (C. and V.)
 Plagioscion surinamensis (Bl.)

One looks in vain for any common physical character in this series of species. Some are huge fishes, Pseudoplatystoma; others are very small, Characidium. The great majority are fishes of the lowlands (1,000 feet and less) and comparatively quiet waters. Such fishes as Astroblepus and Pygidium ought perhaps to be excluded, since they are found at the very highest localities where an occasional crossover may still be expected. At the other extreme such species as the Tarpon which enter the sea might also be excluded, and in fact those found on both sides in estuaries only are not given.

Leaving these out of count, the one thing most of them have in common is their very wide distribution. This signifies either facility in getting about or a greater staying quality of their specific characters under varying environments, or both. Parallel forms have developed in nearly all of the genera found on the two sides in which the species have not remained the same. It would take us too far to go into all of these.

That the similarity on the two sides is not of very recent date is shown by an examination of the fauna at the eastern base of the Andes. Very little is known of the fauna of eastern Colombia and western Venezuela. What we do know of it indicates that the Maracaibo fauna is probably identical with the Magdalena fauna, *i.e.* differs no more from it than the latter differs from the Atrato fauna. Almost all we know of Lake Maracaibo was recorded by Cuvier and Valenciennes. I have had recent opportunities to examine the fishes from and about Barrigon, Villavicencio, and the Llanos to the northeast of them. I find that a number of genera of wide eastern distribution which have not been found in the Magdalena basin come up to the base of the Cordilleras east of Bogota. They are Chasmocranes, Imparfinis and Sciades, three catfishes; Erythrinus, Copeina, Hemigrammus, Moenkhausia, Knodus, Creatochanes, Stevardia, Acestrorhynchus, all Characins; Apistogrammus, and Crenicichla of the Cichlidae. All of them are widely distributed in the east. Did they develop in the east since the formation of the Cordilleras of Bogota or have they migrated to the base of these Cordilleras after they had become an effective barrier? Other conspicuous absentees in the Magdalena are genera of wide distribution in the east which have not been found near the base of the Andes of Colombia. They are the genera of the Hemiodinae, Nannostomus, Tetragonopterus, the Agoniatinae, the Stethaproninae, Serrasalmonin, Acestrorhamphus, all of which belong to the Characidae, Pachyurus of the Sciaenidae, Chatobranchopsis and Cichla of the Cichlidae, Electrophorus the electric eel, the gigantic Arapaima, and the ancient Osteoglossum.

It would be desirable in pursuit of a possible further study of the origin of the Magdalena fauna to make collections in the Maracaibo basin and thence east by way of the Pass of Hato, 800 feet into the Orinoco basin.

A comparison of the genera in the upper Cauca above the rapids of Antioquia and in the Potaro river of Guiana above the Kaieteur fall shows that the two regions have but three genera in common. They are Pygidium, Astyanax, and Rivulus, all genera of the very widest distribution in the whole of South America. The species of the three genera are different in the Cauca and the Potaro. In other respects the fauna of the Cauca and the Potaro are very different.

Table of Distribution of the Fishes of the Magdalena Basin-Continued

	Marine fishes entering mouth of river	Lower Magdalena	Upper Magdalena	Cauca	Torrents and highaltitude
33. <i>Pygidium caliense</i> E.				—	
34. <i>Pygidium stramineum</i> E.					- 7,400
35. <i>Pygidium bogotense</i> E.					- 9,000
36. <i>Pygidium nigromaculatum</i> (B.)					- 4,000
37. <i>Pygidium banneai</i> E.		?	—		
38. <i>Pygidium retropinne</i> R.					- 5,000
39. <i>Pygidium venulosum</i> St.					-10,000
40. <i>Pygidium latistriatum</i> E.					— 4,200
41. <i>Pygidium striatum</i> M. and H					- 7,300
42. <i>Eremophilus mutisii</i> H.					- 9,000
43. ? <i>Corydoras melanotenia</i> R.		?	—		
44. <i>Hoplosternum magdalense</i> E.		—			
45. <i>Plecostomus tenuicauda</i> St.		—	—		
46. <i>Pterygoplichthys undecimalis</i> G.		—			
47. <i>Lasiancistrus caucanus</i> E.					
48. <i>Pseudancistrus carnegiei</i> E.					- 3,320
49. <i>Pseudancistrus setosus</i> (B.)					- 7,400?
50. <i>Panaque gibbosus</i> (St.)		—	—		
51. <i>Cochliodon honda</i> R.		?	—		
52. <i>Chaetostomus</i> <i>fischeri</i> St.		?	—	—	
53. <i>Chaetostomus</i> <i>thomsoni</i> R.					- 7,300
54. <i>Loricaria magdalense</i> St.		—			
55. <i>Loricaria filamentosa</i> St.		—			
56. <i>Loricaria f. seminuda</i> E. and V.			—		
57. <i>Loricaria gymnogaster</i> E. and V			—		
58. <i>Loricaria fimbriata</i> E. and V			—		
59. <i>Loricaria variegata</i> St.		—	—		
60. <i>Sturisoma panamense</i> E. and E.		—	—		
61. <i>Sturisoma aurea</i> St.		—			
62. <i>Sturisoma leightoni</i> (R.)			—	—	
63. <i>Farlowella gracilis</i> B.				—	
64. <i>Curimatus magdalense</i> St.		—			
65. <i>Curimatus mivartii</i> St.		—	—		
66. <i>Parodon suborbitalis</i> C. and V.		—	—		
67. <i>Parodon caliensis</i> B.				—	

Table of Distribution of the Fishes of the Magdalena Basin—Continued

	Marine fishes invering mouth of river	Lower Magdalena	Upper Magdalena	Cauca	Torrents and high altitude'
68. Prochilodus longirostris St		—			
69. Prochilodus magdalena St		—	—	—	
70. Prochilodus steindachneri E		—			
71. Leporinodus sexdentatus E		—			
72. Abramites eques St.		—			
73. Leporinus striatus K		—			
74. Leporinus muyscorum St.		—	—		
75. Characidium fasciatum R.		?		—	
76. Characidium caucanum E				—	
77. Characidium phoxcephalum,				—	
78. Pyrrhulina semifasciata R.		?	—		
79. Grundulus bogotensis H					— 9 000
80. Odontostilbe hastata E		—			
81. Cheirodon insignis St		—			
82. Brycon rubricauda St.		—			
83. Brycon henni E				—	
84. Brycon moorei St.		—	—		
85. Othonophanes labiatus (St.)					
86. Hyphessobrycon inconstans (E. and O.)		—	—		
87. Hyphessobrycon pectilioides E				—	
88. Hyphessobrycon panamensis D		—			
89. Astyanax bimaculatus borealis E		—			
90. Astyanax magdalena E. and H.			—		
91. Astyanax atratoensis E		—			
92. Astyanax caucanus (St.)		—	—		
93. Astyanax filiformis (E.)			—		
94. Astyanax microlepis E				—	
95. Astyanax fasciatus (C.)		—	—	—	
96. Astyanax aurocaudatus E					— 5 00
97. Genycharax tarpon E				—	
98. Creagrutus beni E					— 3 00
99. Creagrutus brevipinnis E				—	
100. Creagrutus magdalena E		—	—		— 7 58
101. Creagrutus affinis St.					
102. Creagrutus caucanus E				—	

Table of Distribution of the Fishes of the Magdalena Basin-Continued

	Marine fishes entering mouth of river	Lower Magdalena	Upper Magdalena	Ca. ca.	Torrents and high altitude?
103. <i>Microgenys minutus</i> E.....				—	
104. <i>Argopleura conventus</i> E.....		—			
105. <i>Argopleura diquensis</i> E.....		—			— 7,258
106. <i>Argopleura magdalenensis</i> E.....		—	—	—	
107. <i>Bryconamericus caucanus</i> E.....				—	— 5,700
108. <i>Hemibrycon tolimæ</i> (E.).....					— 7,000
109. <i>Hemibrycon colombianus</i> E.....					— 4,100
110. <i>Hemibrycon boquillas</i> E.....					— 5,700
111. <i>Hemibrycon dentatus</i> E.....				—	
112. <i>Hemibrycon decurrens</i> E.....		—			
113. <i>Gephyrocharax caucanus</i> E.....				—	
114. <i>Gephyrocharax melanocheir</i> E.....		—	—		
115. <i>Chalcinus magdalene</i> St.....		—	—		
116. <i>Thoracocharax magdalene</i> E.....		—	—		
117. <i>Salminus affinis</i> St.....		—	—		
118. <i>Charax magdalene</i> St.....		—	—		
119. <i>Roeboides magdalene</i> E.....		—	—		
120. <i>Roeboides caucæ</i> E.....				—	
121. <i>Roeboides dayii</i> St.....		—			
122. <i>Acestrocephalus anomalus</i> (St.).....		—	—		
123. <i>Gilbertolus alatus</i> (St.).....		—	—		
124. <i>Ctenolucius insculptus</i> St.....		—	—		
125. <i>Hoplias malabaricus</i> (Bl.).....		—	—		
126. <i>Sternopygus macrurus</i> (Bl. and Sch.).....		—	—	—	
127. <i>Eigenmannia virescens</i> (V.).....		—	—		
128. <i>Hypopomus brevirostris</i> St.....		—	—		
129. <i>Sternarchus rostratus</i> M. and H.....		—	—		
130. <i>Sternarchus marie</i> E. and F.....		—	—		
131. <i>Synbranchus marmoratus</i> Bl.....		—			
132. <i>Anguilla chrysypa</i> R.....		—			
133. <i>Tarpon atlanticus</i> (C. and V.).....		—			
134. <i>Gambusia caliensis</i> E. and H.....				—	
135. <i>Mollienisia sphenops</i> (C. and V.).....		—			
136. <i>Mollienisia caucana</i> (St.).....		—			
137. <i>Rivulus elegans</i> St.....				—	
138. <i>Rivulus magdalene</i> E. and H.....			—		— 4,250

Table of Distribution of the Fishes of the Magdalena Basin—Continued

	Marine fishes entering mouth of river	Lower Magdalena	Cauca	Torrents and high altitudes
139. Rivulus brevis R.?				
140. Mugil brasiliensis A	—			
141. Mugil incilis G	—			
142. Mugil liza C. and V.....	—			
143. Agonostomus macracanthus R.....		—		
144. Centropomus undecimalis (Bl.).....	—			
145. Centropomus ensiferus P	—			
146. Centropomus pedimacula P.....	—			
147. Plagioscion surinamensis (Bl.).....		—		
<i>Hæmulon plumieri</i> L.....	—			
<i>Bairdiella armata</i> Gill.....	—			
<i>Gerres rhombeus</i> C. and V	—			
<i>Gerres plumieri</i> C. and V.....	—			
<i>Trichiurus lepturus</i> L.....	—			
<i>Spheroides testudineus</i> (L).....				
148. Geophagus steindachneri E. and H..		—	—	— 4,250
149. Aequidens latifrons (St.).....		—		
150. <i>Cichlasoma kraussii</i> (St.)		—		
151. <i>Cichlasoma umbriferum</i> M. and H...		—	—	
152. <i>Dormitator maculatus</i> Bl.		—		
153. <i>Eleotris pisonis</i> (Gmelin).....		—		
154. <i>Sicydium salvini</i> Grant		—		
155. <i>Awaous decemlineatus</i> E.....		—		
Totals.....		78	54	29
Per cent of the total, about.....		51	35	18.7

The categories into which I have divided the fauna of the Magdalena basin are not of equal value nor are the contents of the different regions equally well known. Certainly none of them are exhaustively known. The fishes in the first column are really marine fishes that wander into or live more or less permanently in the estuaries. The "Lower Magdalena" includes the Magdalena from its mouth to La Dorado and the Cauca to Caceres.

In the "Upper Magdalena" are included all that are known from south of La Dorado in the main stream and its larger tributaries to (including) *Ibaguá*. It should take in the contents to Neiva. In reality all we know has come from between Honda and Girardot with the tributaries in this short stretch. Many or all of these will also be found in the lower Magdalena. There is always a reasonable expectation that the fishes in any stretch will be found lower down and there is no sharp break between Honda and the river below La Dorado.

Similarly the column for the Cauca should include everything from the rapids below Cartago to the head of navigation, but nothing is known from Cali upward.

Finally, the last column includes a variety of streams from the highest altitudes down to the mouths of the streams where torrential conditions give place to large stream conditions. I give the highest known altitude in feet where it was obtainable. In some cases the altitude may be the sole factor determining the presence or absence of a species. In many others torrential conditions that frequently go with altitude determine the distribution.

Of the species found in the upper Cauca, 11 are also found in the upper Magdalena and 5 in the lower Magdalena.

Of the 54 species in the upper Magdalena, 32 are also found in the lower Magdalena.

Conclusion. The above analysis demonstrates that the fish fauna of the *Magdalena* basin was derived in small part from the ocean and in larger part from Central America. It demonstrates beyond a peradventure that most of it had an origin in common with that of the Orinoco basin to the east of it, and that the fauna of the Magdalena was segregated from the general fauna of the Orinoco by the formation of the Cordillera of Bogota between the two, at a time antedating the development of most of the present species. It also demonstrates that if the above conclusions are valid some species found on both sides antedate the formation of the Cordillera of Bogota; that the stripes of the large catfish, the *Bagre tigre* have persisted during the entire time since the *Cordillera* of Bogota began to be an effective barrier against the intermigration of the fishes of the two sides.

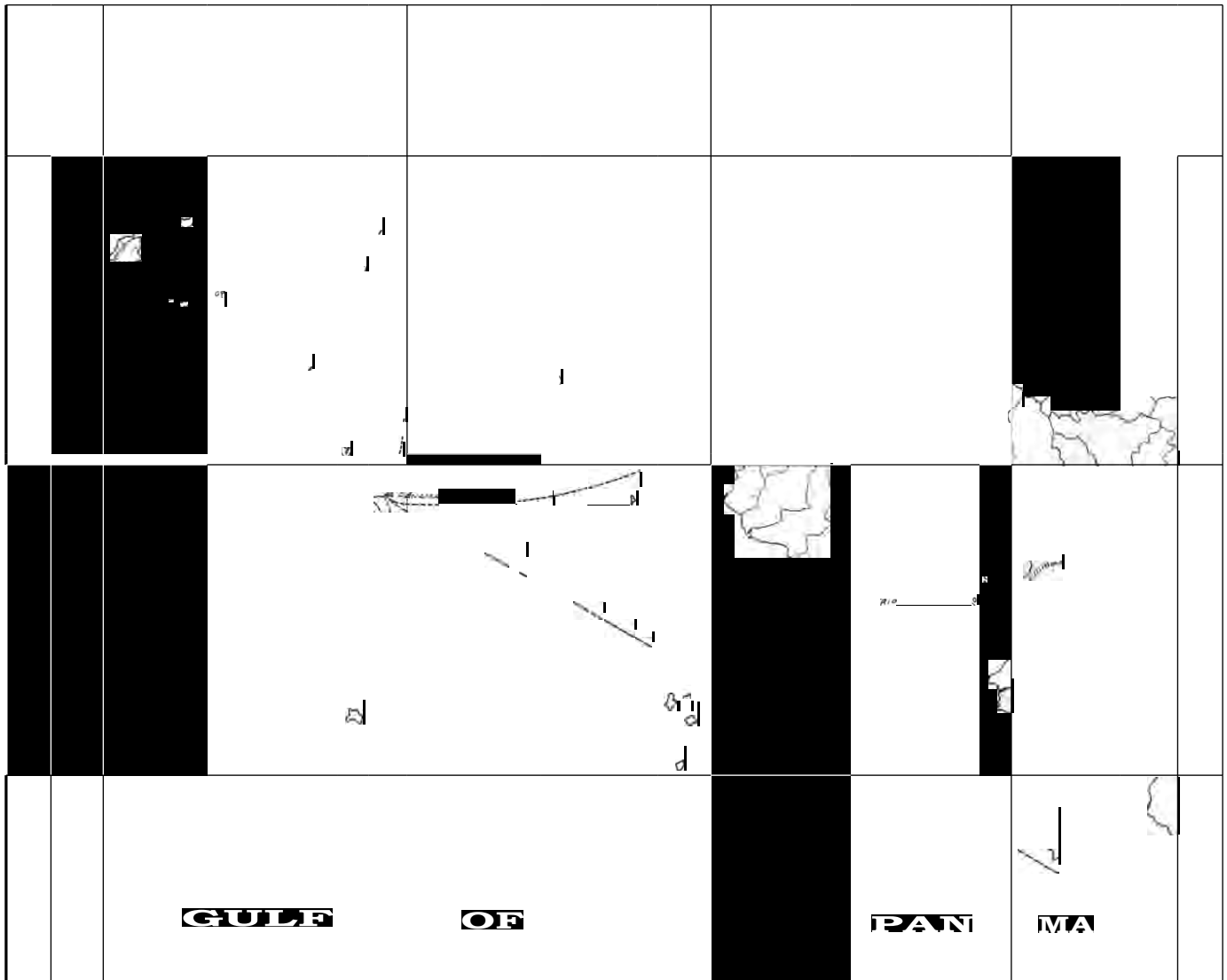


PLATE I

Panama from the 80th meridian to the mouth of the Myra, showing lines of travel of Meek and Hildebrand while collecting fishes. For the continuation eastward and southward see Plate II. From *Report of the Isthmian Canal Commission 1899-1901*.

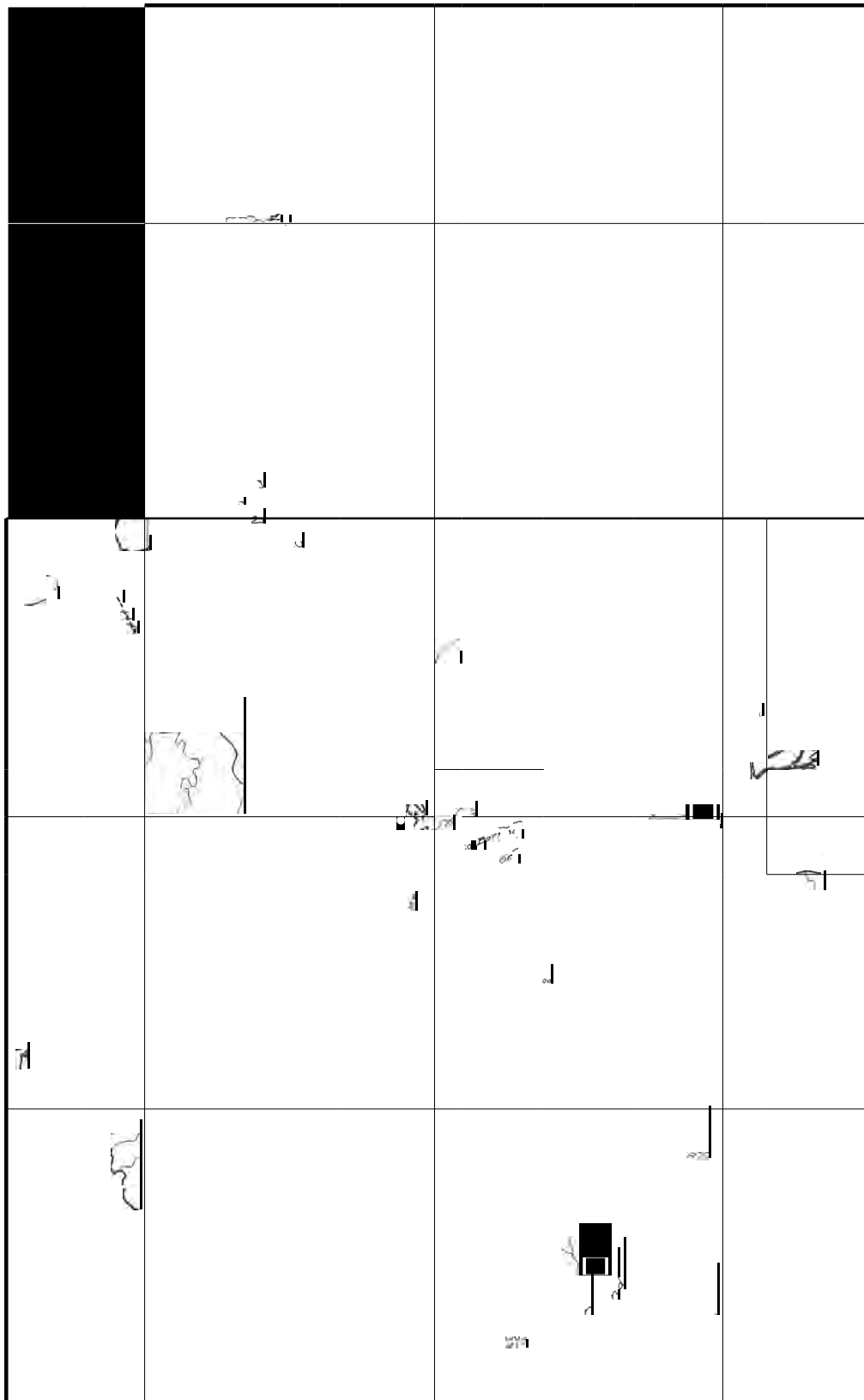


PLATE II
For explanation see Plate I.



Bogotá

Panorama



M. Magdalena

Ibarré

El Moral



Agua Caliente

Quindío

Bogotá

Plan de Moler

Cartago

R. Cauca



Alto de Pato Gordo

Alto del Paramill

Juntas de Tamana