

perhaps, the same mechanical basis as Helmholtz's explanation, it seems not amiss to approach it in this way. An attempt is being made at a mathematical treatment.

C. C. TROWBRIDGE,
Secretary.

DISCUSSION AND CORRESPONDENCE.

HIGHER AND LOWER.

TO THE EDITOR OF SCIENCE: In the *American Naturalist* for June, on page 413, L. J. C. takes exception to the custom of referring to animals as 'higher' and 'lower,' on the ground that these terms tend to give the student an idea that the vertebrate affinities lie in a direct chain, rather than forming a complicated, branching system.

This criticism will strike some as a little captious since the terms do not imply a direct connection, but merely that some animals are on a higher plane than others, just as the dwellers on the fifth floor of an apartment house are higher than those on the fourth floor. The terms generalized and specialized fail to convey the idea intended because a highly specialized animal may be low in the scale of life. The sloth is more specialized than the monkey, but it would naturally be termed a lower animal; thus though what we call the 'higher' animals are, as a rule, more specialized than the 'lower' forms, they are by no means invariably so. To revert to the apartment house it may be said that a family on the fifth floor might be related to one on the fourth and another on the sixth and yet, as a whole, the fifth floor people would be higher than those below.

F. A. L.

A DENIAL.

TO THE EDITOR OF SCIENCE: In a circular sent out by The Macmillan Company advertising one of their recent publications, the assertion is gratuitously made that I 'uphold Wallace's position.' Kindly allow me the space to deny the statement and to explain that it arose first from a misapprehension, which was later compounded by a clerical error—not mine.

HUBERT LYMAN CLARK.

SPECIAL ARTICLES.

THE FISHES OF PANAMA.

IN the Zoological Club of Indiana University in 1885 or 1886 President D. S. Jordan gave a résumé of the facts known at that time concerning the relation of the marine faunas on the two sides of Panama. It was jokingly remarked at that time that at the rate of progress the canal might be finished by 1900 and that zoologists would have to bestir themselves to record the faunas as they exist before the Panama canal would mix things up. It is now 1905 and the canal is not finished. In the meantime the marine faunas have been dealt with by

1. GREGORY, L. W.: 'Contributions to the Palæontology and Physical Geology of the West Indies,' *Quart. Journ. Geol. Soc.*, Vol. 4, 1895, pp. 255-312.

2. FAXON, WALTER: 'The Stalk-eyed Crustacea,' *Mem. Mus. Comp. Zool.*, Harvard College, Vol. XVIII., 1895, pp. 1-292.

3. GILBERT, C. H., and STARKS, EDWIN C.: 'The Fishes of Panama Bay,' *Mem. Cal. Acad. Sci.*, Vol. IV., pp. 1-226.

Gilbert and Stark's conclusions are that:

"The ichthyological evidence is overwhelmingly in favor of the existence of a former open communication between the two oceans, which must have been closed at a period sufficiently remote from the present to have permitted the specific differentiation of a very large majority of the forms involved." They found that 'of the 82 families of fishes represented at Panama all but 3 (Cerdalidæ, Cirhitidæ and Nematostiidæ) occur also on the Atlantic side of Central America; while of the 218 genera of our Panama list, no fewer than 170, are common to both oceans.' Fifty-four out of a total of 374, or 144 per cent., of the Pacific coast species are identical with Atlantic coast species.

I have just finished a consideration of the geographical distribution of the freshwater fishes of tropical America and Patagonia as applied to the Archihelenis-Archiplata theory of von Ihering. The details will appear in one of the volumes of the Hatcher reports of Princeton University. The evidence there collected indicates that the Pacific slope fauna

of tropical America has been derived from the Atlantic slope fauna. Only three of the genera of fresh-water fishes of the Pacific slope are peculiar to it; all the rest are identical with Atlantic slope genera. Even many species are identical on the two sides. The indications are that in the main the Pacific slope fauna was derived from the Atlantic slope fauna in times much more recent than the

be ample to keep apart two marine faunas is not necessarily a barrier to the intermingling of two fresh-water faunas. It is quite within the range of possibilities that the Atlantic slope fauna ascended the Chagres and succeeded in crossing the low divide and descended the Pacific rivers. The Chagres route has a rival farther south. In Colombia the Cordilleras form four separate chains. The east-

	Pacific Slope.	Atlantic Slope.
<i>Rhamdia cinerascens</i> Günther.....	Western Ecuador.	Chagres.
<i>Rhamdia wagneri</i> Günther.....	Bayano.	Chagres.
<i>Pimelodus clarias</i> (Bloch).....	Bayano.	Chagres.
<i>Pimelodella modestus</i> (Günther).....	Esmeraldas.	Chagres.
<i>Pimelodella chagresi</i> (Steind.).....		Chagres.
<i>Pimelodella gracilis</i> (Val.).....		Chagres.
<i>Ancistrus chagresi</i> (Eigenmann & Eigenmann)		Chagres.
<i>Hemiancistrus aspidolepis</i> Günther.....	Bayano.	
<i>Chatostomus fischeri</i> Steind.....	Bayano.	
<i>Loricaria variegata</i> Steind.....	Bayano.	
<i>Loricaria uracantha</i> Kner & Steindachner.....	Bayano.	Chagres.
<i>Loricaria lima</i> Kner.....	Bayano.	Chagres.
<i>Sturisoma panamensis</i> Eigenm. & Eigenm.....	Bayano.	Magdalena.
<i>Hoplias malabaricus</i> Bloch.....	Bayano.	Chagres.
<i>Hoplias microlepis</i> Günther.....	Western Ecuador.	Chagres.
<i>Curimatus magdalence</i> Steind.....	Mamoni.	Magdalena.
<i>Brycon striatulus</i> (Kner).....	Pacific slope of Panama.	Chagres.
<i>Astyanax panamensis</i> Günther.....	Bayano.	Motagua.
<i>Astyanax rutilus</i> Jenyns.....	Western Ecuador.	Chagres.
<i>Astyanax cæneus</i> Günther.....		Chagres.
<i>Raboides guatemalensis</i> Günther.....	Huamuchol.	Chagres.
<i>Gasteropelecus maculatus</i> Steind.....	Bayano.	
<i>Luciocharax insculptus</i> Steind.....	Bayano.	Magdalena.
<i>Eigenmannia humboldti</i> (Steind).....	Mamoni.	Entire east slope.
<i>Pecilia gillii</i> Kner & Steind.....		Chagres.
<i>Pecilia punctatus</i> Kner & Steind.....		Chagres.
<i>Symbranchus marmoratus</i> Bloch.....		Entire east slope.
<i>Geophagus jurupari</i> Heckel.....		Chagres.
<i>Cichlasoma parma</i> (Günther).....		Chagres.
<i>Cichlasoma godmanni</i> (Günther).....	Bayano.	

obliteration of the interoceanic connection between the Pacific and Atlantic. An examination of the distribution of the genera with representatives on the Pacific slope on the Atlantic side of the continent shows that nearly all have a very wide range and are found either in the Rio Magdalena or the Chagres. This indicates that the present fresh-water fauna of the Pacific slope crossed the divide somewhere near Panama. It is to be borne in mind that a barrier which may

ern, east of the Rio Magdalena, the central, between the Magdalena and its tributary, the Cauca, the western, west of the Cauca, and finally, a coast range. Between the western Cordillera and the coast Cordillera is a trough whose highest point is but 300 feet above sea level.

In the west Cordilleras to the east of this trough arise two rivers, both of which flow into the longitudinal valley, where one, the Atrato, flows to the north into the Caribbean,

the other, the San Juan to the south, and then through a break in the coast Cordilleras to the west to the Pacific Ocean. The height of land separating the two systems scarcely reaches a height of 100 m. This waterway is one of the strategic points in the geographical distribution of South American fishes and it is more than to be regretted that there is not a single record of a fresh-water fish from either of these rivers!

We are a little more fortunate about our knowledge of the fishes of the two sides of Panama, but are far from an exhaustive knowledge on the subject.

It would certainly be a disgrace not to make an exhaustive study of the fresh-water faunas of the two slopes before there is a chance of the artificial mingling of the two faunas. It ought to be urged upon congress to make provision for the biological survey of the canal zone if the president or the bureau of fisheries does not already possess authority to provide for it. The work should be undertaken at once.

For the biological survey of the Atrato-San Juan route we must depend upon private enterprise, and it is to be hoped that the means for so interesting and profitable work will not be lacking when the volunteers for the work are so numerous and willing.

On the preceding page I give the fishes recorded from the Chagres on the Atlantic and the Bayano and its tributary, the Mamoni, on the Pacific side of Panama, together with the distribution on the Atlantic or Pacific slope of species found in one of the rivers, but not in the other. C. H. EIGENMANN.

THE NUMBER OF YOUNG OF THE RED BAT.¹

DURING the summer of 1904 four females of *Lasiurus borealis* with their young came under my observation, the data from which add to the information contained in a recent article on the subject by M. W. Lyon, Jr., in *Proc. U. S. National Museum*, Vol. 26, pp. 425-426, recording the capture of a female of

this species with four nursing young, at Washington, D. C., June 18, 1902.

The Milwaukee specimens were all taken in the daytime clinging to the trunks of shade trees between the sidewalks and curbs in thickly populated residential parts of the city.

On July 14 a female with a single rather large young clinging to her was brought to me at the Public Museum. A few days later a female with three much smaller and less developed young was brought in after having been kept in captivity for a day or two until the mother had died. The young of this group were approximately the size of those figured by Mr. Lyon in the above-cited paper.

On July 23 a female with four larger young was brought to the museum. In this case the mother and young were alive. They had been confined for some hours in a pasteboard box and were quite restless. The half-grown young were clinging indiscriminately to each other and to the mother, who seemed fairly mobbed by her numerous progeny. A few days later I was shown another female with but a single young.

Of this bat Mr. Lyon cites observations of two having two young each, two having three and the instance under his own observation of one having four. Adding my own observations to this, we have the following records for number of cases and number of young: 2×1 , 2×2 , 3×3 and 2×4 .

On the face of this tabulation it would appear that three is the more common number of young and that a single young is as frequent as four. However, it is not improbable that the females with single young may have lost others of their families either by death or by their accidentally becoming detached.

Two embryos were found in each of two females included in the above table and three embryos were found in two other included instances; consequently, it is certain that either two or three young may be born, but it does not appear equally certain that as small a number as one may occur at a birth, although that number appears to be common to genera other than *Lasiurus* and, as Mr. Lyon states, probably *Dasypterus*.

¹Presented before the Wisconsin Natural History Society, March, 1905.