

**A Notable Astronomical Work.**

In a finely printed quarto of nearly 600 pages, the heirs of the late Dr. Benjamin Apthorp Gould have just presented, says The Evening Post, to astronomers the substantial completion of the photographic work un-



**PERIOPHTHALMUS KOELREUTERI LEAVING THE WATER.**

dertaken by him twenty-five years ago at the Argentine National Observatory in Cordoba. Although Dr. Gould did not live to see the completion of this task of his inception, still all had been so nearly finished that, with Dr. Chandler's supervision, the whole is now brought forth in entire harmony with the original plan. On Dr. Gould's first going to the southern hemisphere, celestial photography had not yet yielded tangible results in the line of accurate stellar positions, chiefly because the now familiar dry plates were not then available. Much pioneering thus was a matter of necessity; and the misfortunes and obstacles that beset his endeavors were most astonishing—not the least of them a broken object glass, the death of two photographers from pulmonary disease and of a third from a stroke of lightning. The Argentine national government has, however, supplied the necessary funds for preparation and publication, and the finished volume now before us, really monumental in character, gives the accurate positions of nearly 10,000 stars, with a chapter devoted to each of 37 stellar clusters, mostly in the southern celestial hemisphere and invisible from observatories generally in the United States. The conclusion of a significant labor like this, in a field by no means yet overworked, may well induce pride not only in the astronomers whose patient faithfulness has conducted it through all these years, but in the enlightened officials of a sister republic whose helpful generosity alone has made it possible.

**AMPHIBIOUS FISHES.**

BY C. F. HOLDER.

Recently, in collecting below the high tide mark on one of the Pacific coast islands, the writer found beneath almost every stone overturned a little fish, literally out of water and in no way inconvenienced by the lack of its native element.

In the majority of instances the fishes were clinging to a stone by a singular sucker formed by the anal fins. They had been left by the retreating water, but had apparently preferred the change and were now for several hours breathing air directly instead of taking it from the water after the manner of fishes in general.

This peculiar habit has been observed in the European blenny (*Blennius pholis*). In specimens kept in an aquarium it was found that they became restless when the tide went out. The observer now placed a stone in the water, and the little fish at once crawled upon it and rested there, after the manner of a frog, for over an hour, then returning to its native element. Such fishes are almost as truly amphibious as the frogs and other animals which appear to be equally at home on land or in the water. The case of the blenny would seem to be remarkable, but there are a number of fishes, shown in the accompanying

illustrations, which are not only able to breathe out of water, but habitually seek their food on land.

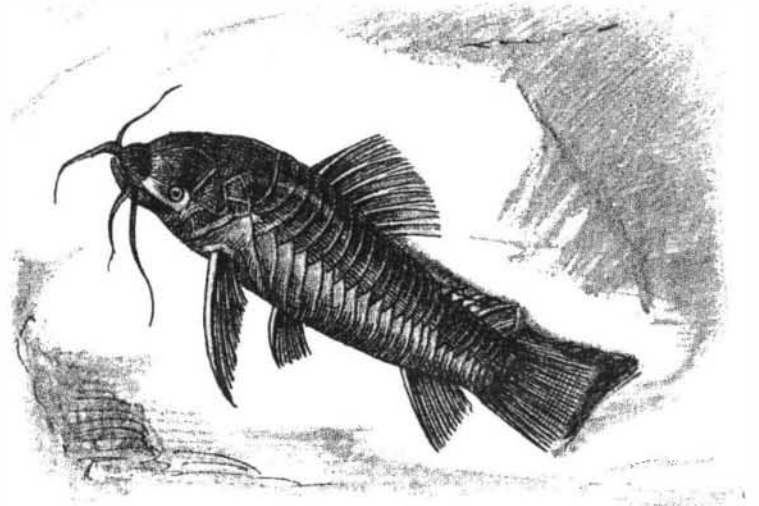
The most interesting examples are found among the Gobies of the tropics. The head in this fish is large, the eyes conspicuous and protruding, the pectoral fins powerful, resembling legs more than fins, and capable of lifting the fish and enabling it to jump along the sands or muddy shores of certain tropical islands. Two genera are known, *Periophthalmus* and *Boleophthalmus*, both equally remarkable for their amphibious habits. They are particularly fond of a shellless mollusk known as *Onchidium*, which is often left stranded on the shore, to obtain which the fishes crawl out upon the muddy flats and hop along like frogs. They are so active that it is difficult to catch them. Col. Nicolas Pike informed the writer that he secured his specimens by shooting them with a shotgun. This was at Mauritius, at Matuku Island. Prof. Moseley, the naturalist of the Challenger expedition, found them in great numbers also at Ceylon. They were hopping about on the mud flats beneath the mangrove trees, and Prof. Moseley states that when pursued they prepared to escape by taking to the land rather

than to the water. At each jump they would clear a foot. He says: "I have chased one at Trincomali Harbor, which skipped along before me until it reached a rock, where it sat on a ledge out of the water in the sun, and waited till I came up, when it skipped along to another rock." The species at the Fijian Islands is *P. Koelreuteri*, and it is usually found sitting or resting upon the dry roots of the mangrove trees, perfectly at home out of water.

When the account of these fishes was first related in Europe it was not believed, but finally it was accepted, and specimens of the fishes may now be found in every well-ordered and equipped museum.

The first fish ever observed to leave the water, by a European naturalist, was the now famous climbing perch (*Anabas*). Daldorf in visiting India heard the story as told by natives, to the effect that these fishes left their native element and walked overland, using their fins as limbs, but did not believe it. One day a native came to his camp and offered to take him to a spot where the emigrating fishes could be seen. Following the man through the forest, they finally came to a pool or swamp that was rapidly drying up, and from the mud proceeded a line or procession of fishes, making their way up through the grass by the aid of their fins, presenting a remarkable spectacle. The fishes were emigrating overland; the water of their pool had dried up, and they were deliberately marching away in search of a locality better suited to a water-loving community.

Daldorf later saw these fishes climbing small palms, presumably in search of food, though regarding this there is much doubt. In certain parts of India this migratory habit of fishes is so well known that the



**CALLICHTHYS CRAWLING ON DRY LAND.**

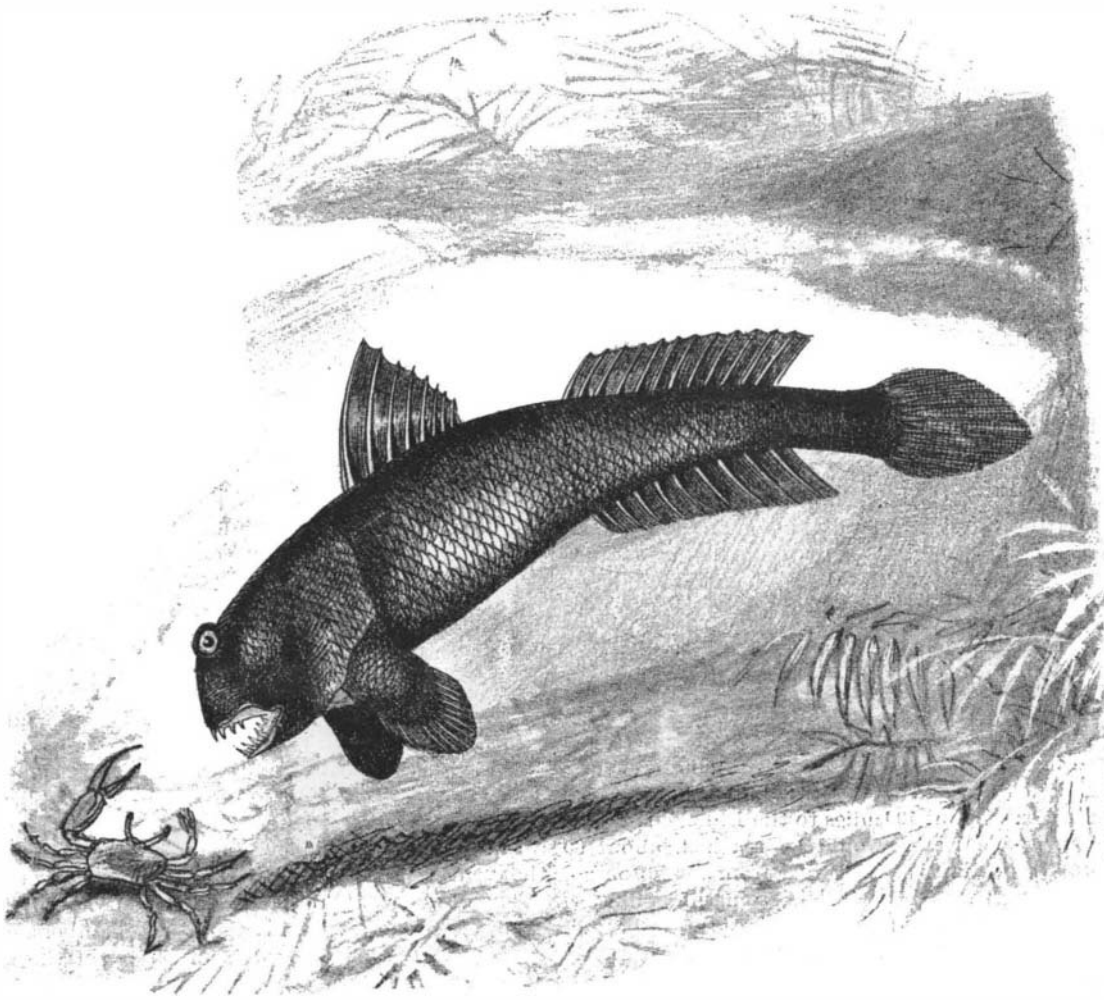
natives anticipate and repair to the localities with baskets and capture them by hundreds. Mr. E. A. Legard states that on the Singalese River also this habit is so well known that all the inclosures in which the *Anabas* are kept are provided with covers, to prevent the fishes from climbing out.

A little fish (*Gobius saporator*), common on the coast of Texas, is almost equally remarkable. A naturalist, in collecting specimens, placed them in a pail, but was astonished, upon returning, to find that the fishes had all crawled up the sides, and were slowly but surely making their way to the water, and were apparently not inconvenienced by the change of element.

Almost equally interesting are the fishes which, at the approach of dry weather, descend into the ground and form cases perfectly devoid of water, in which they lie in a state of seeming hibernation until the water returns again. This habit has often been productive of great astonishment on the part of those not familiar with the fish and its ways. Thus, several years ago a gentleman living in England received a box which apparently contained lumps of clay. Not understanding it, he stored the box away in his warehouse. In the course of three weeks he received a letter from a friend stating that on the previous steamer he had shipped him a lot of small American fishes (see illustration No. 1). He furthermore stated that to be made available for aquarium purposes the earth balls must be soaked in tepid water. This was done, and, to the surprise of the gentleman, each ball produced a small fish, which, perfectly dry, had been packed away in its burrow in a state of presumable hibernation.

In Gambia the fish *Protopterus* has a similar habit. At the first suggestion of the dry season it begins to explore the mud in the bottom of the stream in which it is living and there forms a burrow in which it spends the weeks and months with not a drop of water until the rainy season begins again and it is released.

The natives of Kottiar repair every year to the dry banks of the Vergel River and dig out certain fishes by hundreds as they would potatoes. They perform the work with pick and shovel, the fish in its case being dropped heavily, breaking open, displaying the animal



**PERIOPHTHALMUS FEEDING ON LAND.**

eight or ten inches in length and often as lively as though taken directly from the water. It is evident that these fishes, which can so readily change their method of life, must in some way differ from their companions which find water an essential. An examination of the fishes shows that they have gills over which water flows and by which air is taken and made to serve its peculiar purpose. In other words, they have true gills, but in *Periophthalmus* and *Boleophthalmus* the gill cavity is much larger than in many fishes and the gills do not fill it, leaving a space which might be filled with air or water.

In other fishes which habitually leave the water, as *Anabas* already referred to, the gill cavity reaches upward, the mucous membrane forming a complicated foliated labyrinthine structure, so that the gills really present more of a surface than those of ordinary fishes, which spend all their time in the water. This labyrinthine structure long ago attracted the attention of naturalists, and it was supposed to be a provision for the storage of water when the fish was traveling overland; but investigation does not carry out this idea, and it has been shown that the cavities never contain water and are in no sense reservoirs.

The theory held to-day is that the complicated organs are so adapted that they permit the animal to breathe either in the water or directly from the atmosphere. In other words, the labyrinthine organs are lungs, formed, according to Semper, "by modification of a portion of the water-breathing gill-cavity; the fishes that have them are therefore to be regarded as amphibious with quite as much reason as toads and frogs, or even better, since they are capable of changing the nature of their respiration—of air, that is, or of water—at will and suddenly, without any interruption; nay, are actually accustomed so to change it."

#### Central American Railway Enterprises.

In answer to many inquiries from contractors, manufacturers of supplies and railway men seeking employment, *The Railway Age* has prepared the following review of the principal railway enterprises in each of the five republics of Central America:

##### GUATEMALA.

The Guatemala Central Railway has been for several years in operation from San Jose, on the Pacific, northeasterly to Guatemala City, 71 miles. It is owned by C. P. Huntington and other Californians. The Guatemala Northern Railway, in which the government has a considerable interest, is intended to run from the harbor of Puerto Barrios, on the Atlantic coast, to Guatemala City, a distance of 160 miles, thus completing a transcontinental road. Track is laid to within about 60 miles of the capital. Work has been undertaken at intervals for many years, and as often suspended on account of political or financial complications. If stable conditions were assured in Guatemala, it would not be difficult to secure American capital and skill to push this important road to completion.

##### SAN SALVADOR.

This little republic, lying on the Pacific coast, with Guatemala on the west and Honduras on the north, recently celebrated the completion of its government road from Acajutla, on the coast, inland to Santa Ana, about 50 miles. It was proposed to build a branch to Ahuachapam, on the Guatemala frontier, and by extension eventually to obtain connection with the transcontinental line from Puerto Barrios, but the hostile relations between the two countries at present render the prospects very uncertain. Concessions have been granted for two or three short lines in the republic.

##### HONDURAS.

Special attention has been directed to this country by the recent granting of a concession from the government of Honduras to a number of well-known Americans, for the construction and operation of a railway from Puerto Cortez, on the Atlantic, to Fonseca Bay, on the Pacific. This would form a transcontinental line about 210 miles long, running almost due north and south. The concessionaires are: Chauncey M. Depew, W. Seward Webb, John Jacob Astor, Benjamin F. Tracy, J. G. McCullough, Frederic B. Jennings, George S. Scott, Nathaniel A. Prentiss, Charles McVeigh and Melville E. Ingalls, Jr.—names which are sufficient vouchers for the good faith of the enterprise. The government now owns a short road from Puerto Cortez to La Pinieta, about 30 miles, which is to be turned over to the syndicate, together with a grant of 100 feet of land on each side of the line and 5 square miles of land for every mile of railway; also the use of all construction material which can be obtained from government land, exclusive mining rights on all lands granted to the railway, and various other privileges. The syndicate, on the other hand, obligates itself to liquidate the public debt of Honduras, and in this connection it will establish a bank under government

supervision, to be called the Commercial Bank of Honduras, with a minimum capital of \$500,000. The road, which is to be of not less than 3 feet 6 inches gage, may be bonded for \$20,000 per mile. At the end of 99 years the road and all its appurtenances will become the property of the state, but the government reserves the right to purchase the road after it has been in operation for 75 years.

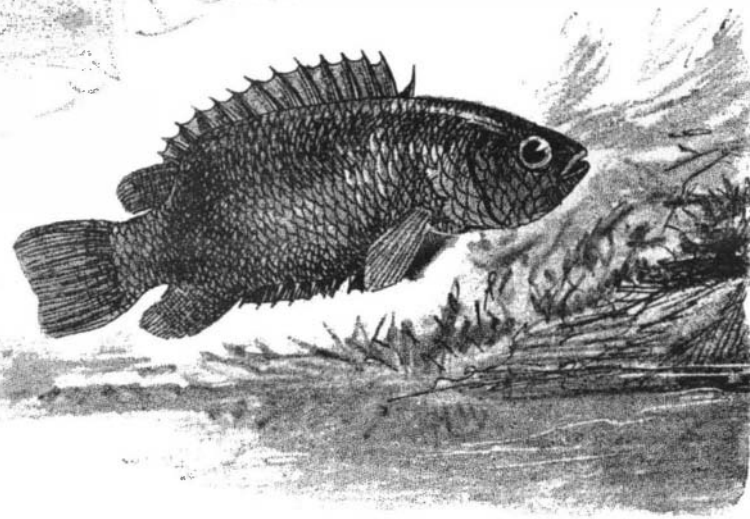
It is provided that 25 miles shall be constructed in the first year and that the entire road shall be completed in six years. Also that a branch shall be built to Tegucigalpa, the capital of the republic.

Some years ago Mr. S. B. McConnico, then general agent of the Illinois Central at New Orleans, obtained a concession for a railway from Truxillo, on the north coast, into the interior, and made investigations which showed that a great business in bananas and other fruits, in choice woods, etc., could be expected. It is not unlikely that this project will be revived.

A French syndicate a few years ago obtained a concession for building a narrow-gage road 93 miles long, from the Pacific Ocean to the capital, Tegucigalpa, following the course of the Rio Grande. It would open rich mineral and agricultural lands.

##### NICARAGUA.

This republic, whose name has become so familiar in connection with the proposed canal from Greytown to San Juan, has made small progress in railway building. The government railway system consists of a road from Corinto, on the Pacific, easterly to Momotombo, on the northwestern shore of Lake Managua, 58 miles, and another section from Managua, the capital city on the southern shore of that lake, to Granada, on the northwestern shore of Lake Nicaragua, 33 miles, a total of 91 miles. In connection with steamer service on the two lakes and on the San Juan River, these roads form part of a trunk line of communication through the country from sea to sea. But the roads have not been successful, and the Nicaraguan government, which is heavily in debt, has decided to send a



AMPHIBIOUS FISHES—ANABAS SCANDENS MIGRATING OVERLAND.

commission to the United States and offer the railways and steamer lines for sale. The *Railway Age* has received from the State Department at Washington some information of interest on this subject, sent by United States Consul Paul Wiesike, at Managua. The consul says:

"The Nicaraguan government is in great need of money, and the railway does not pay any longer. The gross earnings last year were about \$400,000, silver, and the running expenses \$310,000. The road is mortgaged to the English bondholders of the national debt for £285,000 (\$1,425,000), the interest on this sum being secured by the export duties on coffee.

"It is apparent that the road, whose profits, on account of bad management and increase of expenses for repairs, during the last four years, are 25 per cent less than they had been, would be a paying enterprise under a good management of an American company that would buy or lease it from the Nicaraguan government, and would invest a sum of money besides for necessary improvements, and that such arrangement may lead to the completion of the interoceanic railroad in Nicaragua. And this is the main point—if Americans do not buy or lease the national railroad of Nicaragua, it will fall into the hands of the English bondholders and our opportunities for trade development in this republic will experience another setback."

Several railway projects that have been sanctioned by government appear to be awaiting better times. They include (1) a road from San Miguellito, on Lake Nicaragua, east about 100 miles to the Bluefields River, where navigable water would be reached, about 60 miles from the Atlantic; (2) a road from Momotombo, on Lake Managua, to Rio Grande, something like 200 miles, and within 100 miles of the Atlantic; (3) a branch of the government road from Misaya to the Pueblos district on the Pacific coast, about 16 miles.

##### COSTA RICA.

The construction of perhaps 50 miles would complete

a transcontinental railway across the narrow isthmus forming the republic of Costa Rica. A road has for some time been in operation from Port Limon, on the Atlantic, to San Jose, the capital, something like 100 miles. It was intended to continue it to the Pacific at Punta Arenas, but a government commission has recently decided that Tivires, about 20 miles south of Punta Arenas, is the better terminus, and that about \$1,000,000 can be saved by building to that point. The cost of the extension is estimated at \$5,000,000, which does not include the \$1,500,000 that will have to be spent to make a harbor at Tivires. Evidently these figures are not on a gold basis. A survey of this route was completed a year ago, and the congress recently ordered the work to proceed and empowered the executive to make contracts for building the railway and the harbor. The surplus revenue is to be applied to this purpose "after the establishment of the new national money." Whether the Costa Rican finances are in such a condition as to make contracts in connection with this work desirable is a question upon which information is needed.

#### An Anti-Spiritualist Society.

So much fraud has been practiced under the name of spiritualism in the past few years that it has been a difficult matter to keep it respectable as a belief by those who regard it as a religion.

The methods employed by numerous so-called spiritualists to entrap their victims are not well understood, and by many not even suspected. The physical test mediums of the itinerant circuit are not nearly so dangerous as are trance mediums, who pretend to be proficient in clairaudience and clairvoyance. Local mediums usually act as information agents to those who are more adept in this pernicious art of deception. How often we hear it said, "Why, they told me things no one could have known unless they had been acquainted with my family for the past twenty years;" but it seldom occurs to these people that eavesdropping confederates have gathered enough material for the pretended communications, having gleaned their information while acting possibly as book agents or trinket peddlers. Physical test mediums are often run out of business by vigilance committees who unmask these pretenders, but in many cases the trance speakers are allowed to carry on their nefarious practices. Every phase of pretended mind reading by the aid of spirits has been outdone by hypnotists, muscle readers and by persons who have given definite study to psychic research reports, and investigation committees have ascertained the true causes of certain phenomena purporting to proceed from the spirit world.

The object of the National Anti-Spiritualist Association of America is to urge to the front the most plausible theories upon which spiritualists base their revelations. By combining together those

who are opposed to spiritualism it is thought they will be able to meet the mediums squarely, and they propose to undermine their influence by publishing books, tracts, pamphlets and periodicals relating to the teachings and practices of the spiritualist. The society will soon have lecture committees, which will be prepared to furnish lecturers willing and ready to combat the mediums upon their own ground. This association is bringing to its support a large number of people interested in putting a stop to such false representations of alleged materializations as are constantly occurring. Membership in the society costs but a small sum, and the president is Rev. H. J. Decker, of Dayton, O., who is energetic in acquiring information and in prosecuting the work of exposure. One of the best helps he has, is our new work entitled "Magic: Stage Illusions and Scientific Diversions, including Trick Photography," which contains a number of exposés of tricks of spiritualistic mediums. Several papers have, by permission, published some of these tricks, in the hope of combating spurious spiritualism.

#### A Transatlantic Yacht Service.

It is stated that a yacht service for transatlantic travel is now under consideration. It is proposed to build a 2,000-ton four-masted schooner equipped as a yacht. The idea is to carry no freight and only saloon passengers. There are many for whom seasickness has no terrors and they would welcome such a yachting trip across the Atlantic. It is believed that there are enough people who would like to go in a sailing ship with all modern improvements to make the venture a success financially. Twin screw engines of low power would be provided to be used only in the event of a dead calm. Refrigerating chambers, evaporators and distillers would form a part of the equipment, so that all the comforts of the best liners would be secured. The service would, of course, be a summer one.