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## AN ILLUSTRATION OF PRACTICAL RESULTS FROM THE PROTECTION OF NATURAL RESOURCES

ABOUT fifteen years ago a highly enlightened administration of the government of Peru became interested in the decline of the country's valuable guano industry and the apparent diminution in number of guano-producing birds. It was the privilege of the writer to be engaged by the Peruvian government for an investigation of the condition of the guano industry and the possibilities of its preservation, as well as for studies relating to the fisheries and to the marine fauna and flora. On my arrival in Lima I was impressed with the alert attitude of government officials in reference to the guano industry and with their anxiety to take whatever measures might, as the result of careful investigation, be found conducive to the conservation of the guano birds. A most significant preliminary step had indeed already been taken through the closure of the three Chincha Islands.<sup>1</sup> After an extended investigation, a series of recommendations for the general regulation of the guano industry was submitted to the Director de Fomento, and, with his approval, the report was reproduced in *SCIENCE* for July 10, 1908. A few excerpts from that report will be illustrative.

2. The present tendency to decrease in numbers (of birds) may be checked. There is a wealth of reliable testimony from the older men of long experience in the industry, that the useful birds, . . . were formerly vastly more abundant than now. . . . If they have endured the treatment they have received without decrease in numbers, then pro-

<sup>1</sup>Two of the islands were shortly opened for guano extraction under pressure of circumstances, but the South Island remained closed through three breeding seasons, affording a convincing demonstration of the utility of the measure. (See "Habits and Economic Relations of the Guano Birds of Peru," *Proc. U. S. N. M.*, Vol. 56, p. 484.)

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tection can hardly be worth while. On the other hand, if it is true, as represented by every one who should know, that there has been a great diminution in number of birds, then—

3. *We may hope that the protection of the birds will result in a great increase in their numbers.* Before the working for guano on a large scale began and before the nesting grounds began to be plundered for eggs and fowls, the birds must have existed in a condition of abundance dependent upon their food supply, their enemies and their natural prolificness. New factors have entered in recent years which have caused the birds to decrease materially below this *normal condition of abundance*. If these unfavorable factors are removed by well-considered and well-executed protective measures, why may we not see an increase in number toward the former normal abundance?

I think it conservative to say that the proper protection of the birds means the saving to Peru of hundreds of thousands of dollars' worth of guano each year. . . .

We . . . may well plan for protective measures that are intended to work progressively to the advantage of the industry for the next twenty years or more. We want to see many more birds in 1915 than are present in 1908, and more birds in 1920 than in 1915; and this will not be accomplished by routing the birds from their nesting grounds as soon as they are fairly established.

The general plan of protection comprised the following essential elements.

1. The admission of but a single concessionist to an island or a group of islands in order to eliminate the vigorous competition which was resulting in utter disregard of the needs of the birds, requiring also that the concessionist, through a resident representative on each island, should be held responsible for the fullest protection of the birds.

2. The closing of islands for periods of years.

3. The continuation of the existing yearly closed season of months.

4. Placing the extraction of guano for national agriculture in the hands of a single company, which would thus "be induced to plan for the future."

5. Adjustment with the Peruvian Corporation, Limited, whereby detrimental competi-

tion between the exporting corporation (to which a considerable portion of the guano was mortgaged) and the national company might be obviated.

The problem before the government, the national agriculture, and the exporting company, is this: How can the guano industry be saved to the future? Certainly no legitimate interest can be furthered by a continuance of the present unsatisfactory system, with its sacrifice of the birds.

I think the solution of the problem will be furthered if we put the question in this way: What system of regulation will result in the greatest annual deposit of guano twenty years hence?

It was a comparatively easy matter to offer recommendations, but an extremely difficult one to give them effect, because of complications arising from the heavily mortgaged condition of the guano deposits, the inadequacy of the current deposits for the use of national agriculture, and the restive internal conditions which culminated, shortly after the recommendations were presented, in the most serious revolutionary movements known in many years. The matter of the preservation of the guano industry was not, however, lost track of altogether, and it is understood that several of the measures proposed were given effect at an early date. A later government took up the matter again in a serious way and enlisted the services of Professor S. O. Forbes of England who made a careful study of the conditions and submitted a comprehensive report to the Peruvian government. As this report has not been published it can not, unfortunately, be cited in this connection. It is evident that the protective measures now in effect are based upon the essential principles outlined above. The extraction of guano for national agriculture was placed in the hands of a single organization, the Compañía Administradora del Guano, directly responsible to and regulated by the government. Suitable adjustments were made with the Peruvian Corporation Ltd. The closed season was continued, and the closing of islands for periods of years became an established part of the plan of regulation. Guardians were put upon the several islands.

As to the results, we have convincing testimony from Dr. Robert Cushman Murphy, of the Brooklyn Institute of Arts and Sciences, who has recently visited Peru and given especial attention to the birds of the guano islands. Some of his observations are comprised in a series of papers of fascinating interest entitled "The Sea Coast and Islands of Peru" appearing in current numbers of the *Brooklyn Museum Quarterly*. I quote from the last number (October, 1920, p. 250).

The first undertaking of the Compañía Administradora del Guano under the able directorship of Senor Francisco Ballen, was to make each of the numerous guano islands a bird sanctuary, closed at all seasons of the year to unauthorized visitors. Competent guardians with duties scarcely less exacting than those of lighthouse keepers, were posted as permanent residents upon every group. O clandestine guano extraction, the stealing of birds' eggs for food or for the use of the albumin in clearing wine, and other disturbances which had formerly caused havoc in the colonies, ceased at once. The old method of extracting guano without regard to the presence or physiological condition of the birds has, of course, been abolished, the islands, under the new rule, being worked according to a system of rotation which leaves ample and congenial breeding grounds always available. Courting or nesting birds are now carefully shielded from disturbance. Moreover, after removal of the guano, an island is promptly vacated and is thereafter given over to the complete possession of the birds for a period of approximately thirty months, at the expiration of which the date for a renewal of digging operations is determined only after careful reconnaissance.

The régime of the Compañía Administradora del Guano, with its well-balanced regard for both business and conservation, has resulted in a nearly uniform increase in the annual increment of guano, as well as a promising outlook for a continually augmenting supply while the birds are repopulating the breeding grounds to the limits imposed by space and the nutritive resources of the littoral ocean. Since 1910, the administration has issued an annual "Memoria" containing statistical data, from which the following table of production has been taken:

Seasons	Guano Production
1909-1910 .....	25,370 tons
1910-1911 .....	24,921 "
1911-1912 .....	18,636 "
1912-1913 .....	24,350 "
1913-1914 .....	31,486 "
1914-1915 .....	24,446 "
1915-1916 .....	43,721 "
1916-1917 .....	59,208 "
1917-1918 .....	87,898 "
1918-1919 .....	80,517 "

The slight fluctuations in the column are doubtless due to the fact that no island is worked two years in succession, which results in a somewhat disproportionately large yield for the seasons in which the product of the most important islands is included. In a letter dated August 24, 1920, Senor Ballen writes that the guano output for the current year will exceed 82,000 tons, of which 70,000 tons will be required by native agriculturists and 12,000 tons will be at the disposal of the Peruvian Corporation for export. It should be understood that the tabulated figures refer to newly deposited guano, for the so-called "fossil" beds have been long since exhausted except upon Lobos de Tierra and Lobos de Afuera.

Most instructive deductions may be made from the table of guano production just quoted. In the first place, it is evident that in the early years of the period covered the annual production of guano was approximately as estimated in 1908, i.e., from 20 to 25,000 tons per annum. In the second place, it appears that, beginning about 1913, the annual production of guano (proportioned in large measure to the abundance of producing birds) has risen to more than 80,000 tons at the present time. The production now is approximately three times as much as it was ten years ago. In 1908 the annual deposits were far below the estimated requirements of national agriculture, disregarding the export requirement. In 1920 the production substantially exceeds a greatly increased requirement for national agriculture so that a moderate export may be carried on even without sacrifice of internal requirements. The government derives revenue of more than a million dollars a year from the extraction of guano, a reasonable profit accrues to the Compañía Administradora, and presumably to the export

corporation, while Peruvian planters obtain the most valuable fertilizer at a price which our American farmers would consider astonishingly low.

Now, in the words of Captain Cuttle, "The bearings of this observation lays in the application on it."

In the first place, one of the essential principles upon which this scheme of protection is founded is that of closure of breeding grounds in rotation *for periods of years*. This principle must be distinguished from the common measures of protection through closed seasons or the establishment of permanent sanctuaries. While the latter is in many cases an ideal method of protecting animals, it is of course impracticable of application in the case of guano birds and many objects of chase or fishery.

Closed seasons of a few months produce good results in many cases, but such a principle of protection has the defect (often unappreciated) of being based upon an assumption that nothing essential to reproduction takes place except when the reproductive activities are externally evident. It seems sometimes to be assumed that destruction or disturbance of an animal *before* it spawns makes no difference. The closed season of months has, to be sure, its proper place, and is often the only feasible measure.

The second application is that the plan of temporary sanctuaries, as applied to guano-producing birds, has evidently worked and produced the desired results in high degree. The annual production has been *trebled* in ten years. Why then can not the plan be more generally applied in the case of natural objects requiring protection? It seems to be based upon a proper appreciation of physiological, "social" and ecological conditions as affecting successful reproduction. This is the principle, by the way, which for eight years has been advocated for the preservation of the fresh-water mussel resources of our interior streams, but which is as yet being given effect in a small way in only two states.

A final application to be made in this connection is not the least in importance. The

enforcement of any broad and effective plan of protection of guano birds was confronted ten or twelve years ago with obstacles which one might fairly have considered insurmountable: foreign obligations with their customary difficulties of adjustment; national agricultural demands so exceeding the yearly production as to make temporary curtailment most aggravating to Peruvian agriculturists; restive political conditions such as usually demand the service of the present rather than of the future. How do such difficulties compare with those which confront the protection of fresh-water mussels or the development of the oyster industry in the Chesapeake Bay, for example? Surely, as Dr. Murphy has appropriately suggested, credit is due primarily to the patriotic and far-sighted citizens of Peru who accepted the preliminary sacrifices and *did what was evidently needed to be done*.

When we consider that the conservation measures cited were so promptly and fruitfully executed in one of our sister republics south of the equator it ought to "give us pause"—or else it should stimulate us to stop pausing and proceed to take like care of some of our own natural resources.

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#### NATIONAL TEMPERAMENT IN SCIENTIFIC INVESTIGATIONS

WE have too long adjusted our scientific thought to the temperature of a European atmosphere. It should not be necessary to guard the voice of our scientists against the unnatural accent of the parrot. What was true of literature when Emerson read before the Phi Beta Kappa Society at Cambridge his celebrated oration on "The American Scholar" is now true of scientific investigation in the United States. "We have listened too long to the courtly muses of Europe." We have too much taken our problems from European investigators and have too little allowed nature to ask her own questions of us. These problems we have treated too much in the spirit of European (and