Chicago Natural History Museum

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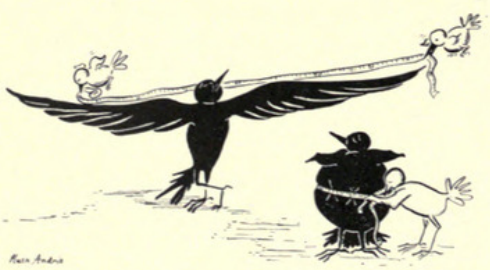
THE LARGEST BIRD

BY AUSTIN L. RAND
CURATOR OF BIRDS

WHAT is the largest of birds?

One must approach such a question as this with caution, straightforward as the question seems. First, do you mean weight or wing spread? These are the two usual



Size by wing spread . . .

criteria and they will give quite different results. In weight the ostrich-like flightless running birds head the list. But in wing spread the ostrich, with degenerate wings, ranks relatively low.

The second element to watch for is the reliability of the records. Somehow, certain records that seem impossibly large have become current and must be discarded. This is well illustrated by Dr. R. C. Murphy's comments in 1936 on wing spread of the albatross. Current authorities gave up to 17 feet as the wing spread of the wandering albatross (which is about the same size as the other "great" albatross, the royal). After sifting the evidence and giving his own measurements, he concludes that about 11½ feet represents the maximum expanse of any known bird.

In the following, a presentation of the average or normal is attempted for comparative purposes rather than an absolute "record."

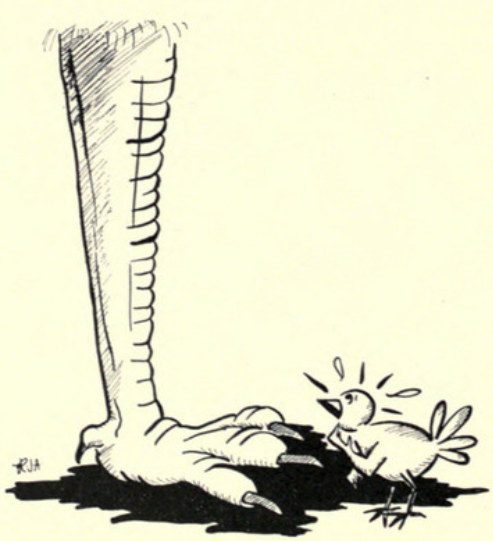
VARIATION

The weight of a bird would obviously vary with age, sex, and the amount of fat the bird carried. In addition, the species may attain different sizes in different parts of its range. This is illustrated by the weights of the Canada geese, adapted from F. H. Kortright's book. Individual and sexual variation is shown by the large eastern subspecies, the common Canada goose: male, 8 pounds 2 ounces to 13 pounds 8 ounces (average, 9 pounds 3 ounces); female, 7 pounds 6 ounces to 13 pounds (average, 7 pounds 14 ounces). Variation correlated with geography (i.e. subspecies) is shown for males, average weight only, as follows:

Common Canada goose	9 pounds 3 ounces
Western Canada goose	10 pounds 4 ounces
Lesser Canada goose	5 pounds 2 ounces
Richardson's Canada goose	4 pounds 14 ounces
Cackling Canada goose	3 pounds 6 ounces

FLIGHTLESS BIRDS—WEIGHT

The ostrich is the largest living bird. When it stands up to look around, its head may be 8 feet from the ground and it may weigh 300 pounds. Ostriches' strength is such that as a stunt people ride on their backs. The ostrich's nearest rival is the emu of Australia that may weigh 100 pounds, and the cassowary of the New Guinea-



. . . or by mass and weight

Australia area is close behind, weighing up to 90 pounds. By comparison the ostrich-like rhea of South America is a pygmy, weighing only about 45 pounds.

That there were giants in earlier days may or may not be true of humans, but it's certainly true of birds. The moas of New Zealand and the Aepyornis of Madagascar are extinct, known only from bones, but from a study of these we find they were certainly much larger than the ostrich. We can never have actual weights, of course, but Dr. Dean Amadon, comparing their remains with the bones of ostriches, comes to the conclusion that moas may have reached a weight of 500 pounds and Aepyornis a weight of 1,000 pounds, the largest known bird of all time.

These flightless birds, of which the ostrich is the best-known type, are all long-legged running birds with degenerate wings that have no function in locomotion. Their wings are so small that they probably are of little use even as balancers. But another type of flightless bird also reaches a large size—the emperor penguin, which may attain a weight of 75 pounds. In the penguins the wings, though reduced, are modified into flippers and still function in locomotion—in swimming—rather than the short, comparatively small feet.

Though the largest birds are flightless, not all flightless birds are large. The kiwi of New Zealand and the smaller species of penguins could probably be matched for weight amongst domestic fowls. There are some flightless rails, such as the one from Tristan da Cunha, that are little larger than sparrows.

FLYING BIRDS—WING SPAN

The largest flying birds are probably the wandering and the royal albatross, with a wing spread of about 11½ feet and a weight

(*Continued on page 5, column 3*)

THIS MONTH'S COVER

Recently volcanoes have rivaled politics, the cold war, and atomic developments for front-page attention. The latest eruption, near Mauna Loa in Hawaii, brought a demand for information on volcanoes, in response to which Dr. Sharat K. Roy, Chief Curator of Geology, prepared the article on page 3. Our cover picture shows the devastating effects of volcanic eruptions of explosive type. The havoc shown was wrought by the eruption of the Mexican volcano, Parícutin, most recent of all volcanoes of steam-blast type. Much of the lava-flows that engulfed the village in foreground of the photograph came from one of the vents in the flank of the volcanic cone.

VOLCANOES AID IN PROBING SECRETS OF INNER EARTH

By SHARAT K. ROY
CHIEF CURATOR, DEPARTMENT OF GEOLOGY

Dr. Roy left in March to make collections of volcanic specimens and continue his studies of volcanoes in El Salvador, Costa Rica, and Nicaragua. The expedition is a continuance of research of the past several years.

RECENT LAVA ERUPTIONS associated with the volcano Mauna Loa in Hawaii have once again brought the subject of volcanism sharply into focus. There does not seem to be any lessening of interest in Nature's pyrotechnics.

From the standpoint of volume, Mauna Loa is the world's largest volcano. At 13,686 feet, it is nearly as high as Mauna Kea (13,835 feet), which is the world's highest mountain if measured from the ocean floor. Of Mauna Kea's total height, 31,750 feet (almost half a mile higher than Mount Everest), fully 17,915 feet is under the sea.

The islands of the Hawaiian group, the largest of which is Hawaii, are but the summits of an enormous submarine volcanic ridge. The material composing the ridge consists almost entirely of basaltic lava that has risen intermittently along a fissure on the ocean floor from an average depth of 18,000 feet. Although Mauna Loa is often referred to as the "monarch of modern volcanoes," it is not of the explosive type, nor are its sister volcanoes, Mauna Kea, Kilauea, and other lesser ones.

"QUIET ERUPTIONS"

The eruptive activities of the Hawaiian volcanoes are confined almost entirely to quiet lava-flows from the cracks in the flanks of the cones or from those at the base of the cones and in the surrounding areas. For this reason the terms "Hawaiian eruption" and "quiet eruption" are used synonymously in geologic literature. The characteristic feature of the Hawaiian eruption is that, preceding an eruption, the lava accumulates in the crater, but before it can rise to the summit and well out, its weight ruptures the walls of the crater. With pressure thus relieved, fountains of incandescent lava leap into the air and fall to form a river of fire, which, when very hot, is known to have moved faster than a man can run, ten to twelve miles an hour. The principal characteristic of Hawaiian lava, which is basaltic, is its fluidity. It is not to be construed that the eruptive behavior of a given type of volcano is always the same. On the contrary, volcanoes are notoriously fickle; the same volcano may and does change from one type to another. In historic times, two disastrous explosive eruptions have taken place in the Hawaiian Islands, and that there will be many more in time to come is almost a certainty.

In direct contrast to the Hawaiian volcanoes are the volcanoes of the Mexican Cordillera, Central America, and the East Indies. In these areas the earth breathes fire and the volcanoes erupt murder. With but a few exceptions these are all viciously explosive volcanoes. Hundreds of catastrophic explosions with successions of earthquakes have killed thousands of people, wiped out great cities, dammed and deflected streams, cut off water supplies, and blocked highways to which survivors fled to escape to safer grounds. Man's memory refuses to recall or relive the death and destruction that accompany violent explosions. In the Messina Straits in 1908 more than 200,000 lives were snuffed out by a single explosion.

CONTINUOUS ERUPTION SINCE 1770

Volcan Izalco in El Salvador, the most active of all Central American volcanoes. It has been erupting almost continuously for more than 184 years.

PACIFIC OCEAN VOLCANO BELT

Fortunately for humanity, the periods of volcanic quiescence far exceed those of violence. If this were not the case, millions of people now inhabiting areas along the "belts of fire" would be forced to abandon their lands made fertile by the decomposition of volcanic ash and migrate inland to start life anew amidst uncertainties and in communities less to their liking. This mass dislocation would be particularly severe in the vast belt around the Pacific Ocean—a belt that begins in Tierra del Fuego and extends through the Andes, Central America, Mexico, and Alaska to the coast of Asia and southward through Japan, the Philippines, East Indies, and New Zealand.

What governs the type and/or character of an eruption? It has been stated that the eruptive element *par excellence* is gas—that the gas is the active agent and that magma or lava is its vehicle. Indeed, eruptions are actuated by lava charged with gas and steam in a fissure underground. Since the gases differ in their proportions and the lavas in their constituents, we have either quiet lava-flows or steam-blast explosions. As a rule, quiet eruptions are associated with the extrusion of basic lavas, which, being more fluid than acidic lavas, permit the imprisoned gases to escape more freely into the air. The acid lavas, on the other hand, are stiff and viscous. They congeal rapidly in the vents, impede the passage of steam and other gases that accumulate in large quantities, and build up a condition for an explosion of immense violence.

HEAT SOURCES

The ultimate cause of volcanic eruptions is heat. Where does the heat come from? If it is a part of the original heat of a once very hot earth it should be evenly distributed. Volcanoes, however, indicate that only certain areas become heated intermittently at certain times in geological history. As a matter of inquiry into whether the radioactivity of uranium and thorium is a source of heat in volcanic actions, volcanic ejecta—lavas, ashes, and the gases evolved from fumaroles—have been analyzed, but the amounts found in each case are too small to be significant. Other probable sources of heat, such as gravitational compression, faulting, and folding may be considered, but these too can hardly be expected to produce, individually or collectively, the magnitude of heat required. Perhaps it is well to assume that the development of high temperature in localized areas during volcanism results from the interactions of several heat sources rather than any one in particular.

Volcanoes offer some of the few means we have for probing into the enigmas of the Earth's turbulent interior. Mere understanding of the morphology and products of volcanoes is not enough. The time is now ripe for concentrated field studies at active volcanoes of their past history, structural setting, and relationship to neighboring volcanoes.

Volcanism has long ceased to be an abstruse science. Though much remains to be known, certain diagnostic criteria as signs of impending volcanic activity are fairly well established, and prediction as to the time and areas to be affected can be made in many cases. The certainties of physical law are behind all this and play a major role. The formula once determined can be applied to various types of volcanoes. We owe much to the volcanologists stationed in volcano observatories for the increasing body of information that gradually makes clearer the physics and chemistry of eruptions and earthquakes. Already the damage to life and property by timely predictions has been appreciably reduced.

FISH COLLECTING ALONG COASTS OF MEXICO

By LOREN P. WOODS
CURATOR OF FISHES

THE MEXICO Zoological Field Trip of 1954–55 left Chicago on last November 26 and returned on March 7. The principal objective was to collect marine fishes along the Pacific Coast of the Isthmus of Tehuantepec in southeastern Mexico and in the vicinity of Acapulco.

BEACH SEINE-FISHING IN MEXICO

At La Ventosa, a fishing village near Salina Cruz, all the men and boys work at hauling seines. Nets 20 feet deep and 100 to 300 yards long are loaded into dugout canoes and set to surround schools of fish in the bay.

The first base of operations was Salina Cruz, a busy but small seaport and Pacific terminus of the trans-isthmus railroad. Salina Cruz, though only of minor importance as a commercial fishing and shrimping port, was chosen because it is the most southern port from which shrimp boats operate and because the shrimping is carried on near a hypothetical zoogeographic boundary line as well as along the Mexico-Guatemala political boundary line.

The Gulf of Tehuantepec is a broad curving bight with east-west shore lying only 125 miles south of the southern shore of the Gulf of Mexico. During the winter months strong north winds spill out of the Gulf of Mexico, funnel across the low mountains of the isthmus, and blow with considerable force out into the Pacific. Winds of nearly gale strength are generally avoided by trawler fishermen who put out to sea in vessels of 50 to 65 feet in length, but in this region the winds are actually more help than hindrance. The large Pacific swells rolling into the shallow Gulf of Tehuantepec toss the trawlers a great deal, and this movement makes trawling and handling of gear very difficult. The effect of the winds is to blow the sea flat or at least to change huge swells to short chops, so that from shore to five or ten miles out the small boats ride on an even keel. The shrimping grounds are far to the east, sheltered from the strongest winds by high mountains but still in the area where the rollers have been flattened.

A few days after arriving in Salina Cruz, arrangements were made for me to make a twelve-day cruise aboard a shrimp boat as a guest of the shrimp company to collect the fish specimens I desired for study. Since shrimp nets capture a large variety and quantity of fishes, there was no difficulty in making the collection, and within a day or two one 25-gallon tank was already full. The second tank was gradually filled during the remaining ten days as additional species were caught. Shrimping in the Gulf of Tehuantepec is carried on day and night, the net being dragged for three hours, hauled, emptied, and immediately set for three more hours. This continues with monotonous regularity round the clock, day after day. Preserving specimens, sleeping, and eating are done while the net is out.

At this time of year the shrimp were living in comparatively shallow water of 12 to 20 fathoms and from one to five miles offshore. Every haul resulted in 500 to 2,000 pounds of fishes and miscellaneous invertebrates to be sorted from shrimp and fish specimens. Several kinds of sea catfishes and numerous species of drums made up the bulk of the catch, but there was also a great variety of grunts, flatfishes, sharks and rays, herrings, anchovies, and other miscellany. Altogether nearly a hundred different kinds of fishes were netted.

OTHER SALINA CRUZ FISHING

The shrimp-boat cruise ended December 24, and so Christmas morning was spent sorting and wrapping the specimens and packing them into the smallest possible space to make room for more. A beach seine-fishery at Salina Cruz produced additional species of fishes, and still other species were taken by fishing with a light at night and by treating tidepools with derris-root powder to drive the fishes from their holes and stun them so they could be caught. Fishing by the latter method was not very productive in number of individuals or species, presumably because the waves carried fine sand, resulting in clean-scoured rocks and very poor living conditions for reef fishes.

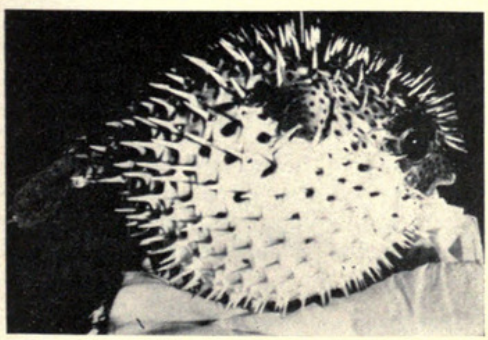
Along the Chiapas coast of Mexico, east and south of Salina Cruz, is a network of shallow mangrove-bordered lagoons. Some of these lagoons are fresh water, others are very salty during the dry season, while still others are merely brackish. They contain a good variety of fresh-water and marine fishes living together. There is usually a fishing village on the shore of each lagoon, and the villagers regard the lagoon as their private family fish-pond. One of the most interesting fishes living in the lagoons is the alligator gar, known locally as the *peje armada*. Gars had been reported from this area, but no specimens had ever been collected for study. No entire specimens were available because the fishermen remove the head and slit the fish as soon as it is speared. Later the fish are filleted, salted, and dried for the market. A three-day trip was made by land down the coast to the lagoon of Cabeza del Toro (the name derived from the shape of the lagoon) near Puerto Arista. Here the fishermen were induced to bring in three small gars without first removing the heads. The alligator gar is known to live in the Usumacinta River on the Gulf of Mexico side of the Isthmus of Tehuantepec and in Lake Nicaragua, as well as in the Mississippi River valley, gulf coast of the United States, and Cuba. Study of these specimens from the Pacific coastal lagoons may provide a clue concerning the route by which they reached their present isolated habitat.

COLLECTING NEAR ACAPULCO

After five weeks of gathering fishes in the vicinity of Salina Cruz, the collection was taken to Mexico City and sent to Chicago. This provided much needed space for additional specimens when the base of operations was shifted to Acapulco. Acapulco, a resort city, is sheltered by mountains from the effects of the strong winds that blow the warm surface-water away from the Gulf of

Tehuantepec, is easily accessible, and provides excellent facilities for shore collecting. In addition there are large bays, sheltered coves, and rocky islets with abundant tidepools and shallow submerged reefs inhabited by a number of small fishes of many varieties. These species, such as butterfly fishes, tangs, wrasses, and demoiselles that are usually associated with living coral and rocky reefs, were very scarce or absent from the sandy shores where we had been collecting earlier. Each particular locality around Acapulco Bay, where rotenone was used to stun the fish, yielded 40 to 50 species, and after three weeks of fishing a collection of between 100 and 150 species was gathered. Some beach and lagoon fishing is carried on by the local fishermen, and in addition another group of fishermen fish at night around the entrance of the bay with handlines, spear and dipnet, using a lantern to attract the fishes. Their catch added a number of species that were not caught by the methods I had been using.

During the past two years the Museum has received collections of fishes from Guaymas (Mexico), from the Gulf of Nicoya on the Pacific Coast of Costa Rica, from both coasts of Panama, and from the Gulf of Mexico and West Indian islands. It is especially helpful to have specimens of a particular species from various parts of its range for study and also useful to have comprehensive collections from various provinces in a particular zoogeographic region in order to delineate the boundaries and thus to understand some of the limiting factors and ecological preferences of certain species. There are a number of resemblances between the fish fauna of the eastern tropical Pacific and the West Indian fish fauna (including the Gulf of Mexico and Caribbean Sea shores)



SPOTTED PORCUPINE-FISH

Increasing its size by swallowing air was disastrous for the fairy-tale frog. The porcupine-fish, better fitted for this behavior, uses inflation as a natural protective device. Swallowing air or water not only changes the shape of the fish but assists in erecting its long hard spines. Other fishes seek less prickly, more appropriately shaped prey for food.

that need further study and explanation. It is hoped that careful study of the collections obtained by this expedition can be combined with data obtained from the collections mentioned above to add to our knowledge of the geographic distribution and variation problems of the American tropical marine fishes.

"Highlights Tours" Offered Daily

Free guide-lecture tours are offered daily except Sundays under the title "Highlights of the Exhibits." These tours are designed to give a general idea of the entire Museum and its scope of activities. They begin at 2 P.M. on Monday through Friday and at 2:30 P.M. on Saturday.

Special tours on subjects within the range of the Museum exhibits are available Mondays through Fridays by advance request.

Although there are no tours on Sundays, the Museum is open from 9 A.M. to 5 P.M.

STAFF NOTES

Dr. Theodor Just, Chief Curator of Botany, told about some of the widespread fallacies concerning mushrooms in a recent guest-appearance on the television program "Women and the World" over station WBKB, illustrating his talk with Museum material. On March 17 he lectured on "Adventures with Plants" in the noontime series presented at the Chicago Public Library for audiences of Loop workers. . . . **Henry S. Dybas,** Associate Curator of Insects, represented both the Museum and the South Cook County Mosquito Abatement District at a meeting of the Illinois Mosquito Control Association held at the University of Illinois in Urbana. . . . **Miss Harriet Smith,** lecturer on the staff of Raymond Foundation, spoke on the mission of the Museum over radio station WNMP in Evanston, Illinois . . . **Colonel Clifford C. Gregg,** Director, recently told "The Inside Story of the Museum" for the Kiwanis Club of Gary, Indiana.

YOUTHFUL SCIENTISTS TO STAGE SHOW

Some of the Darwins, Newtons, and Einsteins of the future will have their day at Chicago Natural History Museum on April 16 at a science fair sponsored by the Chicago Teachers Science Foundation. Grade-school pupils (from the 6th grade up) and high-school students will display their achievements in the fields of biology (including conservation), geology, anthropology, mathematics, physics, and chemistry. The fair at the Museum is for those pupils enrolled in schools of the West Area, bounded by North Avenue, the Sanitary and Ship Canal, and 47th Street. (South Area exhibits go to the Museum of Science and Industry on April 2; the North Area display was held at the Chicago Academy of Sciences on March 26.)

The exhibits, all the creations of young people completed without aid other than advice from teachers, parents, or other adults, will be displayed on the second-floor gallery of the Museum at the head of the grand staircase. The students themselves will be present to explain and demonstrate their products. Theodore W. Wallschlaeger, principal of the Palmer Elementary School, will be in charge. Awards will be made in each grade, and winners may take part in later science exhibitions from all areas. An idea of the type of exhibits that may be expected is shown by last year's list, which included: a model of the human ear, six-inch telescope, Navaho Indian artifacts, model of an atomic pile, a miniature Stone-Age diorama, photo-electric circuit, mechanical model of the earth, a garden-collected exhibit of insects, butterflies of Chicagoland, "do-it-yourself" electronic devices, and classification of plants.

THE LARGEST BIRD

(Continued from page 2)

of 15 to 20 pounds. The next-largest flying birds are the Andean condor that must approach 10 feet in wing spread and the California condor that has a wing spread of about 9 feet and a weight of 20 pounds, according to C. Koford's studies.

Unlike the running ostrich-like birds, the largest fossil flying bird was only a little larger than present-day birds. The largest is *Teratornis*, a Pleistocene vulture of North America, which has been estimated to weigh 50 pounds, a truly enormous weight for a flying bird. We can't get its wing spread directly because we have no feathers of this fossil, but its bones, according to Dr. H. I. Fishers, show it to have a wing spread, in skeleton, of 7¼ feet, and the wing itself a length of about 39 inches compared with 31½ inches for the California condor and 34 inches compared with the Andean condor. If its quills were as long as those of the Andean condor, which it probably exceeded, a couple of feet would be added on each side of the 7¼-foot skeletal spread to give a wing spread of about 12 to 13 feet, slightly larger than that of the albatross.

Surprisingly, while the largest running birds were way in advance of any competition, this is not true of the largest flying birds. The trumpeter swan has a wing spread of 8 feet and a weight of 28 pounds; the white pelican a spread of 9 feet and weight of about 10½ pounds; and the whooping crane a spread of 7 feet and a weight of about 10½ pounds.

Not to isolate these figures, following are the wing spreads and weights of some of our more familiar birds:

	Wing spread	*Weight*
Bald eagle	79 inches	9.5 pounds
Great blue heron	70 inches	7 pounds
Turkey buzzard	70 inches	4.5 pounds
Red-tailed hawk	48 inches	3.25 pounds
Crow	36 inches	1.3 pounds
Sparrow hawk	21 inches	4 ounces
Robin	15 inches	2.5 ounces
Song sparrow	9 inches	.88 ounces