bird breeding at Busch Gardens

by Ed Bish
Tampa, Florida

Until as recently as a few years ago, curators of bird collections took little interest in breeding macaws, but that casual attitude has shifted lately toward a serious interest in good breeding techniques. Importing restrictions on the trade of these birds, along with a ban on exports imposed by a number of countries, have caused bird curators to appreciate the importance of perpetuating the species right here in the United States, in their own zoos.

At Busch Gardens in Tampa we've been active in that effort since our opening in 1959. In those days, of course, our collection included only a small number of macaws and cockatoos, but Busch Gardens has grown over nearly a quarter of a century into one of the finest zoos in the country. Among the numerous breeding awards we've received was the Edward Bean award for the first captive breeding of the Yellow-collared or Yellow-naped Macaw, raised in 1963. Blue and Gold Macaws were hatched in 1964 and the parent birds are still raising young, having hatched two chicks early this summer.

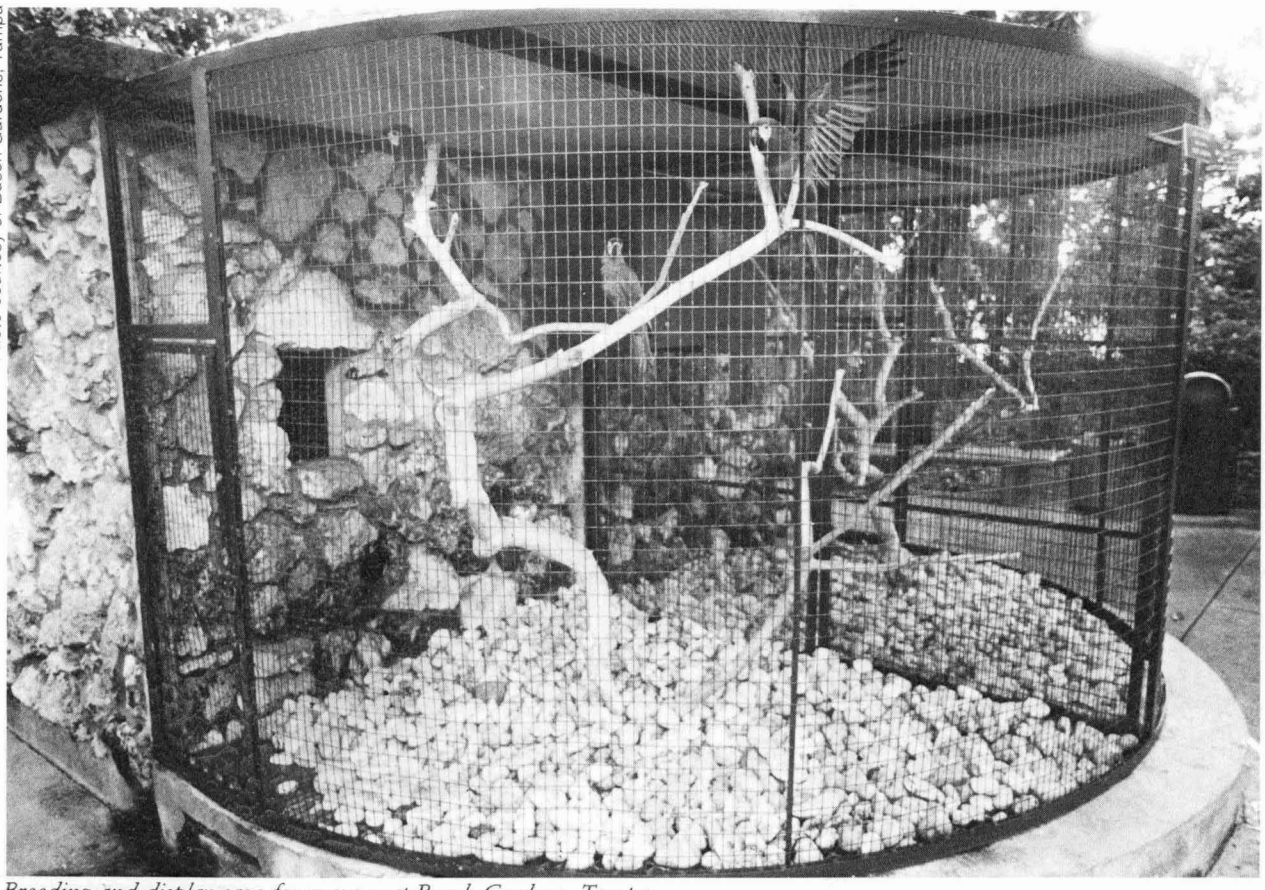
Scarlets were raised a few years later. After the female lost her mate on two different occasions, we mated her again — and she's still raising chicks, with two in the nest at present. A pair of Military Macaws, used in our picture posing area, laid one egg some years ago. We hatched the chick in an incubator, but were unsuccessful in raising it. After giving this pair its own breeding cage, we waited six years before the female laid eggs and hatched a chick. Patience can be an important factor in breeding and raising birds.

Of the twelve species of macaws in the bird collection at Busch Gardens, nine have raised young. Eight species were raised in each of the years 1979 and 1980, including the Blue and Gold, Scarlet, Military, Green-winged, Severe, Illiger's, Yellow-collared and Noble Macaws. In 1981 we successfully hatched and are now hand-raising our first Hyacinth chick. It's doubtful that any other zoo has raised this many species of macaw.

As I mentioned, patience is a vital component of any bird curator's breeding program, but there are other useful tips that can make the job easier, too.

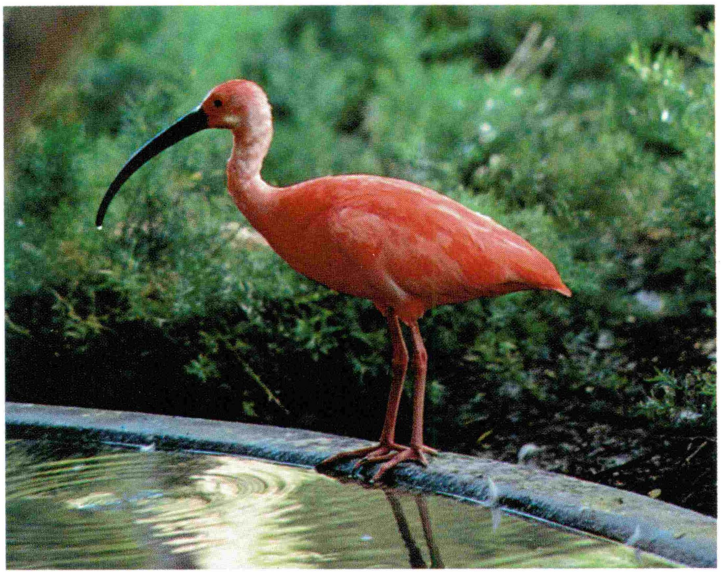
Fiberoptiscopes, for instance, can save valuable time in determining whether birds are old enough for breeding. After

Photo courtesy of Busch Gardens, Tampa



Breeding and display cage for macaws at Busch Gardens, Tampa.

These three macaws are among the nearly 2100 birds of about 250 different species living at The Dark Continent, Busch Gardens, Tampa.



Photos courtesy of Busch Gardens, Tampa

Scarlet ibis like this one are born with matted grey feathers, but gradually develop brilliant plumage as they mature.

American flamingos breed regularly at The Dark Continent, with as many as a dozen or more hatching during each breeding season.

laying infertile eggs for several years, one Green-winged has been paired with a different, more mature mate, and is now producing chicks.

Other medical procedures may be helpful in the breeding process, as well. When two macaws paired up in the past, we assumed they were a mated pair — but sometimes this proved to be untrue. Now all of our macaws are surgically sexed before they're placed in cages with nesting facilities.

Those who believe macaws require large aviaries for mating would be surprised to see the cages Busch Gardens uses for its highly-productive breeding program. Each unit of the macaw breeding cages measures about three feet square, stands seven feet high and houses one mated pair of large macaws. Nesting facilities consist of two metal wash tubs wired together at their open ends, with a small opening cut in the top tub. Obviously, roomy accommodations aren't the most vital aspect to consider when breeding parrots.

Nutrition, on the other hand, is a crucial part of bird breeding. In fact, good nutrition may be largely responsible for a great number of successful breedings.

A busy setting doesn't seem to hamper some hatchings. All of the Dwarf Macaws at Busch Gardens have raised young in sidewalk display cages, constantly on view for the enjoyment of park visitors.

Behind-the-scenes breeding programs in zoological parks heralds a welcome trend away from the importing of parrots. The day will come when imports will cease almost entirely, and successful breeding programs will be of critical value to zoos in the United States. We have recently received on breeding loan from Parrot Jungle a male Lear's Macaw, which we paired with our female, in hopes of raising young. All zoos should seriously consider breeding loans to avoid extinction of some species — especially those that are endangered.

Busch Gardens has raised nearly 200 macaws in the past seventeen years. Twenty-six were raised in 1979 and 27 in 1980. In the next few years this number should increase considerably, with plans calling for more breeding facilities in the near future. •

How Birds Form Eggs

by C.R. Grau
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What a pleasure it is when a breeder discovers a pair's first egg. It signals the successful culmination of complex processes which have lasted months or years. The egg marks the end of what may have been a long period of development, and the beginning of a new bird, separated from its mother. The joy of finding an egg is especially great if it comes from a newly acquired pair, or one that has been boarding for years and has finally produced an egg, or from a species not previously bred in captivity.

It has been pointed out by Forshaw (1978) that surprisingly little information is available about the breeding biology of most psittacines, even those that have been bred in captivity for years. This was brought home to me recently when Lorraine Sellers, a student in our cage-bird class, searched the literature for data on the eggs and breeding biology of 139 species of psittacines. For many of these, not even sizes and descriptions of the eggs were reported.

One part of the research program on cage birds at Davis is concerned with reproduction and how it can be influenced by the breeder. In order to achieve better results, however, it is necessary to know something about normal egg and sperm formation, fertilization, laying, and incubation. This article deals with the egg and how it is formed. A diagram showing the internal structure of a cockatiel egg is shown in Figure 1.

It takes months or even years for the whole cycle of the egg to occur. Special egg cells that can first be identified in a young embryo are carried through the blood and come to rest in the part of the body that will eventually become the ovary. Even at this early age, the larger egg cells can be distinguished from the smaller, ordinary body cells by their distinctive microscopic appearance. After incubation, the embryo hatches into a chick, and eventually reaches sexual maturity, in as short a time as 6 weeks for Japanese Quail to as long as 9 years or more for the Wandering Albatross. Generally speaking, small species mature more rapidly than large ones. Zebra Finches may reach sexual maturity at 3 months; Budgerigars at 4-5 months; Cockatiel females at 10 months, males at 7 months; Amazon parrots at 3 years; and large macaws at 5 or more years. The egg cells of the ovary grow slowly to an intermediate stage, then wait for months or years for the hormone signals that cause the envelope of follicle cells around each egg to begin depositing the yolk. Most cage birds require courtship activity to initiate yolk formation, but some domestic species have been selected to lay eggs without that stimulus.

It is believed that all birds form eggs similarly, but differ in rates of formation, relative amounts of yolk, albumen and shell, size, shape, shell color, and shell texture. The information we have about egg formation comes largely from studies of domestic chickens, turkeys, and quail. At the time of maturity, female hormones (estrogens) stimulate the liver to form proteins that are rich in fat and these are circulated in the blood stream.

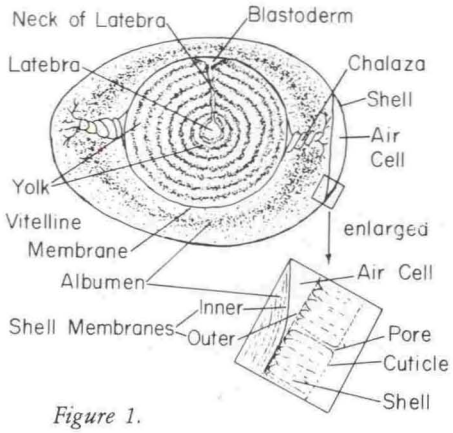

Figure 1.

The internal structure of a cockatiel egg. The yolk and its vitelline membrane are made by the ovary; the albumen, shell membranes and shell are added in the oviduct.

In one or more of the follicles of the ovary these proteins are concentrated and deposited as yolk. Deposition occurred within the egg cell or oocyte, which grows rapidly over a period of days, becoming the mature egg cell which we recognize as the yolk of an egg. This growth may be compared to that of a tree; in both the yolk and the tree new material is added on in successive layers. There are rings in yolks, just as in trees, except that yolk rings represent daily rather than yearly additions (Grau, 1976). We have studied this process by feeding dyes that are deposited in the yolk and then using new techniques of preparing yolks by freezing, fixing with formalin, and staining with dichromate. In this way we can now learn how long the yolk grows, and how much yolk is deposited each day and night. We can also determine the time that elapses between completion of yolk formation and laying of the egg, and for the first time, we can obtain the history of an egg by examining its internal structure.

An example of the way that this is done is shown in Figure 2, showing slices through the yolks of two eggs of the Ring Dove (*Streptopelia risoria*). These particular yolks are unique in that the bird that laid them had been fed capsules containing red or blue dye during the times that the yolks were being formed. My daughter Ellen noted the times of feeding the dyes to her bird and the times of laying, as follows:

Jan. 12, 7:30 AM, blue dye fed
Jan. 13, 7:30 PM, red dye fed
Jan. 16, 6:00 PM, blue dye fed
Jan. 17, between 1 PM and 10 PM egg #1 laid
Jan. 18, 8:30 AM, red dye fed
Jan. 19, between 8 AM and 7 PM egg #2 laid

From these time markers and a study of the daily rings laid down by the dove, we conclude that yolk formation of egg #1 was completed January 15, and the egg laid two days later. In egg #2, yolk was completed January 18, before the dye was fed, and laid January 19, one day later. The interval between eggs was slightly less than 2 days. By counting the total daily rings, it was concluded that it required 7 days to form the yolks of this dove, and a total of 11 days from the beginning of the first yolk to the laying of the second egg. Other doves may be different, hence 5 to 10 eggs are usually studied in order to obtain a valid result. The timing of egg formation in this dove is consistent with the patterns described by Lehrman (1965), in which the first egg is laid about 5:00 P.M., 8 or 9 days after a pair is put into a cage, and the second egg is laid about 9:00 A.M. on the second day following.

By using methods similar to those used with this dove, egg formation times in cockatiels are being studied by Lisa McDaniel, a graduate student at Davis. Other psittacines could also be studied in this way.

After the yolk is completed in the ovarian follicle, the wall of the follicle splits, releasing the ovum (egg cell) into the body cavity, where it is engulfed by the open, funnel-like end of the oviduct. Fertilization occurs by sperm that have been stored in the folds of the upper oviduct. Thousands of them are available to enter the ovum, but only one finally fertilizes the egg cell which then is moved slowly down the oviduct. The