THE GALAPAGOS ISLAND FINCHES

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Introduction

Gregory and Goldman's *Biological Science* (Green version in B.S.C.S. series) gives an impression of a most remarkable adaptive variation in the Darwin finches of the Galapagos Islands (page 729).[1] Though somewhat more realistic, the B.S.C.S. Yellow version, *An Inquiry Into Life,* illustrates the same group on page 593.[2] Forms presumably resembling humming-birds, woodpeckers, large and small seed crushers, and insect-eating types are shown as derived from a single pair of original birds.

It was my good fortune to be able to study the large collection of Darwin's finches at the California Academy of Science in the Fall of 1965 and Spring of 1966. The following is a report on the variations observed and measurements made.

Acknowledgments

I wish to acknowledge the kind cooperation of Dr. Robert F. Orr, ornithologist of the Academy, who permitted me to examine the specimens in this fine collection. He also showed me the remarkable range of variation in the collection of specimens of the song sparrow, *Melospina melodia.*

Material and Methods

The California Academy of Science collection consists of 37 trays, each with about 100 specimens; some 3700 well-preserved Darwin finches. I first made detailed measurements of the height, curvature, length and breadth of each mandible of several specimens of each species. Overall length, breadth, and height of the body and wing measurements were taken. It was soon apparent that such a high correlation usually existed in these various measurements that only four will be reported in this paper, as follows:

1) Length of bird from tip of bill to end of tail.
2) Height from belly to top of the back
3) Total length of the bill.
4) Width of the ventral side of the lower mandible of the bill. (Figure 1)

All the specimens in each tray were first given a general examination, and then those Which showed **extremes** in variation for curvature, width and length of the bill were carefully measured. Then the various trays, **irrespective of their island origin,** were compared both in general appearance and detailed measurements. Unless otherwise mentioned 25 specimens of each species and subspecies were measured.

Results of the Examination

The Darwin finches are a rather drab gray to brownish colored group of birds, except for the almost fully black dorsal plumage of the males of some species. The whole collection had an appearance of general uniformity. Only the *Certhidea* or the Warbler finches seemed truly distinctive.

Were it not for the historical importance of these finches as one of the "pillars" of evidence for the evolution of adaptive variation, I doubt if much attention would be given to them. A resume of the collection may best be given by arbitrarily calling the tray containing the largest finches Tray 1. This is also the order from top to bottom in which they are filed in the collection. (Body measurements are given in centimeters, and bill in millimeters throughout.)

Tray #1

Tray #1 consisted entirely of specimens labeled *Geospiza magnirostris* from Culperrer, Wenman, Abingdon, Bindloe, Tower, and James Islands. This "species" has the largest bill and body. Much fluctuation in measurement was found however.

Body variation: 3½-4 high x 14½-15 long. Bill variation: 13-18 wide x 19-20 long. Total of specimens measured—50.

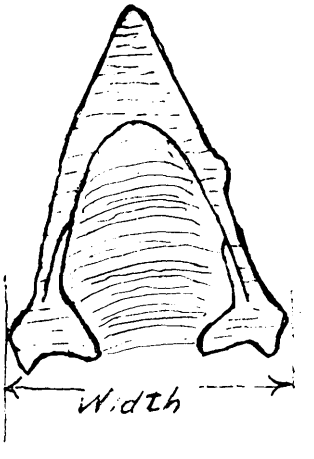

Figure 1. Typical Ventral view of lower mandible of *G. magnirostris*

The general impression was one of remarkable uniformity except for bill variation, The males were mostly black.

Tray #2

G. magnirostris from James, Jervis, Seymour, Indefatigable, Albemarle and Barrington Islands.

Same range in variation shown except that one specimen had a bill only 13mm. wide x 15mm. long. Most of the males had black plumage. Total of 80 specimens measured.

Tray #3

All specimens were labeled *Geospiza fortis.* My first impression was that here we have a small version of *G. magnirostris.* The specimens were from Wenman, Abingdon, Bindloe, James, Jarvis, Daphne, and Seymour Islands.

Body variation—2.5-3 high x 11.5-15 long. Bill variation—9-11 x 10-15.

Tray #4

Also *G. fortis.* Mostly lighter gray forms from Seymour, Indefatigable, and Duncan Islands.

Body—2½-3 x 11-14½. Bill—9-12 x 11-15.

One specimen was as large as the smallest *G. magnirostris,* i.e.: 3½ cm. high x 14½ cm. long.

Tray #5

G. fortis from Duncan and Albemarle Islands. Many black colored males with mostly small bills. One had a bill 13 mm. x 15 mm., exactly similar in shape (curvature size and size of mandibles, 13 x 15 mm.) to the specimen in Tray #2, all of which were labeled *G. magnirostris.*

Tray #6

G. fortis – specimens from Albemarle, Marborough, Barrington, and Chatham Islands. Some specimens had bills as large as 13 mm. wide and 18 mm, long. This bill was on a male 3 cm. high x 13 cm. long. There was also a great difference in the curvature of the bills. Thus one specimen, #5357, was much broader than #6270, as shown in Figure 2. There were many black-plumaged males in this collection.

Tray #7

G. fortis from Chatham, Hood, Gardner, Charles Islands.

Body—3½-3¾ high x 14-14½ long. Some birds were fully as large as G. *magnirostris* in this tray, both regarding body and size of bill.

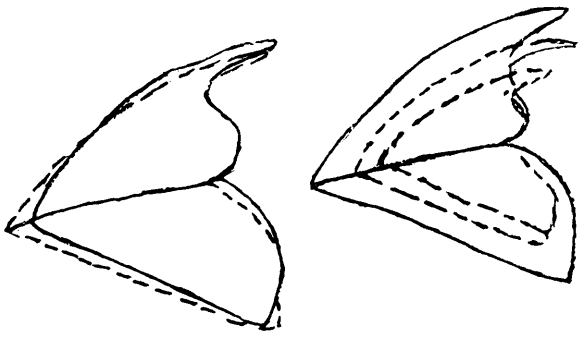

Figure 2. Left: solid line, small G. *magnirostris;* broken line, large *G. fortis.* Right: large, intermediate, and small form of *G. fortis.*

Tray #8

G. fortis from Charles Island. There were many large specimens as Lack reported.[3] As he states it, "where *G. magnirostris* is absent, G. *fortis* is large." But careful study failed to reveal any **difference** between these and *G. magnirostris,* **other than the label!**

Thus specimen #5260 had a bill 12 mm. x 17 mm. and a body 3.2 cm. wide x 12 cm. long. Others had bodies fully as large as the smaller *G. magnirostris.* The bill shape often **identical** as may be seen in Figure 2. Though the bill of the specimen shown is slightly longer, many were exactly the same length and height.

Tray #9

All *G. fortis* from Charles Island. All were grayish-brown specimens and averaged large for the size of the species. One had a bill 13 mm. wide by 17 mm. long. Another (#5501) was 3 cm. x 14½ cm. with a bill 13 mm, x 18 mm.

Tray #10

All *G. fortis* from Charles Island. All except two black-colored males were gray colored on sides and belly and brownish above. One specimen, #6321, was 3.2 high and 14 long with a bill 13 mm. wide x 15 mm. long.

Tray #11

G. fortis from Charles, Champion, Gardner, and *G. fuliginosa fuliginosa* from James, Jervis, Seymour, and Indefatigable Islands. The *G. fortis* specimens were similar to those in Trays 8, 9, and 10. *G. fuliginosa fuliginosa* however had dimensions as follows:

Body—2.5 cm. high x 10 cm. long. Bill—7 mm. width x 11 mm. long.

At first glance this seems a very sharp break in continuity. However one of the smaller *G. fortis* in Tray #3, #6189, had a body 2.5 cm. x 11.5 cm. and a bill 9 mm. x 12 mm.

Tray #12

G. fuliginosa, var. *fuliginosa* from Indefatigable, Duncan, Albemarle. Here a great variation in bill size and conformation occurs, as some were long and slender, (5 mm. x 10 mm.) and others were wider (8 mm. x 13 mm.) About half were black colored males and the rest were light gray to brownish females.

Tray #13

G. fuliginosa fuliginosa from Albemarle, Marborough, Brattle, and Barrington Islands. These had much coarser beaks but many were quite hooked, or rather showed great mandible curvature.

Tray #14

G. fuliginosa fuliginosa from Chatham Island. Many males with black coloration. The specimens were more uniform than most,

Trays #15 and 16

Tray #15 was also G. *fuliginosa fuliginosa* from Chatham, Hood, Gardner, Charles Islands and Tray 16 from Charles and Captive Islands.

Some beak variation, but body size was slightly smaller than that of Tray #11.

Further comparisons with *G. fortis* are as follows:

	Body	Bill
G. fuliginosa fuliginosa Seymour island (typical black male)	2.6X11	8X10
specimen #5781 (black male)	2.5X11	8X12
specimen #6567 (Indefatigable)	2.5X11	9X11
G. fortis (typical black)	2.7X12	10X13
G. fortis Abingdon #5184	2.5X10.5	8X12
G. fortis Indefatigable #5187	2.5X12.5	10X12

So, although *G. fuliginosa fuliginosa* **averaged** smaller, complete intergradation was found.

Tray #17 and 18

All *G. difficilis.* Body variation – 2.5-2.75 x 11-11.5 long. Bill variation—6-65 x 11-12.

The specimens in general had a more rufous colored tail but there was complete intergradation as regards this characteristic with that typical of *G. fuliginosa fuliginosa* and *magnirostris.*

Tray #19, 20 and 21

G. scandens from Abingdon, Albermarle, Bindloe, Charles, Chatham, Duncan, Indefatigable,

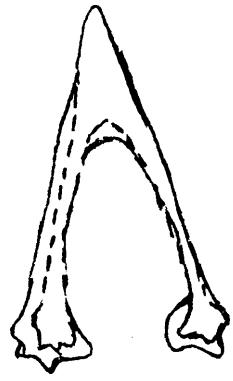

Figure 3. Solid line *G. conirostris,* broken line *G. scandens.* Ventral view of lower mandible adapted from Figure 61 of Bowman's article.

Jervis, and Seymour Islands. At first glance these specimens seemed remarkably uniform for a long narrow bill, and I thought that here at last was a really distinctive species.

The following are some characteristic measurements: Bill–8 x 18; 9 x 20; 9 x 19; and 10 x 19. The body was rather uniform: 3½ cm. high x 14 cm. long. However specimen #7173 had a bill 10 x 20 with a body 3½ x 13.

Tray #22, 23 and 24

G. conirostris conirostris from Culpepper, Hood and Tower Islands. The body was 3-3.5 x 13.5-14 cm. and samples of bill measurements were as follows: 10 x 15, 10 x 17, 12 x 15, (identical to one specimen of *G. magnirostris* in both size and curvature of the bill), and 10 x 18 (identical to *G. scandens* in size and curvature of the bill).

The individuals of the species then are a connecting, intergrading link between *G. magnirostris* and *G. scandens.* Incidentally this fact is also referred to by Bowman on page 285 of his *Morphological Differentiation and Adaption in the Galapagos Finches* where he says, "It would seem, then, that in size and shape the bill of *G. conirostris* spans the morphological 'gap' between *G. magnirostris, G. fortis,* and *G. scandens."*[4]

To be fair in my quotation from him I might also state that he considers *G. conirostris* unique in its structural plan of the mandibles and skull area. His discussion of these slight distinctions on page 247 is not too convincing however in view of the great variation shown. (For comparison of **typical** forms see Figure 3.)

Tray #25, 26 and part of 27

G. crassirostris: the plumage is generally more brownish and the males are black only on the head area. Otherwise this species is so similar

in size to *G. magnirostris* that after a few preliminary measurements further study was not made. The bill also varied greatly such that identical measurements of length and width could easily be found in both "species."

Bowman who is mightily impressed with minute skull differences, shows seventeen differences in his comparative analysis. It would seem that he is comparing the typical or perhaps average rather than those which show marked intergradation. A better comparison emphasizing the similarities is shown in his Figure 56 where variations in *G. magnirostris* are shown. Unfortunately he does not show the marked and overlapping variation found in *G. crassirostris.*

Tray #27, 28, 29, 30, 31, 32, 33 and 34

Camarhynchus psitticula, habeli, and *affinis* from Abingdon, Albermarle, Barrington, Bindloe, Charles, Duncan, Indefatigable, James, Jervis, Marborough and Seymour Islands. All were predominantly gray in color although much variation was found in coloration and some were as brown as *G. conirostris,* Again some *G. magnirostris* were fully as gray as specimens of the "genus" *Camarhynchus.*

	Body	**Bill**
C. habeli	3 x 12	9 x 13
C. psitticula	3 x 13	11 x 12
C. affinis	2.5 x 11	7 x 10
C. pauper	2.5 **X** 11	**7 x** 10
C. parvulus	2.5 x 10.5	7 x 7
	2.8 **X** 10.7	7 x 10
	2.8 **X** 12.5	7 x 10

These all intergraded and except for the difference in species labels would most certainly be considered as a variable group of light gray individuals of the same species.

Tray #35 and 36

Cactospiza pallida from Albermarle, Chatham, Duncan, Indefatigable, James, Jervis, and Seymour Islands. All were very light gray, especially as regards the side and belly plumage coloration. The size was quite uniform, varying only slightly from a body of 2.5 x 12 and bill of 7 x 15.

Figure 4 shows a comparison of the typical *G. magnirostris* at the top, then *G. fortis, G. fuliginosa* and *G. difficilis* compared to *G. scandens* on the right. All are males. The variation in color of bill is not significant for color is a highly variable feature, both intra- and interspecifically.

Figure 5 is a comparison of *G. fortis* at the top, then *G. conirostris* and *G. scandens* at the bottom. The upper two birds are females, the lower one a male. Note the variation in plumage color of background birds.

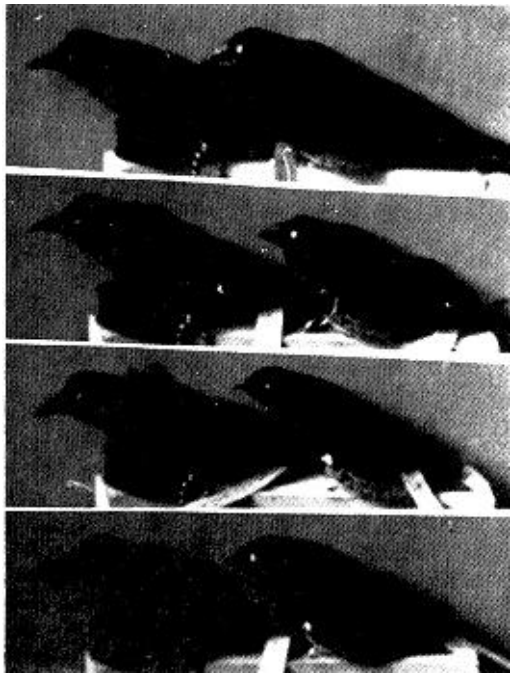

Figure 4. a) *G. scandens* (left) vs. *G. magnirostris* (right) b) *G. scandens* (left) vs. *G. fortis* (right) c) *G. scandens* (left) vs. *G. fuliginosa* (right) d) *G. scandens* (left) vs. *G. difficilis* (right). All specimens are black plumaged males.

Discussion

If one were to remove all the species labels and arrange the Darwin finches from the largest to the smallest in body and bill size, complete intergradation would be found. The same is true of bill length and width. As mentioned above there is complete intergradation of plumage coloration although the smaller birds tend to have lighter gray feathers.

The situation is exactly comparable to that of the song sparrow, *Melospiza melodia,* where one finds a comparable range in size of bird and bill. Here also the small desert forms are light gray in color.

Bowman works hard to show that there is a basic difference in skull configuration between *G. magnirostris, fortis,* and *conirostris.* However his Figure 30 is not very convincing to me. For we must remember that the **broken** lines of *G. fortis* show the **variation** in skull size and the **solid** line of *G. magnirostris* upon which he places much confidence is only an average of many skull size measurements. Also Figure 56 is quite revealing in showing the gradation. One cannot help but feel that the pattern of **distinc-**

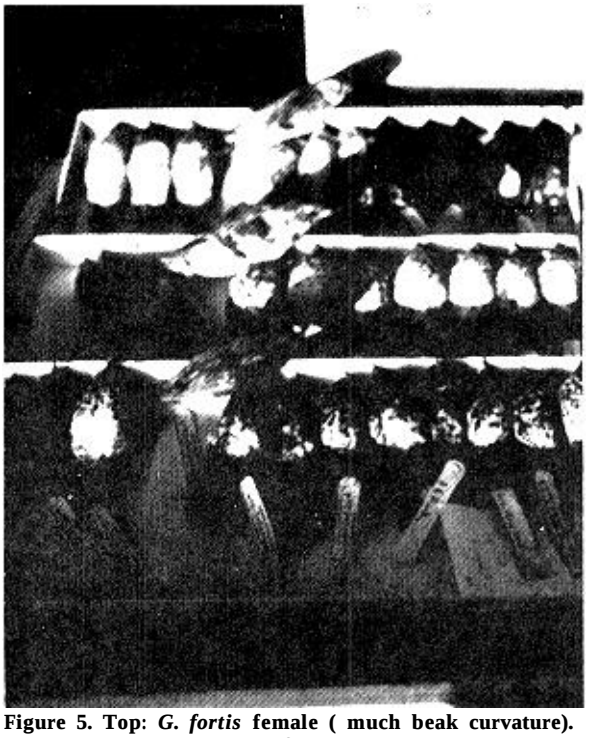

Figure 5. Top: *G. fortis* female (much beak curvature). Middle: *G. conirostris,* female. Bottom: *G. scandens,* male. *G. fortis* varies in curvature of beak some being identical to *G. conirostris.*

tion exists more in the mind of Bowman than in the reality of specimens observed and so carefully measured.

If species are to be erected on such minute norms, then indeed we will be burdened with an almost infinite number of names.

It seems much more in line with reality to consider these birds as all one species, broken up into various island forms as a result of chance arrangement of their original variability potential, as regards the rather minor variation in bill and body size, skull features and plumage coloration. A Sewell Wright random variation pattern would give exactly this sort of thing. Presumably many pairs of finches from either Ecuador or even Central America happened to fly there and settle on these islands.

The *Certhidea* or Warbler finches surely are distinctive though I doubt if the four species are more than merely color variations. *C. fuscus, becki, olivacea,* and *mentalis* were the labels shown on the various individuals in the collection. There was so much intergradation in color that it seemed rather strange to have different labels on these all of which were rather similar in size.

Evidently a different original stock with quite a distinctive variability potential resulted in these Warbler finches, which incidently are remarkably distinctive in feeding habits also, Present feeding habits are the result of the particular types of bills the individuals happened to have inherited. Most emphatically I cannot accept the idea that the variations in size of bill are "adaptive divergencies" resulting from natural selection.

The various races now labeled as species and genera certainly exist and are not imaginary. But they are more comparable to the tribes of Indians existing in North America before Columbus discovered it, than to species, let alone genera. Ornithologists call attention to the fact that these forms remain distinct and have different song patterns. However, Orr reports that the basic song is the same. Again this would be comparable to the various languages of the Indians, all variations of the same basic pattern.

Evidence as to the amount of natural hybridization is far from adequate. Possibly some of the intermediate forms, such as *G. conirostris rothschildi,* are really hybrids. Who really knows? Attempts so far to interbreed the so-called "species" in captivity have failed according to Robert Bowman's assistant, Miss Cutler. However she points out that mating even between **individuals** of the **same** species is difficult to achieve in cages.

One conclusion is certain, the entities called species are certainly not comparable in distinction to the basic species as in the genus *Rosa* or *Prunus* of the family Rosaceae. When it comes to genera, would any ornithologist claim *Geospiza, Camarhynchus, Cactospiza,* and *Platyspiza* are comparable to the genera *Rosa, Rubus, Prunus, Fragaria, (Strawberry),* or *Pyrus* (pear)? With all due respect to the importance of taking seriously subtle and not "easily recognized" differences, I submit that we are here considering variations on a totally different level.

This leads to an even more important question: Are not the families, genera, and species of all mammals and birds based on a lower order of diversity than those existing in plants?

Postscript on Needed Research

Familiar as I have to be in my work with a wide range of flowering plants, and especially the genera of the family Rosaceae and Composite, it has for many years seemed to me that the families, genera, and species of vertebrates are based on characteristics which in plants would be classed as genera, species and varieties.

Furthermore there is an undue emphasis on bone structure, as if this feature outweighed all other characteristics in establishing the validity and importance of the various distinctions.

This emphasis was understandable before we became aware of how the DNA system of inheritance works. But surely it must be apparent now that bone structure really has no more significance than such apparently ephemeral characteristics as color of the hair or indeed the finger print pattern of a foot or hand. For defects in the DNA code show up just as often in defective bone structure as in other parts of the body such as the brain. It is only the **relative permanence** of the bones in terms of time that has given them a **false importance in** the evaluation of resemblances and differences.

We must have a new look at vertebrate systematic in order to bring the classification of animals more in line with reality. On the basis of a world catastrophe we would expect air breathing creatures to be much more reduced in variety than plants or insects (which are preserved as eggs or pupae). Here the facts of nature are in accord with God's revelation in Genesis. For according to the inspired narrative, only representatives of the various **kinds** of animals and birds were preserved. Furthermore the genetic potential of the clean animals and birds is recorded as being greater than that of the unclean ones, since three pairs of clean animals and only one pair of unclean animals were preserved.

Do we indeed now find greater diversity of clean than unclean animals? Lack of space forbids a complete analysis but let us look at a few cases.

The horse is classified as unclean, and we have only **one living** species as compared with the dozen or more living before the Flood, ranging in size from the little five toed, forest dwelling *Eohippus* to the large, open plains and still living *Equus,* We have only two species of camels, yet many are recorded as fossils.

The hog is most interesting. *Mammals of the World* page 1357[5] lists five genera and nine species. The genus *Potomochoerus* has only one species *porcus* living in Southern Africa, Madagascar, and Impalita Islands. It weighs 75 to 150 kg. and resembles the genus *Phacochoerus* and *Sus.* There is less hair on *Phacohoerus* and it has more teeth. The ears are more tufted than those of *Sus.* It is known as the European wild hog but is also living in North Africa, Asia, Japan, and the Malaysian islands.

Frankly, I see little justification for placing *Sus* and *Potomochoerus* in different genera on the basis of differences such as tufting of the ears. *Sus* is credited with five species but they certainly look remarkably similar to one another. *Sus salvanica* is often put in a separate sub-genus *Porcula* simply because it is small, weighing up to 75 kg. By contrast the giant forest hog *Hylochoerus meinertzhayeni* weighs from 160 to 275 kg. It lives in the forests and bamboo jungles of Africa and looks like a great big *Sus.* It does not however have facial glands.

The wart hog, *Phacohoerus aethiopica,* is distinguished mainly by its warts, which are prominent only in the male. They are located on the side of the head and front of the eye.

The above differences seem simply the expression of heterozygocity for size, location of hair, and presence or absence of warts, often a heritable genetic defect.

There appears to be no basically distinctive pattern such as distinguishes the genus *Fragaria* (Strawberry) from the genus *Rosa* (Rose). I am not here claiming that all of these nine species of hogs came from only one ancestral pair, but rather that the distinctions compared to those defining the genera of the family Rosaceae are **relatively slight.** Careful breeding research may indeed show that all are capable of interbreeding and so, as in domestic dogs, are really the result of segregation from an originally heterozygous pair. Mutations for other differences may well have also occured during the **early phase** of their distribution and so added to the distinctions now observed as characteristic.

The case of the fifth genus *Babyrousa* with its single species *babyrussa* is fascinating. Here we have a remarkable example of how an animal can continue to live **in spite** of its **obvious defects.** It lives in such odd places as the North Celebes, Togian Islands, the island of Burn, and Sula. This creature is almost entirely devoid of hair, and has a rough skin which is brownish grey, and hangs in loose folds as if reduced from twice its former weight. It now weighs about 90 kg. Most interesting is that the upper tusk grows through the top of the muzzle and then **curves backwards** and so is of no use as a weapon. Even the lower tusks are little used since they are not kept sharp. The young are not striped like most pigs.

Surely this creature should long ago have been eliminated were natural selection the potent agent for survival of the fittest as usually claimed. Genetically, it seems to be the result of real-functioning of several DNA molecules which resulted in such an abnormal expression of ancestral *Sus* traits.

In birds we have many types of unclean kinds which are now represented by only a few species. Thus the Grehes of the world total 20.

If comparable to western ones I have seen (listed incidentally in Peterson's, *A Field Guide to Western Birds),* they might well be reduced to as few as 10. The pelican is represented by only six species, two of which are in the west. There are only two eagles listed.

By contrast among the clean animals we have dozens of species of grosbeaks, finches, sparrows, and buntings (Fringillids), tanagers (Thraupidae), meadowlarks, blackbirds, orioles (Icteridae), and warblers (Parulidae).

There does indeed seem to be a correlation in survival between the greater number of clean birds and animals saved and their present greater diversity, as compared to the single pair of unclean kinds saved and their present lack of variety. Careful research into this aspect of animal classification is needed.

This paper is presented mainly with the hope of arousing interest on the part of creation research oriented naturalists. It is admittedly only introductory to this vast subject of survival patterns. However I believe it demonstrates that often the picture of genetic diversity given as the result of natural selection is, to put it mildly, exaggerated.

References

[1] *High School Biology* (Biological Sciences Curriculum Study-Green Version). Chicago: Rand McNally and Co., 1963.

[2] *Biological Science: An Inquiry into Life* (Biological Sciences Curriculum Study-Yellow Version). New York: Harcourt, Brace and World, Inc., 1963.

[3] Lack, David, *Darwin's Finches* (An Essay on the General Biological Theory of Evolution). Harper Torchbooks, #TB 544 of The Science Library. New York: Harper and Brothers, 1961. (First published in 1947.)

[4] Bowlllan, Robert I., *Morphological Differentiation and Adaptation in Galapagos Finches.* University of California Publications in Zoology. University of California Press, Berkeley, California, 1961.

[5] *Mammals of the World.* Philadelphia: Johns Hopkins Press, 1964.