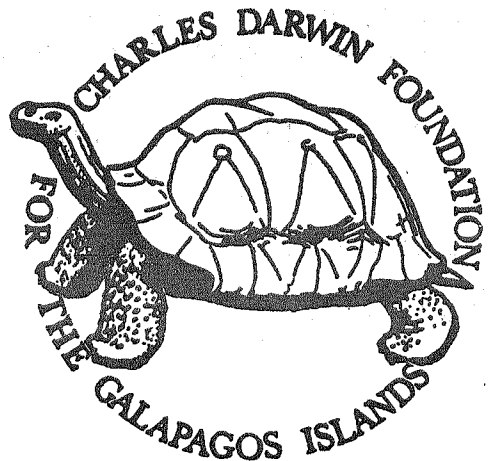


n o t i c i a s d e
GALAPAGOS

The 150th Anniversary
of
Charles Darwin's Visit
to the Galapagos

Greensted Hall,
Ongar, Essex CM5 9LD
England
No. 42 (1985)



DARWIN'S "DOGGED" GENIUS: HIS GALAPAGOS VISIT IN RETROSPECT

by

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One hundred and fifty years ago, on 16 September 1835, Charles Darwin landed in the Galapagos Islands and began five weeks of collecting and observing in this famous "laboratory of evolution". While in the Galapagos Darwin visited four of the major islands, and he had a good glimpse, from H.M.S. *Beagle*, of numerous others. Altogether he spent nineteen days, some only in part, on land in the Galapagos — five days on Chatham; four on Charles, where he visited the highlands settlement; one day at Tagus Cove on Albemarle Island; and nine days on James, where he collected extensively and spent three days in the highlands.

By current research standards, Darwin's Galapagos visit was remarkably brief. And yet his encounter with these islands was seemingly decisive for his biological thinking. As he wrote in the second edition of his *Journal of Researches*:

The archipelago is a little world within itself, or rather a satellite attached to America, whence it has derived a few stray colonists, and has received the general character of its indigenous productions. Considering the small size of these islands, we feel all the more astonished at the number of their aboriginal beings, and at their confined range. Seeing every height crowned with its crater, and the boundaries of most of the lava-streams still distinct, we are led to believe that within a period geologically recent the unbroken ocean was here spread out. Hence both in space and time, we seem to be brought somewhat near to that great fact — that mystery of mysteries — the first appearance of the new beings on this earth. (1845: 377-78).

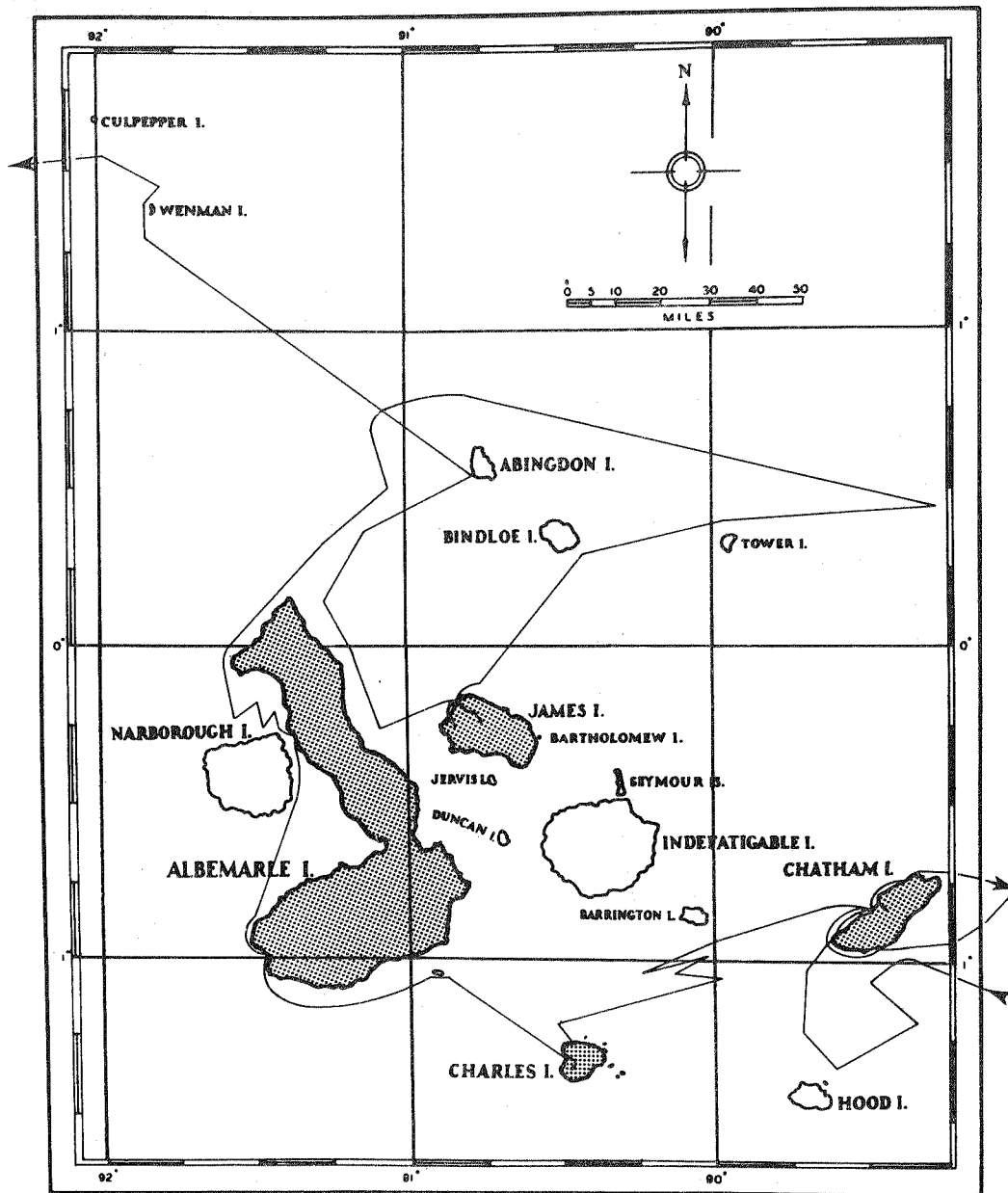
When and how Darwin solved this great "mystery of mysteries", and particularly the role his Galapagos visit played in this regard, have nevertheless become the subject of a considerable legend in the history of science.

According to the legend, Darwin's Galapagos visit first provided him with irrefutable evidence for the mutability of species and converted him, eureka-like, to the theory of evolution. Actually, the impact of the Galapagos was largely retrospective, as I have argued elsewhere (1982a, 1982c, 1984). Thus in order to know precisely what we celebrate in the 150th anniversary year of Darwin's Galapagos visit it is necessary to disentangle myth from historical reality.

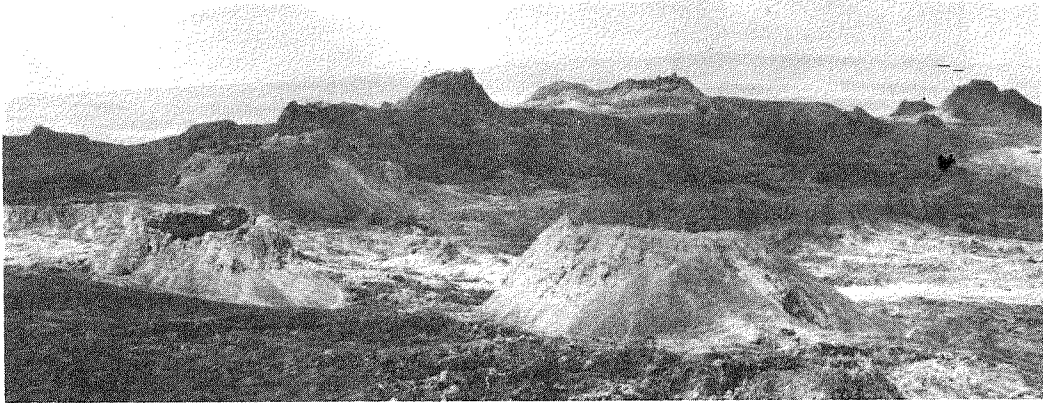
Darwin was first alerted to the evolutionary significance of the Galapagos species by the vice-governor, Nicholas Lawson, who informed him that he could tell "with certainty" from which island any tortoise had been brought (1845: 394). Darwin was on Charles Island at the time; and according to David Lack (1947: 23), among other commentators, he was sufficiently impressed to begin separating his collections of finches and other species by island, thus securing the necessary biological evidence to back up the vice-governor's extraordinary claim. What Lack and others did not appreciate, however, was that the bulk of the locality information on Darwin's type specimens and in his postvoyage publications was actually derived, *after* the voyage, from the carefully labelled collections of three other *Beagle* shipmates. Why Darwin initially failed to heed the vice-governor's remarks about the tortoises must be understood in terms of the intimate relationship between a received theory like creationism, no matter how erroneous, and the gathering and perception of scientific evidence.

To begin with, it would never have occurred to a creationist, which Darwin still was in 1835, to label his collections separately by island within a small archipelago. As part of a presumed "center of creation", the Galapagos would have been expected to exhibit a uniform flora and fauna by island, making such detailed locality designations superfluous. In this regard it is noteworthy that those *Beagle* specimens that were carefully labelled by island were collected by the nonscientists on board, who presumably did not realize how unnecessary such information really ought to have been.

We also fail to appreciate how complex and confusing the Galapagos evidence must initially have been, especially to a nonspecialist and nonsystematist like Darwin. It is not just the theory of evolution that



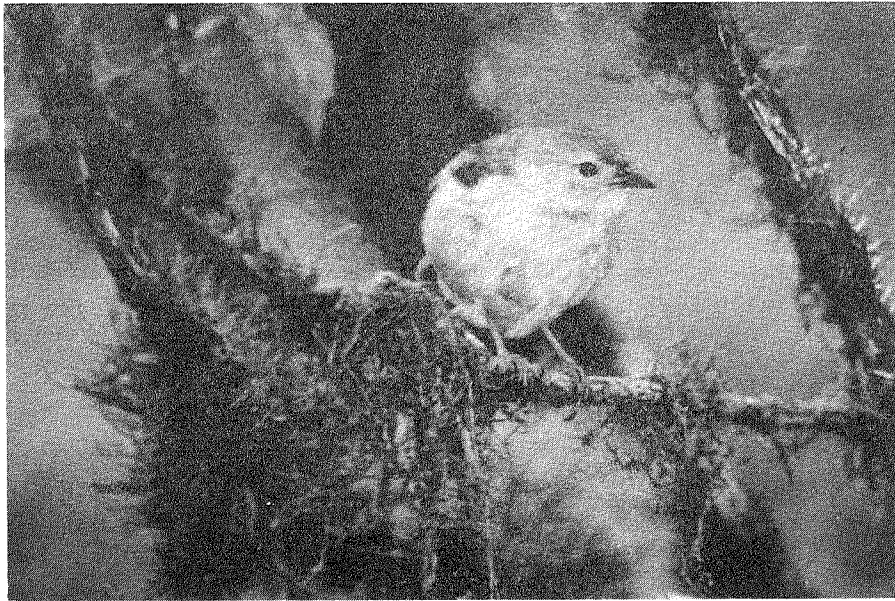
Darwin's route through the Galapagos Archipelago in H.M.S. *Beagle*. He visited the four shaded islands and made several inland excursions; also indicated on the map. The occasionally zigzag nature of the *Beagle's* route reflects the vagaries of winds and currents in the age of sail. (From Sulloway 1984).



The heavily cratered area on Chatham Island, near Stephens Bay, where Darwin made his first extensive geological observations. He explored this region on 21 September 1835 and remarked that the numerous truncated craters “gave the country a *workshop* appearance, which strongly reminded me of those parts of Staffordshire where the great iron-foundaries are most numerous” (1839: 455). Photographed by the author.

introduces unifying order into many of the enigmas of Galapagos biology; creationism also made a certain reasonable, albeit different, sense out of the facts. From his specimen notebooks and manuscript notes it is clear, for example, that Darwin mistook many species of “Darwin’s finches” for the forms that they, through adaptive evolutionary radiation, now appear to mimic. Thus he thought the warbler finch was a “Wren”; and he described the large-beaked ground finch as a “Grosbeak” and the cactus finch as an “Icterus” — the genus to which belong the orioles, blackbirds, and certain other forms possessing a long pointed bill. It is perhaps not surprising then that Darwin, having failed to recognise the closely related nature of the Galapagos finches, also failed to suspect that their island distributions might vary within the archipelago.

The evolutionary evidence provided by the famous Galapagos tortoises was also similarly clouded at the time of Darwin’s visit. This taxon was then believed by most naturalists to have originated in the islands of the Indian Ocean — hence its erroneous name *Testudo indicus* — and to have been transported to the Galapagos by buccaneers. Thus when Darwin was informed that the tortoises differed by island, he probably initially thought it was a matter of local variations somehow induced by transportal to a new and unnatural environment. Moreover, those tortoises actually seen by Darwin, on Chatham and James, were too similar to be distinguished “with certainty”; so the evidence was not as striking, from Darwin’s personal observations, as the vice-governor had claimed. In any event, since tortoises were not supposed to be native to the Galapagos, such differences did not apparently bear directly on the question of what was uniquely “Galapagean”, if anything, about the Galapagos. So little value did Darwin place upon the tortoise evidence that he not only failed, at the time of his visit, to collect specimens for scientific purposes, but he apparently co-operated with his *Beagle* shipmates in consuming the last of some thirty large tortoises during the cruise to Tahiti. It was only a decade later that Darwin finally encountered Captain David Porter’s (1815) description of the dome-shaped and saddleback forms of tortoise and was able to insert this information into the second edition of his *Journal of Researches* (1845: 394).



The remarkable diversity in the forms of the Galapagos finches is shown here by three species that initially misled Darwin into thinking they were members of separate families or subfamilies: the large-beaked ground finch (*Geospiza magnirostris*), using its powerful jaws to crush a large seed; the cactus finch (*G. scandens*), feeding on the flowers of *Opuntia*; and the diminutive warbler finch (*Certhidea olivacea*) looking for insects in the highland *Scalesia* forests.
Photographed by the author on Genovesa (Tower) and Santa Cruz (Indefatigable).

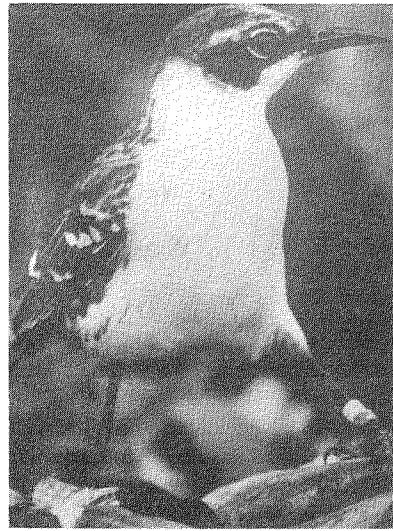
The *Origin of Species* (1859) was never in any real danger, however, of being sacrificed for a bowl of tortoise soup. Darwin had noticed, while still in the Galapagos, that the mockingbirds differed by island; and he had taken care to separate these specimens from the four islands he had visited. Approximately eight months after leaving the Galapagos he returned to this problem in his "Ornithology" notes. There he compared this anomalous finding to that previously reported to him about the tortoises. Although he was still inclined, consonant with the fixity of species, to suspect that his mockingbirds were "only varieties" rather than true species, he nevertheless speculated: "If there is the slightest foundation for these remarks the zoology of Archipelagoes — will be well worth examining; for such facts [would inserted] undermine the stability of Species" (1963 [1836]: 262). Darwin had thus begun, in a tentative but probing manner, the real process of "discovery" about the Galapagos — a process that lay not so much in his observations or collections during his brief visit but rather in his various reconsiderations of this evidence after his departure.

Following his return to England in the autumn of 1836 Darwin had many opportunities to re-evaluate the Galapagos evidence as expert systematists began to work out his voyage collections and he prepared his *Journal of Researches* for publication. In early March of 1837, he met with the celebrated ornithologist John Gould to discuss the results of Gould's examination of his voyage birds. Gould had immediately appreciated the anomalous but closely related nature of Darwin's Galapagos finches, including the warbler finch, and had named thirteen species in three subgenera. In addition, Gould had pronounced as distinct three of the four island forms of Darwin's Galapagos mockingbirds, thus confirming the suspicions Darwin had previously felt might "undermine the stability of Species". Perhaps just as importantly, Gould convinced Darwin of the highly endemic character of the Galapagos ornithology as a whole, something that Darwin, who had not had access to museum collections during the voyage, had not previously realized. These taxonomic opinions, together with a number of others relating to his collections from the South American continent, finally convinced Darwin that species were indeed mutable and sparked his decision to begin collecting facts that might bear on this question. He subsequently commented in this connection: "In July [1837] opened first notebook on 'Transmutation of Species' — Had been greatly struck from about Month of previous March on character of S. American fossils — and species on Galapagos Archipelago. These facts origin (especially latter) of all my views" (de Beer 1959: 7).

In the wake of his conversion to the theory of evolution, Darwin quickly realized his voyage oversight in failing to label his Galapagos specimens by island. He therefore set out to rectify this problem as best he could by asking other *Beagle* shipmates, including Captain Robert FitzRoy, to supply him with the missing evidence. Unfortunately, later curators at the British Museum failed to appreciate that Darwin's published locality designations in the *Zoology of the Voyage of H.M.S. Beagle* (1841) were not derived from his own collections; and where such information was missing from his own type specimens, they added it to some of the labels, creating a number of erroneous localities. Darwin, moreover, compounded the problem by guessing where eight of his own finch specimens had come from; and in several instances he clearly guessed incorrectly. These various confusions over the type specimen localities created a taxonomic nightmare for subsequent ornithologists, who naturally puzzled over the conflicting and aberrant locality designations on Darwin's specimens and found themselves hard pressed to reconcile this information with present-day distributions of Darwin's finches.

Fortunately, clarification of the retrospective and borrowed nature of the localities on many of Darwin's type specimens has now resolved most of these problems, including the status of several long-debated forms of Darwin's finches (Sulloway 1982b). In particular, *Geospiza magnirostris magnirostris*, an extinct form of the large-beaked ground finch, was collected by FitzRoy and others on Chatham and Charles islands, where David Steadman (1981, 1984) has recently found fossil evidence of this subspecies. Similarly, both Darwin and Fitzroy collected specimens of another extinct subspecies on Charles — a particularly large-billed form of the sharp-beaked ground finch ("*G. nebulosa*" Gould).

Although Darwin (1845: 395) later suggested, based on the joint *Beagle* collections, that the Galapagos finches might have different geographic distributions, he was also aware that the case was a complex one and that his own data on the subject were meagre and probably suspect. Partly for this reason he did not mention his celebrated Galapagos finches in the *Origin of Species* (1859). It is only in this century, after the splendid ornithological studies of Harry Swarth (1931), David Lack (1945, 1947), and many other researchers, that these finches have become such a convincing paradigm of evolution in action. In keeping with the Darwin-Galapagos legend, however, much of this modern evidence is often erroneously attributed to Darwin. For example, he never saw all thirteen species of Galapagos finches (Gould's



Left: the Charles Island mockingbird (*Nesomimus trifasciatus*), showing the distinct breast banding that probably first alerted Darwin to the island differences among these birds; *Right:* the Galapagos mockingbird (*N. parvulus*), which Darwin later collected on James Island. Photographed by the author on Champion (near Charles) and Santa Cruz (Indefatigable).

thirteen “species” encompassed only nine of the presently recognized forms), and he was also unaware that differences in the beaks were correlated with differences in diets.

Even after he had finally become an evolutionist in 1837, Darwin’s understanding of the Galapagos Islands continued to undergo a slow evolution of its own. The mockingbirds and tortoises had convinced him of the importance of geographic isolation in the evolution of new species; and in 1838, after reading Malthus’s *Essay on the Principle of Population* (1798), he hit on the theory of natural selection. (Even this important insight, however, was not as sudden as Darwin later recalled — see Gruber 1981.) For approximately a decade more he nevertheless failed to understand why evolution should promote widely divergent species on islands, like the Galapagos, that are seemingly identical in climate and general geographic character.

Darwin only solved this vexing problem in the mid-1840s after reading Joseph Hooker’s reports on the flora of the Galapagos. Hooker had found that numerous representative species were indeed present on the separate islands, as Darwin had always suspected but had never been able to prove conclusively. In July of 1845 Darwin wrote to his friend: “I cannot tell you how delighted and astonished I am at the results of your examination; how wonderfully they support my assertion on the differences in the animals of the different islands, about which I have always been fearful” (1887, 2:22).

Darwin was equally impressed with Hooker’s (1847) discovery that the different islands possessed plants that were apparently random colonists, present only on one island. In the margin of his copy of Hooker’s paper Darwin wrote: “so the flora of different isld[s] must be very different independently of representation”. Darwin now began to appreciate that although the various islands in the Galapagos might look superficially similar, they were biotically quite distinct. These biotic differences, moreover, must provide natural selection with a wide scope for expression, thus explaining how representative species had evolved so easily on each island. This basic idea, which Darwin developed in the 1850s into his principle of divergence, altered much of his general thinking about evolution and was given a prominent place in the *Origin of Species* (1859). Thus Darwin required almost two full decades to understand the biological significance of his Galapagos findings and to integrate them into his theory of evolution by natural selection.

CONCLUSION

The Darwin-Galapagos legend, with its portrayal of the sudden and all-encompassing nature of Darwin's Galapagos insights, is largely a twentieth-century development. This legend has been inspired by many factors, including the triumph of Darwinism; the remarkable progress of Galapagos researches, especially on Darwin's finches; the tendency for history to telescope its past in accounting for great events and achievements; and the need for a suitably "empiricist" account of discovery in biology textbooks and in the history of science.

Although Darwin helped to engender this legend in certain of his own empiricist autobiographical accounts of his discoveries, he seems, privately at least, to have recollected matters differently. When writing his *Autobiography*, for example, he initially recounted his major impressions and achievements during the *Beagle* voyage without even mentioning his Galapagos visit. Only as he was revising his first draft, did he insert as an apparent afterthought: "Nor must I pass over the discovery of the singular relations of the animals and plants inhabiting the several islands of the Galapagos archipelago, and of all of them to the inhabitants of South America" (1958 [1876]: 80). In short, Darwin recalled his Galapagos insights as a "postscript" to his other voyage experiences, consistent with the delayed impact his visit to these islands really had upon his biological thinking.

While it perhaps serves to glorify the Galapagos in the annals of science, the Darwin-Galapagos legend nevertheless tends to rob these islands of their real import in the history of Darwin's discoveries. What is perhaps most impressive about Darwin's famous visit is that, having made so little initial impression on him, the Galapagos nevertheless stayed in his thoughts, serving as a powerful source of inspiration to which he returned again and again. The Galapagos experience therefore provided Darwin with a catalyst, not a sudden moment of discovery; they were a problem to be pondered again and again, not an immediate solution to problems. Darwin acknowledged these aspects of his intellectual relationship to the Galapagos when he remarked to Hooker, in 1846: "The Galapagos seems a perennial source of new things." Demystified, Darwin's Galapagos experience is perhaps a better symbol of his achievements than the famous legend, impressive as it may at first seem. For Darwin's genius involved a slow and persistent type of intelligence and a constant reworking of earlier insights and ideas. This aspect of his genius is captured by one of his favourite expressions, "It's dogged as does it" (a line from one of Trollope's novels); and Darwin personally identified his intellectual success more with patience and determination than with quickness or profundity of mind (1958 [1876]: 140, 145).

Finally, the story of Darwin's Galapagos visit illustrates how intimately connected the facts of science sometimes can be with the history of their discovery. Indeed, only through understanding their historical context have certain of Darwin's Galapagos "facts", such as the original localities of his and other *Beagle* type specimens, finally become clarified. It is perhaps a tribute to the enormity of his achievements that it has taken the history of science a century and a half to understand how Darwin reached them. So, in this anniversary year of Darwin's Galapagos visit we celebrate not only Darwin's evolutionary triumph but also our own in finally coming to understand what a difficult, protracted, and complex intellectual process this triumph really was. It is clearly and aptly the triumph of the tortoise rather than the hare, a triumph of Darwin's "dogged" genius in its quintessential form.

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