viable propagules of about 50 species of plants not found growing on Aldabra. They were picked up from the shores during a 20-month period. Of particular interest from the point of view of conservation is one of the world's rarest species of bird, the brush warbler *Nesillas aldabranus*. These birds are restricted to a thin strip of dense shrub. R. P. Prŷs-Jones saw only five individuals in two years and estimated the population size to be no more than 25.

Understandably, tortoises receive the most attention. Where did they come from? Probably from Madagascar, by floating or swimming, and the fossil evidence shows they colonized at least three times, most recently during the 80,000 years since the last total submergence of the atoll. At one time there were several species of giant tortoises on islands in the western part of the Indian Ocean, but by the 19th century they had died out or were driven extinct by the combined effects of human exploitation, disturbance of their habitat, and harassment from pigs, rats, and so on—except for the population on Aldabra. And this one must have narrowly missed the fate of the others, for a visitor to the atoll in 1906 saw none. Apparently it was a dry period on Aldabra then, to judge from rainfall records on other islands. Thereafter the population increased, under a wetter climatic regime, and has now reached a size of between 134,000 and 167,000 individuals. This seems to be close to the carrying capacity of the atoll.

M. J. Coe, D. Bourn, and I. R. Swingland make a good case for the idea that numbers of tortoises are limited by the amount of food and shade. For example, tortoises make forays up to 300 meters from shade trees, then return to forestall overheating, leaving a perceptible cutoff boundary in the vegetation. An interesting suggestion is made about how past rainfall helps to keep the tortoises alive in dry periods through its effects upon the vegetation. Rainfall percolates through rock and soil to accumulate as a large lens, and this lens is raised close to the surface and within the reach of plants only by high spring tides. Detailed studies of the tortoises have also revealed the age at which they first breed (17 to 23 years), their clutch sizes, their mortality and recruitment patterns, and other such information, so these animals are now better known demographically than are their more famous cousins on the Galápagos.

The implicit theme of this book is that the atoll is undergoing natural recurrent change on the scale of decades. Long-term studies are therefore essential for a proper understanding of its populations. In March of this year, the Royal Society will hand over the prime responsibility for operating the research station it built to another (unidentified) body. I hope a sense of the importance of long-term studies, and especially of the continuity of present ones, will be conveyed at the same time so that the benefits of past research will be fully realized.

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## Darwin's Theology

**Charles Darwin and the Problem of Creation.** NEAL C. GILLESPIE. University of Chicago Press, Chicago, 1979. xiv, 202 pp. $16.50.

The problem with which Gillespie says he began was to explain the surprising amount of "positive theological content" in the *Origin of Species*. To do so, and particularly to understand in what ways creation was a problem for Darwin, Gillespie wisely undertakes an examination of the ideas not only of Darwin but of his contemporaries. He shows that theological considerations played a major role in the biological science of Darwin's day, including Darwin's, and from this he argues that the reason there is so much theology in the *Origin* is that theological issues were still live ones for Darwin and, more important, that special creation was a "living and powerful idea" among his professional colleagues, one that required him to attack it with whatever weapons would be effective, including ridicule. Because theological issues were important for Darwin himself, he attacked on a theological as well as a scientific front. This is eminently reasonable. Even though by the 1850's the idea of miracles had been largely abandoned (to a greater extent than Gillespie allows), it is probably true that many biologists had not yet admitted the scientific and theological implications of doing without them. A shift in imagination was required, and this Darwin endeavored to effect.

Gillespie locates his discussion of Darwin and creation in a larger framework. He presents the 19th century as a period in which there were in existence two "epistemes," borrowing the term, but I think not the concept, from Michel Foucault. He calls one "creationism" and says that the creationist "saw the world and everything in it as being the result of direct or indirect divine activity" (p. 3). The other is "positivism," characterized as "that attitude toward nature that became common . . . in the nineteenth century, and which saw the purpose of science to be the discovery of laws which reflected the operation of purely natural or 'secondary' causes" (p. 8). (I do not think, and Gillespie perhaps would agree [p. 1], that either of these is what Foucault means by "episteme.") Gillespie says that the 19th century witnessed the transition from one episteme to another. In introducing his discussion he makes some very sensible remarks to the effect that in history epistemes, and also Kuhnian paradigms, are not discontinuous but are "dialectically related through human experience"; in other words, that the historian must seek to explain the development of a new episteme over time, rather than merely describing successively existing epistemes. In saying this Gillespie poses an important problem, but he does not seem to me to have succeeded in solving it for the 19th century. Partly this is because as a definition of an episteme or paradigm, or simply as a categorization of the views of many of Darwin's contemporaries, "creationism" is inadequate. Gillespie makes the idea of special creation the heart of "creationism," but he is forced to admit that one form of this idea—creation by law—could (and did) embrace transmutationism. There are good grounds for saying that Darwin himself believed in creation by law. More seriously, Gillespie does not really offer any explanation of why there was a shift to "positivism," instead contenting himself with occasional references to a growing positivism within science.

It is in discussing Darwin's theism that Gillespie makes his most useful, and much needed, contribution to Darwin scholarship. Because during his pre-Malthus speculations Darwin became a "materialist"—in the early-19th-century sense of the word—the idea has gotten around recently that from this early period he was an agnostic or an atheist. But a careful examination of the very notes that prove his materialism proves also that this materialism was theistic. As W. F. Cannon put it, Darwin thought that his materialism "made God grander than other ways of thinking did" (*J. Geol. Soc.* **132**, 379 [1976]). Gillespie rightly insists that to ignore or attempt to explain away Darwin's theism is to cut oneself off from understanding much of Darwin's science.

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