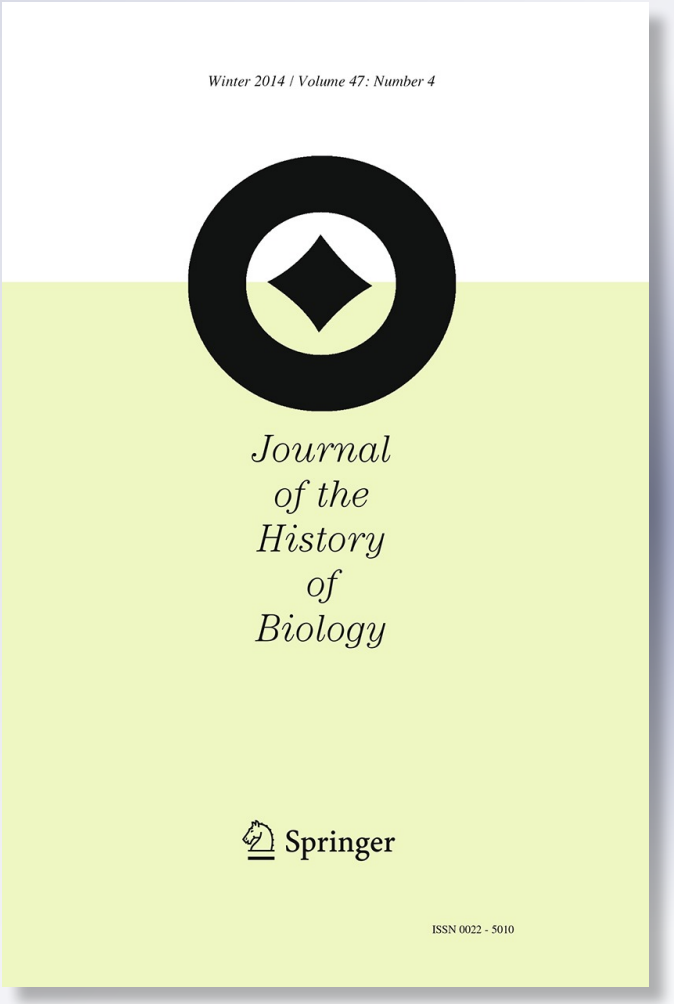
A Delicate Adjustment: Wallace and Bates on the Amazon and "The Problem of the Origin of Species"

John van Wyhe

Journal of the History of Biology

ISSN 0022-5010
Volume 47
Number 4

J Hist Biol (2014) 47:627-659
DOI 10.1007/s10739-014-9378-z



Springer

Journal of the History of Biology (2014) 47:627–659
DOI 10.1007/s10739-014-9378-z

A Delicate Adjustment: Wallace and Bates on the Amazon and "The Problem of the Origin of Species"

JOHN VAN WYHE
National University of Singapore
14 Science Drive 4
Singapore 117543
Singapore
E-mail: dbsjmvw@nus.edu.sg

Abstract. For over a century it has been believed that Alfred Russel Wallace and Henry Walter Bates set out for the Amazon in 1848 with the aim of "solving the problem of the origin of species". Yet this enticing story is based on only one sentence. Bates claimed in the preface to his 1863 book that Wallace stated this was the aim of their expedition in an 1847 letter. Bates gave a quotation from the letter. But Wallace himself never endorsed or repeated this story. Many writers have acknowledged that this letter still survives. Yet the wording is different from that quoted by Bates and the letter says nothing of an expedition. It is argued that the sentence given by Bates is not a genuine quotation from this or any other Wallace letter but was modified by Bates to promote his own reputation. More significantly, this leads to the conclusion that there was a very sudden and dramatic shift in the way species were thought of and discussed after Darwin's Origin of species appeared. Something called "the problem of the origin of species" (and similar variants) never occurred before Darwin's book but exploded in frequency immediately after it. A profound change in how species origins were discussed happened which no one seemed to notice.

Keywords: Alfred Russel Wallace, Henry Walter Bates, Amazon, Evolution, Origin of species, Natural selection

Introduction

> …it is those who know little, and not those who know much, who so positively assert that this or that problem will never be solved by science.
>
> Darwin, *Descent of man*, 1871, 1:3.

> The young Englishmen Alfred Russel Wallace and Henry Walter Bates set out to the Amazon in 1848 on their first collecting expedition with the aim of "solving the problem of the origin of species." This is how the story of the two naturalists has been told in virtually every book, article and documentary for over a century. The source for this inspiring version of events is the preface of Bates' *The naturalist on the river Amazons* (1863):
>
> In the autumn of 1847 Mr. A. R. Wallace, who has since acquired wide fame in connection with the Darwinian theory of Natural Selection, proposed to me a joint expedition to the river Amazons, for the purpose of exploring the Natural History of its banks; the plan being to make for ourselves a collection of objects, dispose of the duplicates in London to pay expenses, and gather facts, as Mr. Wallace expressed it in one of his letters, "towards solving the problem of the origin of species," a subject on which we had conversed and corresponded much together (Bates, 1863, vol. 1, p. 3).[1]

Although this explanation of the purpose of their expedition has been in print since 1863, it has enjoyed increasing emphasis in recent times as Wallace has received more attention as the co-proposer of evolution by natural selection. Yet, remarkably, Wallace himself never claimed or confirmed that this was the inspiration or aim of his first expedition (see Wallace, 1892, 1905, vol. 1, p. 264ff.). Instead he gave the aims as "to observe nature and make a living by collecting" (Wallace, 1905, vol. 1, p. 197).

And while he was alive other writers seem not to have made too much of it. For example, the German naturalist Adolf Bernhard Meyer translated the *Malay Archipelago* into German and corresponded with Wallace about his life and work in order to better familiarize the German-speaking public with Wallace. Meyer proudly based his account on Wallace's letters to him, which are not known to survive. In the ensuing publication, Meyer described the Amazon expedition without reference to a mission about species. (Meyer, 1870) Wallace's later biographer James Marchant wrote a biographical introduction to Wallace's last book, *The revolt of democracy* (1913). Wallace oversaw the text. There Marchant simply noted that "Bates and Wallace finally decided to go to the tropics to study the birds and insects, and to support themselves by their collections" (Marchant, 1916).

[1] On Bates, see Clodd (1892), Moon (1976), Woodcock (1969), Dickenson (1992) and Crawforth (2009).

After Wallace's death, Marchant recast the story in a more romantic fashion using Bates' 1863 version of the story: "From the date of the above letter (1847) on to the early part of 1855 – nearly 8 years later – no reference is found either in [Wallace's] Life or correspondence to the one absorbing idea towards which all his reflective powers were being directed", the problem of the origin of species. (Marchant, 1916, p. 93) Marchant's book became one of the standard works on Wallace's life for the following century.

Historian Arthur Lovejoy (1909) wrote in the Darwin centenary year of 1909 that from 1847 Wallace's "mind was occupied with the problem of explaining the cause and modus operandi of evolution". Book-length biographies since the 1960s have continued to tell the story in much the same way- on the basis of the letter quoted by Bates. Biographer Wilma George (1964) wrote that "[Wallace] had not solved the species problem, which he had intended to do, and he had not apparently given it much thought."[2]

In 1972 historian H. Lewis McKinney began to emphasize the evolutionary aim of the expedition even further: "Wallace set out for the Amazon jungles specifically to gather facts "towards solving the problem of the origin of species" with a definite point of view, and because he was dissatisfied with his efforts in England". Here, it is implied, Wallace was already aiming to solve the problem of the origin of species before leaving for the Amazon. The goal of the Amazon expedition "perhaps above all else an audacious field trip testing the heretical developmental hypothesis of Robert Chambers's *Vestiges*" (1844). Confusingly, McKinney stated that the Bates' letter "confirmed" this was the purpose of the trip – when in fact Bates' letter is the only source of this information.[3] When McKinney quoted the letter passage at greatest length, he strangely combined elements from three sources. He prefaced it with the phrase "towards solving the problem" from Bates (1863), then a sentence of the 1847 letter as found in Wallace's *My Life* (1905) and then the last three sentences from the original manuscript letter, which McKinney was the first modern historian to consult. It is unclear why McKinney combined fragments from three sources given

[2] See also Williams-Ellis (1966, pp. 9–10).

[3] McKinney (1972): "Wallace set out for the Amazon jungles specifically to gather facts "towards solving the problem of the origin of species" and then a third time: "Wallace appears to have journeyed to the tropics because he wanted to test his theory in the field. Bates confirmed this by saying that the purpose of their trip to South America (a trip proposed by Wallace) was to assemble a collection of natural history "objects" and gather facts "towards solving the problem of the origin of species, a subject on which we had conversed and corresponded very much."

that he had access to the original letter, then in family possession.

After all this emphasis on Wallace's hunt for evolution, McKinney, perhaps understandably, was possibly the first writer to state that Wallace must have "lost most of his evidence" for an evolutionary theory when his ship home from the Amazon sank in the mid-Atlantic in 1852. This is another fundamental claim for which there is no suggestion in any of Wallace's writings. But it has since been repeated by several other writers. For example, the conspiracy theorist Arnold Brackman continued this theme in his 1980 book, *A delicate arrangement*.[4]

In 1984 historian John Langdon Brooks elevated the Bates' statement of intent to become not only Wallace's "basic objective" in going to the Amazon but also his "major preoccupation" throughout his four years there. This sweeping claim about the daily activity of Wallace was made despite there being no evidence for this from any other source such as Wallace's contemporary documents or even in later publications or his recollections in later years. Brooks attributed the lack of any references to work on the species problem to the loss of Wallace's notes and specimens in the shipwreck on the way home. But despite the lack of any evidence for "his hypothesis of species formation", Brooks (1984, p. 36) maintained that "we can be certain [it] was never far from the center of his attention".

Since we know Wallace was interested in evolution before the expedition, it makes perfect sense that he remained interested in it during his voyage. However it is invalid to treat inferences as if they were specifically evidenced historical facts. One cannot claim on the basis that a naturalist was interested in evolution that he therefore must have spent the majority of his time in a four year period working on that particular interest.

Brooks thought he saw evidence of Wallace's "major preoccupation" everywhere he looked. This remark in Wallace's 1854 paper on Amazonian butterflies has since became a favourite for those eager to see Wallace on the trail of the solution to the species problem during these early years.

> All these groups are exceedingly productive in closely allied species and varieties of the most interesting description, and often having a very limited range; and as there is every reason to believe that the banks of the lower Amazon are among the most recently formed

[4] Brackman (1980, p. 82): "Wallace proposed to a friend, in a letter that still exists, that they set out for the Amazon with a view "toward solving the problem of *the origin of species*", and later in book.

> parts of South America, we may fairly regard those insects, which are peculiar to that district, as among the youngest of species, the latest in the long series of modifications which the forms of animal life have undergone. (Wallace, 1854, p. 258)

Conspiracy theorist Roy Davies claimed "This brief statement must have disturbed some of the members of the Entomological Society, many of whom were orthodox believers…By advocating a process of modification of existing species over time" (Davies, 2008, p. 48). But this passage did not mention a "process of modification"- but a "series of modifications". The fact that some types of living things such as molluscs, were more ancient than others, such as reptiles, was a commonplace amongst the non-transmutationist naturalists and geologists of the day. Similarly, it was universally accepted that the fossil record revealed a long series of different organic forms. Of course we know Wallace privately believed in some form of evolution at this time, but the language he used was identical to that used by non-evolutionists at the time to refer to the same phenomenon. So this passage, as exciting as it may seem for those seeking evolutionary statements in Wallace's early writings, offers no innovations on Wallace's part nor any information about his views that we could not conclude from the fact that Wallace had already studied Lyell's *Principles of geology*, *Vestiges of creation* and other writers.

In the wake of these early accounts, the Bates-inspired version of Wallace's first expedition and even his second has been repeated and emphasized by virtually all writers on Wallace (Fichman, 1981, p. 54; Mayr, 1982, p. 418; Browne, 1983, p. 169; Knapp, 1999; Wilson, 2000; Raby, 2001; Slotten, 2004; Fichman, 2004; Moore, 2008, p. 356; Davies, 2008, p. 42; Fagan, 2008, p. 71; Mallet, 2008, p. 103; Ruse, 2009, p. 193; Conniff, 2011; Berry, 2013; BBC Radio 4, 2013).[5] Ross Slotten's admirable biography, for example, tells us that after reading the evolutionary best-seller *Vestiges* in 1845: "The 'how' of the origin of species now became Alfred's intellectual holy grail." Hence Wallace proposed to Bates in late 1847 or early 1848 that they go to "the Amazon to comb the banks of the world's mightiest river for botanical and zoological specimens, financing their way by selling duplicates of their collections in London and gathering as many facts as possible to solve that mystery of mysteries, the origin of species, the great riddle that occupied the

[5] A photograph of the 1847 letter is reproduced in Edwards (2009, p. 13).

thoughts of the finest philosophical naturalists of the era'' (Slotten, 2004, p. 35).

The quest for the species problem has supplanted the profession of specimen collecting as the primary motive and the primary activity. Historian Martin Fichman (2004, p. 22) asserts ''But Wallace and Bates were not, primarily, professional collectors. Their travels were motivated, rather, by a 'true love for the objects of' their affection'', quoting historian of science Jane Camerini (1996). Yet Wallace, in his autobiography, makes it clear that were in not for financial exigency, he never would have undertaken the expedition (Wallace, 1905, vol. 1, p. 197).

Writers who aim to revitalize Wallace's reputation seem particularly keen on this detail of Wallace's biography. Perhaps this is because, if Wallace was consciously hunting for a solution to the species problem for a long time, this appears to strengthen a claim that Wallace deserves more credit as a founder of modern evolutionary biology. This seems to be the case for some writers. For example, Barbara Beddall (1968) wrote: ''If Darwin had been working on the problem for 20 years, Wallace had been working on it for at least ten, the major difference being that Darwin had long had a theory against which he was collecting facts, while Wallace was still actively searching for one.''

According to this conventional version of the story, Wallace already had ''the problem'' defined and he was actively seeking a ''solution'' for it. This is reminiscent of Darwin's way of recollecting his own theoretical pathway. In his autobiography drafted from 1876 he wrote: ''I worked on true Baconian principles, and without any theory collected facts on a wholesale scale'' (Darwin, 1887, p. 119). Scholars using Darwin's original notebooks and manuscripts have found that things were rather more complicated. Darwin in fact first came to believe that new species were descended from earlier ones via a long process of genealogical descent. He then went through a series of interim theories before, eventually, after eighteen months of study and reflection, he settled on natural selection (Kohn, 1980; Barrett et al., 1987). But he certainly did collect facts relevant to transmutation per say as a provisional theory.

As far as I am aware no one has ever questioned that Wallace and Bates set out to the Amazon to solve the problem of species.[6] It is taken as not only true but even self-evident by historians and popular writers alike. After all, Wallace later formulated a theory of evolution by natural selection in 1858. It seems to make perfect sense that Wallace had long been hunting for the solution.

[6] Peter Raby, however, does not employ this in his biography of Wallace.

Getting Complicated

But careful scrutiny suggests that the famous quotation in Bates' 1863 book is not genuine. As will be shown below, not only was the passage probably not written by Wallace but it was almost certainly not written in 1847 nor with reference to an expedition. Repeating Bates' version leads us into serious errors and misunderstandings. Even though "solving the problem of the origin of species" sounds so commonsensical and plausible, it has coloured, or discoloured, the plain evidence before us. For example, biographer Michael Shermer combined the sentence from the original letter with a sentence from Wallace's 1905 commentary to make a spurious quotation:

> I should like to take some one family and study it thoroughly, principally with a view to the theory of the origin of species. I firmly believe that a full and careful study of the facts of nature will ultimately lead to a solution of the mystery (Shermer, 2002, p. 57).[7]

But Wallace actually wrote

> These extracts from my early letters to Bates suffice to show… I firmly believed that a full and careful study of the facts of nature would ultimately lead to a solution of the mystery (Wallace, 1905, vol. 1, p. 257).

This error, no doubt an oversight or slip of some kind, is conceivable by accepting the traditional Bates' story since Wallace's 1905 wording "a solution of the mystery" sounds like the (purported) 1847 letter quoted by Bates.

Another error deriving from this traditional story is that, if Wallace set out to the Amazon to solve the problem of the origin of species, and as everyone knows he did not do so, perhaps he set out on his second expedition, to the Malay archipelago in 1854, with the same goal or motive. Fichman tells the story in this way. "He had a clear objective. Wallace wanted to investigate all aspects of the 'species question'" (Fichman, 2004, p. 23). 'Species question' too is not a quotation from Wallace.[8] But, more seriously, Fichman transfers the purported "objective" of Wallace's Amazon expedition to the next expedition in the Malay Archipelago. According to Fichman (2004, p. 29), Wallace

[7] Shermer (2002) cites "Marchant (1916, p. 26)." – although apparently using a 1975 edition with different pagination as this is not on p. 26 of the 1916 edition. The quotation "I firmly believe" has had its tense changed to fit the first sentence. See Wallace (1905, vol. 1, p. 257).

[8] Fichman (2004) cites Wallace (1905, vol. 1, p. 257). The phrase "species question" is not found in any of Wallace's writings.

also went there as a ''means of securing his reputation as a naturalist and of providing the data required for resolving the species problem.'' But Wallace never made such a claim and there is no evidence in his publications from the time, or his surviving notebooks, to suggest that he set out to solve a problem. His notebooks from the voyage reveal no hunt for a solution to a problem (van Wyhe, 2013a, p. 178). On the contrary, Wallace set out already a convinced transmutationist.

Other writers have described how Wallace's aim to solve the species problem was *set back* by the loss of his collection and notes during the homeward voyage from the Amazon in 1852 (McKinney, 1972; Slotten, 2004, p. 95; Conniff, 2011).[9] If Wallace had worked towards such a goal, this would be a reasonable assumption. But we have no evidence that Wallace worked towards solving a species problem or worked on any sort of species theory on the Amazon. Wallace never said so. He never referred to any work on evolutionary theory during the Amazon years.[10] Why did Wallace not later mention being set back in his species work as he did describe (both at the time and in later recollections) the setback to his collections, finances and publications?

Back to Bates

The Wallace letter quotation in Bates' 1863 book is therefore puzzling. Not only is a fundamental statement of purpose infused into Wallace's early life but also a particular way of doing science and conceiving of species and evolution in the pre-1859 era. The ''origin of species'' was ''the problem'' and solving this pre-defined and preconceived task was the goal. This too seems so obvious (after 1859) that it hardly receives any explicit or critical attention.

If one suspends belief in the traditional story for a moment to question, how do we know this? we realize that a great deal rests on a single quotation. It is a completely unique version of events. Wallace himself never said so. Given the number of times Wallace discussed his Amazon expedition, this omission is significant. And no other contemporary evidence suggests that their trip to the Amazon was meant to solve how species evolved or even to study evolution of any kind. The

[9] McKinney (1976) claimed that Wallace did not publish any mention of evolution following his Amazon expedition because there was no point after his data had been lost in the shipwreck.

[10] See for example *Wonderful century*, where Wallace (1898, pp. 138–139) mentions his belief in transmutation dating from 1845 and the next step in theoretical work as his 1855 Sarawak law paper, the Amazon is not mentioned. Thanks to Peter Raby.

closest contemporary documents that mention the aims of their expedition only mention exploring and collecting. Wallace (1849): "Messrs. Wallace and Bates, two enterprising and deserving young men, left this country last April on an expedition to South America to explore some of the vast and unexamined regions of the province of Parà, said to be so rich and varied in its productions of natural history." And essentially the same again in Wallace (1850). As these were published letters one would hardly expect them to mention such a motive. But Wallace's renditions in later life, public and private, give the same reasons.

Therefore, a large part of what has been believed about Wallace's intentions, plans, activities and precise details of how he conceived of species and evolution from 1848s to 1850s are built on the single line from Bates' 1863 book. There is no corroborating evidence, not even a later recollection, from Wallace, to the effect. Even if we had no other materials to go on, the isolated nature of the Bates' version should give us pause.

What Wallace Said

An 1851 letter written during the expedition to his brother-in-law Thomas Sims lists Wallace's planned publishing projects. As it is perhaps the most pertinent contemporary document bearing on the question it is worth quoting at length.

> If I do not get profit I hope at least to get some credit as an industrious and persevering traveller —
>
> You ask me about my book, and I will now give you my present ideas & intentions on that important subject –
>
> 1st. then, my Journal goes steadily on, and I am inclined to think it is now better written and more interesting than the part you have — That will I think have to be cut down & corrected a little, and I by the time I get home the whole will I think form a pretty thick volume –[11]
>
> 2nd. I am preparing a work by which I think I shall obtain some credit, namely, one on the fishes of this country…[12]

[11] This became Wallace (1853).

[12] The drawings are now in the NHM. Wallace never published this work mentioned, though see Toledo-Piza Ragazzo (2002).

> 3rd. I am also making characteristic sketches of the Palms…[13]
>
> 4th. I am collecting information, & thinking about a work on the Physical History of the Great Amazon valley, comprising its Geography, Geology, distribution of Animals and Plants, Meteorology & the history & Languages of the Aboriginal tribes — to be illustrated by a great map showing the colour of the waters, the extent of the flooded lands, the boundaries of the great Forest district &c &c. —[14]
>
> 5th. I shall have a good deal of information, from personal observation & from the Indians, on the habits & natural history of the animals of the country which may perhaps amount to sufficient for a separate little work — as comparatively little is known of many of the animals of this country, except stuffed specimens —.
>
> And lastly there will be my collection of Butterflies which some day will furnish me work describing the new species which are very numerous. —[15]
>
> These are my present idea as to what I shall give to the public on my return & you will see that I have plenty of work for two or three years, as all will require more or less research in Museums & Libraries to make them as complete as I should wish any thing I publish, to be.
>
> I give you all this for you own private information & do not wish it to [become] public, as there is "many a slip ['twixt the cup'] & the lip"…
>
> …it is only because I am determined to return with satisfaction & credit to myself & to you all, that I have resolved on thoroughly investigating this wonderful country, not merely seeing and doing what others have done before me, but adding something to the stores of science, and giving some information to the world that I alone shall be able to do — It is this that impels me[16]

[13] Published as Wallace (1853).

[14] This ambitious work was never published and presumably never written.

[15] Published as Wallace (1854).

[16] Wallace to T. Sims, 20 January 1851. My transcription from the images provided on *Wallace Letters Online* (Beccaloni, 2013) I am very grateful to Peter Raby for calling this letter to my attention.

There is nothing about species theory or the hunt for a solution here. Neither is there any suggestion of a higher philosophical or theoretical aim. "It is this that impels me" — not a desire to find a solution to a species problem. This list of projects has the added interest, from our perspective, of being private.

The surviving correspondence of Wallace's family and friends from the years of the expedition also contain nothing to suggest a species theory motive (Beccaloni, 2013).[17] Wallace wrote to his Australian cousin, Charles Algernon Wilson, that the Amazon expedition was for collecting. According to a report by Wilson, Wallace "formed the idea of going to the Brazils with a single companion, as a collecting naturalist. He … has succeeded well in a pecuniary point of view as a collector. … his principal object was to lay under contribution the hitherto but little known productions of the country of the Amazon and those adjacent, while carrying out which he was often quite alone. …[He] talks of returning to England for two years, to publish a history of his wanderings" (Wilson, 1852).

Wallace introduced his narrative of the Amazon voyage (Wallace, 1853) as follows: "an earnest desire to visit a tropical country, to behold the luxuriance of animal and vegetable life said to exist there, and to see with my own eyes all those wonders which I had so much delighted to read of in the narratives of travellers, were the motives that induced me" to travel abroad. This wording seems highly coloured by his youthful efforts to fit the genre of contemporary scientific travel writing by a gentleman naturalist.

Sarawak

Wallace wrote in his evolutionarily-suggestive Sarawak Law paper (1855) that it had been "about ten years since the idea of such a law suggested itself to the writer of this paper and he has since taken every opportunity of testing it by all the newly ascertained facts with which he has become acquainted, or has been able to observe himself." What is the correct interpretation of this passage? On a casual reading it might seem to confirm the view that Wallace had been searching for a solution to the species problem for 10 years.

But examined carefully, we see that there is nothing in the passage about searching for a solution. He has been thinking about "the idea of such a law" for 10 years. Therefore Wallace's paper is not a mere whim

[17] I am very grateful to Gerald Drawhorne for calling this reference to my attention.

but has a long pedigree. And what is the law? The law was a generalization about the succession of similar organic forms in the same places in a progressive order. The "law" of the Sarawak paper is not evolution, it is what Darwin called "the law of the succession of types" (Darwin, 1839, p. 210, 1859, chap. 10).

The date Wallace referred to was his 1845 conversion to the transmutationism of *Vestiges* with its emphasis on the successive appearance of more advanced living forms during the history of life. In other words, Wallace stated in 1855 that he had suspected that species succeeded each other in a gradual and progressive manner since about 1845 and had been "testing" this idea ever since. This is not the same thing as having an idea that there is a mystery or problem about how new species arise. After all, the Sarawak Law paper says nothing about how new species arise- nor does it acknowledge that there is anything to be explained on this score. In that paper Wallace writes that new species were somehow "formed" or "created" on the "model" of earlier species. Despite what Wallace said about the paper as an older man, the paper was not about the origin of new species, but a generalization about the orderly succession of species. On three occasions during his expedition in the Malay archipelago Wallace referred to the paper as about "the order of succession of species" or "on the succession of species".[18]

When Bates read the Sarawak Law paper, more than 7 years after their joint expedition commenced, he privately wrote to Wallace: "I was startled at first to see you already ripe for the enunciation of the theory."[19] If their main stated aim for going to the Amazon in 1848 was to solve the problem of species, why was 1855 surprisingly early to enunciate it? Perhaps Bates was annoyed that Wallace had made a start on the subject without him.

Even in later years, Wallace continued to describe the motives of the trip to the Amazon as collecting. In 1892, after Bates' death, Wallace (1892) wrote, in an overlooked review of a new printing of the first edition of Bates' book (which contained the purported 1847 letter quotation), that he, Wallace, "proposed a joint expedition to Para in order to collect insects and other natural objects".[20] By 1905, Bates'

[18] "On Law of Succession of Species." *Notebook 4*, p. 122 (Linnean Society Ms 180); Wallace to Darwin (27 Sept. 1857) "my views on the order of succession of species" and Wallace to H. Bates 4 Jan. 1858 "my paper on the succession of species."

[19] H. Bates to Wallace 19 Nov. 1856 NHM Catkey-418383.

[20] This, incidentally, seems to settle the old uncertainty about whether the expedition was a joint idea or proposed by Wallace as Bates maintained at least twice. Bates (1863, p. iii) said the trip was Wallace's idea but Wallace (1905, vol. 1, p. 254) seems to suggest it was a joint proposal (Wallace, 1892).

widow had returned some of Wallace's letters to help with the writing of his autobiography. The 1847 letter in question was among them. In that work Wallace wrote that the Amazon expedition, or rather a "collecting journey to the tropics" was undertaken "in order to observe nature and make a living by collecting" (Wallace, 1905, vol. 1, pp. 197, 254).

There is one purported recollection by Wallace in a posthumously published interview which might cause confusion: "My object in going to [the Amazon] was…with a view to solving the great problem of the origin of species" (Northrop, 1913). This can, however, be safely discarded as a spurious Wallace quotation. The author of the article, American journalist W.B. Northrop made numerous factual errors such as:

- Wallace "requested Sir Charles [Lyell] to show his [Ternate] paper to Darwin". It was the other way around.
- "The reception of this paper by the President of the Royal Society". It was the Linnean Society and not the president of either.
- Wallace returned "in 1858". It was 1862.

The purported quotations by Wallace were clearly written by Northrop at some time later from memory. This is evident in the style which does not sound like Wallace and even more so by the errors that could never have been made by Wallace:

- "I worked in his office" i.e. his brother Williams's "office" during the surveying years.
- "I applied at this time to H. W. Bates…and asked him to send me to the Amazon River on an expedition which he was fitting out." Wallace invited Bates, he did not apply to Bates to send him.
- "On my return to London, in 1866". Wallace returned in 1862.

The quotation Northrop attributed to Wallace "solving the great problem of the origin of species" was widely available in the literature of the time.

There is sufficient evidence from various sources to accept that Wallace and Bates believed in some unspecified version of transmutation before their expedition – apparently derived from the "law of development" of *Vestiges* (1844) – but this neither confirms nor contradicts the "solving the problem" story. It does not necessarily follow from believing in transmutation that one must therefore search for a solution to a problem or a "mechanism." This is a very specific way of thinking and to know whether or not Wallace and Bates saw matters in

this particular way, so common in the years after 1859, we need some clear evidence for it. Wallace and Bates were by no means unique in believing in evolutionary change at the time, even amongst specimen collectors. Their friend the botanist Richard Spruce was another (Raby, 2001, p. 78). Indeed for some naturalists at the time, transmutation *was* the explanation for where current species came from. They were changed versions of earlier ones. I have seen no other pre-1859 transmutationist who explicitly sought to solve a or *the* species problem. This makes it difficult to accept that Wallace and Bates saw things in this way in 1847.

The Letter

As writers on Wallace have so far agreed, the letter Bates quoted from still survives. Wallace retained it after writing his autobiography. It is now in the superb collection of Wallace Papers at the Natural History Museum (London).[21] Most previous writers have read the letter in light of the way Bates told the story in 1863. But the letter must be read with reference to its original 1847 context. Wallace had just returned from a brief trip to Paris where he had admired the collections of insects in the Muséum National d'Histoire Naturelle. He then visited the collections in the British Museum. Writing to Bates in October 1847, Wallace referred to his own modest collection of insects. He remarked in a now famous and frequently cited passage:

> I begin to feel rather dissatisfied with a mere local collection — little is to be learnt by it. I shd. like to take some one family, to study thoroughly — principally with a view to the theory of the origin of species.. By that means I am strongly of opinion that some definite results might be arrived at. One family of moderate extent would be quite sufficient — Can you assist me in choosing one that it will be not be difficult to obtain the greater number of the known species —

So the wording given by Bates differs from what Wallace actually wrote:

> towards solving the problem of the origin of species (Bates, 1863)
> with a view to the theory of the origin of species (Wallace, 1847)

Although these differ by only a few words, the context and meaning Bates attributed to the passage adds far more. In the original letter

[21] Wallace to Bates, 11 Oct. 1847. Wallace Correspondence Project WCP348/348. To my knowledge it has always been accepted that this is the same letter.

Wallace asked about collecting a family of insects for study *in England*. There is no mention or even hint of an expedition in this letter. Hence Bates' statement that the Wallace letter expressed the "purpose" of the expedition here is not correct.

It is unknown when exactly a voyage was first proposed. It is surprising that there is no reference to one in this lengthy letter. The suggestion for an expedition might therefore have arisen after this letter was written. Wallace mentioned in his autobiography that their choice of destination was determined by reading W. H. Edwards *A Voyage up the Amazon*: "I think we read the book in the latter part of the year (1847) (or very early in 1848)". Edwards' book was apparently only published in Britain in September 1847, so it is unclear when the two men may have read it.[22] It is impossible to be sure. But it is quite plausible that they read Edwards more than a month after it was published and so after the October 1847 letter. They then spent a week together in Neath in late 1847 or early 1848 where the expedition was proposed and discussed.

The Bates' story has become so commonplace that even those who have consulted and quote from the original letter continue to add to it that "the origin of species" statement was given as a reason for travelling to Brazil (Shermer, 2002, p. 34; Berry, 2013). But a connection to the Amazon expedition is not there. It was given by Bates in 1863, not by Wallace in 1847 or any other time.

The letter also mentions no problem that needs to be solved. What exactly Wallace meant by "a view to the theory of the origin of species" is not straightforward. This was very unusual language for the time. There was no "origin of species" under discussion, despite the fact that after 1859 this would become one of the most famous phrases in the English language. Also, what was "the theory" Wallace had in mind? Many modern commentators assume it refers to the genealogical tree of descent with modification. This sort of thinking however is not evident in Wallace's manuscripts until the mid-1850s (van Wyhe, 2013a, pp. 32, 82–83). The other common assumption is that it refers to a widely recognized scientific problem of the day. However, as the phrase "the origin of species" was not then in use- how can we know what Wallace meant by it in 1847? Whatever it was, it could be studied by collecting only a single insect "family of moderate extent" in England. Could this really refer to an intention to discover how all new species on earth appear?

[22] *Publishers' circular*, 1847, p. 298, but reviewed in *The Spectator* (Anon., 7 August 1847).

The phrase could refer to the ''theory'' proposed in *Vestiges* which Wallace and Bates had read and discussed during the past two years. *Vestiges* discussed ''the progress of organic life'' under the chapter heading ''the origin of the animated tribes''. Wallace might well have paraphrased this as ''the origin of living species'' or ''the origin of species''. The language ''with a view to the theory'' is also now archaic. Such language by a naturalist in the early nineteenth century generally referred to compiling supportive evidence. So rather than being an incredibly prescient and historically isolated reference to a search for Darwinian evolution, Wallace's 1847 remark was most likely a reference to substantiating the biological part of the development theory of *Vestiges*. Wallace refers to an existing theory he wanted to study. He did not indicate that he proposed to formulate a new theory.

How to Explain It?

So Bates apparently added two crucial details to Wallace's 1847 letter. First, that the letter stated the plan of their Amazon expedition and that the plan was to ''gather facts…towards solving the problem''. Since the words given by Bates are not from Wallace's October 1847 letter, where are they from? One possibility is that Bates was quoting from another, now lost, letter. This is obviously possible in principle- were it not for the words themselves. These should make us very suspicious.

For over a century most writers have portrayed ''the problem of the origin of species'' as a topic that was ''in the air'' that naturalists recognized and were pondering over for many years- perhaps even centuries. But the number of times this view has been repeated does not mean it is historically accurate. In fact there was no widely recognized or discussed ''species problem'', ''species mystery'', or sought after ''solution'' or ''mechanism''.

Even someone not familiar with the way that pre-*Origin* naturalists thought and wrote about species and transmutation can confirm this by searching the millions of pages on Google Books for phrases such as ''problem of the origin of species'', ''problem of species'', ''species problem'', ''the species question'' and so forth. Such phrases *never* occurred in English before 1860. Historian of science James Secord (1994) noted that ''In retrospect, of course, it is easy to see ''the species question'' as the subject of *Vestiges*, which then joins the work of Lamarck, Geoffroy, Grant, and Darwin as an ''evolutionary'' text focused on a single issue.'' But Secord noted that this is a mistaken anachronism.

Of course nothing arises *de novo*. In 1826 Edinburgh professor Robert Jameson referred to the ''Origin of the Species of Animals'' in an 1826 syllabus which would have been seen by his student Darwin (Ashworth, 1935).[23] The German naturalist-explorer Alexander von Humboldt's *Personal narrative* mentioned a similar issue:

> In the vegetable as well as in the animal kingdom, the causes of the distribution of the species are among the number of mysteries, which natural philosophy cannot reach. This science is not occupied in the investigation of the origin of beings, but of the laws according to which they are distributed on the globe (Humboldt 1819–1829, vol. 5 part I, p. 180).

Humboldt referred to geographical distribution not how species became ''modified''. What was a mystery beyond science to answer was how a new ''germe of life'' could come into existence. This is not the same as the origin of species, it could also mean the origin of living matter from non-living matter. While there was a similar mystery here, there was no ''problem''.

The first use of ''problem'' language I have found is in the work of geologist Charles Lyell. He referred to the above Humboldt passage in the third edition of his *Principles of geology* (1835, vol. 3, p. 95) mentioning ''the solution of so difficult a problem''. But Lyell was not referring to the same thing as Humboldt. For Lyell it was the ''introduction of new species'' after the extinction of others in the same region. This expression is much closer to what would be described after Darwin's *Origin of species*.

The astronomer John Herschel wrote to Lyell about ''that mystery of mysteries, the replacement of extinct species by others.''[24] The letter was reproduced in print in Charles Babbage's *Ninth Bridgewater Treatise* (1837) where Darwin encountered it in December 1838. He jotted in his notes: ''Herschel calls the appearance of new species the mystery of mysteries, & has grand passage upon the problem.! Hurrah''.[25] Here

[23] Similarly in Müller (1838–1842, p. 25) ''origin of genera and species''. This section heading is not given in the German original. ''But no fact justifies us in speculations concerning the original, or subsequent origin of living beings; no fact indicates the possibility of explaining all these varieties by transformation, for all creatures maintain unchanged the forms which they originally received'' (p. 26). Ball (1850, p. 9): ''bearing upon some of the arguments upon the question of the origin of species derived from their distribution through definite areas of space.'' Thanks to Jon Hodge.

[24] J.F.W. Herschel to Lyell, 20 February 1836. Original in Wilson (1972).

[25] *Notebook E*: 59. Darwin's notebook is preserved in the University of Cambridge, CUL-DAR124.

was combined the mystery of Humboldt and the problem of Lyell into what would become the modern way of looking at the history of evolutionary theories.

One might think, therefore, that "the problem", was already widely recognized and discussed. But Darwin seems delighted in his note to have found a remark that specifically refers to the issue he believed his new theory addressed. There were no other references to such a thing in the literature of the time. Darwin does not seem to have explicitly described or presented his own theories as the solution to a problem in his drafts of 1842, 1844 or the unfinished book *Natural selection* begun in May 1856 which was so famously interrupted by Wallace's letter on 18 June 1858 (Darwin 1909; Stauffer 1975).[26] But finally, in the *Origin of species* (1859) itself, Darwin presented his arguments and evidence as the solution to a problem. He had found no better quotation than Herschel's to refer to the topic in the years since 1838.

> When on board H.M.S. 'Beagle,' as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species—that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question… (Darwin 1859, p. 1).

The arguments in *Origin of species* were aimed at the "obscure problem" of "the means of modification and coadaptation" of species (Darwin, 1859, pp. 1, 4, also pp. 75, 224).[27]

The *Origin of species* appeared in November 1859 and almost immediately became widely controversial, debated and discussed. It was an unusually ambitious and sweeping scientific work that claimed to provide a new theory for how all living things on earth are related and how they become adapted to their complex ways of life. Immediately after this new theory was announced, the language used to discuss species changed. Darwin's theory was suddenly described as the solution to the now explicitly named "problem". And this has remained probably the most common way of formulating the story ever since. It has become so entrenched that it has seldom been noticed or thought of as an accurate history or that there can be any other way of speaking.

[26] How Wallace's letter arrived on this particular date, as noted at the time by Darwin, is demonstrated in van Wyhe and Rookmaaker (2012).

[27] That Darwin really was the naturalist, and not just the captain's gentleman companion see van Wyhe (2013b).

After the *Origin of species*, therefore, this way of thinking and consequently such phrases became extremely common. The phrase ''species problem'' is found 724 times in Google Books between 1860–1900 and ''problem of species'' occurs 2,050 times between 1860–1900. Neither of these terms occurs before 1860.[28] So it seems that by proposing such a sweeping new scientific theory which was so rapidly accepted, a commensurate ''problem'' was cast as its object and fulfilment.

The first use of such language of solving a species problem I have found is by Darwin's friend, the American botanist Asa Gray with reference to the 1858 papers by Darwin and Wallace. Of course Gray already had private knowledge of Darwin's work and may have better understood its implications as a sweeping new theory in natural history, hence the solution to a big problem.

> The fundamental and most difficult question remaining in natural history is here presented;—the question whether this actual geographical association of congeneric or other nearly related species is primordial, and therefore beyond all scientific explanation, or Whether even this may be to a certain extent a natural result. The only noteworthy attempt at a scientific solution of the problem, aiming to bring the variety as well as the geographical association of existing species more within the domain of cause and effect, is that of Mr. Darwin and (later) of Mr. Wallace (Gray, 1859b, from Gray, 1859a).

This passage is also of note for those interested in questions of contemporary standards of priority between Darwin and Wallace. The publication date of the papers is not the issue for Gray, but the date of conception of their respective ideas.

At any rate, the exact wording of interest to the 1863 Bates' adjustment question first occurs in a February 1860 lecture at the Royal Institution by the naturalist Thomas Henry Huxley.

> I have endeavoured to lay before you what, as I fancy, are the turning points of a great controversy; to render obvious the mode in which the vast problem of the origin of species must be dealt with…The Origin of Species is not the first, and it will not be the last, of the great questions born of science, which will demand settlement from this generation (Huxley, 1862).

At the same time Huxley (1860) wrote a review of *Origin of species* which portrayed the whole debate as one in which there were two

[28] http://books.google.co.uk/advanced_book_search, accessed August 2013.

options; the "special creation" hypothesis and "the so-called 'transmutation' hypothesis". The notorious conflict metaphor between science and religion may also date from this period. It was at any rate certainly more prominent thereafter.[29]

Problem Solving

Problem solving language was prominent from the very first reviews of the *Origin of species*. The physiologist William Benjamin Carpenter wrote in January 1860: "This is a problem which Mr. Darwin has been for some years essaying to resolve."[30] By the end of 1860 economist Henry Fawcett (1860) described it all thus: "The question of species may thus, at the first sight, appear to be a dispute about an arbitrary classification, and it may naturally be asked, Why, therefore, does the problem of the Origin of Species assume an aspect of supreme scientific interest".

Another example may help to illustrate the conquest of problem solving rhetoric after the *Origin of species* appeared. In 1860 the Scottish author Patrick Matthew claimed to have already "discovered" natural selection as given in the appendix to his 1831 book. He argued in the *Gardeners Chronicle* that his book "clearly proves a prior claim" to discovery (Matthew, 1860).[31] But Matthew (1864) described himself as the "solver of the problem of species".

The Chief Justice of South Australia R.D. Hanson writing in 1864 mentioned: "the theory of Mr. Darwin, which, though confessedly incomplete, at any rate offers a solution of the problem of the origin of species strictly in accordance with what we know from experience". A writer in *The Quarterly Journal of Science* mentioned in 1865 that many men of science now regarded Darwin's theory "as the only scientific mode of solving the problem of 'species'" (Anon., 1865).

[29] There is a large literature on conflict metaphors in the history of science, whether conflict between science and religion or conflict between creation and evolution. See Brooke and Cantor (1998), Brooke (1991) and Kjærgaard (2002).

[30] Carpenter (1860a) and again in Carpenter (1860b): "the same solution of this problem" occurred to Darwin and Wallace. Other reviews that refer to Darwin's theory as "the solution of the problem" include Chambers (1859), Hall (1860), Dawson (1860). These and many other reviews are found in John van Wyhe ed., *The Complete Work of Charles Darwin Online* (2002).

[31] Darwin later included Matthew among his predecessors in the 'Historical sketch' published in the third and later eds. of *Origin*. See Burkhardt et al. (1985, CCD) vol. 8, p. 156.

This new way of portraying the history of science, then, became and has remained commonplace. At the time no one seems to have noticed that they had begun not only to see the source of species differently in light of the Darwin-Wallace theory, but they also came to see the new theory specifically as the "solution" to "the problem" that was recognized and sought before *Origin of species*. For example, Huxley later wrote in 1887: "The facts of variability, of the struggle for existence, of adaptation to conditions, were notorious enough; but none of us had suspected that the road to the heart of the species problem lay through them, until Darwin and Wallace dispelled the darkness" (F. Darwin, 1887, vol. 2, p. 197). It's a delightful metaphor, but it is a retrospective and anachronistic way of speaking. No one was talking about "the species problem" before 1859.

Wallace, like his friends and contemporaries, used the same language after 1859. But, at least in print, Wallace only referred to "the problem of the Origin of Species" at the start of his book *Darwinism* in 1889.[32] In his 1905 autobiography he cast his early experiences in the new problem solving language. After quoting from his 1847 letter to Bates, Wallace noted:

> These extracts from my early letters to Bates suffice to show that the great problem of the origin of species was already distinctly formulated in my mind; that I was not satisfied with the more or less vague solutions at that time offered; that I believed the conception of evolution through natural law so clearly formulated in the "Vestiges" to be, so far as it went, a true one; and that I firmly believed that a full and careful study of the facts of nature would ultimately lead to a solution of the mystery (Wallace, 1905, vol. 1, pp. 254–257).[33]

In later years Wallace referred retrospectively to the "problem of the origin of species" in several of his publications (Wallace, 1895, 1900, 1903a, b, 1908, 1909). This highlights a danger long familiar to historians, not to treat later recollections as if they were contemporary recordings of the events they recall. Wallace, like his contemporaries at the end of the nineteenth century, had come to see the history of science in a particular way. But that particular manner of conceiving of these issues did not exist in 1847.

Thus the language given by Bates in 1863 "towards solving the problem of the origin of species," is identifiably time-specific – indeed if

[32] Wallace's complete publications can be found in John van Wyhe ed., *Wallace Online* (2012).

[33] Wallace (1905, vol. 1, pp. 359–360): "a complete solution of the great problem." Bates' widow returned his letters to him to assist writing his autobiography. This would have been the first time he had seen his letter since 1847 (Wallace, 1905, vol. 1, p. 254).

we had nothing else but the line itself, we would date it to no earlier than 1860. Such means allow one to detect historical anachronisms- when words or ideas from a later time are set in an earlier context where they do not belong. For example, no one would refer to a ''scientist'' or a ''physicist'' before the terms were coined by William Whewell in the 1830s, or more likely, before they came into common use. The word ''camouflage'' was never used for animal colouration before the First World War (rather ''protective resemblances''), and ''sexual selection'' first appeared in *Origin of species* (1859). Of course neologisms are easy. Existing words used in new ways are more difficult though they can still be dated. The meaning of the word ''evolution'' has changed since the publication of *Origin of species*. As many textbooks describe, the word once meant to unroll and therefore to unfold pre-existing forms. ''Adaptation'' was in use long before Darwin but has undergone a similar post-Darwin transformation. A phrase such as ''the mechanism of natural selection'' is now a ubiquitous way of speaking. But ''mechanism'' language has been in use only since around 1900. These changes of terminology tend to go unnoticed. Therefore if we see a quotation that claims that someone was trying to ''find the mechanism'' or solve ''the species problem'' before 1859 we should instantly suspect an anachronism- if not a forgery.[34]

What Really Happened?

So if the quotation Bates gave in 1863 is not entirely genuine, what really happened? Why did they set out for the Amazon? As far as the evidence reveals, Wallace and Bates went to the Amazon to work as natural history specimen collectors. Both men had tried a series of jobs in Britain and Bates was leaving behind a particularly uncongenial one (Clodd, 1892). They spent their entire time engaged in specimen collecting. This activity is obvious in all their publications, correspondence and subsequent publications. And both men made a good living doing so.

They also compiled personal collections. This distinguished them from ''mere collectors'' who collected only for pay, such as Wallace's unsung assistant Charles Allen, rather than personal motivation or interest.[35] Is this evidence that they intended to elucidate transmutation? Given that

[34] Ehrman (2011) discusses the use of the word forgery for historical documents.

[35] See Wallace's letter to Frederick Bates, 2 March 1858, NHM WP1/3/42, transcribed in van Wyhe and Rookmaaker (2013) and Marchant (1916, vol. 1, p. 69). On Charles Allen, see Rookmaaker and van Wyhe (2012) and Baker (1995).

many other contemporary collectors retained personal collections, it seems not. Wallace and Bates, like many of their contemporaries, kept personal collections partly or primarily with a view to publishing systematic works during and especially after their expeditions. This is seen in the 1851 letter by Wallace quoted above. In 1860 Bates wrote "I have amassed an extensive private collection…with a view to publishing a "Montfauna" of the Amazon valley" (Clodd, 1892). Wallace did the same in the Malay archipelago, planning a "Coleoptera Malayana".[36]

Of course we know that Wallace and Bates accepted some form of transmutation. They may have planned to compile evidence in support of transmutation on the Amazon. But if they did they left no contemporary evidence for us to know this. And they could not have seen things in a post-1859 light of solving "the problem of species."

The Delicate Adjustment

As Bates wrote his book of travels on his eleven years of hard work and perils in the Amazon, he saw not only Charles Darwin becoming the greatest living name in science for an evolutionary theory, but his old chum Wallace – once his scientific junior whom he had introduced to beetle collecting in Leicester – had now, as Bates put it, "acquired wide fame in connection with the Darwinian theory of Natural Selection". Bates may have felt unfairly eclipsed. After all he and Wallace had been evolutionists (of some stripe) long before it had become the new vogue. As Bates reminded Wallace in 1856 "The theory I quite assent to, and, you know, was conceived by me also."[37] Furthermore, in 1863 Bates was seeking in vain for a job and the prospects looked bleak. A successful book of travels showing him to be a naturalist of the highest calibre and at the vanguard of the latest scientific revolution could improve his reputation and help land him a job and support his new wife.

The earliest occasion I have found when Bates claimed that the Amazon expedition had a higher purpose than collecting was in a, now lost, letter to Darwin in 1860. Darwin replied: "I did not know that you had worked with high philosophical questions before your mind."[38]

[36] On Bates, see Bates to P.H. Gosse (February 1860) in Clodd (1892, p. lxxxvii). On Wallace, see van Wyhe (2013a, p. 308).

[37] H. Bates to Wallace 19 Nov. 1856, NHM Catkey-418383, transcribed in van Wyhe and Rookmaaker (2013) and Marchant (1916, vol. 1, p. 64).

[38] Darwin to Henry Walter Bates 22 November (1860) (Burkhardt et al. (CCD), vol.8, p. 484). Same Bates to Hooker 19 March 1861: "during the whole time directed my attention to the modifications of species and kindred subjects" (Clodd, 1892, p. xxxiii).

Bates wrote to a potential reviewer of his book in 1863 pointing out that the collecting expedition of Wallace and, with proper Victorian modesty, his humble self, was more worthy of notice than that of mere collectors.

> There is nothing very remarkable in persons going out to make collections in new countries for sale; what (I venture to say) *merits some attention* about Mr Wallace, and in a very far less degree of myself, is that his main object — — which he never lost sight of — was the study of the objects collected with a view to philosophical conclusions. For this end we *have both* retained complete collections of certain large groups for private study.[39]

In this letter we see an explicit reason why Bates mentions a philosophical purpose, though not mentioning transmutation specifically. It was this higher purpose, he believed, that made his own voyage to the Amazon, along with his now famous friend Wallace, more important than mere specimen collecting. Bates, like Wallace, wanted to avoid being described as just a lowly collector (van Wyhe, 2013a, p. 120). As Bates once wrote to Darwin, even of practising entomologists, "they cannot be considered scientific men but must be ranked with collectors of postage stamps & crockery."[40]

And thus Bates introduced his story to the readers of his book. *The Naturalist on the River Amazons* was published by John Murray in April 1863 in two volumes in 1250 copies (the same number as the first edition of *Origin of Species*). Bates' book became a best seller. It popularized one of the major new discoveries that supported natural selection, the protective resemblances of mimicry of unrelated insect groups, still known as Batesian mimicry.

Reactions to Bates' Claim

At the suggestion of his publisher, a second abridged edition was published early the following year (Bates, 1864). Curiously, Bates omitted the Wallace letter quotation and any mention of a plan to solve the problem of species. Why would Bates excise any mention of the main aim of the expedition? Of course as the second edition was abridged, many passages

[39] Bates to unknown, 16 April 1863. Quentin Keynes Collection. The words in italics are later additions.http://www.nhm.ac.uk/research-curation/scientific-resources/collections/library-collections/wallace-letters-online/4258/4370/T/details.html.

[40] H. W. Bates to Darwin 24 November 1862. Burkhardt et al. (CCD), vol. 10, p. 449.

were removed. But the passage with the Wallace quotation is not like other passages in the book. It was the dramatic mission statement for the voyage. It had already become, as it still is over a century later, the most frequently quoted line from the entire book. Surely Bates must have been aware of this. Its removal is therefore interesting. The reactions of contemporary readers and reviewers offer some clues.

A reviewer in the *Athenaeum* was the first to notice something. "We have already stated that one of the principal objects of Mr. Bates's explorations was to gather facts "towards solving the problem of the origin of species." He thinks he has found such a solution in adopting Mr. Darwin's theory and making many of his facts bend to it" (Seemann, 1863). This was a serious accusation. Did Bates bend his old facts to fit Darwin's new theory?

A writer in the *London Quarterly Review* made rather disparaging remarks about the species mission:

> There is very little about the Darwinian hypothesis in Mr. Bates's book, far less than the above remark in the preface would lead us to expect. … He tells us that he and Mr. Wallace went out to gather facts towards 'solving the problem of the origin of species.' After an eleven years' search, he brings us back nothing but some differently marked butterflies, and several kinds of monkeys, admirably adapted to a life amongst trees, but surely not amongst South American trees any more than amongst the forests of tropical Africa or Sumatra (Anon., 1864a).

This is not to suggest that these reviewers doubted that Bates and Wallace really did set out to solve the problem of species but they did single out this remark for particular, and in these cases very critical, attention.

The modified Wallace letter was quoted in almost every review and in further discussions in print.[41] A curious exception is the anonymous reviewer in the *Natural History Review* which omitted the Wallace letter quotation and Bates' claim about the aim of the expedition, leaving only: "[Bates] left England in company with Mr. A. R. Wallace – "who has since acquired wide fame in connection with the Darwinian theory

[41] Also noticed and quoted Anon. (1863a), Anon. (1863d, p. 39 and again on p. 47) where the Wallace letter quote is again given followed by "The supposed relevant facts obtained do not at present appear to be numerous" (copied from *British Quarterly Review*, Anon., 1863a, 1864b; Bentham, 1864, p. xx; not a review of Bates book), Anon. (1863c) paraphrases "Wallace and Bates, after long discussion of the problem of the origin of species".

of Natural Selection,'' on a joint expedition up the river Amazons, for the purpose of investigating the Natural History'' (Anon., 1863b).[42]

Darwin and Joseph Dalton Hooker discussed it too. Hooker wrote to Darwin with reference to the *Athenaeum* review:

> It is a little evident to me, here & there, that [Bates'] Darwinistic explanations of what he sees &c are after-thoughts— It is too bad to say that his facts are therefore twisted—but he says here & there, or leaves the impression of saying, in 1849, ''We did so & so which is of such importance ''au point de vue'' of N. Selection or of Variation & N & S.'' whereas he never knew aught of these till 1859[43]

Darwin replied, focusing more specifically on whether Wallace and Bates had transmutation in view during the Amazon years rather than whether Bates had bent any facts:

> With respect to Bates & Wallace having distinct views on species during their Journey; what does astonish me is the extreme poverty of observation on this head in Wallace's book; with one discussion on very dissimilar Birds feeding alike showing, as it seemed to me, complete misunderstanding of the economy of nature.[44]

In other words Darwin thought it was puzzling that they could have set out with ''distinct'' views on the origin of species when he found their level of understanding of the ''economy of nature'' at the time did not reflect this.

Bates made one other ambitious claim in his 1863 preface; that ''no less than 8000'' of the species he collected ''were *new to science*'' (italics in the original) (Bates, 1863, p. v). But he soon ''fell into a nest of hornets at British Museum, in the shape of a knot of the leading curators (Dr. Gray at the head) criticizing fiercely my statement of having found 8000 new species out of 14,700.'' (Clodd, 1892, p. lxv) John Edward Gray, Keeper of Zoology at the British Museum, and his team were the ones who were identifying and cataloguing the species Bates had collected. They had thus far worked out 477, of which 324 were new species.

[42] From 1910 until the 1960s this review was reprinted as 'An appreciation', attributed to Charles Darwin, in Dent's Everyman Library edition of Bates' book (Anon., 1910). Freeman (1977, p. 18) concluded that the review was not by Darwin. The review may have been written by John Lubbock, T.H. Huxley or J.D. Hooker who all contributed to the magazine.

[43] J. D. Hooker to Darwin (13 May 1863). Burkhardt et al. (CCD), vol. 11, p. 411. See Raby (2001, pp. 172–173).

[44] Darwin to J. D. Hooker 15 and 22 May (1863). Burkhardt et al. (CCD), vol. 11, p. 419. Darwin's (1854) reading notes on Wallace (1853) show that he was referring to pp. 84–85.

This accusation greatly upset Bates who worried that any blemish on his reputation might hurt his employment prospects. Bates wrote to Hooker "I should be very vexed if it came to get abroad amongst naturalists that I had exaggerated, but I have not exaggerated".[45] Bates explained that although 8,000 new species had not actually been identified from his collection, he had extrapolated from the 477 species thus far worked out. Bates certainly did exaggerate from 324 to "no less than 8000", and this is what so annoyed the men at the British Museum. Revealingly, the claim of 8,000 new species was also dropped from the second edition of his book.

Just as Bates exaggerated the number of new species identified in his collections, he apparently also exaggerated the aim and purpose of his (and Wallace's) expedition. He probably felt justified to over-emphasize their species aims given that the two really were transmutationists and Wallace had used the now famous phrase "the origin of species" in an 1847 letter. Both the claim of a grand objective and the claim of grand results received a lot of attention after Bates' book appeared, and both were quickly dropped in the second edition.

Conclusion

In the absence of any documents from 1848 about the purposes of their expedition, we can never be sure about all of the reasons that Wallace and Bates went to the Amazon. What is indisputable, however, is that they went "in order to collect insects and other natural objects" (Wallace, 1892). And it was this activity that constituted the vast majority of their activity and their sole income.

It is, of course, possible that they did intend their expedition to investigate or substantiate transmutation in some way, and hence Bates may have felt justified in modifying Wallace's letter to that effect. But if they did intend their expedition for any such ends – they left no evidence to suggest it in their voluminous writings. If one looks for it specifically, there is a remarkable absence of any reference to such a thing in the writings of both men. All we have is the "adjusted" quotation in Bates' 1863 book. All of Wallace's references to the purposes of the expedition state that it was for collecting. Even the lengthy letter to his brother-in-law, written during the Amazon expedition itself, covers a list of Wallace's projects but with no mention of species transmutation.

[45] Bates to Hooker 12 May 1863, Clodd (1892, p. lxv).

Our acceptance and repetition of the story that Wallace and Bates went to the Amazon to study transmutation should be proportionate to the evidence. And yet the quotation and its surrounding statements by Bates entirely dictate almost every publication on this subject. The Bates' version has now been reproduced hundreds, perhaps thousands of times, and greatly altered the way his own and Wallace's biographies have been written. It is time to recognize it for what it is, a spurious quotation. And this quotation is our *only* source for a very specific if irresistibly appealing version of events.

In addition to Bates' embellishment this study highlights an unappreciated effect of Darwin's *Origin of species* – the dramatic shift in the way the Victorians, and their descendants, see the theory of evolution by natural selection as the solution to "the species problem". This is an almost whiggish picture of how science works. Problems are identified and solutions for them are directly sought and found. This way of telling the story seems to suggest that science is a series of steps towards inevitable progress. Searching for solutions to problems may sometimes be the case, but the source(s) of new species was a far more amorphous set of issues and questions and therefore far less straightforward than the modern problem-solving language implies.

Acknowledgements

I am grateful to the following for discussing or debating these issues with me: Ahren Lester, George Beccaloni, Charles Smith, Anthony Crawforth, James Secord, and especially to Peter Raby, Jon Hodge, Kees Rookmaaker and Peter Kjaergaard for reading earlier drafts and providing helpful suggestions. Charles Smith called Northrop (1913) to my attention and Jon Hodge kindly suggested Ashworth (1935) and Müller (1838–1842). I am most grateful to Peter Raby for suggesting "a delicate adjustment" as a pun on the "delicate arrangement" of Brackman (1980).

References

Anon. 1847. "[Review of] Edwards, A Voyage Up the River AMAZON." *Spectator* 7, August 1847.

—— 1863a. "[Review of] Bates, H. W. The Naturalist on the River AMAZONS." *British Quarterly Review* 38: 169–186.

—— 1863b. "[Review of] Bates, H. W. The Naturalist on the River Amazons – A Record of Adventures – Habits of Animals – Sketches of Brazilian and Indian Life, and Aspects of Nature Under the Equator During Eleven Years of Travel." *Natural History Review* 3: 385–389.
—— 1863c. "[Review of] Bates, H. W. The naturalist on the river Amazons." *Westminster Review* 80: 62–66.
—— 1863d. "The river Amazons." *Eclectic Magazine of Foreign Literature, Science and Art* 60: 39–49.
—— 1864a. "The naturalist on the river Amazons." *London Quarterly Review* 22: 48–71.
—— 1864b. "Natural history of the Amazons." *Quarterly Journal of Science* 1: 181–189.
—— 1865. "Science, Politics, and Religion." *Quarterly Journal of Science* 2: 194.
—— 1910. "An appreciation." H.W. Bates (ed.), *A Naturalist on the River Amazons*. London: J. M. Dent & Sons (Everyman Library).
Ashworth, J.H. 1935. "Charles Darwin as a student in Edinburgh, 1825–1827." *Proceedings of the Royal Society of Edinburgh* 55: 97–113, 100 (Available online: http://darwin-online.org.uk/content/frameset?pageseq=1&itemID=A349&viewtype=text).
Babbage, Charles. 1837. *The Ninth Bridgewater Treatise*. London: John Murray.
Baker, D.B. 1995. "Pfeiffer, Wallace, Allen and Smith the Discovery of the Hymenoptera of the Malay Archipelago." *Archives of Natural History* 23(2): 153–200.
Ball, John. 1850. "Outlines of a Monograph of the Genus *Leontodon*." *Annals and Magazine of Natural History* 6: 9.
Barrett, Paul H., Gautrey, Peter J., Herbert, Sandra, Kohn, David, and Smith, Sydney (eds.). 1987. *Charles Darwin's Notebooks, 1836–1844: Geology, Transmutation of Species, Metaphysical Enquiries*. British Museum (Natural History) and Cambridge: Cambridge University Press. .
Bates, Henry Walter. 1863. *The Naturalist on the River Amazons: A Record of Adventures, Habits of Animals, Sketches of Brazilian and Indian Life and Aspects of Nature Under the Equator During Eleven Years of Travel*. London: John Murray.
—— 1864. *The Naturalist on the River Amazons*, 2nd ed. London: John Murray.
BBC Radio 4. 2013. Alfred Russel Wallace. Documentary in the Series "In Our Time" Presented by Melvin Bragg, First Broadcast on 21 March 2013.
Beccaloni, George W. (ed.). 2013. *Wallace Letters Online* (http://www.nhm.ac.uk/wallacelettersonline).
Beddall, Barbara. 1968. "Wallace, Darwin, and the Theory of Natural Selection: A Study in the Development of Ideas and Attitudes." *Journal of the History of Biology* 1(2): 261–323.
Bentham, George. 1864. President's Address to the Anniversary Meeting. *Journal of the Linnean Society: Zoology* 7: xi–xxix.
Berry, Andrew. 2013. Evolution's Red-Hot Radical. *Nature* 496: 162–164.
Brackman, Arnold C. 1980. *A Delicate Arrangement: The Strange Case of Charles Darwin and Alfred Russel Wallace*. New York: Times Books.
Brooke, John H., and Cantor, Geoffrey. 1998. *Reconstructing Nature: The Engagement of Science and Nature*. Edinburgh: T. & T. Clark.
Brooke, John H. 1991. *Science and Religion*. Cambridge: Cambridge University Press.
Brooks, John L. 1984. *Just Before the Origin: Alfred Russel Wallace's Theory of Evolution*. New York: Columbia University Press.

Browne, Janet. 1983. *The Secular Ark: Studies in the History of Biogeography*. New Haven and London: Yale University Press.
Burkhardt, F. et al. (eds.). 1985. *The Correspondence of Charles Darwin*. 20 vols. Cambridge: Cambridge University Press.
Camerini, J. 1996. Wallace in the field. *Osiris* n.s., 11: 44–65.
Carpenter, W.B. 1860a. Darwin on the Origin of Species. *National Review* 10: 188–214.
—— 1860b. "The Theory of Development in Nature." *British and Foreign Medico-Chirurgical Review* 25(April): 367–404.
Chambers, Robert. 1844. *Vestiges of the Natural History of Creation*. London: John Churchill.
—— 1859. Charles Darwin on the Origin of Species. *Chambers's Journal* 11: 388–391.
Clodd, Edward. 1892. "Memoir [of Henry Walter Bates]." H.W. Bates (ed.), *The Naturalist on the River AMAZONS, with a Memoir of the Author by Edward Clodd*. London: John Murray, pp. xvii–lxxxix.
Conniff, Richard. 2011. *The Species Seekers: Heroes, Fools, and the Mad Pursuit of Life on Earth*. New York and London: W. W. Norton & Co.
Crawforth, A. 2009. *The Butterfly Hunter: The Life of Henry Walter Bates*. Buckingham: University of Buckingham Press.
Darwin, Charles R. 1839. *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle*. London: Henry Colburn.
—— 1854. Wallace: "Narrative of Travels on the Amazon' 1853. CUL-DAR205.3.156-157 Transcribed by Kees Rookmaaker, edited by John van Wyhe (Available online: http://darwin-online.org.uk/content/frameset?pageseq=1&itemID=CUL-DAR205.3.156-157&viewtype=text).
—— 1859. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. London: John Murray.
—— 1887. *The Life and Letters of Charles Darwin, Including an Autobiographical Chapter*, 3 vols. London: John Murray.
—— 1909. *The Foundations of the Origin of Species. Two essays written in 1842 and 1844*. Cambridge: Cambridge University Press.
Davies, Roy. 2008. *The Darwin Conspiracy: Origins of a Scientific Crime*. London: Golden Square.
Dawson, J.W. 1860. "Darwin on the origin of Species by Means of Natural Selection." *Canadian Naturalist and Geologist* 5: 100–120.
Dickenson, John. 1992. "The Naturalist on the River Amazons and a Wider World: Reflections on the Centenary of Henry Walter Bates." *Geographical Journal* 158(2): 207–214.
Edwards, Fred L. 2009. *Alfred Russel Wallace: The Forgotten Evolutionist*. Ikonolux.
Edwards, William Henry. 1847. *A Voyage up the River Amazon, Including a Residence at Pará*. London: John Murray.
Ehrman, Bart D. 2011. *Forged: Writing in the Name of God – Why the Bible's Authors are Not Who We Think They are*. New York: HarperOne.
Fagan, Melinda B. 2008. "Theory and Practice in the Field: Wallace's Work in Natural History (1844–1858)." Charles H. Smith and George Beccaloni (eds.), *Natural Selection and Beyond: The Intellectual Legacy of Alfred Russel Wallace*. Oxford: Oxford University Press, pp. 66–90.
Fawcett, H. 1860. A Popular Exposition of Mr. Darwin on the Origin of Species. *Macmillan's Magazine* 3: 81–92.
Fichman, M. 1981. *Alfred Russel Wallace*. Boston: Twayne.

—— 2004. *An elusive Victorian: The Evolution of Alfred Russel Wallace*. Chicago: Chicago University Press.

Freeman, R.B. 1977. *The Works of Charles Darwin: An Annotated Bibliographical Handlist*, 2nd ed. Dawson: Folkestone.

George, Wilma. 1964. *Biologist Philosopher: A Study of the Life and Writings of Alfred Russel Wallace*. London: Abelard-Schuman.

Gray, Asa. 1859a. Diagnostic Characters of New Species of Phtenogamous Plants, Collected in Japan by Charles Wright, Botanist of the U.S. North Pacific Exploring Expedition… With Observations Upon the Relations of the Japanese Flora to that of North America, and of Other Parts of the Northern Temperate Zone. With an Appendix by N. J. Andersson. *Memoirs of the American Academy of Arts and Sciences* n.s. 6: 377–452.

—— 1859b. "Extract from the Concluding Part of a Memoir on the Botany of Japan, in Its Relations to that of North America, and of Other Parts of the Northern Temperate Zone." *American Journal of Science* 28: 187–200.

Hall. 1860. "[Review of] On the Origin of Species." *New York Times* 9 (2658): 3.

Hanson, Richard D. 1864. *Law in Nature, and Other Papers, Read Before the Adelaide Philosophical Society*. Adelaide: W.K. Thomas.

Humboldt, Alexander von. 1819–1829. *Personal Narrative of Travels to the Equinoctial Regions of the New Continent*. 7 vols. London: Longman, Hurst, Rees, Orme & Brown.

Huxley, T.H. 1860. The Origin of Species. *Westminster Review* 17(n.s.): 541–570.

—— 1862. "On Species, Races, and Their Origin." *Notices of the Proceedings at the Meetings of the Members of the Royal Institution* 3: 198.

Kjærgaard, Peter C. 2002. Conflict Between Science and Religion?: The Inadequacy of Simple History. H. Gregersen; K. van Kooten Niekerk, and K. Ochsner (eds.), *Science and Theology: Twin Sisters?* Århus: Afdeling for Kunsthistorie, Institut for Æstetiske Fag, Aarhus Universitet, pp. 25–55.

Knapp, Sandra. 1999. *Footsteps in the Forest: Alfred Russel Wallace in the Amazon*. London: Natural History Museum.

Kohn, David. 1980. "Theories to Work by: Rejected Theories, Reproduction, and Darwin's Path to Natural Selection." *Studies in History of Biology* 4: 67–170.

Lovejoy, Arthur. 1909. The Argument for Organic Evolution Before the "Origin of Species". *Popular Science Monthly* 75: 499–514.

Lyell, Charles. 1835. *Principles of Geology: Being an Inquiry How Far the Former Changes of the Earth's Surface are Referable to Causes Now in Operation*. London: John Murray.

Mallet, James. 2008. "Wallace and the Species Concept of the Early Darwinians." Charles H. Smith and George Beccaloni (eds.), *Natural Selection and Beyond: The Intellectual Legacy of Alfred Russel Wallace*. Oxford: Oxford University Press, pp. 102–113.

Marchant, James (ed.). 1916. *Alfred Russel Wallace Letters and Reminiscences*. London: Cassell.

Matthew, Patrick. 1860. Nature's Law of Selection. *Gardeners' Chronicle and Agricultural Gazette* (7 April): 312–313.

—— 1864. *Schleswig-Holstein*. London: Spottiswoode & Co.

Mayr, Ernst. 1982. *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*. Cambridge, MA and London: Belknap Press of Harvard University Press.

McKinney, H Lewis. 1972. *Alfred Russel Wallace and the Discovery of Natural Selection*. New Haven, Conn: Yale University Press.

—— 1976. Wallace, Alfred Russel. C.C. Gillispie (ed.), *Dictionary of Scientific Biography*, vol. 14. New York: Charles Scribner's Sons, pp. 133–140.

Meyer, A.B. 1870. *Charles Darwin und Alfred Russel Wallace. Ihre ersten Publicationen über die Entstehung der Arten, nebst einer Skizze ihres Lebens und einem Verzeichniss ihrer Schriften*. Erlangen: E. Besold.

Moon, H.P. 1976. *Henry Walter Bates FRS: 1825–1892: Explorer, Scientist and Darwinian*. Leicestershire: Leicestershire Museums.

Moore, J.R. 2008. "Wallace in Wonderland." Charles H. Smith and George Beccaloni (eds.), *Natural Selection and Beyond: The Intellectual Legacy of Alfred Russel Wallace*. Oxford: Oxford University Press, pp. 353–367.

Müller, Johannes. 1838–1842. *Elements of Physiology*, Translated from the German, with notes, by William Baly. London: Taylor and Walton.

Northrop, W.B. 1913. "Alfred Russel Wallace." *Outlook* (New York) 105: 618–622 (Available online: http://wallace-online.org/content/frameset?pageseq=1&itemID=S753&viewtype=text).

Raby, Peter. 2001. *Alfred Russel Wallace: A Life*. Princeton: Princeton University Press.

Rookmaaker, Kees, and van Wyhe, John. 2012. "In Alfred Russel Wallace's Shadow: His Forgotten Assistant, Charles Allen (1839–1892)." *Journal of the Malaysian Branch of the Royal Asiatic Society* 85(2): 17–54.

Ruse, Michael. 2009. *Monad to Man: The Concept of Progress in Evolutionary Biology*. Cambridge, MA and London: Harvard University Press.

Secord, James A. (ed.). 1994. *Robert Chambers, Vestiges of the Natural History of Creation and Other Evolutionary Writings*. Chicago: University of Chicago Press.

Seemann, Berthold Carl. 1863. "Review of H.W. Bates, The Naturalist on the River Amazons." *Athenaeum* 11: 488–489.

Shermer, Michael. 2002. *In Darwin's Shadow: The Life and Science of Alfred Russel Wallace*. Oxford: Oxford University Press.

Slotten, Ross A. 2004. *The Heretic in Darwin's Court: The Life of Alfred Russel Wallace*. New York: Columbia University Press.

Stauffer, R.C. (ed.). 1975. *Charles Darwin's Natural Selection; Being the Second Part of His Big Species Book Written from 1856 to 1858*. Cambridge: Cambridge University Press.

Toledo-Piza Ragazzo, Mônica de. 2002. *Peixes do Rio Negro – Fishes of the Rio Negro*. São Paulo: Editora da Universidade de São Paulo, Imprensa Oficial do Estado.

van Wyhe, John (ed.). 2002. *The Complete Work of Charles Darwin Online* (http://darwin-online.org.uk/).

—— 2012. *Wallace Online* (http://wallace-online.org/).

—— 2013a. *Dispelling the Darkness: Voyage in the Malay Archipelago and the Discovery of Evolution by Wallace and Darwin*. Singapore: World Scientific Publishing Co., Pte. Ltd.

—— 2013b. ""My Appointment Received the Sanction of the Admiralty": Why Charles Darwin Really was the Naturalist on HMS Beagle." *Studies in History and Philosophy of Science, Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 44(3): 316–326.

van Wyhe, John, and Rookmaaker, Kees. 2012. "A New Theory to Explain the Receipt of Wallace's Ternate Essay by Darwin in 1858." *Biological Journal of the Linnean Society* 105(1): 249–252.

—— 2013. *Alfred Russel Wallace: Letters from the Malay Archipelago*. Oxford: Oxford University Press.
Wallace, A.R. 1849. Journey to Explore the Province of Pará. *Annals and Magazine of Natural History* (ser. 2) 3(13): 74–75.
—— 1850. "Journey to explore the natural history of South America." *Annals and Magazine of Natural History* (ser. 2) 5(26): 156–157.
—— 1853. *Narrative of Travels on the Amazon and Rio Negro, with an Account of the Native Tribes, and Observations on the Climate, Geology, and Natural History of the Amazon Valley*. London: Reeve & Co.
—— 1854. "On the habits of the butterflies of the Amazon Valley." *Transactions of the Entomological Society of London* (n.s.) 2 (part VIII): 253–264.
—— 1889. *Darwinism: an exposition of the theory of natural selection with some of its applications*. London & New York: Macmillan & Co.
—— 1892. "H. W. Bates, the naturalist of the Amazons." *Nature* 45(1165): 398–399.
—— 1895. "The method of organic evolution, I." *Fortnightly Review* (n.s.) 57(338): 211–224.
—— 1898. *The wonderful century; its successes and its failures*. London: Swan Sonnenschein & Co. and New York: Dodd, Mead & Co. and Toronto: George N. Morang.
—— 1900. *Studies scientific and social*. London: Macmillan & Co., Ltd. and New York: The Macmillan Co.
—— 1903a. "[Letter to Cockerell]. In: Cockerell, T.D.A. 1903. The making of biologists." *Popular Science Monthly* 62(6): 517.
—— 1903b. *Man's Place in the Universe*. London: Chapman & Hall.
—— 1905. *My Life: A Record of Events and Opinions*. London: Chapman & Hall.
—— 1908. "The Present Position of Darwinism." *Contemporary Review* 94: 129–141.
—— 1909. "The Centenary of Darwin." *Clarion* 897: 5.
—— 1913. *The Revolt of Democracy*. London, New York, Toronto and Melbourne: Cassell & Co., Ltd.
Williams-Ellis, Amabel. 1966. *Darwin's Moon: A Biography of Alfred Russel Wallace*. London: Blackie.
Wilson, C.A. 1852. *Adelaide Morning Chronicle*, November 8, p. 3.
Wilson, John G. 2000. *The Forgotten Naturalist: In Search of Alfred Russel Wallace*. Tennyson, S.A.: Arcadia.
Wilson, L.G. 1972. *Charles Lyell: The Years to 1841*. New Haven and London: Yale University Press.
Woodcock, George. 1969. *Henry Walter Bates, Naturalist of the Amazons*. London: Faber and Faber.