Chapter 1

A History of Nominalist Interpretation

Ever since the publication of Darwin's *Origin*, biologists, historians, and philosophers have interpreted Darwin as being a species nominalist. Species nominalism is the view that species are not real, that they are not out there in nature, existing irrespective of observation, but rather that they are man-made, like monetary currency or constellations, so that, from an objective, naturalistic point of view, they are real in name only.

This "received view" is based mainly on a literal reading of a number of passages in the *Origin.* In this chapter I shall begin by examining those passages. Following that I shall go back and examine Darwin's species concept(s) in his early period as an evolutionist, the period of his transmutation notebooks. I shall then proceed briefly up through the strata of his writings, trying to find where his supposed species nominalism began. I shall then take a brief excursion through the secondary literature, beginning with reviews of Darwin's *Origin* and proceeding right up to today. It will be interesting to see how the perception of Darwin as a species nominalist has been employed by a number of authors. Finally, I shall then examine how Darwin himself replied to the charge of species nominalism, as well as examine some other evidence which, together with what we shall see in subsequent chapters, should lead one to conclude that Darwin was in fact a species realist. In the very least, the end of this chapter along with the next four should bring to a close the easy days of finding in Darwin an ally for species nominalism.

Beginning with the *Origin* (1859),[1] in the concluding chapter Darwin proclaims that as a result of his investigations "we shall have to treat species in the same manner as those naturalists treat genera, who admit that genera are merely artificial combinations made for convenience. This may not be a cheering prospect; but we shall at least be freed from the vain search for the undiscovered and undiscoverable essence of the term species" (485). This passage relates to both halves of a modern distinction that partly defines the modern species problem, namely, the distinction between species as a taxon and species as a category, a distinction not always recognized but made much of by, for example, Ernst Mayr (e.g., 1987, 146). Again, briefly, species taxa are particular species, each of which is given a binomial, such as *Tyrannosaurus rex* or *Homo sapiens*. The species category, on the other hand, is the class of all species taxa. Among realists, the species category is captured in their respective definitions of the species concept. Thus, what is a genuine species according to one definition might not be counted as a genuine species according to another definition. A species nominalist, of course, would say that species definitions are ultimately arbitrary, because species taxa are ultimately arbitrary.

In the passage from Darwin's *Origin* quoted above, he seems quite clearly in the first part to assert that species taxa are unreal. He says that we shall have to treat species in the same way as genera nominalists treat genera, as not real but man-made, made simply for the sake of convenience.[2] In the second part of the passage, by referring to the "term species," Darwin seems clearly to be referring to the species category. There are other passages in the *Origin* that seem to second this view. For example, he says "From these remarks it will be seen that I look at the term species, as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other" (52). This passage is often quoted as supporting the interpretation of Darwin as a species nominalist, but it has to be remarked that the context of the passage makes it clear that Darwin is drawing his conclusion not from nature or from his own theory of evolution but from the taxonomic behavior of other naturalists. For in the previous paragraph he states that "If a variety were to flourish so as to exceed in numbers the parent species, it would then rank as the species, and the species as the variety" (52). This was not Darwin's view. Instead it was a practice common to his fellow naturalists.

Indeed, part of Darwin's overall argument for evolution was that in many cases expert naturalists could not themselves agree on whether a particular form was a variety or a species. For example, in the *Origin* he says "wherever many closely-allied species occur, there will be found many forms

which some naturalists rank as distinct species, and some as varieties; these doubtful forms showing us the steps in the process of modification" (404; cf. 47, 49, 111, 248, 296–297). It was essential for Darwin that there be no clear distinction between species and varieties, otherwise varieties could not be what he called "incipient species" (52, 111, 114, 128), and the fact that expert naturalists could not agree in many cases on what is a species and what is a variety added a further prong in his attack on the fixity of species (in addition to his arguments from the fossil record, from biogeography, from embryology, from artificial breeding, etc.). And so again and again in the *Origin* we see Darwin assert that there is no essential or fundamental distinction between species and varieties. For example, he says "neither sterility nor fertility affords any clear distinction between species and varieties; but that the evidence from this source graduates away, and is doubtful in the same degree as is the evidence derived from other constitutional and structural differences" (248; cf. 51–52, 268, 272, 484–485).

A further part of Darwin's argument was that not only did naturalists in many cases disagree on what is a species and what is a variety, but they themselves could not agree on a definition of the species category. Even though, as Darwin early in the *Origin* recognized, "most naturalists" viewed species as "independently created" (6)—one might call this the common denominator[3]—they nevertheless gave "various definitions . . . of the term species" (44), definitions that concerned mainly the diagnostic criteria. This created a problem in itself, for as Darwin later in the *Origin* pointed out, "to discuss whether they ['many forms'] are rightly called species or varieties, before any definition of these terms has been generally accepted, is vainly to beat the air" (49).

And yet Darwin clearly recognized in the *Origin* the need for species talk. Consequently, on the issue of whether a particular form should be ranked as a species or a variety, he took the position that "the opinion of naturalists having sound judgment and wide experience seems the only guide to follow," and where they disagree the problem is to be settled simply by appealing to "a majority of naturalists" (47). This, of course, has an arbitrary ring to it. And indeed Darwin in the *Origin*, as we have seen earlier in this chapter, in apparent reference to his contemporaries, stated that he looks "at the term species, as one arbitrarily given for the sake of convenience" (52). Furthermore, again as we have seen earlier, in his concluding chapter Darwin took his own position that there is in fact no essential and fundamental distinction between species and varieties as a liberating one, since systematists "will not be incessantly haunted by the shadowy doubt whether this or that form be in essence a species" (484) and "shall at last be

freed from the vain search for the undiscovered and undiscoverable essence of the term species" (485).

Small wonder, then, given all of the above, that scholars have commonly interpreted Darwin as a species nominalist, as we shall see later in this chapter. And yet how utterly odd, if those scholars are right, that Darwin would title his book *On the Origin of Species*, let alone with the addition *by Means of Natural Selection*! That the received view is wrong, that it is based on a superficial reading of Darwin, is something I shall argue later. For now, we need to ask when such apparently nominalist talk on Darwin's part began.

Certainly it did not start when Darwin began developing his evolutionary views. In his transmutation notebooks (Barrett *et al.* 1987) Darwin provides a number of definitions of "species," all realist in tone. Sometimes his definition is in terms of constant characters, as in Notebook B, begun in July 1837: "Definition of Species: one that remains at large with constant characters, together with other beings of very near structure" (213).

In other definitions Darwin focused on interbreeding, as in Notebook C, begun in March 1838 and finished in July of the same year: "A species is only fixed thing with reference to other living being—one species May have passed through a thousand changes, keeping distinct from other & if a first & last individual were put together, they would not according to all analogy breed together" (152). Darwin at some time later added an annotation to this page, writing "As species is real thing with regard to contemporaries—fertility must settle it." This page, both the original passage and the annotation, is interesting for its relation to the modern biological species concept made famous by Dobzhansky (1937) and especially Mayr (1942, 1970), which is based on interbreeding populations and genetic reproductive isolation mechanisms. What makes it interesting is not the emphasis on the fertility test. This was common in Darwin's time and before, having been made famous by Buffon (Lovejoy 1959). Instead, what is interesting about Darwin's passage is that as a species evolves radically over time, so that *vertically* in the Tree of Life it would in principle be incapable of interbreeding with its originals if they could be brought together, Darwin still insists on the reality of species at any given *horizontal* dimension, at any given cross-section in time. Like the modern biological species concept, Darwin, the evolutionist, provided a horizontal species concept and fixed the reality of species in the horizontal dimension, unlike a number of modern species concepts that insist on the vertical reality of species. What we shall see in Chapter 3 is that Darwin maintained this view in the *Origin* and that his main analogy for species (namely, languages) provides a powerful

reason for believing that we today should also conceive of the reality of species primarily as horizontal rather than as vertical entities.

Interestingly, a little later in Notebook C Darwin seems to slightly change his mind, insisting now that "My definition of species. has nothing to do with hybridity,, is simply, an instinctive impulse to keep separate, which no doubt be overcome, but until it is the animals are distinct species" (161). However, earlier in Notebook B he had already used this criterion, when with regard to speciation he wrote that "repugnance to intermarriage—settles it" (24).

Indeed there can be little doubt that in his transmutation notebooks Darwin waffled between fertility/sterility and instinct. For example, in Notebook E, in an entry dated between October 16 and 19 of 1838, he states that "If they give up infertility in largest sense, as test of species.—they must deny species which is absurd.—their only escape is that rule applies to *wild* animals only. from which plain inference might be drawn that whole infertility was consequent on mind or instinct, now this is directly incorrect" (25). Similarly in his abstract of John Macculloch's *Proofs and Illustrations of the Attributes of God* (also in Barrett *et al.* 1987), which Darwin probably wrote in late 1838, he wrote "With respect to whether Galapagos beings are species, . . . it his highly unphilosophical to assert, that they are not species, until their breeding together has been tried" (167).

Except for his evolutionary perspective with his emphasis on the horizontal reality of species, Darwin in the above was doing nothing new. Indeed, years earlier James Prichard (1813, 3–15) provided a fairly detailed summary of the various criteria by which naturalists characterized species, which included not only constant character differences and the sterility test but also instinctual repugnance, immunological differences, and parasitological differences. It is not known whether Darwin had, by the time of the transmutation notebooks, read Prichard or a later edition, but it would not seem to matter, since he could have gotten the same ideas from other sources.

Turning now to Darwin's *Sketch of 1842* and his *Essay of 1844* (Darwin 1909), although they contain many ideas that are to be found later elaborated in the *Origin*, such as the idea that sterility is not an unfailing test, or that there are many forms about which expert naturalists cannot agree on whether they are species or varieties, there is not, unlike the *Origin*, any clear hint of species nominalism. Beginning with the *Sketch*, we find, actually, just like the transmutation notebooks, statements to the contrary. For example, Darwin says "Looking now to the affinities of organisms, without relation to their distribution, and taking all fossil and recent, we see the degrees of relationship are of different degrees and arbitrary—

sub-genera—genera—sub-families, families, orders and classes and kingdoms" (35). Granted, Darwin is referring to his contemporaries, for he follows this passage with the sentence "The kind of classification which everyone feels is most correct is called the natural system, but no one can define this." Nevertheless, what is interesting is that with other higher taxa nominalists of his time (and most were higher taxa nominalists), Darwin does not include species in his list of arbitrary categories. Moreover, a little later in the *Sketch* he writes of "undoubted species" (48) and of "real species" (49). There is, however, immediately following, a passage that hints of species nominalism. In reference to "real species," which are distinct by every criterion, but admitting common descent, he writes "Can genera restrain us; many of the same arguments, which made us give up species, inexorably demand genera and families and orders to fall, and classes tottering. We ought to stop only when clear unity of type, independent of use and adaptation, ceases" (49). But here there is no reason to suppose that by the phrase "giving up species" Darwin means giving up the reality of species. A much more natural reading, given the basic presupposition of the majority of his antagonists, is "giving up the independent creation of species," or "giving up the fixity of species," which amounts to the same thing. Indeed we shall see in this and in later chapters that the phrase "giving up species" was a common one with Darwin, even though, again as we shall see in this and in later chapters, he did not give up their reality.

Turning now to the much longer *Essay*, beginning with the second chapter where he first uses the word "breed," Darwin added a note in the manuscript, writing "Here discuss *what a species is*" (81). However, unlike the *Origin*, Darwin did not follow through. Instead, much like the *Sketch*, even though he raises numerous problems for the independent creation of species and their fixity, and argues for evolution, he still continues to write of species as real. In fact, much like the *Sketch*, even though he denounces the categories of his contemporaries above the species level as "quite arbitrary" (202, 204–205), he continues to write of "true species" (204, 212, 241, 243, 246). And so unlike the *Origin,* with its many implied references to species as arbitrary, and with its concluding chapter which states that we shall have to treat species taxa as artificial and made for convenience, there is absolutely none of this in the *Essay*, neither in its nine argumentative chapters nor in its tenth concluding chapter.

Turning next to Darwin's correspondence, we do not find any clear signs of species nominalism until well into the 1850s. In fact, until that time, the impression we get from Darwin's correspondents is that most experienced naturalists believed in the reality of species, and Darwin, in turn,

does not indicate that his view was otherwise. For example, in a letter from his closest friend and main correspondent, the botanist Joseph Dalton Hooker (September 4–9, 1845), Hooker wrote that "Those who have had most species pass under their hands as Bentham, Brown, Linneaus, Decaisne & Miquel, all I believe argue for the validity of *species* in nature" (Burkhardt and Smith 1987, 250). In his reply letter (September 10, 1845), Darwin recognized that "Lamarck is the only exception, that I can think of, of an accurate describer of species at least in the invertebrate kingdom, who has disbelieved in permanent species" (253). (As we shall see later in this chapter, Lamarck did more, and disbelieved in the reality of species.) Instead, the main effect that Hooker's letter had on Darwin was to doubt his own competence to theorize about species. Remarkably, Darwin wrote "How painfully (to me) true is your remark that no one has hardly a right to examine the question of species who has not minutely described many" (253). Darwin was especially taken by Hooker's extended criticism of the French writer Frédéric Gérard, who argued for species nominalism caused by his poor understanding of messy situations in nature and his lack of experience. (Indeed in an earlier letter to Darwin, written in late February 1845, Hooker states Gérard's species nominalism explicitly, and offers to send Darwin a copy of Gérard's tract; Burkhardt and Smith 1987, 149.) And even though Hooker would reply that he by no means meant to imply that Darwin was not in a position to theorize about species, Darwin did not attempt to procure species nominalism from his evolutionary theories. Instead, toward the end of 1846 he embarked on an eight-year taxonomic study of barnacles, which he completed in September of 1854.

Much of what is interesting about Darwin's work on barnacles is that he was struck by the variability of organisms. What we shall see in chapter 3, when we focus on his published works on barnacles, is that even though he stressed that variability, he did not talk of species as if they were arbitrary. Instead he argued that most species of barnacles, even when minutely studied, turn out to be taxonomically good species. Equally revealing is what Darwin wrote in his correspondence. However problematic was the variability of barnacles taxonomically, Darwin still did not espouse species nominalism. The following reply letter to Hooker (June 13, 1850) perfectly captures Darwin's thinking throughout this period:

> You ask what effect studying species has had on my variation theories; I do not think much; I have felt some difficulties more; on the other hand I have been struck (& probably unfairly from the class) with the variability of every part in some slight degree of every species: when the same

> organ is *rigorously* compared in many individuals I always find some slight variability, & consequently that the diagnosis of species from minute differences is always dangerous. I had thought the same parts, of the same species more resembled than they do anyhow in Cirripedia, objects cast in the same mould. Systematic work w^{d} be easy were it not for this confounded variation, which, however, is pleasant to me as a speculatist though odious to me as a systematist. [Burkhardt and Smith 1988, 344]

Other letters confirm this view. For example, earlier in the same year, in a letter to J.J. Steenstrup (January 25, 1850), Darwin wrote "I much dislike giving specific names to *each* separate valve, & thereby almost certainly making three or four *nominal* species for each true species" (Burkhardt and Smith 1988, 306).

Granted, toward the end of his work on barnacles, Darwin had become quite tired of detailed species work, so much so that he started to sound like he might be swaying to species nominalism. In an often-quoted letter to Hooker (September 25, 1853), Darwin wrote

> In my own cirripedial work (by the way, thank you for the dose of soft solder [i.e., flattery—*OED*], it does one, (or at least me) a great deal of good,—in my own work, I have not felt conscious that disbelieving in the *permanence* of species has made much difference one way or the other; in some few cases (if publishing avowedly on doctrine of non-permanence) I sh^{d}. *not* have affixed names, & in some few cases sh^{d}. have affixed names to remarkable varieties. Certainly I have felt it humiliating, discussing & doubting & examining over & over again, when in my own mind, the only doubt has been, whether the form varied *today or yesterday* (to put a fine point on it, as Snagsby would say). After describing a set of forms, as distinct species, tearing up my M.S., & making them one species; tearing that up and making them separate, & then making them one again (which has happened to me) I have gnashed my teeth, cursed species, & asked what sin I had committed to be so punished: But I must confess, that perhaps nearly the same thing w^{d}. have happened to me on any scheme of work. [Burkhardt and Smith 1989, 155–156]

What is typically overlooked, however, is what Darwin says to Hooker at the very end of his letter: "whether you make the species hold up their heads or hang them down, as long as you don't quite annihilate them or make them quite permanent; it will all be nuts to me [i.e., a source of pleasure or delight—*OED*]." Darwin was not yet talking the language of species nominalism.

The fact is, we don't first start to find species nominalism talk in Darwin until we turn to his long though unfinished book on species evolution,

titled *Natural Selection*, which was begun in mid-1856 and stopped on June 18, 1858, when Darwin received the letter from Alfred Russel Wallace basically anticipating Darwin's views (which was of course to spark the writing of his *Abstract*, later to be titled *On the Origin of Species*). As Stauffer (1975, 7–9) points out, Darwin waited roughly 20 years to publish his evolutionary views because he wanted to present a strong *scientific* case for evolution (more particularly, evolution by natural selection and divergence) and thus avoid the scientific ridicule heaped upon earlier writers on evolution, in particular, Lamarck and Chambers. Before we turn to *Natural Selection*, though, we have to wonder why Darwin would wait so long to start sounding like a species nominalist.

One theory that might suggest itself follows from the important work of Dov Ospovat (though I know of no one who has used Ospovat to develop it). According to Ospovat (1981), from the time Darwin hit upon natural selection in his transmutation notebooks, through the *Sketch* and *Essay*, and until he had finished his barnacle work, Darwin shared with his contemporaries the belief (which was theologically based) in harmony and perfect adaptation in nature, with variation being minor, so that in his view natural selection worked only intermittently, in those periods when changes in conditions meant that a species was no longer perfectly adapted to its environment. Between September 1854, however, and June 1858, when he received the shocking letter from Wallace, Darwin's view on variation and adaptation gradually though radically changed, from perfect adaptation with intermittent natural selection to imperfect adaptation with continuous natural selection. One might think that this new view would have occurred to him early on in his barnacle work. But Ospovat (ch. 7) argues that it was not until after Darwin finished his barnacle work that he sat down to seriously rethink his theory of evolution. The main problem was to explain the treelike, group nested in group, hierarchical classification schemes of his fellow naturalists. Darwin's solution was his principle of divergence, which he developed in the period from 1854 to 1858 and which, in a letter to Hooker (June 8, 1858), he called (along with natural selection) "the key-stone of my Book" (Burkhardt and Smith 1991, 102). According to this principle, wide-ranging species will typically be exposed within their range to a variety of conditions, most importantly to empty niches (to use modern terminology) which they will tend to fill, and hence evolve in a branchlike fashion.

Based on Ospovat's work, then, one might conjecture that prior to 1854—prior to when Darwin started rethinking his theory and still believed in perfect adaptation with only intermittent natural selection—Darwin would naturally think that species are real so long as natural selection is not

working upon them (possibly there was an influence from Lamarck here; cf. note 6), so that once his view changed to imperfect adaptation with continuous natural selection he consequently became a species nominalist.

This is an interesting conjecture. Unfortunately it fails for the fact, as we shall see in this and in later chapters, that under his skin Darwin was not really a species nominalist, not in his post-barnacle period nor in the *Origin* or beyond.

There is something else, however, which went on in the period between 1854 and 1858, which does help to fully explain Darwin's species nominalism talk, begun in *Natural Selection*. The evidence is in his correspondence. As pointed out earlier, Darwin began his big species book, what was to be his heavily detailed case for evolution to the world, in mid-1856, and the problem was to avoid the scientific ridicule heaped upon the mainly speculative attempts of earlier writers, in particular Lamarck and Chambers. The problem, in short, was to convince expert naturalists more than anyone else. What Darwin got from botanist correspondents such as Hooker, but mainly from Hewett Cottrell Watson, was that the very concept of species itself was a major impediment to convincing the scientific world that species are not fixed but evolve.

Interesting in this regard is a letter from Hooker (July 8, 1855), in which Hooker comments on a Himalayan thistle intermediate between two common species of English thistles. Hooker writes "The more I study the more vague my conception of a species grows, & I have given up caring whether they are all pups of one generic type or not" (Burkhardt and Smith 1989, 372). Hooker goes on to say that not caring anymore whether this or that is a real species forms no impediment to tracing character distribution and discovering the laws of distribution, which he thinks "is certainly all we can expect to prove in our day" (372). Here Darwin may have begun to realize that the species concept, when trying to get his evolutionary views across, presented more of an impediment than anything else, and so was best bypassed. And yet, interestingly, when we turn to chapter 8, we shall see that in his correspondence, when Darwin is trying to convince an important naturalist of his views on evolution, he uses the language of species nominalism, but only until he is convinced that he had a convert, after which time he reverted to the language of species realism. (Indeed, as I argue later in this chapter and in chapters 2 through 6, Darwin had an implicit but fairly clear species concept that was both realist and evolutionary.)

If Hooker's letter did not make Darwin think of the value of not getting bogged down on the topic of what a species really is when presenting his scientific case to the world for evolution, one of the letters from Watson almost

certainly did. Watson, who was converted to evolution (Watson 1845a) shortly after reading Chambers' *Vestiges*, anonymously published in 1844, wrote to Darwin (August 13, 1855) that "The grand difficulty for naturalists or botanists of our turn of thought, is, that the use of the word '*species*' by technical describers is indefinite & variable. . . . Practically, it means only an idea of the mind, with no more real restriction in its application to objects, than have the words '*genus*' or *'order*.'" Watson then cites Hooker and the French botanist Alexis Jordan as examples of lumpers and splitters respectively (the former grouping varieties into species, the latter making a species out of the smallest variety). Watson goes on to say "In all my attempts to advance geographical botany, I am stopt by the application & signification of the word 'Species.' Where I seek to effect precise comparisons of objects & numbers & proportions,—that word constantly frustrates & makes vague & indefinite" (Burkhardt and Smith 1989, 406).

Indeed, turning now to *Natural Selection*, we can see the influence of Watson, on both the "grand difficulty" presented by the variability of species concepts in Darwin's contemporaries, as well as the implicit suggestion that it is better to bypass the concept altogether.[4] First, in a choice of words echoed shortly after in the *Origin*, he says "In the following pages I mean by species, those collections of individuals, which have commonly been so designated by naturalists" (Stauffer 1975, 98).

What is equally interesting is what Darwin wrote immediately before this:

> . . . how various are the ideas, that enter into the minds of naturalists when speaking of species. With some, resemblance is the reigning idea & descent goes for little; with others descent is the infallible criterion; with others resemblance goes for almost nothing, & Creation is everything; with others sterility in crossed forms is an unfailing test, whilst with others it is regarded of no value. At the end of this chapter, it will be seen that according to the views, which we have to discuss in this volume, it is no wonder that there should be difficulty in defining the difference between a species & a variety;—there being no essential, only an arbitrary difference. [Stauffer 1975, 98]

This passage compares, interestingly, with a letter Darwin wrote to Hooker (December 24, 1856) at roughly the same time:

> I have just been comparing definitions of species, & stating briefly how systematic naturalists work out their subject: . . . It is really laughable to see what different ideas are prominent in various naturalists minds, when they speak of "species" in some resemblance is everything & descent of

> little weight—in some resemblance seems to go for nothing & Creation the reigning idea—in some descent the key—in some sterility an unfailing test, with others not worth a farthing. It all comes, I believe, from trying to define the undefinable. [Burkhardt and Smith 1990, 309]

In later chapters, after examining what I believe to be Darwin's objective set of criteria for delimiting species taxa, only then will the disingenuous nature of these passages become apparent, especially when put in their context, and only then will it make sense to develop in detail a strategy theory to explain them (chapter 8).

For the present, it will be useful to examine how reviewers of the *Origin* responded to the apparent species nominalism of that book. The first point to notice, using late 1859 and 1860 as typical, is that many if not most of the reviewers simply bypassed the issue of Darwin's apparent species nominalism. They didn't so much as even mention it. Instead they focused on Darwin's argument for evolution, in the main rejecting it (e.g., Anon. 1859; Crawfurd 1859; Leifchild 1859; Murray 1859; Anon. 1860a; Anon. 1860b; Bowen 1860; Haughton 1860; Sedgwick 1860; Simpson 1860; Wilberforce 1860).

Even among Darwin's supporters, his apparent species nominalism was typically ignored (e.g., Chambers 1859; Hooker 1859; Huxley 1859b, 1859c, 1860a, 1860b; Carpenter 1860; Gray 1860b).

Returning to his critics, there were some, however, who did indeed take Darwin's apparent species nominalism to be in fact his position. For example, Louis Agassiz (1860b) raised what seemed to him a perfectly logical point: "If species do not exist at all, as the supporters of the transmutation theory maintain, how can they vary? and if individuals alone exist, how can the differences which may be observed among them prove the variability of species?" (143). Richard Owen (1860) claimed that "on the hypothesis of 'natural selection' . . . . the species, like every other group, is a mere creature of the brain; it is no longer from nature" (532), which he rejects on what he calls "present evidence from form, structure, and procreative phenomena." Instead he agrees with the Linnean axiom that species are the work of nature, which he quotes as "*Classis et Ordo* est sapientiæ, *Species* naturæ opus" (532). Thomas Vernon Wollaston (1860) referred explicitly to a page of the *Origin* where we find apparent species nominalism and wrote that "it is no sign of metaphysical clearness when our author (p. 51) refuses to acknowledge any kind of difference between 'genera,' 'species,' and 'varieties,' except one of *degree*" (133), which was, he continued, "to throw doubt on a distinction between essentially different *ideas*"

(134). Others, without claiming or implying that their interpretation of Darwin's species nominalism came explicitly from Darwin himself in the *Origin*, claimed that species nominalism followed from his theory of evolution. John Dawson (1860), for example, claimed that Darwin's book "seeks . . . to reduce all species to mere varieties of ancient and perhaps perished prototypes" (101) and that with his doctrine we "break down the distinction between species and varieties as to deprive our classifications of any real value" (119). Similarly, William Hopkins (1860) wrote that "all theories—like those of Lamarck and Mr. Darwin—which assert the derivation of all classes of animals from one origin, do, in fact, deny the existence of natural species at all," where by "natural species" he means "the grouping is formed by nature," whereas with "artificial species" the grouping is "arbitrary" (747).

Among Darwin's supporters, so too did some recognize his species nominalism, although often they did not actually quote Darwin as such but inferred it from his views. Asa Gray (1860a), for example, argued that it follows from Darwin's theory that whether the human races constitute one species or more is to be settled "according to the notions of each naturalist as to what differences are specific" (158). Interestingly, against Agassiz, who in his species concept "discards the idea of a common descent as the real bond of union among the individuals of a species, and also the idea of a local origin,—supposing, instead, that each species originated simultaneously, generally speaking over the whole geographical area it now occupies or has occupied" (155), Gray claims that his (Agassiz's) theory equally makes species "subjective and ideal" (158)! This is an interesting use of Darwin's species nominalism. Henry Fawcett (1860) too, although he did not quote anything from the *Origin* as espousing species nominalism, implied that it also followed from Darwin's view. Repeating (though magnifying) the radical disagreement between Babington and Bentham on the number of species of English plants (cf. *Origin*, 48), Fawcett writes "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?" (82). Similarly George Henry Lewes (1860), likewise feeding off the disagreement between naturalists over whether a particular form is a species or a variety (which of course Darwin himself made much of in the *Origin*), writes that "The reason of this uncertainty is that the *thing* Species does not exist: the term expresses an *abstraction*, like Virtue or Whiteness; not a definite concrete reality, which can be separated from other things, and always be found the same" (443).[5]

What we have to keep in mind in all of this is that in Darwin's time, so unlike today, the equation of evolution with species nominalism was deeply entrenched. And arguably it was Lamarck who began this equation. In the first chapter of his book on evolution (Lamarck 1809), he states that all divisions of nature into classes, orders, families, genera, and species are "artificial devices" (20), that "they appear to derive from certain apparently isolated portions of the natural series with which we are acquainted," and that nature has produced "only individuals who succeed one another and resemble those from which they sprung." The relation of individual organisms to the natural series, he immediately goes on to say, is that "these individuals belong to infinitely diversified races; which blend together every variety of form and degree of organisation; and this is maintained by each without variation, so long as no cause of change acts upon them" (21).[6]

Consequently we find Charles Lyell (1832), as he begins his long critique of Lamarck's evolutionism, state the issue as "whether species have a real and permanent existence in nature; or whether they are capable . . . of being indefinitely modified in the course of a long series of gradations?" (1; cf. 23), which, following his critique, he concludes that "it appears that species have a real existence in nature, and that each was endowed, at the time of its creation, with the attributes and organization by which it is now distinguished" (65). This dichotomy—either species are permanent and therefore real or impermanent and therefore unreal—is repeated again and again in the literature of Darwin's time. For example, William Whewell (1837 III) wrote that "in short, *species have a real existence in nature*, and a transmutation from one to another does not exist" (576). A further example is Watson (1845b), who after arguing empirically about the mutability of primroses and cowslips, wrote that "If we allow the cowslip and primrose to be two species, and yet allow that one can pass into the other, either directly or through the intermediate oxlip, we abandon the definition of species, as usually given, and fall into the transition-of-species theory. . . . Let a few other cases be adduced, between reputed species equally similar, and we shall be forced to recast our ideas and definition of the term 'species.' It would unavoidably become arbitrary and conventional; with no more exactness or constancy of application, than we can give to the terms 'genus' or 'order'" (219). As one final example, Wollaston (1860) claimed that either species are permanent and real (the traditional species concept) or else we are left with "the otherwise hopeless task of understanding what a species really is" (133), which may be taken as an epistemological assertion only, but possibly also as an ontological one.

So it was easy and natural for reviewers to read species nominalism in Darwin's *Origin* and to see no need to scratch beneath the surface. In later commentators on Darwin's *Origin*, however, living in a different scientific milieu, what we often find is that those who interpret Darwin as a species nominalist do so to use Darwin as an imprimatur for their own nominalist arguments. We shall also find, of course, that they just plain overlooked the evidence for Darwin's species realism.

A good example to begin with is E.B. Poulton (1903), a naturalist and selectionist whom Mayr (1982, 272) took to be a "pioneer" of the biological species concept. In reply to Max Müller, who claimed that in spite of the title of the *Origin* Darwin never gave us a species concept, Poulton (78) replies that Darwin did and that it is given at the end of the *Origin* where he says "Systematists will have only to decide (not that this will be easy) whether any form be sufficiently constant and distinct from other forms, to be capable of definition; and if definable, whether the differences be sufficiently important to deserve a specific name" (484). Throughout his paper Poulton gives the impression that Darwin was a precursor of the syngamic species concept which he himself prefers, "syngamic" meaning "free interbreeding under natural conditions" (90), an "inter-breeding community" (94). But Poulton does nothing to elaborate on Darwin's species concept, for example, whether it includes sterility between forms or even whether indeed Darwin himself thought that species are fully syngamic. Instead, he repeatedly emphasizes the "subjective character" (89), the "subjective element" (92), the "subjective criterion" (93) in Darwin's species concept. This, however, is not to attribute to Darwin species realism. Indeed naturalists at this time tended to read Darwin as a species nominalist (e.g., Arthur 1908, 244, who quotes Darwin approvingly; Cowles 1908, 267), in conformity with the species nominalism of the time (e.g., Morgan 1903, 33; Bessey 1908, 218; Coulter 1908, 272).

On the other side of the coin, keeping to the pre-Modern Synthesis era, we have the geneticists, who were principally saltationists and tended to be species nominalists (Mayr 1957a, 4–5, 1982, 540–550). I have found it impossible, however, to find any of them quote Darwin as a species nominalist, which makes sense since they were anti-selectionists and so therefore would be unlikely to appeal to Darwin as an authority on the matter.

Turning now to the post-Synthesis period, it is remarkable to find biologists, philosophers, and historians repeatedly ascribe to Darwin species nominalism. A good example to begin with is the geneticist J.B.S. Haldane, together with Fisher and Wright one of the three main founders of

the Modern Synthesis. In his contribution to a symposium on the species concept in paleontology, Haldane (1956) states at the outset that "I share the views of Darwin" (95), which he goes on to elaborate as being that "A species . . . is a name given to a group of organisms for convenience, and indeed of necessity" (95), and moreover that "the concept of a species is a concession to our linguistic habits and neurological mechanisms" (96). Seeing species in both space and time, he adds that "in a complete paleontology all taxonomic distinctions would be as arbitrary as the division of a road by milestones" (96). As we shall see in subsequent chapters, however, this view fails to recognize that Darwin thought of species as primarily horizontal entities and as being delimited in the main by natural selection, which is a far cry from the subjectivity that Haldane ascribes to Darwin's view.

In many ways a more important example is the ornithologist Ernst Mayr (1957a), according to whom "In Darwin, as the idea of evolution became firmly fixed in his mind, so grew his conviction that this should make it impossible to delimit species. He finally regarded species as something purely arbitrary and subjective" (4; cf. Grant 1957, 58–59, for the same view expressed in the same volume, and also Mayr 1970, 13, 1976, 259, 1991, 30). What is interesting about Mayr is not that he was using Darwin as the imprimatur for his own view (Mayr was, after all, a hardcore species realist), but that he would later blame Darwin's species nominalism on Darwin's association with botanists. In explanation of Darwin's mature view of species as "purely arbitrary designations" (269), as opposed to Darwin's earlier view in the 1830s which "was very close to the modern biological species concept" (266), Mayr wrote that "His reading as well as his correspondence indicate that after 1840, and particularly from the 1850s on, Darwin was increasingly influenced by the botanical literature" (267), and he goes on to quote William Herbert (a leading English authority on plant hybridization), for whom he says "the genus was the only 'natural' category" and of whom he says "Perhaps no other botanist influenced Darwin's thinking more" (268).

There are at least two problems with this view, however. The first one concerns Herbert in particular. Darwin had indeed read Herbert (his *Amaryllidaceæ* is frequently cited in Darwin's Notebook E), had exchanged a number of letters with him in mid-1839, and had even visited him once in September 1845 (Herbert died in 1847). Equally important, in the *Origin* Darwin favorably refers to Herbert on the topic of the struggle for existence among plants (62), and even more favorably on the topic of perfect fertility in interspecific hybrids in the genera *Crinum* and *Hippeastrum*

(249–251). For Herbert, hybrids are sometimes very fertile, so that the distinction between species and varieties has "no real or natural line of difference" (Burkhardt and Smith 1986, xvii–xviii, 182 n. 1). His species nominalism, however, if indeed it was such, followed apparently from taking sterility as the defining criterion of species. It was like Lyell, who thought that if evolution is true then species must be unreal. But as we shall see, in spite of Darwin's acceptance of evolution and of the non-universality of the sterility of hybrids, he nevertheless thought that species were real (a view shared, of course, with most biologists today). Moreover, in his correspondence Darwin does not seem particularly impressed by Herbert's expertise. For example, in a letter to Hooker (October 28, 1845) written shortly after visiting Herbert, Darwin remarks that Herbert "knows surprisingly little what others have done on same subjects" (Burkhardt and Smith 1987, 261).

But even more importantly against Mayr, Darwin repeatedly tells us that most of his contemporary naturalists were species realists. For example, near the beginning of the *Origin* Darwin tells us that "the view which most naturalists entertain" is that "each species has been independently created" (6). Later in the *Origin* he gives specific names in the fields of paleontology and geology, stating that "all the most eminent paleontologists" and "all of our greatest geologists . . . have unanimously, often vehemently, maintained the immutability of species" (310). But we should not take this to mean that Darwin did not think the same was true of botanists. As we have seen earlier in this chapter, Bentham, Hooker, Gray, and even Watson (each of them eminent botanists, with the latter three being Darwin's main botanist correspondents) were species realists. Moreover, that the vast majority of eminent botanists were species realists had been driven home to Darwin a number of times. For example, Watson (1843) states that there is a consensus among British botanists that although "genera are allowed to be purely conventional groups, . . . species are commonly believed to have a distinct and permanent existence in nature" (613). Moreover there is Hooker's letter to Darwin (September 4–9, 1845) which we have seen earlier, in which he wrote "Those who have had most species pass under their hands as Bentham, Brown, Linnaeus, Decaisne & Miquel, all I believe argue for the validity of *species* in nature" (Burkhardt and Smith 1987, 250). Each member of this list was a first-rate botanist. In sum, all of this adds credence to Darwin's remark in his autobiography (1876a), when looking back at his pre-*Origin* days, that "I occasionally sounded not a few naturalists, and never happened to come across a single one who seemed to doubt about the permanence of species. Even Lyell and Hooker, . . ." (124).

Given the above evidence, it is quite possible that Mayr, then, in blaming the influence of Darwin's botanist correspondents, was actually projecting onto history his own problems with botanists, for many modern botanists have argued that the biological species concept (endorsed more strongly by Mayr than by anyone else) applies poorly to the world of plants, a claim that Mayr was long eager to discount and that he attempted to refute by studying a local flora (Mayr 1992). In chapter 6, I shall examine the views of some of these modern botanist critics of a reproductive criterion for species.

What is interesting for our purposes here is that one of them, Donald Levin (1979), in arguing that the biological species concept does not apply well to plants, argues consequently for species nominalism—"plant species are utilitarian mental constructs" (381)—and quotes Darwin in support. As he puts it, "Darwin concurs with Locke" (382; cf. Cowan 1962, 434–435, for the same equation). John Locke, of course, is famous for arguing in his *Essay Concerning Human Understanding*, first published in 1689, that our species designations are not made by nature but by ourselves, that species words simply refer to our abstract ideas produced by abstracting what is common from a number of individuals. Thus, for Locke, "this is a Man, that a Drill [baboon]: And in this, I think, consists the whole business of *Genus* and *Species*" (cf. Stamos 2003, 40–47). In an earlier work (Stamos 1996, 128–129), in reply to Antony Flew who believed that Darwin never read Locke, I not only cited a source to the contrary, but quoted an interesting passage from Darwin's Notebook M (84), in which he wrote, "Origin of man now proved.—Metaphysic must flourish.—He who understands baboon would do more towards metaphysics than Locke" (Barrett *et al.* 1987, 285). Although Notebook M was devoted to the metaphysics of mind, it is quite possible that in this passage Darwin was referring to Locke's species nominalism as well as to his own rejection of that view. What we have to keep in mind is that Darwin in his transmutation notebooks, as we have seen, was a species realist. What we shall see in subsequent chapters is that he never, not even in his mature period, concurred with Locke.

In the above we have looked at three biologists who read Darwin as a species nominalist. There are, of course, many more (e.g., Gould 1980, 205–206; Wiley 1981, 41; Howard 1982, 17, 37; Rieppel 1986, 304, 307; Eldredge 1989, 109–110; Luckow 1995, 590). And among philosophers the same view naturally persists. For example, the philosopher Elliott Sober (1993) wrote that Darwin's book should have been titled "*On the Unreality of Species as Shown by Natural Selection*" (143). (For other examples of

philosophers who share this view, cf. Hull 1965, 203; Thompson 1989, 8; Ereshefsky 1992a, 190).

Historians are interesting here in a slightly different way. Alvar Ellegård (1958, 200), for example, repeats the same view. In fact, the winds of change did not begin to blow until the biologist Michael Ghiselin (1969) argued that for Darwin species taxa are real but not the species category, that Darwin was in one sense a species realist but in another sense a nominalist, so that Darwin did not have a species concept/definition. A number of years later the philosopher John Beatty (1985), following a suggestion by Frank Sulloway (1979), added a strategy theory to Ghiselin's thesis to explain why Darwin in the *Origin* would repeatedly define species nominalistically and yet in fact hold that species taxa are real. Historians have seemed to simply follow this lead. Jon Hodge (1987), for example, as well as Gordon McOuatt (1996, 2001), both subscribe to the Ghiselin/Beatty thesis, while attempting to provide their own twists. I shall return to these authors in chapter 8, where I develop my own strategy theory. What is interesting to note at this point is that among professional historians, and increasingly among philosophers (e.g., Kitcher 1993, 32 n. 45; Laporte 2004, 192 n. 13; Grene and Depew 2004, 213), the Ghiselin/Beatty thesis has become the received view (cf. chapter 8).[7]

What I shall attempt to do in the following chapters is to take the now received view—that Darwin was a species taxa realist but not a species category realist—to the next level, that is, to show that he was in fact a species category realist, that when he looked at taxa he had an implicit species concept that he applied again and again. But that is not all that I shall do.

Before we begin, however, it is important to finish off this chapter with some strong evidence, direct and indirect, that Darwin's view in the *Origin* and beyond was not that of a species nominalist, in other words that he did not think of species as akin to constellations, the standard example of nominalism (e.g., Lyell 1832, 19; Darwin 1859, 411), where the individuals are real but the groupings of them are subjective and arbitrary. A good place to begin is with Darwin's reply to Agassiz's quip that if species are not real then it makes no sense to say they vary. In a letter to Asa Gray (August 11, 1860) Darwin wrote "I am surprised that Agassiz did not succeed in writing something better. How absurd that logical quibble;—'if species do not exist how can they vary?' As if anyone doubted their *temporary* existence" (Burkhardt *et al.* 1993, 317, italics mine). Moreover, in the margin of his copy of Agassiz's review, where Agassiz's quip is to be found, Darwin wrote "exist only temporarily" (Burkhardt *et al.* 1993, 318 n. 4). Temporary existence is, of

course, nonetheless real existence, not nominal existence, and in chapter 3 I shall attempt to determine exactly what Darwin meant.[8]

There is other evidence as well. In the *Origin* itself, Darwin wrote "I believe that species come to be tolerably well-defined objects, and do not at any one period present an inextricable chaos of varying and intermediate links" (177). This passage, along with many others, will help to establish an important part of what Darwin thought on the ontology of species, again as well shall see in chapter 3. Another piece of good evidence is to be found in Darwin's letter to Hooker (October 22, 1864), in which he wrote "The power of remaining for a good long period constant, I look at as the essence of a species, combined with an appreciable amount of difference; & no one can say there is not this amount of difference between Primrose & Cowslip" (Burkhardt *et al*. 2001, 376). Without the last clause, this passage has the power to mislead, as, for example, it did Poulton (1903, 91). Both parts together, however, help to determine a further important feature of Darwin's mature species concept, as we shall see in Chapter 5. As a final piece of evidence that should suffice for the present, Darwin in one of his articles (1863b) calls it a "great truth," regardless of evolutionary mechanisms, "that species have descended from other species and have not been created immutable" (81).

It remains now to determine exactly—inasmuch as that is possible—what Darwin meant when he wrote of "species."