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## Population Clines of the North American Sasquatch as Evidenced by Track Lengths and Estimated Statures<sup>1</sup>

This article notes that there is a striking degree of internal consistency amongst reports of purported Sasquatch sightings and footprints. The author applies zoological rules of distribution to the reported stature, track length, and fur colour of the creatures and finds that the conformity of sighted characteristics to these rules is high. He concludes that such evidence argues against considering all such sightings as hoaxes and that it supports the possibility that these beings are natural phenomena.

Scientific attention to the mystery of the North American Sasquatch has increased markedly over the past decade due to the rapidly expanding body of "soft evidence" for the actual existence of this giant hominid primate. Evidence for its existence consists of a large number of supposed eyewitness accounts reported by both American Indian and white hunters, trappers, and others;<sup>2</sup> reports, photographs, and casts of tracks;<sup>3</sup> feces and hair found near the tracks; a large body of American Indian folklore relating to the subject;<sup>4</sup> tape recordings of purported vocalizations; and the famous Patterson film which apparently shows a fleeing female Sasquatch.<sup>5</sup> Most reports come from the heavily forested region of western North America, extending from northern California in the south to British Columbia in the north, and encompass a temporal span of some ninety-four years. A few accounts do antedate these and come from the earliest centuries of European settlement.

Grover Krantz and John Napier have been the first physical anthropologists to undertake serious examination of much of this Bigfoot evidence. Even though some appear to be obvious hoaxes, the degree of internal consistency within most of them is striking. Napier, in his thorough examination of both track evidence and the supposed eyewitness reports, also notes this high degree of internal consistency. Regarding the tracks Napier states,

There is a curious and persuasive consistency about the hourglass footprints. They present an aberrant but, nevertheless, uniform pattern. This is hard to reconcile with fakery. One might pose the question:

who other than God or natural selection is sufficiently conversant with the subtleties of the human foot and the human walking style to 'design' an artificial foot which is so perfectly harmonious in terms of structure and function?<sup>6</sup>

Krantz provides further specific details about the unique anatomy of the Sasquatch foot.<sup>7</sup> He has discovered a large width of heel, a double ball, and an unusually straight row of similarly sized toes. Close examination of several of the more consistent and convincing sets of tracks reveal these features. He thinks these traits are due to changes in proportion of the various bones of the feet—an adaptation to great body weight upon a pair of bipedally adapted legs.

Even more convincing to Napier and some other scientists have been the Bossburg tracks, a series of 1,089 prints in all, from an area near Bossburg, Washington. The remarkable feature of the Bossburg tracks is that they appear to have been made by a crippled Sasquatch whose right foot was a club-foot, technically referred to as *talipes-equino-varus*. Napier has diagnosed the deformity as most likely being the result of a crushing injury to the foot during childhood, a condition that would be almost impossible to deliberately fake.

John Green, journalist and author from Victoria, British Columbia, has collected over fifteen hundred Sasquatch reports over the past twenty years, and has noted a number of remarkable consistencies within them. Of particular interest here is his observation about range and distribution. He has noted that, "where the annual rainfall is under 20 inches a year there are hardly any sasquatch reports,"<sup>8</sup> as opposed to the situation in moister areas, especially in the Northwest, where sightings are frequent. Regarding this point Green goes on to say, "Why mankind's supposed need to imagine monsters should dry up where it doesn't rain much I will leave to someone else to explain."<sup>9</sup>

The particular kind of consistency within the reports considered here, however, is not the combination of features described either by Napier, Green, or Krantz (even though these certainly constitute important lines of evidence), but rather it is the consistent variation in size, geographically, of not only Sasquatch tracks but of the hypothetical animals themselves.

#### ANALYSIS OF EVIDENCE

Attention to the Bigfoot reports led to the discovery of what was thought to be a clinal pattern within them regarding body size. Reports of both the

tracks and the eyewitness sightings seemed to characterize a larger creature in the northern part of the hypothetical species range.

Subsequent compilation of data in 1973 (both track measurements and estimated statures) from the collections of reports available at that time, strongly reinforced this hypothesis (see Table 1). The particular reports utilized in that preliminary study were all of those listed by Napier,<sup>10</sup> a few others collected and published by Roger Patterson and not included by Napier,<sup>11</sup> additional Canadian reports compiled by John Green<sup>12</sup>, and some 1973 Canadian newspaper accounts. *The Sasquatch File*, a more complete compilation of reports than the earlier ones, was not available at the time of preliminary analysis, but it has since been screened for pertinent information about both tracks and estimated statures. Also, additional files of more recent reports, from 1974 to the present, have since been offered for study. Comments concerning recent findings will be made at the end of this section.

The results of the preliminary investigation, listed in Table 1, show that the average length of tracks ( $n = 44$ ) vary gradually in a south-north direction from an average of 15" in California to 18½" in Canada. Corresponding to this is a gradual increase in average stature, as estimated by alleged eyewitness observers ( $n = 47$ ), from 7'4" in California to 8'8" in western Canada.

A statistical test of the Table 1 data shows that the clines are in all probability quite real and not the product of chance sampling bias. By plotting track lengths and estimated statures against latitude, regression lines were produced (Figure 1), and the t-test was applied to the slope estimates.<sup>13</sup>

Application of the t-test to the slope estimate of the track-length regression lines shows that if the true slope were zero, then the slope of .12 inches/degree of latitude shown in Figure 1 would have less than a 15 per cent chance of being produced. Application of the same test to the slope estimate of the stature regression (.0746 feet/degree of latitude) shows less than a 10 per cent chance that such a slope would exist in face of an actual slope of zero. The two regression lines, then, appear to be showing actual clines and not sampl-

TABLE 1: NORTH AMERICAN SASQUATCH SIZE VARIATION FOLLOWING BERGMANN'S RULE

Location	Tracks			Stature		
	Mean	No.	Range	Mean	No.	Range
California	15"	17	12½"-18"	7'4"	11	6'-9'
Oregon	16 <sup>3</sup> / <sub>10</sub> "	5	13½"-20"	8'0"	7	6½'-9½'
Washington	17 <sup>1</sup> / <sub>10</sub> "	15	13½"-22"	8'4"	12	7'-10'
W. Canada	18½"	7	15"-24"	8'8"	17	6½'-14'

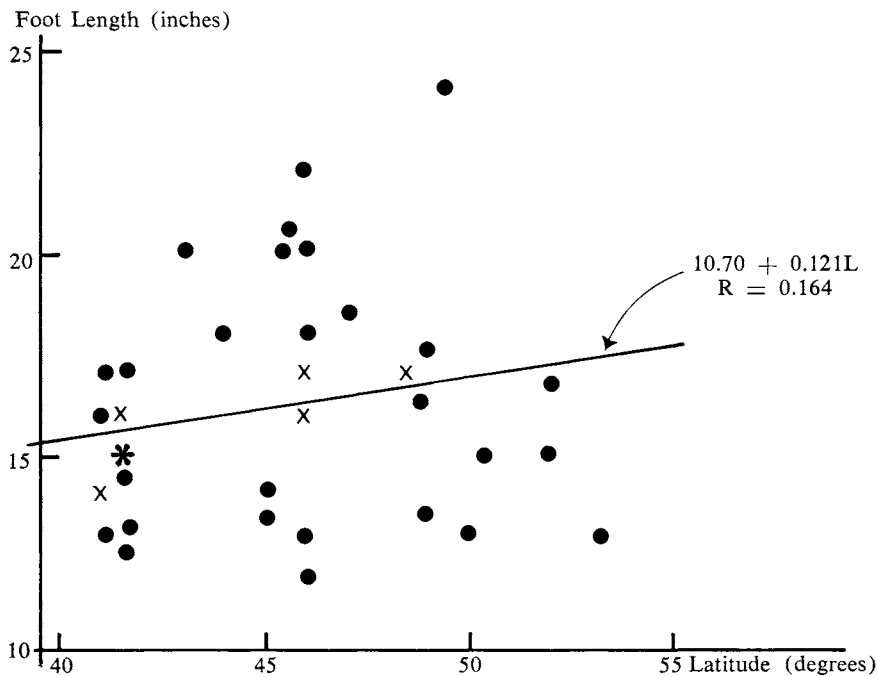
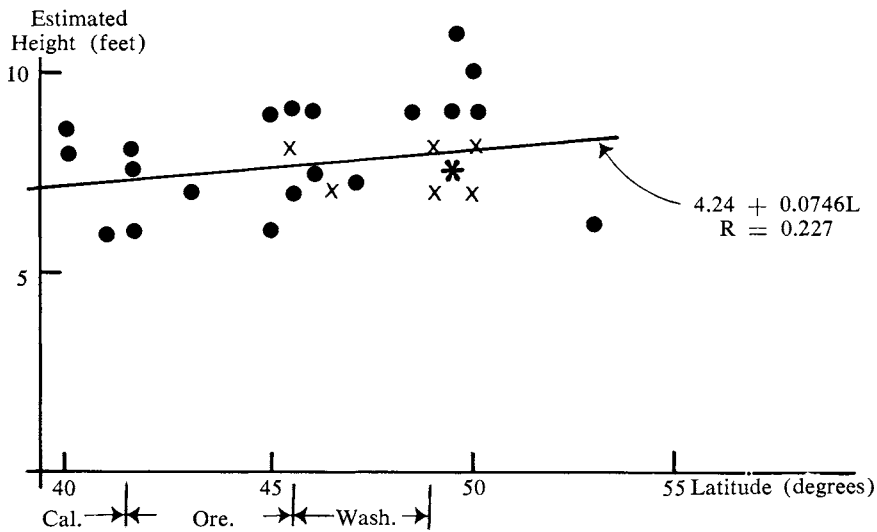


FIGURE 1: LINEAR REGRESSION LINES AND CORRELATION COEFFICIENTS "R" FOR FOOT LENGTH AND ESTIMATED HEIGHT VS. LATITUDE

• = one point x = two points \* = three points

ing bias. This is not to say that the Sasquatch itself has to be real, only that the reported size variations are real and apparently regular from south to north.

All of this is of particular scientific interest because the suggested increase in body size from south to north within the hypothetical species range is exactly what one would predict in nature according to the well-known ecogeographical principle, Bergmann's Rule. Bergmann's Rule states that, among many species and genera of homeotherm vertebrates, those populations closer to the equator tend to have a smaller mean body size than those toward the poles at cooler latitudes. The size differences are thought to exist because of the relationship of body mass to exposed surface area. A large body simply has a smaller surface area per unit volume than does a small one, thus heat conservation is promoted in the cooler regions and heat loss

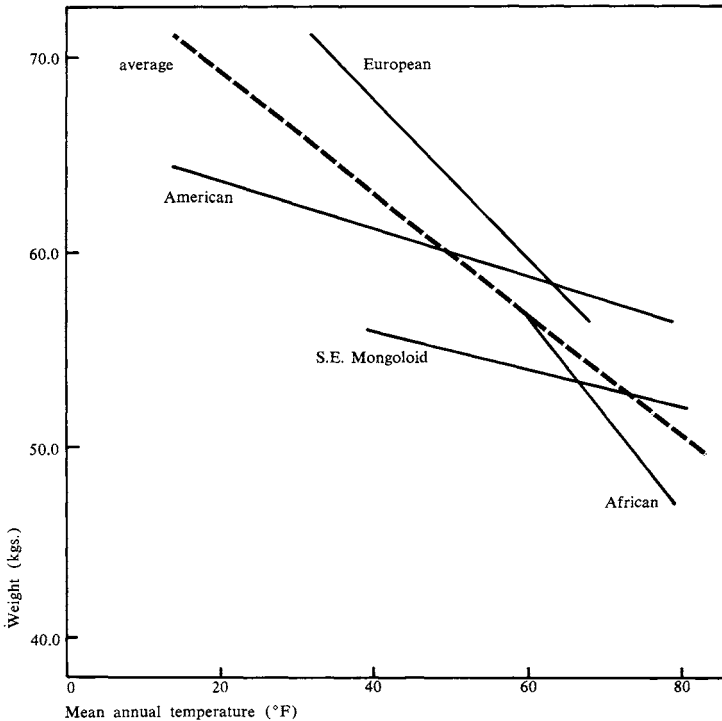


FIGURE 2: BODY SIZE (WEIGHT) CLINES WITHIN THE GEOGRAPHICAL RACES OF *Homo sapiens*, SHOWING A MARKED CONFORMITY TO BERGMANN'S RULE

Source: Mark L. Weiss and Alan E. Mann, *Human Biology and Behavior: An Anthropological Perspective* (Boston: Little, Brown, 1978).

in warmer regions.<sup>14</sup> For many years North American hunters have known that the moose, coyote, wolf, and several other mammalian species vary in size according to this rule from south to north. Actual studies have been conducted on some of these, such as the cougar and the barren ground caribou; as well as several species of birds. Basically, these studies show conformity to Bergmann's Rule; the deviations among some of the bird populations probably result from local influences and other variables not well understood at present.

Perhaps more important to our concern here is the fact that the various geographical races of *Homo sapiens* likewise show marked conformity to Bergmann's Rule (Figure 2). Various studies of both stature and body weight over the years have tended to confirm this even though local exceptions do exist within human samples.<sup>15</sup> The reason that human conformity to Bergmann's Rule is of particular interest here, of course, is due to the assumed phylogenetic closeness of the alleged Sasquatch to *Homo sapiens*.

The very few recent reports that have been examined thus far (since the 1973 published data) seem to conform generally to the established clines, but a much broader study of this information will be necessary before anything meaningful can be said about trends within it.

Results of a recent tabulation from *The Sasquatch File*, however, have presented a few problems in terms of comparability with the earlier findings of our preliminary study. *The Sasquatch File* is no more current than the sources utilized in our 1973 preliminary analysis, but it is much more complete. It contains over two hundred reports from California to western Canada that contain mention of track lengths, estimated statures, or both. The tabulations from these data show a certain conformity to the patterns established in the preliminary study, but the clines are not as sharply defined. Furthermore, recent calculations by Green from his entire file (both published and unpublished reports) show the expected increases in track sizes and estimated statures only from California through Oregon, but *not* farther northward;<sup>16</sup> that is, from Washington through British Columbia sizes decline again. In fact, his reported sizes from Washington and western Canada are smaller than for either Oregon or California.

This raises the question of why the results differ between the various tabulations. Examination of procedures used in the three approaches does show some important differences between the sources used in the original study presented here and the later tabulations that draw from broader samples of reports. First of all, in the preliminary study those Sasquatches reported as definite juveniles were eliminated from the samples. This type of screening was not performed in Green's 1978 tabulation, nor was it in our own tabulation from *The Sasquatch File*. Screening becomes a more difficult

task with a greater volume of reports and even more of a problem when only tracks are reported. Secondly, according to Green there are clearly more females and juveniles reported from the more northerly parts of the range, particularly in Canada, than from California or Oregon. Therefore, if Green's generalization bears up under the close scrutiny of future examination, it could certainly account for the drop in northern average statures found in both of the more recent, broader surveys. Lastly, the earlier published accounts which constitute the basis for the results presented here come from newspapers and popular books containing only the quite "readable" and sometimes sensational accounts, mostly of direct encounters with what appear to be in almost all instances male Sasquatches.

Therefore, at this point it would seem as though the only data studied thus far which actually traces from south to north a single age group (and to some extent a single sex group) is the original data of the preliminary study presented here. The other tabulations, as they come to include a broader spectrum of reports, seem to entail more and more reports of females and juveniles, and this then reduces or even reverses the cline.

Of course it is also possible (although statistically improbable) that the two clines have been produced fortuitously as a result of the relatively small samples in the initial study. In this case, if the clines are not real, then a broadening of the samples could also be expected to eventually remove all appearances of the clinal differences. Further study utilizing some established standard for screening reports to eliminate obvious hoaxes as well as reports of juveniles will likely settle the question as to whether the clines are real or have been accidentally produced by sampling bias.

Perhaps it should be mentioned at this point that during the screening of Sasquatch reports it appeared as though not only size but also coat colour varied in similar fashion from south to north. Coat colour variations do exist within mammalian species, and they do often vary by latitude. This zoological principle is sometimes referred to as Gloger's Rule, and holds that darker shades tend to occur more frequently in moister, warmer regions (such as the more southerly zones in North America) and that blonder tones are more frequent in cooler, drier places. Among the California and Oregon Bigfoot reports surveyed so far, only 13.6 per cent are reported beige or white in colour and the vast majority are listed as brown or black. In Washington and western Canada, on the other hand, 26 per cent are reported as beige or white. Still, the majority in Washington and Canada are reported as brown, reddish, or black, but the much larger percentage of light coat colours in the north may be significant. Since, however, Gloger's Rule is not well understood (and often imperfectly expressed within mammalian species), little more can be said about the whole subject of coat colour at this time.

## SUMMARY AND CONCLUSIONS

The present analysis of reports of alleged eyewitness sightings and tracks of the Sasquatch was undertaken as a result of the increasing seriousness of this anthropological mystery. The preliminary results of our study support the hypothesis that the Sasquatch actually exists, in that population clines in reported body size and track lengths (and apparently coat colour) not only seem to exist but conform to ecogeographical rules. Statistical tests applied to the track and stature data support the assumption that the clines are actual and not the function of sampling bias. Of course, the problems presented by the addition of more recent data and broader samples must be re-examined, and the generalizations presented here tested further. This will be accomplished by careful screening of additional reports with regard to age group and perhaps sex group. Also, attempts will be made to plot reported sizes against mean annual temperature within the hypothetical species range, not merely latitude. According to the principles of Bergmann's Rule this should produce a steeper cline since adaptive size features are actually more climatic than geographic.

If further analysis confirms the clinal patterns shown within this report, and in light of the fact that the reports constituting the data base for the study encompass a geographical span of over a thousand miles and a temporal span of ninety-four years, the likelihood of a hoax would appear minimal. The possibility of a hoax is still possible, however, even if the clines are eventually proven real. Such a hoax could be perpetrated perhaps by zoologists or other very knowledgeable individuals conversant in the basic tenets of Bergmann's and Gloger's Rules.

In summary, assuming that future analysis does demonstrate that random data have not fortuitously produced the meaningful results shown here, then the following alternate hypotheses must be listed as the two possible explanations for our results:

1. that the most complex and sophisticated hoax in the history of anthropology has continued for centuries without being exposed;
2. that the most manlike (and largest) non-human primate on earth has managed to survive in parts of North America and remains undiscovered by modern science.

Either conclusion appears totally preposterous in light of the problem-solving capability of modern science; yet, one of these two possible conclusions must be true.



## Notes

1. Travel funds to the conference were provided by the University of Wyoming.
2. See Roger Patterson, *Do Abominable Snowmen of America Really Exist?* (Yakima, Wash.: Franklin Press, 1966); Don Hunter and Rene Dahinden, *Sasquatch* (Toronto: McClelland and Stewart, 1973); John Green, *Bigfoot: On the Track of the Sasquatch* (New York: Ballantine Books, 1973), *The Sasquatch File* (Agassiz, B.C.: Cheam Publishing, 1973), and *Sasquatch: The Apes among Us* (Sannichton, B.C.: Hancock House, 1978); and Peter Byrne, *The Search for Bigfoot: Monster, Myth or Man?* (New York: Pocket Books, 1975).
3. See Roderick Sprague and Grover S. Krantz, *The Scientist Looks at the Sasquatch* (Moscow, Idaho: University Press of Idaho, 1977) and John Napier, *Bigfoot: The Yeti and Sasquatch in Myth and Reality* (London: Jonathan Cape, 1972).
4. See Wayne Suttles, "On the Cultural Track of the Sasquatch," *Northwest Anthropological Research Notes* 6, no. 1 (1972): 65-90.
5. See Hunter and Dahinden, *Sasquatch*, and Green, *The Apes among Us*.
6. Napier, *Bigfoot*, p. 123.
7. Grover S. Krantz, "Anatomy of the Sasquatch Foot," *Northwest Anthropological Research Notes* 6, no. 1 (1972): 91-103 and "Additional Notes on Sasquatch Foot Anatomy," *Northwest Anthropological Research Notes* 6, no. 2 (1972): 230-41.
8. Green, *The Apes among Us*, p. 171.
9. *Ibid.*, p. 172.
10. Napier, *Bigfoot*, Table 2, pp. 210-12.
11. See Patterson, *Abominable Snowmen of America*.
12. In *On the Track of the Sasquatch*.
13. A University of Wyoming colleague, R. Lynn Kirlin, plotted the regression lines and performed the statistical tests. His contribution to the study is particularly significant because it required researching the reports that formed the data base for Table 1 in order to obtain the actual latitude for the sightings.
14. See L.S. Dillon, *Evolution: Concepts and Consequences* (St. Louis: C.V. Mosby, 1973).
15. See C.S. Coon, "Some Problems of Human Variability and Natural Selection in Climate and Culture," *American Naturalist* 89 (1955): 257-80 and *The Living Races of Man* (New York: Alfred A. Knopf, 1965).
16. In *The Apes among Us*.