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PRESIDENTIAL ADDRESS 1993: ON THE COMPARATIVE DISTRIBUTIONS OF LEPIDOPTERA AND LEPIDOPTERISTS

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Both Lepidoptera and lepidopterists, each part of a much larger group of similar organisms, represent but fleeting moments in time. But the Lepidoptera have flitted a great deal longer than we have as their students, by four orders of magnitude. I have been interested in the spatial and temporal distribution of butterflies for nearly 50 years, beginning in the neighborhood of my house and expanding incrementally to all of western North America (Stanford & Opler 1993), but began to notice a consistent artifact on the dot maps: butterflies are shown to be more common in cities, along paved roads, and in beautiful mountain meadows than in deserts, on farms, or in abandoned minefields. This presentation is an attempt to put these biases into perspective, based on several years' attempts by me and others to find out what species do occur (and even thrive) in the less-well-known habitats of our large region. Before summarizing my own research in this realm, it is necessary to give some historical perspective both on bugs and buggers.

Although some insect orders are known from fossils dating from early Cretaceous time, the first Lepidoptera appeared along with flowering plants about 120 million years before the present (mybp), and probably all families of Lepidoptera that exist today had differentiated by 66 mybp (Emmel et al. 1992). Most fossil butterflies date from the late Eocene to early Oligocene epochs, about 48–34 mybp, or later. Extensive movements of species occurred during and following the Pleistocene glaciations, as has been determined both from examination of fossils and study of today's distributions taking geologic evidence into consideration. Humans undertook equally extensive movements at the same time, extending into much of North and South America from

Eurasia perhaps as long ago as 35 thousand ybp. Lepidoptera appear in pictographs and caves dating from then, but it would be a stretch to refer to the artists as lepidopterists! The first drawings that are fairly easily determined to species are from Egyptian and Sumerian tombs from 5000 to 3000 ybp; *Danaus chrysippus* can be dated from drawings in Luxor created about 3500 ybp (Larsen 1990). The first surviving descriptions of Lepidoptera which may be considered scientific were by the Greek philosopher/scientist Aristotle, who lived and wrote in the 4th century BC. His accounts are sufficiently detailed that several species of butterflies and moths which still occur in his country could be considered described by him, but he failed to assign them Latin names or designate type localities! Common names (in Greek for *chrysippus*) are entirely appropriate for common species (Miller 1992), but are a conundrum for uncommon ones (Scott 1993) for which every author seems to make up a different common name. For example, what should be "Edwards' skipper"? He described 51 species of them (as presently classified) from the western United States alone. I shall not attempt to review the history of lepidopterists since the time of Linnaeus (1753), Cramer (1775), or Fabricius (1807), but the late F. Martin Brown wrote many historical papers in addition to his monumental series on the W. H. Edwards taxa. Brown influenced many of us over several decades, and I find it appropriate to dedicate my remarks here to his memory since he was long a guiding force behind my research.

Many factors influence the distribution of butterflies in space and time, including climate, host plants and other biological requirements, and the effects of human activity. In order for range maps to show the actual distribution of a species for any given interval of time, these factors and the potential biases and artifacts mentioned at the outset must be considered carefully. Also, the mapper must beware of introducing errors by the very process of making maps (Monmonier 1991), and the changes in a species' range over time require either several maps or different symbols denoting different time periods on a single map (e.g., Heath 1970). The British Atlas (Heath 1970) also shows different intensities of observation/collecting among the thousands of 10 km grid squares, so that the presence or absence of a species in a certain area may be evaluated in terms of observation density as well as other factors.

First off, I shall address the issue of errors which originate from the mapping process itself. All maps tell little white lies of necessity. Most of us grew up seeing Mercator-projection maps on classroom walls, where Greenland appears larger than the United States, and Antarctica is as long as the equator, but we learned quickly to adapt to these "lies." My well-worn Colorado highway map shows a prominent north-south ribbon about 2 mm wide running from Cheyenne, Wyoming, to Raton, New Mexico, Interstate Highway 25. If that width were to scale, a DC-10 could easily land crosswise and never see or hit an automobile! Similar types of misinterpretation are possible on dot maps of small scale, where only a single dot in the center of each county (or other unit) will fit. For example, a common species such as *Vanessa cardui,* known from all counties of both Kansas and Nevada, appears to be very much more common in Kansas (105 tiny counties) than in Nevada (13 gigantic ones and 4 tiny ones) simply because the dots are nearly confluent in Kansas. Also, *Boloria acrocnema* shows in 4 large Colorado counties, with a total area of thousands of square miles, but the insect actually occurs in only a few several-acre colonies above treeline on the San Juan massif. Of course, in a scientific paper addressing either of these issues, the maps would be prepared in different formats, with equal size grid squares for the painted lady in Kansas and Nevada, and a large scale map to show the specific localities for the Uncompahgre fritillary in Colorado. In a work with over 1000 identical-format maps, these matters must be summarized by a simple caveat in the introduction: Beware of [implied] lies! Most range maps, whether showing discrete dots or shading, are based on county records in the United States because the county of the locality on the specimen label is usually easy to determine given the other label data and ready access to historical maps; also there is no standard grid system used among disciplines, although longitude/latitude could be used. However, using counties as the basis requires considerable care to avoid plotting errors. Counties sometimes come or go, or change boundaries, or even names, and the names of towns correlate poorly with county names. Here are some examples. Before Colorado became a State in 1876, Denver was in Montana! That is, Montana Co., Kansas Territory. Several butterfly species were described from "Denver" which do not occur anywhere near the city and certainly didn't then either, so a dot must not be placed there without better information. Grand Co., Utah Territory, included what are now Grand Co., Colorado, Grand Co., Utah, and nearly everything in between. In more recent years, Washabaugh Co., South Dakota, vanished into Jackson Co., South Dakota (combining the map dots was quite easily accomplished), while Yuma Co., Arizona, and Valencia Co., New Mexico split into 2 counties each (we had to go back to ground zero for many records), and Denver Co., Colorado gobbled up a lot of real estate in Adams Co. (requiring transfer of a few county dots). Bullfrog Co., Nevada, was created and then abolished so quickly that no action was necessary on our part. Several of the Sierra foothill counties in California changed their boundaries almost weekly in the days of the Gold Rush and afterward, but have fortunately been stable during most of col-

A

CABBAGE WHITE (P. RAPAE), 1800

LEPIDOPTERISTS, 1800

B

CABBAGE WHITE (P. RAPAE), 1956
(Published records)

LEPIDOPTERISTS, 1956
(Lepidopterists' Society membership list)

C

CABBAGE WHITE (P. RAPAE), 1993

LEPIDOPTERISTS, 1993 (Season Summaries 1983-1993) lecting efforts there since the time of Lorquin. The Sonora blue, described from "Sonora," was from near the California gold camps, not Mexico! Then, beware of ambiguous and misleading names: Bent, Colorado, is in Las Animas Co., while Las Animas is the seat of Bent Co.; also Cheyenne Co. is in Nebraska, while Cheyenne, Wyoming is in Laramie Co., and Laramie, Wyoming is in Albany Co. (NOT New York)!

Secondly, maps reflect the habitats of lepidopterists at least as much as those of the Lepidoptera they study, and also the goals and biases of the students. I mentioned earlier that populated, easy-access, and beautiful places tend to be better known than unpopulated, remote, and barren ones, but another principle has been called Powell's Law for its perpetrator J. A. Powell: distant places are more thoroughly studied than close ones, or "No field biologist does any significant work closer than 1000 miles from his home!" A case in point could be the Chiricahua Mtns of Arizona, or the Galapagos Islands, but if one looks at the evolving knowledge of common species' distributions, the exact opposite seems to be true. I have chosen the cabbage white, *Pieris rapae*, to illustrate this point. Panel A of Fig. 1 shows the range of this introduced Eurasian species in 1800, several years before it first appeared on our continent, side-by-side with the range of serious lepidopterists in the same year in the western United States: both zero! Panel B shows the known locations for each group in 1956, again nearly the same, in cities and towns only. Panel C shows where they are documented to exist in 1993—again identical, but this time nearly everywhere. So my corollary to Powell's Law is the converse: "No one notices cabbage whites except in his/her own back yard!" Except that a certain map-dotter finally picked one up on the west side of Loveland Pass, Colorado, 12,000′ above sea level, to complete the dots for all 63 counties and prove Powell correct after all. The distribution of lepidopterists also is shown by the fact that 110 butterfly species are known from Scott Co., Kansas, compared with 30 to 45 in surrounding and equally depauperate counties, because Virgil Calkins lived and recorded species in his back yard in Scott City for several decades this century. In his honor I have therefore formulated Calkins' Law: If one studies a habitat for long enough, more than 100 butterfly species will be found there. Anywhere! Another artifact is caused by the interests of the observers. Swallowtails and fritillaries are much better known (but probably NOT more widespread) than skippers or noctuid moths, be-

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FIG. 1. County records for the cabbage white (*Pieris rapae*) (left column) and the distribution of lepidopterists (right column). A) 1800; B) 1956; C) 1993.

cause they are more popular. Methods of observers affect the results also; like authors who accept literature records or sightings show more polka dots than those who accept only captures with voucher specimens and extremely detailed label data (frequently only their own). I am not faulting careful work, and am sometimes annoyed at papers that show everything from soup to nuts thereby conferring a measure of credibility on frank errors that should be expunged, but I support a middle ground. Maps that are revised frequently, or are on computer files, can be updated to show deletions and corrections as well as additions and format changes.

Finally, I pose a somewhat rhetorical question: When do range maps reach their maximal utility? An important point is reached when all common species are known from all or most grid squares or counties, because it can be inferred then that the ranges of rarer species are well-known also since most biologists are more interested in them, and that a scattergram stray species (such as *Eurema mexicana*) has not been encountered very frequently but can pop up nearly anywhere. We are nearing that inflection point for western butterflies now, and a map showing *E. mexicana* for all counties from Canada to Mexico in a few centuries would tell a different sort of lie, unless the relentless march of Eurasian weeds and fungi into the region—replacing most native plant species—should allow this particular species to flourish continent-wide. Will the range maps for cabbage whites in the year 2093 in western North American look very much like today's, with a few more squares filled in, or will they look like those in 1800? In either case, the comparative distributions of common Lepidoptera and common people will finally be identical, but where will the uncommon ones be? Hopefully the uncommon lepidopterists will still be pursuing the uncommon insects, as Rindge urged in his 1965 presidential address, which I had the privilege to hear in person. Collect NOW, he urged, because it soon would be too late. His message is still true, and even more urgent than nearly 30 years ago. Much collecting is possible with a good telephoto camera, but museums and universities still need material, especially of yet unknown or poorly known species, so the process of obtaining permits to collect specimens is well worth the effort. When all that is left is cabbage whites, a permit will probably not be required. If so, the butterflies may have to issue it.

LITERATURE CITED

EMMEL, T. C., M. C. MINNO & B. A. DRUMMOND. 1992. Florissant butterflies: A guide to the fossil and present-day species of central Colorado. Stanford University Press, California. x plus 118 pp., 9 color plates.

HEATH, J. 1970. Provisional atlas of the insects of the British Isles, Part 1: Lepidoptera (Rhopalocera, Butterflies). Biological Records Centre, Monks Wood Experimental

Station, Abbots Ripton, Huntingdon, England, front matter plus index plus 57 full page maps.

LARSEN, T. B. 1990. The butterflies of Egypt. American University in Cairo Press. 112 pp., 8 color plates.

MILLER, J. Y. (ed.). 1992. The common names of North American butterflies. Smithsonian Institution Press, Washington, D.C. ix plus 177 pp.

MONMONIER, M. 1991. How to lie with maps. University of Chicago Press. xi plus 176 pp.

RINDGE, F. H. 1965. Presidential Address 1965: The importance of collecting—Now. J. Lepid. Soc. 19(4):193–195.

SCOTT, J. A. 1993. The common names of North American butterflies (book review). J. Lepid. Soc. 47(2):170–171.

STANFORD, R. E. & P. A. OPLER. 1993. Atlas of Western U.S.A. butterflies, including adjacent parts of Canada and Mexico. Privately published. x plus 275 pp.

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