STANDARDIZATION OF MIST NET CAPTURES FOR QUANTIFICATION OF AVIAN MIGRATION

By C. John Ralph

In recent years many studies have used mist net capture data to quantify avian populations, especially during migration. Such studies have compared the species, age, and sex composition as well as the intensity and timing of migration through the seasons and at different locations (e.g., Preston, 1966; Leberman and Clench, 1971; Stewart et al., 1973).

Although comparison is a valuable tool, its validity is at risk unless the data used are as equivalent as is possible. Capture effort can vary with the season, weather conditions, and availability of workers. An accurate estimate of the bird populations passing through an area requires correction for these varying factors.

In this paper I suggest a more appropriate way to correct for variation in capture effort than the method described below which is generally used. I also offer a method to correct for the time of day the nets are operated. These corrections can improve the accuracy of population estimates and put them on a more comparable basis. The data used for these examples are based upon field work during 1971 in northcentral Massachusetts at the Ashby Bird Observatory, Ashby, Mass.

Net-hours. The measure of capture effort presently used by some investigators is the number of "net-hours" per unit time. This is usually calculated by multiplying the number of 12 m mist nets in use by the sum of the number of hours the nets were open. To compare catches between stations investigators often compare the total number of birds caught per 1,000 (or other unit) net-hours. This figure is calculated for whatever time period is under consideration—an entire season or shorter intervals. As any researcher using mist nets knows, the number of birds per 1,000 net-hours can vary greatly from day to day, especially during migration. Seasonal totals calculated simply as total birds per net-hour obscure this daily variation and can misrepresent the actual population present. I propose that a more realistic index of the population would be an *average* of all the days' birds per net-hour. This average also has the advantage of permitting a standard deviation for use in statistical tests.

As an example, consider the situation illustrated in Table 1, which contrasts two five-day periods, "A" and "B". The bird populations are sampled in each of these periods by two netting regimes. One has the same number of net-hours each day ("equal net-hours"), the other, an irregular schedule ("varying net-hours"). When nets are operated the same number of hours on each day, 14 birds are caught in period A, while 17 are caught in period B. Both total birds per net-hour and the average of birds per net-hour are greater in period B. Clearly the bird population is greater (21% greater) during period B than during A. However, net-hours usually vary between days, as in the lower portion of the

TABLE 1.

Capture of birds during two periods of different densities of migrants
(See text for explanation)

	Day	PERIOD A 1	2	3	4	5	Total	PERIOD B 1	2	3	4	5	Total
Equal Net-hours	Net-hours	500	500	500	500	500	2,500	500	500	500	500	500	2,500
	Number of birds caught	2	4	2	4	2	14	2	8	1	6	0	17
	Birds/1,000 net-hours	4	8	4	8	4		4	16	2	12	0	
	Total birds/1,000 net-hours						5.6						6.8
	Average of birds/1,000 net-hours						5.6						6.8
Varying Net-hours	Net-hours	500	250	500	250	500	2,000	500	250	500	250	500	2,000
	Number of birds caught	2	2	2	2	2	10	2	4	1	3	0	10
	Birds/1,000 net-hours	4	8	4	8	4		4	16	2	12	0	
	Total birds/1,000 net-hours						5.0						5.0
	Average of birds/1,000 net-hours						5.6						6.8

table ("varying net-hours"). In this case the density of birds is the same as above, but on some days nets were only run for half the time. Under these conditions, only the average of birds per net-hour reveals the relatively higher population during period B, but the traditional figure, total birds per net-hour, does not. Of course, the average of birds per net-hour is a more accurate correction for unequal capture effort whether there are many or few birds, or many or few net-hours.

As an example of how the method might prevent misinterpretation, consider a species in which the adults migrated, for example, during period A and the young during period B. If net-hours varied and the investigator used the total birds per net-hour, the calculation of an age ratio at the station would be biased towards adults. Thus, any study comparing either the abundance of all birds, a particular species, or the sex or age class between time periods should use the average of birds per net-hour. The average reflects better the abundance of individuals and hence their ecological impact on the food resources of the area.

TABLE 2.
Time of day birds were caught in nets at Ashby
(See text for explanation)

Time caught	Number caught	Percent of total
Before sunrise	2	0.1
sunrise - .1	313	15.6
.1 - .2	312	15.6
.2 - .3	256	12.8
.3 - .4	160	8.0
.4 - .5	175	8.7
.5 - .6	142	7.1
.6 - .7	119	5.9
.7 - .8	129	6.4
.8 - .9	102	5.1
.9 - sunset	110	5.5
after sunset	182	9.1
TOTALS	2,002	99.9

Time of day. Birds-per-net-hour varies with the time of day as well as between days because birds are usually more active in the morning. With a given number present in an area, a higher proportion will be caught by nets operated in the morning than by nets open in the afternoon. In other words, a single bird caught in the afternoon represents a larger actual population, and presumed impact on the habitat, than a single bird caught in the morning. To arrive at a correction factor for the time of capture, I divided the 53 days in which nets were operated for the entire day at Ashby into 10 units between sunrise and sunset. I then calculated the percent of birds caught in each of these units of time, as well as before sunrise and after sunset (Table 2). On days when nets were operated for only a portion of a day, the bird per net-hour figure can be corrected by a factor determined from Table 2. For instance, let us use the example of the nets being operated for only the first half of the day, usually catching 61 percent. To make the catch comparable with other days, the birds per net-hour figure would be corrected by dividing it by 0.61. A banding station can determine its own correction values, or can use Table 2, as capture rates will probably not vary markedly between sites. This supposition is supported by the fact that in this study I found no consistent or significant differences between capture rates in spring, summer or fall (with their varying day lengths), nor between nets in the sun or under the forest canopy.

In using any of the above corrections in statistical tests, one should remember that the sample size should remain, of course, the actual number of birds captured.

I would strongly urge that investigators use at least the daily average of birds per net-hour to help insure the accurate comparison of data from different capture stations, as well as to make more meaningful the comparisons at a single station.

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