NET-SHYNESS AND WOOD THRUSH POPULATIONS

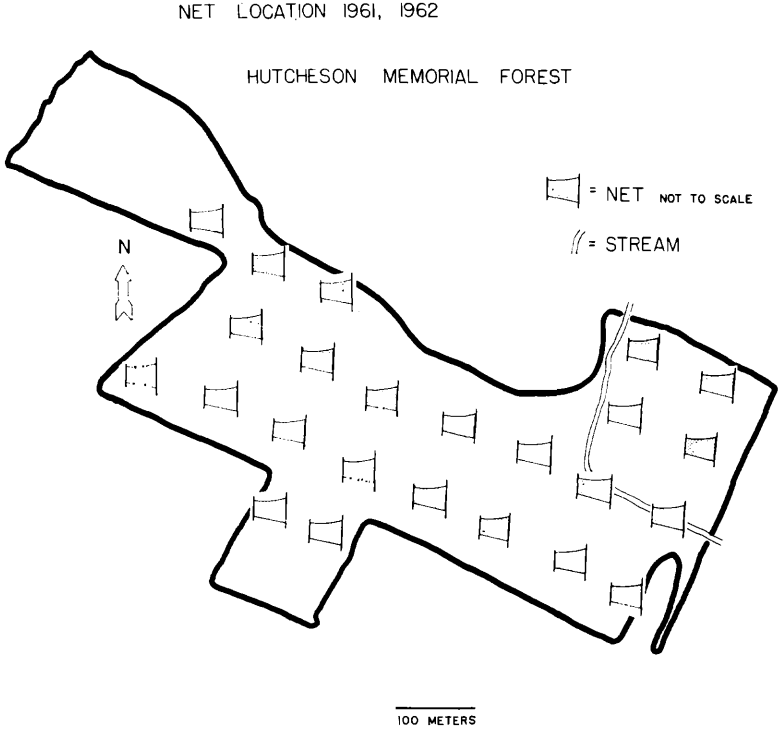
By Jeff Swinebroad

Introduction

Bird banders know of the variation in trap response of birds. Some birds seem to take up permanent residence in the trap and others, although remaining in the vicinity, never repeat. This differential behavior affects studies of population dynamics, of migration, and the like, which use the mark and release method to make population estimates. Young, Ness, and Emlen (1952) presented a cogent argument for considering trap response when establishing confidence in population estimates using recapture (repeat) data. Young (1955) reiterated this point in a paper dealing with Cardinal (*Richmondena cardinalis*) populations.

Currently, some investigators use mist nets rather than traps for catching birds. Stamm, Davis, and Robbins (1960) analyzed the effectiveness of making population estimates from mist-netted samples. They point out that a possible source of error in population

Figure 1



estimates is net-shyness, which they consider as a decline in catch per effort, and which is expressed as a decrease in the percentage of banded birds recaptured in successive samples from a presumably stable population. This decrease means a decrease in the number of repeats with time.

The purpose of this paper is to consider the problem of net-shyness, whether all decreases in repeats with time indicate net-shyness, and to consider net-shyness in a population of Wood Thrush (*Hylocichla mustelina*).

Methods

The data on Wood Thrush populations are taken from the years 1961 and 1962 of a continuing study of the avifauna of the William L. Hutcheson Memorial Forest, Somerset County, New Jersey. Hutcheson Forest is a mature white oak (*Quercus alba*) forest of about 65 acres, almost entirely bounded by pastures, abandoned fields, or row crop fields (Buell, 1957). Hutcheson Forest has been divided into quadrats 100 meters on a side. One 12 meter net (1-1/2" mesh) was placed in the center of each of 24 quadrats. The nets thus were arranged in a grid pattern (figure 1). The woods divided about evenly into an east and a west half with 12 nets in each half. One half of the woods was sampled for a three day period, and then the other half of the woods was sampled for a three day period. The three day sample periods were not necessarily continuous as nets were not operated during rainy days. The break between netting periods in each half of the woods, or the interruption of a netting sequence during a period of inclement weather might be considered a sufficient rest, during which birds' net-shyness or area-shyness might wane. However, our 1960 data (which are not reported here because only 12 days were involved) include a sample during a continuous six day period and the repeat data agree essentially with the data presented herein.

The net sites were maintained almost in the original condition. No shrubs or trees were cut, but herbaceous growth, such as May Apple (*Podophyllum peltatum*) was cleared out in a 2 feet wide strip below the net. Nets were visited every hour or hour and a half. Birds were removed from the nets, banded, and released at the net sites.

The sequence of original captures in each year was tested for random distribution using the theory of runs as described by Young (1961).

The Wood Thrush population also was estimated by the singing male count, or spot-mapping technique, based on censuses run over standard routes three times a week (see Williams, 1936).

Young, Ness, and Emlen (1952) and Young (1958) provided a method of calculating a theoretical probability for repeats. Their method assumes that the probability of capture (p) on any one day is equal to the number of times a bird repeats (n) divided by the total number of days a bird is exposed to the nets (t) or $p = \frac{n}{t}$.

In this report, p is calculated from only those birds that repeated in one year and returned in a subsequent year. These individuals

probably were present throughout the banding period of a given year following their initial capture. This selection resulted in using the repeat records of 21 adult birds repeating a total of 35 times in 1961, and 20 adult birds repeating a total of 45 times in 1962. All of these birds were exposed from 10 to 21 days of netting following their initial capture. p was therefore calculated from total number of repeats during a probable total time exposed to nets. A maximum estimate of p may be calculated using n as number of first repeats, and t as time exposed to nets until first repeat (see Young, et. al. 1952). This second value of p seems less reliable here, and, although it gives a higher value, does not change the final results of the analysis.

If p is the probability of being caught, then the probability of not being caught is 1-p. The probability of first repeating on day n, without being caught during the period n-1 is $p\ (1-p)^{n-1}$. A probability series may be generated by: $p, p(1-p), p\ (1-p)^2, - - -, p\ (1-p)^i$. For a full explanation see Young et. al. (1952). This series indicates the chance of a bird first repeating on a given day, e.g., the day of initial capture (day 1), or, on day 2, or day 3, etc. The distribution of the time of first repeats of 40 birds in 1961 and 47 birds in 1962 was compared to the power-series distribution for the first 10 days after capture (see table 2 and figure 2).

Each thrush's record was examined to find how many repeats occurred in nets where the bird had been caught previously (same-net repeats), compared to all repeats.

TABLE 1. DATES OF NETTING, TOTAL ADULT WOOD THRUSH CAPTURES AND PERCENT OF CATCH UNBANDED

1961				1962			
Netting Date		Total	Percent Unbanded	Netting Date		Total	Percent Unbanded
May	30	5	80%	June	7	7	100%
	31	3	67%		8	18	61%
June	1	6	67%		9	8	62%
	15	15	67%		16	10	80%
	16	11	55%		17	6	33%
	17	10	60%		18	6	50%
	21	7	71%		23	22	54%
	22	3	33%		25	12	42%
	26	12	50%		27	16	31%
	28	4	100%		30	18	33%
	29	6	83%	July	1	10	62%
July	4	20	50%		3	6	17%
	5	17	47%		14	8	50%
	6	9	22%		15	7	14%
	10	9	0		19	1	0
	11	3	33%		20	0	—
	12	5	20%		28	5	40%
Aug.	2	1	0		29	7	0
	4	4	75%		31	2	0
	10	1	0	Aug.	4	4	25%
	11	0	—		5	2	50%

Results

Table 1 shows the days of netting and the total adult Wood Thrush captures in 1961 and 1962. Initial captures were distributed at random according to the theory of runs. A population estimate made from the netting data following the procedure of Stamm, et al. (1960) indicated a population of about 120 adult Wood Thrush in each breeding season. Spot mapping data, however, indicated a population of only about 40 adult Wood Thrush. A similar disagreement between these methods of estimating bird populations at the Patuxent Research Refuge in Maryland has been noted by Stamm, et al. (1960). Regardless of either estimate, 78 adults were banded in 1961, and 79 were banded in 1962.

Table 2 and figure 2 compare the actual distributions of the time of first repeat after initial capture with that expected from the power series generated by $p\ (1\text{-}p)^{n-1}$.

Of 77 repeat records in 1961, 22 or 28 percent were of repeats of the same bird in the same net with a mean of 1.54 ± 1.25 days between these repeats. Of 101 repeats in 1962, 22 or 22 percent were same-net repeats with a mean of $1.41 \pm .94$ days between the repeats.

Discussion and conclusions

Stamm, et al., presented some evidence of net shyness in their 1960 paper. In one situation the data from several species combined shows a decline in catch per effort (see tables 6 and 8 pp. 125, 126, Stamm, et al., 1960). Additional data on Wood Thrush show only one instance in which there is an unexpected decrease in percent of recapture of banded birds which is not coincident with an obvious influx of new birds (see table 8, p. 126, Stamm, et al., 1960).

Net-shyness should be investigated species by species. Lumping data of several species will obscure true individual differences.

We could expect a decline in total catch (unbanded and banded birds) per effort in a stable population if there were net-shyness or area-shyness, and it was communicated to birds not yet caught, even of different species. This does not seem likely.

TABLE 2. DISTRIBUTION OF DAYS BETWEEN INITIAL CAPTURE AND FIRST REPEATS COMPARED TO AN EXPECTED DISTRIBUTION

1961				1962			
Day	p	Expected	Observed	Day	p	Expected	Observed
1	0.109	4.36	9	1	0.129	6.06	8
2	.097	3.88	10	2	.098	4.61	11
3	.086	3.44	2	3	.085	3.99	10
4	.077	3.08	7	4	.074	3.48	7
5	.069	2.76	8	5	.065	3.05	3
6	.061	2.44	0	6	.056	2.63	6
7	.054	2.16	2	7	.049	2.30	1
8	.048	1.92	0	8	.043	2.02	0
9	.043	1.72	1	9	.037	1.74	1
10	.038	1.52	1	10	.032	1.50	0

Figure 2

DISTRIBUTION OF DAYS OF FIRST REPEATS COMPARED TO AN EXPECTED DISTRIBUTION

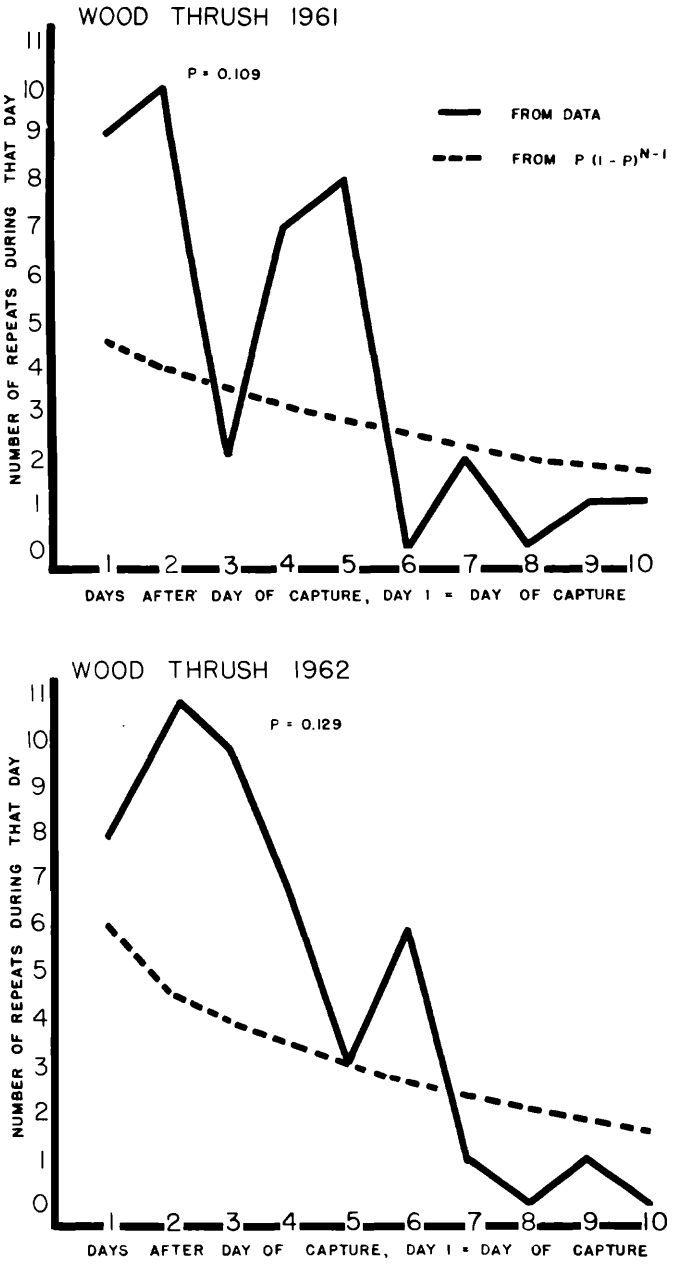


TABLE 3. DISTRIBUTION OF REPEATS BY INDIVIDUALS

No. Repeats by an Individual	No. Individuals Repeating	
	1961	1962
1	23	19
2	7	15
3	5	7
4	3	2
5	1	2
6	1	2

The large number of repeats especially of a few individuals, will weaken the validity of a population estimate of the Wood Thrush.

We could expect a percent decline in unbanded birds caught in a stable population if progressively more and more of the population is banded and there is a limit to the area of activity of individuals, as through territorial behavior.

A decrease in the percent catch of previously banded individuals might be due to a number of events. Net-shyness or area-shyness may be a factor. But, mortality would also cause a similar decrease. There may be shifts of territories in some species, as for example, between successive clutches. There may be shifts in territorial boundaries, or seasonal changes in territorial size and behavior during the breeding season. Each of these might contribute to a decrease in percent catch of repeats, depending on the relevant effectiveness of different patterns of net placement.

The analyses of the distribution of the time of first repeats avoids some problems. The survival of the individuals after first repeat is not a problem, neither are shifts of range, for the individuals used are ones that, after all, have repeated (Young, et al., 1952).

In the data presented here, clearly there are more first repeats occurring in the first 10 days of exposure after banding than expected. Also, a good number of birds repeated within a short time in nets in which they had been previously caught. The Wood Thrush of Hutcheson Forest do not seem to be net-shy, indeed the opposite seems to be true. How may we account for this? The assumption of equal chance of recapture of individuals is critical to use of unmodified mark and release formulae. But, what if there is an unequal chance for recapturing banded individuals? Suppose that in placing nets, some were located within the maximum activity areas of certain individual Wood Thrush and at the fringes of the activity range of other individuals. We would expect many repeats for a few individuals and one repeat for many individuals if the birds are not appreciably influenced by the nets. The distribution of repeats (table 3) shows that this is indeed the case.

The error is in indicating a *smaller* population than is true. The divergence between the actual population and that estimated by spot-mapping is actually greater than indicated by the mark and release estimate!

We need to direct attention to all of the foregoing problems. Furthermore, as Young (1958) indicated, where banding data is

used in calculations of populations, some attempt should be made to measure the variations in trap (and now, net) reactions with enough precision that appropriate mathematical adjustments can be made.

Summary

Wood Thrush were netted in a 65 acre woods during 1961 and 1962. The data were analyzed for probability of occurrence of first repeats with time, and for the frequency of same-net repeats by individual birds. The Wood Thrush data showed a higher frequency of first repeats with time than expected and a substantial number of same-net repeats, so presumably these birds were not net- or area-shy. A decline in catch per effort does not necessarily mean net-shyness. The problem of net-shyness must be examined on a species by species and net by net basis.

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