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A STUDY OF THE WEIGHT ESTIMATION METHOD OF BOTANICAL ANALYSIS

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ABSTRACT

The weight estimate method of determining standing crop by species is reviewed and applied to data from the Pawnee Site of the IBP Grassland Biome. The procedure is evaluated as a double sampling technique for reducing the variance for a fixed cost of the estimate of aboveground plant biomass by species, over the standard plot-clipping procedure. Two statistical estimators (regression and ratio) are used. In addition, a computer simulation model of the estimation procedure is developed in order to study the distributional properties of the two double sampling estimators. Double sampling is effective in reducing the variance of the estimate in a majority of the cases tested.

1. INTRODUCTION

It is readily apparent from a review of the literature (Kelly et al. 1969, Hughes 1959) that there is a need for precise estimates of species biomass composition in native plant communities. Since plant species vary with regard to their palatibility, digestibility, toxicity, and nutrient value to grazing animals, it is important to be able to precisely estimate the way in which species biomass densities vary over time in order that proper grassland management may be implemented.

In the U.S. IBP Grassland Biome, three methods of determining botanical composition have been used: clipping and hand separation, dry weight rank, and weight estimation. The latter two are double sampling procedures which require calibration to reach an "accurate" estimate of botanical composition. Thus, clipping and hand separation have been used as the "standard" for these two double sampling procedures.

Based upon field studies reported by Hughes (1969), the dry weight rank method was tried at several Grassland Biome field sites during the 1970 season. The data were received and processed in a routine manner. However, doubts concerning the validity of the estimates arose due to the lack of any uncer-lying statistical theory to the estimation technique. These lead to a critical examination of the dry weight rank estimation procedure through the use of computer simulation, by Bledsoe et al. (1971). It was determined that the dry weight rank method was relatively useless as a double sampling technique. This leads to the rational for this paper, the objectives of which are: (i) a complete mathematical formulation of the weight estimation double sampling technique; and (ii) a thorough examination of the technique, under field and simulated conditions, in order to determine its usefulness in the U.S. IBP Grassland Biome research project.

2. PAST APPLICATIONS OF WEIGHT ESTIMATION

Grasslands researchers have used a variety of techniques as the "rapid method" in double sampling procedures. The most commonly employed techniques have been to estimate the percentage composition of the vegetation by species or groups in the field or else to estimate the actual weight of the species or groups in the vegetation. The latter method was used by Pechanec and Pickford (1937) in early range research studies and has been the basis of several studies which followed (Burton 1944; Wilm, Costello, and Klipple 1944; Ragsdale 1956; Blair 1959; Hilmon 1959; Hughes 1959; and several others).

The vegetation sampled in these studies has varied widely, including sagebrush grassland in southeastern Idaho (Pechanec and Pickford 1937), mountain grassland-herbland in western Colorado (Wilm, Costello, and Klipple 1944), saw palmetto-wiregrass type in Florida (Hilmon 1959), mixed prairie-sandhill grassland in eastern Colorado (Ragsdale 1956), and browse vegetation stands under longleaf pine in central Louisiana (Blair 1959). The technique has been used on plots varying from 4.8 up to 100 ft^2, and mean herbage yields in these plots has been from about 40 up to about 550 g/m^2, respectively. Typical ratios of time to clip, only separating a few species, relative to time to estimate are from 5 to 10 to 1. There is a high correlation between predicted values of weight and actual weight as clipped in the field. Coefficients of determination vary from around 80% to 96% in the studies mentioned above. Estimation in the field has generally been done to the nearest 5 to 10 grams per plot, although some workers have attempted to estimate to the nearest gram for minor species on small plots.

Estimates generally are within 10% of the actual weight over a fairly wide range of weights, although estimators appear to overestimate actual weights for lower weights and underestimate actual weights for higher weights. Overall, there is an underestimation of weight. Error in estimation seems to be a personal factor rather than a mechanical factor, and experience through the season improves estimation. Training and concentration are needed at each sampling period, and with such efforts, estimates are improved. Estimation appears easiest where the vegetation is most uniform, and it appears easier for bunchgrasses than for sod-forming plants. Percent moisture in the vegetation appears to have little influence, i.e., for a given species over a season. Optimum sample size ratios for such double sampling procedures vary widely from study to study but generally are in the range of 4 to 1 up to 11 to 1.

Various authors have used a regression through the origin, or a linear regression not through the origin, for converting estimated weights to actual green weights. Essentially, the regression through the origin is a ratio estimator. When the amount of herbage in the plot is very small, the use of the ratio estimator avoids the anomaly of predicting a positive or negative dry weight for a quadrat having no plants of the species in question. The regression estimator assumes approximately equal variances about the regression line for all values of estimated weight. This may or may not be true in any given study. If the variance about the regression line is proportionate to the estimated green weight, then the ratio estimator may be the better one to use.

Although a number of scientists have examined equations for calculated optimum ratios between two estimation procedures in a double sampling context, none seem to have thoroughly examined the statistical problem.

3. WEIGHT ESTIMATION AS A DOUBLE SAMPLING TECHNIQUE

The material developed in this section is fully referenced by Cochran (1963). Further reference can be obtained in Schumacher and Chapman (1948).

The objective of any sampling design is to minimize the variance of an estimate for a fixed cost. In this case, one is trying to estimate the mean aboveground biomass density of a particular plant species. Two methods of estimating this density are considered: (i) clipping, and (ii) weight estimation.

For any given plot (sample), i, let

y_i = biomass density determined by clipping

x_i = biomass density determined by weight estimation

The possibility of using double sampling as a means of reducing the variance of a biomass density estimate comes into play if y can be monitored more precisely than x, but x is less expensive to monitor than y.

The method of double sampling is applied as follows:

(i) Monitor both y and x on a fixed number, n, of plots.

(ii) Derive a mathematical relationship between y and x based upon those n plots (i.e., calibrate the double sampling estimator).

$$y = F(x) \tag{3.1}$$

(iii) Monitor x alone on a fixed number, $n' - n$, of plots (i.e., n' = total number of plots upon which x is monitored).

(iv) Determine the mean value of x for all of the n' plots sampled.

$$\overline{x}' = \frac{1}{n'} \sum_{i=1}^{n'} x_i$$

(v) Estimate the value of y that one would expect to correspond to $\overline{x}'$ (i.e., the value of y that one would expect to obtain if y was observed on all n' plots).

$$\hat{y} = F(\overline{x}')$$

Then, double sampling is said to be an effective technique if the variance of $\hat{y}$ is less than the variance of the estimate that one would expect to obtain if y alone was measured for the same total cost as that of the double sampling procedure.

Let c_n = cost of obtaining one y-value

$c_{n'}$ = cost of obtaining one x-value

n = number of y-values obtained in sample

n' = number of x-values obtained in sample

Then C = total cost of double sampling

$= nc_n + n'c_{n'}$

n_s ns = number of y-values that could be obtained for a fixed cost C (cost of double sampling)

$= \frac{C}{c_n}$ (rounded down to the nearest integer)

Let s^2_y = sample variance of y based upon the n samples taken

Then, if y was sampled alone for the same total cost as double sampling both y and x,

$$\text{Var }(\bar{y}) = \frac{s^2_y}{n_s} = \frac{c_n s^2_y}{C}$$

Thus, in order for double sampling to be effective for a fixed cost, C,

$$\frac{\text{Var }(\hat{y})}{\text{Var }(\bar{y})} = \frac{C \text{ Var }(\hat{y})}{c_n s^2_y} < 1 \qquad (3.2)$$

Suppose that the variance of the double sampling estimate can be expressed in the following form:

$$\text{Var }(\hat{y}) = \frac{V_n}{n} + \frac{V_{n'}}{n'}$$

where V_n and $V_{n'}$ are functions of the first n measurements on y and x.

Then, according to Cochran (1963), for a fixed cost, C, optimum allocation (minimum variance) of the double sampling technique is obtained when

$$\frac{n}{\sqrt{V_n c_{n'}}} = \frac{n'}{\sqrt{V_{n'} c_n}}$$

or

$$\frac{n'}{n} = \sqrt{\frac{V_{n'} c_n}{V_n c_{n'}}} \qquad (3.3)$$

$$= \sqrt{\frac{\left(\frac{V_{n'}}{V_n}\right)}{\left(\frac{c_{n'}}{c_n}\right)}}$$

It should be noted that if the mathematical relationship between y and x is represented by a linear regression of y on x, i.e.,

$$y = F(x) = a + bx$$

then the optimum sampling ratio is given by the familiar expression

$$\frac{n'}{n} = \sqrt{\frac{c_{n'}\,(1 - r^2)}{c_n\, r^2}}$$

where r is the sample correlation coefficient between y and x.

The variance of the double sampling estimate, under optimum allocation for a fixed cost, C, is given by

$$V_{opt} = \frac{(\sqrt{V_n c_n} + \sqrt{V_{n'} c_{n'}})^2}{C}$$

If double sampling is used, it is obvious that optimum allocation should be employed. Thus, given $\frac{c_{n'}}{c_n}$, V_n, and $V_{n'}$, double sampling will be an effective technique if

$$\frac{C\, V_{opt}}{c_n s^2_y} < 1$$

$$\rightarrow \frac{V_n + 2\sqrt{V_n V_{n'} \frac{c_{n'}}{c_n}} + V_{n'} \frac{c_{n'}}{c_n}}{s^2_y} < 1$$

And, if double sampling is employed, n and n' will be chosen according to (3.1).

Two mathematical procedures are used in order to express the relationship between y and x:

(i) Linear regression, and

(ii) Ratio estimation.

Based upon the sample of size, n, for which both y and x are measured, let

$$\bar{y} = \frac{1}{n} \sum_{i=1}^{n} y_i \quad , \quad \bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

$$s^2_y = \frac{1}{n-1} \sum_{i=1}^{n} (y_i - \bar{y})^2 \quad , \quad s^2_x = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2$$

$$s_{yx} = \frac{1}{n-1} \sum_{i=1}^{n} (y_i - \bar{y})(x_i - \bar{x}) \quad , \quad r_{yx} = \frac{s_{yx}}{s^2_x}$$

Linear Regression Estimation

$$\hat{y}_{LR} = a + b\bar{x}' \tag{3.4}$$

where

$$b = \frac{s_{yx}}{s^2 \hat{x}}$$

$$a = \bar{y} - b\bar{x}$$

$$\mathrm{Var}\ (\hat{y}_{LR}) = \frac{s^2_y(1 - r^2_{yx})}{n}\left[1 + \frac{(n' - n)}{n'(n - 3)}\right] + \frac{r^2_{yx}\ s^2_y}{n'}$$

$$\doteq \frac{s^2_y(1 - r^2_{yx})}{n} + \frac{r^2_{yx}s^2_y}{n'}$$

Thus
$$V_n = s^2_y(1 - r^2_{yx})$$
$$V_{n'} = r^2_{yx}\ s^2_y$$

Thus, in this case, a linear relationship between y and x is assumed. In addition, no assumptions are made about the line passing through the origin. The only restriction on the linear relationship is that the variance of y is constant over the range of x (homoscedasticity). Note that by substituting V_n and $V_{n'}$ in the expression for the optimum ratio, $\frac{n'}{n}$, the formulation (3.1) is obtained.

Ratio Estimation

$$\hat{y}_R = R\bar{x}' \qquad (3.5)$$

where
$$R = \frac{\bar{y}}{\bar{x}}$$

$$\mathrm{Var}\ (\hat{y}_R) = \frac{s^2_y - 2Rs_{yx} + R^2s^2_x}{n} + \frac{2Rs_{yx} - R^2s^2_x}{n'} \qquad (3.6)$$

Thus
$$V_n = s^2_y - 2Rs_{yx} + R^2s^2_x$$

$$V_{n'} = 2Rs_{yx} - R^2s^2_x$$

It should be noted that this is not a linear regression estimator, and thus, assumptions of homoscedasticity need not be made. However, it is, in many ways, analogous to fitting a linear relationship between y and x which passes through the origin.

4. EVALUATION OF 1970 HERBAGE DYNAMICS DATA

4.1 Estimation of Sample Sizes Needed if Clipping Alone Were Used

An analysis of the 1970 Comprehensive Site and Pawnee Site aboveground biomass estimates, based upon clipping alone, is now performed.

In order to determine for which plant species more precise information is required than can be obtained from clipping alone, some measure of species importance must be defined. The statistic used here as an estimate of year-long importance, YI, is:

$$YI_{j} = \frac{\sum_{i=1}^{d} PC_{ij}\ WT_{ij}}{\sum_{j=1}^{n} \sum_{i=1}^{d} PC_{ij}\ WT_{ij}} \times 100$$

where PC_{ij} = percent composition of species j on date i

WT_{ij} = biomass of species j on date i

d = number of dates that treatment was sampled on that site

n = number of species encountered on that treatment/site in 1970

Thus, YI is a mean of percent composition weighted by biomass on each date, normalized over species.

Table 1 summarizes the YI's on each comprehensive site and on the Pawnee Site for those species having a yearly importance of .01 or greater. For each site, a breakdown is given in the table between those species having YI $\geq$ 10% and 1% $\leq$ YI < 10%. In most cases, the first two letters of the species code refer to the first two letters of the genus, and the last two letters of the species code refer to the first two letters of the species. A complete listing of the code is given in Appendix IV.

In most cases, no more than three species have a YI greater than 10%; the Bridger Site has four on treatment 7 (9 ft snowfence) but one of these, MIFB, is actually a miscellaneous forb category.

For each species with a yearly importance (YI) of .10 or more, the sample size (number of quadrats) needed to estimate its mean within 20% of its true value 80% of the time was computed, based on the 1970 clipped plot data. The sample size required was computed as (Sokal and Rohlf 1969):

$$n = \frac{S_{ij}^2 \; t_{.90}^2 \; (df_i)}{D_{ij}^2}$$

where S_{ij}^2 = sample variance of the j species on date i

$t_{.90}$ (df_i) = point on the Student-t distribution (with df_i = # plots clipped on date i minus 1) above which 10% of the probability lies

D_{ij} = 0.20 times the mean of species j on date i, i.e., the square of 20% of the mean

Table 2 gives the results of these calculations by site and treatment on each date sampled in 1970. Blanks indicate the treatment was not sampled, dashes that that species did not occur.

In general, many of these important species were estimated to the precision specified (within 20% of the mean 80% of the time). Notable exceptions were those species which are difficult to estimate because of pattern and size, such as cactus, yucca, and brush species, and those species which are rare or nonexistant in the standing live biomass early and/or late in the year.

Several conclusions can be reached as to the precision of clipping alone on these sites, from inspection of Table 2:

(i) In general, the most important species in a treatment on a site can be estimated with a sampling of 10 or fewer plots. The only exceptions to this conclusion are at Hays throughout the year, at Jornada throughout the year, and in treatment 5 at Osage.

(ii) Those species which require extremely large sample sizes in order to estimate precisely are, in general, cactus, yucca, and brush species (OPPO at Pawnee and Pantex, YUEL and GUSA at Jornada). Because of their plant sizes and/or their non-random distributions within the sites, these species are difficult to estimate by clipping, and as will be seen later, are the ones in which the weight estimation double sampling procedure becomes an extremely useful technique.

4.2 Evaluation of 1970 Pawnee Site Weight Estimation Application

The weight estimation technique was used on the Pawnee Site during the 1970 field season. On each of 11 sampling dates in each of the eight watersheds, eight 0.25 m^2 plots were both clipped and estimated. It should be noted that periodic training of the individual estimator was not employed. The watersheds refer to grazing treatments as follows:

Watershed	Grazing Treatment
1	Heavy
2	None
3	Heavy
4	Light
5	Light
6	Moderate
7	Moderate
8	None

Fig. 1 gives 16 plots of y (clipped value) against x (weight estimated value) for four selected plant species.

Plant Species	Code
Western wheatgrass	AGSM
Blue grama	BOGR
Plains prickly pear	OPPO
Scarlet globemallow	SPCO

All values obtained over the 11 sampling days are plotted separately for each grazing treatment and plant species.

From inspection of the graphs in Fig. 1, one can ascertain two important things:

(i) The variance of y is relatively constant over the range of x. It seems that the variance of x could be an increasing function of y, but this has no bearing on the assumption of the ratio or on linear regression estimation techniques. Thus, the homoscedasticity assumption necessary to implement the linear regression estimation technique appears to hold for the 1970 Pawnee Site data.

(ii) The weight estimates are fairly consistent underestimates of the associated clipped values, especially for OPPO and BOGR. In this context, underestimation does not affect the precision or accuracy of the double sampling estimator as long as the underestimation is consistent. This is the basis for a reduction in variance through the use of double sampling.

The 1970 Pawnee Site data was thus analyzed in order to determine whether the weight estimation double sampling procedure could significantly reduce the variance of the watershed aboveground biomass estimates for the four selected plant species.

For each date, watershed, and species, the following statistics were computed for both the ratio and the regression estimators and for cost ratios of $\frac{c_{n'}}{c_n} = \frac{1}{15}$ and $\frac{c_{n'}}{c_n} = \frac{1}{30}$.

(i) Sampling ratio (2) under optimum allocation; and

(ii) Variance ratio (1) under optimum allocation.

The reason for employing $\frac{1}{30} \leq \frac{c_{n'}}{c_n} \leq \frac{1}{15}$ was that it was estimated (Uresk, personal communication) that in the 1970 field season on the Pawnee Site, one field worker doing weight estimation could sample from 5 to 10 times as many plots as three field workers doing clipping.

The results are given in detail in Appendix I. A blank indicates that a double sampling technique does not provide interpretable results, and thus, its applicability is assumed to be invalid. In most cases, this is due to the fact that the species of concern has appeared in one or less of the eight plots measured for that date and watershed.

If one examines the results closely, it becomes readily apparent that if either ratio or regression estimation works under optimum allocation, the regression technique always produces the smaller variance ratio $(\frac{V_{opt}}{Var(\bar{y})})$. This implies that the linear relationship between y and x does not pass through the origin.

Table 3 gives a breakdown on the number of replicates in the various categories outlined where the regression estimator, under optimum allocation reduced the variance of the estimate of aboveground biomass by at least 10% of that which would be obtained by clipping alone for the same cost. This is indicated in the "yes" column of the table.

Several things are apparent:

(i) Weight estimation double sampling becomes more effective on the Pawnee Site as grazing intensity is reduced. This is especially true for BOGR and SPCO. If Table 3 is collapsed over species, the following results:

Grazing Treatment	$\frac{c_{n'}}{c_n} = \frac{1}{15}$		$\frac{c_{n'}}{c_n} = \frac{1}{30}$		Total
	Yes	No	Yes	No	
Heavy	45 (51%)	43 (49%)	50 (51%)	38 (43%)	176
Moderate	49 (56%)	39 (44%)	51 (58%)	37 (42%)	176
Light	53 (60%)	35 (40%)	57 (65%)	31 (35%)	176
None	69 (78%)	19 (22%)	70 (80%)	18 (20%)	176
	216 (61%)	136 (39%)	228 (65%)	124 (35%)	704

(ii) Weight estimation with double sampling is an extremely effective procedure for increasing the precision of the estimate of the aboveground biomass of OPPO and SPCO. It has questionable value in increasing the precision of the estimate of the aboveground biomass of BOGR, especially in heavily grazed treatments. And, it is quite ineffective, except in the non-grazed treatment, in increasing the precision of the estimate of the aboveground biomass of AGSM. If Table 3 is collapsed over treatments, the following results:

Plant Species	$\frac{c_{n'}}{c_n} = \frac{1}{15}$		$\frac{c_{n'}}{c_n} = \frac{1}{30}$		Total
	Yes	No	Yes	No	
AGSM	18 (20%)	70 (80%)	18 (20%)	70 (80%)	176
BOGR	48 (55%)	40 (45%)	57 (65%)	31 (35%)	176
OPPO	81 (92%)	7 (8%)	81 (92%)	7 (8%)	176
SPCO	69 (78%)	19 (22%)	72 (80%)	16 (20%)	176
	216 (61%)	136 (39%)	228 (65%)	124 (35%)	704

(iii) Although, in the above tables, there appears to be little difference between a cost ratio of $\frac{c_{n'}}{c_n} = \frac{1}{15}$ and a cost ratio of $\frac{c_{n'}}{c_n} = \frac{1}{30}$, one can surmise, from inspection of Appendix I, a significant reduction in variance ratio $\left(\frac{V_{opt}}{Var(\bar{y})}\right)$ with a cost ratio of $\frac{c_{n'}}{c_n} = \frac{1}{30}$ as opposed to a cost ratio of $\frac{c_{n'}}{c_n} = \frac{1}{15}$.

5. COMPUTER SIMULATION OF THE WEIGHT ESTIMATION DOUBLE SAMPLING PROCEDURE

5.1 Description of the Simulation Model

It was decided that the only realistic way to evaluate the weight estimation double sampling procedure was through the use of a Monte Carlo simulation model.

Suppose that, at a particular field station, one wishes to investigate the possibility of using the weight estimation double sampling procedure to estimate the aboveground biomass of k plant species at a point in time. Further, suppose that one can estimate the mean vector ($\underline{\mu}$) and element variance-covariance matrix (Σ) that will result from such a sample if clipping alone is employed. In order to make one run of the simulation model, let n'_{max} = maximum number of plots that will be weight estimated.

(i) Select n'_{max} random vectors, $\underline{y}$, from the multivariate normal distribution $N(\underline{\mu}, \Sigma)$, the multivariate normal random variable generator of Bledsoe (1971). If any $y_i > 0$, $i = 1, \ldots, k$, delete that random vector and numbers used, select another such that $y_i \geq 0$, $i = 1, \ldots, k$.

$$\underline{y} = (y_1\ y_2\ \ldots\ y_k)$$

Thus, one is really selecting from a truncated multivariate normal distribution.

(ii) Assuming that a weight estimate (x_i) will lie within C% of the clipped value (y_i) $1-\alpha$ of the time, i.e.,

$$Pr(|x_i - y_i| \leq \frac{Cy_i}{100}) = 1-\alpha\ ,$$

and that the weight estimated values are normally distributed about the clipped values, select x_i, for a given y_i, from the distribution

$$x_i \sim N(y_i, \sigma_i^2)$$

where
$$\sigma_i^2 = \left[\frac{\frac{C}{100} y_i}{z_{1-\alpha/2}} \right]^2$$

$z_{1-\alpha/2}$ = 1-α/2, cumulative probability point on the standard normal distribution

Thus, for the ith plant species ($i = 1, \ldots, k$) n'_{max} pairs of the form (x_i, y_i) are simulated.

Suppose that one wishes to test the double sampling procedure for fixed values of n and n' ($\leq n'_{max}$). Then the following data points are used for the ith plant species.

(i) The first n pairs of observations (x_i, y_i) are used for calibration of the double sampling estimators (both regression and ratio). The following computations are made at this stage:

(a) General Statistics: $\bar{x}$, $\bar{y}$, s_x^2, s_y^2, s_{yx}, r_{yx}

(b) Regression Estimation: b, a, V_n^{LR}, $V_{n'}^{LR}$

(c) Ratio Estimation: R, V_n^R, $V_{n'}^R$

(ii) The first n' observations on x are used in order to make the double sampling estimates and to compute their theoretical variances. Thus, the following computations are made at this stage:

(a) General Statistics: $\bar{x}'$

(b) Regression Estimation:

$$\hat{y}_{LR} = a + b\overline{x}'$$

$$\text{Var}\ (\hat{y}_{LR}) = \frac{V_n^{LR}}{n} + \frac{V_{n'}^{LR}}{n'}$$

(c) Ratio Estimation:

$$\hat{y}_R = R\overline{x}'$$

$$\text{Var}\ (\hat{y}_R) = \frac{V_n^R}{n} + \frac{V_{n'}^R}{n'}$$

(iii) Assuming that it costs 1 unit to sample x once and c_n units to sample y once (i.e., $\frac{c_{n'}}{c_n} = \frac{1}{c_n}$), the first n_{c_n} values of y are used in order to make clipping only estimates for the same cost as double sampling (C). Thus,

$$C = (n)(c_n) + (n')(1)$$

$$\rightarrow n_{c_n} = \frac{C}{c_n} = \frac{n_{c_n} + n'}{c_n}$$

rounded down to the nearest integer.

$$\hat{y}_{c_n} = \frac{1}{n_{c_n}} \sum_{i=1}^{n_{c_n}} y_i$$

Suppose r runs of the total simulation are made in order to obtain the sampling distributions of the statistics being evaluated. The objectives of the Monte Carlo simulations are:

(i) To compare the sample variances of $\hat{y}_{LR}$ and $\hat{y}_R$ with their average theoretical variances, Var $(\hat{y}_{LR})$ and Var $(\hat{y}_R)$, over the r simulation runs. Let

$\hat{y}_{LR}(i) = \hat{y}_{LR}$ from the ith simulation run; $i = 1, \ldots, r$.

Var $(\hat{y}_{LR}(i))$ = theoretical variance of $\hat{y}_{LR}(i)$; $i = 1, \ldots, r$.

$$\bar{y}_{LR} = \frac{1}{r} \sum_{i=1}^{r} \hat{y}_{LR}(i).$$

$\hat{y}_R(i) = \hat{y}_R$ from the ith simulation run; $i = 1, \ldots, r$.

Var $(\hat{y}_R(i))$ = theoretical variance of $\hat{y}_R(i)$; $i = 1, \ldots, r$.

$$\bar{y}_R(i) = \frac{1}{r} \sum_{i=1}^{r} \hat{y}_R(i).$$

Then

$$s^2(\hat{y}_{LR}) = \frac{1}{r-1} \sum_{i=1}^{r} (\hat{y}_{LR}(i) - \bar{y}_{LR})^2$$

$$\overline{\text{Var}(\hat{y}_{LR})} = \frac{1}{r} \sum_{i=1}^{r} \text{Var}(\hat{y}_{LR}(i))$$

$$s^2(\hat{y}_R) = \frac{1}{r-1} \sum_{i=1}^{r} (\hat{y}_R(i) - \hat{y}_R)^2$$

$$\overline{\text{Var}(\hat{y}_R)} = \frac{1}{r} \sum_{i=1}^{r} \text{Var}(\hat{y}_R(i))$$

It is hoped that

(a) $s^2\ (\hat{y}_{LR}) \stackrel{\sim}{=} Var\ (\hat{y}_{LR})$

(b) $s^2\ (\hat{y}_R) \stackrel{\sim}{=} Var\ (\hat{y}_R)$

If (a) and (b) hold, it would imply that the theoretical variance formulae could be relied upon when making double sampling estimates.

(ii) To compare the sample variances under double sampling with the sample variances of clipping only estimates for the same cost as double sampling and under a fixed cost ratio $\frac{c_{n'}}{c_n}$, let

$$\hat{y}_{c_n}\ (i) = \hat{y}_{c_n}\text{, from the } i\text{th simulation; } i = 1, \ldots, r.$$

$$\overline{y}_{c_n} = \frac{1}{r} \sum_{i=1}^{r} \hat{y}_{c_n}(i)$$

Then

$$s^2(\hat{y}_{c_n}) = \frac{1}{r-1} \sum_{i=1}^{n} (\hat{y}_{c_n}(i) - \overline{y}_{c_n})^2$$

The relationship of $s^2(\hat{y}_{LR})$ to $s^2(\hat{y}_R)$ to $s^2(\hat{y}_{c_n})$ will determine if weight estimation double sampling does reduce the variance of the estimate of the aboveground biomass of a particular simulated plant species over clipping for a fixed total cost and cost ratio.

5.2 Description of the Conditions Simulated

The initial runs of the model were made in order to duplicate the clipped values of aboveground biomass that were reported during the month of June 1970 for the four most prevalent plant species on the US IBP Grassland Biome Osage Site, located in northeastern Oklahoma. r = 50 runs of the model were made for each simulation. Several simulations were made with $r = 150$ runs of the model. From the results of these it was quite apparent that the sample variances converge to their assymptote values in 50 runs. For each of the four variables, regression and ratio estimators were evaluated against clipping only estimators for cost ratios of $\frac{c_{n'}}{c_n} = \frac{1}{10}, \frac{1}{15}, \frac{1}{30}$, and $\frac{1}{50}$. All possible combinations of n and n' were evaluated where $n = 5, 10, 15$ and $n' = 50, 100, 150, 250$. Thus $n'_{max} = 250$. For all of the simulations, the clipped values were drawn from the distribution $N(\underline{\mu}, \Sigma)$, where

$$\underline{\mu} = \begin{pmatrix} 339.70 \\ 27.75 \\ 23.34 \\ 10.63 \end{pmatrix}$$

$$\Sigma = \begin{pmatrix} 9243.97 & -878.34 & -2622.28 & 74.05 \\ & 1892.02 & -354.07 & -27.07 \\ & & 2235.39 & -128.04 \\ & & & 381.85 \end{pmatrix}$$

$$R = \frac{\sigma_{ij}}{\sigma_i \sigma_j} = (r_{ij})$$

$$= \begin{pmatrix} 1.00 & -0.21 & -0.58 & 0.04 \\ & 1.00 & -0.17 & -0.32 \\ & & 1.00 & -0.14 \\ & & & 1.00 \end{pmatrix}$$

Eight separate sets of simulations were made. The simulations differed in the way that x_{ik}, the weight estimate value for a given y_{ik} for species k, was selected. In general,

$$x_{ik} \sim N[f(y_{ik}),\ \sigma^2_{ik}]$$

The simulations differed in the following way:

Run	$F(y_{ik})$	σ_{ik}
1	y_{ik}	$\frac{(0.10)\ (y_{ik})}{1.96}$
2	y_{ik}	$\frac{(0.20)\ (y_{ik})}{1.96}$
3	$\frac{y_{ik}}{2}$	$\frac{(0.10)\ (y_{ik})}{1.96}$
4	$\frac{y_{ik}}{2}$	$\frac{(0.20)\ (y_{ik})}{1.96}$
5	y_{ik}	$\frac{(0.10)\ (\mu_k)}{1.96}$
6	y_{ik}	$\frac{(0.20)\ (\mu_k)}{1.96}$
7	$\frac{y_{ik}}{2}$	$\frac{(0.10)\ (\mu_k)}{1.96}$
8	$\frac{y_{ik}}{2}$	$\frac{(0.20)\ (\mu_k)}{1.96}$

μ_k = value for species k in the input mean vector $\underline{\mu}$.

In the cases of runs 1, 2, 5, and 6, a weight estimate (x) is assumed to be an unbiased estimate of a clipped value (y), whereas in runs 3, 4, 7, and 8, a weight estimate is assumed to be a consistent underestimate of a clipped estimate by one-half of the clipped value.

In runs 1 to 4, the precision of a weight estimate is assumed to be proportional to the magnitude of the associated clipped value (i.e., in run 1, x_{ik} will lie within 10% of y_{ik} 95% of the time). In runs 5 to 8, the precision of a weight estimate is constant over the range of the clipped values (i.e., in run 5, x_{ik} will lie within 10% of μ_k (a constant for species k) 95% of the time).

For any simulation, the random vectors $\underline{y}$ will never be drawn from the distribution $N(\underline{\mu}, \Sigma)$ due to the fact that none of the entries in a random vector can take on a negative value. Thus, due to truncation, the clipped vector $\underline{y}$ was actually drawn from a distribution $N(\underline{\mu}', \Sigma')$, where, in the case of Run 1,

$$\underline{\mu}' \tilde{=} \begin{pmatrix} 301.30 \\ 44.57 \\ 42.27 \\ 20.45 \end{pmatrix}$$

$$\Sigma' \tilde{=} \begin{pmatrix} 7571.75 & -406.15 & -1182.57 & -49.47 \\ & 752.88 & -130.27 & 7.36 \\ & & 1078.79 & -61.62 \\ & & & 209.81 \end{pmatrix}$$

$$\tilde{R}' = \begin{pmatrix} 1.00 & -0.17 & -0.41 & -0.04 \\ & 1.00 & -0.14 & 0.02 \\ & & 1.00 & -0.13 \\ & & & 1.00 \end{pmatrix}$$

5.3 Results of the Monte Carlo Simulations

The results of runs 1 through 8 are presented in Appendix II. For any run and set (n, n'), the following computer coding is used in the margins, and associated values are printed in the body of the appendix.

Mean	Variance	Coding
$\frac{\bar{y}}{\bar{x}} = R$		$\frac{\text{YBAR}}{\text{XBAR}}$
$\hat{y}_R$	$s^2(\hat{y}_R)$	R-EST
$\overline{\text{Var}\ (\hat{y}_R)}$		Var (R-EST)
$\hat{y}_{10}$	$s^2(\hat{y}_{10})$	N10
$\hat{y}_{15}$	$s^2(\hat{y}_{15})$	N15
$\hat{y}_{30}$	$s^2(\hat{y}_{30})$	N30
$\hat{y}_{50}$	$s^2(\hat{y}_{50})$	N50

Mean	Variance	Coding
b		B
a		A
$\hat{y}_{LR}$	$s^2(\hat{y}_{LR})$	LR
r_{yx}		RHO
$\overline{\text{Var}\ (\hat{y}_{LR})}$		VAR (LR)

In Fig. 2 through 9, plots of the following variances are given for n = 5, 10, 15 and n' = 50, 100, 150, 250 for each of runs 1 through 6, respectively.

(i) $s^2(\hat{y}_R)$

(ii) $s^2(\hat{y}_{LR})$

(iii) $s^2(\hat{y}_{30})$

$s^2(\hat{y}_{30})$ is equal to the variance of the estimate from clipping only for the same cost as double sampling where

$$\frac{c_{n'}}{c_n} = \frac{1}{30}$$

Several things become apparent from the close study of these figures.

(i) The variances of both double sampling estimators decrease significantly as n (number of plots clipped) increases. However, the general shapes of the curves (plots of the three variances against n' = 50, 100, 150, and 250) are approximately the same for n = 5, 10, and 15 for any given species and run.

(ii) In Fig. 2 through 5, the variances decrease between n' = 50 and n' = 100 and then remain fairly constant for n' > 100. In these cases, the variance of x is proportional to the value of y in the simulation. In Fig. 6 through 9, there is more of a constant decrease in the variances as n' increases. In these cases, the variance of x is constant over the range of y in the simulation.

(iii) For species 1, the dominant species (74% of the simulated biomass), the ratio estimator always has a significantly larger variance than the clipped only and regression estimators. The variances of the latter two estimators are always very close together, with the clipped only always slightly smaller than the regression estimator. It is interesting to note that the variances of both the clipped only and the linear regression estimators do not change significantly as n' increases.

(iv) For species 2, 3, and 4 (11%, 10%, and 5% of the simulated biomass, respectively) the general patterns are the same

(a) If the simulated variance of x is an increasing function of y (Fig. 2 through 5), the variances of the estimators are quite unstable functions of n'. In addition, the regression estimator consistently has the minimum variance of the three.

(b) If the simulated variance of x is constant over the range of y (Fig. 6 through 9), the variances of the estimators are rather consistently decreasing functions of n'. In addition, the variances of the ratio and regression estimators are almost identical, and both are significantly smaller than the variance of the clipping only estimator.

(v) The only difference between runs 1 and 3, 2 and 4, 5 and 7, 6 and 8 is that, in the first of each pair, the simulated value of x is centrally distributed about the value of y, whereas in the second of each pair the simulated value of x is centrally distributed about a linearly decreasing function of y (i.e., a constantly increasing underestimate of y). Note that, particularly in the case of the variance of x being constant over the range of y, the consistent underestimate has little effect on the relative performances of the estimators or on the magnitudes of their variances. This is the crux of double sampling. As long as one is consistent in determining the relation of x to y, one can be consistently biased and not effect the precision of the double sampling estimate.

Finally, in Fig. 10 plots were made of the mean value of the theoretical variance (Var $(\hat{y}_R)$) against the sample variance of the ratio estimate $(s^2(\hat{y}_R))$ for all runs on species 1 through 4, respectively. In Fig. 11 the same plots were made for the regression estimates for all runs on species 1 through 4. In the eight figures, the squares refer to n = 5, circles to n = 10, and triangles to n = 15. Since both theoretical variance formulae are approximations, it is of interest to rate their behavior against the sample variances over many simulations.

Species 1 and 3 appear to adhere to the one-to-one relation between the theoretical and sample variances of both the ratio and regression estimator quite consistently. However, with species 2 and 4, the theoretical variance becomes an increasing underestimate of the sample variance as that value increases for both the ratio and regression estimates. The trend is not as pronounced for the regression estimator as for the ratio estimator. However, one should be cognizant of the fact that the approximate theoretical variance of a ratio or regression estimate might possibly be a slight underestimate of the true variance of that estimate.

In summary, the following seems to hold for the double sampling estimators:

(i) The regression estimate is almost universally the minimum variance estimation technique of the three employed in the simulations.

(ii) If one uses the clipped only estimate for a cost ratio of $\frac{c_n}{c_{n'}} = \frac{1}{10}$ as the true value of the aboveground biomass for a particular run, one can see from examination of Tables 5 through 12 that, if bias does enter into the estimation process, it is more pronounced when the ratio estimate is used than when the regression estimate is used.

(iii) If the variance of the weight estimate is constant over the range of the clipped (true) values for a particular species, double sampling will significantly reduce the variance of the estimate over clipping only for the same cost. For a dominant species, the regression estimate should be used. For a species of relatively low biomass, either the regression or ratio technique may be employed.

6. APPLICATIONS

The results of the pervious sections of this paper are now being used in order to arrive at a uniform sampling plan for the estimation of aboveground plant biomass, by species, for the 1971 field season. Our philosophy is to attempt to formulate our current year's sampling plan, based upon the information on hand from previous years' sampling as well as our better judgement.

Thus, our sampling procedures are never really static, but are in a continuous state of evolution.

The sampling plan for 1971 on the network and intensive sites will be employed as follows:

(i) Uniform plot sizes and shapes will be used at all sites. A 0.5 m^2 square plot will be used for the major species (the three or four most prevalent species, each of which must make up at least 10% of the total live herbage biomass) and a 2.0 m^2 square plot for the minor species (those non-major species, each of which make up at least 5% of the total live herbage biomass). The smaller plots will be imbedded within the larger plots.

(ii) A uniform field training procedure will be used across sites for the personnel performing the weight estimation. The estimator will be trained on wet weight clipped values. Training plots will be systematically selected so that a wide range of sizes and species of plants will be encountered during the training period.

(iii) The actual field estimates will then be made of wet weights. The clipped values to which the calibration is made will be oven-dry weights. Thus, the mathematical relationship derived will relate estimated wet weights to oven-dried weights by species. A linear regression calibration will be used (non-linear calibration was considered, but no particular form is indicated by the inspection of the 1970 Pawnee Site data).

(iv) Any negative predictions will be corrected to zero.

(v) Separate regression (calibration) equations will be computed for each treatment, species, and sampling date.

(vi) For a given site and treatment, the number of plots to be both clipped and estimated (n) on the first sampling date of the year will be that sample size, based upon last years results at that time of the year, needed to estimate the mean of the most prevalent plant species on the site within 20% of its true value 80% of the time. These values are given in Table 2. Then, ten times that number of plots will be estimated alone ($n' - n = 10n$). The sample sizes (n, n') on successive sampling dates will be determined from the estimates of optimum ratios ($\frac{n'}{n}$) from the previous sampling periods. Thus, for a particular plant species, treatment, and site, let

n'_i = number of plots estimated in sampling period i.

$\frac{n'}{n} = k_i$ = optimum ratio computed from sampling period i.

c_n = cost of one clipping estimate.

$c_{n'}$ = cost of one weight estimate.

n_{i+1} = number of plots that will be clipped and estimated during sampling period $i+1$.

n'_{i+1} = total number of plots that will be estimated during sampling period $i+1$.

$t_{.90}(j)$ = point on the Student-t distribution, with j degrees of freedom, above which 10% of the probability lies.

D_i = 20% of the estimated biomass of that species during sampling period i.

$V_n(i)$ = the value of V_n for linear regression obtained in sampling period i.

$V_{n'}(i)$ = the value of $V_{n'}$ for linear regression obtained in sampling period i.

Then

$$n_{i+1} = \frac{\left[\sqrt{c_n V_n(i)} + \sqrt{c_{n'} V_{n'}(i)}\right]^2 \left[t^2_{.90}\,(n'_i - 1)\right]}{\left(k_i c_{n'} + c_n\right) \quad \left(D^2_i\right)}$$

$$n'_{i+1} = k_i n_{i+1}$$

A complete formulation is given in Appendix III.

(vii) The question of computing weight estimates for groups of plant species (shortgrass, sod-forming, bunchgrass, single stem, etc.) has arisen. We would recommend that new calibration equations be computed directly from the raw data for the pooled groups as opposed to pooling the original species estimates. The reasoning is that if the species estimates were pooled in order to make the group estimates, the covariances between the species estimates (within each group) would have to be computed in order to properly represent the variances of the pooled estimates. This would be a more difficult task than simply doing the weight estimation directly on the pooled individual observations. In addition, the estimated variance would be more precise in the former case.

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Table 1. Yearly importance (YI) of species on the Comprehensive and Pawnee Sites, 1970 field season.

Site	Treatment Code	Species (Yearly importance)	
		YI ≥ 10%	1% ≤ YI < 10%
Bison	1	FESC (93)	LUSE (5)
	2	AGSP (36) FEID (35)	LUSE (9) MISC 2 (7) FESC (2) ASFA (1)
Bridger	1	FEID (46) MIFB (20) AGSU (18)	LUAR (9) MIGR (4)
	2	FEID (54) MIFB (17)	MIGR (9) LUAR (8) DAIN (5) AGSU (4)
	6	MIFB (43) LUAR (24) FEID (21)	MIGR (4) AGSU (3) ACMI (2) DAIN (2) ARCO (1)
	7	MIFB (34) LUAR (30) AGSU (15) FEID (13)	MIGR (3)
Dickinson	1	STCO (62) ARLU (21)	AGSM (8) BOGR (4) CALO (2) ASER (1)
	2	SEDE (43) BOGR (27) STCO (13)	CAMO (9) CAEL (2) AGSM (2) LAFO (1) LAFO 6 (1)
Hays	1	ANGE (62) ANSC (24)	PSTE (4) BOCU (4) SONU (3) SCUN (1)
	2	BOCU (47) PSTE (21) ANGE (20)	BOGR (4) ARLO (3) BUDA (3) BRJA (1)
Jornada	1	BOER (71) YUEL (13)	GUSA (9) SPFL (4)
	5	GUSA (53) SAKA (28) YUEL (10)	SPFL (6) BOER (2)
Osage	1	ANSC (93)	SONU (3) SPAS (1)
	5	ANSC (32) SPAS (29) MISC A (21)	BRJA (9) PAVI (5) SONU (1)
Pantex	1	OPU (41) BOGR (37) BOBU + (22)	
	3	OPPO (81) BOGR (13)	BOBU + (6)
	5	OPPO (97)	BOGR (3)
Pawnee	1	BOGR (77) OPPO (16)	ARLO (4)
	2	BOGR (61) OPPO (15) ARLO (13)	ARFR (7)
	3	BOGR (65) OPPO (20)	MUTO (9) ARLO (2)
	4	BOGR (55) OPPO (43)	

a/ Treatment Code:
1 = Ungrazed
2 = Light
3 = Moderate
4 = Heavy
5 = Grazed 1969, Ungrazed 1970
6 = Bridger only - 4 ft. snow fence
7 = Bridger only - 9 ft. snow fence

Table 2. Sample sizes (quadrats) needed to estimate standing crop within 20% of its true value with a probability of 0.80 for those species with YI ≥ 10%.

Site	Treatment Code	Species Code	Sampling Period a/											
			1	2	3	4	5	6	7	8	9	10	11	12
Bison	1	FESC	2	2	2	3	3	3	4	4	3			
	2	FEID	5	3	3	2	4	6	6	6	4			
		AGSP	18	7	7	7	15	7	11	12	25			
Bridger	1	FEID	5	5	3	6	3	3						
		AGSU	4	7	23	10	24	18						
		MIFB	2	8	2	7	8	11						
	3	FEID	4	5	3	4	3	3						
		MIFB	3	3	6	6	5	14						
	6	FEID	12	8	2	2	2	5						
		LUAR	9	8	29	8	36	24						
		MIFB	8	5	13	1	10	9						
	7	FEID		32	15	8	7	6						
		LUAR		15	5	8	10	2						
		AGSU		11	13	8	7	5						
		MIFB		8	9	12	3	7						
Dickinson	1	STCO	4	2	5	5	3	2	2					
		ARLU	106	12	28	56	25	15	43					
	4	STCO	14	6	2	5	7	10	27					
		BOGR	1	9	3	3	5	4	24					
		SEDE	5	6	13	9	16	11	11					
Hays	1	ANSC	--	--		--	--	17	5	22		33	24	
		ANGE	--	--		--	193	7	20	11		4	5	
	5	ANGE	--	--	--		189	12	11	17	32		20	
		BOCU	--	--	--		--	4	9	4	3		12	
		PSTE	--	--	--		--	1	22	10	7		41	
Jornada	1	BOER	18	15	8	12	19	54	16	--				
		YUEL	164	262	202	370	162	52	357	--				
	5	SAKA	9	19	8	8	10	13	10	20				
		GUSA	87	53	70	25	183	41	51	25				
		YUEL	363	262	263	370	309	167	368	371				
Osage	1	ANSC	--		13	4	2	3	4	4	2	2	3	--
	5	ANSC		--	18	21	65	24	9	9	12	18	15	155
		SPAS		--	194	22	22	25	22	14	107	11	14	166
		MISC A		--	--	7	2	12	19	14	59	57	51	58
Pantex	1	BOGR	9	5	3	6	2	3	4	--	--			
		OPPO	256	229	140	229	47	62	229	229	232			
		BOBU +	2	--	--	--	--	--	--	--	--			
	3	BOGR	9	3	4	17	4	3	6	--	--			
		OPPO	208	142	153	44	139	58	228	192	124			
	5	OPPO	65	147	85	199	62	103	25	184	36			
Pawnee	1	BOGR	7	5	5	5	17	3	14	3	4	2	4	
		OPPO	90	46	77	34	21	57	58	52	77	94	59	
	2	BOGR	2	2	2	4	2	1	1	1	2	3	2	
		OPPO	62	271	100	108	179	80	111	98	32	203	141	
		ARLO	39	59	35	65	38	28	50	67	126	81	31	
	3	BOGR	1	4	2	3	4	2	4	2	2	2	1	
		OPPO	73	80	152	67	153	81	72	81	107	163	116	
	4	BOGR	3	1	2	2	2	1	1	1	2	1	2	
		OPPO	46	44	41	93	90	33	156	93	72	33	51	

a/ Sampling dates (day/month) for each site for 1970.

Table 2. (Continued)

Site	Sampling Period											
	1	2	3	4	5	6	7	8	9	10	11	12
Bison	2/5	15/5	30/5	17/6	2/7	16/7	4/ 8	24/ 8	26/ 9			
Bridger	30/6	8/7	20/7	3/8	17/8	31/8						
Dickinson	25/5	10/6	24/6	7/7	27/7	18/8	17/ 9					
Hays	16/1	15/2	15/3	24/3	16/4	15/5	16/ 6	1/ 7	16/ 7	21/7	4/ 8	
Jornada	14/7	30/7	10/8	20/8	1/9	26/9	31/10	1/12				
Osage	27/3	11/4	1/5	1/6	17/6	1/7	16/ 7	3/ 8	17/ 8	26/9	18/10	14/11
Pantex	15/6	29/6	13/7	27/7	10/8	24/8	5/ 9	2/10	31/10			
Pawnee	11/4	7/5	19/5	1/6	18/6	1/7	16/ 7	28/ 7	12/ 8	25/8	8/ 9	

Table 3. Results of regression estimation double sampling on Pawnee Site, 1970.

		$\frac{c_{n'}}{c_n} = \frac{1}{15}$		$\frac{c_{n'}}{c_n} = \frac{1}{30}$	
		Yes[a/]	No[b/]	Yes	No
Heavy (WS 1, 3)	AGSM	0	22	0	22
	BOGR	8	14	11	11
	OPPO	21	1	21	1
	SPCO	16	6	18	4
Moderate (WS 6, 7)	AGSM	2	20	2	20
	BOGR	10	12	12	10
	OPPO	20	2	20	2
	SPCO	17	5	17	5
Light (WS 4, 5)	AGSM	2	20	2	20
	BOGR	14	8	17	5
	OPPO	20	2	20	2
	SPCO	17	5	18	4
None (WS 3, 8)	AGSM	14	8	14	8
	BOGR	16	6	17	5
	OPPO	20	2	20	2
	SPCO	19	3	19	3

a/ Yes $\rightarrow \frac{V_{opt}}{Var(\bar{y})} < .90$

b/ No $\rightarrow \frac{V_{opt}}{Var(\bar{y})} \geq .90$

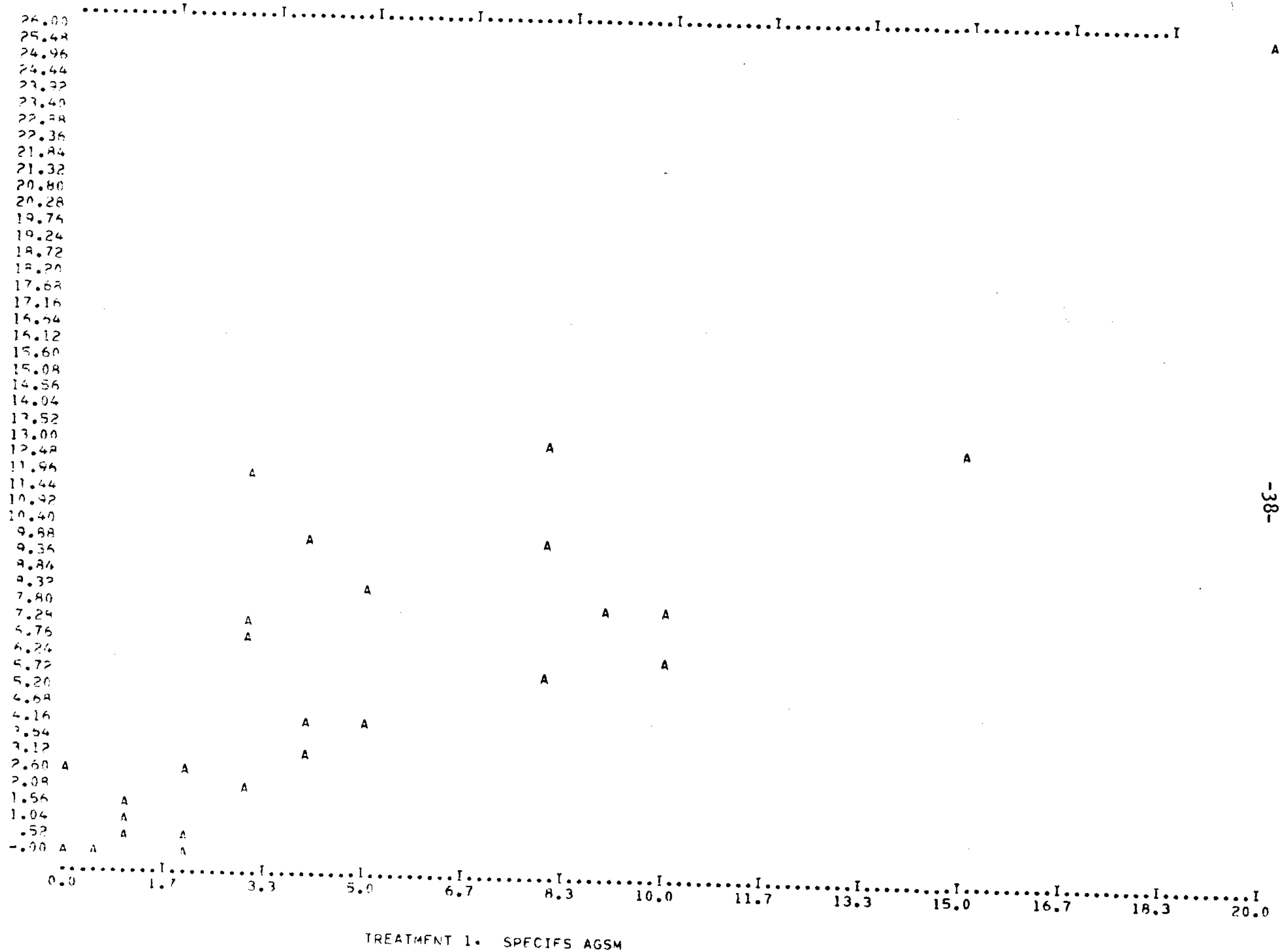
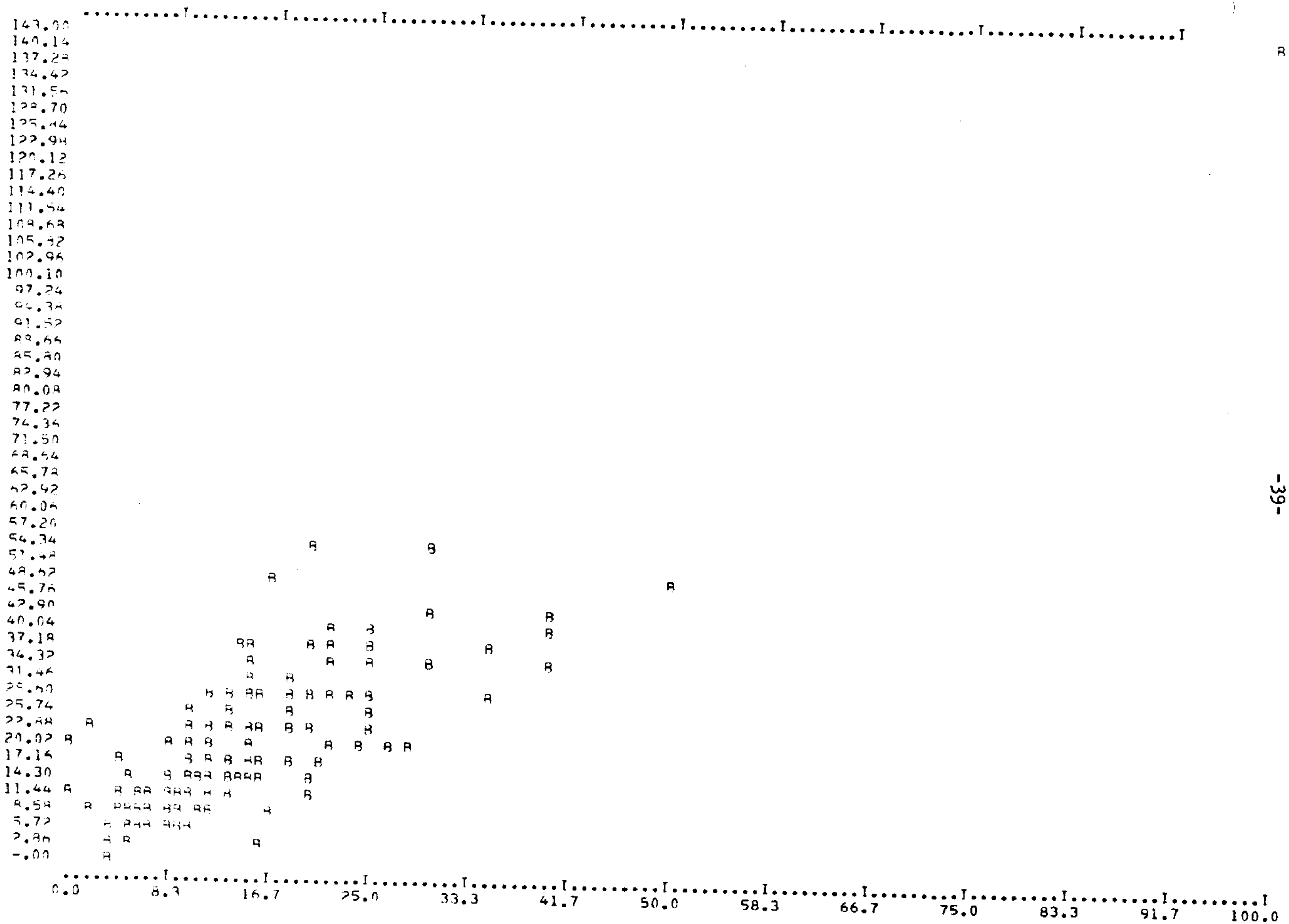


Fig. 1. Clipped (y) vs. weight estimates (x) for Pawnee Site, 1970.



TREATMENT 1. SPECIES BOGR

Fig. 1. (Continued)

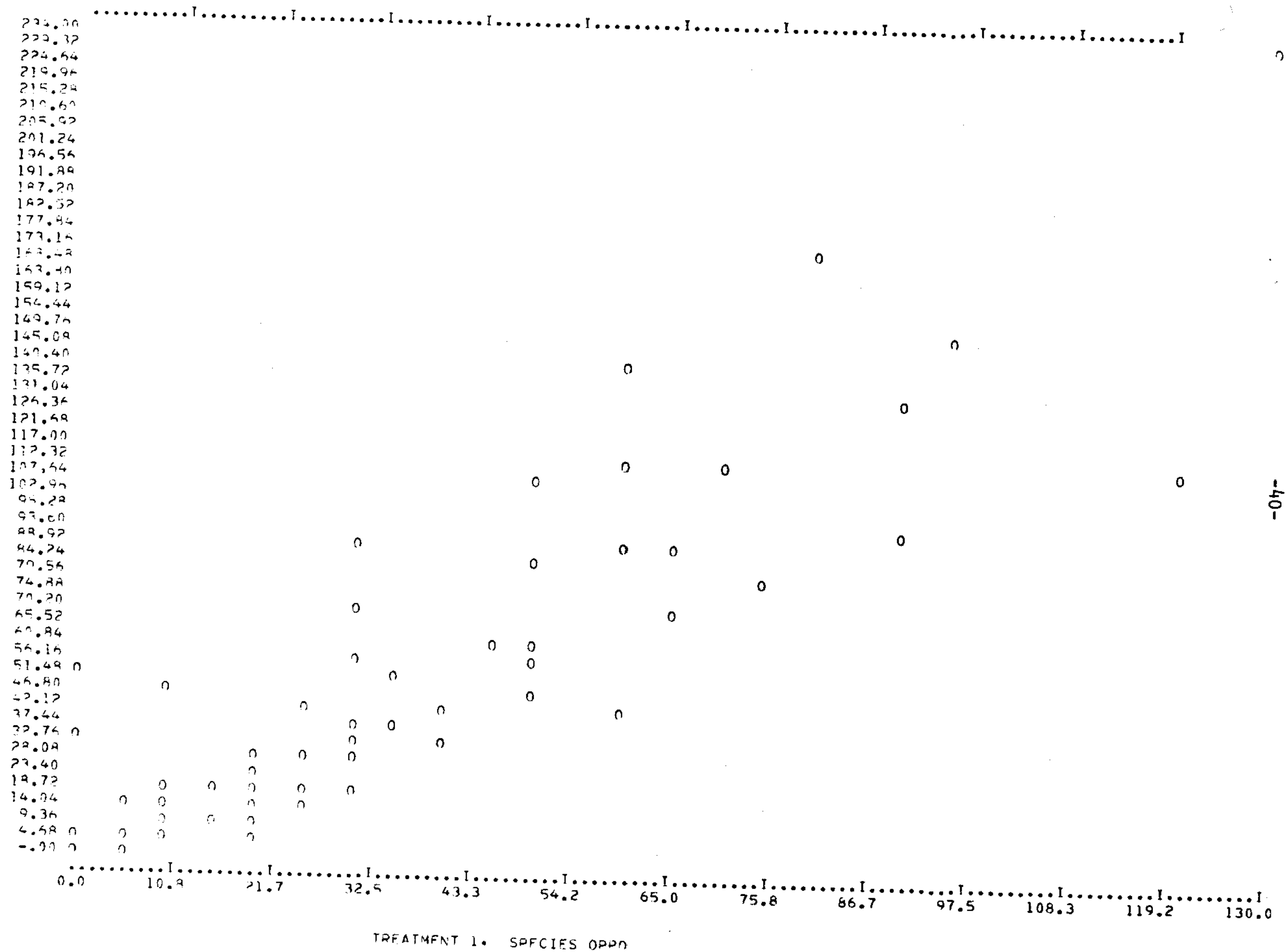
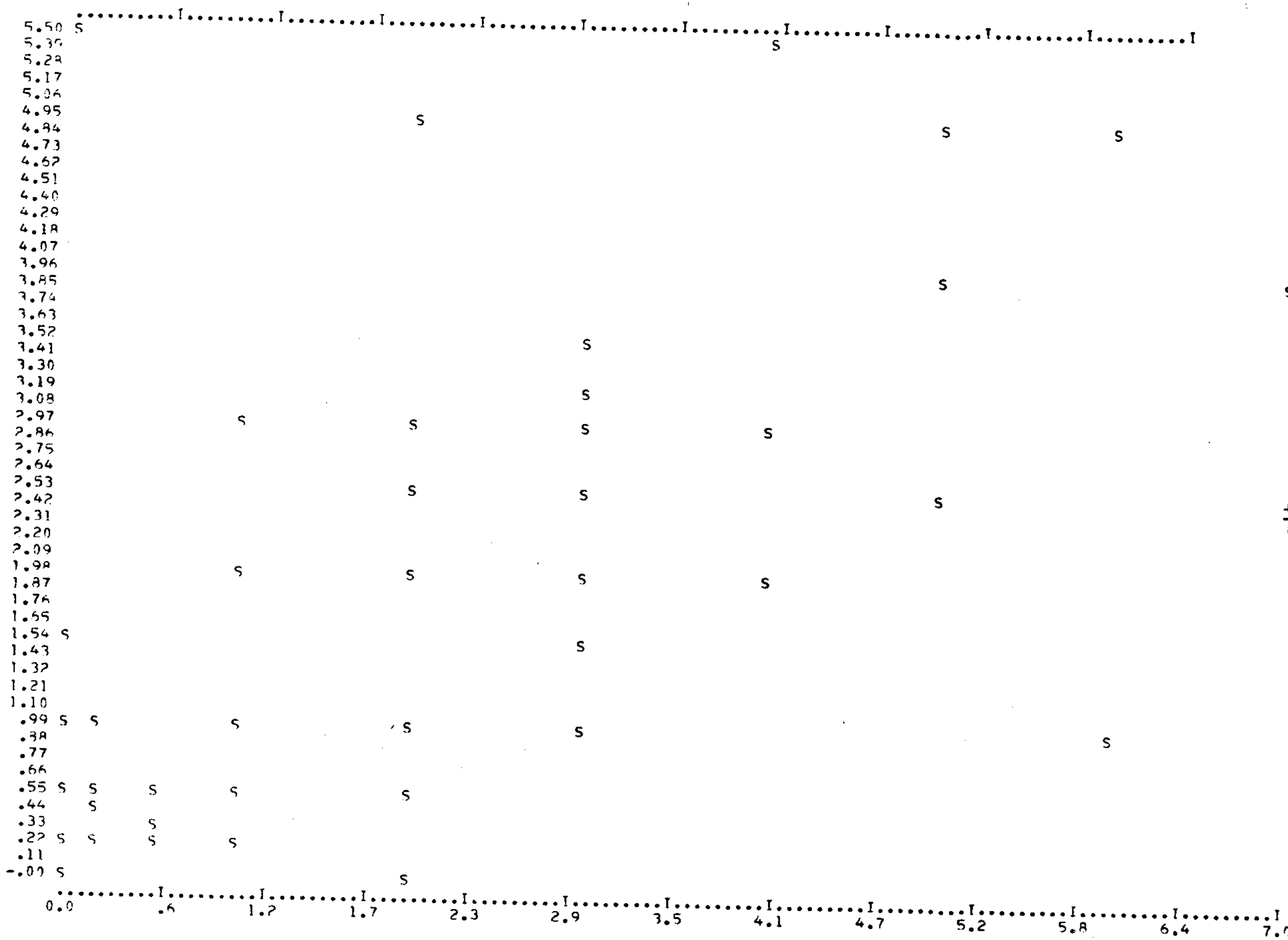
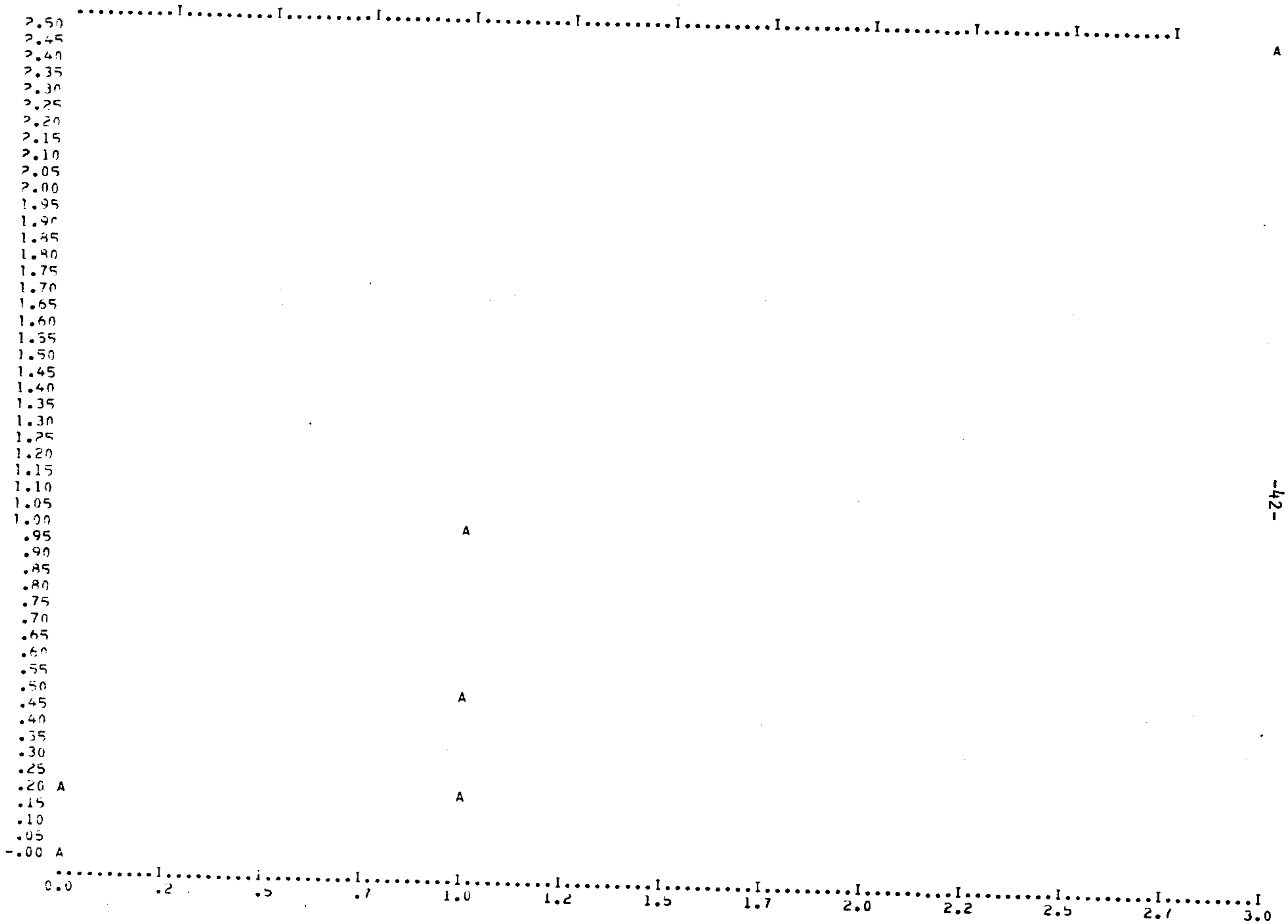


Fig. 1. (Continued)



TREATMENT 1. SPECIES SPCO

Fig. 1. (Continued)



TREATMENT 2, SPECIES AGSM

Fig. 1. (Continued)

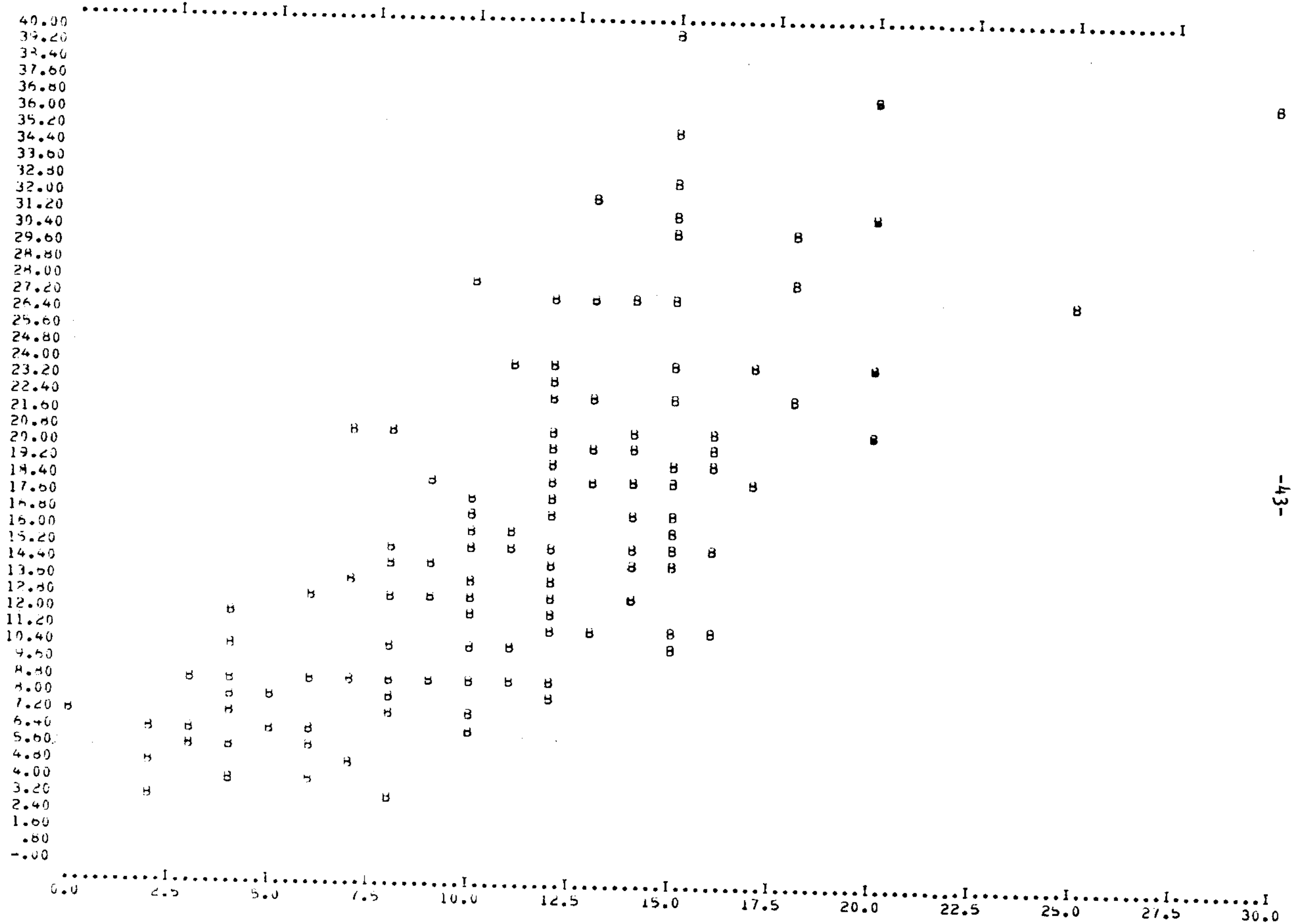
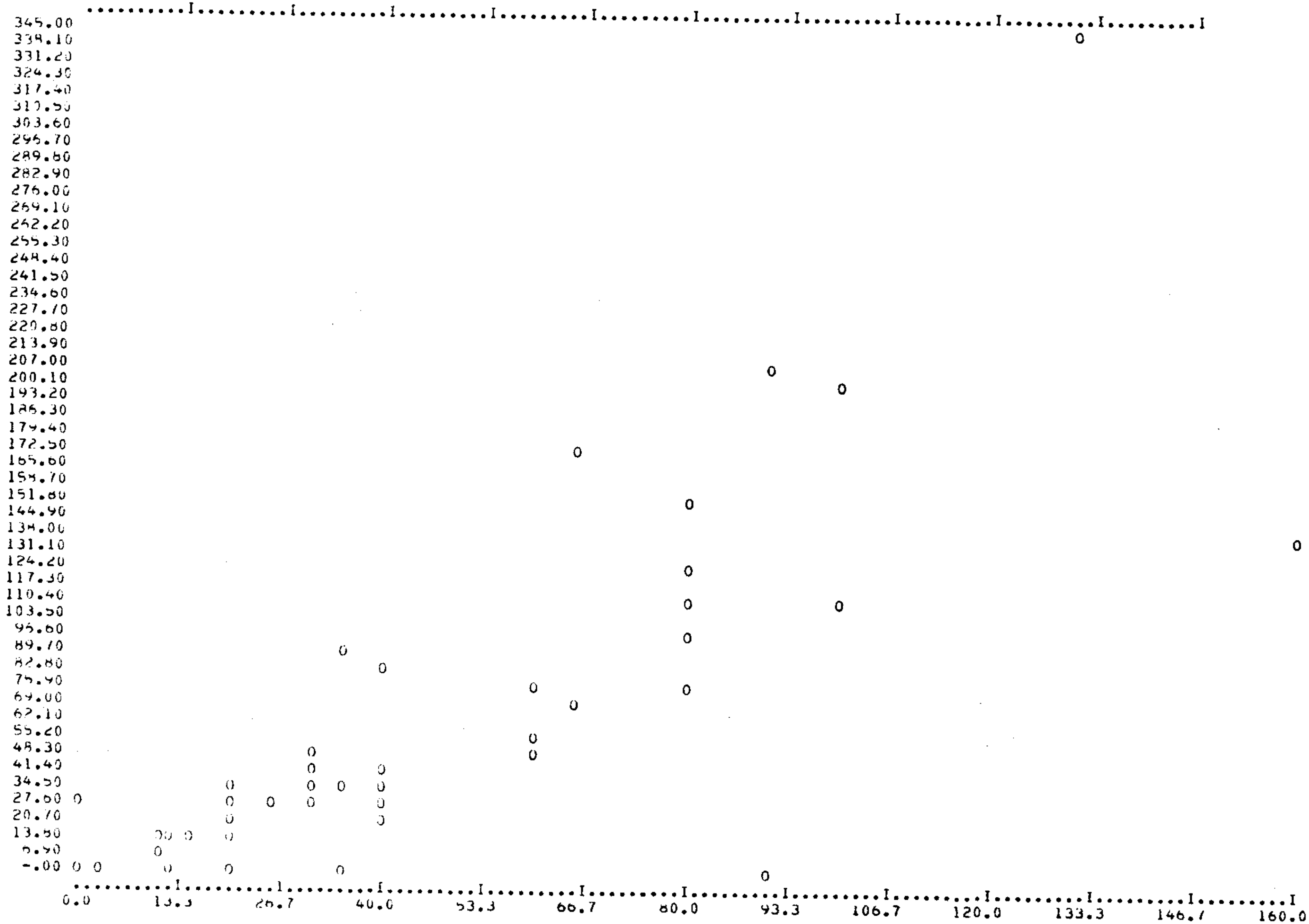
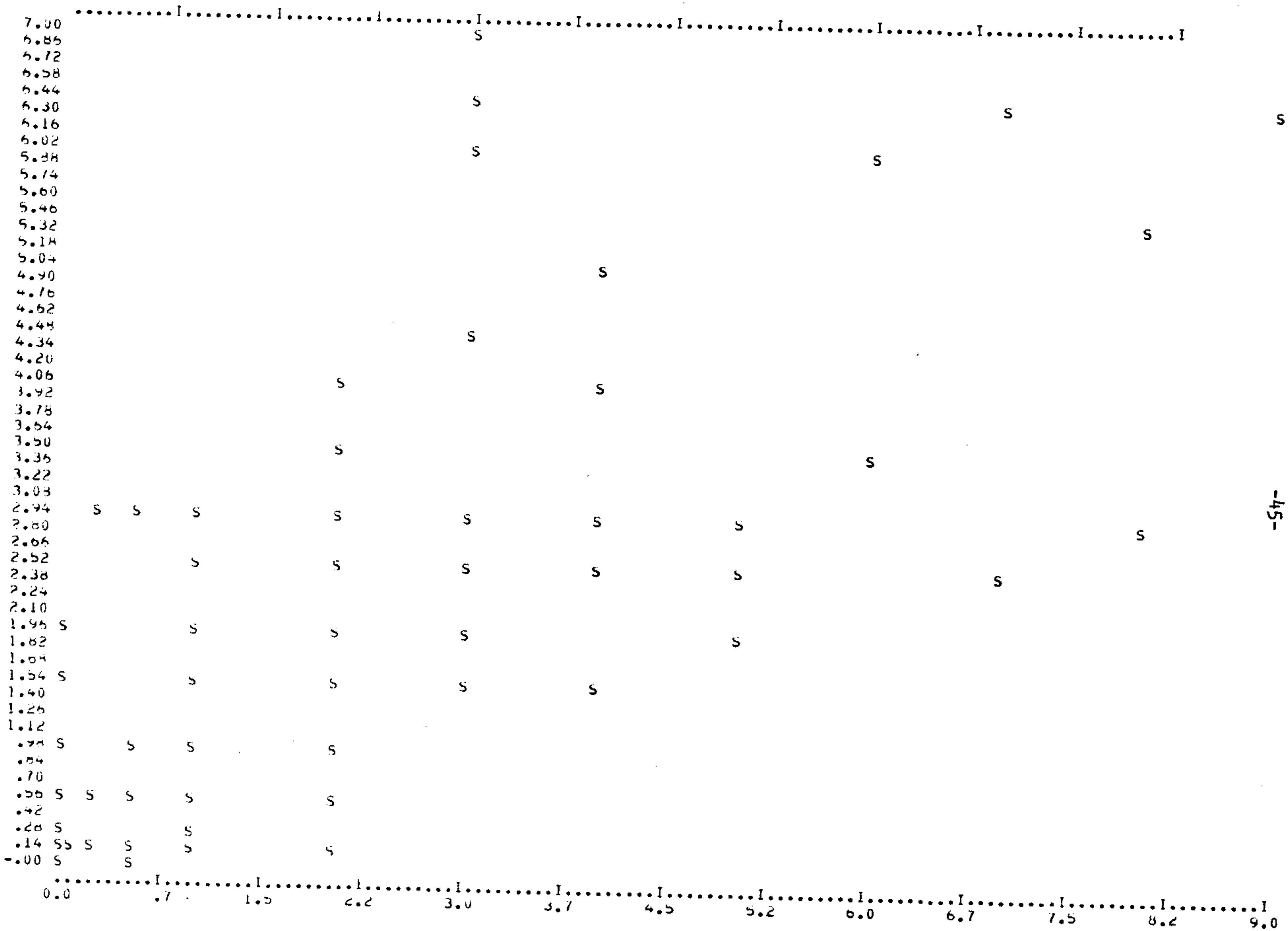


Fig. 1. (Continued)



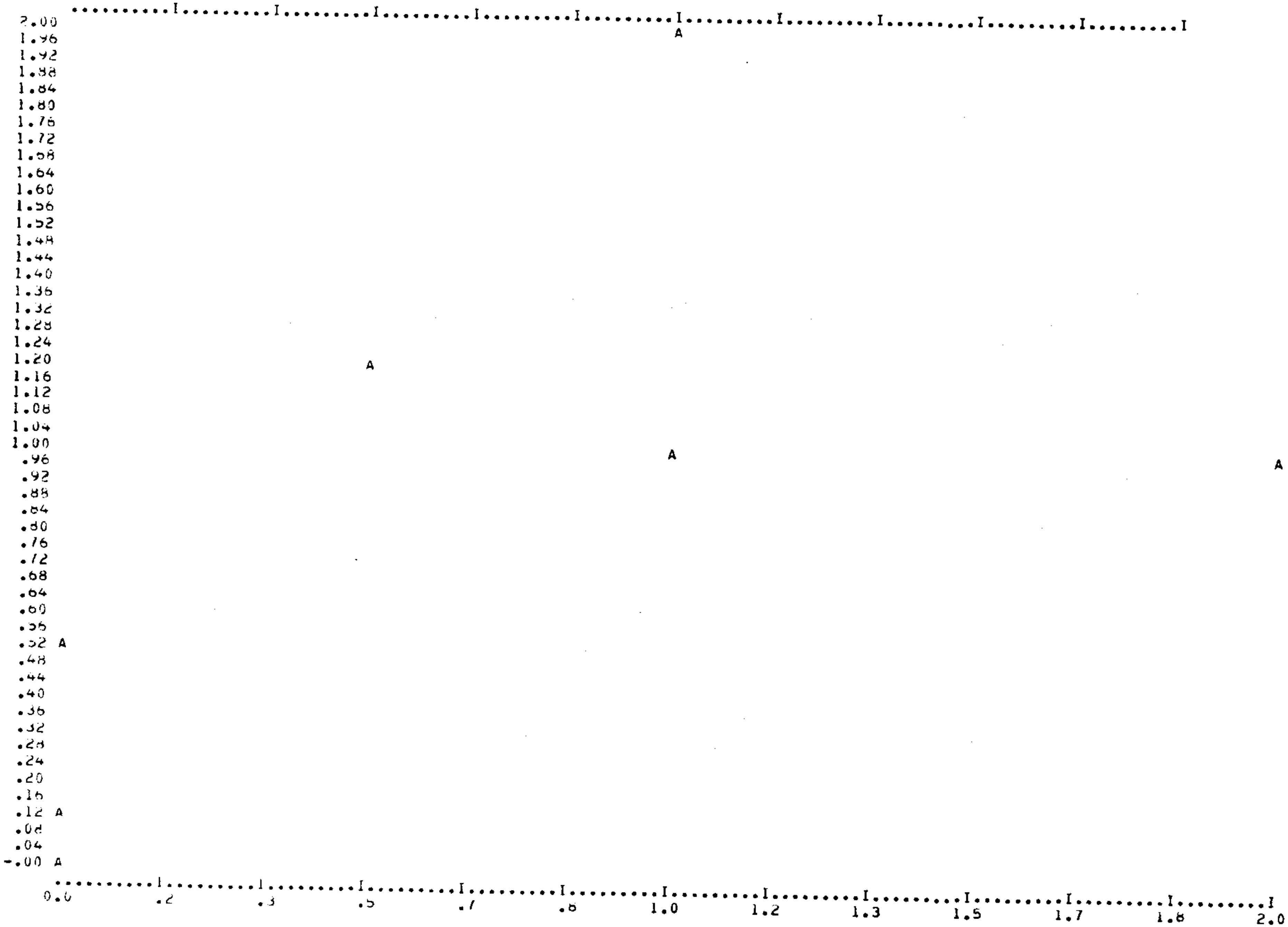
TREATMENT 2. SPECIES OPPO

Fig. 1. (Continued)



TREATMENT 2, SPECIES SPCO

Fig. 1. (Continued)



TREATMENT 3, SPECIES AGSM

Fig. 1. (Continued)

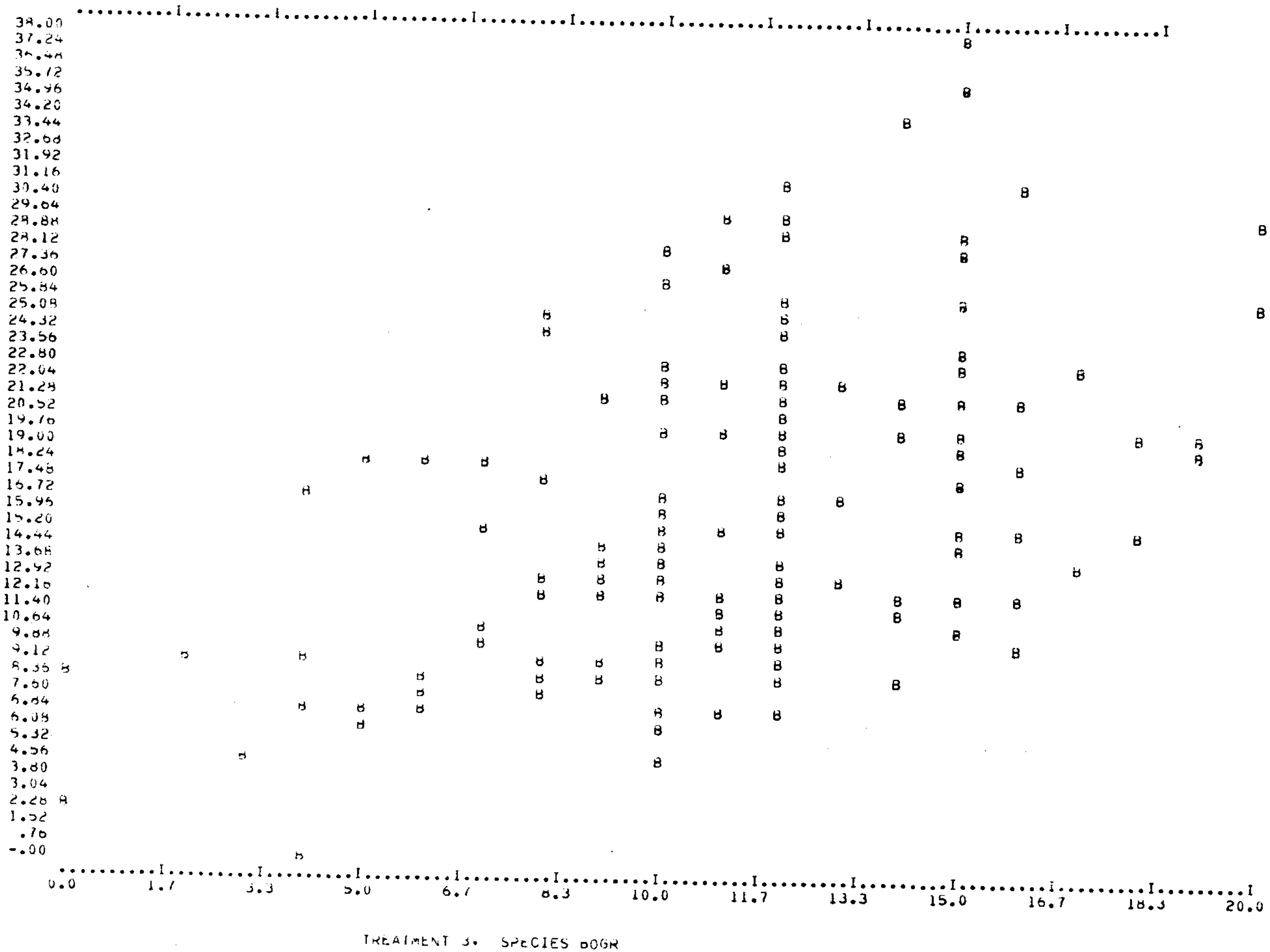


Fig. 1. (Continued)

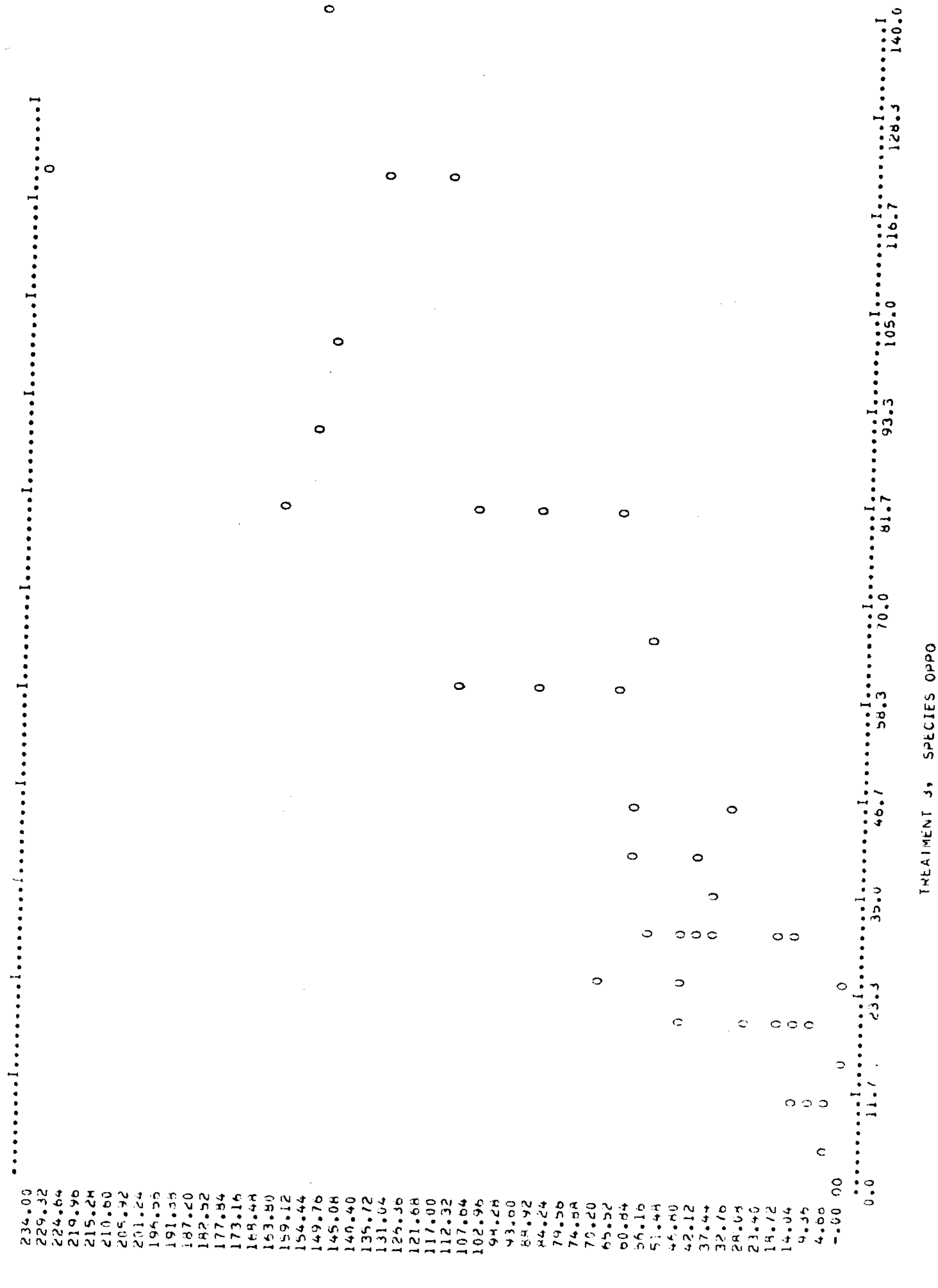


Fig. 1. (Continued)

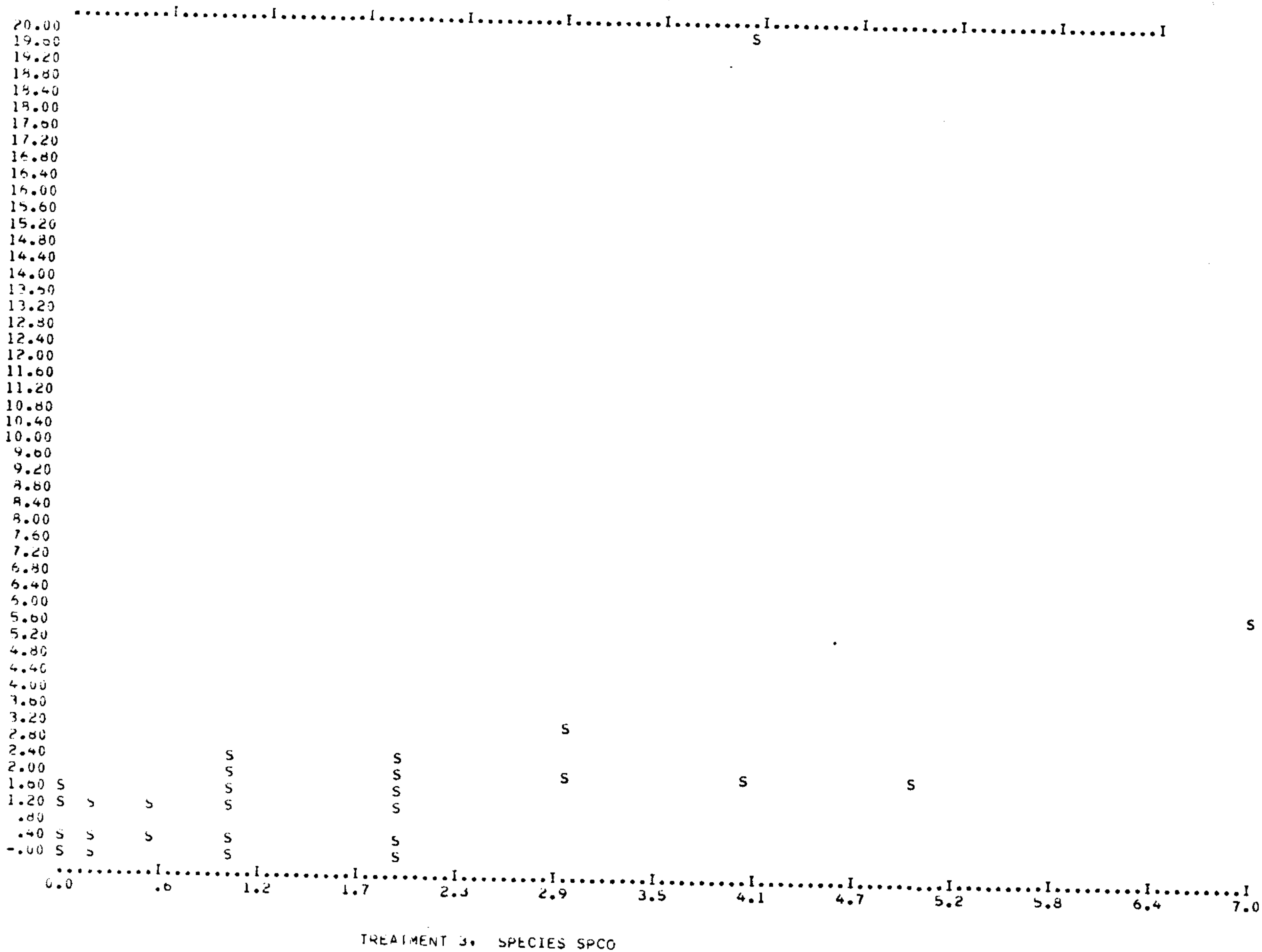


Fig. 1. (Continued)

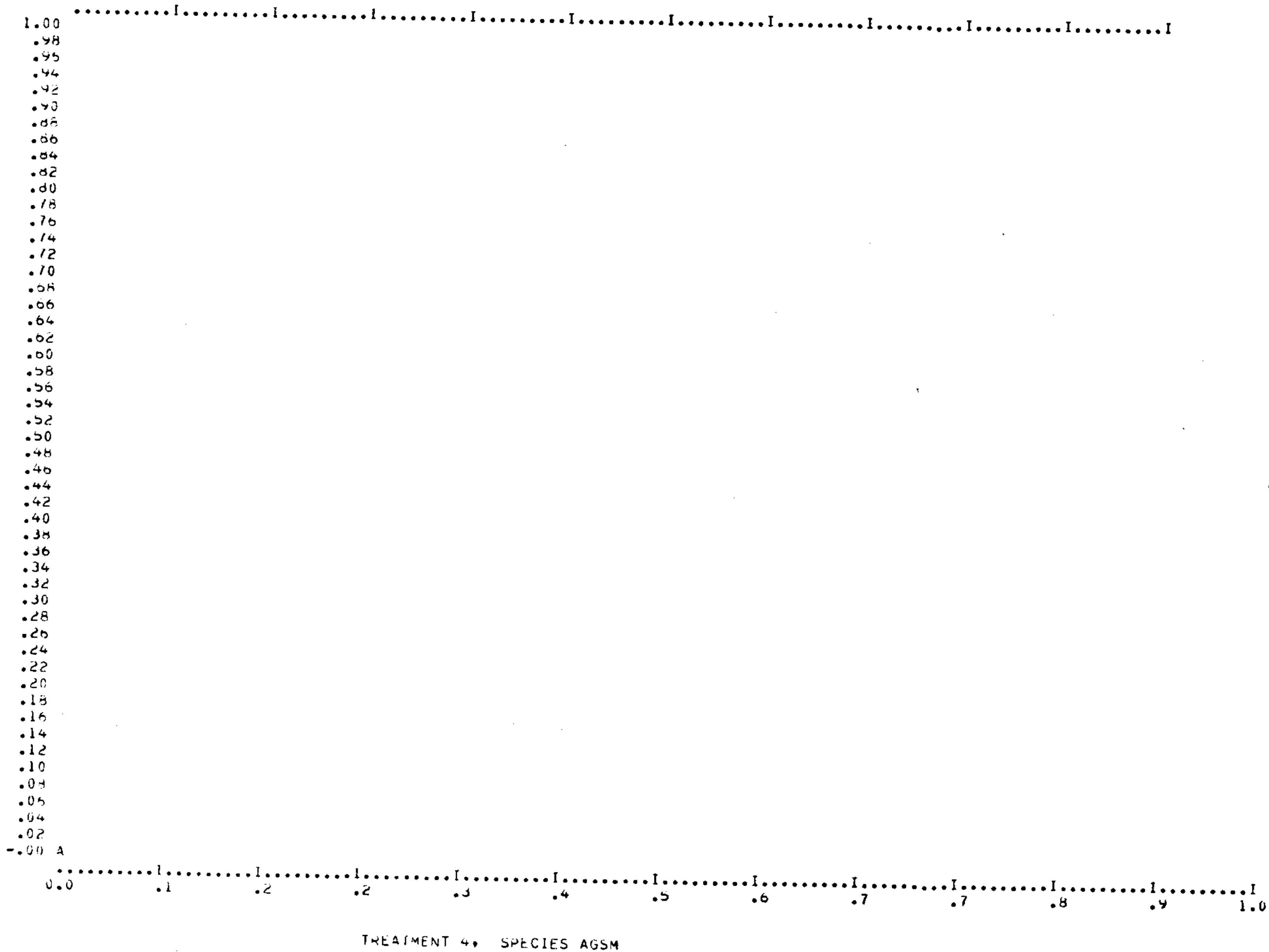


Fig. 1. (Continued)

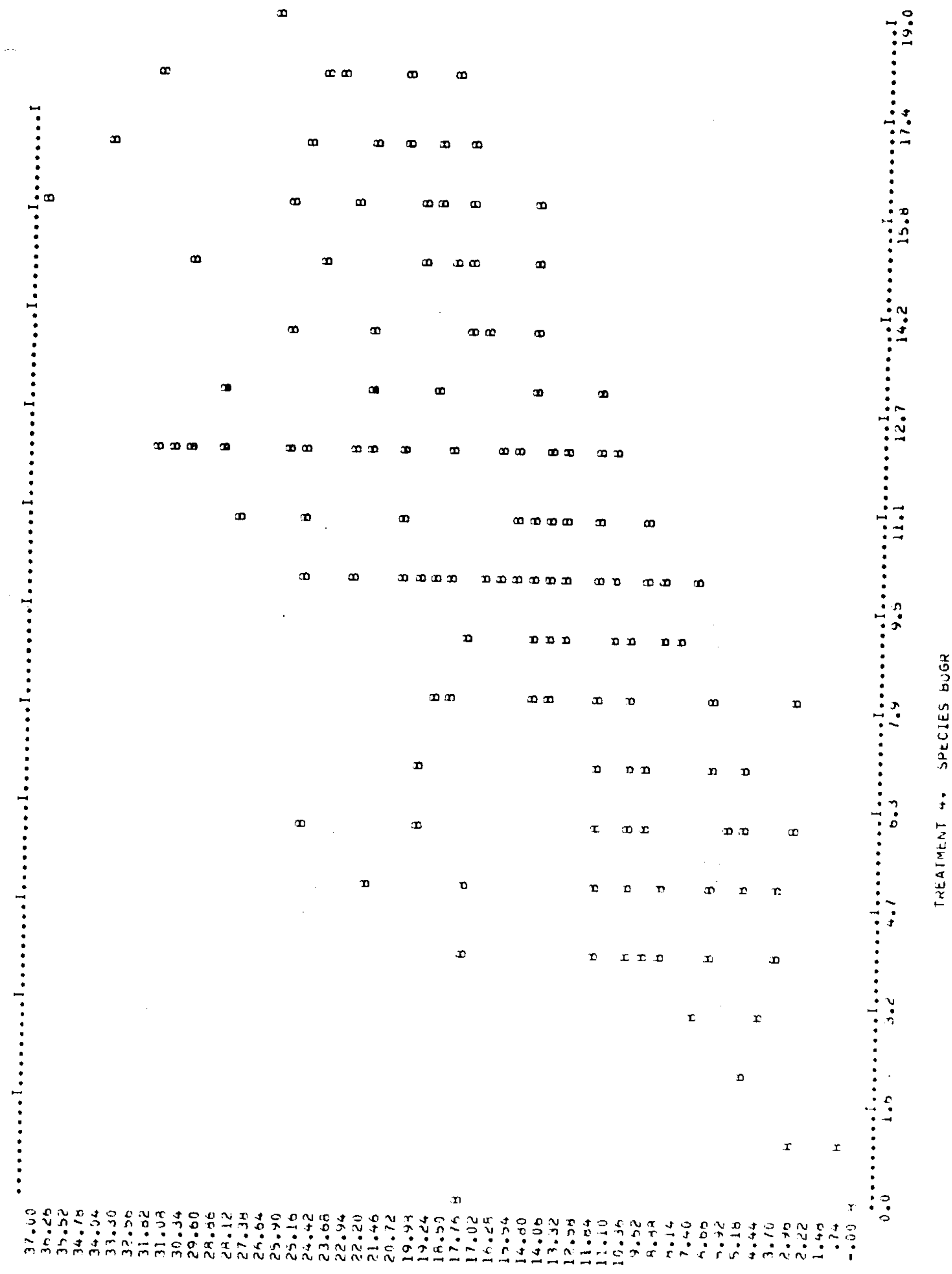
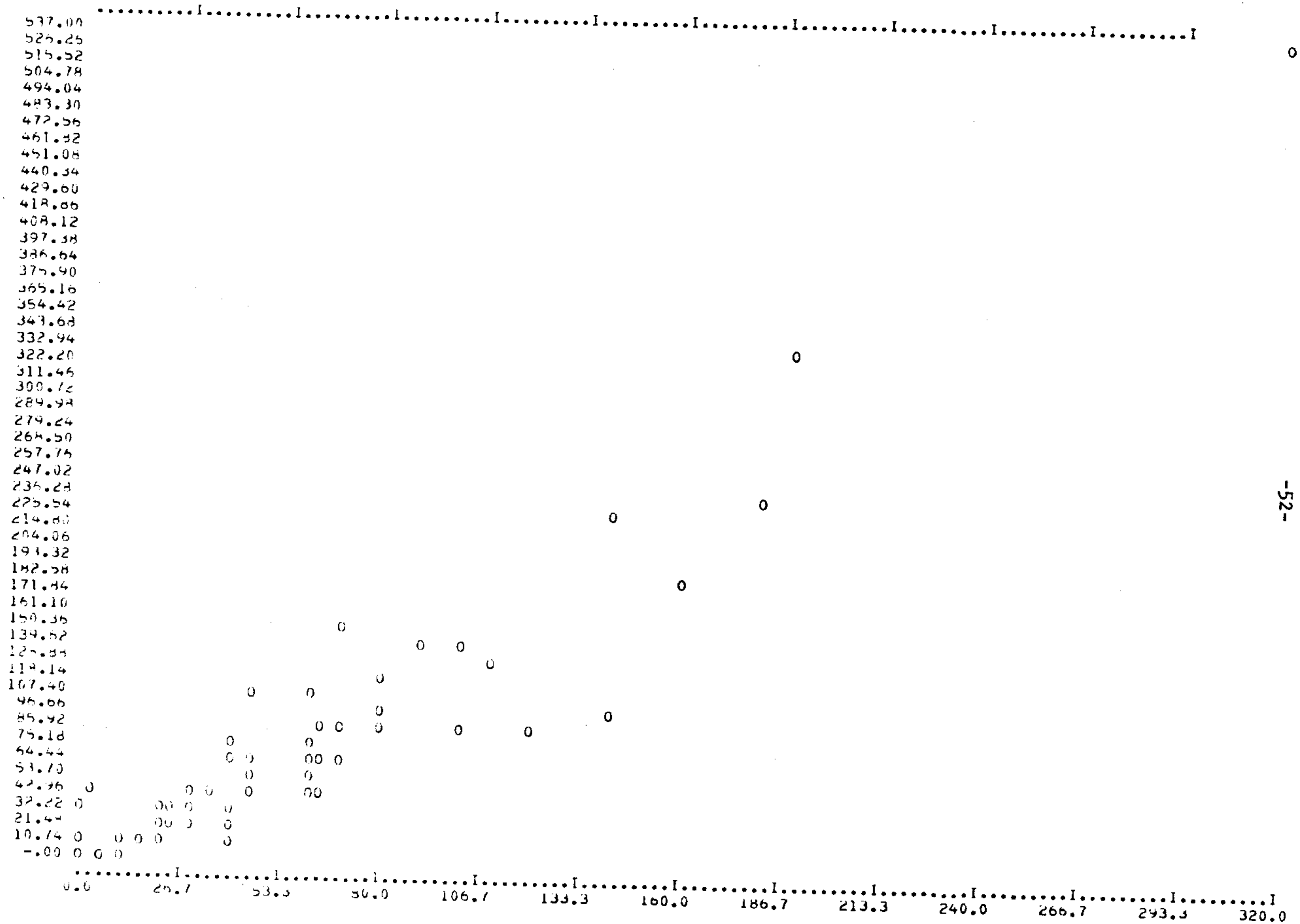


Fig. 1. (Continued)



TREATMENT 4. SPECIES OPPO

Fig. 1. (Continued)

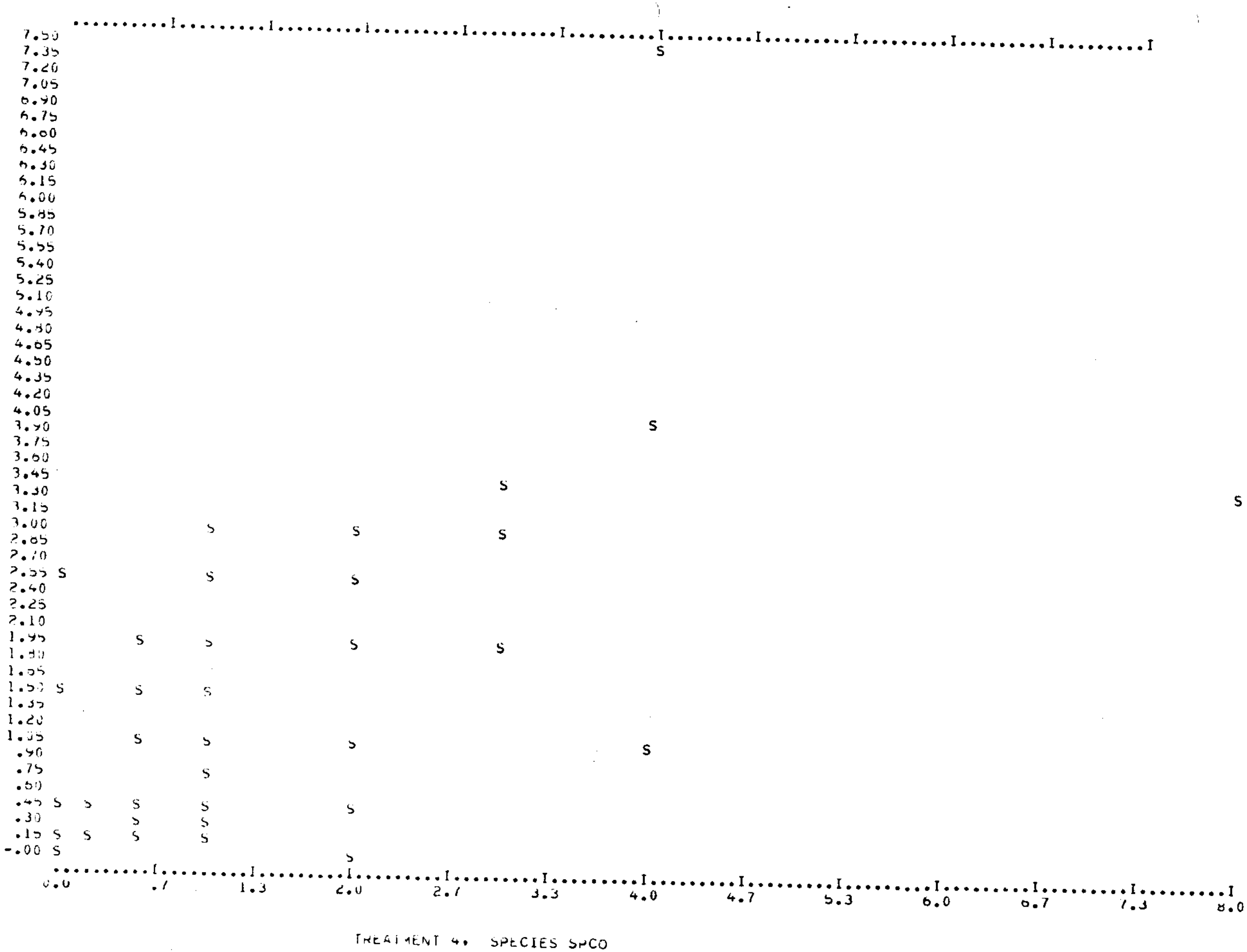


Fig. 1. (Continued)

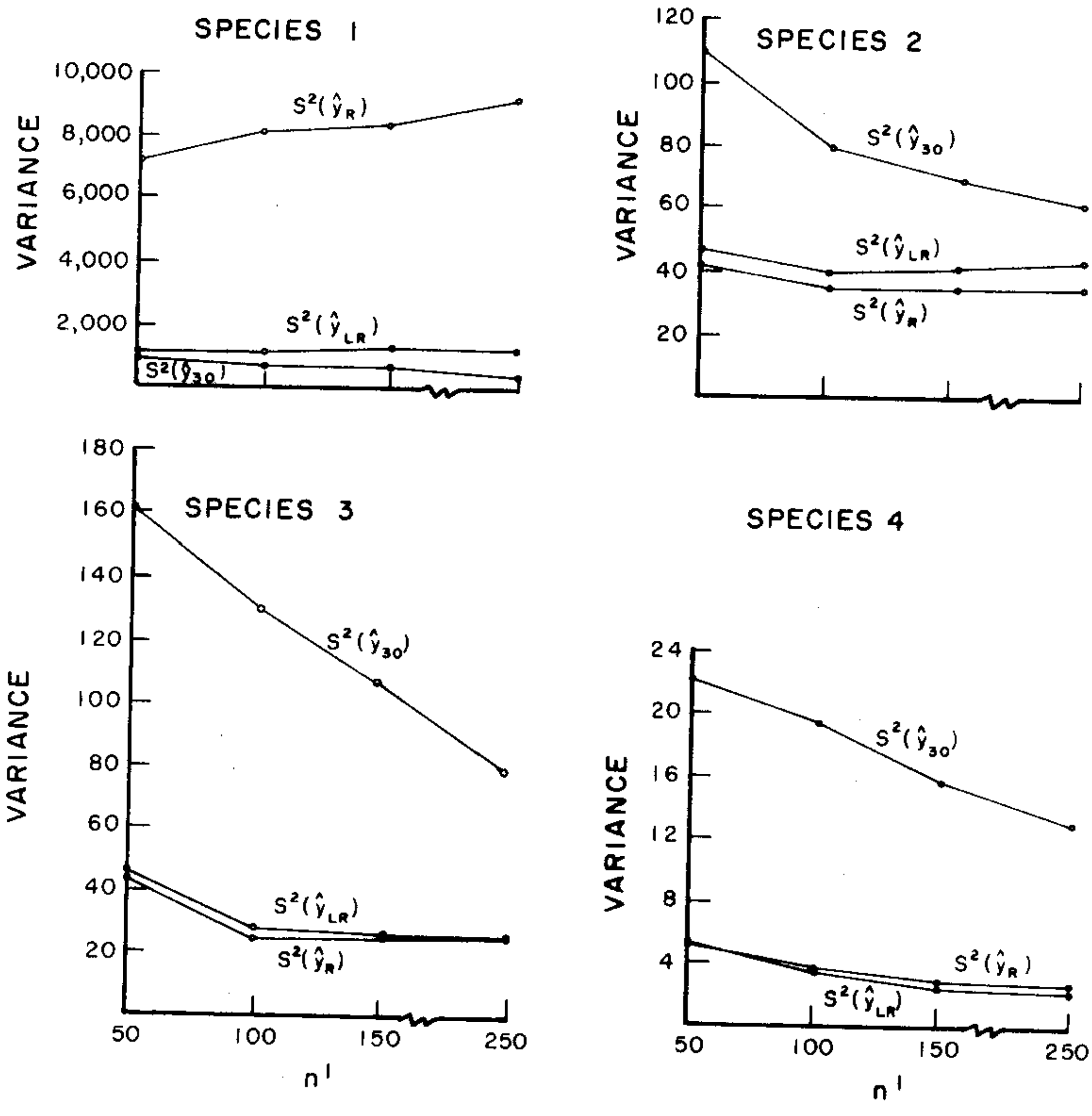


Fig. 2a. Results of weight estimation simulation run 1, for n = 5.

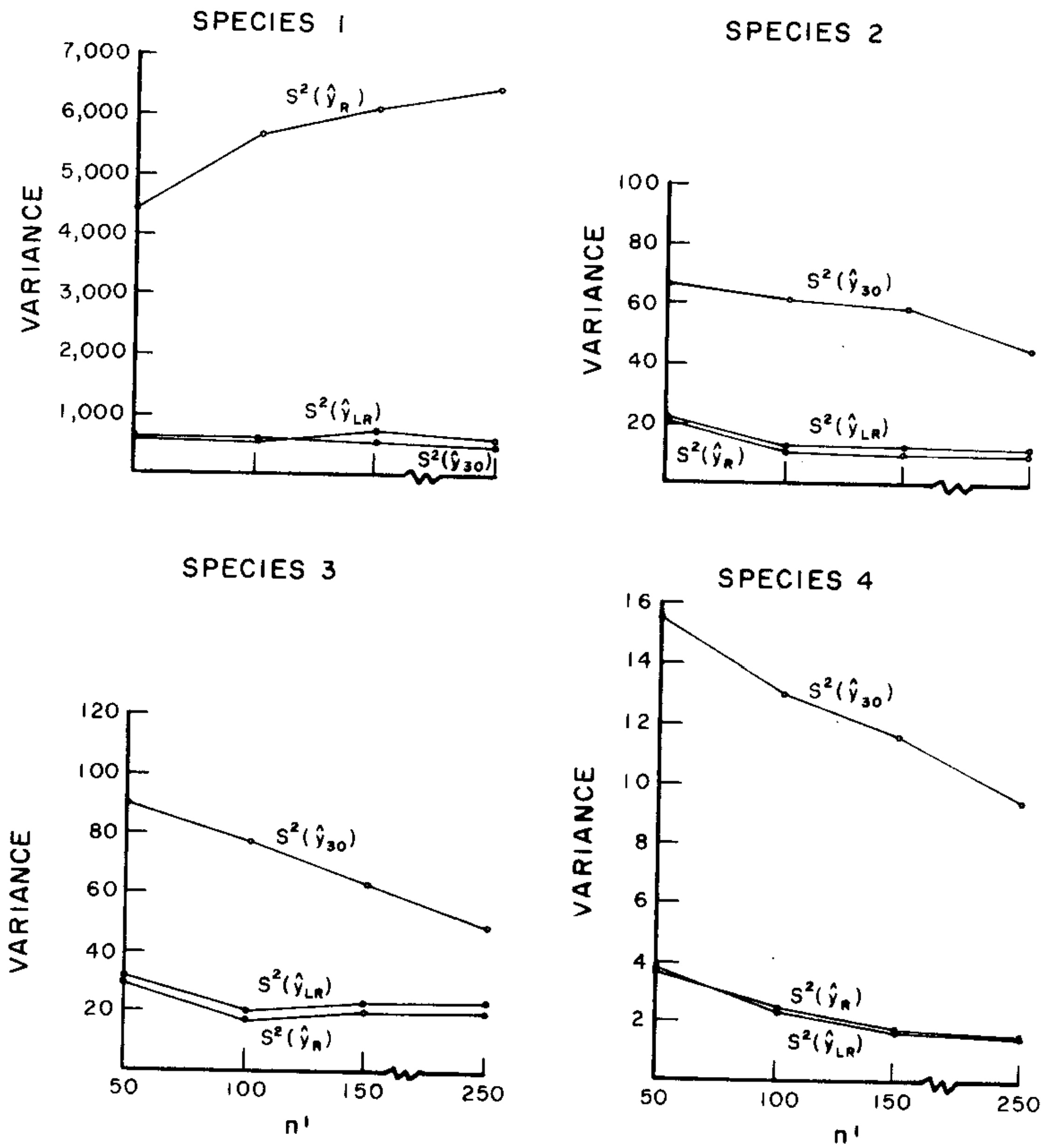


Fig. 2b. Results of weight estimation simulation run 1, for n = 10.

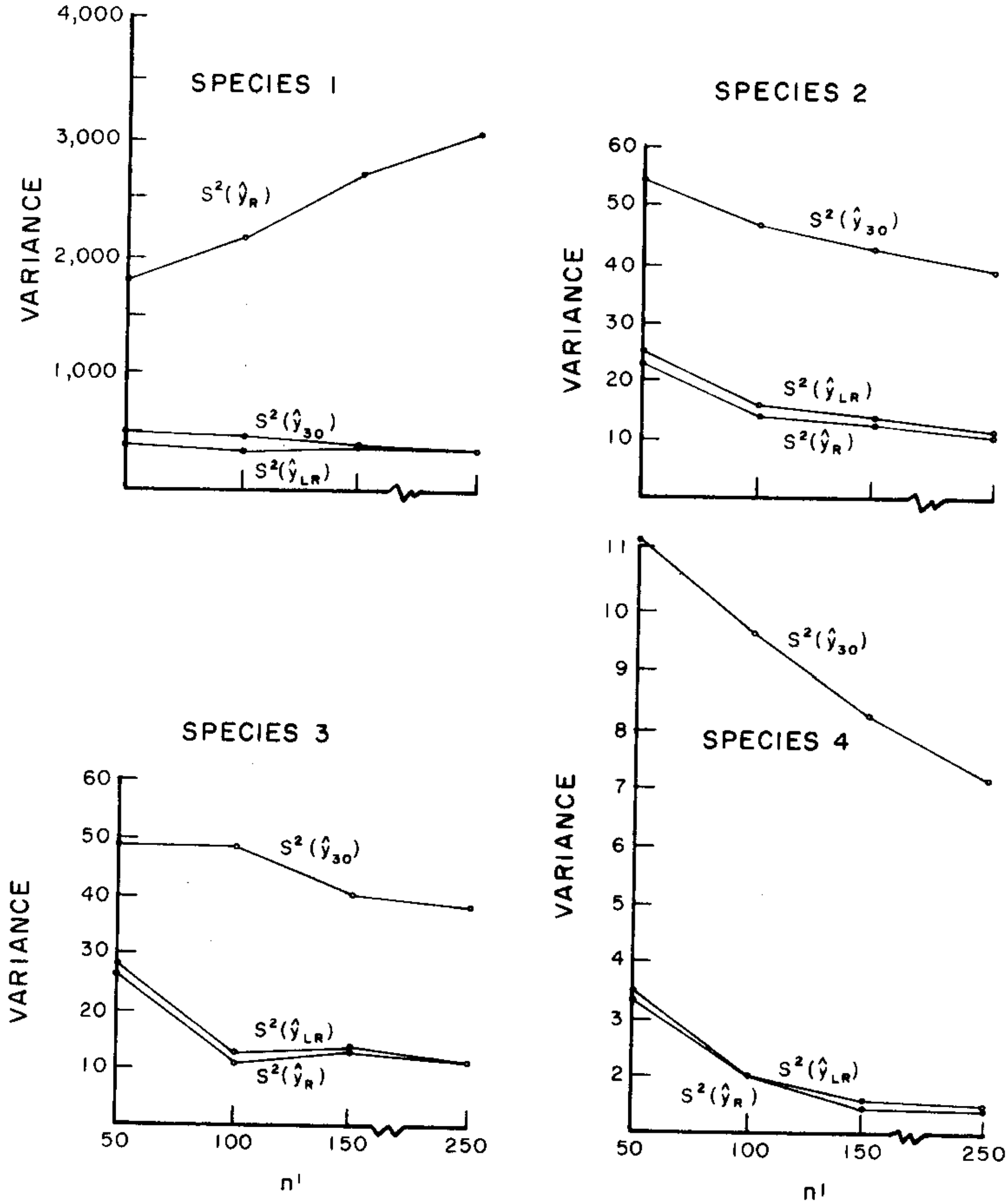


Fig. 2c. Results of weight estimation simulation run 1, for n = 15.

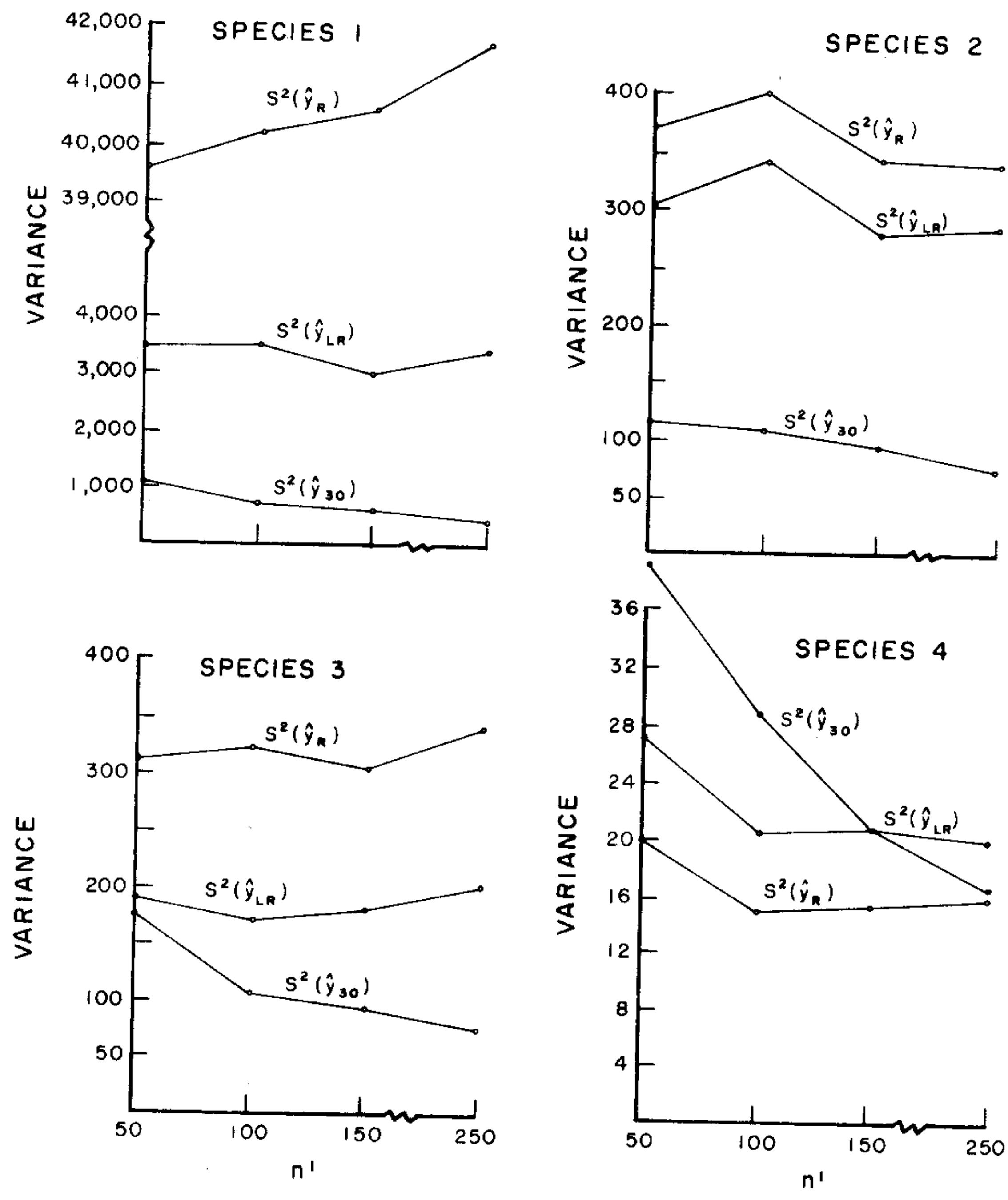


Fig. 3a. Results of weight estimation simulation run 2, for n = 5.

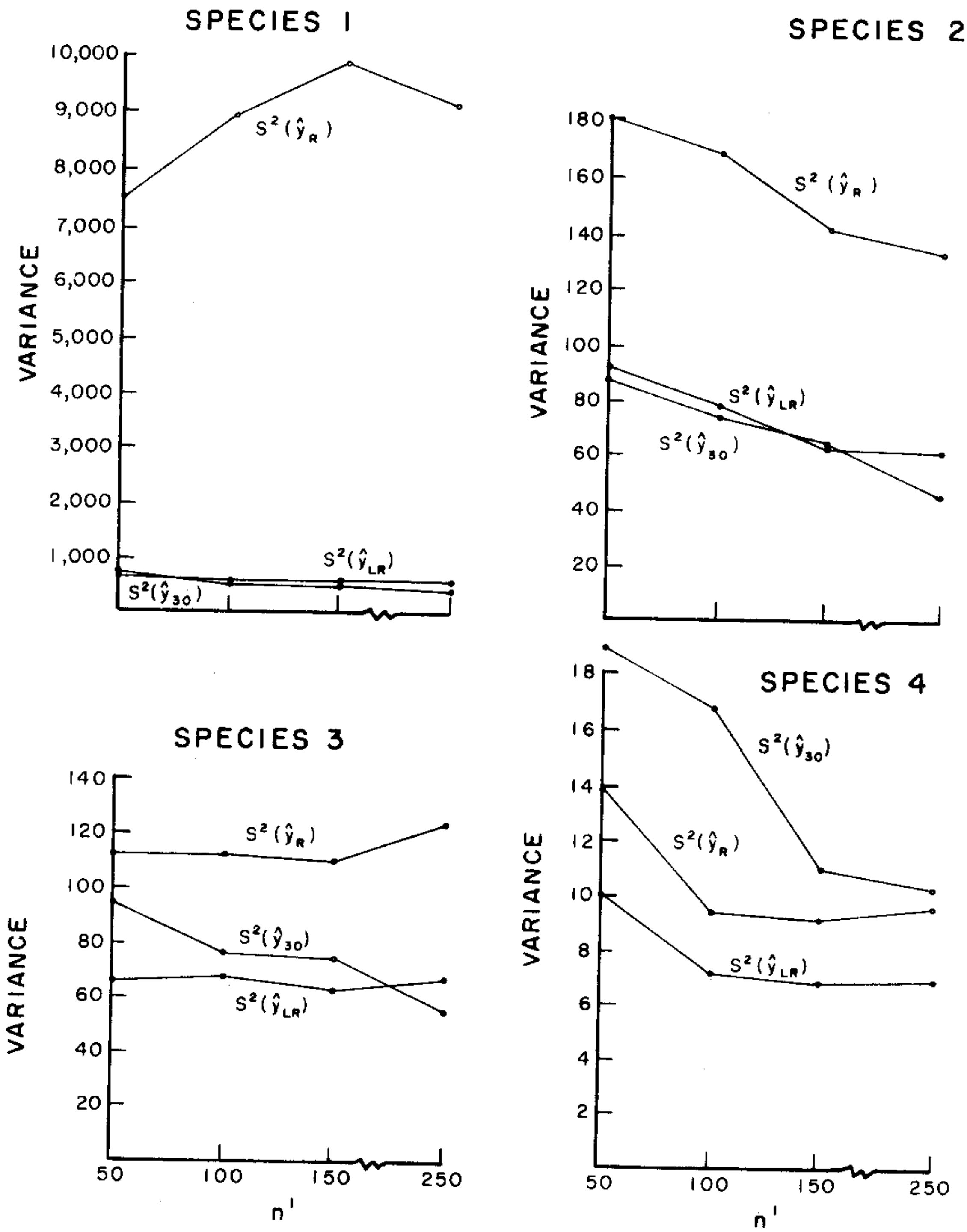


Fig. 3b. Results of weight estimation simulation run 2, for n = 10.

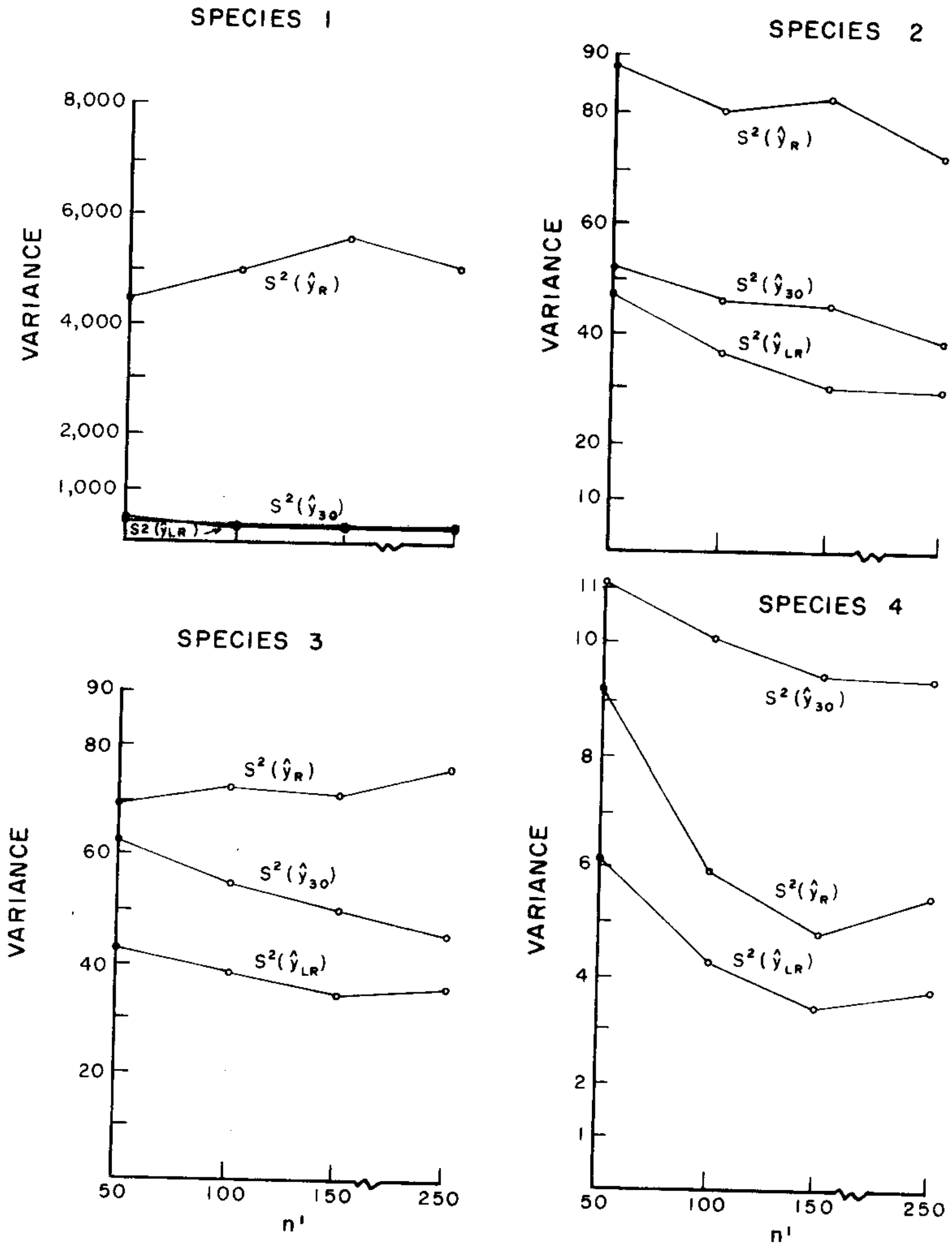


Fig. 3c. Results of weight estimation simulation run 2, for n = 15.

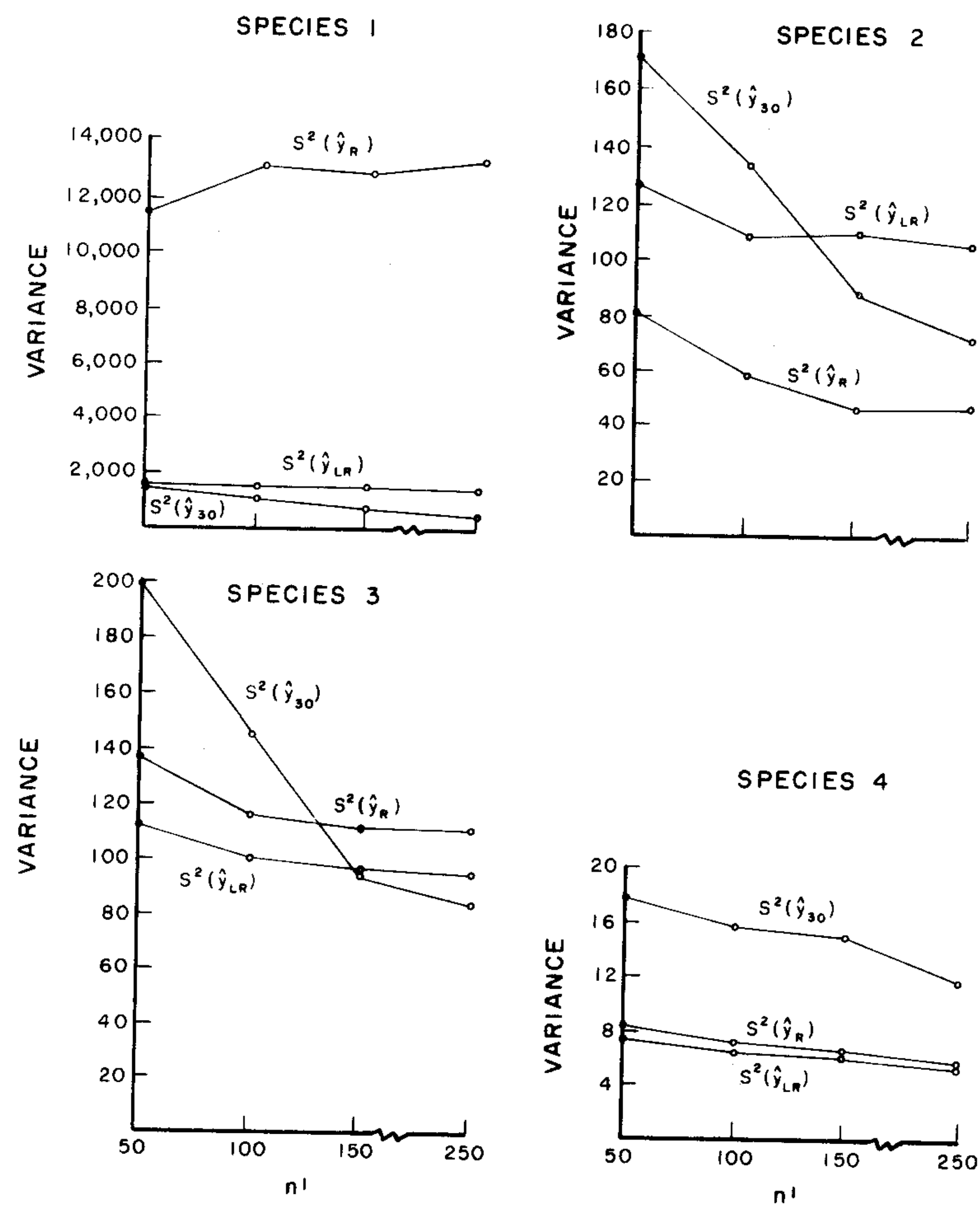


Fig. 4a. Results of weight estimation simulation run 3, for n = 5.

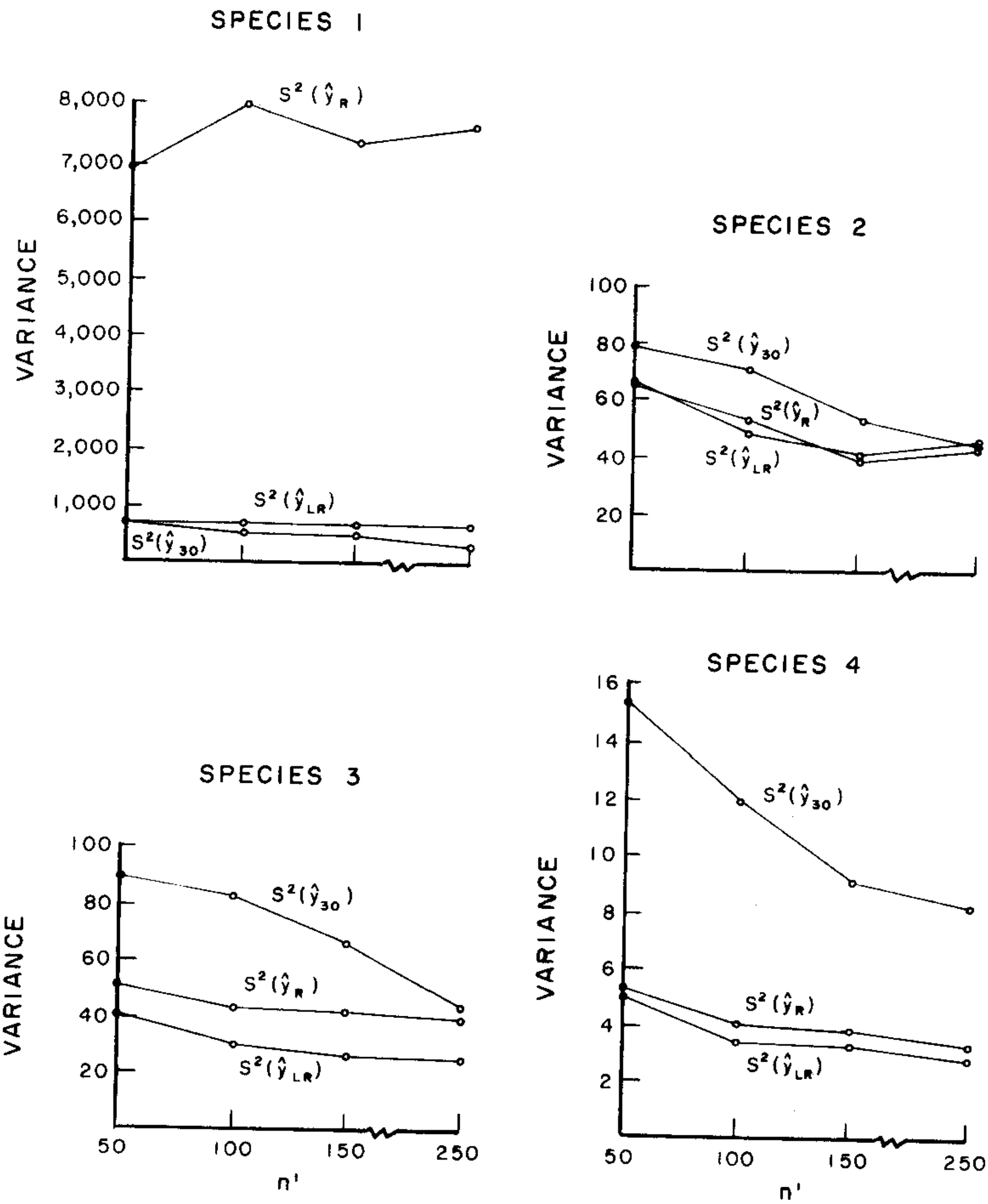


Fig. 4b. Results of weight estimation simulation run 3, for n = 10.

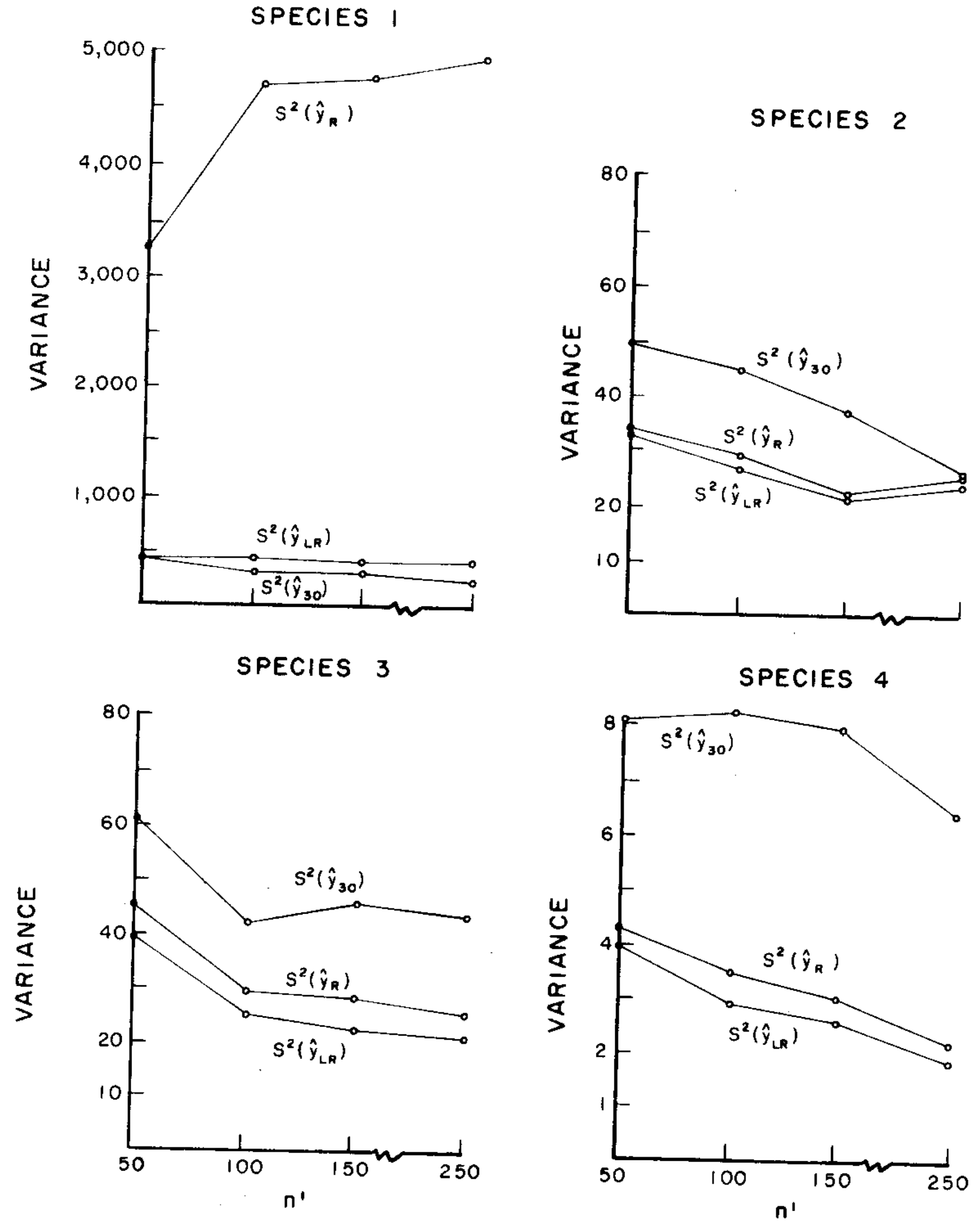


Fig. 4c. Results of weight estimation simulation run 3, for n = 15.

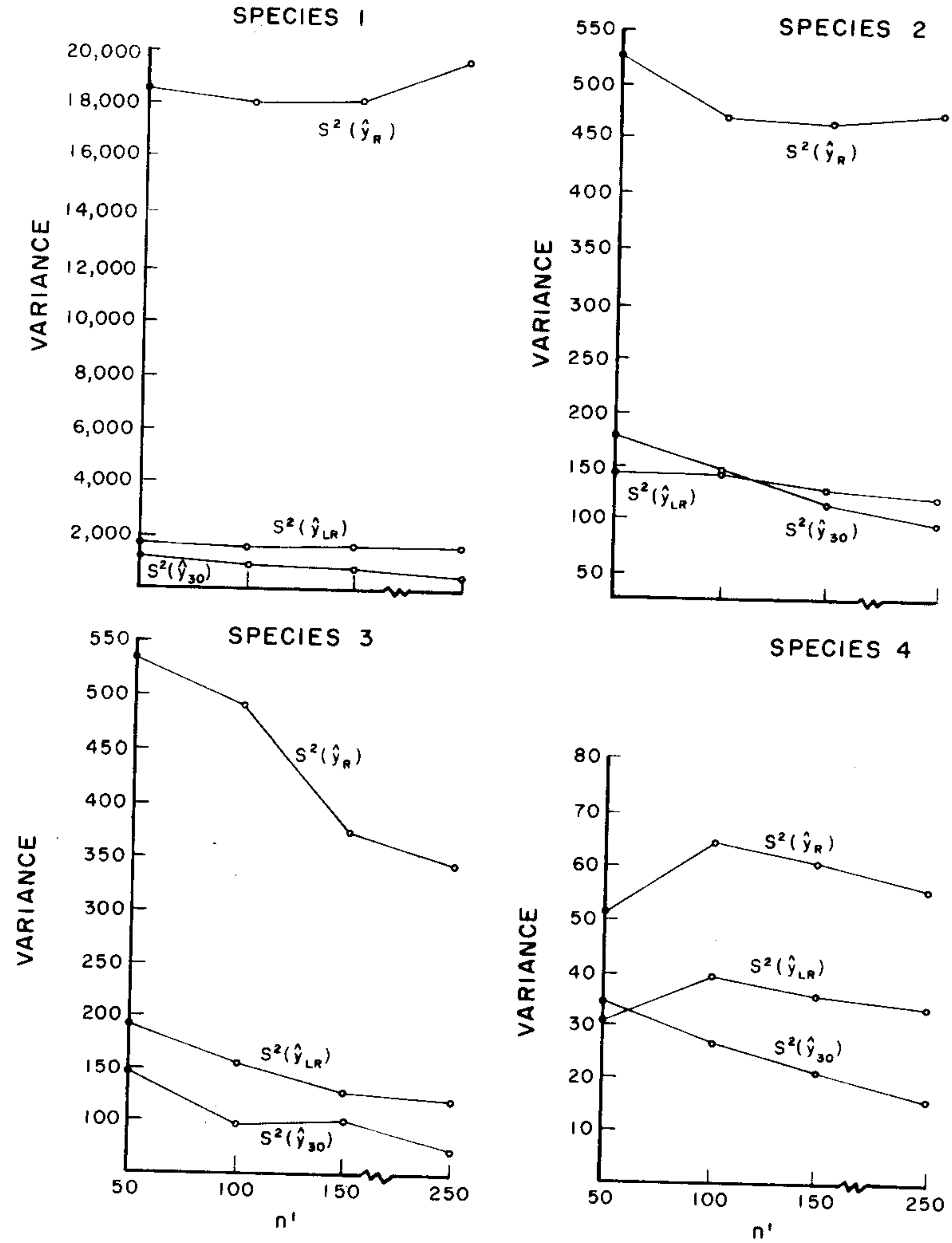


Fig. 5a. Results of weight estimation simulation run 4, for n = 5.

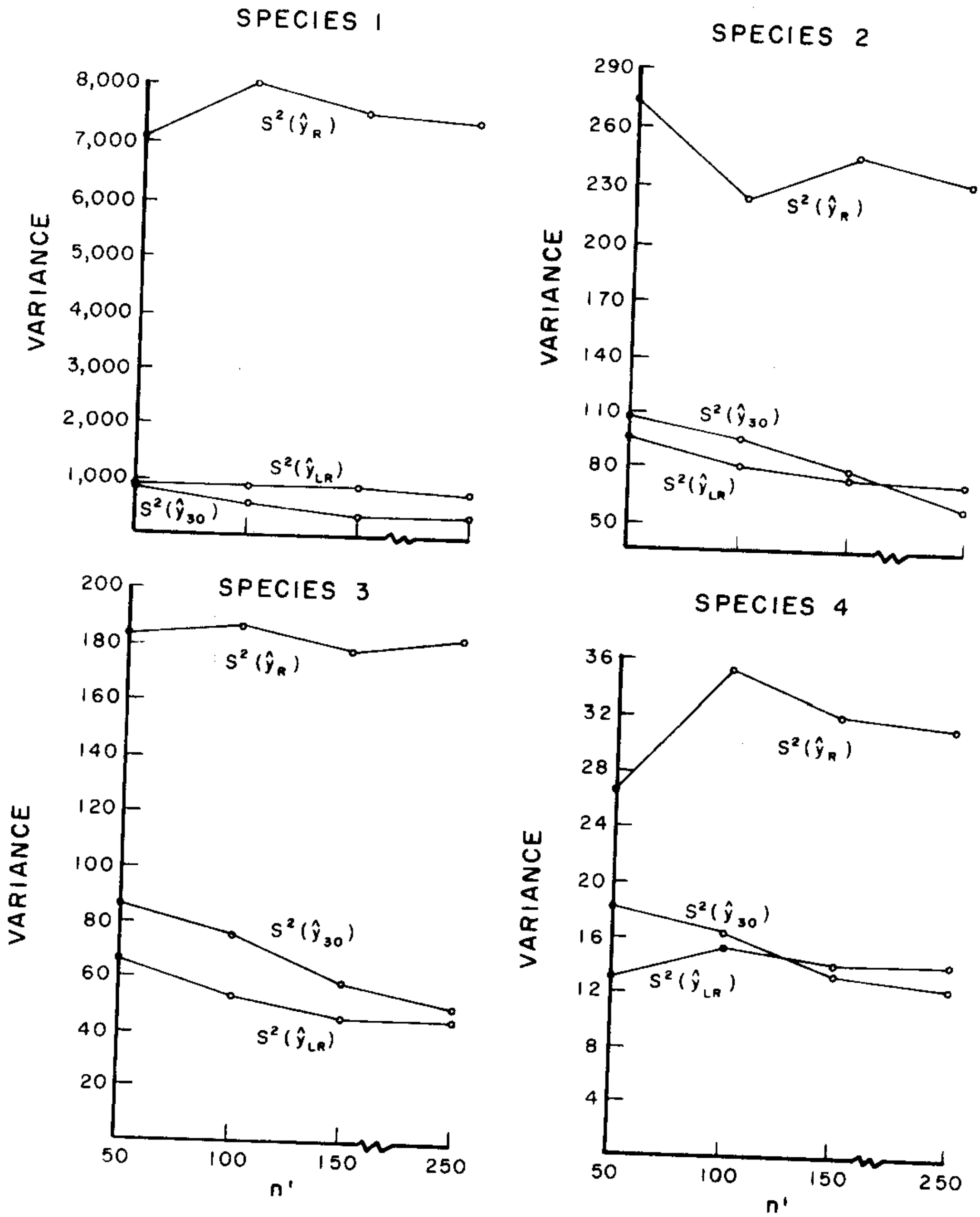


Fig. 5b. Results of weight estimation simulation run 4, for n = 10.

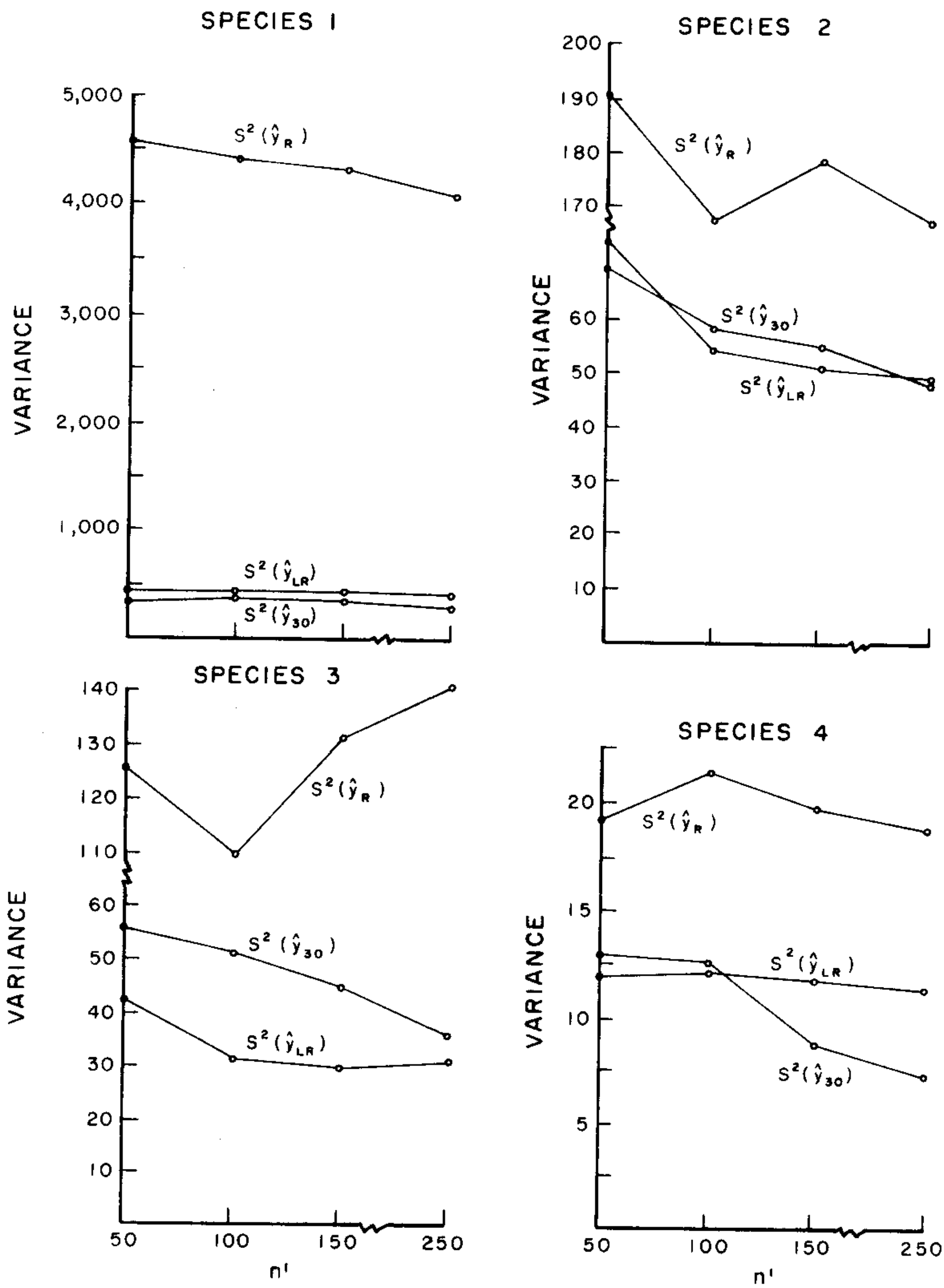


Fig. 5c. Results of weight estimation simulation run 4, for n = 15.

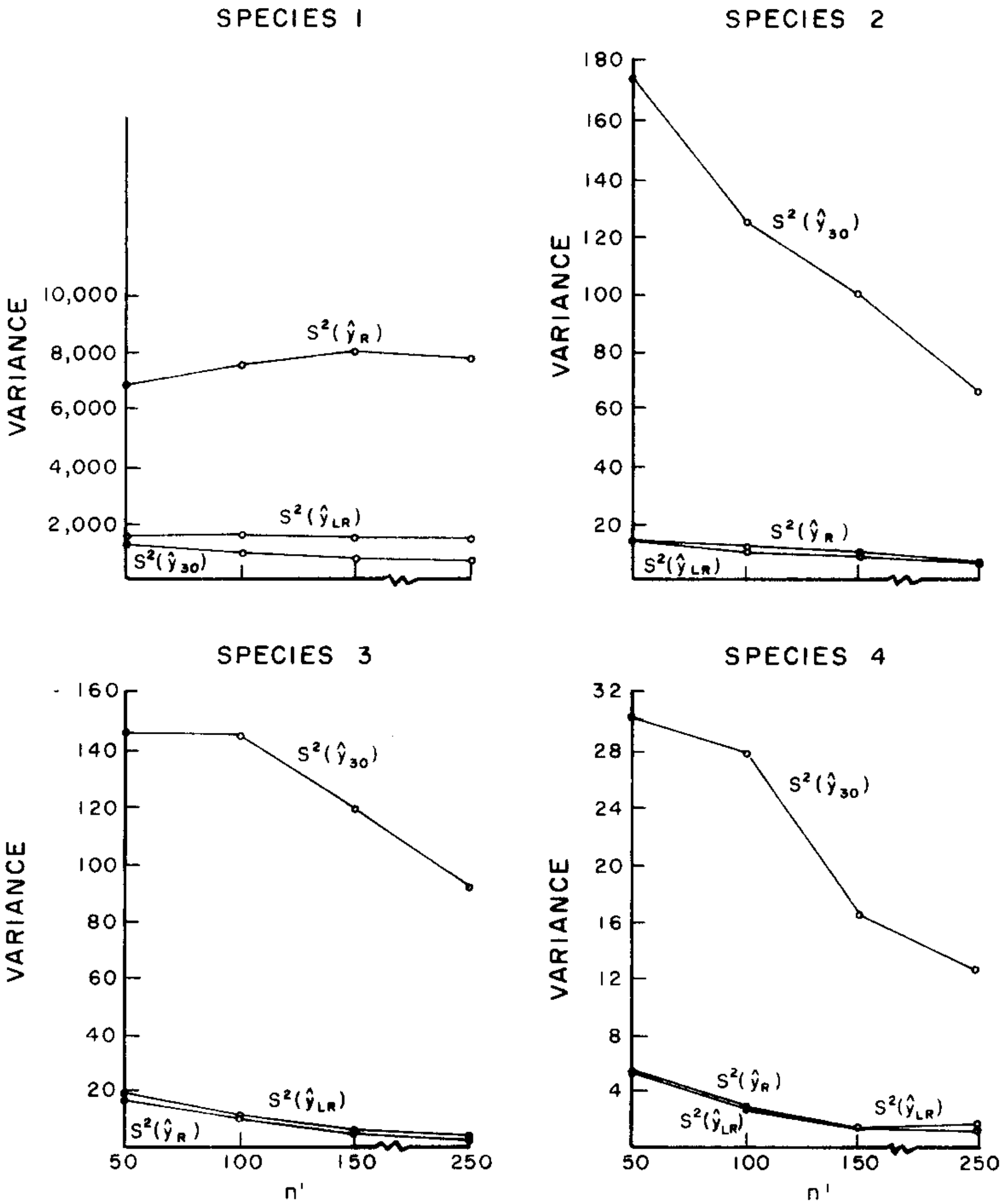


Fig. 6a. Results of weight estimation simulation run 5, for n = 5.

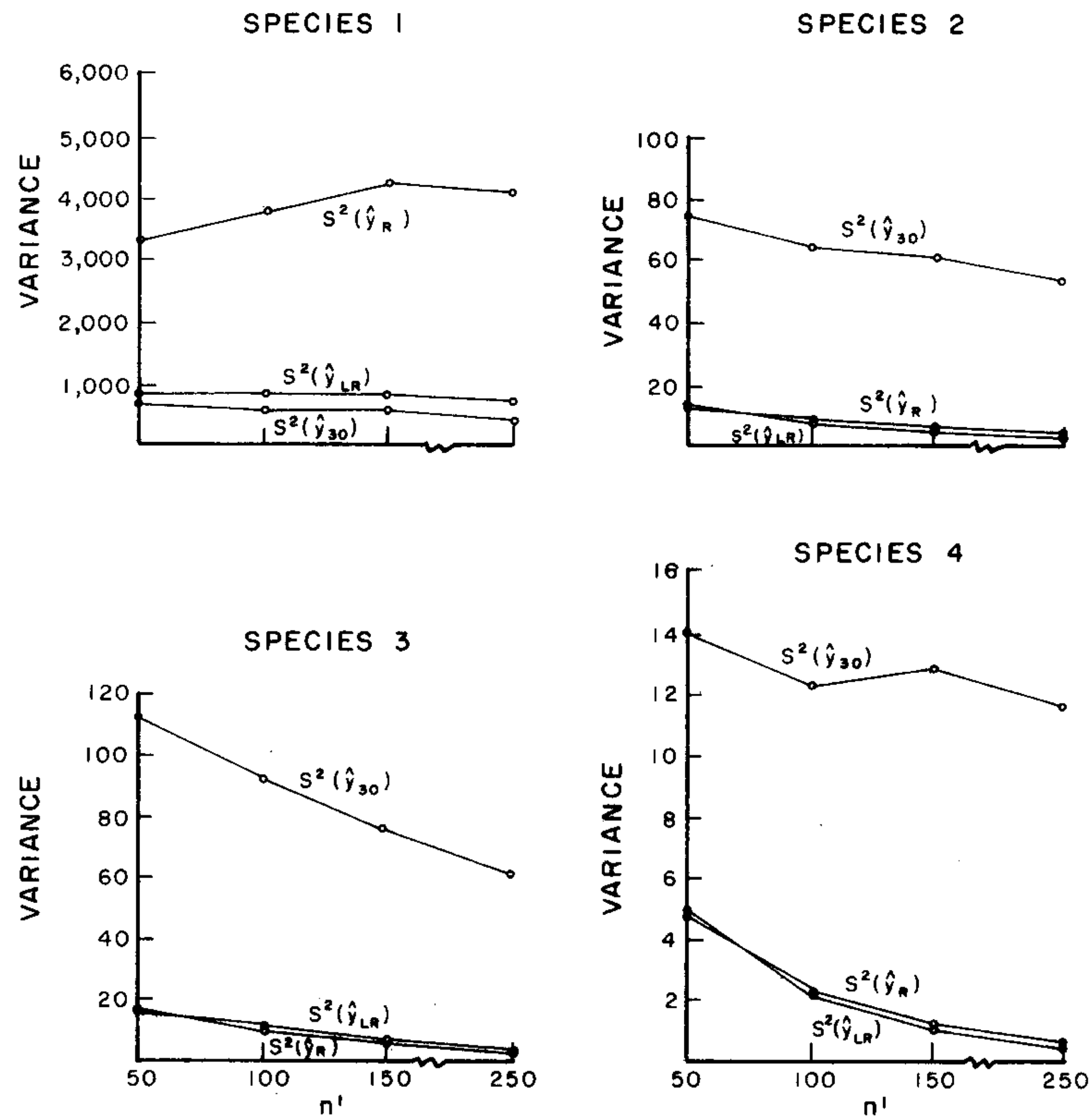


Fig. 6b. Results of weight estimation simulation run 5, for n = 10.

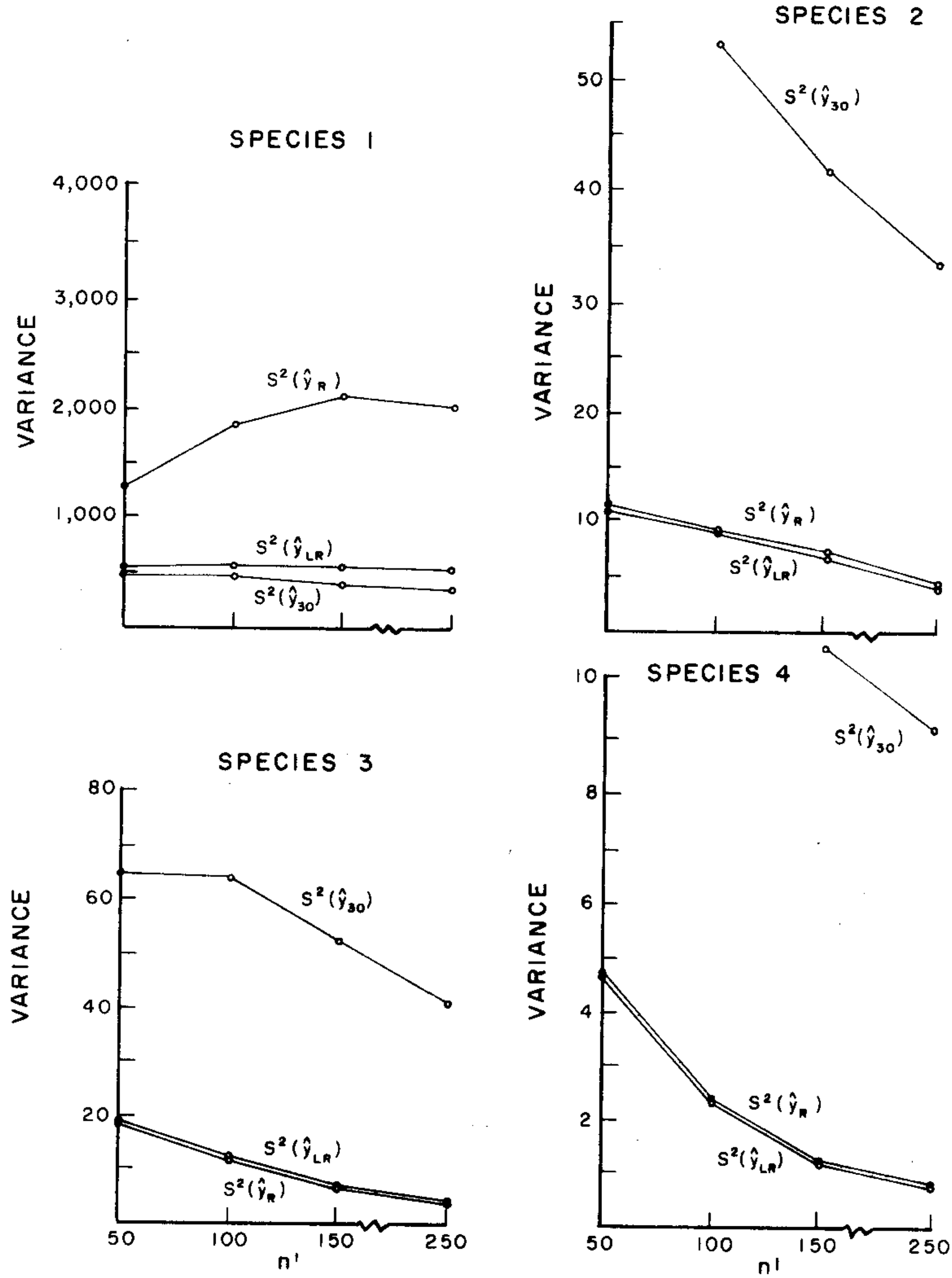


Fig. 6c. Results of weight estimation simulation run 5, for n = 15.

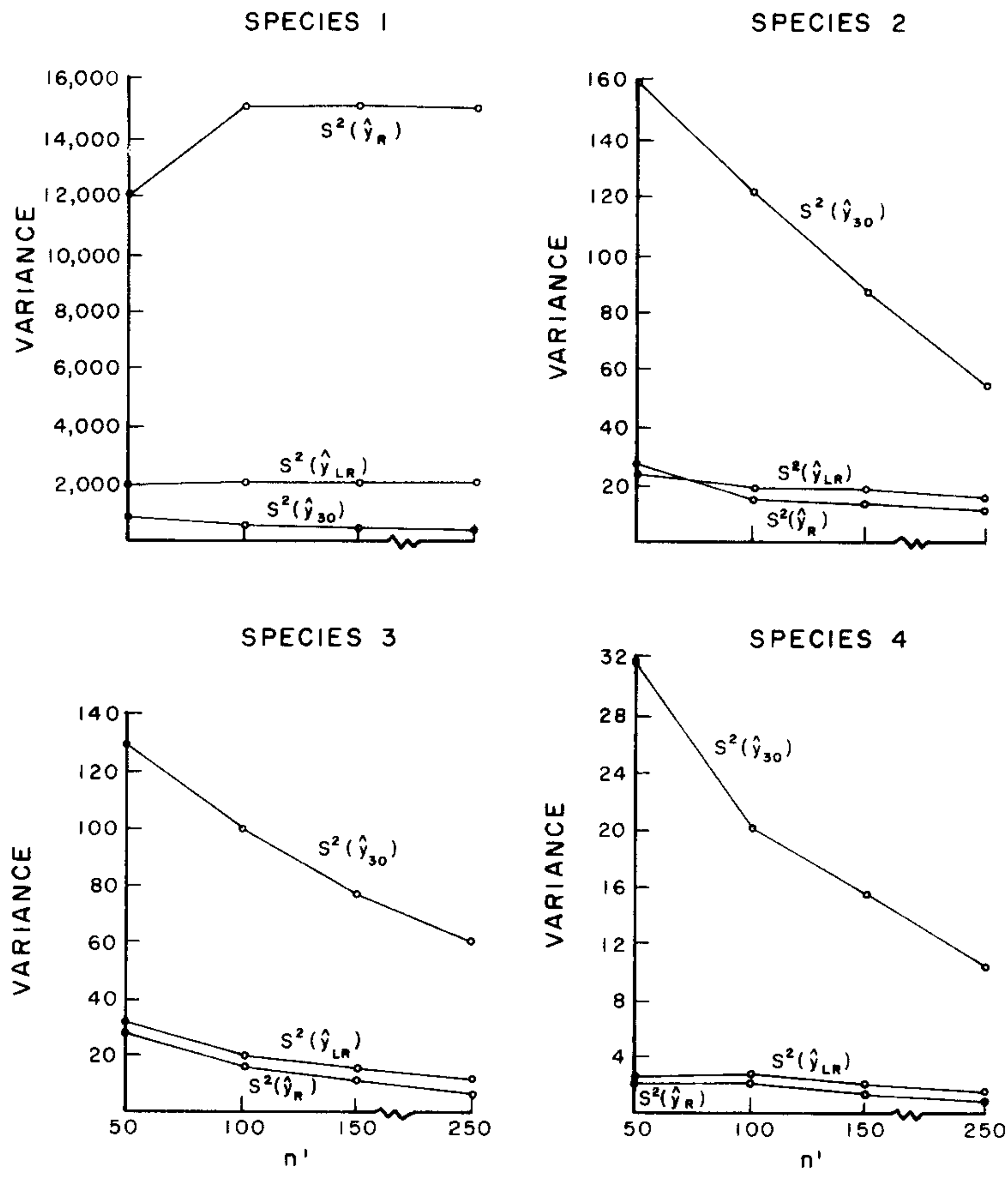


Fig. 7a. Results of weight estimation simulation run 6, for n = 5.

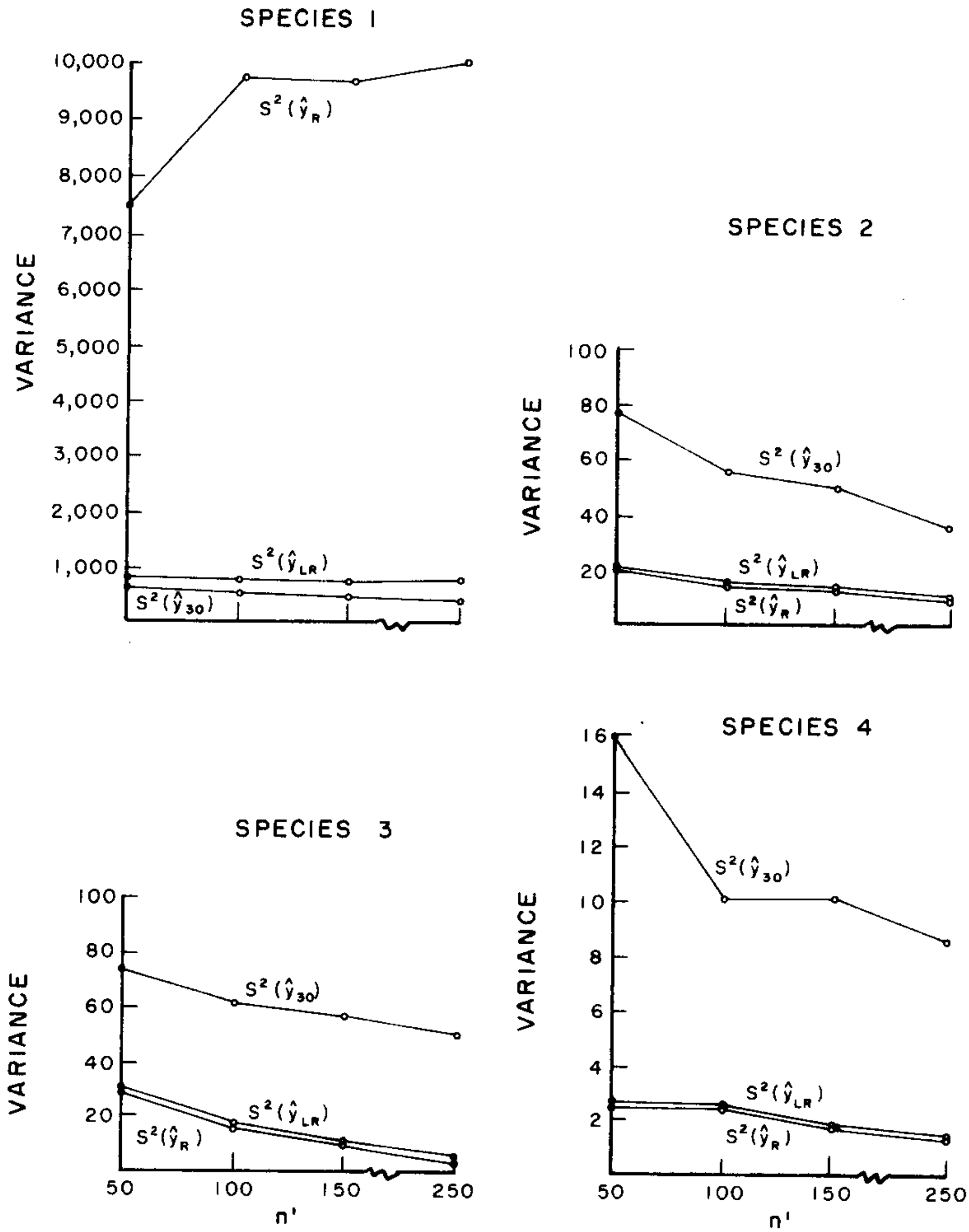


Fig. 7b. Results of weight estimation simulation run 6, for n = 10.

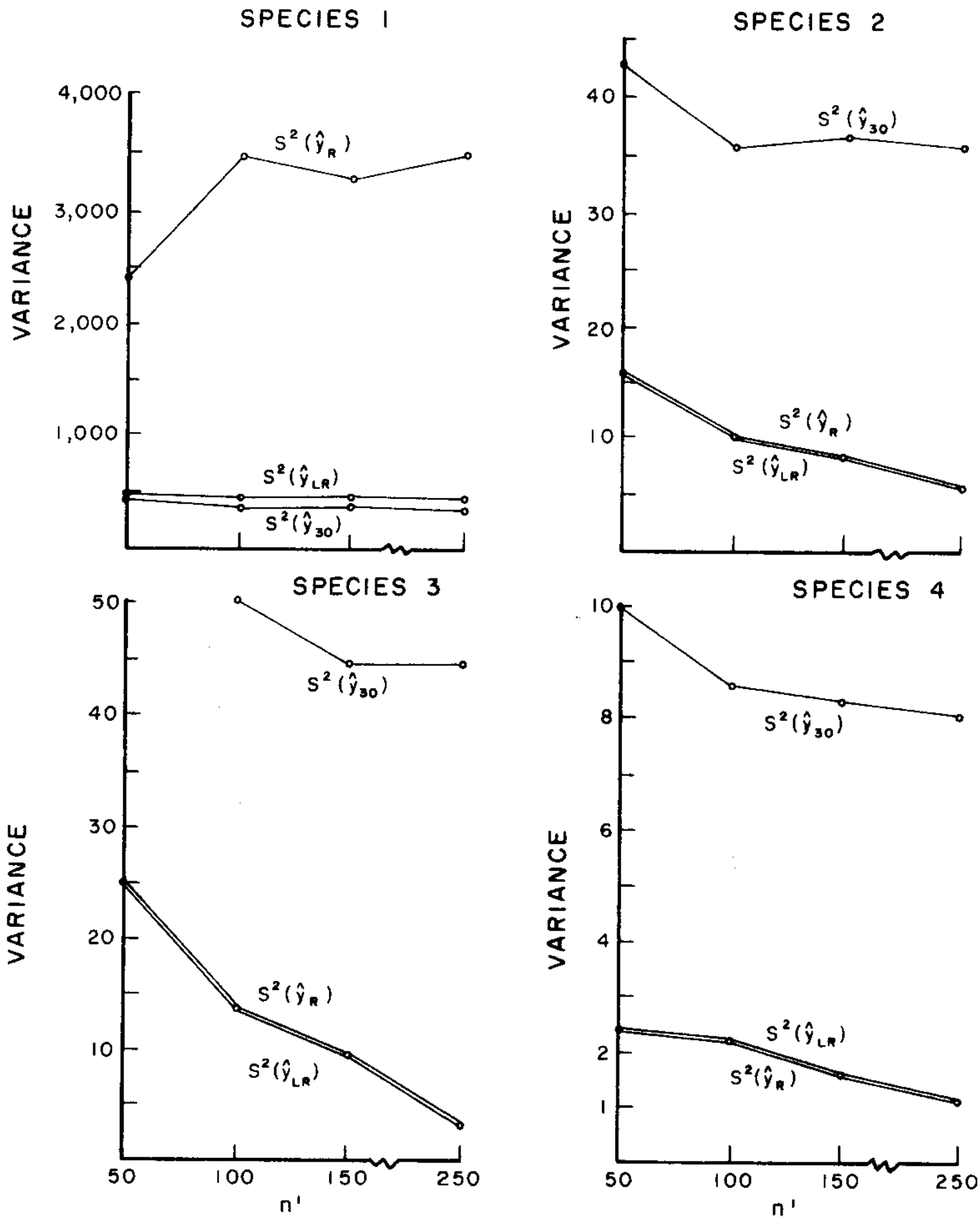


Fig. 7c. Results of weight estimation simulation run 6, for n = 15.

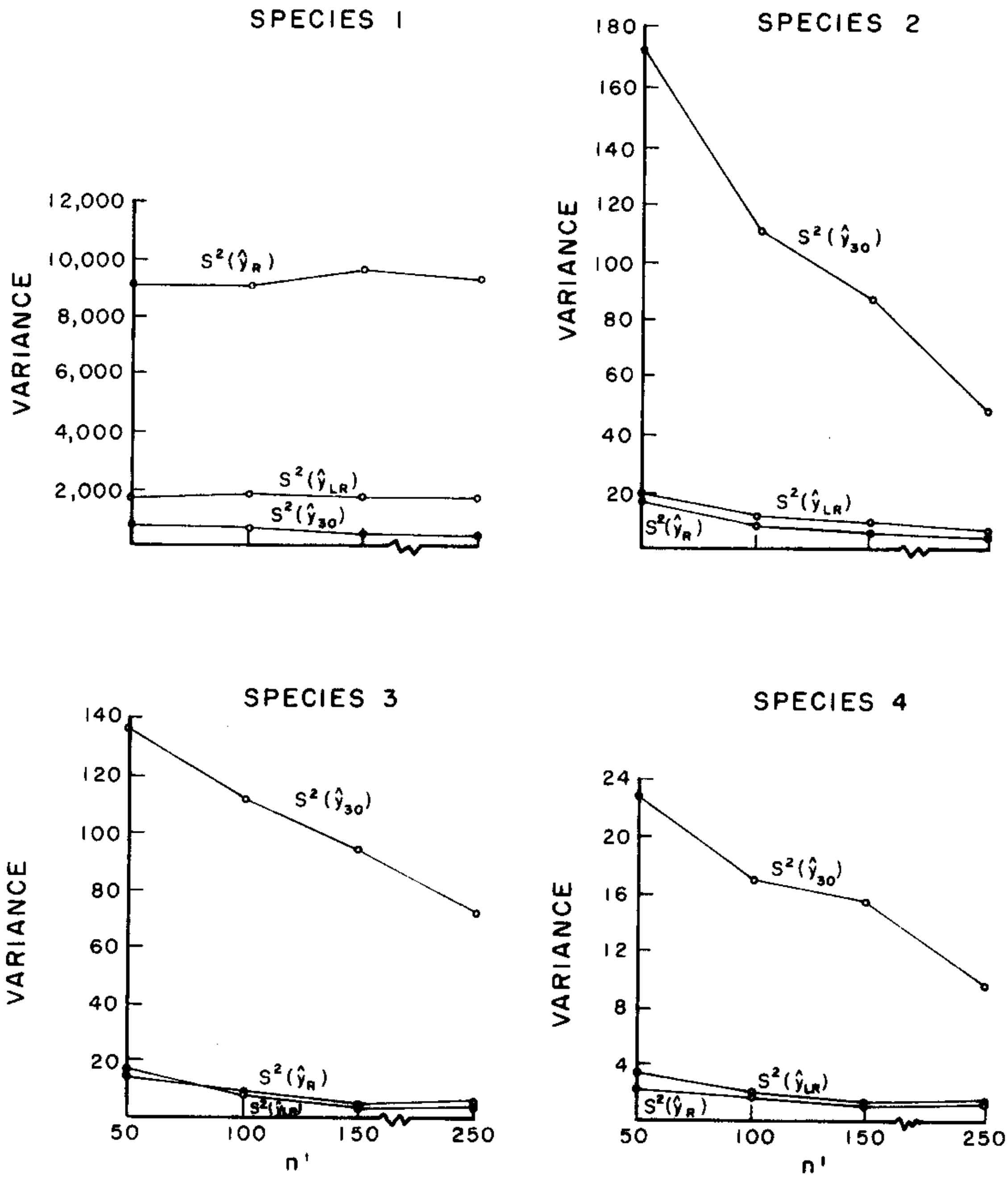


Fig. 8a. Results of weight estimation simulation run 7, for n = 5.

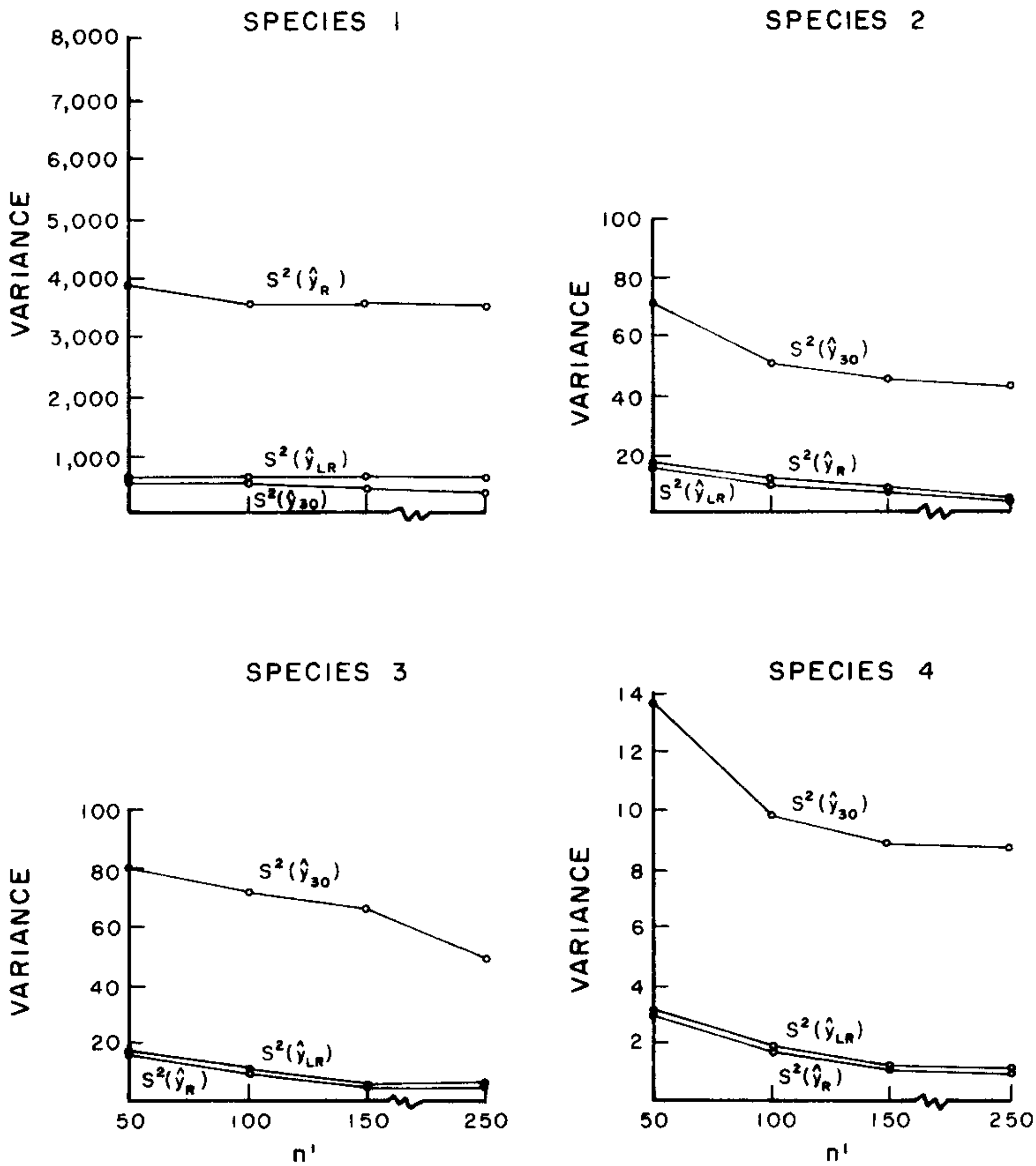


Fig. 8b. Results of weight estimation simulation run 7, for n = 10.

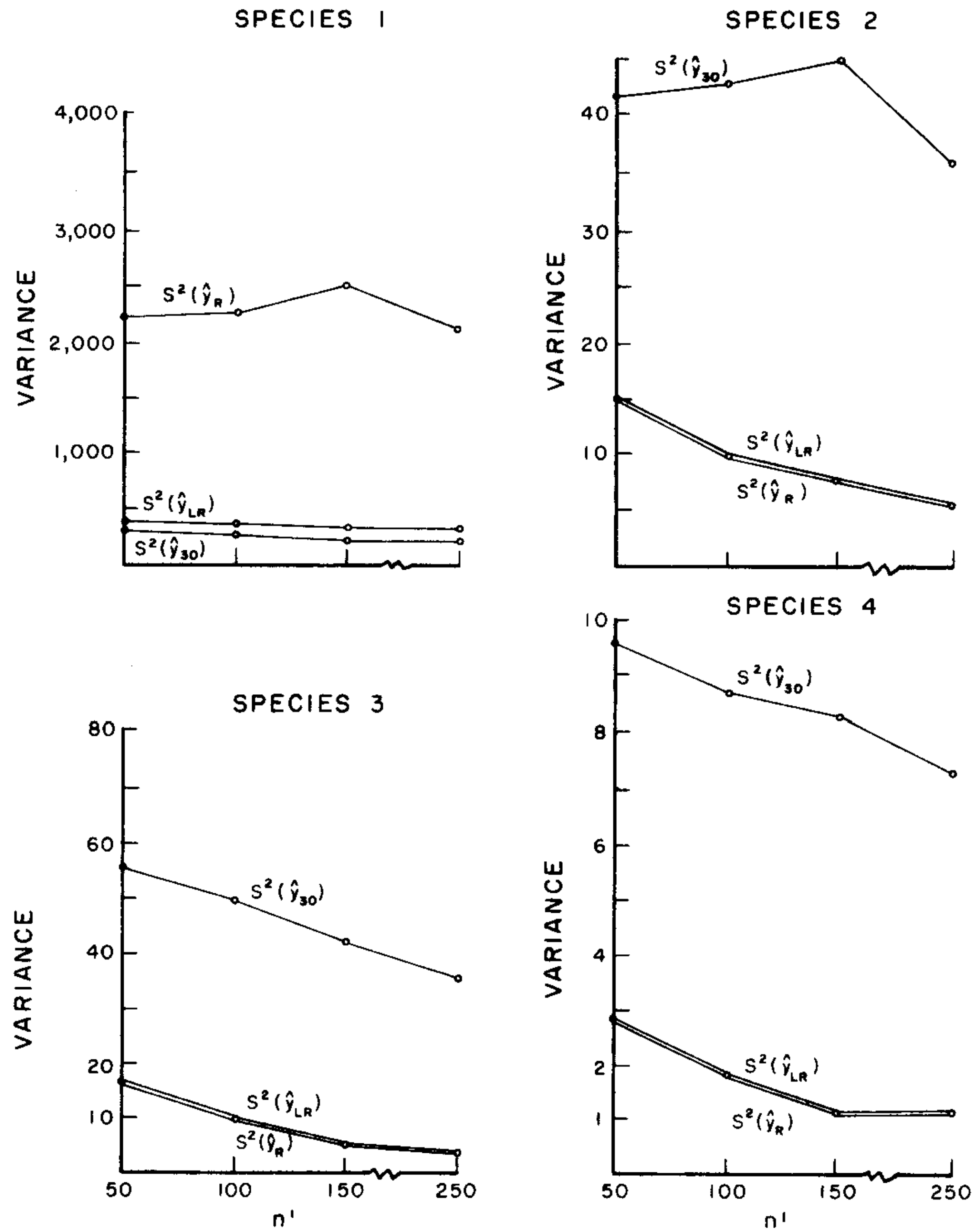


Fig. 8c. Results of weight estimation simulation run 7, for n = 15.

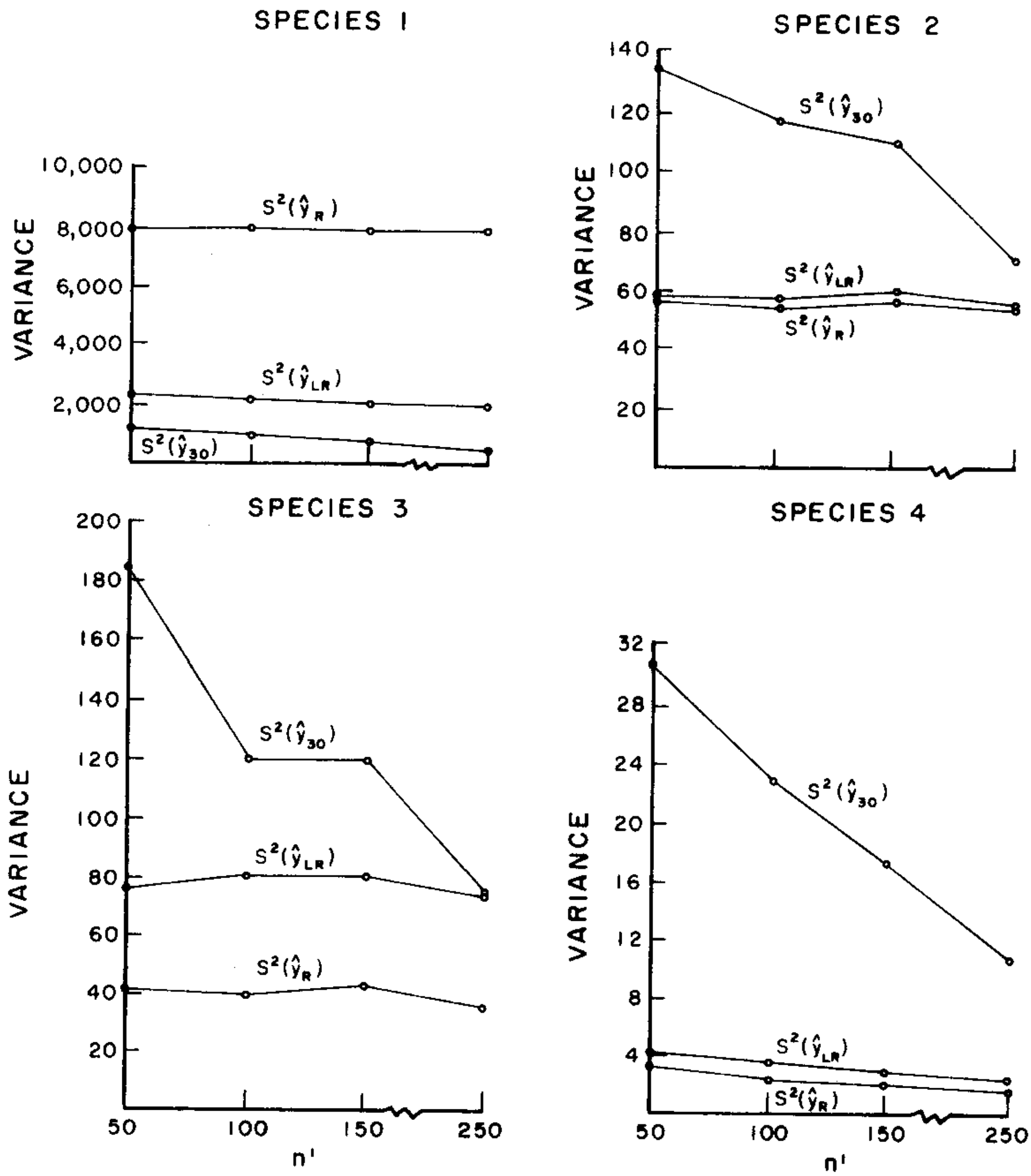


Fig. 9a. Results of weight estimation simulation run 8, for n = 5.

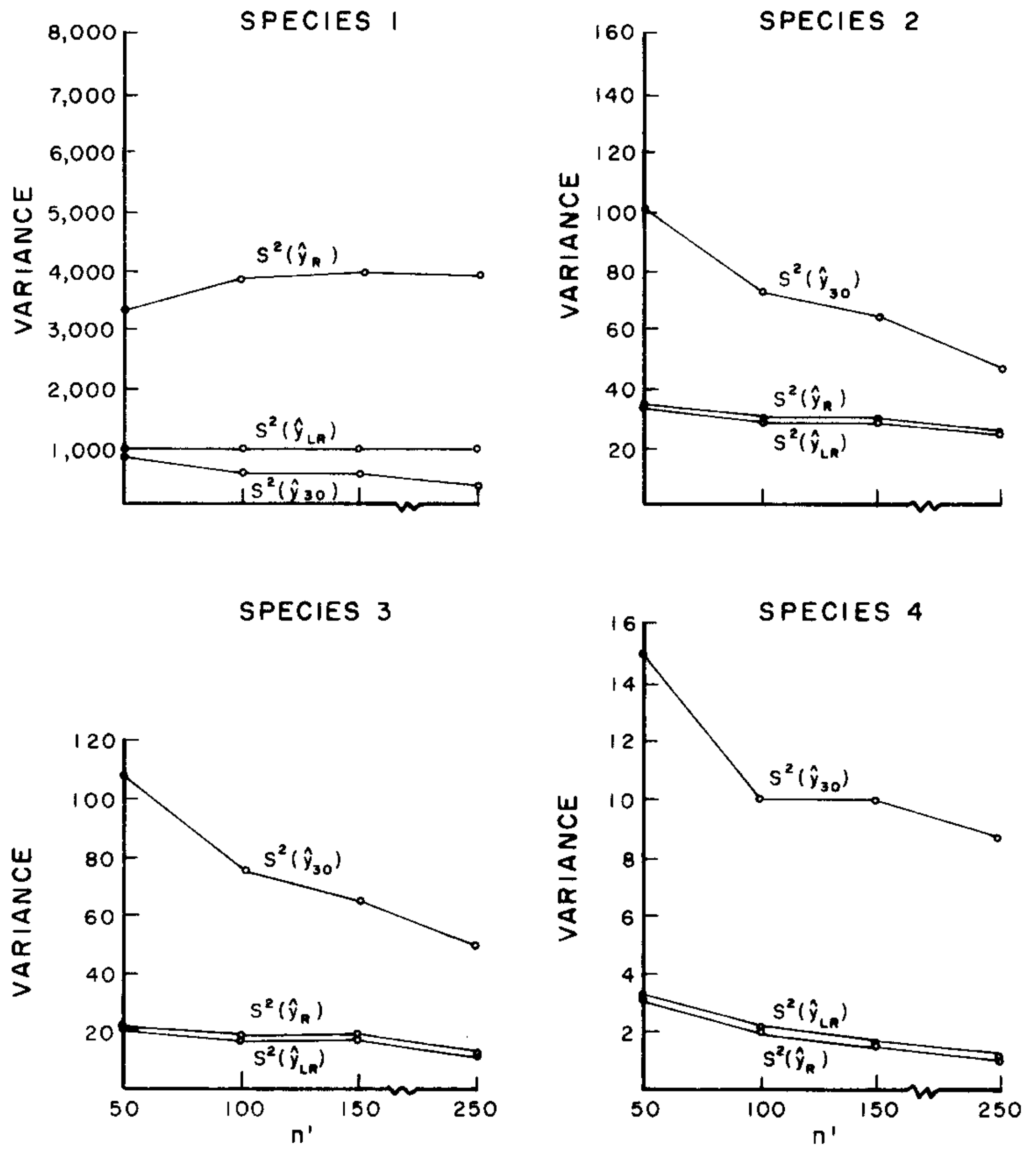


Fig. 9b. Results of weight estimation simulation run 8, for n = 10.

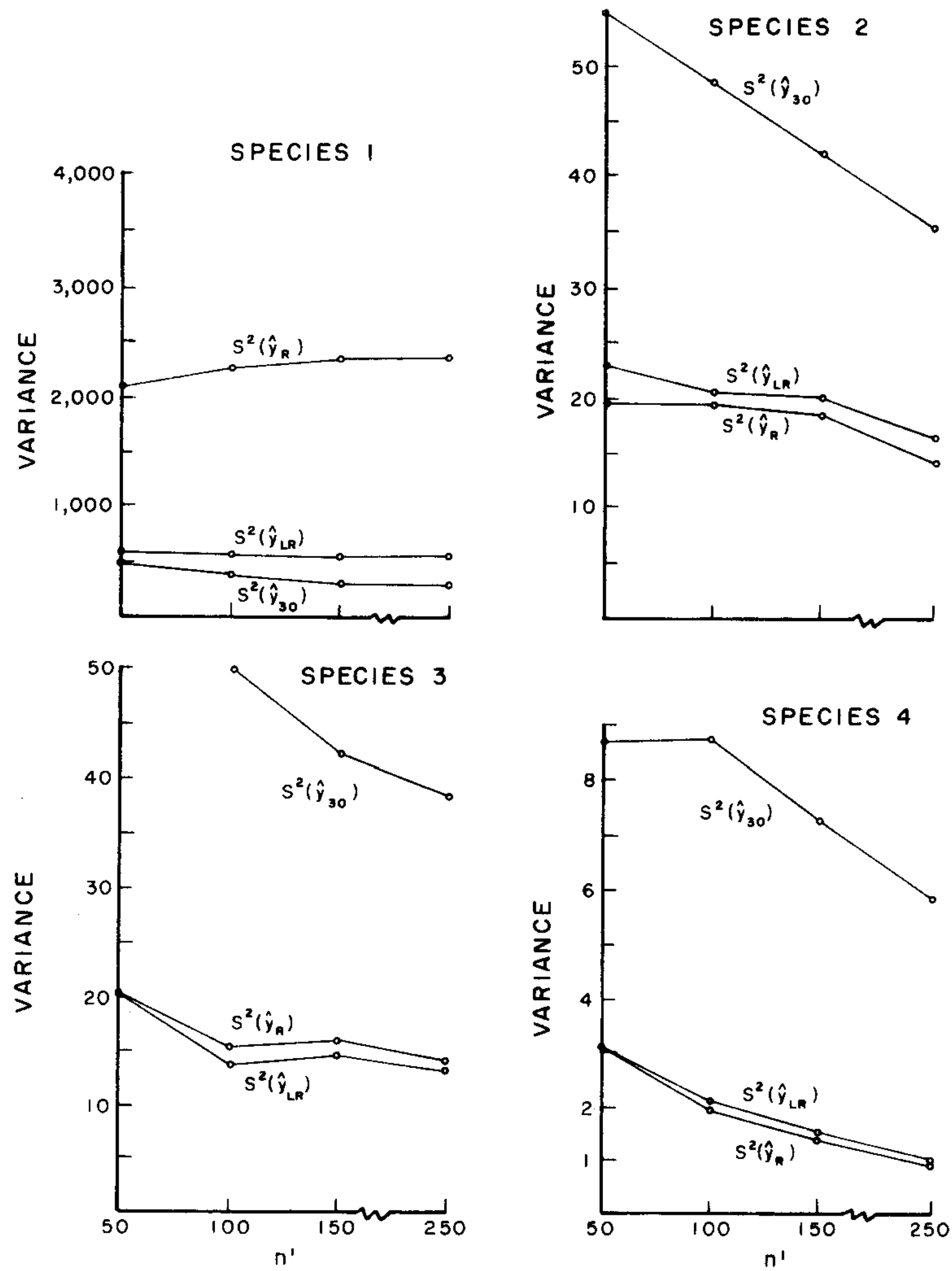


Fig. 9c. Results of weight estimation simulation run 8, n = 15.

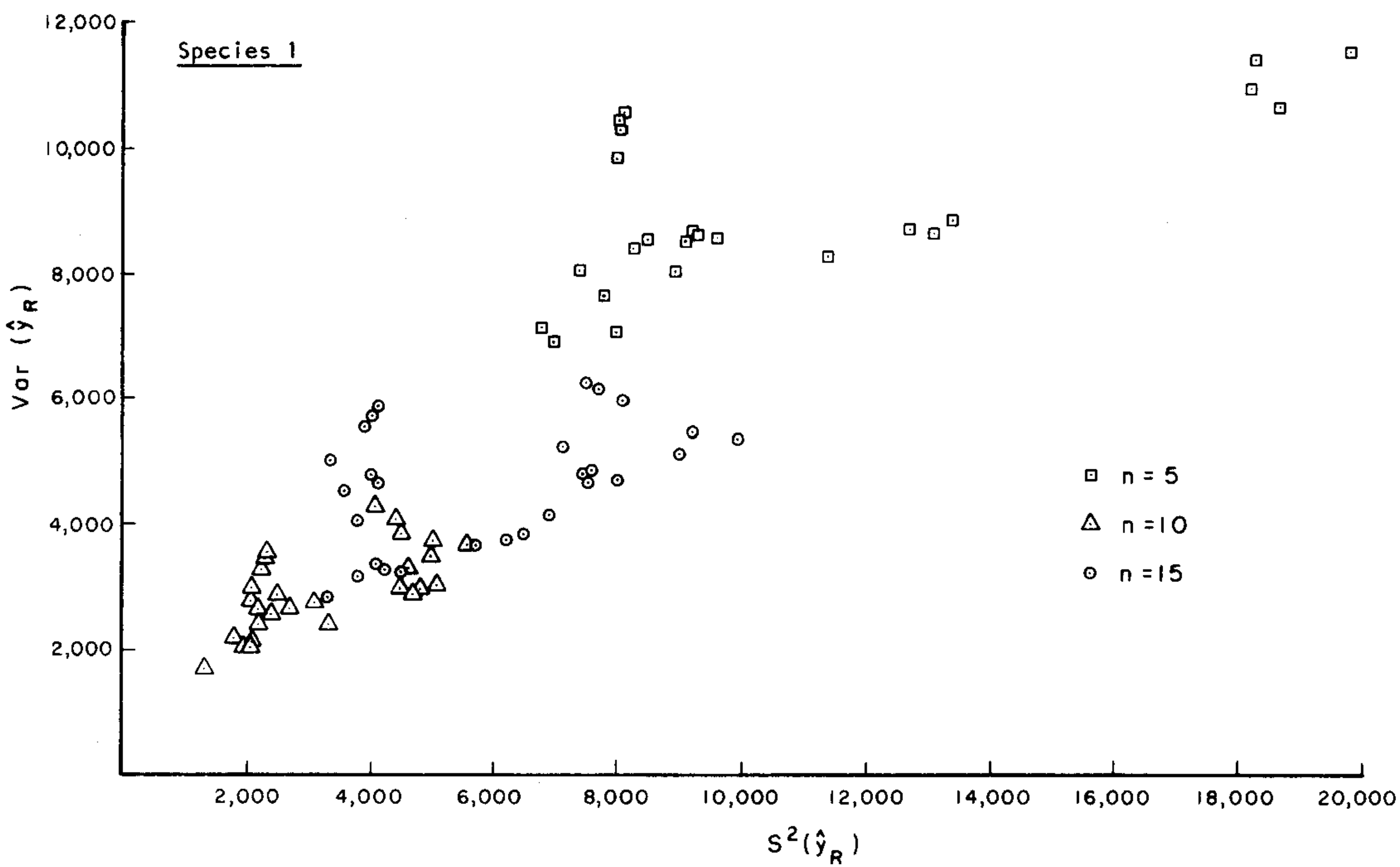


Fig. 10. Theoretical vs. sample variances, ratio estimation.

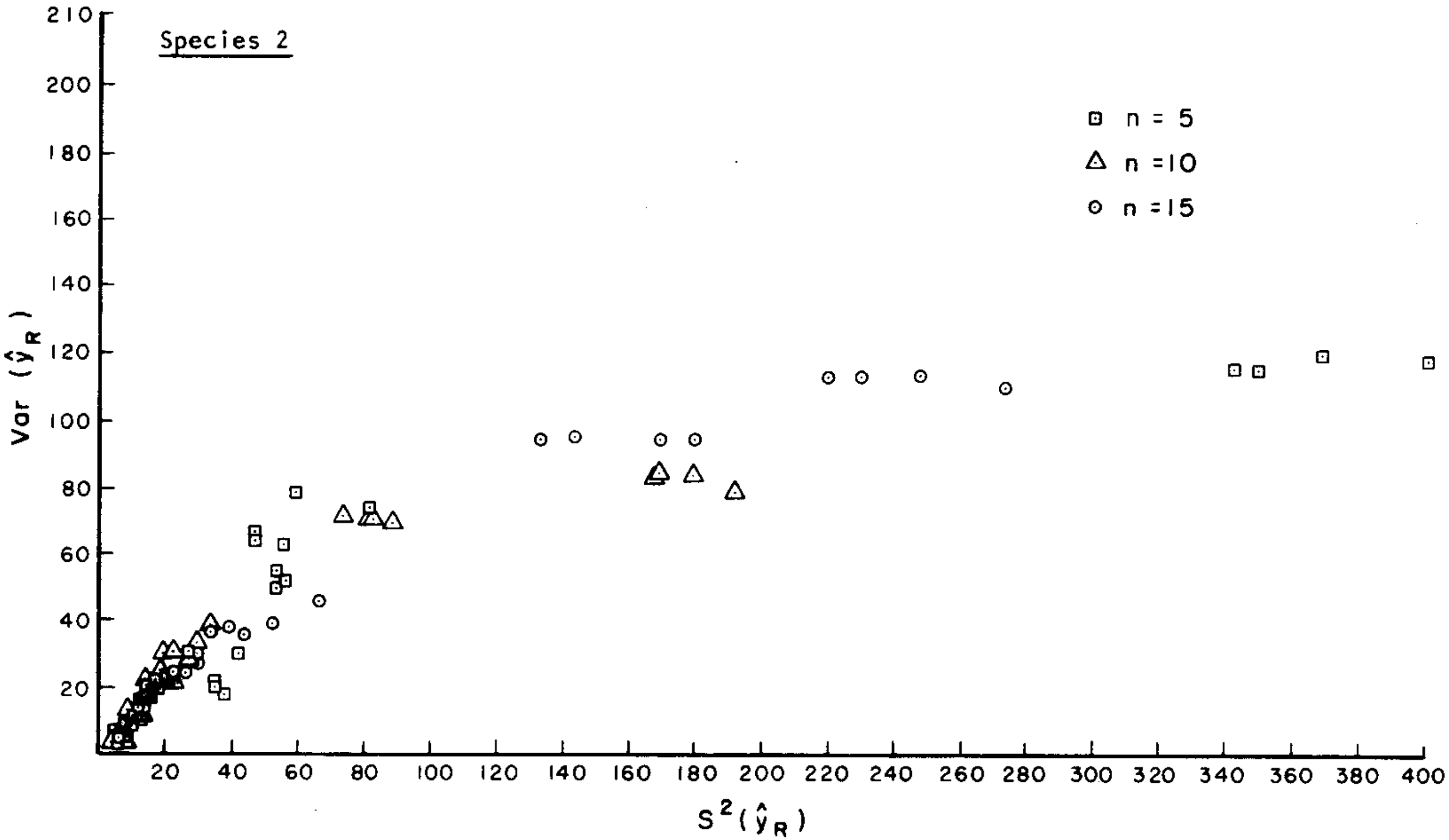


Fig. 10. (Continued).

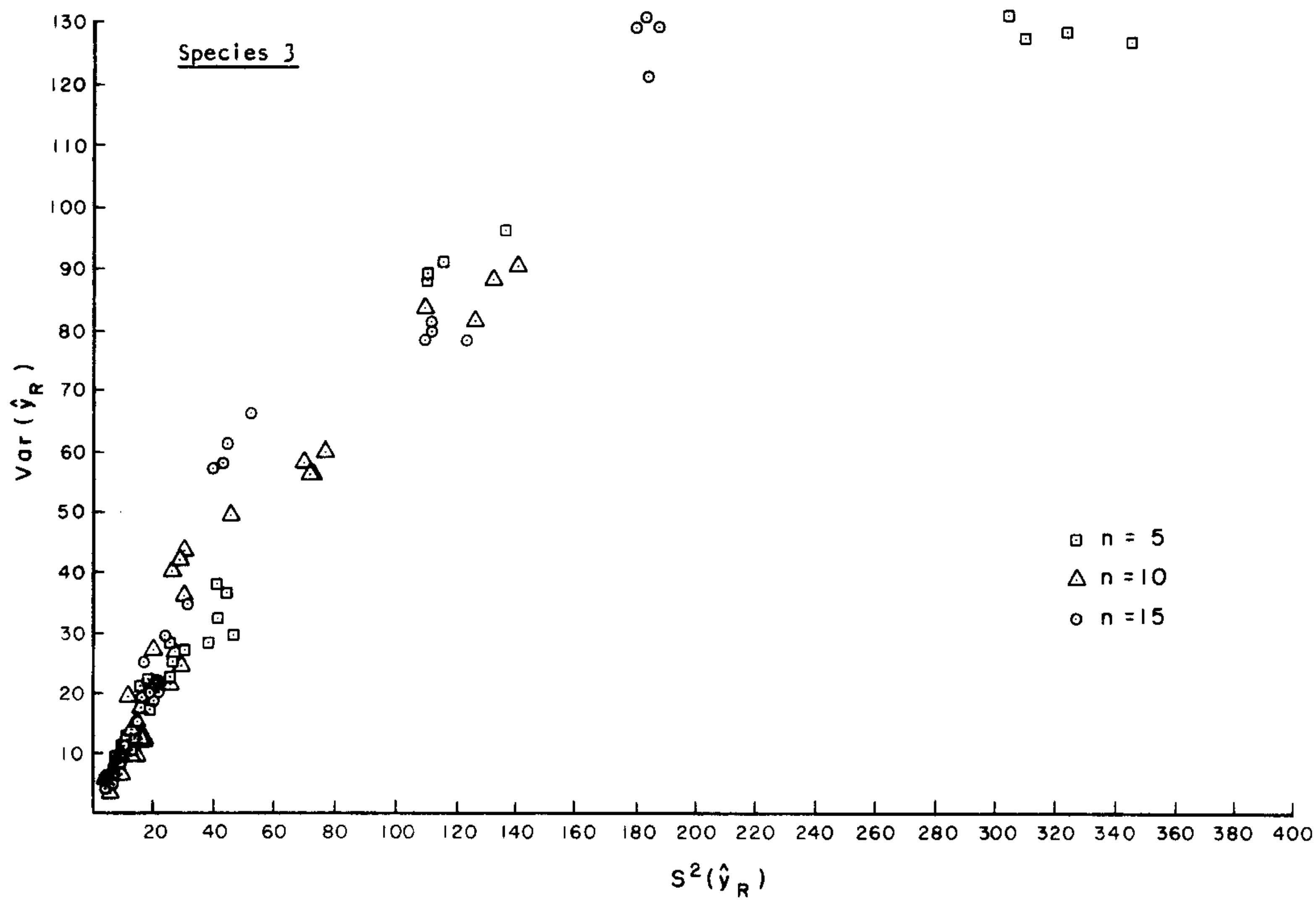


Fig. 10. (Continued).

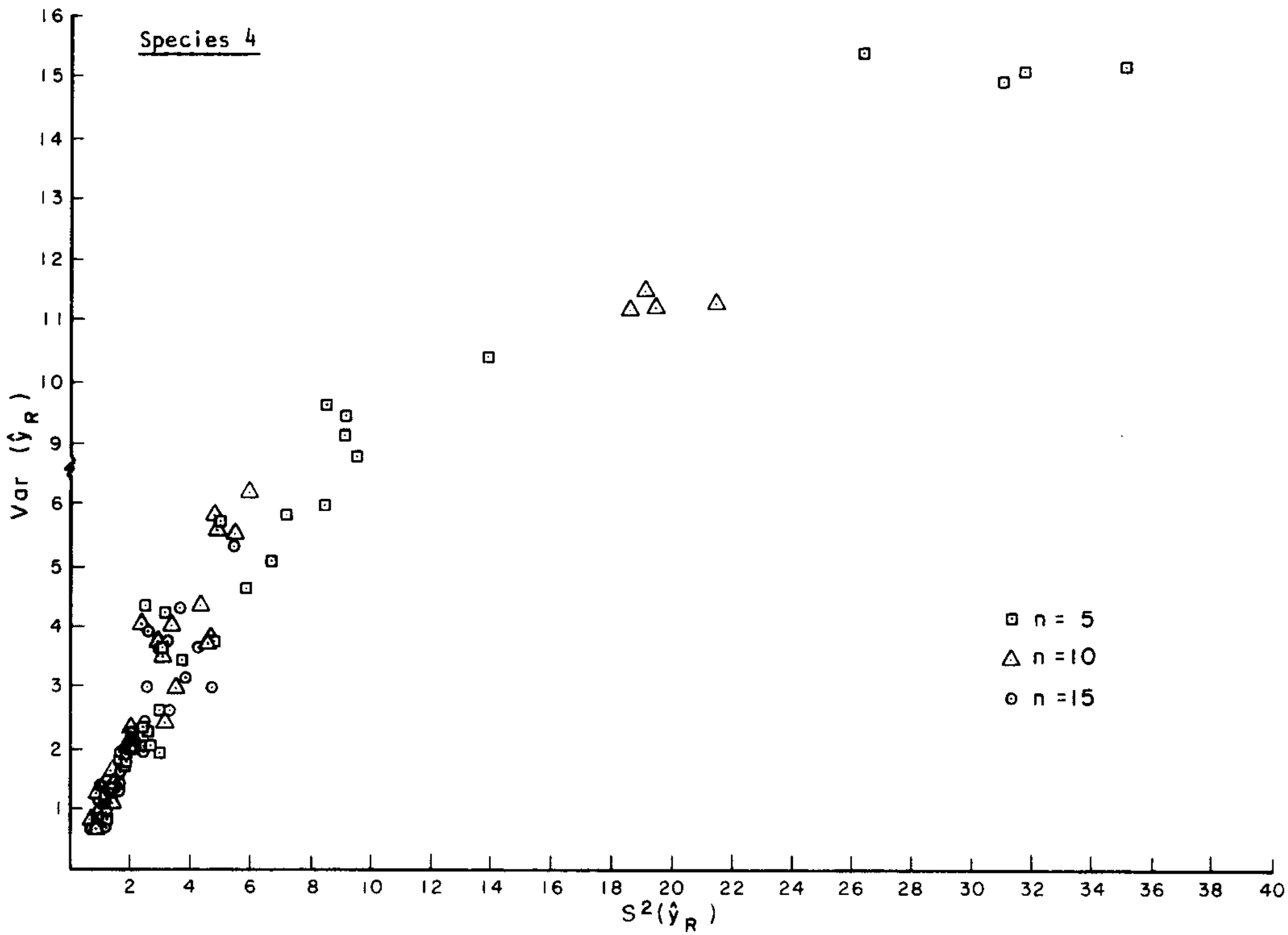


Fig. 10. (Continued).

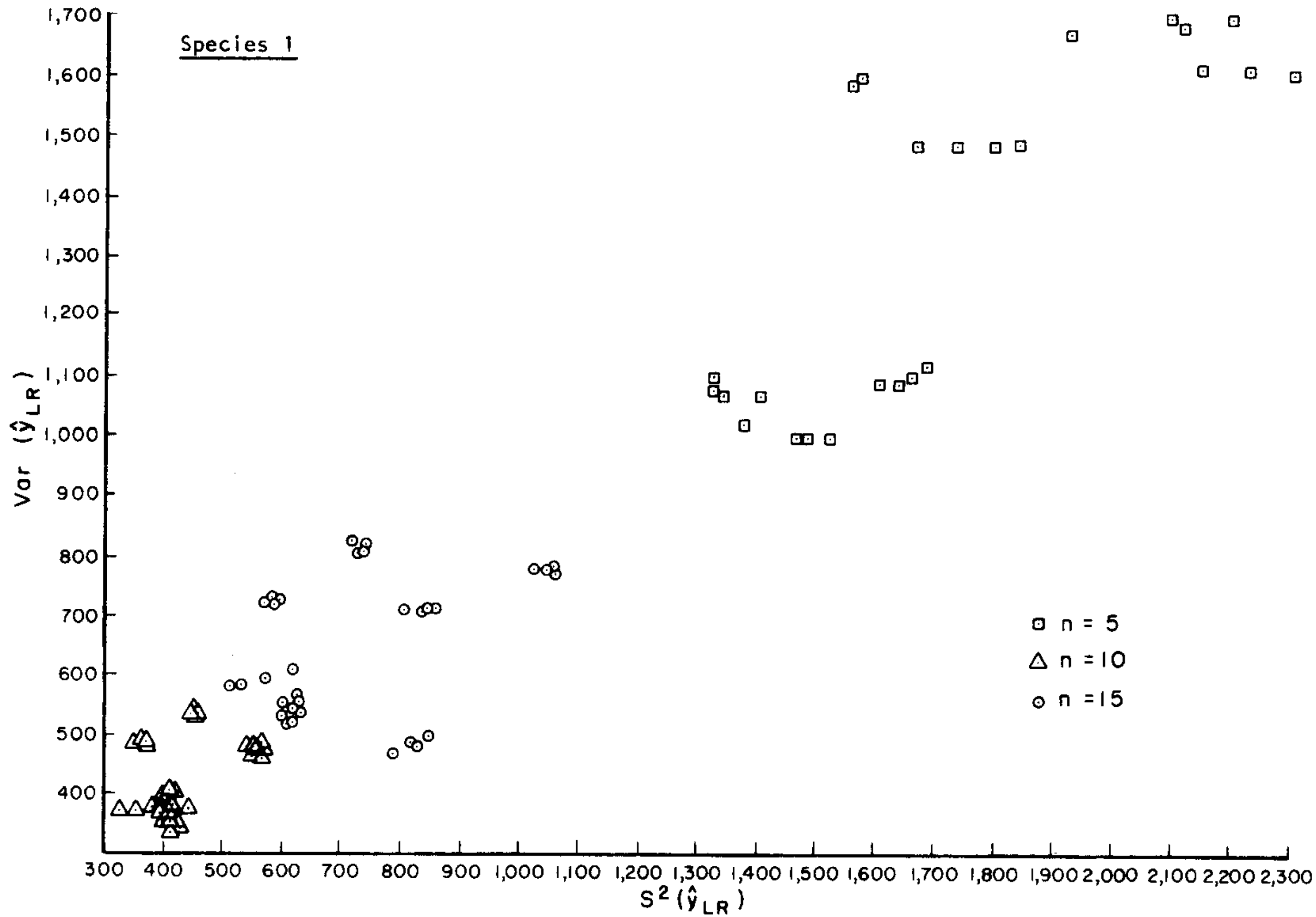


Fig. 11. Theoretical vs. sample variances, regression estimation.

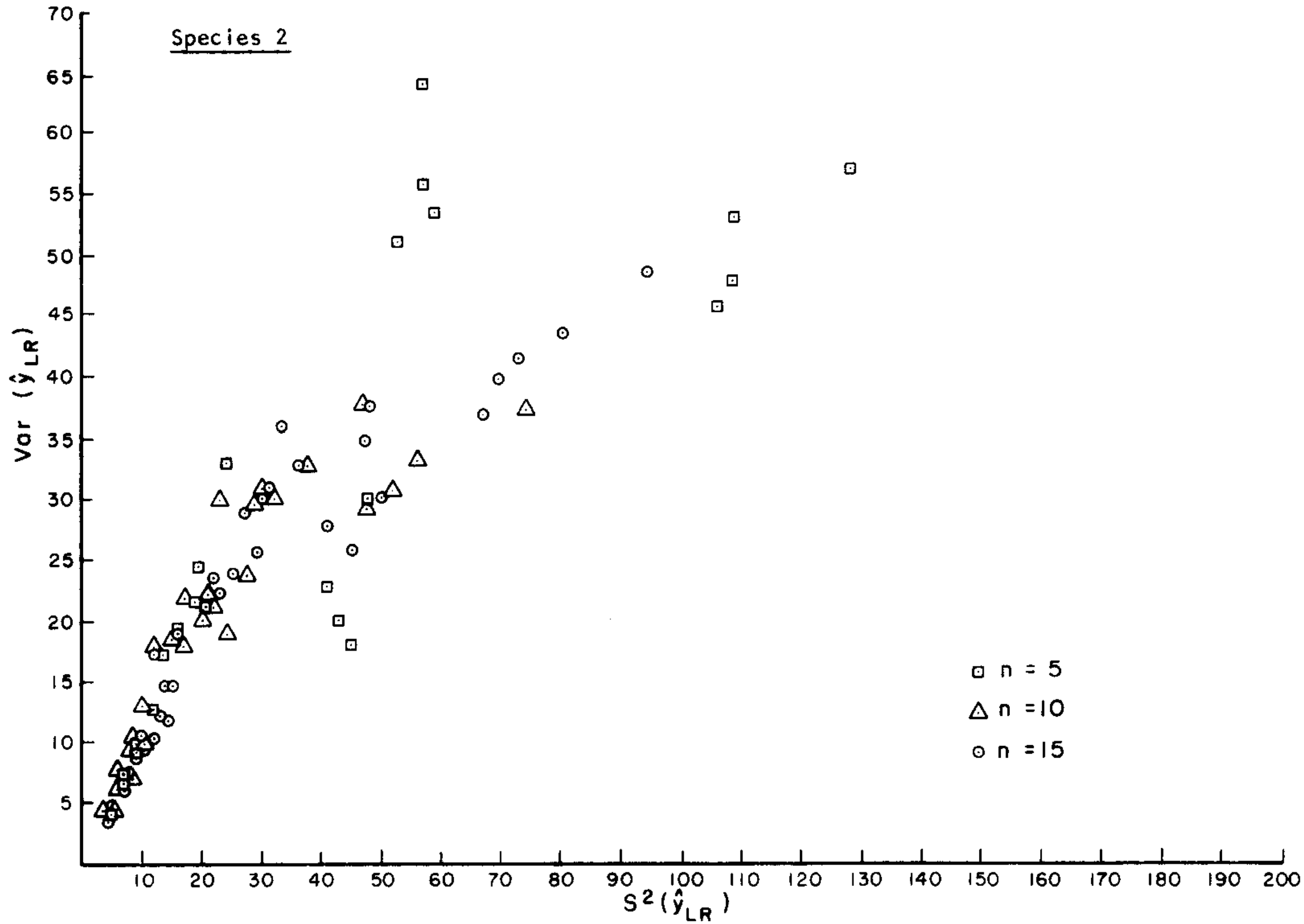


Fig. 11. (Continued).

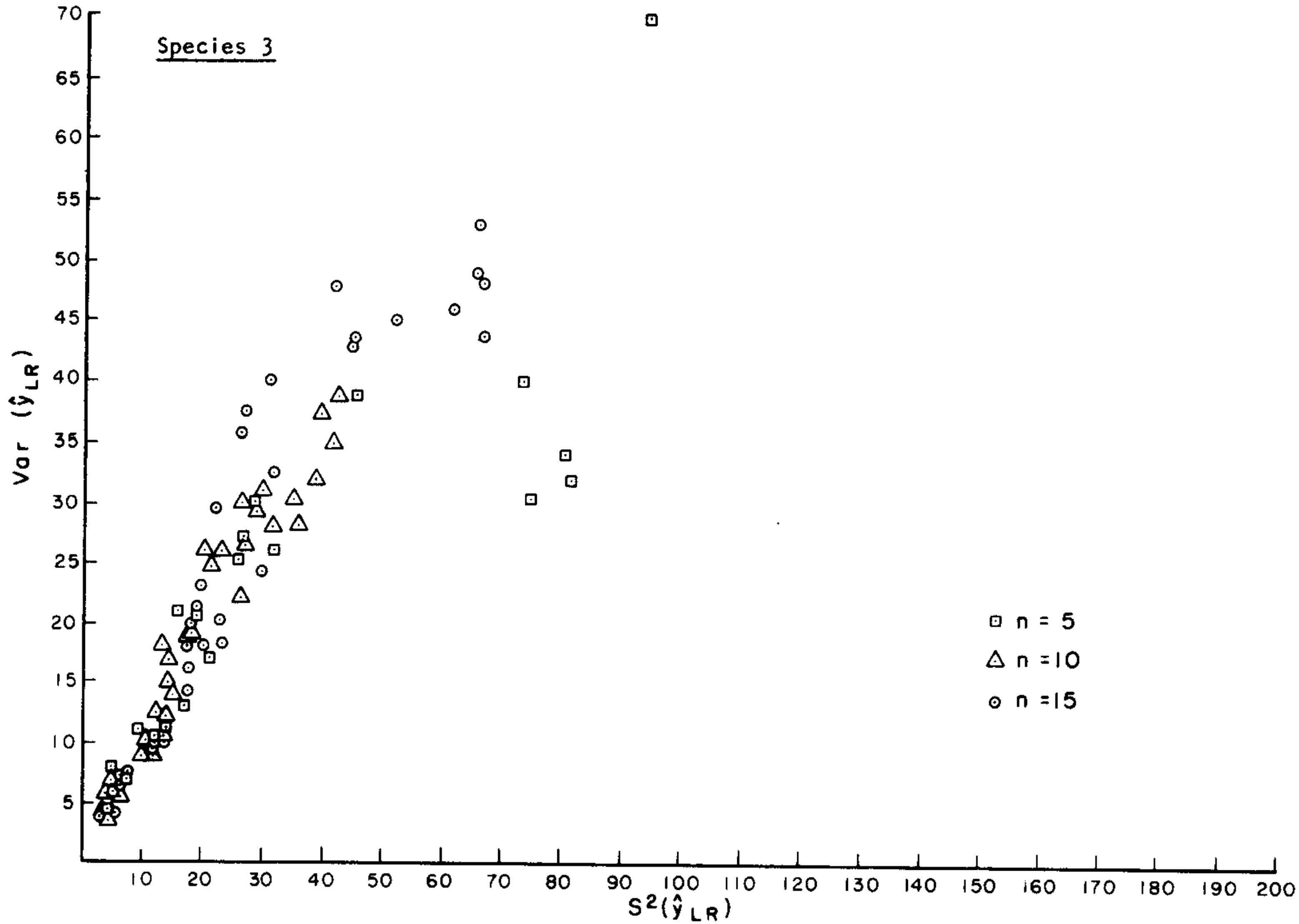


Fig. 11. (Continued).

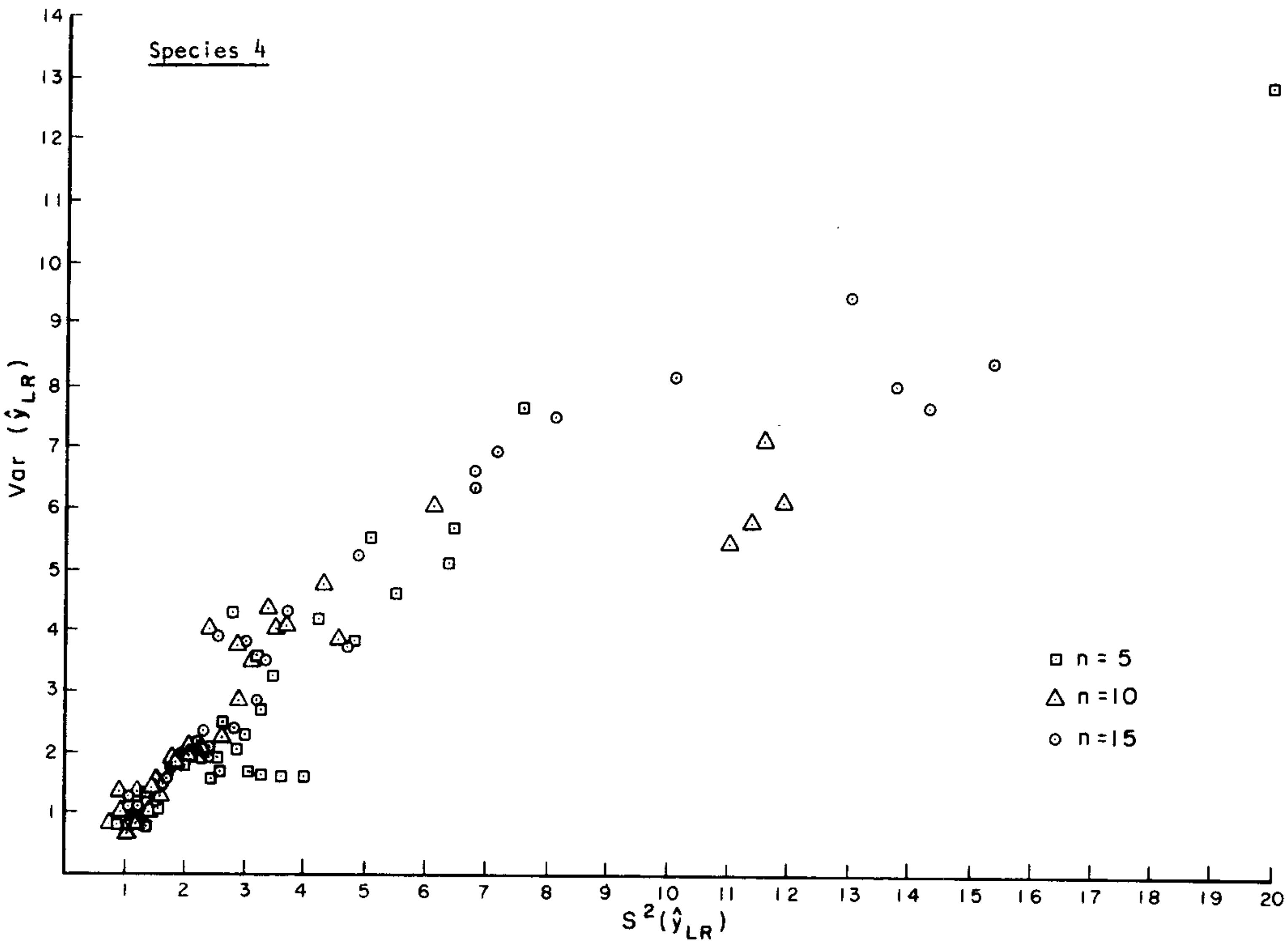


Fig. 11. (Continued).

APPENDIX I

Results of 1970 Pawnee Site Estimation

Results of 1970 Pawnee Site estimation.

DS SR15 = $\frac{n'}{n}$ for optimum allocation under ratio estimate with $\frac{c_{n'}}{c_n} = \frac{1}{15}$

DS SR30 = $\frac{n'}{n}$ for optimum allocation under ratio estimate with $\frac{c_{n'}}{c_n} = \frac{1}{30}$

DS VR15 = $\frac{V_{opt}}{Var\ (\overline{y})}$ for ratio estimate under optimum allocation with $\frac{c_{n'}}{c_n} = \frac{1}{15}$

DS VR30 = $\frac{V_{opt}}{Var\ (\overline{y})}$ for ratio estimate under optimum allocation with $\frac{c_{n'}}{c_n} = \frac{1}{30}$

RG SR15 = $\frac{n'}{n}$ for optimum allocation under regression estimate with $\frac{c_{n'}}{c_n} = \frac{1}{15}$

RG SR30 = $\frac{n'}{n}$ for optimum allocation under regression estimate with $\frac{c_{n'}}{c_n} = \frac{1}{30}$

RG VR15 = $\frac{V_{opt}}{Var\ (\overline{y})}$ for regression estimate under optimum allocation with

$\frac{c_{n'}}{c_n} = \frac{1}{15}$

RG VR30 = $\frac{V_{opt}}{Var\ (\overline{y})}$ for regression estimate under optimum allocation with

$\frac{c_{n'}}{c_n} = \frac{1}{30}$

SAMPLING DATE 1

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/ 9/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	.333	.471	1.037	1.024	1.075	1.521	1.066	1.025
		OPPO	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000
		SPCO	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/ 9/70	2	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	.673	.952	1.060	1.033
		OPPO	11.763	16.637	.311	.236	12.072	17.073	.304	.230
		SPCO	0.000	0.000	9999.000	9999.000	2.151	3.042	.999	.927

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/ 9/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.319	1.865	1.061	1.011
		OPPO	10.248	14.494	.354	.275	10.341	14.625	.351	.272
		SPCO	0.000	0.000	9999.000	9999.000	3.354	4.744	.856	.766

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/10/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.370	4.766	.854	.764	4.128	5.839	.761	.668
		OPPO	16.704	23.625	.228	.163	16.807	23.770	.227	.162
		SPCO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/11/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.824	2.579	1.030	.965
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	0.000	0.000	9999.000	9999.000	1.237	1.750	1.063	1.016

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/11/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	.295	.418	1.034	1.022
		OPPO	3.156	4.464	.880	.793	3.411	4.825	.848	.759
		SPCO	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/14/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000
		BOGR	.744	1.053	1.062	1.033	2.072	2.930	1.007	.937
		OPPO	26.413	37.356	.160	.106	26.745	37.826	.159	.105
		SPCO	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
4/14/70	8	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	6.008	8.498	.576	.483	6.157	8.709	.564	.472
		OPPO	42.977	60.642	.120	.074	71.648	101.334	.097	.056
		SPCO	8.660	12.248	.415	.331	8.660	12.248	.415	.331

SAMPLING DATE 2

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 5/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	2.619	3.704	.947	.866
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	6.401	9.618	.517	.427	7.826	11.069	.456	.369

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 5/70	2	AGSM	12.411	17.553	.296	.223	16.779	23.730	.227	.162
		BOGR	3.825	5.410	.797	.705	3.883	5.492	.790	.698
		OPPO	23.593	33.368	.174	.117	25.273	35.744	.165	.110
		SPCO	2.468	3.491	.964	.886	3.264	4.616	.867	.778

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 5/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	.088	.124	1.011	1.008
		OPPO	9.337	13.205	.386	.304	10.051	14.215	.361	.281
		SPCO	0.000	0.000	9999.000	9999.000	2.705	3.826	.936	.854

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 6/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000
		BOGR	0.000	0.000	9999.000	9999.000	2.925	4.137	.909	.825
		OPPO	115.400	163.212	.085	.047	173.695	245.661	.079	.042
		SPCO	0.000	0.000	9999.000	9999.000	3.452	4.882	.843	.753

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 6/70	5	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	6.889	9.743	.511	.421	6.977	9.868	.506	.416
		OPPO	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		SPCO	0.000	0.000	9999.000	9999.000	2.905	4.108	.912	.827

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 6/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.759	5.316	.805	.714	3.772	5.335	.804	.712
		OPPO	31.194	44.118	.144	.093	34.660	49.021	.135	.086
		SPCO	5.590	7.906	.611	.518	7.675	10.855	.464	.376

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 7/70	7	AGSM	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000
		BOGR	2.345	3.316	.978	.902	2.732	3.864	.933	.851
		OPPO	48.748	68.945	.113	.068	53.367	75.478	.109	.065
		SPCO	0.000	0.000	9999.000	9999.000	3.354	4.744	.856	.766

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/ 7/70	8	AGSM	38.001	53.746	.128	.080	51.195	72.407	.111	.066
		BOGR	6.984	9.877	.505	.416	7.005	9.908	.504	.414
		OPPO	11.164	15.790	.327	.250	11.768	16.644	.311	.236
		SPCO	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000

SAMPLING DATE 3

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	10.431	14.753	.348	.270	10.625	15.028	.342	.264
		OPPO	14.415	20.387	.259	.190	15.777	22.313	.239	.173
		SPCO	9.273	13.115	.389	.307	11.852	16.763	.309	.234

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	2	AGSM	5.475	7.743	.621	.528	6.847	9.684	.514	.424
		BOGR	6.507	9.203	.538	.447	7.459	10.550	.476	.388
		OPPO	17.990	25.444	.214	.151	28.759	40.675	.152	.099
		SPCO	10.328	14.607	.352	.273	11.994	16.963	.306	.231

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.084	2.947	1.006	.935	2.115	2.991	1.003	.932
		OPPO	12.268	17.351	.300	.226	12.365	17.487	.297	.224
		SPCO	1.610	2.277	1.046	.987	2.981	4.216	.902	.817

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	9.023	12.762	.399	.316	9.321	13.182	.387	.305
		OPPO	0.000	0.000	9988.000	9986.000	*45149.662	*81127.301	.067	.033
		SPCO	1.301	1.840	1.061	1.012	1.958	2.769	1.018	.950

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	4.104	5.804	.764	.671	4.431	6.267	.727	.633
		OPPO	11.452	16.197	.319	.243	12.035	17.022	.305	.231
		SPCO	0.000	0.000	9999.000	9999.000	1.650	2.334	1.043	.983

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	6	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	4.850	6.859	.682	.588	4.900	6.930	.677	.583
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	17.566	24.844	.219	.155	18.260	25.826	.212	.149

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	20.923	29.592	.190	.131	28.823	40.764	.151	.099
		OPPO	31.788	44.958	.142	.091	45.031	63.689	.118	.072
		SPCO	6.666	9.427	.527	.436	7.111	10.057	.497	.408

DATF	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
5/19/70	8	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	3.101	4.386	.887	.800
		OPPO	10.322	14.598	.352	.273	11.160	15.784	.327	.250
		SPCO	4.669	6.886	.680	.586	12.681	17.936	.291	.218

SAMPLING DATE 4

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/16/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.092	2.958	1.005	.934	2.837	4.013	.920	.836
		OPPO	17.727	25.071	.217	.154	32.280	45.655	.141	.090
		SPCO	9.404	13.301	.384	.302	12.113	17.132	.303	.229

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/16/70	2	AGSM	10.042	14.202	.361	.281	11.480	16.236	.318	.243
		BOGR	4.202	5.942	.753	.659	4.317	6.105	.740	.646
		OPPO	8.012	11.331	.446	.359	8.450	11.951	.424	.339
		SPCO	8.347	11.805	.429	.344	9.487	13.417	.381	.299

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/17/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	6.339	8.965	.550	.459	6.540	9.249	.535	.444
		OPPO	6.434	9.100	.543	.452	6.653	9.409	.527	.437
		SPCO	11.637	16.458	.314	.239	12.192	17.244	.301	.227

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/17/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	2.196	3.105	.995	.922
		OPPO	0.000	0.000	9988.000	9986.000	*45149.662	*81127.301	.067	.033
		SPCO	6.783	9.594	.518	.428	7.846	11.096	.455	.368

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/18/70	5	AGSM	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000
		BOGR	.930	1.315	1.066	1.030	5.367	7.590	.631	.538
		OPPO	3119.067	4411.273	.067	.034	3758.807	5316.155	.067	.034
		SPCO	2.942	4.160	.907	.822	3.151	4.457	.881	.794

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/18/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	3.916	5.538	.786	.694
		OPPO	204.632	289.415	.077	.041	305.667	432.310	.073	.038
		SPCO	6.012	8.503	.575	.483	8.449	11.950	.424	.339

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/18/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000
		BOGR	2.042	2.888	1.010	.940	2.261	3.197	.988	.913
		OPPO	460.726	651.614	.071	.036	703.785	995.377	.070	.035
		SPCO	6.864	9.708	.513	.423	6.867	9.711	.513	.423

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/18/70	8	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	11.683	16.524	.313	.238	12.248	17.323	.300	.226
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	5.100	7.214	.657	.563	5.311	7.511	.637	.543

SAMPLING DATE 5

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.529	3.577	.957	.878	2.717	3.842	.935	.853
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	18.204	25.746	.212	.150	21.232	30.029	.188	.129

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	2	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	.853	1.206	1.065	1.032	2.490	3.522	.962	.883
		OPPO	14.030	19.843	.265	.195	14.455	20.444	.258	.189
		SPCO	10.641	15.050	.342	.264	10.642	15.052	.342	.264

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	22.244	31.460	.181	.123	24.495	34.643	.169	.113
		OPPO	14.788	20.916	.253	.185	14.876	21.039	.252	.184
		SPCO	23.339	33.009	.175	.118	27.475	38.858	.156	.103

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.111	2.986	1.003	.932	2.126	3.007	1.002	.930
		OPPO	32.844	46.452	.140	.089	47.372	66.999	.115	.069
		SPCO	6.048	8.554	.573	.480	8.155	11.533	.439	.353

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	5.705	8.068	.601	.508	5.820	8.231	.591	.498
		OPPO	8.377	11.848	.428	.343	8.753	12.380	.411	.327
		SPCO	2.636	3.728	.945	.864	3.082	4.359	.890	.803

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.039	2.883	1.010	.941	2.042	2.888	1.010	.940
		OPPO	14.869	21.029	.252	.184	15.286	21.620	.246	.179
		SPCO	8.417	11.904	.426	.341	9.144	12.933	.394	.311

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.943	5.577	.783	.691	3.982	5.631	.779	.686
		OPPO	31.098	43.983	.144	.093	31.157	44.066	.144	.093
		SPCO	18.631	26.351	.208	.146	18.644	26.369	.208	.146

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/ 1/70	8	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	7.511	10.623	.473	.385	7.620	10.777	.467	.379
		OPPO	39.374	55.687	.126	.078	60.310	85.298	.104	.061
		SPCO	16.770	23.718	.227	.162	16.770	23.718	.227	.162

SAMPLING DATE 6

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/29/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.034	1.463	1.067	1.027
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	3.651	5.164	.819	.727	3.939	5.570	.784	.691

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/29/70	2	AGSM	725.921	1026.684	.069	.035	998.659	1412.423	.069	.035
		BOGR	0.000	0.000	9999.000	9999.000	1.220	1.726	1.064	1.017
		OPPO	8.205	11.607	.436	.350	8.475	11.987	.423	.338
		SPCO	5.757	8.143	.597	.504	5.800	8.203	.593	.500

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/29/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	1.021	1.445	1.067	1.027	1.863	2.634	1.026	.961
		OPPO	21.292	30.114	.187	.129	23.020	32.557	.177	.120
		SPCO	0.000	0.000	9999.000	9999.000	1.557	2.202	1.049	.992

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
6/29/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.223	4.558	.872	.784	3.578	5.060	.828	.737
		OPPO	11.672	16.508	.314	.238	13.870	19.617	.268	.198
		SPCO	14.058	19.883	.265	.195	16.932	23.947	.225	.161

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/ 1/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	8.219	11.625	.435	.350	8.651	12.235	.415	.331
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	3.042	4.303	.895	.808	3.726	5.270	.809	.718

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/ 1/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.036	2.880	1.011	.941	2.074	2.933	1.007	.937
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/ 1/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	1.320	1.866	1.061	1.011	1.339	1.893	1.060	1.010
		OPPO	22.974	32.493	.177	.120	23.600	33.378	.174	.117
		SPCO	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/ 1/70	8	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	0.000	0.000	9999.000	9999.000	7.952	11.246	.449	.362
		OPPO	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		SPCO	11.984	16.949	.306	.232	14.919	21.101	.251	.183

SAMPLING DATE 7

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/19/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.403	3.398	.972	.895	2.411	3.410	.971	.894
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	3.358	4.749	.855	.766	4.049	5.727	.771	.678

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/15/70	2	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.809	2.558	1.031	.967
		OPPO	15.004	21.220	.250	.182	16.063	22.719	.236	.170
		SPCO	5.265	7.447	.641	.547	6.268	8.865	.555	.464

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/15/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	7.037	9.953	.502	.412	7.238	10.238	.489	.400
		OPPO	30.879	43.673	.145	.093	37.898	53.600	.129	.080
		SPCO	7.320	10.354	.484	.396	13.912	19.676	.267	.197

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/15/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	2.019	2.856	1.012	.943
		OPPO	10.062	14.231	.360	.280	10.062	14.231	.360	.280
		SPCO	13.011	18.401	.284	.212	13.560	19.178	.273	.203

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/16/70	5	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	1.257	1.778	1.063	1.015	2.728	3.859	.934	.851
		OPPO	10.230	14.468	.355	.275	10.230	14.468	.355	.275
		SPCO	7.814	11.052	.456	.369	7.840	11.089	.455	.368

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/16/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.102	4.387	.887	.800	3.307	4.677	.861	.773
		OPPO	8.681	12.277	.414	.330	8.682	12.279	.414	.330
		SPCO	4.047	5.724	.771	.678	4.050	5.729	.770	.677

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/16/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.572	5.052	.828	.738	3.578	5.060	.828	.737
		OPPO	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		SPCO	4.204	5.946	.752	.659	5.367	7.590	.631	.538

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/16/70	8	AGSM	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		BOGR	8.144	11.518	.439	.353	8.384	11.858	.427	.342
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	2.571	3.637	.952	.873	4.163	5.887	.757	.664

SAMPLING DATE 8

DATF	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/29/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	4.455	6.301	.724	.630
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	0.000	0.000	9999.000	9999.000	3.817	5.399	.798	.706

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/29/70	2	AGSM	62.634	88.584	.102	.060	79.099	111.871	.094	.053
		BOGR	2.410	3.409	.971	.894	5.176	7.320	.649	.555
		OPPO	12.583	17.797	.293	.220	15.735	22.254	.240	.173
		SPCO	7.692	10.879	.463	.375	11.272	15.942	.324	.248

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/29/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	8.425	11.916	.425	.341	8.830	12.488	.407	.324
		OPPO	9.377	13.262	.385	.303	10.832	15.320	.336	.259
		SPCO	15.028	21.254	.250	.182	15.037	21.267	.249	.182

DATF	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/28/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.733	3.866	.933	.851	2.735	3.868	.933	.850
		OPPO	13.456	19.032	.275	.204	17.017	24.067	.224	.160
		SPCO	3.627	5.130	.822	.730	4.815	6.810	.686	.591

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/28/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	2.859	4.044	.918	.833	2.861	4.047	.917	.833
		OPPO	90.992	128.692	.090	.051	105.093	148.634	.087	.048
		SPCO	0.000	0.000	9999.000	9999.000	5.473	7.740	.622	.528

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/28/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	2.258	3.193	.988	.914
		OPPO	21.872	30.934	.184	.125	23.454	33.171	.174	.118
		SPCO	7.277	10.292	.487	.398	7.758	10.972	.459	.372

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/28/70	7	AGSM	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000
		BOGR	5.501	7.779	.619	.526	6.123	8.659	.567	.475
		OPPO	913.293	1291.688	.069	.035	1395.085	1973.096	.068	.034
		SPCO	4.530	6.408	.716	.622	4.568	6.461	.712	.618

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
7/28/70	8	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	1.265	1.704	1.064	1.018	3.538	5.004	.833	.742
		OPPO	2.759	3.903	.930	.847	5.108	7.225	.656	.562
		SPCO	10.275	14.532	.353	.274	13.637	19.287	.272	.201

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DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/11/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.646	2.328	1.043	.984
		OPPO	27.355	38.690	.157	.103	34.066	48.180	.137	.087
		SPCO	8.914	12.607	.404	.320	9.949	14.071	.364	.284

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/11/20	2	AGSM	83.694	118.370	.093	.052	112.546	159.176	.086	.047
		BOGR	0.000	0.000	9999.000	9999.000	1.332	1.884	1.060	1.010
		OPPO	8.583	12.139	.418	.334	10.821	15.304	.336	.259
		SPCO	0.000	0.000	9999.000	9999.000	.191	.270	1.023	1.016

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/11/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	5.827	8.241	.591	.498	5.844	8.265	.589	.496
		OPPO	16.370	23.152	.232	.166	24.004	33.949	.172	.115
		SPCO	0.000	0.000	9999.000	9999.000	1.395	1.973	1.057	1.005

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/11/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.523	4.983	.834	.744	3.786	5.355	.802	.710
		OPPO	37.401	52.896	.129	.081	37.467	52.991	.129	.081
		SPCO	0.000	0.000	9999.000	9999.000	.130	.184	1.016	1.011

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/11/70	5	AGSM	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000
		BOGR	0.000	0.000	9999.000	9999.000	.516	.730	1.051	1.031
		OPPO	13.848	19.585	.268	.198	14.107	19.951	.264	.194
		SPCO	10.674	15.096	.341	.263	11.137	15.752	.328	.251

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/11/70	6	AGSM	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000
		BOGR	3.505	4.957	.837	.746	3.507	4.961	.836	.746
		OPPO	524.841	742.293	.071	.036	553.492	782.815	.070	.036
		SPCO	0.000	0.000	9999.000	9999.000	3.052	4.317	.893	.807

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/12/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	1.947	2.754	1.019	.951	2.324	3.287	.981	.905
		OPPO	61.711	87.279	.103	.060	62.292	88.101	.102	.060
		SPCO	14.874	21.037	.252	.184	19.006	26.881	.205	.143

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/12/70	8	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	5.475	7.743	.621	.528	5.564	7.869	.613	.520
		OPPO	0.000	0.000	9999.000	9999.000	0.000	0.000	9999.000	9999.000
		SPCO	14.405	20.373	.259	.190	15.523	21.955	.243	.176

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DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/24/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.743	2.465	1.036	.974
		OPPO	20.524	29.027	.193	.133	24.457	34.590	.169	.113
		SPCO	0.000	0.000	9999.000	9999.000	3.285	4.647	.864	.776

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/24/70	2	AGSM	46.475	65.730	.116	.070	77.940	110.233	.095	.054
		BOGR	4.854	6.864	.682	.587	5.787	8.185	.594	.501
		OPPO	12.263	17.344	.300	.226	12.477	17.646	.295	.222
		SPCO	4.688	6.630	.699	.605	6.073	8.589	.571	.478

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/25/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	1.521	2.152	1.051	.995
		OPPO	13.534	19.142	.274	.203	14.756	20.870	.254	.185
		SPCO	3.611	5.108	.823	.733	10.588	14.975	.343	.265

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/25/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	4.931	6.973	.674	.580	6.611	9.351	.530	.440
		OPPO	108.920	154.047	.086	.048	122.740	173.593	.084	.046
		SPCO	9.006	12.738	.400	.317	14.235	20.133	.262	.192

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/25/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.109	4.397	.886	.799	3.111	4.399	.886	.799
		OPPO	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		SPCO	7.343	10.386	.483	.394	7.370	10.423	.481	.393

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/25/70	6	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	1.375	1.945	1.058	1.007	2.308	3.264	.983	.907
		OPPO	396.535	560.828	.072	.037	601.162	850.236	.070	.036
		SPCO	.937	1.325	1.066	1.030	3.592	5.081	.826	.735

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/25/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	4.807	6.799	.686	.592	5.596	7.914	.611	.517
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
8/25/70	8	AGSM	11.589	16.390	.316	.240	13.624	19.269	.272	.202
		BOGR	1.351	1.911	1.059	1.009	1.946	2.752	1.019	.952
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	0.000	0.000	9999.000	9999.000	3.197	4.522	.875	.787

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DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	1	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	.725	1.026	1.062	1.033
		OPPO	42.952	60.748	.120	.074	44.720	63.249	.118	.072
		SPCO	0.000	0.000	9999.000	9999.000	1.045	1.478	1.067	1.026

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	2	AGSM	76.428	108.094	.095	.054	116.832	165.237	.085	.046
		BOGR	1.965	2.780	1.017	.949	3.503	4.955	.837	.747
		OPPO	11.021	15.587	.331	.254	11.123	15.732	.328	.251
		SPCO	12.726	17.999	.290	.217	14.006	19.808	.266	.196

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	3	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	6.007	8.496	.576	.483	6.598	9.332	.531	.440
		OPPO	10.461	14.795	.347	.269	10.461	14.796	.347	.269
		SPCO	9.287	13.135	.388	.306	10.062	14.231	.360	.280

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	4	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	3.090	4.370	.869	.802	4.621	6.536	.706	.612
		OPPO	107.130	151.516	.087	.048	140.882	199.252	.082	.044
		SPCO	3.037	4.296	.895	.809	3.228	4.566	.871	.783

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	5	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	4.074	5.761	.768	.675	4.125	5.834	.762	.668
		OPPO	19.835	28.054	.198	.138	20.104	28.434	.196	.136
		SPCO	0.000	0.000	9999.000	9999.000	3.328	4.707	.859	.770

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	6	AGSM	0.000	0.000	9988.000	9988.000	0.000	0.000	9988.000	9988.000
		BOGR	4.032	5.702	.773	.680	6.333	8.957	.551	.459
		OPPO	10.447	14.775	.348	.269	10.867	15.370	.335	.258
		SPCO	13.567	19.188	.273	.203	13.818	19.543	.269	.199

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/ 8/70	7	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	0.000	0.000	9999.000	9999.000	2.981	4.216	.902	.817
		OPPO	2.502	3.539	.961	.882	2.571	3.637	.952	.872
		SPCO	2.518	3.561	.959	.880	4.207	5.949	.752	.659

DATE	WATERSHED	SPECIES	DS SR15	DS SR30	DS VR15	DS VR30	RG SR15	RG SR30	RG VR15	RG VR30
9/12/70	8	AGSM	0.000	0.000	9999.000	9999.000	0.000	0.000	0.000	0.000
		BOGR	4.822	6.819	.685	.591	4.822	6.820	.685	.591
		OPPO	0.000	0.000	9988.000	9988.000	*45149.662	*81127.301	.067	.033
		SPCO	9.287	13.135	.388	.306	10.062	14.231	.360	.280

APPENDIX II

Results of Monte Carlo Simulation Runs 1 Through 8

Results of simulation run 1.
Species No. 1

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.8852E+00		.8852E+00		.8852E+00		.8852E+00		YBAR/XBAR
	.3112E+03	.7356E+04	.3114E+03	.8261E+04	.3130E+03	.8469E+04	.3174E+03	.9322E+04	R-EST
	.8128E+04		.8500E+04		.8624E+04		.8724E+04		VAR(R-EST)
	.3028E+03	.6602E+03	.3026E+03	.5651E+03	.2994E+03	.4164E+03	.2971E+03	.2985E+03	N10
5	.3019E+03	.8248E+03	.3042E+03	.6280E+03	.3026E+03	.5651E+03	.2985E+03	.4464E+03	N15
	.3031E+03	.1164E+04	.3019E+03	.8248E+03	.3028E+03	.6602E+03	.3047E+03	.6041E+03	N30
	.3031E+03	.1164E+04	.3023E+03	.1001E+04	.3019E+03	.8248E+03	.3028E+03	.6602E+03	N50
	.1789E+00		.1789E+00		.1789E+00		.1789E+00		B
	.2369E+03		.2369E+03		.2369E+03		.2369E+03		A
	.3001E+03	.1333E+04	.3004E+03	.1336E+04	.3002E+03	.1351E+04	.3007E+03	.1408E+04	LR
	.4878E+00		.4878E+00		.4878E+00		.4878E+00		RHO
	.1102E+04		.1084E+04		.1078E+04		.1073E+04		VAR(LR)
	.8994E+00		.8994E+00		.8994E+00		.8994E+00		YBAR/XBAR
	.3163E+03	.4516E+04	.3168E+03	.5731E+04	.3189E+03	.6200E+04	.3227E+03	.6537E+04	R-EST
	.3335E+04		.3666E+04		.3776E+04		.3864E+04		VAR(R-EST)
	.3026E+03	.5651E+03	.2994E+03	.4164E+03	.2979E+03	.3484E+03	.2992E+03	.2192E+03	N10
	.3047E+03	.6041E+03	.3016E+03	.4896E+03	.2994E+03	.4164E+03	.2981E+03	.3040E+03	N15
10	.3042E+03	.6280E+03	.3047E+03	.6041E+03	.3026E+03	.5651E+03	.2998E+03	.4837E+03	N30
	.3042E+03	.6280E+03	.3050E+03	.5973E+03	.3047E+03	.6041E+03	.3026E+03	.5651E+03	N50
	.1449E+00		.1448E+00		.1448E+00		.1448E+00		B
	.2485E+03		.2485E+03		.2485E+03		.2485E+03		A
	.3004E+03	.6019E+03	.2998E+03	.6038E+03	.2994E+03	.6096E+03	.2999E+03	.6167E+03	LR
	.4593E+00		.4593E+00		.4593E+00		.4593E+00		RHO
	.5482E+03		.5305E+03		.5246E+03		.5198E+03		VAR(LR)
	.8692E+00		.8692E+00		.8692E+00		.8692E+00		YBAR/XBAR
	.3059E+03	.1829E+04	.3058E+03	.2373E+04	.3078E+03	.2749E+04	.3116E+03	.3100E+04	R-EST
	.2228E+04		.2606E+04		.2732E+04		.2832E+04		VAR(R-EST)
	.2994E+03	.4164E+03	.2979E+03	.3484E+03	.2971E+03	.2985E+03	.2989E+03	.1518E+03	N10
15	.2998E+03	.4837E+03	.2985E+03	.4464E+03	.2979E+03	.3484E+03	.2978E+03	.2893E+03	N15
	.3016E+03	.4896E+03	.2998E+03	.4837E+03	.2994E+03	.4164E+03	.2991E+03	.4073E+03	N30
	.3016E+03	.4896E+03	.3007E+03	.4565E+03	.2998E+03	.4837E+03	.2994E+03	.4164E+03	N50
	.1529E+00		.1529E+00		.1529E+00		.1529E+00		B
	.2474E+03		.2474E+03		.2474E+03		.2474E+03		A
	.3019E+03	.4114E+03	.3015E+03	.3855E+03	.3015E+03	.4015E+03	.3020E+03	.4181E+03	LR
	.4875E+00		.4875E+00		.4875E+00		.4875E+00		RHO
	.3847E+03		.3673E+03		.3615E+03		.3569E+03		VAR(LR)

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1013E+01		.1013E+01		.1013E+01		.1013E+01		YBAR/XBAR
	.4368E+02	.4202E+02	.4413E+02	.3470E+02	.4432E+02	.3467E+02	.4459E+02	.3653E+02	R-EST
	.2998E+02		.2234E+02		.1980E+02		.1776E+02		VAR(R-EST)
	.4097E+02	.7136E+02	.4206E+02	.5920E+02	.4283E+02	.4346E+02	.4300E+02	.2838E+02	N10
	.4101E+02	.8090E+02	.4123E+02	.6817E+02	.4206E+02	.5920E+02	.4318E+02	.4193E+02	N15
5	.4209E+02	.1110E+03	.4101E+02	.8090E+02	.4097E+02	.7136E+02	.4131E+02	.6389E+02	N30
	.4209E+02	.1110E+03	.4125E+02	.9653E+02	.4101E+02	.8090E+02	.4097E+02	.7136E+02	N50
	.9761E+00		.9761E+00		.9761E+00		.9761E+00		B
	.2240E+01		.2240E+01		.2240E+01		.2240E+01		A
	.4433E+02	.4766E+02	.4476E+02	.4101E+02	.4494E+02	.4257E+02	.4526E+02	.4491E+02	LR
	.9667E+00		.9667E+00		.9667E+00		.9667E+00		RHO
	.3032E+02		.2271E+02		.2017E+02		.1814E+02		VAR(LR)
	.9964E+00		.9964E+00		.9964E+00		.9964E+00		YBAR/XBAR
	.4293E+02	.2168E+02	.4335E+02	.1228E+02	.4354E+02	.1183E+02	.4379E+02	.1167E+02	R-EST
	.2334E+02		.1593E+02		.1346E+02		.1148E+02		VAR(R-EST)
	.4206E+02	.5920E+02	.4283E+02	.4346E+02	.4295E+02	.3710E+02	.4278E+02	.2486E+02	N10
	.4131E+02	.6389E+02	.4201E+02	.5544E+02	.4283E+02	.4346E+02	.4287E+02	.3724E+02	N15
10	.4123E+02	.6817E+02	.4131E+02	.6389E+02	.4206E+02	.5920E+02	.4241E+02	.4714E+02	N30
	.4123E+02	.6817E+02	.4148E+02	.6849E+02	.4131E+02	.6389E+02	.4206E+02	.5920E+02	N50
	.9224E+00		.9224E+00		.9224E+00		.9224E+00		B
	.3343E+01		.3343E+01		.3343E+01		.3343E+01		A
	.4297E+02	.2314E+02	.4332E+02	.1403E+02	.4353E+02	.1342E+02	.4382E+02	.1291E+02	LR
	.9613E+00		.9613E+00		.9613E+00		.9613E+00		RHO
	.2231E+02		.1477E+02		.1226E+02		.1025E+02		VAR(LR)
	.9990E+00		.9990E+00		.9990E+00		.9990E+00		YBAR/XBAR
	.4306E+02	.2323E+02	.4350E+02	.1398E+02	.4368E+02	.1271E+02	.4391E+02	.1036E+02	R-EST
	.2141E+02		.1418E+02		.1177E+02		.9841E+01		VAR(R-EST)
	.4283E+02	.4346E+02	.4295E+02	.3710E+02	.4300E+02	.2838E+02	.4272E+02	.2310E+02	N10
	.4241E+02	.4714E+02	.4318E+02	.4193E+02	.4295E+02	.3710E+02	.4283E+02	.2649E+02	N15
15	.4201E+02	.5544E+02	.4241E+02	.4714E+02	.4283E+02	.4346E+02	.4285E+02	.3955E+02	N30
	.4201E+02	.5544E+02	.4235E+02	.5091E+02	.4241E+02	.4714E+02	.4283E+02	.4346E+02	N50
	.9078E+00		.9078E+00		.9078E+00		.9078E+00		B
	.4126E+01		.4126E+01		.4126E+01		.4126E+01		A
	.4316E+02	.2568E+02	.4354E+02	.1597E+02	.4372E+02	.1386E+02	.4396E+02	.1133E+02	LR
	.9529E+00		.9529E+00		.9529E+00		.9529E+00		RHO
	.2052E+02		.1310E+02		.1063E+02		.8651E+01		VAR(LR)

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1006E+01		.1006E+01		.1006E+01		.1006E+01		YBAR/XBAR
	.4537E+02	.4433E+02	.4550E+02	.2517E+02	.4507E+02	.2564E+02	.4471E+02	.2518E+02	R-EST
	.3663E+02		.2754E+02		.2451E+02		.2209E+02		VAR(R-EST)
	.4660E+02	.1063E+03	.4547E+02	.6326E+02	.4594E+02	.4082E+02	.4607E+02	.2934E+02	N10
	.4638E+02	.1318E+03	.4582E+02	.8911E+02	.4547E+02	.6326E+02	.4621E+02	.3905E+02	N15
5	.4601E+02	.1635E+03	.4638E+02	.1318E+03	.4660E+02	.1063E+03	.4564E+02	.7857E+02	N30
	.4601E+02	.1635E+03	.4639E+02	.1405E+03	.4638E+02	.1318E+03	.4660E+02	.1063E+03	N50
	.9901E+00		.9901E+00		.9901E+00		.9901E+00		B
	.9488E+00		.9488E+00		.9488E+00		.9488E+00		A
	.4549E+02	.4644E+02	.4564E+02	.2929E+02	.4526E+02	.2727E+02	.4491E+02	.2631E+02	LR
	.9618E+00		.9618E+00		.9618E+00		.9618E+00		RHO
	.3933E+02		.3038E+02		.2740E+02		.2502E+02		VAR(LR)
	.1011E+01		.1011E+01		.1011E+01		.1011E+01		YBAR/XBAR
	.4554E+02	.2967E+02	.4573E+02	.1639E+02	.4533E+02	.2052E+02	.4498E+02	.2080E+02	R-EST
	.3361E+02		.2467E+02		.2170E+02		.1931E+02		VAR(R-EST)
	.4547E+02	.6326E+02	.4594E+02	.4082E+02	.4612E+02	.3240E+02	.4572E+02	.2774E+02	N10
	.4564E+02	.7857E+02	.4546E+02	.4887E+02	.4594E+02	.4082E+02	.4636E+02	.2944E+02	N15
10	.4582E+02	.8911E+02	.4564E+02	.7857E+02	.4547E+02	.6326E+02	.4542E+02	.4862E+02	N30
	.4582E+02	.8911E+02	.4550E+02	.7759E+02	.4564E+02	.7857E+02	.4547E+02	.6326E+02	N50
	.9409E+00		.9409E+00		.9409E+00		.9409E+00		B
	.3859E+01		.3859E+01		.3859E+01		.3859E+01		A
	.4607E+02	.3182E+02	.4632E+02	.1990E+02	.4600E+02	.2306E+02	.4573E+02	.2306E+02	LR
	.9414E+00		.9414E+00		.9414E+00		.9414E+00		RHO
	.3245E+02		.2337E+02		.2035E+02		.1793E+02		VAR(LR)
	.1005E+01		.1005E+01		.1005E+01		.1005E+01		YBAR/XBAR
	.4529E+02	.2671E+02	.4546E+02	.1126E+02	.4504E+02	.1354E+02	.4467E+02	.1169E+02	R-EST
	.2749E+02		.1880E+02		.1590E+02		.1358E+02		VAR(R-EST)
	.4594E+02	.4082E+02	.4612E+02	.3240E+02	.4607E+02	.2934E+02	.4550E+02	.2277E+02	N10
	.4542E+02	.4862E+02	.4621E+02	.3905E+02	.4612E+02	.3240E+02	.4606E+02	.3212E+02	N15
15	.4546E+02	.4887E+02	.4542E+02	.4862E+02	.4594E+02	.4082E+02	.4580E+02	.3872E+02	N30
	.4546E+02	.4887E+02	.4526E+02	.4697E+02	.4542E+02	.4862E+02	.4594E+02	.4082E+02	N50
	.9244E+00		.9244E+00		.9244E+00		.9244E+00		B
	.3943E+01		.3943E+01		.3943E+01		.3943E+01		A
	.4550E+02	.2737E+02	.4568E+02	.1291E+02	.4532E+02	.1373E+02	.4503E+02	.1174E+02	LR
	.9406E+00		.9406E+00		.9406E+00		.9406E+00		RHO
	.2675E+02		.1790E+02		.1495E+02		.1259E+02		VAR(LR)

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1003E+01		.1003E+01		.1003E+01		.1003E+01		YBAR/XBAR
	.1947E+02	.5024E+01	.1948E+02	.3703E+01	.1950E+02	.2951E+01	.1947E+02	.2626E+01	R-EST
	.5666E+01		.3399E+01		.2644E+01		.2039E+01		VAR(R-EST)
	.1903E+02	.1576E+02	.1936E+02	.1172E+02	.1941E+02	.8118E+01	.1968E+02	.5130E+01	N10
	.1876E+02	.1950E+02	.1919E+02	.1563E+02	.1936E+02	.1172E+02	.1937E+02	.7975E+01	N15
5	.1906E+02	.2219E+02	.1876E+02	.1950E+02	.1903E+02	.1576E+02	.1939E+02	.1321E+02	N30
	.1906E+02	.2219E+02	.1877E+02	.2060E+02	.1876E+02	.1950E+02	.1903E+02	.1576E+02	N50
	.9845E+00		.9845E+00		.9845E+00		.9845E+00		R
	.5261E+00		.5261E+00		.5261E+00		.5261E+00		A
	.1965E+02	.5055E+01	.1966E+02	.3497E+01	.1967E+02	.2660E+01	.1965E+02	.2299E+01	LR
	.9927E+00		.9927E+00		.9927E+00		.9927E+00		RHO
	.5538E+01		.3264E+01		.2506E+01		.1899E+01		VAR(LR)
	.9991E+00		.9991E+00		.9991E+00		.9991E+00		YBAR/XBAR
	.1939E+02	.3600E+01	.1940E+02	.2397E+01	.1942E+02	.1804E+01	.1939E+02	.1556E+01	R-EST
	.4345E+01		.2447E+01		.1814E+01		.1308E+01		VAR(R-EST)
	.1936E+02	.1172E+02	.1941E+02	.8118E+01	.1956E+02	.6398E+01	.1952E+02	.4999E+01	N10
	.1939E+02	.1321E+02	.1950E+02	.1269E+02	.1941E+02	.8118E+01	.1974E+02	.5966E+01	N15
10	.1919E+02	.1563E+02	.1939E+02	.1321E+02	.1936E+02	.1172E+02	.1947E+02	.9601E+01	N30
	.1919E+02	.1563E+02	.1922E+02	.1364E+02	.1939E+02	.1321E+02	.1936E+02	.1172E+02	N50
	.9833E+00		.9833E+00		.9833E+00		.9833E+00		R
	.3686E+00		.3686E+00		.3686E+00		.3686E+00		A
	.1943E+02	.3685E+01	.1946E+02	.2342E+01	.1948E+02	.1737E+01	.1946E+02	.1451E+01	LR
	.9899E+00		.9899E+00		.9899E+00		.9899E+00		RHO
	.4278E+01		.2372E+01		.1737E+01		.1228E+01		VAR(LR)
	.1000E+01		.1000E+01		.1000E+01		.1000E+01		YBAR/XBAR
	.1941E+02	.3392E+01	.1942E+02	.2009E+01	.1944E+02	.1475E+01	.1942E+02	.1360E+01	R-EST
	.3986E+01		.2173E+01		.1569E+01		.1086E+01		VAR(R-EST)
	.1941E+02	.8118E+01	.1956E+02	.6398E+01	.1968E+02	.5130E+01	.1953E+02	.4233E+01	N10
	.1947E+02	.9601E+01	.1937E+02	.7975E+01	.1956E+02	.6398E+01	.1964E+02	.5042E+01	N15
15	.1950E+02	.1269E+02	.1947E+02	.9601E+01	.1941E+02	.8118E+01	.1962E+02	.7176E+01	N30
	.1950E+02	.1269E+02	.1953E+02	.1075E+02	.1947E+02	.9601E+01	.1941E+02	.8118E+01	N50
	.9783E+00		.9783E+00		.9783E+00		.9783E+00		R
	.4923E+00		.4923E+00		.4923E+00		.4923E+00		A
	.1945E+02	.3469E+01	.1948E+02	.2069E+01	.1950E+02	.1513E+01	.1948E+02	.1419E+01	LR
	.9886E+00		.9886E+00		.9886E+00		.9886E+00		RHO
	.3954E+01		.2134E+01		.1528E+01		.1043E+01		VAR(LR)

Results of simulation run 2.
Species No. 1

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		50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
5		.3995E+00		.3995E+00		.3995E+00		.3995E+00		YBAR/XBAR
		.3661E+03	.3959E+05	.3658E+03	.4029E+05	.3688E+03	.4063E+05	.3672E+03	.4188E+05	R-EST
		.9543E+04		.9980E+04		.1013E+05		.1024E+05		VAR(R-EST)
		.3010E+03	.6148E+03	.2999E+03	.4630E+03	.3014E+03	.3720E+03	.3021E+03	.3307E+03	N10
		.3049E+03	.7607E+03	.2991E+03	.6317E+03	.2999E+03	.4			
		.3054E+03	.1134E+04	.3049E+03	.7607E+03	.3010E+03	.6148E+03	.3006E+03	.4784E+03	N30
		.3054E+03	.1134E+04	.3055E+03	.7050E+03	.3049E+03	.7607E+03	.3010E+03	.6148E+03	N50
		.4354E-01		.4354E-01		.4354E-01		.4354E-01		B
		.2599E+03		.2599E+03		.2599E+03		.2599E+03		A
		.3011E+03	.3492E+04	.3003E+03	.3517E+04	.3009E+03	.3087E+04	.2995E+03	.3434E+04	LR
		.4619E+00		.4619E+00		.4619E+00		.4619E+00		RHO
		.1431E+04		.1417E+04		.1413E+04		.1409E+04		VAR(LR)
10		.3523E+00		.3523E+00		.3523E+00		.3523E+00		YBAR/XBAR
		.3221E+03	.7528E+04	.3221E+03	.8999E+04	.3257E+03	.9933E+04	.3235E+03	.9230E+04	R-EST
		.4716E+04		.5211E+04		.5376E+04		.5508E+04		VAR(R-EST)
		.2999E+03	.4630E+03	.3014E+03	.3720E+03	.3016E+03	.3868E+03	.3018E+03	.2752E+03	N10
		.3006E+03	.4784E+03	.2996E+03	.4331E+03	.3014E+03	.3720E+03	.3019E+03	.3761E+03	N15
		.2991E+03	.6317E+03	.3006E+03	.4784E+03	.2999E+03	.4630E+03	.3000E+03	.4091E+03	N30
		.2991E+03	.6317E+03	.3000E+03	.5798E+03	.3006E+03	.4784E+03	.2999E+03	.4630E+03	N50
		.5981E-01		.5981E-01		.5981E-01		.5981E-01		B
		.2481E+03		.2481E+03		.2481E+03		.2481E+03		A
		.3029E+03	.6172E+03	.3026E+03	.5742E+03	.3031E+03	.5309E+03	.3026E+03	.5147E+03	LR
		.5244E+00		.5244E+00		.5244E+00		.5244E+00		RHO
		.6073E+03		.5887E+03		.5825E+03		.5775E+03		VAR(LR)
15		.3416E+00		.3416E+00		.3416E+00		.3416E+00		YBAR/XBAR
		.3138E+03	.4504E+04	.3125E+03	.5014E+04	.3158E+03	.5613E+04	.3136E+03	.5023E+04	R-EST
		.2989E+04		.3525E+04		.3704E+04		.3847E+04		VAR(R-EST)
		.3014E+03	.3720E+03	.3016E+03	.3868E+03	.3021E+03	.3307E+03	.3011E+03	.2244E+03	N10
		.3000E+03	.4091E+03	.3011E+03	.3604E+03	.3016E+03	.3868E+03	.3012E+03	.3099E+03	N15
		.2996E+03	.4331E+03	.3000E+03	.4091E+03	.3014E+03	.3720E+03	.3009E+03	.3836E+03	N30
		.2996E+03	.4331E+03	.3004E+03	.4268E+03	.3000E+03	.4091E+03	.3014E+03	.3720E+03	N50
		.5351E-01		.5351E-01		.5351E-01		.5351E-01		B
		.2519E+03		.2519E+03		.2519E+03		.2519E+03		A
		.3008E+03	.4243E+03	.3007E+03	.3773E+03	.3012E+03	.3475E+03	.3007E+03	.3219E+03	LR
		.5103E+00		.5103E+00		.5103E+00		.5103E+00		RHO
		.3982E+03		.3790E+03		.3725E+03		.3674E+03		VAR(LR)

Species No. 2

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1059E+01		.1059E+01		.1059E+01		.1059E+01		YBAR/XBAR
	.5383E+02	.3701E+03	.5377E+02	.4033E+03	.5323E+02	.3457E+03	.5360E+02	.3432E+03	R-EST
	.1208E+03		.1177E+03		.1166E+03		.1158E+03		VAR(R-EST)
	.4385E+02	.9584E+02	.4457E+02	.6211E+02	.4473E+02	.4528E+02	.4409E+02	.2225E+02	N10
	.4343E+02	.1105E+03	.4384E+02	.8686E+02	.4457E+02	.6211E+02	.4506E+02	.4111E+02	N15
5	.4357E+02	.1158E+03	.4343E+02	.1105E+03	.4385E+02	.9584E+02	.4408E+02	.7434E+02	N30
	.4357E+02	.1158E+03	.4330E+02	.1109E+03	.4343E+02	.1105E+03	.4385E+02	.9584E+02	N50
	.6643E+00		.6643E+00		.6643E+00		.6643E+00		B
	.1607E+02		.1607E+02		.1607E+02		.1607E+02		A
	.4907E+02	.3052E+03	.4938E+02	.3479E+03	.4883E+02	.2807E+03	.4933E+02	.2846E+03	LR
	.7256E+00		.7256E+00		.7256E+00		.7256E+00		RHO
	.8221E+02		.7694E+02		.7519E+02		.7378E+02		VAR(LR)
	.9474E+00		.9474E+00		.9474E+00		.9474E+00		YBAR/XBAR
	.4806E+02	.1803E+03	.4804E+02	.1702E+03	.4761E+02	.1420E+03	.4793E+02	.1346E+03	R-EST
	.9460E+02		.9470E+02		.9473E+02		.9475E+02		VAR(R-EST)
	.4457E+02	.6211E+02	.4473E+02	.4528E+02	.4442E+02	.3115E+02	.4422E+02	.2102E+02	N10
	.4408E+02	.7434E+02	.4418E+02	.5186E+02	.4473E+02	.4528E+02	.4429E+02	.3002E+02	N15
10	.4384E+02	.8686E+02	.4408E+02	.7434E+02	.4457E+02	.6211E+02	.4444E+02	.4560E+02	N30
	.4384E+02	.8686E+02	.4368E+02	.7657E+02	.4408E+02	.7434E+02	.4457E+02	.6211E+02	N50
	.5276E+00		.5276E+00		.5276E+00		.5276E+00		B
	.2012E+02		.2012E+02		.2012E+02		.2012E+02		A
	.4630E+02	.9050E+02	.4653E+02	.7665E+02	.4638E+02	.6198E+02	.4656E+02	.6022E+02	LR
	.7559E+00		.7559E+00		.7559E+00		.7559E+00		RHO
	.5197E+02		.4673E+02		.4499E+02		.4359E+02		VAR(LR)
	.8898E+00		.8898E+00		.8898E+00		.8898E+00		YBAR/XBAR
	.4487E+02	.8843E+02	.4485E+02	.8132E+02	.4469E+02	.8311E+02	.4499E+02	.7353E+02	R-EST
	.6981E+02		.7124E+02		.7172E+02		.7210E+02		VAR(R-EST)
	.4473E+02	.4528E+02	.4442E+02	.3115E+02	.4409E+02	.2225E+02	.4430E+02	.2248E+02	N10
	.4444E+02	.4560E+02	.4506E+02	.4111E+02	.4442E+02	.3115E+02	.4397E+02	.1907E+02	N15
15	.4418E+02	.5186E+02	.4444E+02	.4560E+02	.4473E+02	.4528E+02	.4490E+02	.3812E+02	N30
	.4418E+02	.5186E+02	.4449E+02	.5130E+02	.4444E+02	.4560E+02	.4473E+02	.4528E+02	N50
	.4707E+00		.4707E+00		.4707E+00		.4707E+00		B
	.2158E+02		.2158E+02		.2158E+02		.2158E+02		A
	.4487E+02	.4762E+02	.4514E+02	.3643E+02	.4511E+02	.3072E+02	.4532E+02	.2966E+02	LR
	.7589E+00		.7589E+00		.7589E+00		.7589E+00		RHO
	.3832E+02		.3301E+02		.3124E+02		.2982E+02		VAR(LR)

Species No. 3

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1068E+01		.1068E+01		.1068E+01		.1068E+01		YBAR/XBAR
	.5179E+02	.3140E+03	.5394E+02	.3243E+03	.5379E+02	.3094E+03	.5413E+02	.3448E+03	R-EST
	.1321E+03		.1291E+03		.1281E+03		.1273E+03		VAR(R-EST)
	.4310E+02	.9561E+02	.4340E+02	.7448E+02	.4320E+02	.5042E+02	.4394E+02	.3922E+02	N10
	.4191E+02	.1087E+03	.4362E+02	.9356E+02	.4340E+02	.7448E+02	.4337E+02	.4638E+02	N15
5	.4274E+02	.1779E+03	.4191E+02	.1087E+03	.4310E+02	.9561E+02	.4318E+02	.7780E+02	N30
	.4274E+02	.1779E+03	.4177E+02	.1336E+03	.4191E+02	.1087E+03	.4310E+02	.9561E+02	N50
	.6816E+00		.6816E+00		.6816E+00		.6816E+00		B
	.1565E+02		.1565E+02		.1565E+02		.1565E+02		A
	.4887E+02	.1894E+03	.4993E+02	.1725E+03	.4997E+02	.1820E+03	.5014E+02	.2034E+03	LR
	.7867E+00		.7867E+00		.7867E+00		.7867E+00		RHO
	.1019E+03		.9718E+02		.9562E+02		.9437E+02		VAR(LR)
	.9646E+00		.9646E+00		.9646E+00		.9646E+00		YBAR/XBAR
	.4672E+02	.1117E+03	.4869E+02	.1123E+03	.4859E+02	.1104E+03	.4877E+02	.1232E+03	R-EST
	.8113E+02		.7898E+02		.7826E+02		.7768E+02		VAR(R-EST)
	.4340E+02	.7448E+02	.4320E+02	.5042E+02	.4364E+02	.4636E+02	.4397E+02	.3288E+02	N10
	.4318E+02	.7780E+02	.4375E+02	.6305E+02	.4320E+02	.5042E+02	.4388E+02	.4821E+02	N15
10	.4362E+02	.9356E+02	.4318E+02	.7780E+02	.4340E+02	.7448E+02	.4321E+02	.5589E+02	N30
	.4362E+02	.9356E+02	.4342E+02	.9560E+02	.4318E+02	.7780E+02	.4340E+02	.7448E+02	N50
	.5925E+00		.5925E+00		.5925E+00		.5925E+00		B
	.1737E+02		.1737E+02		.1737E+02		.1737E+02		A
	.4563E+02	.6576E+02	.4708E+02	.6744E+02	.4701E+02	.6203E+02	.4714E+02	.6678E+02	LR
	.7712E+00		.7712E+00		.7712E+00		.7712E+00		RHO
	.5336E+02		.4772E+02		.4585E+02		.4435E+02		VAR(LR)
	.9370E+00		.9370E+00		.9370E+00		.9370E+00		YBAR/XBAR
	.4547E+02	.6970E+02	.4739E+02	.7311E+02	.4730E+02	.7203E+02	.4744E+02	.7702E+02	R-EST
	.5781E+02		.5618E+02		.5563E+02		.5520E+02		VAR(R-EST)
	.4320E+02	.5042E+02	.4364E+02	.4636E+02	.4394E+02	.3922E+02	.4389E+02	.3122E+02	N10
	.4321E+02	.5589E+02	.4337E+02	.4638E+02	.4364E+02	.4636E+02	.4402E+02	.3804E+02	N15
15	.4375E+02	.6305E+02	.4321E+02	.5589E+02	.4320E+02	.5042E+02	.4359E+02	.4683E+02	N30
	.4375E+02	.6305E+02	.4352E+02	.6082E+02	.4321E+02	.5589E+02	.4320E+02	.5042E+02	N50
	.5534E+00		.5534E+00		.5534E+00		.5534E+00		B
	.1844E+02		.1844E+02		.1844E+02		.1844E+02		A
	.4484E+02	.4317E+02	.4619E+02	.3941E+02	.4617E+02	.3505E+02	.4624E+02	.3632E+02	LR
	.7795E+00		.7795E+00		.7795E+00		.7795E+00		RHO
	.3779E+02		.3186E+02		.2989E+02		.2831E+02		VAR(LR)

Species No. 4

	50		100		150				
	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	
	.1007E+01		.1007E+01		.1007E+01		.1007E+01		YBAR/XBAR
	.1998E+02	.2001E+02	.1952E+02	.1514E+02	.1947E+02	.1545E+02	.1935E+02	.1603E+02	R-EST
	.1943E+02		.1823E+02		.1783E+02		.1751E+02		VAR(R-EST)
	.1984E+02	.2060E+02	.1933E+02	.1082E+02	.1993E+02	.9576E+01	.2012E+02	.7816E+01	N10
	.2042E+02	.2879E+02	.1970E+02	.1889E+02	.1933E+02	.1082E+02	.1992E+02	.9722E+01	N15
5	.2096E+02	.3918E+02	.2042E+02	.2879E+02	.1984E+02	.2060E+02	.1945E+02	.1666E+02	N30
	.2096E+02	.3918E+02	.2106E+02	.3625E+02	.2042E+02	.2879E+02	.1984E+02	.2060E+02	N50
	.8239E+00		.8239E+00		.8239E+00		.8239E+00		B
	.5280E+01		.5280E+01		.5280E+01		.5280E+01		A
	.2153E+02	.2735E+02	.2126E+02	.2064E+02	.2121E+02	.2056E+02	.2109E+02	.1997E+02	LR
	.8659E+00		.8659E+00		.8659E+00		.8659E+00		RHO
	.1529E+02		.1386E+02		.1338E+02		.1300E+02		VAR(LR)
	.1019E+01		.1019E+01		.1019E+01		.1019E+01		YBAR/XBAR
	.2027E+02	.1391E+02	.1980E+02	.9249E+01	.1972E+02	.9125E+01	.1960E+02	.9524E+01	R-EST
	.1038E+02		.9430E+01		.9112E+01		.8858E+01		VAR(R-EST)
	.1933E+02	.1082E+02	.1993E+02	.9576E+01	.2016E+02	.8746E+01	.2003E+02	.5907E+01	N10
	.1945E+02	.1666E+02	.1953E+02	.1188E+02	.1993E+02	.9576E+01	.2013E+02	.8674E+01	N15
10	.1970E+02	.1889E+02	.1945E+02	.1666E+02	.1933E+02	.1082E+02	.1945E+02	.1021E+02	N30
	.1970E+02	.1889E+02	.1958E+02	.1754E+02	.1945E+02	.1666E+02	.1933E+02	.1082E+02	N50
	.7792E+00		.7792E+00		.7792E+00		.7792E+00		B
	.5122E+01		.5122E+01		.5122E+01		.5122E+01		A
	.2040E+02	.1008E+02	.2019E+02	.7176E+01	.2015E+02	.6771E+01	.2008E+02	.6779E+01	LR
	.8482E+00		.8482E+00		.8482E+00		.8482E+00		RHO
	.8246E+01		.7025E+01		.6618E+01		.6292E+01		VAR(LR)
	.1009E+01		.1009E+01		.1009E+01		.1009E+01		YBAR/XBAR
	.2008E+02	.9295E+01	.1963E+02	.5963E+01	.1953E+02	.4799E+01	.1941E+02	.5504E+01	R-EST
	.7214E+01		.6166E+01		.5817E+01		.5537E+01		VAR(R-EST)
	.1993E+02	.9576E+01	.2016E+02	.8746E+01	.2012E+02	.7816E+01	.2010E+02	.4703E+01	N10
	.1945E+02	.1021E+02	.1992E+02	.9722E+01	.2016E+02	.8746E+01	.2001E+02	.7232E+01	N15
15	.1953E+02	.1188E+02	.1945E+02	.1021E+02	.1993E+02	.9576E+01	.1989E+02	.9497E+01	N30
	.1953E+02	.1188E+02	.1947E+02	.1153E+02	.1945E+02	.1021E+02	.1993E+02	.9576E+01	N50
	.7578E+00		.7578E+00		.7578E+00		.7578E+00		B
	.5074E+01		.5074E+01		.5074E+01		.5074E+01		A
	.1997E+02	.6181E+01	.1975E+02	.4281E+01	.1969E+02	.3448E+01	.1963E+02	.3749E+01	LR
	.8541E+00		.8541E+00		.8541E+00		.8541E+00		RHO
	.6111E+01		.4826E+01		.4398E+01		.4056E+01		VAR(LR)

Results of simulation run 3.
Species No. 1

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
5	.1292E+01		.1292E+01		.1292E+01		.1292E+01		YBAR/XBAR
	.3395E+03	.1137E+05	.3472E+03	.1318E+05	.3453E+03	.1269E+05	.3464E+03	.1342E+05	R-EST
	.8310E+04		.8703E+04		.8834E+04		.8939E+04		VAR(R-EST)
	.2990E+03	.7048E+03	.2972E+03	.4551E+03	.2968E+03	.2910E+03	.2965E+03	.2182E+03	N10
	.2990E+03	.1011E+04	.2998E+03	.6318E+03	.2972E+03	.4551E+03	.2967E+03	.3026E+03	N15
	.2994E+03	.1267E+04	.2990E+03	.1011E+04	.2990E+03	.7048E+03	.2971E+03	.5431E+03	N30
	.2994E+03	.1267E+04	.2998E+03	.1062E+04	.2990E+03	.1011E+04	.2990E+03	.7048E+03	N50
	.1653E+00		.1653E+00		.1653E+00		.1653E+00		B
	.2573E+03		.2573E+03		.2573E+03		.2573E+03		A
	.3033E+03	.1379E+04	.3025E+03	.1489E+04	.3021E+03	.1474E+04	.3019E+03	.1525E+04	LR
	.3818E+00		.3818E+00		.3818E+00		.3818E+00		RHO
	.1020E+04		.1008E+04		.1004E+04		.1000E+04		VAR(LR)
10	.1218E+01		.1218E+01		.1218E+01		.1218E+01		YBAR/XBAR
	.3198E+03	.6899E+04	.3271E+03	.8046E+04	.3251E+03	.7357E+04	.3257E+03	.7604E+04	R-EST
	.4243E+04		.4682E+04		.4829E+04		.4946E+04		VAR(R-EST)
	.2972E+03	.4551E+03	.2968E+03	.2910E+03	.2960E+03	.2562E+03	.2957E+03	.1888E+03	N10
	.2971E+03	.5431E+03	.2967E+03	.3966E+03	.2968E+03	.2910E+03	.2960E+03	.2471E+03	N15
	.2998E+03	.6318E+03	.2971E+03	.5431E+03	.2972E+03	.4551E+03	.2966E+03	.3055E+03	N30
	.2998E+03	.6318E+03	.2986E+03	.5724E+03	.2971E+03	.5431E+03	.2972E+03	.4551E+03	N50
	.1934E+00		.1934E+00		.1934E+00		.1934E+00		B
	.2467E+03		.2467E+03		.2467E+03		.2467E+03		A
	.2980E+03	.6313E+03	.2988E+03	.6300E+03	.2986E+03	.6168E+03	.2985E+03	.6318E+03	LR
	.4950E+00		.4950E+00		.4950E+00		.4950E+00		RHO
	.5685E+03		.5488E+03		.5422E+03		.5369E+03		VAR(LR)
15	.1188E+01		.1188E+01		.1188E+01		.1188E+01		YBAR/XBAR
	.3111E+03	.3266E+04	.3186E+03	.4742E+04	.3172E+03	.4801E+04	.3177E+03	.5080E+04	R-EST
	.2443E+04		.2858E+04		.2996E+04		.3107E+04		VAR(R-EST)
	.2968E+03	.2910E+03	.2960E+03	.2562E+03	.2965E+03	.2182E+03	.2959E+03	.1653E+03	N10
	.2966E+03	.3055E+03	.2967E+03	.3026E+03	.2960E+03	.2562E+03	.2957E+03	.2142E+03	N15
	.2967E+03	.3966E+03	.2966E+03	.3055E+03	.2968E+03	.2910E+03	.2966E+03	.2472E+03	N30
	.2967E+03	.3966E+03	.2975E+03	.3574E+03	.2966E+03	.3055E+03	.2968E+03	.2910E+03	N50
	.2023E+00		.2023E+00		.2023E+00		.2023E+00		B
	.2439E+03		.2439E+03		.2439E+03		.2439E+03		A
	.2979E+03	.4076E+03	.2986E+03	.4045E+03	.2984E+03	.3948E+03	.2981E+03	.4070E+03	LR
	.4986E+00		.4986E+00		.4986E+00		.4986E+00		RHO
	.4102E+03		.3895E+03		.3825E+03		.3770E+03		VAR(LR)

Species No. 2

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1974E+01		.1974E+01		.1974E+01		.1974E+01		YBAR/XBAR
	.4514E+02	.8201E+02	.4419E+02	.5858E+02	.4442E+02	.4657E+02	.4452E+02	.4714E+02	R-EST
	.7507E+02		.6894E+02		.6690E+02		.6527E+02		VAR(R-EST)
	.4448E+02	.8740E+02	.4467E+02	.5375E+02	.4506E+02	.3673E+02	.4426E+02	.1858E+02	N10
	.4566E+02	.1341E+03	.4439E+02	.7905E+02	.4467E+02	.5375E+02	.4495E+02	.3237E+02	N15
5	.4544E+02	.1711E+03	.4566E+02	.1341E+03	.4448E+02	.8740E+02	.4460E+02	.7137E+02	N30
	.4544E+02	.1711E+03	.4530E+02	.1458E+03	.4566E+02	.1341E+03	.4448E+02	.8740E+02	N50
	.1736E+01		.1736E+01		.1736E+01		.1736E+01		B
	.8059E+01		.8059E+01		.8059E+01		.8059E+01		A
	.4761E+02	.1276E+03	.4680E+02	.1086E+03	.4708E+02	.1091E+03	.4716E+02	.1061E+03	LR
	.9101E+00		.9101E+00		.9101E+00		.9101E+00		RHO
	.5747E+02		.5037E+02		.4801E+02		.4611E+02		VAR(LR)
	.1981E+01		.1981E+01		.1981E+01		.1981E+01		YBAR/XBAR
	.4534E+02	.6594E+02	.4444E+02	.5231E+02	.4466E+02	.3924E+02	.4479E+02	.4311E+02	R-EST
	.4552E+02		.3967E+02		.3772E+02		.3616E+02		VAR(R-EST)
	.4467E+02	.5375E+02	.4506E+02	.3673E+02	.4466E+02	.2780E+02	.4456E+02	.1527E+02	N10
	.4460E+02	.7137E+02	.4501E+02	.4982E+02	.4506E+02	.3673E+02	.4455E+02	.2663E+02	N15
10	.4439E+02	.7905E+02	.4460E+02	.7137E+02	.4467E+02	.5375E+02	.4510E+02	.4418E+02	N30
	.4439E+02	.7905E+02	.4446E+02	.7163E+02	.4460E+02	.7137E+02	.4467E+02	.5375E+02	N50
	.1564E+01		.1564E+01		.1564E+01		.1564E+01		B
	.1050E+02		.1050E+02		.1050E+02		.1050E+02		A
	.4638E+02	.6662E+02	.4565E+02	.4954E+02	.4580E+02	.4066E+02	.4589E+02	.4498E+02	LR
	.8747E+00		.8747E+00		.8747E+00		.8747E+00		RHO
	.3711E+02		.3021E+02		.2791E+02		.2607E+02		VAR(LR)
	.1920E+01		.1920E+01		.1920E+01		.1920E+01		YBAR/XBAR
	.4377E+02	.3431E+02	.4296E+02	.2920E+02	.4325E+02	.2225E+02	.4338E+02	.2585E+02	R-EST
	.3788E+02		.3254E+02		.3075E+02		.2933E+02		VAR(R-EST)
	.4506E+02	.3673E+02	.4466E+02	.2780E+02	.4426E+02	.1858E+02	.4487E+02	.1517E+02	N10
	.4510E+02	.4418E+02	.4495E+02	.3237E+02	.4466E+02	.2780E+02	.4447E+02	.1900E+02	N15
15	.4501E+02	.4982E+02	.4510E+02	.4418E+02	.4506E+02	.3673E+02	.4468E+02	.2652E+02	N30
	.4501E+02	.4982E+02	.4479E+02	.4518E+02	.4510E+02	.4418E+02	.4506E+02	.3673E+02	N50
	.1409E+01		.1409E+01		.1409E+01		.1409E+01		B
	.1244E+02		.1244E+02		.1244E+02		.1244E+02		A
	.4440E+02	.3235E+02	.4389E+02	.2688E+02	.4415E+02	.2179E+02	.4426E+02	.2418E+02	LR
	.8644E+00		.8644E+00		.8644E+00		.8644E+00		RHO
	.3045E+02		.2352E+02		.2120E+02		.1935E+02		VAR(LR)

Species No. 3

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
5	.2083E+01		.2083E+01		.2083E+01		.2083E+01		YBAR/XBAR
	.4728E+02	.1374E+03	.4661E+02	.1166E+03	.4666E+02	.1109E+03	.4669E+02	.1105E+03	R-EST
	.9666E+02		.9113E+02		.8929E+02		.8781E+02		VAR(R-EST)
	.4596E+02	.9303E+02	.4605E+02	.6583E+02	.4546E+02	.4642E+02	.4498E+02	.3469E+02	N10
	.4555E+02	.1436E+03	.4559E+02	.9055E+02	.4605E+02	.6583E+02	.4546E+02	.4376E+02	N15
	.4685E+02	.1997E+03	.4555E+02	.1436E+03	.4596E+02	.9303E+02	.4606E+02	.8380E+02	N30
	.4685E+02	.1997E+03	.4604E+02	.1544E+03	.4555E+02	.1436E+03	.4596E+02	.9303E+02	N50
	.1611E+01		.1611E+01		.1611E+01		.1611E+01		B
	.1274E+02		.1274E+02		.1274E+02		.1274E+02		A
	.4892E+02	.1118E+03	.4871E+02	.9973E+02	.4874E+02	.9555E+02	.4861E+02	.9522E+02	LR
	.8469E+00		.8469E+00		.8469E+00		.8469E+00		RHO
	.8034E+02		.7390E+02		.7175E+02		.7003E+02		VAR(LR)
10	.1976E+01		.1976E+01		.1976E+01		.1976E+01		YBAR/XBAR
	.4474E+02	.5211E+02	.4418E+02	.4401E+02	.4422E+02	.4173E+02	.4424E+02	.3874E+02	R-EST
	.6585E+02		.6053E+02		.5875E+02		.5733E+02		VAR(R-EST)
	.4605E+02	.6583E+02	.4546E+02	.4642E+02	.4546E+02	.4664E+02	.4510E+02	.3139E+02	N10
	.4606E+02	.8380E+02	.4585E+02	.6134E+02	.4546E+02	.4642E+02	.4539E+02	.4134E+02	N15
	.4559E+02	.9055E+02	.4606E+02	.8380E+02	.4605E+02	.6583E+02	.4543E+02	.4276E+02	N30
	.4559E+02	.9055E+02	.4559E+02	.8863E+02	.4606E+02	.8380E+02	.4605E+02	.6583E+02	N50
	.1467E+01		.1467E+01		.1467E+01		.1467E+01		B
	.1263E+02		.1263E+02		.1263E+02		.1263E+02		A
	.4550E+02	.4181E+02	.4532E+02	.3081E+02	.4544E+02	.2681E+02	.4541E+02	.2565E+02	LR
	.8634E+00		.8634E+00		.8634E+00		.8634E+00		RHO
	.4765E+02		.4005E+02		.3751E+02		.3549E+02		VAR(LR)
15	.1985E+01		.1985E+01		.1985E+01		.1985E+01		YBAR/XBAR
	.4502E+02	.4542E+02	.4440E+02	.3033E+02	.4444E+02	.2880E+02	.4446E+02	.2612E+02	R-EST
	.4862E+02		.4341E+02		.4168E+02		.4029E+02		VAR(R-EST)
	.4546E+02	.4642E+02	.4546E+02	.4664E+02	.4498E+02	.3469E+02	.4494E+02	.2482E+02	N10
	.4543E+02	.4276E+02	.4546E+02	.4376E+02	.4546E+02	.4664E+02	.4503E+02	.3527E+02	N15
	.4585E+02	.6134E+02	.4543E+02	.4276E+02	.4546E+02	.4642E+02	.4555E+02	.4445E+02	N30
	.4585E+02	.6134E+02	.4590E+02	.4747E+02	.4543E+02	.4276E+02	.4546E+02	.4642E+02	N50
	.1405E+01		.1405E+01		.1405E+01		.1405E+01		B
	.1392E+02		.1392E+02		.1392E+02		.1392E+02		A
	.4558E+02	.3961E+02	.4529E+02	.2609E+02	.4538E+02	.2335E+02	.4533E+02	.2147E+02	LR
	.8420E+00		.8420E+00		.8420E+00		.8420E+00		RHO
	.3750E+02		.2990E+02		.2737E+02		.2535E+02		VAR(LR)

Species No. 4

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
5	.2015E+01		.2015E+01		.2015E+01		.2015E+01		YBAR/XBAR
	.1959E+02	.8520F+01	.1970E+02	.7209E+01	.1958F+02	.6657E+01	.1940E+02	.5918E+01	R-FST
	.7686E+01		.5761E+01		.5119E+01		.4606E+01		VAR(R-FST)
	.2006E+02	.1511E+02	.1969E+02	.9127E+01	.1939E+02	.7988E+01	.1952E+02	.5577E+01	N10
	.2047E+02	.1561F+02	.2002E+02	.1530E+02	.1969F+02	.9127E+01	.1936E+02	.7680E+01	N15
	.2160E+02	.1795E+02	.2047E+02	.1561E+02	.2006F+02	.1511E+02	.1975E+02	.1171E+02	N30
	.2160E+02	.1795F+02	.2074E+02	.1731E+02	.2047E+02	.1561E+02	.2006E+02	.1511E+02	N50
	.1903E+01		.1903E+01		.1903E+01		.1903E+01		B
	.1644F+01		.1644E+01		.1644E+01		.1644E+01		A
	.2012F+02	.7611F+01	.2025E+02	.6460E+01	.2015E+02	.6387E+01	.1998E+02	.5510E+01	LR
	.9584E+00		.9584E+00		.9584E+00		.9584E+00		RHO
	.7663E+01		.5736E+01		.5094E+01		.4581E+01		VAR(LR)
10	.2012E+01		.2012E+01		.2012E+01		.2012E+01		YBAR/XBAR
	.1955E+02	.5410F+01	.1965E+02	.4152E+01	.1954E+02	.3838E+01	.1937E+02	.3264E+01	R-EST
	.5315E+01		.3631E+01		.3070F+01		.2621E+01		VAR(R-EST)
	.1969E+02	.9127E+01	.1939E+02	.7988E+01	.1947E+02	.5774E+01	.1948E+02	.5270E+01	N10
	.1975E+02	.1171E+02	.1948E+02	.8041E+01	.1939E+02	.7988E+01	.1958E+02	.6028E+01	N15
	.2002E+02	.1530E+02	.1975E+02	.1171E+02	.1969E+02	.9127E+01	.1934E+02	.8229E+01	N30
	.2002E+02	.1530E+02	.2010E+02	.1452E+02	.1975E+02	.1171E+02	.1969E+02	.9127E+01	N50
	.1873E+01		.1873E+01		.1873E+01		.1873E+01		B
	.1590E+01		.1590E+01		.1590E+01		.1590F+01		A
	.1974E+02	.4922E+01	.1987E+02	.3312E+01	.1977F+02	.3203E+01	.1961E+02	.2810E+01	LR
	.9578E+00		.9578E+00		.9578E+00		.9578E+00		RHO
	.5157E+01		.3453E+01		.2886F+01		.2432F+01		VAR(LR)
15	.2010E+01		.2010F+01		.2010F+01		.2010E+01		YBAR/XBAR
	.1952E+02	.4306F+01	.1964E+02	.3567E+01	.1952F+02	.3096F+01	.1934E+02	.2227E+01	R-EST
	.4610E+01		.2977E+01		.2433E+01		.1998E+01		VAR(R-EST)
	.1939E+02	.7988F+01	.1947E+02	.5774E+01	.1952F+02	.5577E+01	.1958E+02	.3762E+01	N10
	.1934E+02	.8229E+01	.1936E+02	.7680E+01	.1947E+02	.5774E+01	.1954F+02	.5589E+01	N15
	.1948F+02	.8041E+01	.1934E+02	.8229E+01	.1939E+02	.7988E+01	.1951F+02	.6492E+01	N30
	.1948E+02	.8041F+01	.1959F+02	.8158E+01	.1934F+02	.8229E+01	.1939E+02	.7988E+01	N50
	.1875E+01		.1875E+01		.1875E+01		.1875E+01		B
	.1474F+01		.1474E+01		.1474E+01		.1474E+01		A
	.1964E+02	.4004E+01	.1979E+02	.2907E+01	.1969E+02	.2600E+01	.1952E+02	.1913E+01	LR
	.9534E+00		.9534E+00		.9534E+00		.9534F+00		RHO
	.4501E+01		.2845E+01		.2293F+01		.1852E+01		VAR(LR)

Results of simulation run 4.
Species No. 1

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
5	.3778E+00		.3778E+00		.3778E+00		.3778E+00		YBAR/XBAR
	.3312E+03	.1870E+05	.3279E+03	.1827E+05	.3237E+03	.1830E+05	.3279E+03	.1985E+05	R-EST
	.1077E+05		.1129E+05		.1146E+05		.1160E+05		VAR(R-EST)
	.3058E+03	.9661E+03	.3094E+03	.3855E+03	.3090E+03	.3486E+03	.3063E+03	.2541E+03	N10
	.3050E+03	.1000E+04	.3066E+03	.8374E+03	.3094E+03	.3855E+03	.3082E+03	.3586E+03	N15
	.3044E+03	.1262E+04	.3050E+03	.1000E+04	.3058E+03	.9661E+03	.3086E+03	.5580E+03	N30
	.3044E+03	.1262E+04	.3072E+03	.9934E+03	.3050E+03	.1000E+04	.3058E+03	.9661E+03	N50
	.6393E-01		.6393E-01		.6393E-01		.6393E-01		B
	.2538E+03		.2538E+03		.2538E+03		.2538E+03		A
	.3097E+03	.1689E+04	.3087E+03	.1658E+04	.3078E+03	.1636E+04	.3090E+03	.1612E+04	LR
	.4867E+00		.4867E+00		.4867E+00		.4867E+00		RHO
	.1120E+04		.1099E+04		.1092E+04		.1086E+04		VAR(LR)
10	.3523E+00		.3523E+00		.3523E+00		.3523E+00		YBAR/XBAR
	.3091E+03	.7149E+04	.3072E+03	.8144E+04	.3027E+03	.7662E+04	.3059E+03	.7453E+04	R-EST
	.5377E+04		.5965E+04		.6161E+04		.6318E+04		VAR(R-EST)
	.3094E+03	.3855E+03	.3090E+03	.3486E+03	.3065E+03	.2772E+03	.3052E+03	.2346E+03	N10
	.3086E+03	.5580E+03	.3089E+03	.3442E+03	.3090E+03	.3486E+03	.3065E+03	.2611E+03	N15
	.3066E+03	.8374E+03	.3086E+03	.5580E+03	.3094E+03	.3855E+03	.3077E+03	.3585E+03	N30
	.3066E+03	.8374E+03	.3075E+03	.6994E+03	.3086E+03	.5580E+03	.3094E+03	.3855E+03	N50
	.5578E-01		.5578E-01		.5578E-01		.5578E-01		B
	.2567E+03		.2567E+03		.2567E+03		.2567E+03		A
	.3051E+03	.8459E+03	.3047E+03	.8281E+03	.3040E+03	.8258E+03	.3050E+03	.7950E+03	LR
	.5366E+00		.5366E+00		.5366E+00		.5366E+00		RHO
	.5031E+03		.4823E+03		.4754E+03		.4698E+03		VAR(LR)
15	.3412E+00		.3412E+00		.3412E+00		.3412E+00		YBAR/XBAR
	.3001E+03	.4615E+04	.2969E+03	.4488E+04	.2929E+03	.4390E+04	.2961E+03	.4115E+04	R-EST
	.3301E+04		.3906E+04		.4108E+04		.4269E+04		VAR(R-EST)
	.3090E+03	.3486E+03	.3065E+03	.2772E+03	.3063E+03	.2541E+03	.3040E+03	.2380E+03	N10
	.3077E+03	.3585E+03	.3082E+03	.3586E+03	.3065E+03	.2772E+03	.3061E+03	.2667E+03	N15
	.3089E+03	.3442E+03	.3077E+03	.3585E+03	.3090E+03	.3486E+03	.3058E+03	.3074E+03	N30
	.3089E+03	.3442E+03	.3092E+03	.3628E+03	.3077E+03	.3585E+03	.3090E+03	.3486E+03	N50
	.5616E-01		.5616E-01		.5616E-01		.5616E-01		B
	.2577E+03		.2577E+03		.2577E+03		.2577E+03		A
	.3067E+03	.4403E+03	.3063E+03	.4233E+03	.3056E+03	.4248E+03	.3065E+03	.4058E+03	LR
	.5588E+00		.5588E+00		.5588E+00		.5588E+00		RHO
	.3795E+03		.3579E+03		.3508E+03		.3450E+03		VAR(LR)

Species No. 2

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1502E+01		.1502E+01		.1502E+01		.1502E+01		YBAR/XBAR
	.5110E+02	.5327E+03	.5033E+02	.4747E+03	.5047E+02	.4690E+03	.5174E+02	.5024E+03	R-EST
	.2139E+03		.2157E+03		.2163E+03		.2167E+03		VAR(R-EST)
	.4293E+02	.1143E+03	.4288E+02	.7665E+02	.4333E+02	.5519E+02	.4396E+02	.3051E+02	N10
	.4373E+02	.1455E+03	.4335E+02	.1051E+03	.4288E+02	.7665E+02	.4363E+02	.5613E+02	N15
5	.4372E+02	.1775E+03	.4373E+02	.1455E+03	.4293E+02	.1143E+03	.4272E+02	.9546E+02	N30
	.4372E+02	.1775E+03	.4347E+02	.1495E+03	.4373E+02	.1455E+03	.4293E+02	.1143E+03	N50
	.6804E+00		.6804E+00		.6804E+00		.6804E+00		B
	.2356E+02		.2356E+02		.2356E+02		.2356E+02		A
	.4684E+02	.1420E+03	.4653E+02	.1422E+03	.4644E+02	.1294E+03	.4689E+02	.1197E+03	LR
	.7245E+00		.7245E+00		.7245E+00		.7245E+00		RHO
	.9744E+02		.9272E+02		.9115E+02		.8989E+02		VAR(LR)
	.1394E+01		.1394E+01		.1394E+01		.1394E+01		YBAR/XBAR
	.4725E+02	.2731E+03	.4639E+02	.2220E+03	.4674E+02	.2482E+03	.4768E+02	.2358E+03	R-EST
	.1107E+03		.1129E+03		.1137E+03		.1143E+03		VAR(R-EST)
	.4288E+02	.7665E+02	.4333E+02	.5519E+02	.4405E+02	.4064E+02	.4414E+02	.2848E+02	N10
	.4272E+02	.9546E+02	.4285E+02	.7058E+02	.4333E+02	.5519E+02	.4397E+02	.3818E+02	N15
10	.4335E+02	.1051E+03	.4272E+02	.9546E+02	.4288E+02	.7665E+02	.4292E+02	.5804E+02	N30
	.4335E+02	.1051E+03	.4301E+02	.9480E+02	.4272E+02	.9546E+02	.4288E+02	.7665E+02	N50
	.6368E+00		.6368E+00		.6368E+00		.6368E+00		B
	.2339E+02		.2339E+02		.2339E+02		.2339E+02		A
	.4536E+02	.9472E+02	.4474E+02	.8003E+02	.4473E+02	.7307E+02	.4518E+02	.7023E+02	LR
	.7405E+00		.7405E+00		.7405E+00		.7405E+00		RHO
	.4902E+02		.4360E+02		.4179E+02		.4035E+02		VAR(LR)
	.1401E+01		.1401E+01		.1401E+01		.1401E+01		YBAR/XBAR
	.4741E+02	.1924E+03	.4671E+02	.1682E+03	.4700E+02	.1803E+03	.4799E+02	.1686E+03	R-EST
	.7921E+02		.8303E+02		.8430E+02		.8532E+02		VAR(R-EST)
	.4333E+02	.5519E+02	.4405E+02	.4064E+02	.4396E+02	.3051E+02	.4390E+02	.2606E+02	N10
	.4292E+02	.5804E+02	.4363E+02	.5613E+02	.4405E+02	.4064E+02	.4378E+02	.2763E+02	N15
15	.4285E+02	.7058E+02	.4292E+02	.5804E+02	.4333E+02	.5519E+02	.4406E+02	.4800E+02	N30
	.4285E+02	.7058E+02	.4317E+02	.6299E+02	.4292E+02	.5804E+02	.4333E+02	.5519E+02	N50
	.6172E+00		.6172E+00		.6172E+00		.6172E+00		B
	.2401E+02		.2401E+02		.2401E+02		.2401E+02		A
	.4529E+02	.7412E+02	.4466E+02	.5552E+02	.4466E+02	.5191E+02	.4511E+02	.4843E+02	LR
	.7276E+00		.7276E+00		.7276E+00		.7276E+00		RHO
	.3777E+02		.3272E+02		.3103E+02		.2969E+02		VAR(LR)

Species No. 3

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1512E+01		.1512E+01		.1512E+01		.1512E+01		YBAR/XBAR
	.5320E+02	.5330E+03	.5421E+02	.4939E+03	.5347E+02	.3743E+03	.5238E+02	.3481E+03	R-EST
	.1954E+03		.1974E+03		.1981E+03		.1986E+03		VAR(R-EST)
	.4436E+02	.1032E+03	.4332E+02	.5772E+02	.4330E+02	.4479E+02	.4359E+02	.2915E+02	N10
	.4408E+02	.9763E+02	.4360E+02	.8566E+02	.4332E+02	.5772E+02	.4325E+02	.4009E+02	N15
5	.4361E+02	.1458E+03	.4408E+02	.9763E+02	.4436E+02	.1032E+03	.4340E+02	.7559E+02	N30
	.4361E+02	.1458E+03	.4311E+02	.1140E+03	.4408E+02	.9763E+02	.4436E+02	.1032E+03	N50
	.7074E+00		.7074E+00		.7074E+00		.7074E+00		R
	.2421E+02		.2421E+02		.2421E+02		.2421E+02		A
	.4899E+02	.1889E+03	.4921E+02	.1538E+03	.4904E+02	.1253E+03	.4871E+02	.1169E+03	LR
	.7060E+00		.7060E+00		.7060E+00		.7060E+00		RHO
	.8841E+02		.8450E+02		.8320E+02		.8215E+02		VAR(LR)
	.1409E+01		.1409E+01		.1409E+01		.1409E+01		YBAR/XBAR
	.4860E+02	.1837E+03	.4969E+02	.1870E+03	.4959E+02	.1797E+03	.4866E+02	.1836E+03	R-EST
	.1227E+03		.1279E+03		.1296E+03		.1309E+03		VAR(R-EST)
	.4332E+02	.5772E+02	.4330E+02	.4479E+02	.4376E+02	.3206E+02	.4372E+02	.2210E+02	N10
	.4340E+02	.7559E+02	.4334E+02	.5490E+02	.4330E+02	.4479E+02	.4368E+02	.3309E+02	N15
10	.4360E+02	.8566E+02	.4340E+02	.7559E+02	.4332E+02	.5772E+02	.4371E+02	.5049E+02	N30
	.4360E+02	.8566E+02	.4368E+02	.8215E+02	.4340E+02	.7559E+02	.4332E+02	.5772E+02	N50
	.6110E+00		.6110E+00		.6110E+00		.6110E+00		R
	.2600E+02		.2600E+02		.2600E+02		.2600E+02		A
	.4704E+02	.6590E+02	.4742E+02	.5208E+02	.4734E+02	.4540E+02	.4698E+02	.4469E+02	LR
	.7069E+00		.7069E+00		.7069E+00		.7069E+00		RHO
	.4906E+02		.4496E+02		.4360E+02		.4251E+02		VAR(LR)
	.1370E+01		.1370E+01		.1370E+01		.1370E+01		YBAR/XBAR
	.4723E+02	.1268E+03	.4804E+02	.1098E+03	.4816E+02	.1328E+03	.4730E+02	.1414E+03	R-EST
	.8107E+02		.8649E+02		.8830E+02		.8975E+02		VAR(R-EST)
	.4330E+02	.4479E+02	.4376E+02	.3206E+02	.4359E+02	.2915E+02	.4368E+02	.2177E+02	N10
	.4371E+02	.5049E+02	.4325E+02	.4009E+02	.4376E+02	.3206E+02	.4363E+02	.2870E+02	N15
15	.4334E+02	.5490E+02	.4371E+02	.5049E+02	.4330E+02	.4479E+02	.4348E+02	.3575E+02	N30
	.4334E+02	.5490E+02	.4362E+02	.5126E+02	.4371E+02	.5049E+02	.4330E+02	.4479E+02	N50
	.5924E+00		.5924E+00		.5924E+00		.5924E+00		R
	.2524E+02		.2524E+02		.2524E+02		.2524E+02		A
	.4544E+02	.4216E+02	.4580E+02	.3035E+02	.4591E+02	.2917E+02	.4563E+02	.3175E+02	LR
	.7273E+00		.7273E+00		.7273E+00		.7273E+00		RHO
	.3525E+02		.3085E+02		.2939E+02		.2821E+02		VAR(LR)

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	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.2041E+01		.2041E+01		.2041E+01		.2041E+01		YBAR/XBAR
	.2150E+02	.5083E+02	.2183E+02	.6404E+02	.2172E+02	.6010E+02	.2158E+02	.5559E+02	R-EST
	.2763E+02		.2735E+02		.2726E+02		.2719E+02		VAR(R-EST)
	.1924E+02	.2146E+02	.1956E+02	.1351E+02	.1931E+02	.8549E+01	.1940E+02	.5644E+01	N10
	.1952E+02	.2681E+02	.1919E+02	.1801E+02	.1956E+02	.1351E+02	.1929E+02	.8446E+01	N15
5	.1951E+02	.3411E+02	.1952E+02	.2681E+02	.1924E+02	.2146E+02	.1950E+02	.1592E+02	N30
	.1951E+02	.3411E+02	.1944E+02	.2772E+02	.1952E+02	.2681E+02	.1924E+02	.2146E+02	N50
	.1322E+01		.1322E+01		.1322E+01		.1322E+01		B
	.7906E+01		.7906E+01		.7906E+01		.7906E+01		A
	.2179E+02	.3118E+02	.2212E+02	.3958E+02	.2201E+02	.3620E+02	.2190E+02	.3343E+02	LR
	.7755E+00		.7755E+00		.7755E+00		.7755E+00		RHO
	.1693E+02		.1606E+02		.1577E+02		.1554E+02		VAR(LR)
	.2024E+01		.2024E+01		.2024E+01		.2024E+01		YBAR/XBAR
	.2130E+02	.2637E+02	.2160E+02	.3537E+02	.2151E+02	.3173E+02	.2143E+02	.3118E+02	R-EST
	.1554E+02		.1520E+02		.1509E+02		.1500E+02		VAR(R-EST)
	.1956E+02	.1351E+02	.1931E+02	.8549E+01	.1936E+02	.6469E+01	.1948E+02	.3729E+01	N10
	.1950E+02	.1592E+02	.1937E+02	.1277E+02	.1931E+02	.8549E+01	.1935E+02	.6282E+01	N15
10	.1919E+02	.1801E+02	.1950E+02	.1592E+02	.1956E+02	.1351E+02	.1916E+02	.1234E+02	N30
	.1919E+02	.1801E+02	.1926E+02	.1828E+02	.1950E+02	.1592E+02	.1956E+02	.1351E+02	N50
	.1277E+01		.1277E+01		.1277E+01		.1277E+01		B
	.7616E+01		.7616E+01		.7616E+01		.7616E+01		A
	.2094E+02	.1301E+02	.2114E+02	.1543E+02	.2111E+02	.1380E+02	.2108E+02	.1427E+02	LR
	.7753E+00		.7753E+00		.7753E+00		.7753E+00		RHO
	.9482E+01		.8383E+01		.8017E+01		.7724E+01		VAR(LR)
	.1907E+01		.1907E+01		.1907E+01		.1907E+01		YBAR/XBAR
	.2018E+02	.1917E+02	.2036E+02	.2137E+02	.2029E+02	.1944E+02	.2020E+02	.1861E+02	R-EST
	.1149E+02		.1131E+02		.1125E+02		.1120E+02		VAR(R-EST)
	.1931E+02	.8549E+01	.1936E+02	.6469E+01	.1940E+02	.5644E+01	.1948E+02	.3968E+01	N10
	.1916E+02	.1234E+02	.1929E+02	.8446E+01	.1936E+02	.6469E+01	.1940E+02	.5322E+01	N15
15	.1937E+02	.1277E+02	.1916E+02	.1234E+02	.1931E+02	.8549E+01	.1932E+02	.7173E+01	N30
	.1937E+02	.1277E+02	.1924E+02	.1212E+02	.1916E+02	.1234E+02	.1931E+02	.8549E+01	N50
	.1105E+01		.1105E+01		.1105E+01		.1105E+01		B
	.8497E+01		.8487E+01		.8487E+01		.8487E+01		A
	.2014E+02	.1160E+02	.2026E+02	.1190E+02	.2027E+02	.1142E+02	.2020E+02	.1107E+02	LR
	.7660E+00		.7660E+00		.7660E+00		.7660E+00		RHO
	.7277E+01		.6191E+01		.5829E+01		.5539E+01		VAR(LR)

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	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.8331E+00		.8331E+00		.8331E+00		.8331E+00		YBAR/XBAR
	.3180E+03	.6766E+04	.3219E+03	.7506E+04	.3219E+03	.8012E+04	.3230E+03	.7807E+04	R-EST
	.7160E+04		.7477E+04		.7582E+04		.7667E+04		VAR(R-EST)
	.2951E+03	.7450E+03	.2950E+03	.5797E+03	.2958E+03	.4099E+03	.2976E+03	.2103E+03	N10
	.2963E+03	.8990E+03	.2966E+03	.6289E+03	.2950E+03	.5797E+03	.2956E+03	.3760E+03	N15
5	.2958E+03	.1115E+04	.2963E+03	.8990E+03	.2951E+03	.7450E+03	.2980E+03	.5652E+03	N30
	.2958E+03	.1115E+04	.2959E+03	.9490E+03	.2963E+03	.8990E+03	.2951E+03	.7450E+03	N50
	.1377E-01		.1377E-01		.1377E-01		.1377E-01		B
	.2863E+03		.2863E+03		.2863E+03		.2863E+03		A
	.2946E+03	.1560E+04	.2928E+03	.1577E+04	.2925E+03	.1581E+04	.2918E+03	.1582E+04	LR
	.1567E+00		.1567E+00		.1567E+00		.1567E+00		RHO
	.1591E+04		.1598E+04		.1600E+04		.1602E+04		VAR(LR)
	.7884E+00		.7884E+00		.7884E+00		.7884E+00		YBAR/XBAR
	.3011E+03	.3293E+04	.3046E+03	.3787E+04	.3046E+03	.4217E+04	.3056E+03	.4135E+04	R-EST
	.2922E+04		.3195E+04		.3286E+04		.3359E+04		VAR(R-EST)
	.2950E+03	.5797E+03	.2958E+03	.4099E+03	.2969E+03	.3011E+03	.2972E+03	.1770E+03	N10
	.2980E+03	.5652E+03	.2937E+03	.5012E+03	.2958E+03	.4099E+03	.2969E+03	.3112E+03	N15
10	.2966E+03	.6289E+03	.2980E+03	.5652E+03	.2950E+03	.5797E+03	.2951E+03	.4643E+03	N30
	.2966E+03	.6289E+03	.2970E+03	.5397E+03	.2980E+03	.5652E+03	.2950E+03	.5797E+03	N50
	.1050E+00		.1050E+00		.1050E+00		.1050E+00		B
	.2552E+03		.2552E+03		.2552E+03		.2552E+03		A
	.2951E+03	.8088E+03	.2956E+03	.8553E+03	.2958E+03	.8511E+03	.2957E+03	.8424E+03	LR
	.2678E+00		.2678E+00		.2678E+00		.2678E+00		RHO
	.7136E+03		.7103E+03		.7092E+03		.7083E+03		VAR(LR)
	.7663E+00		.7663E+00		.7663E+00		.7663E+00		YBAR/XBAR
	.2930E+03	.1301E+04	.2965E+03	.1861E+04	.2963E+03	.2130E+04	.2974E+03	.2074E+04	R-EST
	.1725E+04		.1989E+04		.2077E+04		.2147E+04		VAR(R-EST)
	.2958E+03	.4099E+03	.2969E+03	.3011E+03	.2976E+03	.2103E+03	.2983E+03	.1761E+03	N10
	.2951E+03	.4643E+03	.2956E+03	.3760E+03	.2969E+03	.3011E+03	.2978E+03	.2000E+03	N15
15	.2937E+03	.5012E+03	.2951E+03	.4643E+03	.2958E+03	.4099E+03	.2963E+03	.3515E+03	N30
	.2937E+03	.5012E+03	.2949E+03	.4598E+03	.2951E+03	.4643E+03	.2958E+03	.4099E+03	N50
	.9722E-01		.9722E-01		.9722E-01		.9722E-01		B
	.2573E+03		.2573E+03		.2573E+03		.2573E+03		A
	.2948E+03	.5648E+03	.2951E+03	.5702E+03	.2952E+03	.5601E+03	.2952E+03	.5474E+03	LR
	.2634E+00		.2634E+00		.2634E+00		.2634E+00		RHO
	.4723E+03		.4680E+03		.4665E+03		.4653E+03		VAR(LR)

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	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
5	.9933E+00		.9933E+00		.9933E+00		.9933E+00		YBAR/XBAR
	.4470E+02	.1234E+02	.4385E+02	.9644E+01	.4370E+02	.8134E+01	.4412E+02	.5305E+01	R-EST
	.1716E+02		.9047E+01		.6341E+01		.4176E+01		VAR(R-EST)
	.4577E+02	.1015E+03	.4566E+02	.6088E+02	.4536E+02	.4181E+02	.4474E+02	.2185E+02	N10
	.4616E+02	.1255E+03	.4558E+02	.7424E+02	.4566E+02	.6088E+02	.4552E+02	.3989E+02	N15
	.4583E+02	.1751E+03	.4616E+02	.1255E+03	.4577E+02	.1015E+03	.4488E+02	.6557E+02	N30
	.4583E+02	.1751E+03	.4594E+02	.1487E+03	.4616E+02	.1255E+03	.4577E+02	.1015E+03	N50
	.9999E+00		.9999E+00		.9999E+00		.9999E+00		B
	-.4650E+00		-.4650E+00		-.4650E+00		-.4650E+00		A
	.4459E+02	.1218E+02	.4371E+02	.8784E+01	.4355E+02	.7408E+01	.4396E+02	.5095E+01	LR
	.9956E+00		.9956E+00		.9956E+00		.9956E+00		RHO
	.1722E+02		.9102E+01		.6397E+01		.4233E+01		VAR(LR)
10	.9980E+00		.9980E+00		.9980E+00		.9980E+00		YBAR/XBAR
	.4491E+02	.1213E+02	.4405E+02	.9166E+01	.4390E+02	.7377E+01	.4433E+02	.4691E+01	R-EST
	.1705E+02		.8742E+01		.5971E+01		.3754E+01		VAR(R-EST)
	.4566E+02	.6088E+02	.4536E+02	.4181E+02	.4504E+02	.2588E+02	.4474E+02	.1906E+02	N10
	.4488E+02	.6557E+02	.4545E+02	.5456E+02	.4536E+02	.4181E+02	.4484E+02	.2423E+02	N15
	.4558E+02	.7424E+02	.4488E+02	.6557E+02	.4566E+02	.6088E+02	.4533E+02	.5365E+02	N30
	.4558E+02	.7424E+02	.4502E+02	.5941E+02	.4488E+02	.6557E+02	.4566E+02	.6088E+02	N50
	.9990E+00		.9990E+00		.9990E+00		.9990E+00		B
	-.1494E+00		-.1494E+00		-.1494E+00		-.1494E+00		A
	.4484E+02	.1223E+02	.4397E+02	.8958E+01	.4380E+02	.7117E+01	.4423E+02	.4450E+01	LR
	.9972E+00		.9972E+00		.9972E+00		.9972E+00		RHO
	.1705E+02		.8732E+01		.5960E+01		.3743E+01		VAR(LR)
15	.9976E+00		.9976E+00		.9976E+00		.9976E+00		YBAR/XBAR
	.4490E+02	.1220E+02	.4404E+02	.9341E+01	.4388E+02	.7320E+01	.4431E+02	.4450E+01	R-EST
	.1776E+02		.9023E+01		.6111E+01		.3781E+01		VAR(R-EST)
	.4536E+02	.4181E+02	.4504E+02	.2588E+02	.4474E+02	.2185E+02	.4523E+02	.1370E+02	N10
	.4533E+02	.5365E+02	.4552E+02	.3989E+02	.4504E+02	.2588E+02	.4465E+02	.2234E+02	N15
	.4545E+02	.5456E+02	.4533E+02	.5365E+02	.4536E+02	.4181E+02	.4537E+02	.3348E+02	N30
	.4545E+02	.5456E+02	.4566E+02	.5226E+02	.4533E+02	.5365E+02	.4536E+02	.4181E+02	N50
	.9975E+00		.9975E+00		.9975E+00		.9975E+00		B
	-.5425E-01		-.5425E-01		-.5425E-01		-.5425E-01		A
	.4487E+02	.1211E+02	.4400E+02	.9243E+01	.4383E+02	.7151E+01	.4425E+02	.4372E+01	LR
	.9975E+00		.9975E+00		.9975E+00		.9975E+00		RHO
	.1775E+02		.9015E+01		.6102E+01		.3772E+01		VAR(LR)

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		50		100		150		250	
		MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE
	YBAR/XBAR	.9993E+00		.9993E+00		.9993E+00		.9993E+00	
	R-EST	.4447E+02	.1766E+02	.4466E+02	.1119E+02	.4434E+02	.6093E+01	.4437E+02	.3503E+01
	VAR(R-EST)	.2044E+02		.1040E+02		.7054E+01		.4377E+01	
	N10	.4680E+02	.1216E+03	.4615E+02	.7696E+02	.4541E+02	.5282E+02	.4529E+02	.3404E+02
5	N15	.4672E+02	.1461E+03	.4590E+02	.1133E+03	.4615E+02	.7696E+02	.4557E+02	.4922E+02
	N30	.4600E+02	.1478E+03	.4672E+02	.1461E+03	.4680E+02	.1216E+03	.4583E+02	.9461E+02
	N50	.4600E+02	.1478E+03	.4666E+02	.1613E+03	.4672E+02	.1461E+03	.4680E+02	.1216E+03
	B	.9997E+00		.9997E+00		.9997E+00		.9997E+00	
	A	-.1672E+00		-.1672E+00		-.1672E+00		-.1672E+00	
	LR	.4435E+02	.1871E+02	.4454E+02	.1203E+02	.4421E+02	.6644E+01	.4424E+02	.4062E+01
	RHO	.9979E+00		.9979E+00		.9979E+00		.9979E+00	
	VAR(LR)	.2045E+02		.1041E+02		.7069E+01		.4393E+01	
	YBAR/XBAR	.1001E+01		.1001E+01		.1001E+01		.1001E+01	
	R-EST	.4454E+02	.1816E+02	.4473E+02	.1135E+02	.4440E+02	.6061E+01	.4443E+02	.3308E+01
	VAR(R-EST)	.2028E+02		.1024E+02		.6891E+01		.4213E+01	
	N10	.4615E+02	.7696E+02	.4541E+02	.5282E+02	.4539E+02	.4018E+02	.4533E+02	.3090E+02
10	N15	.4583E+02	.9461E+02	.4611E+02	.6408E+02	.4541E+02	.5282E+02	.4562E+02	.4110E+02
	N30	.4590E+02	.1133E+03	.4583E+02	.9461E+02	.4615E+02	.7696E+02	.4553E+02	.6405E+02
	N50	.4590E+02	.1133E+03	.4622E+02	.1095E+03	.4583E+02	.9461E+02	.4615E+02	.7696E+02
	B	.9988E+00		.9988E+00		.9988E+00		.9988E+00	
	A	.1296E-01		.1296E-01		.1296E-01		.1296E-01	
	LR	.4448E+02	.1808E+02	.4466E+02	.1153E+02	.4433E+02	.6228E+01	.4436E+02	.3430E+01
	RHO	.9989E+00		.9989E+00		.9989E+00		.9989E+00	
	VAR(LR)	.2027E+02		.1022E+02		.6877E+01		.4198E+01	
	YBAR/XBAR	.1001E+01		.1001E+01		.1001E+01		.1001E+01	
	R-EST	.4453E+02	.1824E+02	.4472E+02	.1126E+02	.4439E+02	.6011E+01	.4442E+02	.3328E+01
	VAR(R-EST)	.1969E+02		.9908E+01		.6648E+01		.4041E+01	
	N10	.4541E+02	.5282E+02	.4539E+02	.4018E+02	.4529E+02	.3404E+02	.4508E+02	.2436E+02
15	N15	.4553E+02	.6405E+02	.4557E+02	.4922E+02	.4539E+02	.4018E+02	.4539E+02	.3245E+02
	N30	.4611E+02	.6408E+02	.4553E+02	.6405E+02	.4541E+02	.5282E+02	.4533E+02	.4093E+02
	N50	.4611E+02	.6408E+02	.4548E+02	.6253E+02	.4553E+02	.6405E+02	.4541E+02	.5282E+02
	B	.1000E+01		.1000E+01		.1000E+01		.1000E+01	
	A	-.2988E-01		-.2988E-01		-.2988E-01		-.2988E-01	
	LR	.4450E+02	.1825E+02	.4469E+02	.1145E+02	.4435E+02	.6078E+01	.4438E+02	.3423E+01
	RHO	.9990E+00		.9990E+00		.9990E+00		.9990E+00	
	VAR(LR)	.1968E+02		.9897E+01		.6638E+01		.4030E+01	

Species No. 4

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.9981E+00		.9981E+00		.9981E+00		.9981E+00		YBAR/XBAR
	.1976E+02	.4850E+01	.1940E+02	.2475E+01	.1929E+02	.1295E+01	.1914E+02	.9027E+00	R-EST
	.3781E+01		.1901E+01		.1274E+01		.7727E+00		VAR(R-EST)
	.1968E+02	.1593E+02	.2002E+02	.1298E+02	.1977E+02	.1064E+02	.1980E+02	.7518E+01	N10
5	.2003E+02	.2734E+02	.1975E+02	.1409E+02	.2002E+02	.1298E+02	.1983E+02	.1024E+02	N15
	.2055E+02	.3021E+02	.2003E+02	.2734E+02	.1968E+02	.1593E+02	.2013E+02	.1241E+02	N30
	.2055E+02	.3021E+02	.2046E+02	.2513E+02	.2003E+02	.2734E+02	.1968E+02	.1593E+02	N50
	.1001E+01		.1001E+01		.1001E+01		.1001E+01		B
	-.3957E-01		-.3957E-01		-.3957E-01		-.3957E-01		A
	.1977E+02	.4822E+01	.1942E+02	.2463E+01	.1931E+02	.1297E+01	.1916E+02	.9073E+00	LR
	.9994E+00		.9994E+00		.9994E+00		.9994E+00		RHO
	.3784E+01		.1903E+01		.1277E+01		.7753E+00		VAR(LR)
	.9990E+00		.9990E+00		.9990E+00		.9990E+00		YBAR/XBAR
	.1977E+02	.4727E+01	.1941E+02	.2363E+01	.1930E+02	.1211E+01	.1915E+02	.8204E+00	R-EST
	.3709E+01		.1860E+01		.1243E+01		.7498E+00		VAR(R-EST)
	.2002E+02	.1298E+02	.1977E+02	.1064E+02	.1973E+02	.9553E+01	.1998E+02	.7195E+01	N10
10	.2013E+02	.1241E+02	.1981E+02	.1232E+02	.1977E+02	.1064E+02	.1975E+02	.8772E+01	N15
	.1975E+02	.1409E+02	.2013E+02	.1241E+02	.2002E+02	.1298E+02	.1955E+02	.1174E+02	N30
	.1975E+02	.1409E+02	.1971E+02	.1213E+02	.2013E+02	.1241E+02	.2002E+02	.1298E+02	N50
	.1000E+01		.1000E+01		.1000E+01		.1000E+01		B
	-.1460E-01		-.1460E-01		-.1460E-01		-.1460E-01		A
	.1977E+02	.4742E+01	.1942E+02	.2357E+01	.1931E+02	.1202E+01	.1916E+02	.8143E+00	LR
	.9997E+00		.9997E+00		.9997E+00		.9997E+00		RHO
	.3709E+01		.1859E+01		.1243E+01		.7493E+00		VAR(LR)
	.9992E+00		.9992E+00		.9992E+00		.9992E+00		YBAR/XBAR
	.1977E+02	.4620E+01	.1942E+02	.2307E+01	.1931E+02	.1178E+01	.1916E+02	.7949E+00	R-EST
	.3813E+01		.1909E+01		.1275E+01		.7676E+00		VAR(R-EST)
	.1977E+02	.1064E+02	.1973E+02	.9553E+01	.1980E+02	.7518E+01	.1972E+02	.5864E+01	N10
15	.1955E+02	.1174E+02	.1983E+02	.1024E+02	.1973E+02	.9553E+01	.1978E+02	.7684E+01	N15
	.1981E+02	.1232E+02	.1955E+02	.1174E+02	.1977E+02	.1064E+02	.1989E+02	.9168E+01	N30
	.1981E+02	.1232E+02	.1959E+02	.1311E+02	.1955E+02	.1174E+02	.1977E+02	.1064E+02	N50
	.9995E+00		.9995E+00		.9995E+00		.9995E+00		B
	-.6923E-02		-.6923E-02		-.6923E-02		-.6923E-02		A
	.1977E+02	.4604E+01	.1942E+02	.2287E+01	.1931E+02	.1162E+01	.1915E+02	.7896E+00	LR
	.9997E+00		.9997E+00		.9997E+00		.9997E+00		RHO
	.3812E+01		.1909E+01		.1275E+01		.7674E+00		VAR(LR)

Results of simulation run 6.
Species No. 1

	50		100		150		250		
	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	
	.3034E+00		.3034E+00		.3034E+00		.3034E+00		YBAR/XBAR
	.3180E+03	.1212E+05	.3267E+03	.1525E+05	.3262E+03	.1515E+05	.3257E+03	.1511E+05	R-EST
	.1024E+05		.1073E+05		.1089E+05		.1102E+05		VAR(R-EST)
	.2974E+03	.6498E+03	.2988E+03	.4476E+03	.2979E+03	.3625E+03	.2999E+03	.2788E+03	N10
	.2933E+03	.7521E+03	.2973E+03	.6140E+03	.2988E+03	.4476E+03	.2989E+03	.3532E+03	N15
5	.2958E+03	.9195E+03	.2933E+03	.7521E+03	.2974E+03	.6498E+03	.2968E+03	.5271E+03	N30
	.2958E+03	.9195E+03	.2918E+03	.8790E+03	.2933E+03	.7521E+03	.2974E+03	.6498E+03	N50
	.6564E-03		.6564E-03		.6564E-03		.6564E-03		B
	.2873E+03		.2873E+03		.2873E+03		.2873E+03		A
	.2897E+03	.1932E+04	.2893E+03	.2122E+04	.2889E+03	.2098E+04	.2883E+03	.2200E+04	LR
	.5820E-01		.5820E-01		.5820E-01		.5820E-01		RHO
	.1686E+04		.1697E+04		.1701E+04		.1703E+04		VAR(LR)
	.2945E+00		.2945E+00		.2945E+00		.2945E+00		YBAR/XBAR
	.3091E+03	.7515E+04	.3168E+03	.9778E+04	.3161E+03	.9624E+04	.3161E+03	.1042E+05	R-EST
	.4404E+04		.4855E+04		.5005E+04		.5125E+04		VAR(R-EST)
	.2988E+03	.4476E+03	.2979E+03	.3625E+03	.2981E+03	.3134E+03	.3006E+03	.2507E+03	N10
	.2968E+03	.5271E+03	.2973E+03	.4225E+03	.2979E+03	.3625E+03	.2991E+03	.3044E+03	N15
10	.2973E+03	.6140E+03	.2968E+03	.5271E+03	.2988E+03	.4476E+03	.2975E+03	.3489E+03	N30
	.2973E+03	.6140E+03	.2971E+03	.5869E+03	.2968E+03	.5271E+03	.2988E+03	.4476E+03	N50
	.5841E-02		.5841E-02		.5841E-02		.5841E-02		B
	.2889E+03		.2889E+03		.2889E+03		.2889E+03		A
	.2956E+03	.7298E+03	.2959E+03	.7371E+03	.2956E+03	.7367E+03	.2954E+03	.7223E+03	LR
	.6331E-01		.6331E-01		.6331E-01		.6331E-01		RHO
	.8133E+03		.8150E+03		.8156E+03		.8160E+03		VAR(LR)
	.2793E+00		.2793E+00		.2793E+00		.2793E+00		YBAR/XBAR
	.2942E+03	.2400E+04	.3007E+03	.3521E+04	.2999E+03	.3331E+04	.2998E+03	.3561E+04	R-EST
	.2661E+04		.3116E+04		.3268E+04		.3389E+04		VAR(R-EST)
	.2979E+03	.3625E+03	.2981E+03	.3134E+03	.2999E+03	.2788E+03	.3001E+03	.2233E+03	N10
	.2975E+03	.3489E+03	.2989E+03	.3532E+03	.2981E+03	.3134E+03	.2994E+03	.2582E+03	N15
15	.2973E+03	.4225E+03	.2975E+03	.3489E+03	.2979E+03	.3625E+03	.2987E+03	.3253E+03	N30
	.2973E+03	.4225E+03	.2966E+03	.3758E+03	.2975E+03	.3489E+03	.2979E+03	.3625E+03	N50
	.6770E-02		.6770E-02		.6770E-02		.6770E-02		B
	.2914E+03		.2914E+03		.2914E+03		.2914E+03		A
	.2965E+03	.4542E+03	.2989E+03	.4511E+03	.2989E+03	.4524E+03	.2988E+03	.4472E+03	LR
	.6376E-01		.6376E-01		.6376E-01		.6376E-01		RHO
	.5374E+03		.5373E+03		.5373E+03		.5373E+03		VAR(LR)

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1007E+01		.1007E+01		.1007E+01		.1007E+01		YBAR/XBAR
	.4469E+02	.2707E+02	.4499E+02	.1675E+02	.4494E+02	.1448E+02	.4513E+02	.1185E+02	R-EST
	.3115E+02		.2241E+02		.1950E+02		.1716E+02		VAR(R-EST)
	.4533E+02	.8784E+02	.4562E+02	.5065E+02	.4517E+02	.3748E+02	.4420E+02	.2244E+02	N10
5	.4530E+02	.1230E+03	.4539E+02	.7744E+02	.4562E+02	.5065E+02	.4486E+02	.3543E+02	N15
	.4584E+02	.1590E+03	.4530E+02	.1230E+03	.4533E+02	.8784E+02	.4595E+02	.5621E+02	N30
	.4584E+02	.1590E+03	.4516E+02	.1439E+03	.4530E+02	.1230E+03	.4533E+02	.8784E+02	N50
	.9586E+00		.9586E+00		.9586E+00		.9586E+00		B
	.1752E+01		.1752E+01		.1752E+01		.1752E+01		A
	.4439E+02	.2406E+02	.4465E+02	.1919E+02	.4458E+02	.1939E+02	.4476E+02	.1672E+02	LR
	.9557E+00		.9557E+00		.9557E+00		.9557E+00		RHO
	.3303E+02		.2439E+02		.2151E+02		.1921E+02		VAR(LR)
	.1000E+01		.1000E+01		.1000E+01		.1000E+01		YBAR/XBAR
	.4439E+02	.2181E+02	.4471E+02	.1447E+02	.4466E+02	.1275E+02	.4485E+02	.9980E+01	R-EST
	.2386E+02		.1509E+02		.1216E+02		.9824E+01		VAR(R-EST)
	.4562E+02	.5065E+02	.4517E+02	.3748E+02	.4450E+02	.3080E+02	.4383E+02	.2181E+02	N10
10	.4595E+02	.5621E+02	.4603E+02	.4323E+02	.4517E+02	.3748E+02	.4428E+02	.2840E+02	N15
	.4539E+02	.7744E+02	.4595E+02	.5621E+02	.4562E+02	.5065E+02	.4587E+02	.3651E+02	N30
	.4539E+02	.7744E+02	.4557E+02	.6123E+02	.4595E+02	.5621E+02	.4562E+02	.5065E+02	N50
	.9543E+00		.9543E+00		.9543E+00		.9543E+00		B
	.1768E+01		.1768E+01		.1768E+01		.1768E+01		A
	.4416E+02	.2225E+02	.4443E+02	.1516E+02	.4439E+02	.1368E+02	.4456E+02	.1035E+02	LR
	.9647E+00		.9647E+00		.9647E+00		.9647E+00		RHO
	.2358E+02		.1477E+02		.1184E+02		.9492E+01		VAR(LR)
	.9952E+00		.9952E+00		.9952E+00		.9952E+00		YBAR/XBAR
	.4414E+02	.1687E+02	.4447E+02	.1023E+02	.4442E+02	.8425E+01	.4461E+02	.6006E+01	R-EST
	.2230E+02		.1316E+02		.1011E+02		.7668E+01		VAR(R-EST)
	.4517E+02	.3748E+02	.4450E+02	.3080E+02	.4420E+02	.2244E+02	.4378E+02	.2088E+02	N10
15	.4587E+02	.3651E+02	.4486E+02	.3543E+02	.4450E+02	.3080E+02	.4418E+02	.2249E+02	N15
	.4603E+02	.4323E+02	.4587E+02	.3651E+02	.4517E+02	.3748E+02	.4449E+02	.3643E+02	N30
	.4603E+02	.4323E+02	.4578E+02	.3931E+02	.4587E+02	.3651E+02	.4517E+02	.3748E+02	N50
	.9620E+0								
	.1392E+01		.1392E+01		.1392E+01		.1392E+01		A
	.4414E+02	.1664E+02	.4441E+02	.1003E+02	.4434E+02	.8757E+01	.4451E+02	.6227E+01	LR
	.9695E+00		.9695E+00		.9695E+00		.9695E+00		RHO
	.2216E+02		.1298E+02		.9919E+01		.7472E+01		VAR(LR)

Species No. 3

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1000E+01		.1000E+01		.1000E+01		.1000E+01		YBAR/XBAR
	.4475E+02	.3042E+02	.4455E+02	.1778E+02	.4441E+02	.1339E+02	.4461E+02	.8171E+01	R-EST
	.2725E+02		.1708E+02		.1368E+02		.1097E+02		VAR(R-EST)
	.4490E+02	.7652E+02	.4426E+02	.5869E+02	.4429E+02	.4447E+02	.4445E+02	.3463E+02	N10
	.4571E+02	.1023E+03	.4424E+02	.7283E+02	.4426E+02	.5869E+02	.4413E+02	.3958E+02	N15
5	.4550E+02	.1308E+03	.4571E+02	.1023E+03	.4490E+02	.7652E+02	.4452E+02	.6195E+02	N30
	.4550E+02	.1308E+03	.4610E+02	.1126E+03	.4571E+02	.1023E+03	.4490E+02	.7652E+02	N50
	.9639E+00		.9639E+00		.9639E+00		.9639E+00		B
	.1485E+01		.1485E+01		.1485E+01		.1485E+01		A
	.4462E+02	.3234E+02	.4442E+02	.2107E+02	.4431E+02	.1663E+02	.4446E+02	.1299E+02	LR
	.9784E+00		.9784E+00		.9784E+00		.9784E+00		RHO
	.2716E+02		.1698E+02		.1358E+02		.1087E+02		VAR(LR)
	.9860E+00		.9860E+00		.9860E+00		.9860E+00		YBAR/XBAR
	.4414E+02	.2903E+02	.4394E+02	.1608E+02	.4380E+02	.1159E+02	.4398E+02	.5272E+01	R-EST
	.2395E+02		.1373E+02		.1032E+02		.7597E+01		VAR(R-EST)
	.4426E+02	.5869E+02	.4429E+02	.4447E+02	.4454E+02	.3895E+02	.4419E+02	.3384E+02	N10
	.4452E+02	.6195E+02	.4444E+02	.5349E+02	.4429E+02	.4447E+02	.4450E+02	.4124E+02	N15
10	.4424E+02	.7283E+02	.4452E+02	.6195E+02	.4426E+02	.5869E+02	.4437E+02	.5004E+02	N30
	.4424E+02	.7283E+02	.4442E+02	.7323E+02	.4452E+02	.6195E+02	.4426E+02	.5869E+02	N50
	.9805E+00		.9805E+00		.9805E+00		.9805E+00		B
	.1392E-01		.1392E-01		.1392E-01		.1392E-01		A
	.4390E+02	.3026E+02	.4374E+02	.1675E+02	.4360E+02	.1250E+02	.4375E+02	.6862E+01	LR
	.9788E+00		.9788E+00		.9788E+00		.9788E+00		RHO
	.2399E+02		.1377E+02		.1037E+02		.7642E+01		VAR(LR)
	.9892E+00		.9892E+00		.9892E+00		.9892E+00		YBAR/XBAR
	.4426E+02	.2540E+02	.4407E+02	.1350E+02	.4394E+02	.9611E+01	.4412E+02	.3398E+01	R-EST
	.2204E+02		.1211E+02		.8798E+01		.6150E+01		VAR(R-EST)
	.4429E+02	.4447E+02	.4454E+02	.3895E+02	.4445E+02	.3463E+02	.4410E+02	.3189E+02	N10
	.4437E+02	.5004E+02	.4413E+02	.3958E+02	.4454E+02	.3895E+02	.4461E+02	.3434E+02	N15
15	.4444E+02	.5349E+02	.4437E+02	.5004E+02	.4429E+02	.4447E+02	.4426E+02	.4488E+02	N30
	.4444E+02	.5349E+02	.4442E+02	.5009E+02	.4437E+02	.5004E+02	.4429E+02	.4447E+02	N50
	.9725E+00		.9725E+00		.9725E+00		.9725E+00		B
	.6142E+00		.6142E+00		.6142E+00		.6142E+00		A
	.4416E+02	.2598E+02	.4397E+02	.1385E+02	.4384E+02	.1020E+02	.4400E+02	.4103E+01	LR
	.9811E+00		.9811E+00		.9811E+00		.9811E+00		RHO
	.2205E+02		.1212E+02		.8811E+01		.6162E+01		VAR(LR)

Species No. 4

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1000E+01		.1000E+01		.1000E+01		.1000E+01		YBAR/XBAR
	.1977E+02	.2493E+01	.1956E+02	.2404E+01	.1949E+02	.1703E+01	.1914E+02	.1186E+01	R-EST
	.4265E+01		.2270E+01		.1605E+01		.1073E+01		VAR(R-EST)
	.1891E+02	.1565E+02	.1960E+02	.1034E+02	.1995E+02	.8298E+01	.2004E+02	.5805E+01	N10
5	.1968E+02	.2048E+02	.1905E+02	.1596E+02	.1960E+02	.1034E+02	.1981E+02	.7836E+01	N15
	.2056E+02	.3170E+02	.1968E+02	.2048E+02	.1891E+02	.1565E+02	.1941E+02	.1079E+02	N30
	.2056E+02	.3170E+02	.2038E+02	.2840E+02	.1968E+02	.2048E+02	.1891E+02	.1565E+02	N50
	.9967E+00		.9967E+00		.9967E+00		.9967E+00		B
	.1645E+00		.1646E+00		.1646E+00		.1646E+00		A
	.1984E+02	.2821E+01	.1965E+02	.3042E+01	.1959E+02	.2419E+01	.1923E+02	.1636E+01	LR
	.9948E+00		.9948E+00		.9948E+00		.9948E+00		RHO
	.4270E+01		.2275E+01		.1610E+01		.1078E+01		VAR(LR)
	.9984E+00		.9984E+00		.9984E+00		.9984E+00		YBAR/XBAR
	.1974E+02	.2477E+01	.1953E+02	.2416E+01	.1946E+02	.1635E+01	.1911E+02	.1212E+01	R-EST
	.3933E+01		.2039E+01		.1408E+01		.9027E+00		VAR(R-EST)
	.1960E+02	.1034E+02	.1995E+02	.8298E+01	.2017E+02	.7172E+01	.1998E+02	.4454E+01	N10
10	.1941E+02	.1079E+02	.1959E+02	.1007E+02	.1995E+02	.8298E+01	.2005E+02	.6808E+01	N15
	.1905E+02	.1596E+02	.1941E+02	.1079E+02	.1960E+02	.1034E+02	.1952E+02	.8531E+01	N30
	.1905E+02	.1596E+02	.1913E+02	.1316E+02	.1941E+02	.1079E+02	.1960E+02	.1034E+02	N50
	.9900E+00		.9900E+00		.9900E+00		.9900E+00		B
	.1301E+00		.1301E+00		.1301E+00		.1301E+00		A
	.1970E+02	.2493E+01	.1949E+02	.2419E+01	.1943E+02	.1648E+01	.1907E+02	.1246E+01	LR
	.9955E+00		.9955E+00		.9955E+00		.9955E+00		RHO
	.3930E+01		.2036E+01		.1404E+01		.8991E+00		VAR(LR)
	.9997E+00		.9997E+00		.9997E+00		.9997E+00		YBAR/XBAR
	.1976E+02	.2419E+01	.1955E+02	.2279E+01	.1948E+02	.1573E+01	.1913E+02	.1164E+01	R-EST
	.3965E+01		.2028E+01		.1382E+01		.8654E+00		VAR(R-EST)
	.1995E+02	.8298E+01	.2017E+02	.7172E+01	.2004E+02	.5805E+01	.2013E+02	.3085E+01	N10
15	.1952E+02	.8531E+01	.1981E+02	.7836E+01	.2017E+02	.7172E+01	.2000E+02	.5680E+01	N15
	.1959E+02	.1007E+02	.1952E+02	.8531E+01	.1995E+02	.8298E+01	.2006E+02	.8063E+01	N30
	.1959E+02	.1007E+02	.1953E+02	.9769E+01	.1952E+02	.8531E+01	.1995E+02	.8298E+01	N50
	.9931E+00		.9931E+00		.9931E+00		.9931E+00		B
	.1061E+00		.1061E+00		.1061E+00		.1061E+00		A
	.1974E+02	.2449E+01	.1953E+02	.2309E+01	.1946E+02	.1610E+01	.1910E+02	.1214E+01	LR
	.9963E+00		.9963E+00		.9963E+00		.9963E+00		RHO
	.3962E+01		.2025E+01		.1379E+01		.8622E+00		VAR(LR)

Results of simulation run 7.
Species No. 1

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	50		100		150		250		
	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	
	.1031E+01		.1031E+01		.1031E+01		.1031E+01		YBAR/XBAR
	.3113E+03	.8956E+04	.3110E+03	.9109E+04	.3129E+03	.9665E+04	.3128E+03	.9216E+04	R-EST
	.8177E+04		.8550E+04		.8675E+04		.8774E+04		VAR(R-EST)
	.3041E+03	.5189E+03	.3040E+03	.3375E+03	.3049E+03	.2367E+03	.3022E+03	.1466E+03	N10
5	.3023E+03	.6117E+03	.3056E+03	.4624E+03	.3040E+03	.3375E+03	.3047E+03	.2489E+03	N15
	.3002E+03	.8874E+03	.3023E+03	.6117E+03	.3041E+03	.5189E+03	.3067E+03	.4215E+03	N30
	.3002E+03	.8874E+03	.2994E+03	.7281E+03	.3023E+03	.6117E+03	.3041E+03	.5189E+03	N50
	.1594E-01		.1594E-01		.1594E-01		.1594E-01		B
	.2964E+03		.2964E+03		.2964E+03		.2964E+03		A
	.3015E+03	.1748E+04	.3010E+03	.1803E+04	.3017E+03	.1841E+04	.3011E+03	.1672E+04	LR
	.8189E-02		.8189E-02		.8189E-02		.8189E-02		RHO
	.1492E+04		.1494E+04		.1495E+04		.1495E+04		VAR(LR)
	.1040E+01		.1040E+01		.1040E+01		.1040E+01		YBAR/XBAR
	.3138E+03	.3803E+04	.3135E+03	.3589E+04	.3149E+03	.4091E+04	.3153E+03	.3975E+04	R-EST
	.4138E+04		.4567E+04		.4710E+04		.4824E+04		VAR(R-EST)
	.3040E+03	.3375E+03	.3049E+03	.2367E+03	.3026E+03	.2037E+03	.3021E+03	.1749E+03	N10
10	.3067E+03	.4215E+03	.3047E+03	.2844E+03	.3049E+03	.2367E+03	.3022E+03	.1959E+03	N15
	.3056E+03	.4624E+03	.3067E+03	.4215E+03	.3040E+03	.3375E+03	.3045E+03	.2728E+03	N30
	.3056E+03	.4624E+03	.3074E+03	.4447E+03	.3067E+03	.4215E+03	.3040E+03	.3375E+03	N50
	.7610E-02		.7610E-02		.7610E-02		.7610E-02		B
	.3031E+03		.3031E+03		.3031E+03		.3031E+03		A
	.3050E+03	.5932E+03	.3054E+03	.5910E+03	.3058E+03	.5908E+03	.3055E+03	.5723E+03	LR
	.2008E-01		.2008E-01		.2008E-01		.2008E-01		RHO
	.7203E+03		.7218E+03		.7223E+03		.7227E+03		VAR(LR)
	.1043E+01		.1043E+01		.1043E+01		.1043E+01		YBAR/XBAR
	.3150E+03	.2220E+04	.3151E+03	.2260E+04	.3163E+03	.2519E+04	.3163E+03	.2147E+04	R-EST
	.2380E+04		.2787E+04		.2922E+04		.3030E+04		VAR(R-EST)
	.3049E+03	.2367E+03	.3026E+03	.2037E+03	.3022E+03	.1466E+03	.3018E+03	.1432E+03	N10
15	.3045E+03	.2728E+03	.3047E+03	.2489E+03	.3026E+03	.2037E+03	.3019E+03	.1467E+03	N15
	.3047E+03	.2844E+03	.3045E+03	.2728E+03	.3049E+03	.2367E+03	.3043E+03	.2207E+03	N30
	.3047E+03	.2844E+03	.3053E+03	.2939E+03	.3045E+03	.2728E+03	.3049E+03	.2367E+03	N50
	.2328E-01		.2328E-01		.2328E-01		.2328E-01		B
	.2988E+03		.2988E+03		.2988E+03		.2988E+03		A
	.3056E+03	.3703E+03	.3060E+03	.3731E+03	.3062E+03	.3634E+03	.3060E+03	.3521E+03	LR
	.3938E-01		.3938E-01		.3938E-01		.3938E-01		RHO
	.4879E+03		.4887E+03		.4889E+03		.4891E+03		VAR(LR)

Species No. 2

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1986E+01		.1986E+01		.1986E+01		.1986E+01		YBAR/XBAR
	.4358E+02	.1775E+02	.4315E+02	.9398E+01	.4318E+02	.7060E+01	.4376E+02	.5272E+01	R-EST
	.2154E+02		.1267E+02		.9709E+01		.7343E+01		VAR(R-EST)
	.4281E+02	.8754E+02	.4283E+02	.4492E+02	.4267E+02	.4436E+02	.4327E+02	.2467E+02	N10
	.4257E+02	.1114E+03	.4245E+02	.7083E+02	.4283E+02	.4492E+02	.4300E+02	.4240E+02	N15
5	.4427E+02	.1737E+03	.4257E+02	.1114E+03	.4281E+02	.8754E+02	.4286E+02	.5064E+02	N30
	.4427E+02	.1737E+03	.4304E+02	.1414E+03	.4257E+02	.1114E+03	.4281E+02	.8754E+02	N50
	.2031E+01		.2031E+01		.2031E+01		.2031E+01		B
	-.7322E+00		-.7322E+00		-.7322E+00		-.7322E+00		A
	.4384E+02	.2049E+02	.4342E+02	.1166E+02	.4343E+02	.9440E+01	.4405E+02	.7295E+01	LR
	.9874E+00		.9874E+00		.9874E+00		.9874E+00		RHO
	.2150E+02		.1262E+02		.9662E+01		.7295E+01		VAR(LR)
	.1989E+01		.1989E+01		.1989E+01		.1989E+01		YBAR/XBAR
	.4363E+02	.1597E+02	.4323E+02	.1025E+02	.4326E+02	.8248E+01	.4384E+02	.5706E+01	R-EST
	.1934E+02		.1059E+02		.7668E+01		.5334E+01		VAR(R-EST)
	.4283E+02	.4492E+02	.4267E+02	.4436E+02	.4360E+02	.3299E+02	.4365E+02	.2040E+02	N10
	.4286E+02	.5064E+02	.4252E+02	.4155E+02	.4267E+02	.4436E+02	.4330E+02	.2989E+02	N15
10	.4245E+02	.7083E+02	.4286E+02	.5064E+02	.4283E+02	.4492E+02	.4294E+02	.4381E+02	N30
	.4245E+02	.7083E+02	.4326E+02	.5737E+02	.4286E+02	.5064E+02	.4283E+02	.4492E+02	N50
	.1994E+01		.1994E+01		.1994E+01		.1994E+01		B
	-.1187E+00		-.1187E+00		-.1187E+00		-.1187E+00		A
	.4365E+02	.1589E+02	.4326E+02	.9858E+01	.4328E+02	.7866E+01	.4387E+02	.5522E+01	LR
	.9889E+00		.9889E+00		.9889E+00		.9889E+00		RHO
	.1922E+02		.1045E+02		.7529E+01		.5191E+01		VAR(LR)
	.1995E+01		.1995E+01		.1995E+01		.1995E+01		YBAR/XBAR
	.4377E+02	.1505E+02	.4337E+02	.9786E+01	.4340E+02	.7480E+01	.4398E+02	.5084E+01	R-EST
	.1862E+02		.9881E+01		.6969E+01		.4640E+01		VAR(R-EST)
	.4267E+02	.4436E+02	.4360E+02	.3299E+02	.4327E+02	.2467E+02	.4376E+02	.1910E+02	N10
	.4294E+02	.4381E+02	.4300E+02	.4240E+02	.4360E+02	.3299E+02	.4337E+02	.2437E+02	N15
15	.4252E+02	.4155E+02	.4294E+02	.4381E+02	.4267E+02	.4436E+02	.4317E+02	.3502E+02	N30
	.4252E+02	.4155E+02	.4258E+02	.4352E+02	.4294E+02	.4381E+02	.4267E+02	.4436E+02	N50
	.1998E+01		.1998E+01		.1998E+01		.1998E+01		B
	-.9410E-01		-.9410E-01		-.9410E-01		-.9410E-01		A
	.4376E+02	.1517E+02	.4336E+02	.9826E+01	.4337E+02	.7609E+01	.4396E+02	.5312E+01	LR
	.9894E+00		.9894E+00		.9894E+00		.9894E+00		RHO
	.1858E+02		.9838E+01		.6924E+01		.4592E+01		VAR(LR)

Species No. 3

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1991E+01		.1991E+01		.1991E+01		.1991E+01		YBAR/XBAR
	.4366E+02	.1490E+02	.4407E+02	.9669E+01	.4417E+02	.5035E+01	.4403E+02	.5192E+01	R-FST
	.2102E+02		.1136E+02		.8142E+01		.5567E+01		VAR(R-FST)
	.4326E+02	.9545E+02	.4302E+02	.6777E+02	.4300E+02	.4361E+02	.4393E+02	.2665E+02	N10
	.4358E+02	.1127E+03	.4282E+02	.8117E+02	.4302E+02	.6777E+02	.4313E+02	.4028E+02	N15
5	.4380E+02	.1373E+03	.4358E+02	.1127E+03	.4326E+02	.9545E+02	.4245E+02	.7350E+02	N30
	.4380E+02	.1373E+03	.4401E+02	.1223E+03	.4358E+02	.1127E+03	.4326E+02	.9545E+02	N50
	.1980E+01		.1980E+01		.1980E+01		.1980E+01		B
	.1990E-01		.1990E-01		.1990E-01		.1990E-01		A
	.4352E+02	.1578E+02	.4389E+02	.9391E+01	.4399E+02	.4921E+01	.4384E+02	.5046E+01	LR
	.9943E+00		.9943E+00		.9943E+00		.9943E+00		RHO
	.2117E+02		.1152E+02		.8305E+01		.5732E+01		VAR(LR)
	.1992E+01		.1992E+01		.1992E+01		.1992E+01		YBAR/XBAR
	.4373E+02	.1635E+02	.4413E+02	.1104E+02	.4422E+02	.5498E+01	.4407E+02	.4853E+01	R-FST
	.1824E+02		.9528E+01		.6623E+01		.4299E+01		VAR(R-FST)
	.4302E+02	.6777E+02	.4300E+02	.4361E+02	.4355E+02	.3220E+02	.4412E+02	.1997E+02	N10
	.4245E+02	.7350E+02	.4312E+02	.5597E+02	.4300E+02	.4361E+02	.4372E+02	.3146E+02	N15
10	.4282E+02	.8117E+02	.4245E+02	.7350E+02	.4302E+02	.6777E+02	.4301E+02	.5128E+02	N30
	.4282E+02	.8117E+02	.4249E+02	.7245E+02	.4245E+02	.7350E+02	.4302E+02	.6777E+02	N50
	.1984E+01		.1984E+01		.1984E+01		.1984E+01		B
	.3191E-01		.3191E-01		.3191E-01		.3191E-01		A
	.4364E+02	.1714E+02	.4401E+02	.1116E+02	.4410E+02	.5540E+01	.4395E+02	.5116E+01	LR
	.9949E+00		.9949E+00		.9949E+00		.9949E+00		RHO
	.1824E+02		.9527E+01		.6622E+01		.4298E+01		VAR(LR)
	.1995E+01		.1995E+01		.1995E+01		.1995E+01		YBAR/XBAR
	.4381E+02	.1704E+02	.4420E+02	.1088E+02	.4430E+02	.5609E+01	.4415E+02	.4543E+01	R-EST
	.1792E+02		.9229E+01		.6332E+01		.4013E+01		VAR(R-FST)
	.4300E+02	.4361E+02	.4355E+02	.3220E+02	.4393E+02	.2665E+02	.4399E+02	.1928E+02	N10
	.4301E+02	.5128E+02	.4313E+02	.4028E+02	.4355E+02	.3220E+02	.4403E+02	.2307E+02	N15
15	.4312E+02	.5597E+02	.4301E+02	.5128E+02	.4300E+02	.4361E+02	.4341E+02	.3657E+02	N30
	.4312E+02	.5597E+02	.4277E+02	.4826E+02	.4301E+02	.5128E+02	.4300E+02	.4361E+02	N50
	.1985E+01		.1985E+01		.1985E+01		.1985E+01		B
	.1426E+00		.1426E+00		.1426E+00		.1426E+00		A
	.4375E+02	.1740E+02	.4413E+02	.1087E+02	.4423E+02	.5660E+01	.4407E+02	.4788E+01	LR
	.9950E+00		.9950E+00		.9950E+00		.9950E+00		RHO
	.1792E+02		.9224E+01		.6326E+01		.4007E+01		VAR(LR)

Species No. 4

	50		100		150		250		
	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	
	.2003E+01		.2003E+01		.2003E+01		.2003E+01		YBAR/XBAR
	.1865E+02	.3050E+01	.1882E+02	.1889E+01	.1886E+02	.1114E+01	.1918E+02	.1217E+01	R-EST
	.3562E+01		.1820E+01		.1239E+01		.7749E+00		VAR(R-EST)
	.1849E+02	.1529E+02	.1851E+02	.8887E+01	.1869E+02	.8295E+01	.1876E+02	.5719E+01	N10
	.1803E+02	.1668E+02	.1870E+02	.1364E+02	.1851E+02	.8887E+01	.1878E+02	.8314E+01	N15
5	.1843E+02	.2236E+02	.1803E+02	.1668E+02	.1849E+02	.1529E+02	.1846E+02	.9704E+01	N30
	.1843E+02	.2236E+02	.1802E+02	.1848E+02	.1803E+02	.1668E+02	.1849E+02	.1529E+02	N50
	.2002E+01		.2002E+01		.2002E+01		.2002E+01		B
	.1086E-02		.1086E-02		.1086E-02		.1086E-02		A
	.1864E+02	.3222E+01	.1881E+02	.1961E+01	.1886E+02	.1249E+01	.1918E+02	.1408E+01	LR
	.9985E+00		.9985E+00		.9985E+00		.9985E+00		RHO
	.3565E+01		.1823E+01		.1243E+01		.7783E+00		VAR(LR)
	.2003E+01		.2003E+01		.2003E+01		.2003E+01		YBAR/XBAR
	.1865E+02	.2932E+01	.1882E+02	.1847E+01	.1887E+02	.1043E+01	.1918E+02	.1128E+01	R-EST
	.3750E+01		.1894E+01		.1275E+01		.7800E+00		VAR(R-EST)
	.1851E+02	.8887E+01	.1869E+02	.8295E+01	.1886E+02	.7064E+01	.1864E+02	.5148E+01	N10
	.1846E+02	.9704E+01	.1857E+02	.9486E+01	.1869E+02	.8295E+01	.1875E+02	.6805E+01	N15
10	.1870E+02	.1364E+02	.1846E+02	.9704E+01	.1851E+02	.8887E+01	.1858E+02	.8674E+01	N30
	.1870E+02	.1364E+02	.1849E+02	.1101E+02	.1846E+02	.9704E+01	.1851E+02	.8887E+01	N50
	.2000E+01		.2000E+01		.2000E+01		.2000E+01		B
	.2548E-01		.2548E-01		.2548E-01		.2548E-01		A
	.1864E+02	.2952E+01	.1882E+02	.1886E+01	.1886E+02	.1067E+01	.1918E+02	.1137E+01	LR
	.9989E+00		.9989E+00		.9989E+00		.9989E+00		RHO
	.3750E+01		.1894E+01		.1275E+01		.7799E+00		VAR(LR)
	.2004E+01		.2004E+01		.2004E+01		.2004E+01		YBAR/XBAR
	.1866E+02	.2893E+01	.1884E+02	.1855E+01	.1888E+02	.1038E+01	.1919E+02	.1130E+01	R-EST
	.3790E+01		.1908E+01		.1280E+01		.7781E+00		VAR(R-EST)
	.1869E+02	.8295E+01	.1886E+02	.7064E+01	.1876E+02	.5719E+01	.1856E+02	.4203E+01	N10
	.1858E+02	.8674E+01	.1878E+02	.8314E+01	.1886E+02	.7064E+01	.1868E+02	.5445E+01	N15
15	.1857E+02	.9486E+01	.1858E+02	.8674E+01	.1869E+02	.8295E+01	.1880E+02	.7301E+01	N30
	.1857E+02	.9486E+01	.1871E+02	.1006E+02	.1858E+02	.8674E+01	.1869E+02	.8295E+01	N50
	.1996E+01		.1996E+01		.1996E+01		.1996E+01		B
	.7232E-01		.7232E-01		.7232E-01		.7232E-01		A
	.1865E+02	.2886E+01	.1883E+02	.1877E+01	.1887E+02	.1049E+01	.1918E+02	.1125E+01	LR
	.9990E+00		.9990E+00		.9990E+00		.9990E+00		RHO
	.3789E+01		.1907E+01		.1279E+01		.7773E+00		VAR(LR)

Results of simulation run 8.
Species No. 1

		50		100		150		250	
		MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE
5	YBAR/XBAR	.2864E+00		.2864E+00		.2864E+00		.2864E+00	
	R-EST	.2913E+03	.8002E+04	.2909E+03	.8058E+04	.2887E+03	.8057E+04	.2895E+03	.8129E+04
	VAR(R-EST)	.9886E+04		.1035E+05		.1051E+05		.1064E+05	
	N10	.2985E+03	.9274E+03	.2996E+03	.5261E+03	.3012E+03	.3067E+03	.3033E+03	.2403E+03
	N15	.2967E+03	.1054E+04	.2988E+03	.8239E+03	.2996E+03	.5261E+03	.3032E+03	.3044E+03
	N30	.2969E+03	.1337E+04	.2967E+03	.1054E+04	.2985E+03	.9274E+03	.2999E+03	.5989E+03
	N50	.2969E+03	.1337E+04	.2981E+03	.1110E+04	.2967E+03	.1054E+04	.2985E+03	.9274E+03
	B	-.3314E-02		-.3314E-02		-.3314E-02		-.3314E-02	
	A	.2985E+03		.2985E+03		.2985E+03		.2985E+03	
	LR	.2964E+03	.2404E+04	.2972E+03	.2316E+04	.2965E+03	.2234E+04	.2956E+03	.2150E+04
	RHO	-.4917E-01		-.4917E-01		-.4917E-01		-.4917E-01	
	VAR(LR)	.1607E+04		.1616E+04		.1619E+04		.1621E+04	
10	YBAR/XBAR	.3035E+00		.3035E+00		.3035E+00		.3035E+00	
	R-EST	.3092E+03	.3377E+04	.3093E+03	.3902E+04	.3071E+03	.4014E+04	.3079E+03	.4104E+04
	VAR(R-EST)	.5059E+04		.5598E+04		.5777E+04		.5921E+04	
	N10	.2996E+03	.5261E+03	.3012E+03	.3067E+03	.3042E+03	.2858E+03	.3036E+03	.1940E+03
	N15	.2999E+03	.5989E+03	.2995E+03	.4872E+03	.3012E+03	.3067E+03	.3044E+03	.2690E+03
	N30	.2988E+03	.8239E+03	.2999E+03	.5989E+03	.2996E+03	.5261E+03	.3016E+03	.3774E+03
	N50	.2988E+03	.8239E+03	.3007E+03	.7133E+03	.2999E+03	.5989E+03	.2996E+03	.5261E+03
	B	-.3657E-02		-.3657E-02		-.3657E-02		-.3657E-02	
	A	.3017E+03		.3017E+03		.3017E+03		.3017E+03	
	LR	.2979E+03	.1062E+04	.2980E+03	.1066E+04	.2982E+03	.1050E+04	.2983E+03	.1030E+04
	RHO	-.2686E-01		-.2686E-01		-.2686E-01		-.2686E-01	
	VAR(LR)	.7757E+03		.7788E+03		.7799E+03		.7807E+03	
15	YBAR/XBAR	.2965E+00		.2965E+00		.2965E+00		.2965E+00	
	R-EST	.3024E+03	.2107E+04	.3020E+03	.2282E+04	.2997E+03	.2326E+04	.3005E+03	.2354E+04
	VAR(R-EST)	.2831E+04		.3336E+04		.3504E+04		.3638E+04	
	N10	.3012E+03	.3067E+03	.3042E+03	.2858E+03	.3033E+03	.2403E+03	.3024E+03	.1885E+03
	N15	.3016E+03	.3774E+03	.3032E+03	.3044E+03	.3042E+03	.2858E+03	.3028E+03	.2182E+03
	N30	.2995E+03	.4872E+03	.3016E+03	.3774E+03	.3012E+03	.3067E+03	.3041E+03	.2817E+03
	N50	.2995E+03	.4872E+03	.3012E+03	.4443E+03	.3016E+03	.3774E+03	.3012E+03	.3067E+03
	B	.1688E-03		.1688E-03		.1688E-03		.1688E-03	
	A	.2983E+03		.2983E+03		.2983E+03		.2983E+03	
	LR	.2985E+03	.5593E+03	.2987E+03	.5592E+03	.2989E+03	.5544E+03	.2989E+03	.5388E+03
	RHO	.3378E-02		.3378E-02		.3378E-02		.3378E-02	
	VAR(LR)	.4824E+03		.4837E+03		.4841E+03		.4844E+03	

Species No. 2

	50		100		150		250		
	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	MEAN	VARIANCE	
	.1905E+01		.1905E+01		.1905E+01		.1905E+01		YBAR/XBAR
	.4326E+02	.5652E+02	.4391E+02	.5403E+02	.4387E+02	.5637E+02	.4396E+02	.5288E+02	R-EST
	.6301E+02		.5510E+02		.5246E+02		.5035E+02		VAR(R-EST)
	.4536E+02	.1090E+03	.4451E+02	.6591E+02	.4373E+02	.4192E+02	.4349E+02	.1968E+02	N10
	.4507E+02	.1170E+03	.4477E+02	.1018E+03	.4451E+02	.6591E+02	.4357E+02	.3889E+02	N15
5	.4589E+02	.1353E+03	.4507E+02	.1170E+03	.4536E+02	.1090E+03	.4470E+02	.7073E+02	N30
	.4589E+02	.1353E+03	.4591E+02	.1356E+03	.4507E+02	.1170E+03	.4536E+02	.1090E+03	N50
	.1589E+01		.1589E+01		.1589E+01		.1589E+01		B
	.6857E+01		.6857E+01		.6857E+01		.6857E+01		A
	.4305E+02	.5745E+02	.4368E+02	.5757E+02	.4353E+02	.5927E+02	.4359E+02	.5295E+02	LR
	.8618E+00		.8618E+00		.8618E+00		.8618E+00		RHO
	.6422E+02		.5637E+02		.5376E+02		.5166E+02		VAR(LR)
	.1878E+01		.1878E+01		.1878E+01		.1878E+01		YBAR/XBAR
	.4272E+02	.3349E+02	.4335E+02	.2867E+02	.4329E+02	.2990E+02	.4338E+02	.2575E+02	R-EST
	.3669E+02		.2933E+02		.2688E+02		.2491E+02		VAR(R-EST)
	.4451E+02	.6591E+02	.4373E+02	.4192E+02	.4355E+02	.3222E+02	.4335E+02	.1687E+02	N10
	.4470E+02	.7073E+02	.4447E+02	.5551E+02	.4373E+02	.4192E+02	.4341E+02	.3076E+02	N15
10	.4477E+02	.1018E+03	.4470E+02	.7073E+02	.4451E+02	.6591E+02	.4392E+02	.4839E+02	N30
	.4477E+02	.1018E+03	.4483E+02	.7333E+02	.4470E+02	.7073E+02	.4451E+02	.6591E+02	N50
	.1693E+01		.1693E+01		.1693E+01		.1693E+01		B
	.4199E+01		.4199E+01		.4199E+01		.4199E+01		A
	.4286E+02	.3301E+02	.4340E+02	.2745E+02	.4325E+02	.2938E+02	.4335E+02	.2499E+02	LR
	.8617E+00		.8617E+00		.8617E+00		.8617E+00		RHO
	.3625E+02		.2883E+02		.2636E+02		.2438E+02		VAR(LR)
	.1920E+01		.1920E+01		.1920E+01		.1920E+01		YBAR/XBAR
	.4360E+02	.1959E+02	.4431E+02	.1936E+02	.4422E+02	.1821E+02	.4432E+02	.1420E+02	R-EST
	.2958E+02		.2278E+02		.2051E+02		.1870E+02		VAR(R-EST)
	.4373E+02	.4192E+02	.4355E+02	.3222E+02	.4349E+02	.1968E+02	.4322E+02	.1517E+02	N10
	.4392E+02	.4839E+02	.4357E+02	.3889E+02	.4355E+02	.3222E+02	.4340E+02	.1924E+02	N15
15	.4447E+02	.5551E+02	.4392E+02	.4839E+02	.4373E+02	.4192E+02	.4375E+02	.3541E+02	N30
	.4447E+02	.5551E+02	.4430E+02	.4918E+02	.4392E+02	.4839E+02	.4373E+02	.4192E+02	N50
	.1668E+01		.1668E+01		.1668E+01		.1668E+01		B
	.5316E+01		.5316E+01		.5316E+01		.5316E+01		A
	.4347E+02	.2268E+02	.4395E+02	.2053E+02	.4381E+02	.1986E+02	.4390E+02	.1655E+02	LR
	.8465E+00		.8465E+00		.8465E+00		.8465E+00		RHO
	.2892E+02		.2197E+02		.1966E+02		.1780E+02		VAR(LR)

Species No. 3

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.1955E+01		.1955E+01		.1955E+01		.1955E+01		YBAR/XBAR
	.4495E+02	.4134E+02	.4426E+02	.4068E+02	.4451E+02	.4339E+02	.4425E+02	.3753E+02	R-EST
	.3801E+02		.3159E+02		.2945E+02		.2774E+02		VAR(R-EST)
	.4280E+02	.1215E+03	.4411E+02	.6724E+02	.4431E+02	.4255E+02	.4433E+02	.3359E+02	N10
	.4214E+02	.1216E+03	.4300E+02	.1092E+03	.4411E+02	.6724E+02	.4406E+02	.4079E+02	N15
5	.4124E+02	.1835E+03	.4214E+02	.1216E+03	.4280E+02	.1215E+03	.4397E+02	.7641E+02	N30
	.4124E+02	.1835E+03	.4105E+02	.1172E+03	.4214E+02	.1216E+03	.4280E+02	.1215E+03	N50
	.1826E+01		.1826E+01		.1826E+01		.1826E+01		B
	.2889E+01		.2889E+01		.2889E+01		.2889E+01		A
	.4478E+02	.7466E+02	.4414E+02	.8063E+02	.4443E+02	.8183E+02	.4416E+02	.7494E+02	LR
	.8816E+00		.8816E+00		.8816E+00		.8816E+00		RHO
	.4029E+02		.3400E+02		.3190E+02		.3023E+02		VAR(LR)
	.1965E+01		.1965E+01		.1965E+01		.1965E+01		YBAR/XBAR
	.4520E+02	.2341E+02	.4446E+02	.1953E+02	.4469E+02	.2042E+02	.4447E+02	.1712E+02	R-EST
	.2932E+02		.2076E+02		.1791E+02		.1563E+02		VAR(R-EST)
	.4411E+02	.6724E+02	.4431E+02	.4255E+02	.4374E+02	.3472E+02	.4423E+02	.2401E+02	N10
	.4397E+02	.7641E+02	.4427E+02	.6203E+02	.4431E+02	.4255E+02	.4365E+02	.3624E+02	N15
10	.4300E+02	.1092E+03	.4397E+02	.7641E+02	.4411E+02	.6724E+02	.4426E+02	.5040E+02	N30
	.4300E+02	.1092E+03	.4364E+02	.8347E+02	.4397E+02	.7641E+02	.4411E+02	.6724E+02	N50
	.1871E+01		.1871E+01		.1871E+01		.1871E+01		B
	.2017E+01		.2017E+01		.2017E+01		.2017E+01		A
	.4499E+02	.2189E+02	.4432E+02	.1859E+02	.4451E+02	.1988E+02	.4430E+02	.1674E+02	LR
	.9306E+00		.9306E+00		.9306E+00		.9306E+00		RHO
	.2942E+02		.2087E+02		.1802E+02		.1574E+02		VAR(LR)
	.1966E+01		.1966E+01		.1966E+01		.1966E+01		YBAR/XBAR
	.4523E+02	.2029E+02	.4447E+02	.1530E+02	.4470E+02	.1629E+02	.4450E+02	.1458E+02	R-EST
	.2652E+02		.1724E+02		.1415E+02		.1168E+02		VAR(R-EST)
	.4431E+02	.4255E+02	.4374E+02	.3472E+02	.4433E+02	.3359E+02	.4439E+02	.1983E+02	N10
	.4426E+02	.5040E+02	.4406E+02	.4079E+02	.4374E+02	.3472E+02	.4439E+02	.3066E+02	N15
15	.4427E+02	.6203E+02	.4426E+02	.5040E+02	.4431E+02	.4255E+02	.4358E+02	.3878E+02	N30
	.4427E+02	.6203E+02	.4422E+02	.6024E+02	.4426E+02	.5040E+02	.4431E+02	.4255E+02	N50
	.1841E+01		.1841E+01		.1841E+01		.1841E+01		B
	.2726E+01		.2726E+01		.2726E+01		.2726E+01		A
	.4502E+02	.1985E+02	.4434E+02	.1390E+02	.4454E+02	.1480E+02	.4432E+02	.1312E+02	LR
	.9367E+00		.9367E+00		.9367E+00		.9367E+00		RHO
	.2630E+02		.1698E+02		.1387E+02		.1138E+02		VAR(LR)

Species No. 4

	50 MEAN	50 VARIANCE	100 MEAN	100 VARIANCE	150 MEAN	150 VARIANCE	250 MEAN	250 VARIANCE	
	.2015E+01		.2015E+01		.2015E+01		.2015E+01		YBAR/XBAR
	.1958E+02	.3204E+01	.1937E+02	.2397E+01	.1949E+02	.2135E+01	.1954E+02	.1783E+01	R-EST
	.4231E+01		.2658E+01		.2134E+01		.1714E+01		VAR(R-EST)
	.2008E+02	.1718E+02	.1973E+02	.1005E+02	.1956E+02	.7236E+01	.1956E+02	.5510E+01	N10
	.1986E+02	.2280E+02	.2018E+02	.1502E+02	.1973E+02	.1005E+02	.1958E+02	.6617E+01	N15
5	.1987E+02	.2950E+02	.1986E+02	.2280E+02	.2008E+02	.1718E+02	.1975E+02	.1036E+02	N30
	.1987E+02	.2950E+02	.1934E+02	.2731E+02	.1986E+02	.2280E+02	.2008E+02	.1718E+02	N50
	.1942E+01		.1942E+01		.1942E+01		.1942E+01		B
	.5645E+00		.5645E+00		.5645E+00		.5645E+00		A
	.1946E+02	.4288E+01	.1923E+02	.3311E+01	.1935E+02	.2882E+01	.1939E+02	.2587E+01	LR
	.9784E+00		.9784E+00		.9784E+00		.9784E+00		RHO
	.4232E+01		.2659E+01		.2134E+01		.1715E+01		VAR(LR)
	.1998E+01		.1998E+01		.1998E+01		.1998E+01		YBAR/XBAR
	.1944E+02	.3215E+01	.1923E+02	.2010E+01	.1934E+02	.1572E+01	.1938E+02	.1068E+01	R-EST
	.3787E+01		.2153E+01		.1608E+01		.1172E+01		VAR(R-EST)
	.1973E+02	.1005E+02	.1956E+02	.7236E+01	.1949E+02	.6214E+01	.1952E+02	.4590E+01	N10
	.1975E+02	.1036E+02	.1958E+02	.8712E+01	.1956E+02	.7236E+01	.1957E+02	.6542E+01	N15
10	.2018E+02	.1502E+02	.1975E+02	.1036E+02	.1973E+02	.1005E+02	.1936E+02	.8783E+01	N30
	.2018E+02	.1502E+02	.1993E+02	.1369E+02	.1975E+02	.1036E+02	.1973E+02	.1005E+02	N50
	.1963E+01		.1963E+01		.1963E+01		.1963E+01		B
	.2978E+00		.2978E+00		.2978E+00		.2978E+00		A
	.1941E+02	.3332E+01	.1917E+02	.2244E+01	.1929E+02	.1686E+01	.1934E+02	.1134E+01	LR
	.9845E+00		.9845E+00		.9845E+00		.9845E+00		RHO
	.3765E+01		.2128E+01		.1582E+01		.1145E+01		VAR(LR)
	.1994E+01		.1994E+01		.1994E+01		.1994E+01		YBAR/XBAR
	.1941E+02	.3118E+01	.1919E+02	.1956E+01	.1930E+02	.1479E+01	.1935E+02	.9841E+00	R-EST
	.3537E+01		.1953E+01		.1424E+01		.1002E+01		VAR(R-EST)
	.1956E+02	.7236E+01	.1949E+02	.6214E+01	.1956E+02	.5510E+01	.1952E+02	.3777E+01	N10
	.1936E+02	.8783E+01	.1958E+02	.6617E+01	.1949E+02	.6214E+01	.1966E+02	.5368E+01	N15
15	.1958E+02	.8712E+01	.1936E+02	.8783E+01	.1956E+02	.7236E+01	.1951E+02	.5905E+01	N30
	.1958E+02	.8712E+01	.1946E+02	.8327E+01	.1936E+02	.8783E+01	.1956E+02	.7236E+01	N50
	.1976E+01		.1976E+01		.1976E+01		.1976E+01		B
	.1388E+00		.1388E+00		.1388E+00		.1388E+00		A
	.1939E+02	.3143E+01	.1915E+02	.2108E+01	.1927E+02	.1530E+01	.1931E+02	.9603E+00	LR
	.9832E+00		.9832E+00		.9832E+00		.9832E+00		RHO
	.3526E+01		.1939E+01		.1410E+01		.9863E+00		VAR(LR)

APPENDIX III

Estimation of Weight Estimation Sample Sizes Necessary to be Within 100P Percent of the True Value of the Mean 1-β of the Time Under Optimum Allocation

For a given plant species, let

μ = true value of the biomass density

$\hat{\bar{y}}'$ = weight estimate of the biomass density

k = optimum sampling ratio $(\frac{n'}{n})$ for weight estimation double sampling

In order that $\hat{\bar{y}}'$ lie within 100P percent of μ with probability 1-β, let

n_β = number of plots that must be clipped and estimated

n'_β = total number of plots that must be estimated

$= kn_\beta$

c_β = total cost of the double sampling procedure

$= n_\beta c_n + n'_\beta c_{n'}$

$= n_\beta c_n + kn_\beta c_{n'}$

$= n_\beta [c_n + kc_{n'}]$

V_{opt} = variance of the weight estimate under optimum allocation

$$= \frac{[\sqrt{V_n c_n} + \sqrt{V_{n'} c_{n'}}]^2}{c_\beta}$$

$$= \frac{[\sqrt{V_n c_n} + \sqrt{V_{n'} c_{n'}}]^2}{n_\beta [c_n + kc_{n'}]}$$

In order to attain our sampling goal, we want

$$Pr(|\hat{\bar{y}}' - \mu| \leq p\mu) = 1 - \beta$$

$$\rightarrow Pr\left(\frac{|\hat{\bar{y}}' - \mu|}{\sqrt{V_{opt}}} \leq \frac{p\mu}{\sqrt{V_{opt}}}\right) = 1 - \beta$$

Under the distributional assumption that

$$\frac{\hat{\bar{y}}' - \mu}{\sqrt{V_{opt}}} \sim t(n' - 1)$$

Then

$$\frac{p\mu}{\sqrt{V_{opt}}} = t_{1-\frac{\beta}{2}}(n' - 1)$$

where $t_{1-\frac{\beta}{2}}(n' - 1)$ = point on the Student-t distribution, with $n' - 1$ degrees of freedom above which $\frac{\beta}{2}$ of the probability lies

Letting $D = p\mu$

$$t = t_{1-\frac{\beta}{2}}(n' - 1)$$

Then in order to attain the sampling objective

$$\sqrt{V_{opt}} = \frac{D}{t}$$

$$\rightarrow V_{opt} = \frac{D^2}{t^2}$$

$$\rightarrow \frac{[\sqrt{V_n c_n} + \sqrt{V_{n'} c_{n'}}]^2}{n_\beta [c_n + k c_{n'}]} = \frac{D^2}{t^2}$$

$$n_\beta = \frac{[\sqrt{V_n c_n} + \sqrt{V_{n'} c_{n'}}]^2 [t^2]}{[c_n + kc_{n'}] [D^2]}$$

$$n'_\beta = kn_\beta$$

APPENDIX IV

Plant Species Code

Species Code	Scientific Name	Common Name
ACMI	*Achillea millefolium*	Common yarrow
AGSM	*Agropyron smithii*	Western wheatgrass
AGSP	*Agropyron spicatum*	Bluebunch wheatgrass
AGSU	*Agropyron subsecundum*	Bearded wheatgrass
ANGE	*Andropogon gerardi*	Big bluestem
ANSC	*Andropogon scoparius*	Little bluestem
ARCO	*Arenaria congesta*	Ballhead sandwort
ARLO	*Aristida longiseta*	Red three-awn
ARLU	*Artemisia ludoviciana*	Cudweed sagewort
ASER	*Aster ericoides*	Many-flowered aster
ASFA	*Aster falcatus*	Sickle-shaped aster
BOBU+	BOGR + BUDA	Blue grama + buffalo grass
BOCU	*Bouteloua curtipendula*	Side oats grama
BOER	*Bouteloua eriopoda*	Black grama
BOGR	*Bouteloua gracilis*	Blue grama
BRJA	*Bromus japonicus*	Japanese brome
BUDA	*Buchloe dactyloides*	Buffalo grass
CAEL	*Carex eleocharis*	Needleleaf sedge
CALO	*Calamovilfa longifolia*	Prairie sand reed
CAMO	*Calamagrostis montanensis*	Plains reed grass
DAIN	*Danthonia intermedia*	Timber oat grass
FEID	*Festuca idahoensis*	Idaho fescue
FESC	*Festuca scabrella*	Rough fescue
GUSA	*Gutierrezia sarothrae*	Broom snakeweed
LAFO		Late annual forb (Dickinson)
LAFO-6		Late annual forb (Dickinson)
LUAR	*Lupinus argenteus*	Silver lupine
LUSE	*Lupinus sericeus*	Silky lupine
MIFB		Miscellaneous forb (Bridger)
MIGR		Miscellaneous grass (Bridger)
MISC-A		Miscellaneous grass (Osage)
MISC-2	*Collinsia parviflora*	Blue-eyed mary
MUTO	*Muhlenbergia torreyi*	Ring muhly

Species Code	Scientific Name	Common Name
OPPO	*Opuntia polyacantha*	Plains prickly pear
PAVI	*Panicum virgatum*	Switch grass
PSTE	*Psoralea tenuiflora*	Slimflower scurf pea
SAKA	*Salsola kali*	Russian thistle
SCUN	*Schrankia unicata*	Sensitive brier
SEDE	*Selaginella densa*	Small club moss
SONU	*Sorghastrum nulins*	Indian grass
SPAS	*Sporobolus asper*	Tall dropseed
SPFL	*Sporobolus flexuosus*	Mesa dropseed
STCO	*Stipa comata*	Needle-and-thread
YUEL	*Yucca elata*	Soap-tree yucca