TOPIC 3. INDICES OF NATALITY AND MORTALITY RATES

Knowledge of natality and mortality rates is difficult, time-consuming, and expensive to obtain, just as censuses of entire populations are. Population estimates are often replaced by indices; changes from year to year are easier to determine than are absolute numbers.

Indices of natality and mortality rates may sometimes be derived from easily-collected field data. The use of teat length as an indicator of the nursing of young is an example of a rather simple technique that can yield significant biological information (see UNIT 1.1). Antler beam diameters of white-tailed deer are indicators of range conditions. Such an indicator may be related to female reproductive rates since both males and females respond to the range conditions present (see UNIT 2.1).

The two UNITS in this TOPIC are examples of the kinds of indices that may be used to estimate absolute rates. The evaluation of these two indices for other species may prove to be worthwhile, and other indices may also be added.

UNIT 3.1: TEAT LENGTH AS AN INDEX OF NATALITY RATES

The use of teat length as an indicator of previous suckling of young is a common-sense procedure. Only recently, however, has the technique been described and used for determining reproductive rates. Sauer and Severinghaus (1977) examined hunter-killed yearling does for teat lengths and the presence of milk in the udder, indicating that the doe had been bred as a fawn. This indicator permits one to calculate the percent of fawns breeding.

There was minimal overlap in teat lengths between the bred and unbred groups of does. The fawn breeding rate can be used to predict yearling and adult reproductive rates. Equations given by Sauer and Severinghaus (1977:82), based on data from the Seneca Army Depot in western New York, are:

$$YERR = 1.28 + 1.06\ FARR;\ r = 0.821 \text{ and } SE = 0.19$$

$$ADRR = 1.79 + 0.41\ FARR;\ r = 0.757 \text{ and } SE = 0.10$$

where YERR = yearling reproductive rate,
FARR = fawn reproductive rate, and
ADRR = adult reproductive rate.

These equations may be used to estimate the reproductive rates of three important age groups in white-tailed deer populations. The rates are used when making the population predictions described in TOPIC 4.

LITERATURE CITED

Sauer, P. R. and C. W. Severinghaus. 1977. Determination and application of fawn reproductive rates from yearling teat lengths. Page 81-88, 84a and 84b. In Proceedings, Joint Northeast-Southeast Deer Study Group Meeting. September 6-8, 1977. 149 p.

REFERENCES, UNIT 3.1

TEAT LENGTH AS AN INDEX OF NATALITY RATES

SERIALS

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

odvi

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

odhe

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

ceel

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UNIT 3.2: ANTLER BEAM DIAMETER AS AN INDEX OF NATALITY RATES

Antler beams are expected to be larger on animals on good range than on poor range. Antler beam diameters can be predicted from live or dressed weights. Dressed weight and antler beam diameter data from five regions of New York State were analyzed by C. W. Severinghaus (See 1981 citation) and the following linear regression equation proposed as a first approximation:

$$YABD = 3.21 + 0.29\ YDWK; \quad R^2 = 0.97$$

where:

YABD = yearling antler beam diameter in mm, and
YDWK = yearling dressed weight in kg.

The equation above has been modified to be used with live weights (dressed weight : live weight conversion equation for New York deer from CHAPTER 1, page 26a). The live weight : antler beam diameter relationship is:

$$YABD = 2.83 + 0.23\ YLWK$$

where YABD = yearling antler beam diameter in mm, and
YLWK = yearling calculated live weight in kg.

Antler beam diameters in yearling white-tailed deer may be used to predict yearling reproductive rates. Linear regression of antler beam diameter and reproductive rate data from the Seneca Army Depot and several regions of New York State has been prepared by C. W. Severinghaus (1981), and the following equation for YERR proposed:

$$YERR = -1.187 + 0.14\ YABD; \quad R^2 = 0.93$$

where YERR = yearling reproductive rate, and
YABD = yearling antler beam diameter in mm.

Adult reproductive rates (ADRR) and fawn reproductive rates (FARR) can also be determined from the yearling antler beam diameter with the following equations from Severinghaus (1981):

$$ADRR = 0.765 + 0.056\ (YABD)$$

$$FARR = -0.700 + 0.054\ (YABD)$$

where:

ADRR = adult reproductive rate,
YABD = yearling antler beam diameter, and
FARR = fawn reproductive rate.

LITERATURE CITED

Severinghaus, C. W. 1981. The predictive relationships of dressed weights to antler beam diameters of yearling males and yearling antler beam diameters to reproductive rates of 1 year, 2 year and 3 year and older female white-tailed deer in New York State. Unpublished report, Wildlife Ecology Laboratory, Cornell University. 7 p.

REFERENCES, UNIT 3.2

ANTLER BEAM DIAMETER AS AN INDEX OF NATALITY RATES

SERIALS

CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

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CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

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CODEN VO-NU BEPA ENPA ANIM KEY WORDS---------- AUTHORS---------- YEAR

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CHAPTER 19, WORKSHEET 3.2a

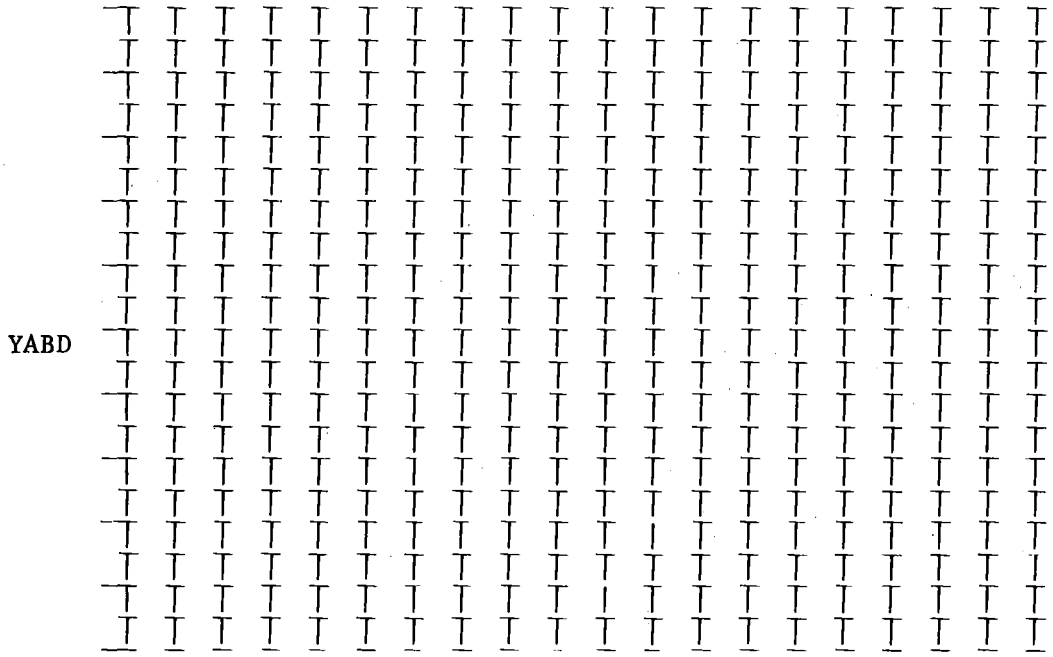
Predicting antler beam diameters from dressed weights

Yearling antler beam diameters can be predicted from dressed weight in kilograms (YDWK) using the following equation proposed by Severinghaus (1981) for New York deer:

$$YABD = 3.21 + 0.29\ YDWK; \quad R^2 = 0.97$$

where YABD = yearling antler beam diameter in mm, and
YDWK = yearling dressed weight in kg.

Using yearling dressed weights from your area or from the literature (see CHAPTER 1, UNIT 1.5), calculate antler beam diameters and plot on the grid below.



LITERATURE CITED

Severinghaus, C. W. 1981. The predictive relationships of dressed weights to antler beam diameters of yearling males and yearling antler beam diameters to reproductive rates of 1 year, 2 year and 3 year and older female white-tailed deer in New York State. Unpublished report 80-07, Wildlife Ecology Laboratory, Cornell University. 7 p.

CHAPTER 19, WORKSHEET 3.2b

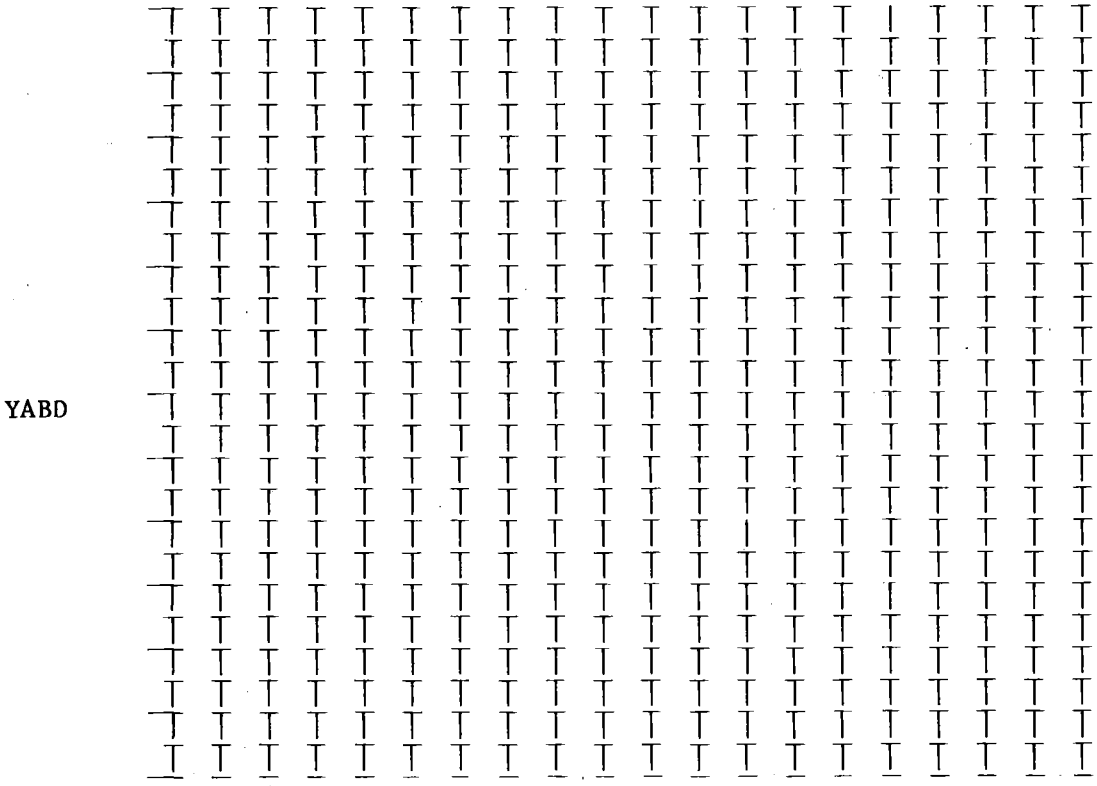
Predicting antler beam diameters from live weights

Yearling antler beam diameters can be predicted from live weight in kg (YLWK) using the equation below. This is a modified version of the equation found on the previous WORKSHEET, with live weights being calculated from dressed weights using conversion equations from CHAPTER 1, UNIT 1.5 of this book. The live weight : antler beam diameter relationship is:

$$YABD = 2.83 + 0.23\ YLWK$$

where YABD = yearling antler beam diameter in mm, and
YLWK = yearling live weight in kg.

Using live weights from your area or from the literature, calculate antler beam diameters and plot on the grid below.



CHAPTER 19, WORKSHEET 3.2c

Predicting reproductive rates from antler beam diameters

Reproductive rates of yearling, adults, and fawns are correlated with yearling antler beam diameters, and may be predicted from them using the following equations from Severinghaus (1981):

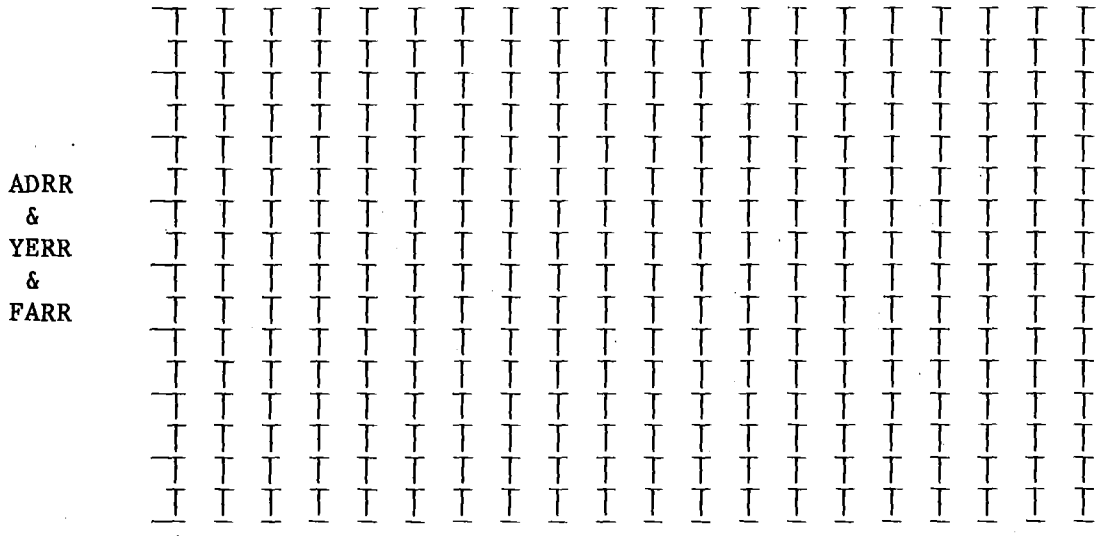
$$YERR = -1.187 + 0.140\ YABD; \quad R^2 = 0.93$$

$$ADRR = 0.765 + 0.056\ YABD; \quad R^2 = 0.69$$

$$FARR = -0.700 + 0.054\ YABD; \quad R^2 = 0.59$$

where YERR = yearling reproductive rate,
YABD = yearling antler beam diameter in mm,
ADRR = adult reproductive rate, and
FARR = fawn reproductive rate.

Using antler beam diameter from your area, from WORKSHEETS 3.2a or 3.2b, or from the literature, calculate reproductive rates for yearlings, adults, and fawns, and plot on the grid below.



LITERATURE CITED

Severinghaus, C. W. 1981. The predictive relationships of dressed weights to antler beam diameters of yearling males and yearling antler beam diameters to reproductive rates of 1 year, 2 year and 3 year and older female white-tailed deer in New York State. Unpublished report 80-07, Wildlife Ecology Laboratory, Cornell University. 7 p.

CHAPTER 19, WORKSHEET 3.2d

Conversion of yearling antler beam diameters to yearling dressed weights and reproductive rates for fawn, yearling and adult female white-tailed deer in New York State

The following equations from Severinghaus (1981) were used to set up the following table which can be used to predict yearling antler beam diameter (YABD), yearling dressed weight in pounds (YDWP), or reproductive rates of fawns (FARR), yearlings (YERR), and adults (ADRR) if one of the five variables is known:

$$YABD = 1.865 + 0.147\ YDWP;\quad R^2 = 0.90$$
$$YDWP = -12.627 + 6.791\ YABD;\quad R^2 = 1.00$$
$$FARR = -0.700 + 0.054\ YABD;\quad R^2 = 0.59$$
$$YERR = -1.187 + 0.140\ YABD;\quad R^2 = 0.93$$
$$ADRR = 0.765 + 0.056\ YABD;\quad R^2 = 0.69$$

where YABD = yearling beam diameter in mm,
YDWP = yearling dressed weight in pounds,
FARR = fawn reproductive rate,
YERR = yearling reproductive rate, and
ADRR = adult reproductive rate.

Yearling Antler Beam Diameter (mm)

	12	13	14	15	16	17	18	19	20	21	22
YDWP	69.0	75.6	82.4	89.2	96.0	102.8	109.6	116.4	123.2	130.0	136.8
FARR	0.00	0.00	0.60	0.11	0.16	0.22	0.27	0.33	0.38	0.43	0.49
YERR	0.49	0.63	0.77	0.91	1.05	1.19	1.33	1.47	1.61	1.75	1.89
ADRR	1.44	1.49	1.55	1.61	1.66	1.72	1.77	1.83	1.89	1.94	2.00

LITERATURE CITED

Severinghaus, C. W. 1981. The predictive relationships of dressed weights to antler beam diameters of yearling males and yearling antler beam diameters to reproductive rates of 1 year, 2 year and 3 year and older female white-tailed deer in New York State. Unpublished report 80-07, Wildlife Ecology Laboratory, Cornell University. 7 p.