

# COHORT ANALYSIS



## Introduction

The aim of this guide is to outline how information is collected for a cohort analysis and how the results might be used. The Census Introduction guide should be regarded as companion reading. This guide also links to Ageing and Cull Planning guides.

## Description

Cohort analysis uses cull information to indicate the minimum number of deer born in any one year (a "cohort"). Cohort analysis is most useful in populations that have a significant cull (at least 10-15%) taken each year.

The method analyses past cull figures and at least 5 years of data is required to yield meaningful results. It nonetheless requires very little effort and can be useful in corroborating past census results and giving confidence in long term population management. The method will work with muntjac even though they are culled year round and may breed more than once in a year.

## Method

Animals culled or found dead are assigned an age in years (see Ageing guide) Errors will be made, but usually only in the adult age classes. Errors +/- 1 year are not too serious because as they get older each age class tends to become a progressively smaller proportion of overall numbers.

Since females usually form the largest part of any cull it is sufficient to record only female deer and assume that equal numbers of females and males are born in any one year during the analysis.

Using a table (see Table 1) the number of animals culled or found dead are entered into the vertical column for each cull year, according to their age (diagonal rows). For example, in table 1, in the cull year 03/04, seven kids (< 1 year old), four yearlings (< 2 years), four 2 year olds (<3 years) were culled and so on.

Cohort	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	
1990	6	2	2	4	1	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	15
1991		3	3	3	4	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	20
1992			5	4	5	1	2	1	1	0	1	0	0	0	0	0	0	0	0	0	15
1993				3	1	5	3	2	0	2	1	0	0	1	0	0	0	0	0	0	25
1994					11	2	4	6	1	1	1	0	0	0	0	0	0	0	0	0	24
1995						6	4	4	4	3	1	1	0	1	0	0	0	0	0	0	25
1996							8	4	6	4	2	0	1	0	0	0	0	0	0	0	21
1997								3	2	10	2	3	0	0	0	0	1	0	0	0	26
1998									13	2	7	2	0	0	0	0	1	0	0	0	24
1999										9	5	3	2	1	1	1	0	0	0	0	3
2000											1	0	1	1	0	0	0	0	0	0	24
2001												5	10	4	1	3	1	0	0	0	21
2002													7	4	3	4	2	1	0	0	17
2003														3	3	3	3	3	3	3	12
2004															3	4	4	4	4	4	9
2005																6	3	3	3	3	7
2006																	4	5	2	1	7
2007																		7	1	0	0
Total cull						22	18	21	22	28	31	21	16	21	19	10	22	19	22	0	0

## Analysis

When the table is complete for the cull year (the year end date is not important but is usually during the close season for females), the horizontal rows are totalled to give the minimum size of the cohort born in any particular year. After 5 years or so this statistic starts to become useful since it indicates minimum known recruitment for a particular year. This can be compared with the cull taken that year to give some idea of whether it was adequate (see Cull Planning guide).

If information about young:female ratios and sex ratios is available for that year (from a census) it becomes possible to estimate the number of females required to produce the cohort and the number of males associated with them and thus the minimum size of the whole population.

The table is a record for female roe deer. The population is culled at an assumed rate of 30% per annum. The cohort totals are fairly consistent from 1992 indicating a stable population. In 2000 there appears to be a drop in recruitment, this coincided with a very wet, cold spring in which many kids may have died.

Table 1 Cohort analysis example

Cohort	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	Age in years	No in cohort
1990	5	2	2	4	1	3	0	1	1	0	0	0	0	0	0	0	0	0		19
1991		3	3	3	4	1	0	1	0	0	0	0	0	0	0	0	0	0		15
1992			5	4	5	1	2	1	1	0	1	0	0	0	0	0	0	0		20
1993				3	1	5	3	2	0	2	1	0	0	1	0	0	0	0	15	18
1994					11	2	4	6	1	1	1	0	0	0	0	0	0	0	14	26
1995						6	4	4	4	3	1	1	0	1	0	0	0	0	13	24
1996							8	4	6	4	2	0	1	0	0	0	0	0	12	25
1997								3	2	10	2	3	0	0	0	1	0	0	11	21
1998									13	2	7	3	0	0	0	0	1	0	10	26
1999									9	5	4	2	1	1	1	1	1	0	9	24
2000										1	0	1	1	0	0	0	0	0	8	3
2001											5	10	4	1	3	1	0	7	24	
2002												7	4	3	4	2	1	6	21	
2003													7	2	3	3	2	5	17	
2004														3	4	4	4	4	15	
2005															6	3	3	3	12	
2006																4	5	2	9	
2007																	7	1	7	
Total cull					22	18	21	22	28	31	21	16	21	19	10	22	19	22	0	

An estimate of minimum population for the year 1998 is calculated as follows:

October 1998 vantage point estimate of doe:kid ratio = 1 : 1.4 (doe count includes yearlings)

March 1998 vantage point estimate of buck:doe ratio = 1 : 1.2 (buck count includes yearlings)

Minimum kids born in 1998 = 26 does (from table) and 26 bucks (assuming 1:1 birth rate) = 52

Number of does (including yearlings) required to produce kids =  $52 \div 1.4 = 37$

Number of bucks (including yearlings) associated with does =  $37 \div 1.2 = 31$

Total minimum population in 1998 = 120

There are many ways of arriving at estimates of deer numbers apart from cohort analysis. Wherever possible results from this method should be considered with results from other methods, each hopefully adding confidence to the other.

## Reducing potential errors

A potential source of error is that the method requires that the age of culled deer is known. The more accurately that animals are aged the better, but there has to be a balance between time taken to age animals and the accuracy required. It is usually sufficient to use tooth eruption and wear, preferably by comparison with known age jaws, to assign age. Estimates for young:female and sex ratios are normally derived from visual counts, the more accurate these are the better.

The larger the proportion of culled animals is of the total of animals dying each year, the more animals will be included in the cohort tables and thus the fewer unknown animals that will not be accounted for.

## Further info

Mayle, B.A., Peace, A.J. & Gill, R.M.A. (1999).

How many deer? A field guide to estimating deer populations. Forestry Commission Fieldbook 18.