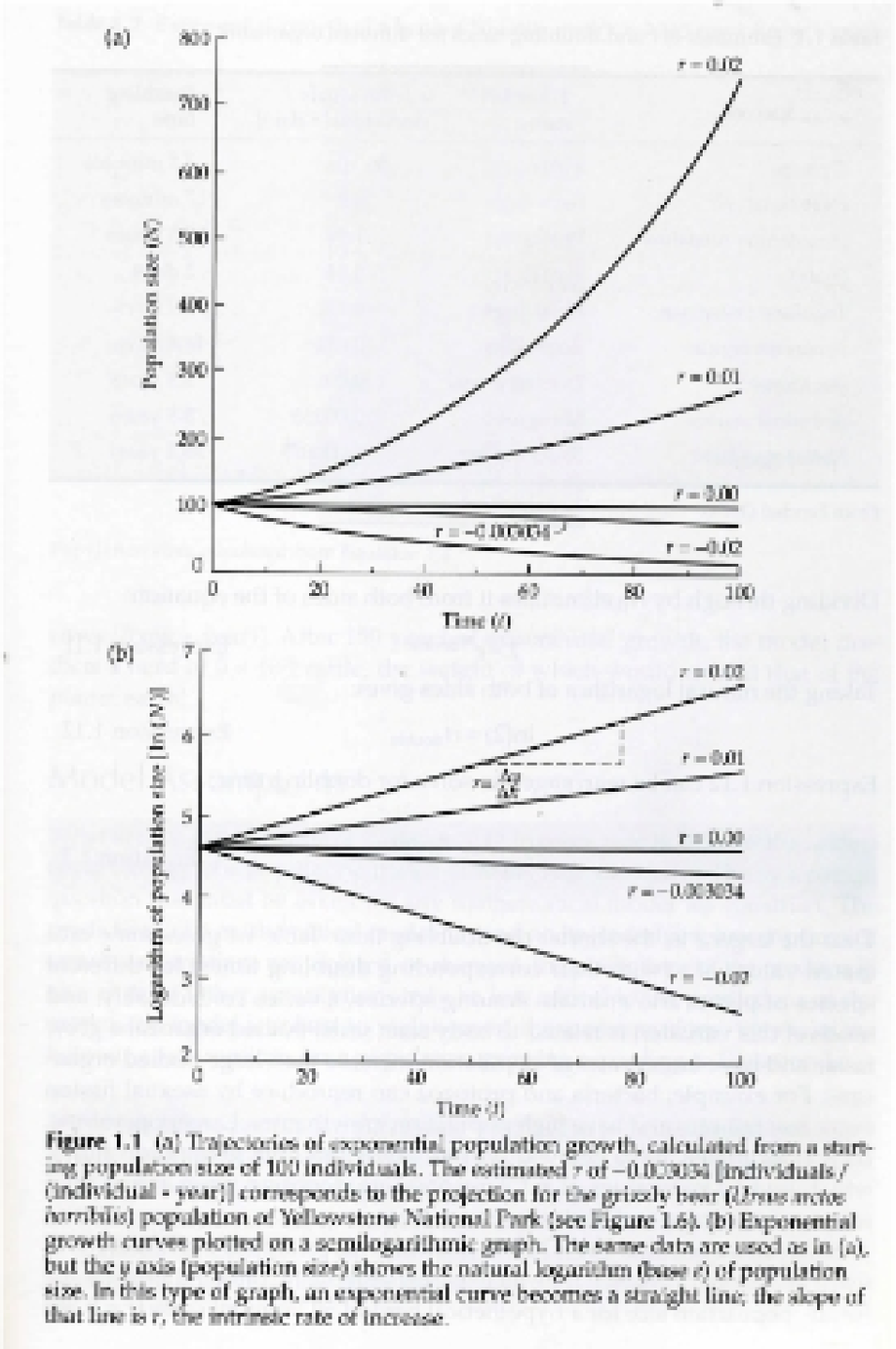

Figure 1.1 (a) Trajectories of exponential population growth, calculated from a starting population size of 100 individuals. The estimated r of −0.003034 [individuals/(individual · year)] corresponds to the projection for the grizzly bear (*Ursus arctos horribilis*) population of Yellowstone National Park (see Figure 1.6). (b) Exponential growth curves plotted on a semilogarithmic graph. The same data are used as in (a), but the y axis (population size) shows the natural logarithm (base e) of population size. In this type of graph, an exponential curve becomes a straight line; the slope of that line is r, the intrinsic rate of increase.

Using models to project population growth

- Variation in *r* affects N at time t+x

We can think about *r* (which is the same as ($\log_e \lambda$.) in several ways:

- it is a measure of the rate of increase of the population
- it is a measure of an average individual's contribution to population growth
- It is equal to birth rate - death rate (*r*=b-d)

Key assumptions of exponential growth model

- no environmental effects on N, b or d
- resources are unlimited
- population is panmictic - all individuals randomly mate with each other.
- No migration - (remember we are modelling a closed population)
- All individuals are equal and identical (same probabilities of giving birth or dying, same rates of brith or death, no age differences, etc.

Examine some of the other examples from the last lecture-

they, too, show evidence of a deviation from exponential growth after a while

Why?

Density-independent factors:

- disturbance, environmental conditions, e.g.,
  - hurricane, flood, colder than normal winter, or drought, or heat wave, which kills off many individuals

Photographs taken during a severe heat wave in western Australia in January 2009
(supplied by Northern Guardian Newspaper)

Figure 1. Dead Budgerigars (*Melopsittacus undulatus*) during a severe heat wave in western Australia during January 2009. The birds appear to have been seeking shade when they perished from dehydration and/or hyperthermia.

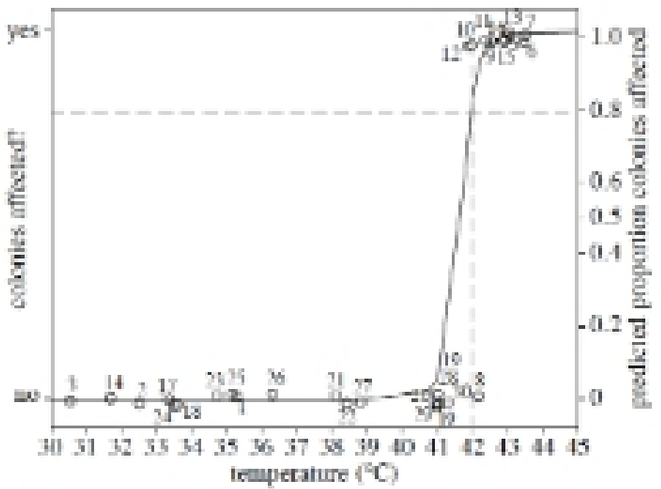

Figure 1. The colonies that were and were not affected versus the temperature recorded at their respective nearest weather station during the temperature extreme of 12 January 2002 in the Northern Rivers area, New South Wales, Australia