Introduction

- A **population** is a group of individuals of a single species that simultaneously occupy the same general area.
  - The characteristics of populations are shaped by the interactions between individuals and their environment.

1. The characteristics of populations are shaped by the interactions between individuals and their environment

- Populations have size and geographical boundaries.
  - The **density** of a population is measured as the number of individuals per unit area.
  - The **dispersion** of a population is the pattern of spacing among individuals within the geographic boundaries.

- Measuring density of populations is a difficult task.
  - We can count individuals; we can estimate population numbers.
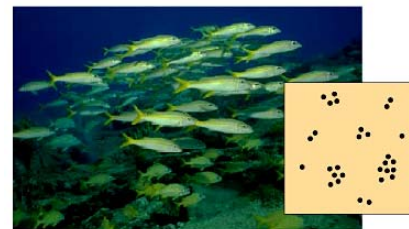

Fig. 52.1

- Unfortunately, it is usually impractical to attempt to count individuals in a population.
- One sampling technique that researchers use is known as the **mark-recapture method**.
  - Individuals are trapped in an area and captured, marked with a tag, recorded, and then released.
  - After a period of time has elapsed, traps are set again, and individuals are captured and identified.
  - This information allows estimates of population changes to be made.

- Patterns of dispersion.
  - Within a population's geographic range, local densities may vary considerably.
  - Different dispersion patterns result within the range.
  - Overall, dispersion depends on resource distribution.

- **Clumped** dispersion is when individuals aggregate in patches.

(a) Clumped

Fig. 52.2a

• By contrast, **uniform** dispersion is when individuals are evenly spaced.
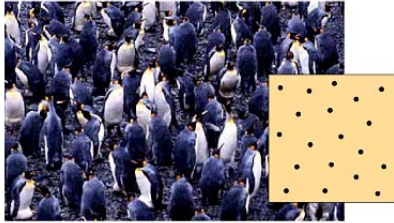
(b) Uniform

Fig. 52.2b

• In **random** dispersion, the position of each individual is independent of the others.

• Overall, dispersion depends on resource distribution.

(c) Random

Fig. 52.2c

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2. Demography is the study of factors that affect the growth and decline of populations

• Additions occur through birth, and subtractions occur through death.

  • **Demography** studies the vital statistics that affect population size.

• Life tables and survivorship curves.

  • A **life table** is an age-specific summary of the survival pattern of a population.

• The best way to construct life table is to follow a **cohort**, a group of individuals of the same age throughout their lifetime.

Table 52.1 Life Table for Belding Ground Squirrels (*Spermophilus beldingi*) at Tioga Pass, in the Sierra Nevada Mountains of California*

	Females					Males				
Age (years)	Number Alive at Start of Year	Proportion Alive at Start of Year	Number of Deaths During Year	Death Rate†	Average Life Expectancy (years)	Number Alive at Start of Year	Proportion Alive at Start of Year	Number of Deaths During Year	Death Rate†	Average Life Expectancy (years)
0–1	337	1.000	207	0.61	1.33	349	1.000	227	0.65	1.07
1–2	252††	0.386	125	0.50	1.56	248††	0.350	140	0.56	1.12
2–3	127	0.197	60	0.47	1.60	108	0.152	74	0.69	0.93
3–4	67	0.106	32	0.48	1.59	34	0.048	23	0.68	0.89
4–5	35	0.054	16	0.46	1.59	11	0.015	9	0.82	0.68
5–6	19	0.029	10	0.53	1.50	2	0.003	0	1.00	0.50
6–7	9	0.014	4	0.44	1.61	0				
7–8	5	0.008	1	0.20	1.50					
8–9	4	0.006	3	0.75	0.75					
9–10	1	0.002	1	1.00	0.50					

*Males and females have different mortality schedules, so they are tallied separately.
†The death rate is the proportion of individuals dying in the specific time interval.
††Includes 122 females and 126 males first captured as one-year-olds and therefore not included in the count of squirrels age 0–1.
SOURCE: Data from P. W. Sherman and M. L. Morton, "Demography of Belding's Ground Squirrel," *Ecology* 65(1984):
1617–1628.

Table 52.1

• A graphic way of representing the data is a **survivorship curve**.

  • This is a plot of the number of individuals in a cohort still alive at each age.

    • A Type I curve shows a low death rate early in life (humans).

    • The Type II curve shows constant mortality (squirrels).

    • Type III curve shows a high death rate early in life (oysters).
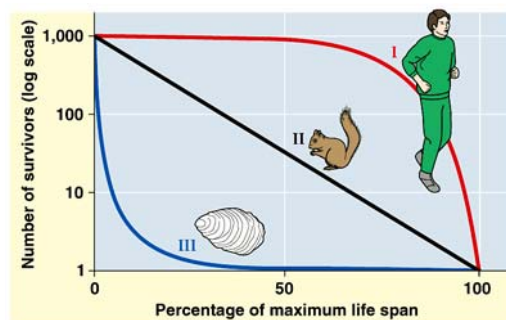
Fig. 52.3

- Reproductive rates.

  - Demographers that study populations usually ignore males, and focus on females because only females give birth to offspring.

  - A **reproductive table** is an age-specific summary of the reproductive rates in a population.

    - For sexual species, the table tallies the number of female offspring produced by each age group.

Table 52.2 Reproductive Table for Belding Ground Squirrels (*Spermophilus beldingi*) at Tioga Pass, in the Sierra Nevada Mountains of California

Age (years)	Proportion of Females Weaning a Litter	Mean Size of Litters (Males + Females)	Mean Number of Females in a Litter	Average Number of Female Offspring*
0–1	0.00	0.00	0.00	0.00
1–2	0.65	3.30	1.65	1.07
2–3	0.92	4.05	2.03	1.87
3–4	0.90	4.90	2.45	2.21
4–5	0.95	5.45	2.73	2.59
5–6	1.00	4.15	2.08	2.08
6–7	1.00	3.40	1.70	1.70
7–8	1.00	3.85	1.93	1.93
8–9	1.00	3.85	1.93	1.93
9–10	1.00	3.15	1.58	1.58

*The average number of female offspring is the proportion weaning a litter multiplied by the mean number of females in a litter.

SOURCE: Data from P. W. Sherman and M. L. Morton, "Demography of Belding's Ground Squirrel," *Ecology* 65 (1984): 1617–1628.

Table 52.2