Kinship and social evolution

- Altruism
  - Kin selection
  - Reciprocal altruism
- Parent-offspring conflict
- Eusociality

Types of social interactions

- Mutualism (cooperation)
  - Both actor and recipient benefit
- Selfishness
  - Actor benefits, recipient pays cost
- Spite
  - Actors pays cost, recipient pays cost
- Altruism
  - Actor pays cost, recipient benefits
- Costs and benefits in terms of fitness

Kin selection and altruism

- A gene that favors its own transmission will spread in the population
  - Can favor its own transmission *in other individuals with that gene*
  - Genetic similarity more likely in relatives, or *kin*

Hamilton's rule

- Gene will spread if:

  $Br - C > 0$

- W. D. Hamilton developed theory of kin selection and *inclusive fitness*
- Inclusive fitness is the sum of:

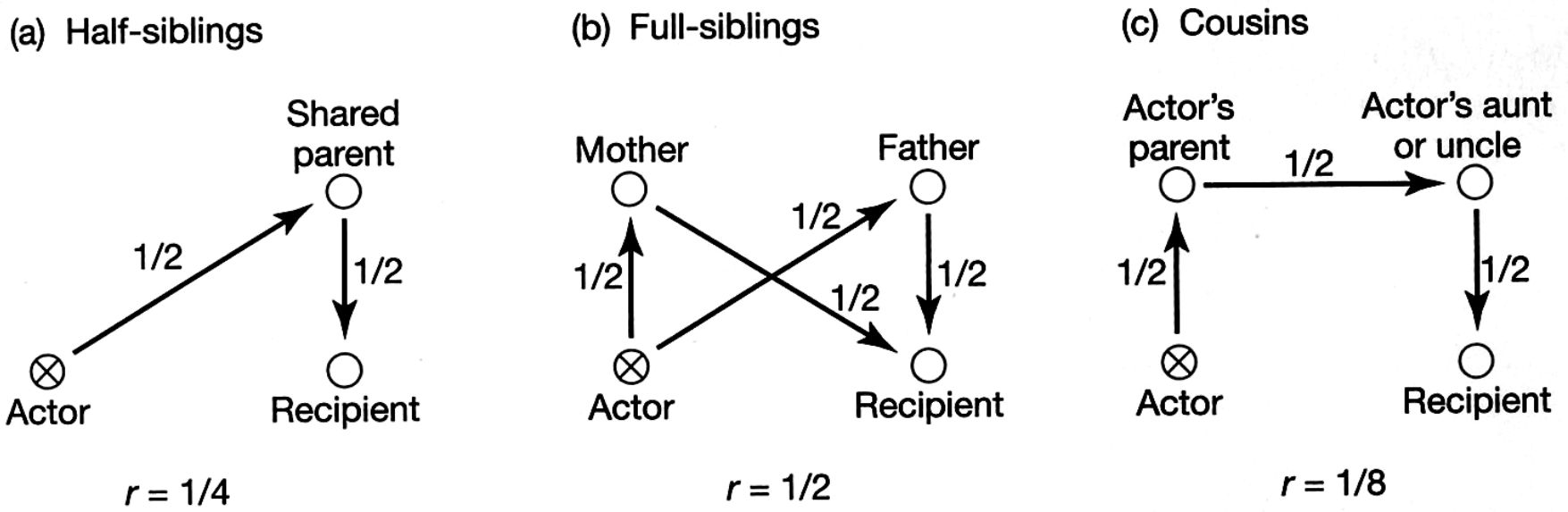
  direct fitness = own reproduction

  Indirect fitness = reproduction of genetic kin made possible by own assistance, weighted by relatedness *r*

Calculating *r* index of relatedness

- *r* reflects 50% reduction in genetic identity with each sexual generation

  because 50% of genes from mom and 50% from dad



Some familial *r*'s, diploids

- Full siblings $r = 0.5$
- Parent - offspring $r = 0.5$
- Self $r = 1$
- Identical twin $r = 1$
- Uncle or aunt $r = 1/4$
  - Genetic ones not married in
- Grandparent $r = 1/4$
- Cousin $r = 1/8$

Do animals know or calculate that?

- No, they don’t need to
- Behavioral rules of thumb
- Selection on rules of thumb
- If Br - C > 0, behavior (and rule of thumb) spreads by kin selection
- If Br - C < 0, selected against

Most cases of altruism in nature are result of kin selection

- Parental care
- Alarm calling, Belding's ground squirrels, studied by Paul Sherman
- Helpers-at-the-nest
  - Bee-eaters, other birds
  - Social carnivore mammals
  - Naked mole rats
  - Social insects

Spermophilus beldingi

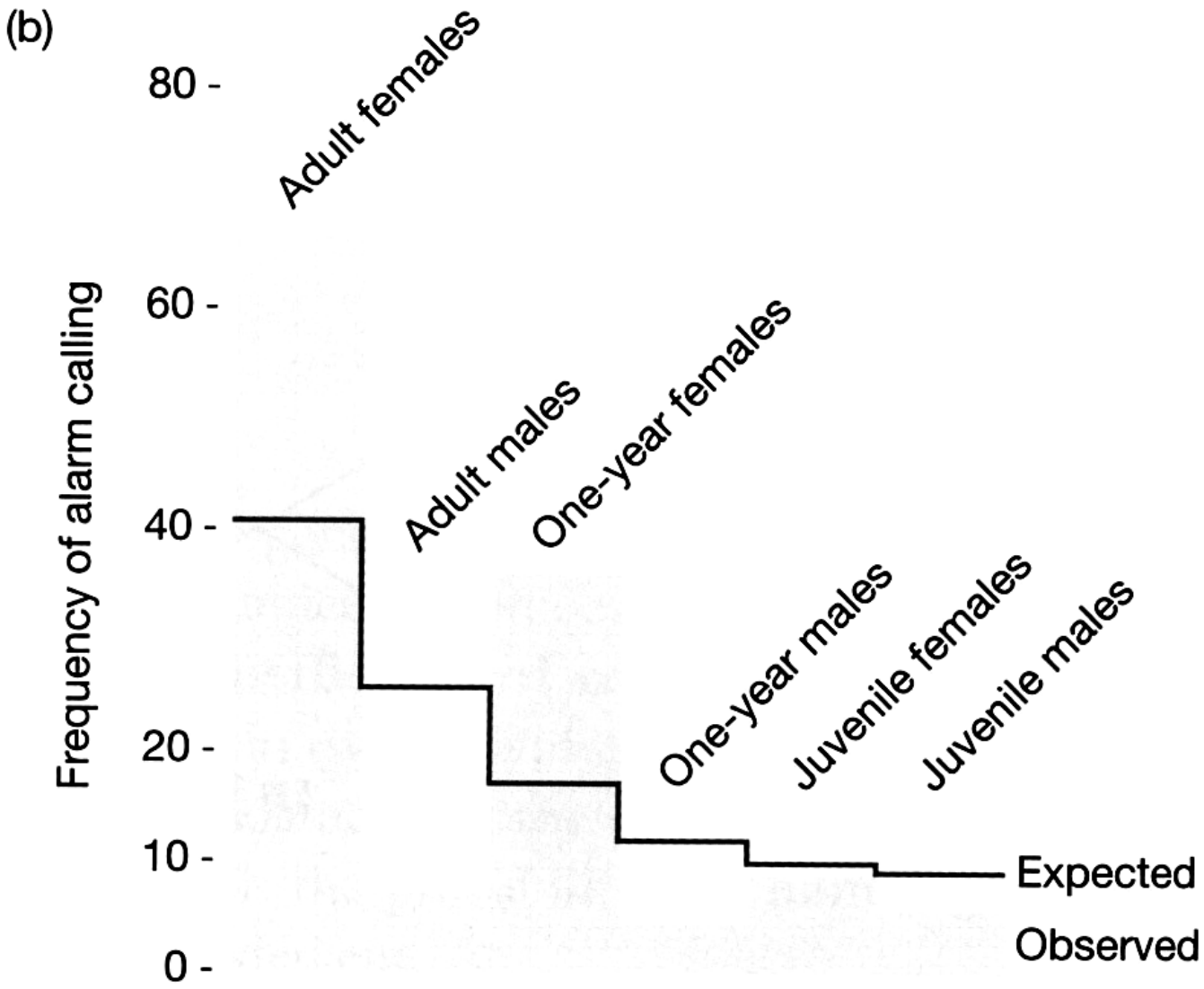
Social groups of related females.

Male offspring disperse from natal area.

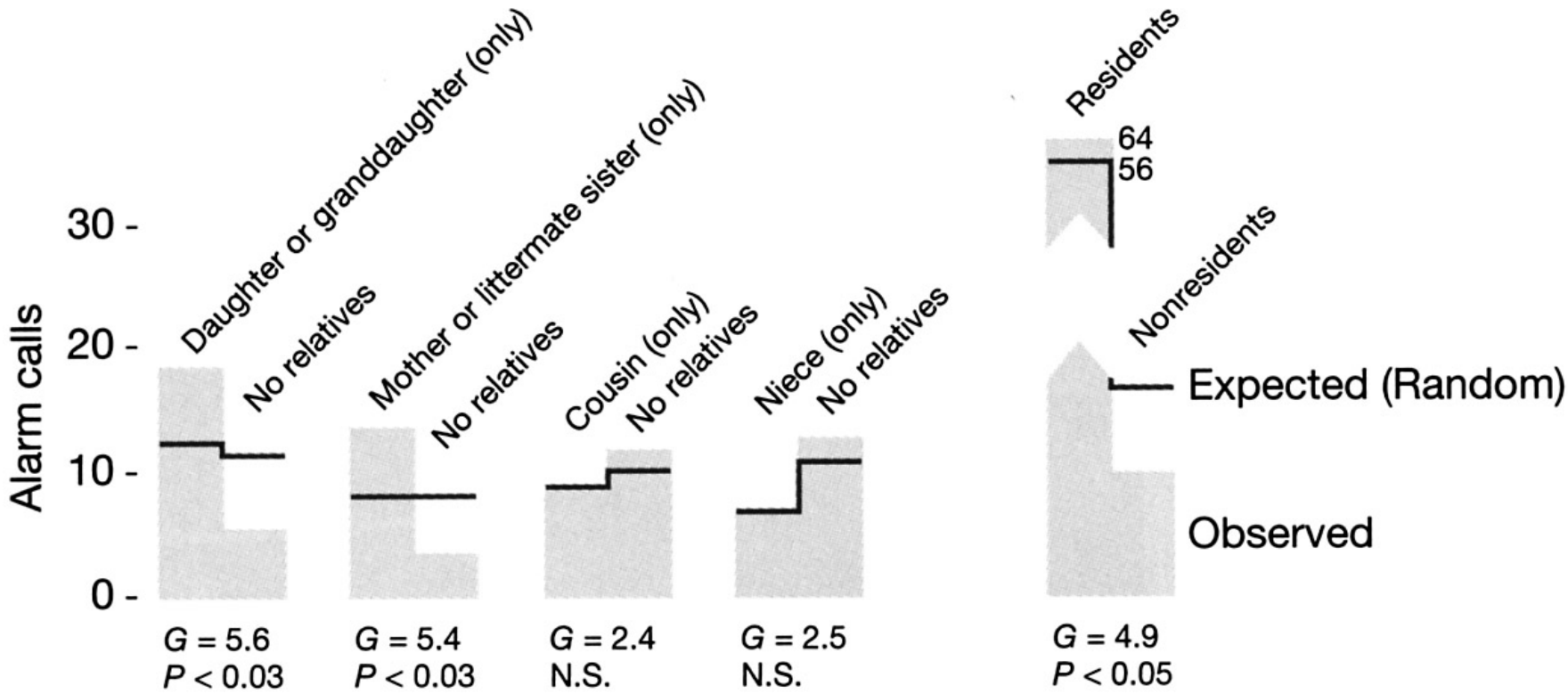
When predators spotted, individuals sometimes give and alarm call.

Caller is more than twice as likely to be stalked and chased (13%) as a non-caller (5%).

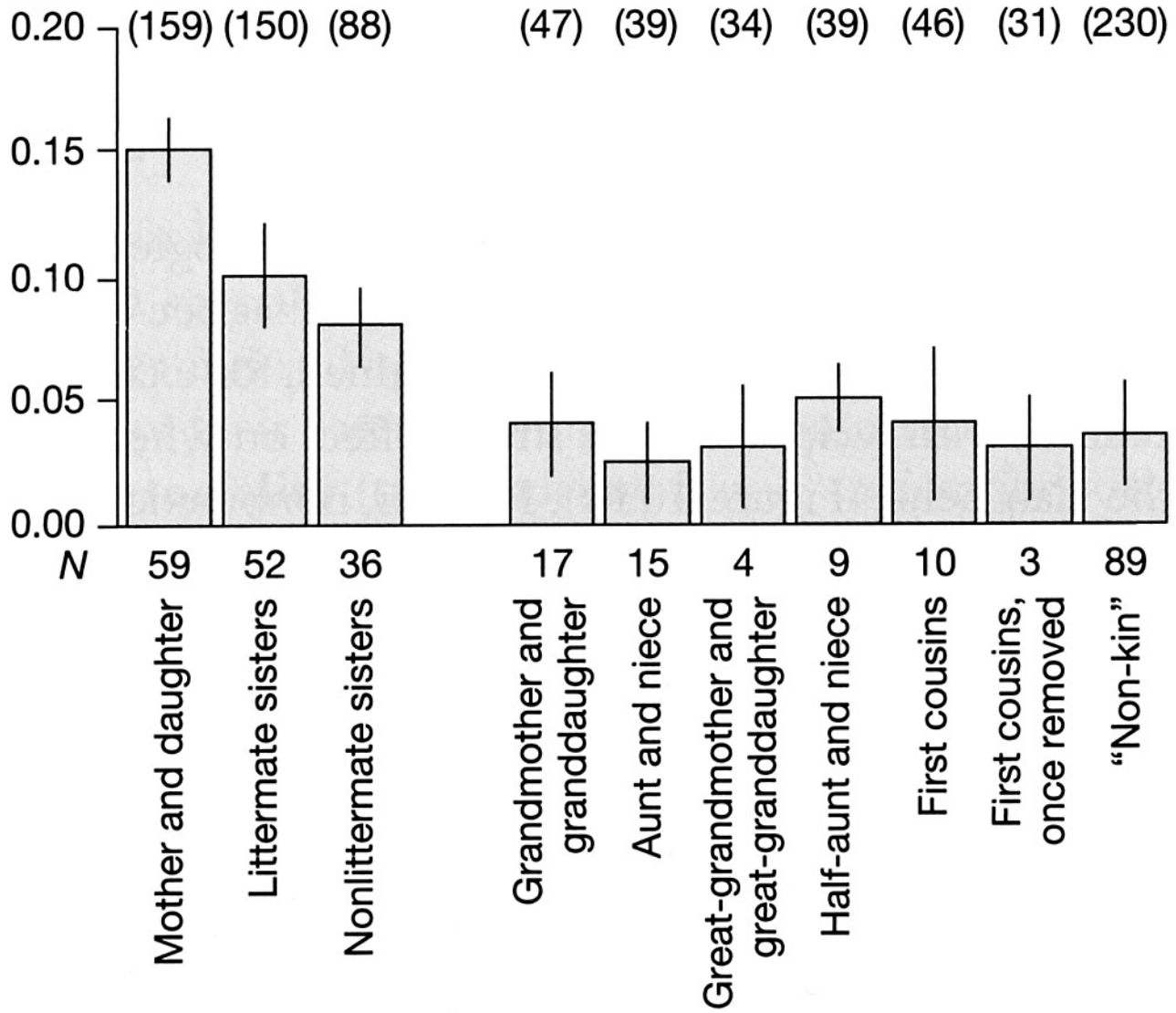
Who calls?


(b)
Frequency of alarm calling
80 -
60 -
40 -
20 -
10 -
0 -
Adult females
Adult males
One-year females
One-year males
Juvenile females
Juvenile males
Expected
Observed

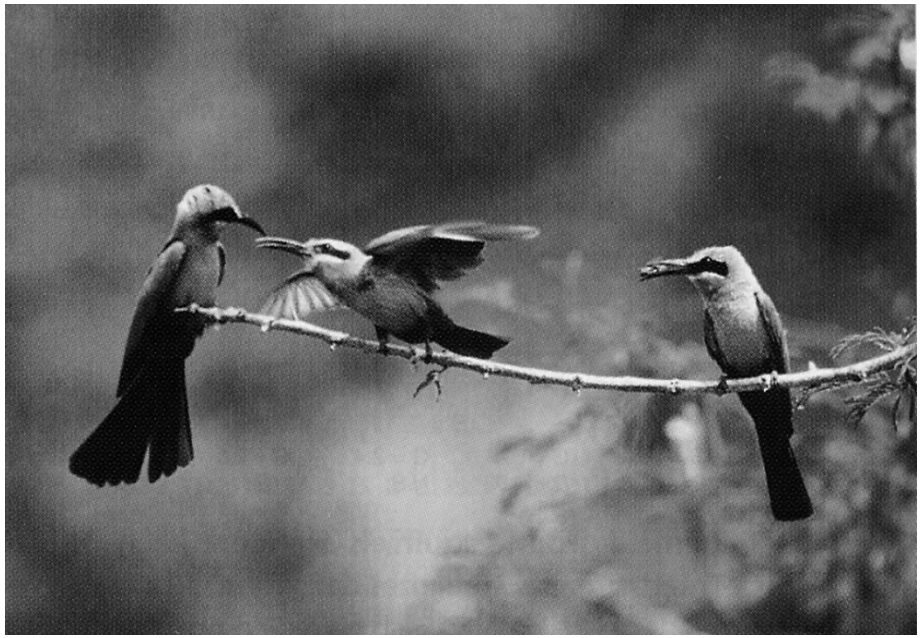
Selective calling: who is nearby?



Cooperation in ground squirrels

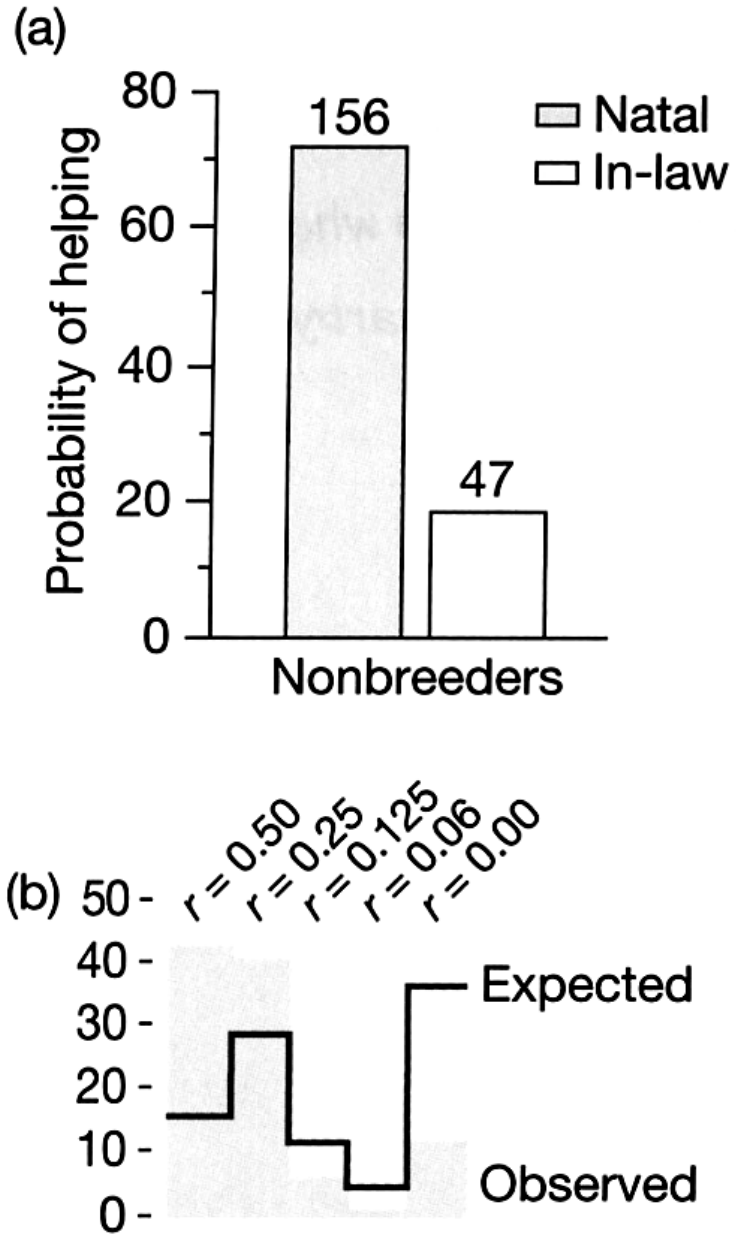


Merops bullockoides



Young of previous season sometimes stay with parents and help rear siblings.

Ecological constraint on reproduction elsewhere.



Helpers help relatives

Because of clan structure, they have choices of different offspring to help based on different relatedness.

Helping increases reproduction

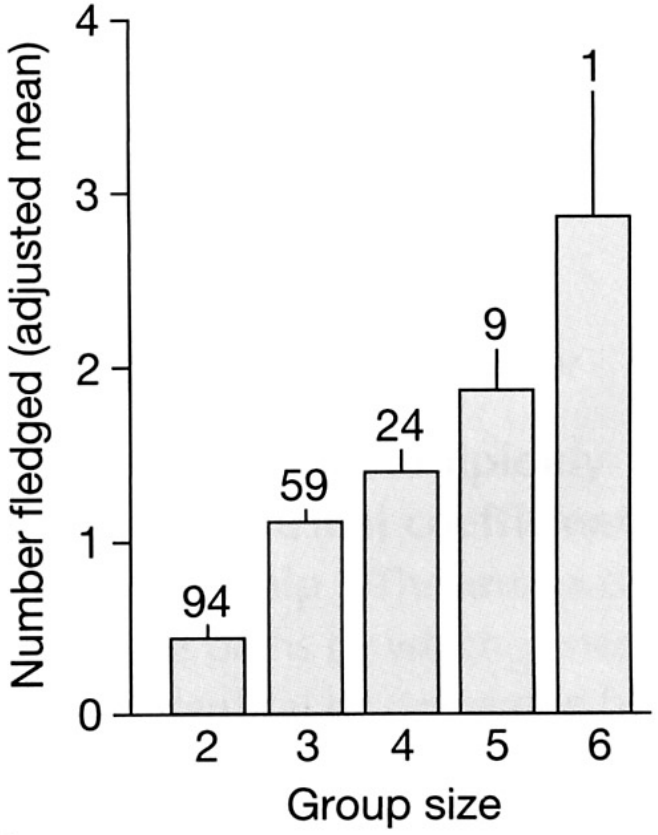


Figure 10.7 Fitness gains due to helping From Emlen and Wrege (1991).

On average, each helper adds 0.47 offspring fledged.

If they are full siblings, then the gain in inclusive fitness is 1/2 of 0.47.

Since reproduction elsewhere is unlikely, the cost, is low.

Br - C > 0

How else might altruism evolve?

- ‘one good turn deserves another’
- Reciprocity, or *Reciprocal altruism*
- Requires two conditions be met:

  Cost to actor less than benefit to recipient

  Cheaters must be punished somehow

    requires repeated interactions over time

Cooperation: the prisoner's dilemma

Potential payoff's to prisoner (player) A

		Player B's action	
		C Cooperation	**D Defection**
Player A's action	**C Cooperation**	R (reward for cooperation—both receive light sentences)	S (sucker gets longer sentence if partner defects)
	D Defection	T (temptation—reduced sentence for defector)	P (punishment for mutual defection—both receive intermediate sentences)

Vampire bat blood sharing

- Social group usually 8 to 12 females and dependent young; roost together
- Search for blood meals, 33% of young fail, 7% of adults fail on any given night
- Three nights without food greatly increases risk of starvation

Non-random barfing of blood