The Role of Kinship in helping behavior among white-fronted bee-eaters

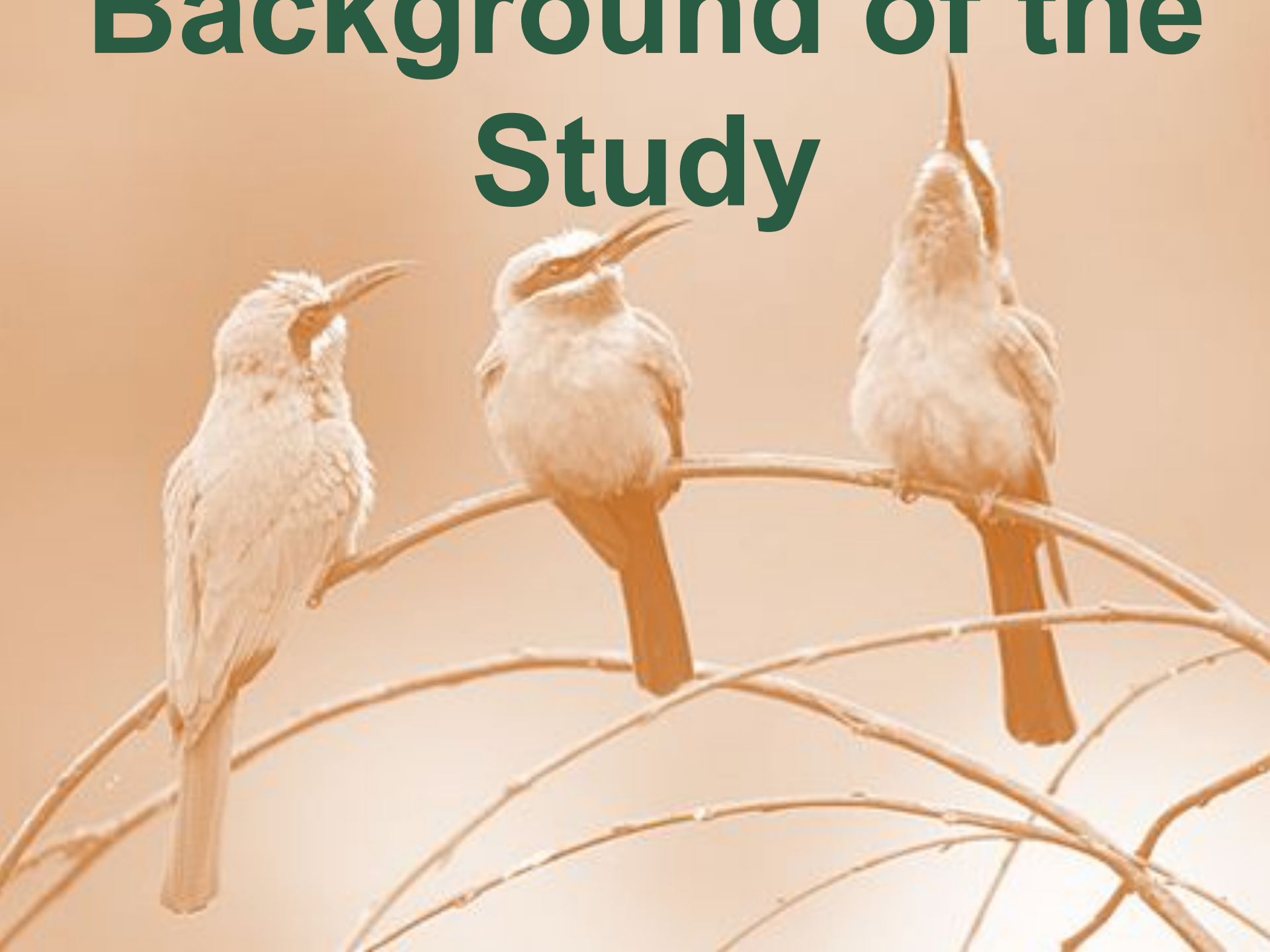
Group

The aim of the study is to examine the role of kinship in helping decisions made by white fronted bee-eaters.

Source of the Data:

Five year observation of color-marked and genealogically known population of white fronted bee-eaters in Kenya.

Background of the Study



How often do bee-eaters help each other?

1

Helping-at-the-nest is frequent, with half (50%) of all nesting attempts being attended by one or more helpers in addition to the breeding pair.

The average number of helpers at nests with helpers is 1.52 (Emlen 1988).

How bee-eaters help?

2

When a bee-eater becomes a helper, it attaches itself to one nesting group and assists at only that one nest until either the young fledge or the nesting attempt fails.
If young fledge, the helper generally continues to feed the fledglings during their transition to independence.

Who helps more: male or female bee-eaters?

3

Males and females contribute almost equally to the pool of helpers, 53 percent being female (Emlen 1988). Further, the likelihood that any given bird becomes a helper is independent of gender. There was no sexual bias in the probability of helping for any category of natal potential helper.

How bee-eaters become helpers?

4

White-fronted bee-eater helpers come from the ranks of breeders as well as non-breeders. When a nesting attempt fails, it is common for one (and rarely both) breeders to shift and become "redirected helpers" at another nest within the clan (Emlen 1981, 1988).

3 key research questions of the study:

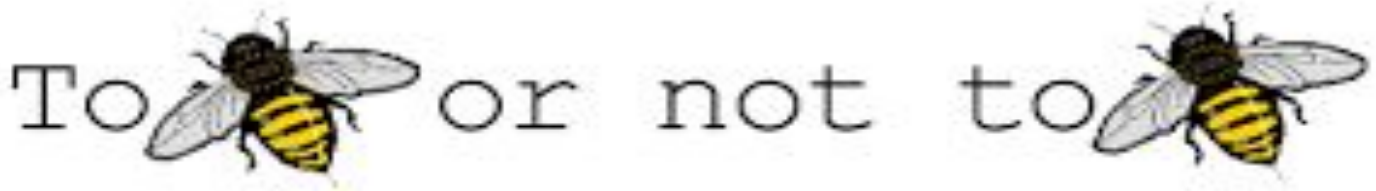
How they decide…

Whether or not to become a helper?

Whom to help?

How much help to provide?

Whether or not to become a helper?



that is the question

Whether or not to become a helper?

According to the Hamilton's equation 3 specific predictions follow:

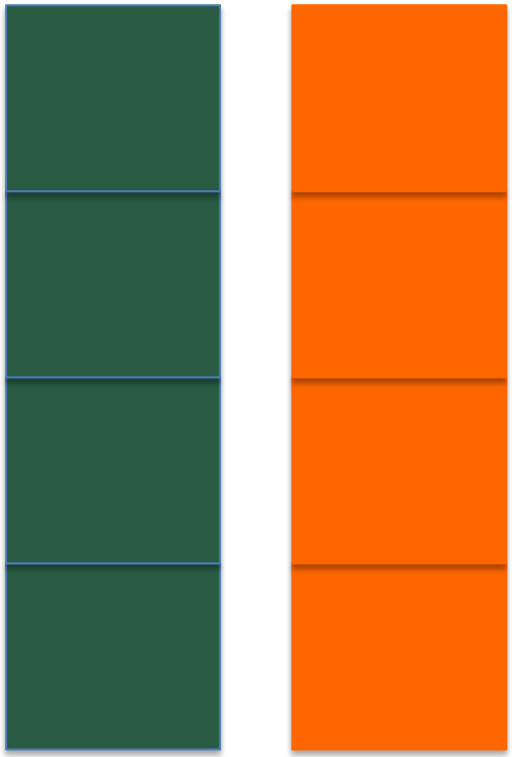
More individuals should become helpers when the magnitude of the benefit realized by the recipient is large

More individuals should become helpers when the cost to the donor of providing aid is small

More individuals should become helpers when the coefficient of relatedness between recipient and donor is large

Testing the Benefit Variable

More individuals should become helpers when the magnitude of the benefit realized by the recipient is large

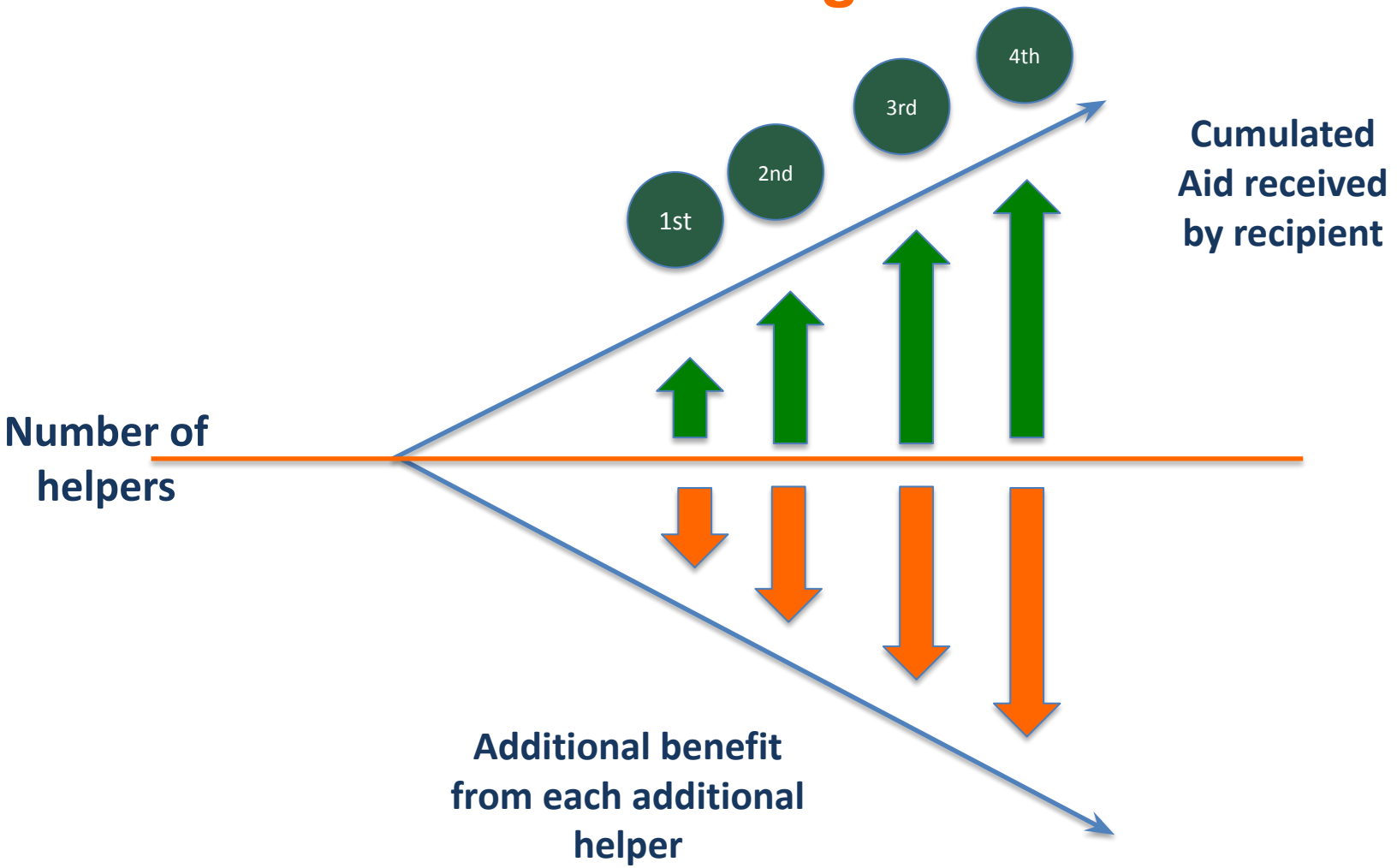


Cumulated Aid

Benefit of recipient

Testing the Benefit Variable

More individuals should become helpers when the magnitude of the benefit realized by the recipient is large



Benefit Variable Analysis Results

The relationship between number of helpers and fledging success was linear:

0.44 off-spring per additional helper

Nestlings continue to benefit from increasing number of helpers and observed helper number has rarely reached the point of diminishing returns

Prediction of decreasing likelihood of becoming helper cannot be tested with this species

Testing the Costs Variable

More individuals should become helpers when the cost to the donor of providing aid is small

Two types of costs were examined

Energetic costs for helping

Deferring one's own reproduction

Testing the Costs Variable

Energeticcosts for helping

If the case of an initial nest failure bee-eaters either renest or become helpers at other ongoing nests.

Also some bee-eaters nest a second time after successful fledging first broods of young.

Testing the Costs Variable

Energetic costs for helping

Two categories of helpers:

Low-Effort

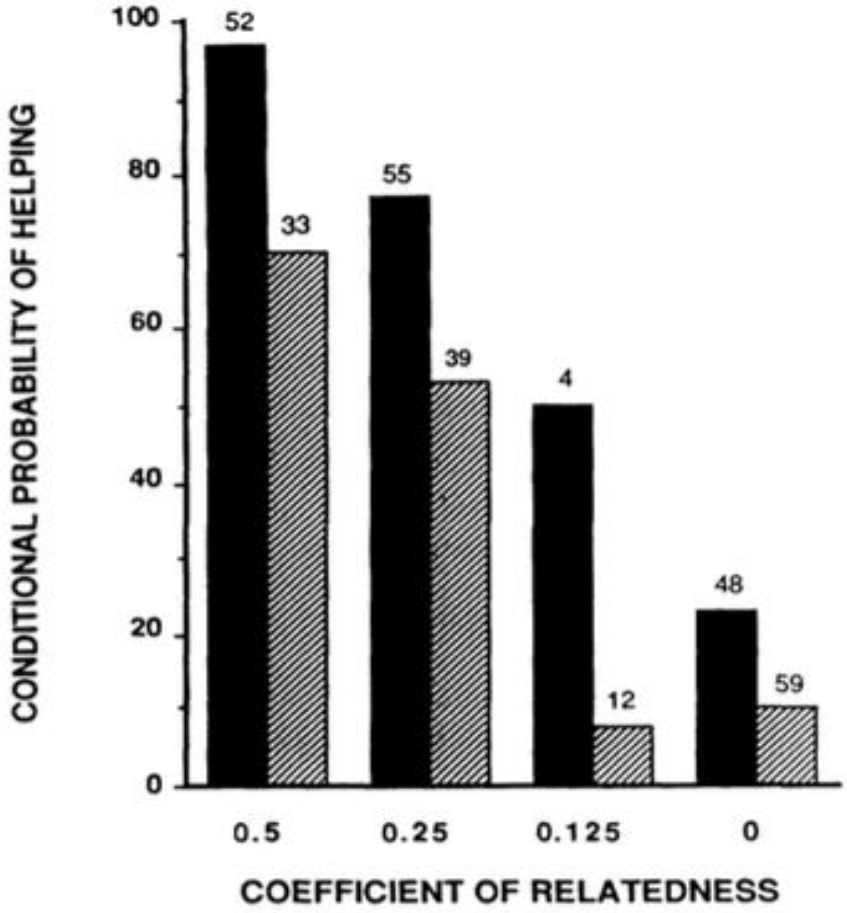
Helpers that had not participated in any previous nesting attempt that season or that had failed early in their first nesting attempt

High-Effor

Helpers that had involved in any successful nesting attempt that had reached the point of feeding young.

Costs Variable Analysis Results

Energetic costs for helping



Low-effort helpers demonstrated higher conditional probabilities of helping that birds from the High-Effort category.

This effect is significant for all kin classes (0.5, 0.25, 0.0)

Higher Costs → Less Help

Testing the Costs Variable

Delayed breeding costs

Two categories of helpers:

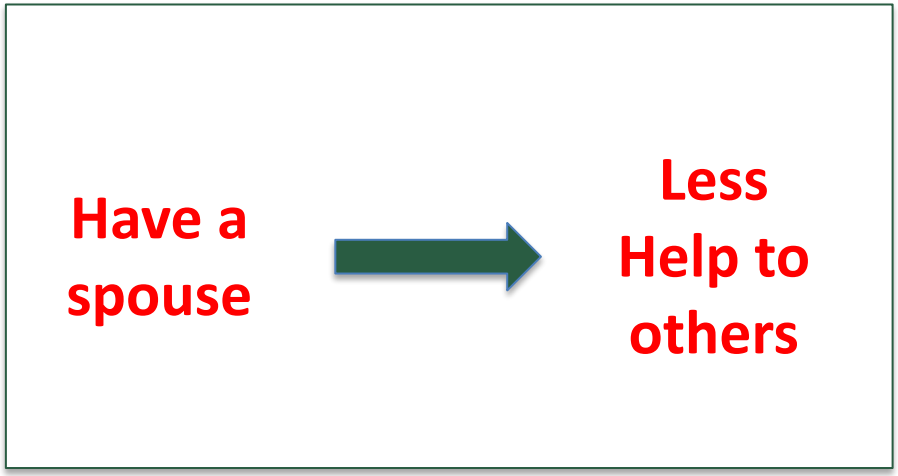
Low Cost **Single Birds**

High Cost **Paired Birds**

Costs Variable Analysis Results

Delayed breeding costs

Paired birds were significantly less likely to become helpers than were single individuals



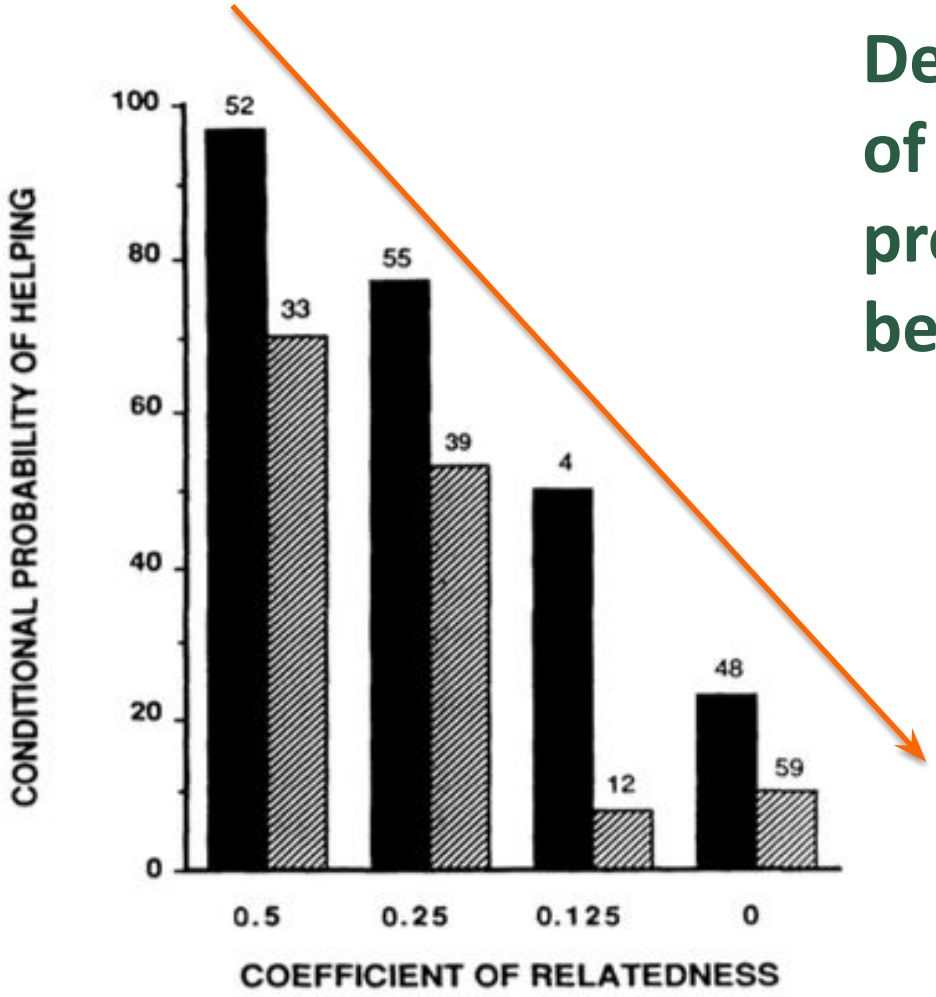
Testing the Kinship Variable

More individuals should become helpers when the coefficient of relatedness between recipient and donor is large

If the case of an initial nest failure bee-eaters either renest or become helpers at other ongoing nests.

Also some bee-eaters nest a second time after successful fledging first broods of young.

Kinship Variable Analysis Results



Decreasing the coefficient of relatedness decrease probability of helping behavior.

Less Related → Less Help

Kinship Variable Analysis Results

The non-incestuous nature of pair-bonding in bee-eaters clans creates the simple kin-nonkin dichotomy within each clan.

Clan 1

Clan 1

One member of the new pair remains in its natal plan and other (usually female) leaves its natal clan.

Kinship Variable Analysis Results

The question is that will the new (in-law member) receive the same amount of help from the members of non-natal clan?

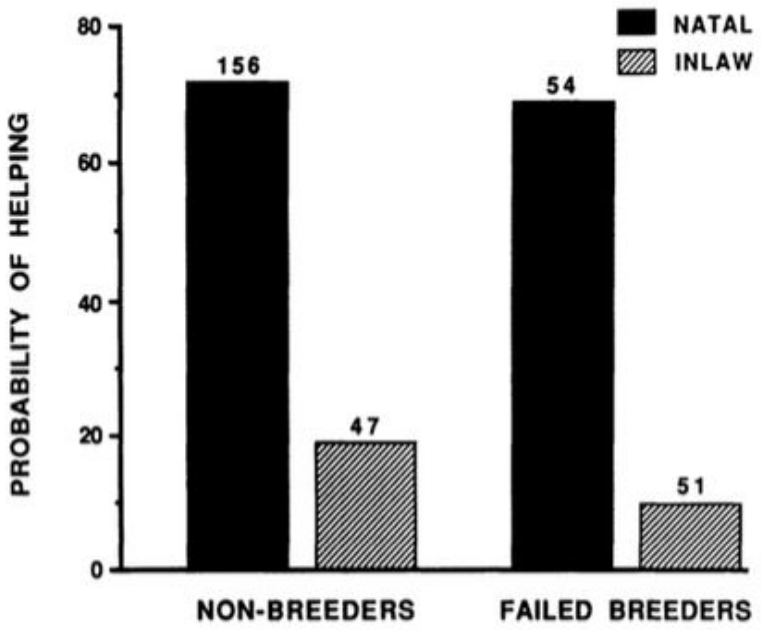


Fig. 2. The probability that a potential helper becomes an actual helper, partitioned according to its genealogical status within the social unit (clan). "Natal" members refer to birds born into the clan; "In-laws" refer to unrelated mates that join the clan at the time of pairing. Non-breeding potential helpers and redirected potential helpers are plotted separately. For both conditions, natal birds were much more likely to become helpers than were unrelated ones (see text)

Natal members receive much more helping, than unrelated mates due to they social situation.

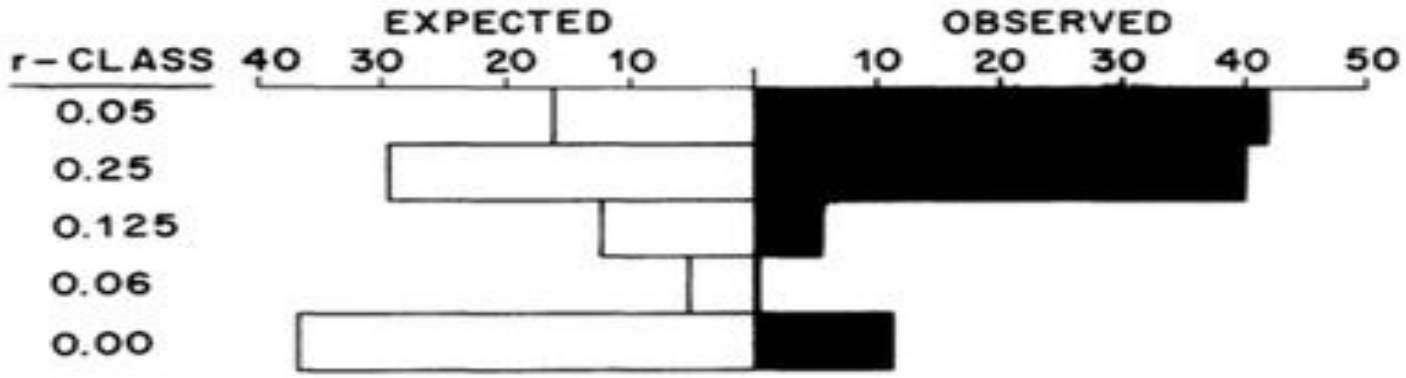
"Higher Social Status" → **More Help**

Whom to help?

Whom to help?

Breeders	*r*	No. of cases	%
Father–Mother	0.50	78 (59)	44.8 (47.6)
Father–Step-Mother	0.25	17 (13)	9.8 (10.5)
Mother–Step-Father	0.25	16 (15)	9.2 (12.1)
Son–Non-relative	0.25	18 (11)	10.3 (8.9)
Brother–Non-relative	0.25	12 (4)	6.9 (3.2)
Grandfather–Grandmother	0.25	5 (1)	2.9 (0.8)
Half-Brother–Non-relative	0.13	3 (1)	1.7 (0.8)
Uncle–Non-relative	0.13	2 (1)	1.1 (0.8)
Grandmother–Non-relative	0.13	1 (1)	0.6 (0.8)
Grandson–Non-relative	0.13	1 (0)	0.6 (0)
Great-Grandfather–Non-relative	0.06	1 (1)	0.6 (0.8)
Non-relative–Non-relative	0.00	20 (17)	11.5 (13.7)
Total		174 (124)	100 (100)

Whom to help?



Expected probabilities of helping based on:

- Direct proportion of available recipients in the clan

Assumption that helpers choose their recipients randomly

Observation demonstrated that:

Bee eaters are more likely to help the most closely related recipients.

Whom to help?

The average relatedness between helper and nestlings being helped was **0.33**

Kin recipients were involved in **88%** of the cases and the most frequent associations were **among the closest kin**

There were **10 instances** in which helping was directed towards recipients outside of the clan. But, **in 8 cases** birds temporarily rejoined their natal groups to **help their parents or step-parents.**

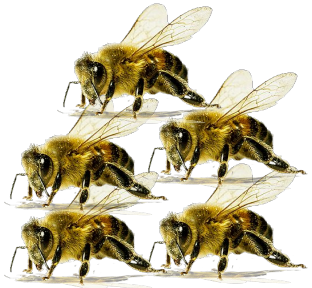
How much help to provide?

How much help to provide?

Does kinship predict the amount of aid bee-eaters will provide?

How much help to provide? In bee-eaters, the major contribution of helping is feeding nestlings.

Will the feeding rate differ between relative and non-relative recipients?



Relati
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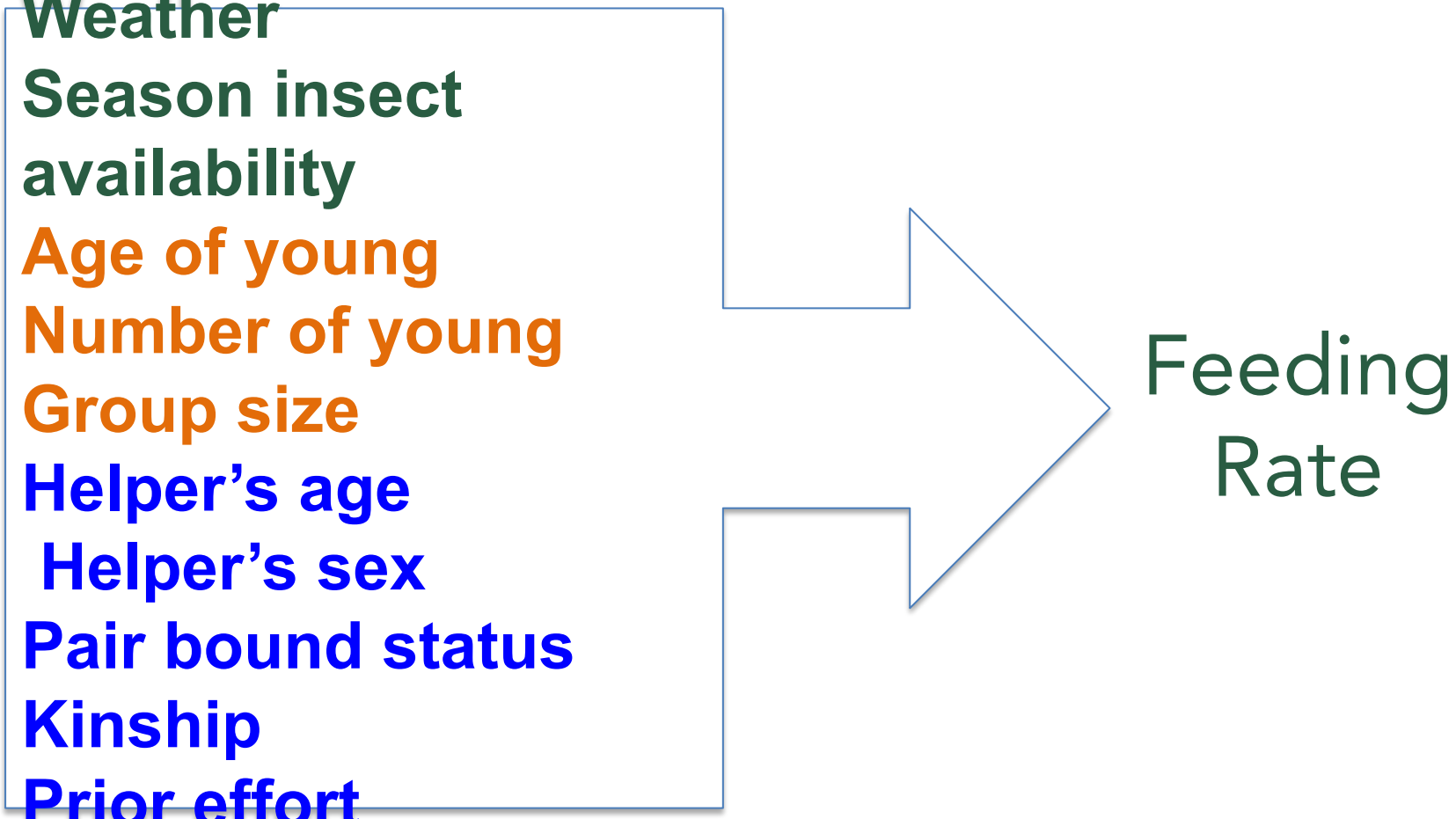
Non-relati
ve

How much help to provide?

The model included ten independent variables:



How much help to provide?

The model explained only 34% of variance

Genetic relatedness explained only 4% of variance

Bee eaters did not vary their amount of help in accordance with their degree of relatedness to the recipients

Thank you for your attention!