Group Selection

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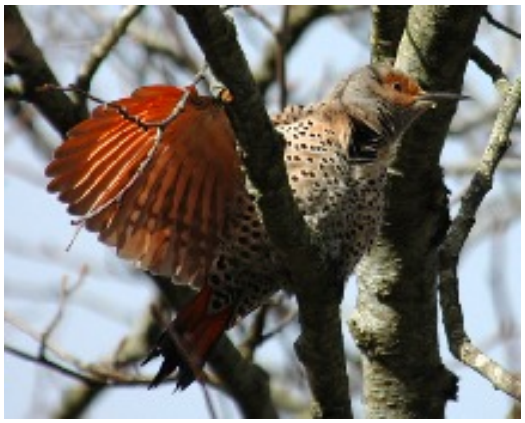
Puzzle

- Many animals have fewer offspring than they might.
- Why?

Example

- Many American Hutterite families have 10+ children.
- Most ethnic groups have fewer.
- Why don't they all have 10+?

1887 experiment with red-shafted flicker



- Experimenter removed eggs as flicker laid them.
- Flicker laid 71 eggs in 72 days.
- Normally: only 8–10 eggs.
- Why?

C.L. Phillips 1887

If selection favors those who reproduce most, why do we have so few children?

Group selection hypothesis

- Without limits on reproduction, a population would soon exhaust its resources, and then starve.
- Selection favors *groups* that limit reproduction.
- Reproductive restraint may be an adaptation for the good of the group.

Requires that natural selection operate on variation among groups (V C Wynne-Edwards, 1962).

Group and individual adaptations

Individual adaptation Favored *individuals* contribute more genes to future generations.

Group adaptation Favored *groups* contribute more genes to future generations.

Wolf fights

- Wolves are capable of killing each other, yet rarely do.
- A group adaptation?

People used to think so, although few do today.

Necessary conditions for group selection

1. Variation: groups must differ
2. Effects on group fitness
   - rate of group extinction
   - rate at which groups produce emigrants
3. Heredity: Offspring must resemble parents.

These conditions are often met, so group selection often operates.

But is group selection important?

- Only if its effect is stronger than that of individual selection.
- Strength affected by two factors:
  - amount of variation among groups
  - rate of change

How migration affects variation among groups

- Reduces variation among groups but not among individuals.
- Usually makes group differences smaller than individual differences.

Rate of change

- Individuals are replaced each generation.
- Groups often last many generations.
- Rate of change due to group selection is therefore slow.

Group selection is weaker than individual selection.

- Less variation among groups than among individuals.
- Group selection is slow.

Be skeptical

This was a "hand-waving" argument against group selection.

But not too skeptical

- Detailed mathematical models reach same conclusion.
- Most biologists doubt that group selection is important in nature.

The opposing argument

- In experiments with flour beetles, group selection is more potent than models predict (Wade, 1975).
- Argument against group selection has a hidden assumption—that gene effects are "additive."
- People still argue about the importance of group selection.

Cultural group selection

Group selection may be more important for cultural traits than for genetic ones.
(More on this later in the course.)

Summary

- Group selection is probably less important than individual selection because
  1. groups vary less
  2. groups evolve more slowly
- May be more important where gene effects are nonadditive
- or for culture traits.