Intraspecific Effects I.

So far, we have assumed that:
• Individuals have no effects on each other
• Resources are unlimited

Sometimes these assumptions are justified, but often they are not.

Intraspecific competition:
*When individuals of the same species interfere with each other either directly or through preemptive use of resources*

---

Characteristics of Intraspecific Competition

1. The ultimate effect is a decrease in either reproduction or survival (decrease in the contribution to the next generation).

---

Characteristics of Intraspecific Competition

2. The resource for which individuals are competing must be in short supply.

3. Competing individuals are inherently equivalent (e.g., circumstances, more than individual differences, determines who “wins”).

---

Characteristics of Intraspecific Competition

4. The effects of intra-specific competition are density dependent.

Density dependence:
*The greater the number of individuals, the greater the probability any given individual will be adversely affected.*

---

Density dependence

Not all DD effects are a result of intra-specific competition.

They can arise from other processes such as inter-specific competition.

Density dependence tends to regulate population size.

---

Scramble and Contest Competition

• These are the theoretical extremes originally proposed by the ecologist A.J. Nicholson in 1954.

• Scramble: All individuals get an equal share of resources

• Contest: A few “winners” get all the resources, the remaining individuals get nothing.
Scramble competition

(From Begon et al. 1996)

Size-Symmetric Competition in Plants

• This is the equivalent of scramble competition in animals
• Also known as two-sided competition
• Resources are utilized in proportion to an individual plant’s size

Example: soil nutrients are usually taken up in a size-symmetric manner

Contest Competition

(From Begon et al. 1996)

Size-Asymmetric Competition in Plants

• Equivalent to contest competition in animals
• Also known as one-sided competition
• Resources are disproportionately used by larger individuals

Example: light is often taken up in a size-asymmetric manner: the bigger plant gets most or all, smaller plant dies

Are these extremes reasonable?

Probably not.

However, illustrate the range of possible responses by real individuals.

Intraspecific Competition in Plants

Law of constant final yield

• This is a form of intraspecific competition
• Survival is not decreased, but plant size, and reproductive output, are affected.
• This relationship compares plots of different densities at a single instant of time; it is not a dynamic process.
Self-thinning in plants

As plants grow in size, density-dependent mortality may start to occur. This is a dynamic process known as self-thinning

The -4/3 Thinning Law

Size Hierarchies Under Crowded Conditions

In both plants and animals, dense populations tend to lead to many small individuals but only a few large ones.

This is a result of intra-specific competition and can occur even if all organisms start out the same size initially.

Size Distributions: Examples

(Silvertown and Charlesworth 2001)

(Silvertown and Charlesworth 2001)

(Silvertown and Charlesworth 2001)

(Silvertown and Charlesworth 2001)

(Vandermeer and Goldberg 2003)
Review
Intraspecific competition is characterized by four conditions:
1. Decrease in demographic rates with increasing density
2. A critical resource must be in limiting supply
3. Individuals are inherently equivalent
4. The effects of intraspecific competition are density dependent.

Review
Density dependence tends to regulate population size.

Two forms of intraspecific competition are scramble competition and contest competition in plants.
These are equivalent to size symmetric and size asymmetric in plants.

Review
In plants, the Law of Constant Final Yield describes a pattern of decreasing size and reproduction, but no mortality, with increasing density.
At a certain threshold, mortality will increase.
This process is known as Self-Thinning.
The slope of the relationship is generally described by -3/2 or -4/3.

Review
Self-thinning usually is called the -3/2 thinning law or the -4/3 thinning law.
Intraspecific competition in both plants and animals leads to size hierarchies.