Ideal Free Distribution (**IFD**)

Pattern in Consumers across Resource Patches

Ideal: Information on Resource Availability

"Fully Informed"

Free: No Cost to Move to, Enter Any Patch

Fitness (Currency): **Density-dependent**

"Dispersion Economy"

Individuals Move until Moving Reduces Currency

Nash Equilibrium N-Person Game

Resource Input Rate Patch i: k_i

Individuals in Patch i at IFD: n_i

$$n_i / n_j = k_i / k_j$$ Habitat-matching Rule

$$\frac{n_i}{\sum_j n_j} = \frac{k_i}{\sum_j k_j}$$ Input-matching Rule

IFD

Distribution of consumers follows resource distribution

Same for different total numbers of consumers (?)

Groups of consumers

Social: Affect Each Other's Fitness (Currency)

Aggregations: Attracted to Resource,
Not Other Consumers

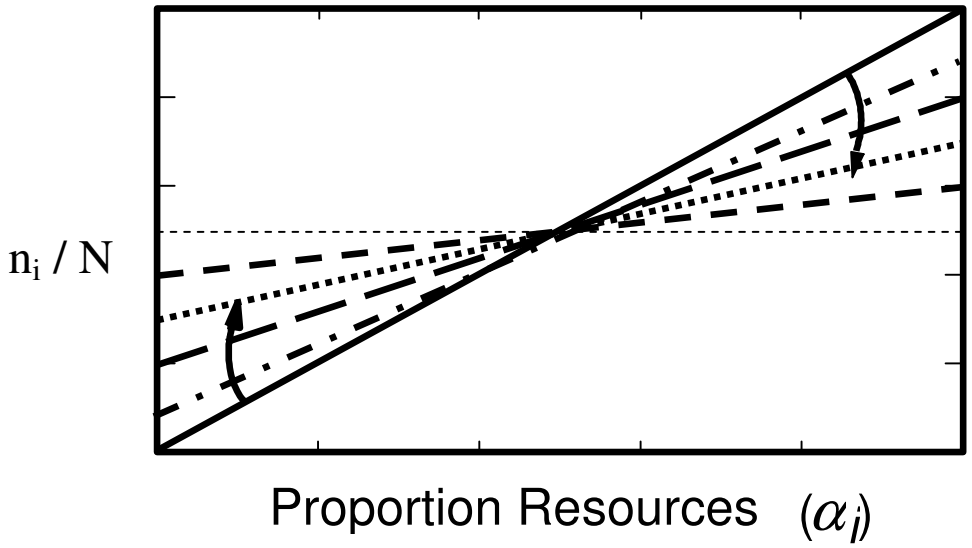
Suppose Consumers Not Ideal

Perceptual Constraint: Consumers Limited in Ability to

Distinguish Input-rate Differences (k_i *vs* k_j)

Homogenizes Consumer Distribution

No Perception: Uniform Consumer Distribution



Learning: Consumers Must Gain Information, Sample

Predicts IFD, Sufficient Time

Suppose Consumers Not Free

Entry Cost of Aggression, No Interference within Patch

"Undermatching" More Consumers than IFD Predicts

In Poor Patches, Fewer in Good Patches

Travel Costs: IFD

Complex Currency of Fitness

Consumers Subject to **Predation** in Patches

Trade-off: Resource Intake & Avoiding Predation

Risk-sensitivity: “Overmatching”

Interference Model

Consumers Ideal & Free

Competitors in Same Group Inhibit Resource Uptake

m: Effect of Group on Individual's Food-Encounter Rate

m: Interference During Search

k_i: Resource density, n_i: Equilibrium Consumer Number

All Consumers Have Same Resource-Intake Rate

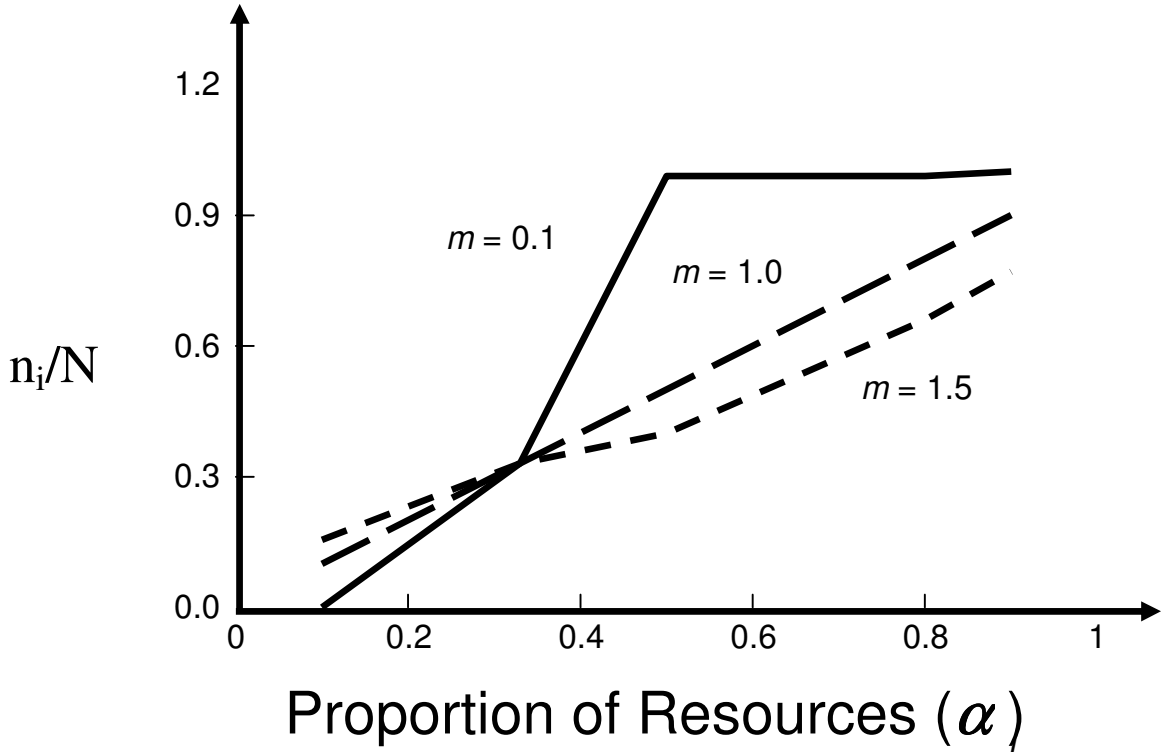
Interference Habitat-matching Rule:

$$\frac{n_i}{\sum n_j} \propto \left(\frac{k_i}{\sum_j k_j} \right)^{1/m}$$

$m = 1$ Standard IFD

$m > 1$ Strong Interference, Undermatching Predicted

$m < 1$ Weak Interference, Overmatching Predicted



Dispersion Economy

Any Increase in Size G of Consumer Group

Reduces Individual i's Direct Fitness (Currency) w_i

$$\partial w_i / \partial G < 0; \quad all \;\; G \geq 1$$

Aggregation Economy

Increase in Group Size Initially Increases Individual Fitness

Large Groups: Competition May Reduce Individual Fitness

$$\left(\partial w_i / \partial G\right)_{G=1} > 0$$

Groups **Social**: Affect Each Other's Currency of Fitness

Attraction to Individuals in Group