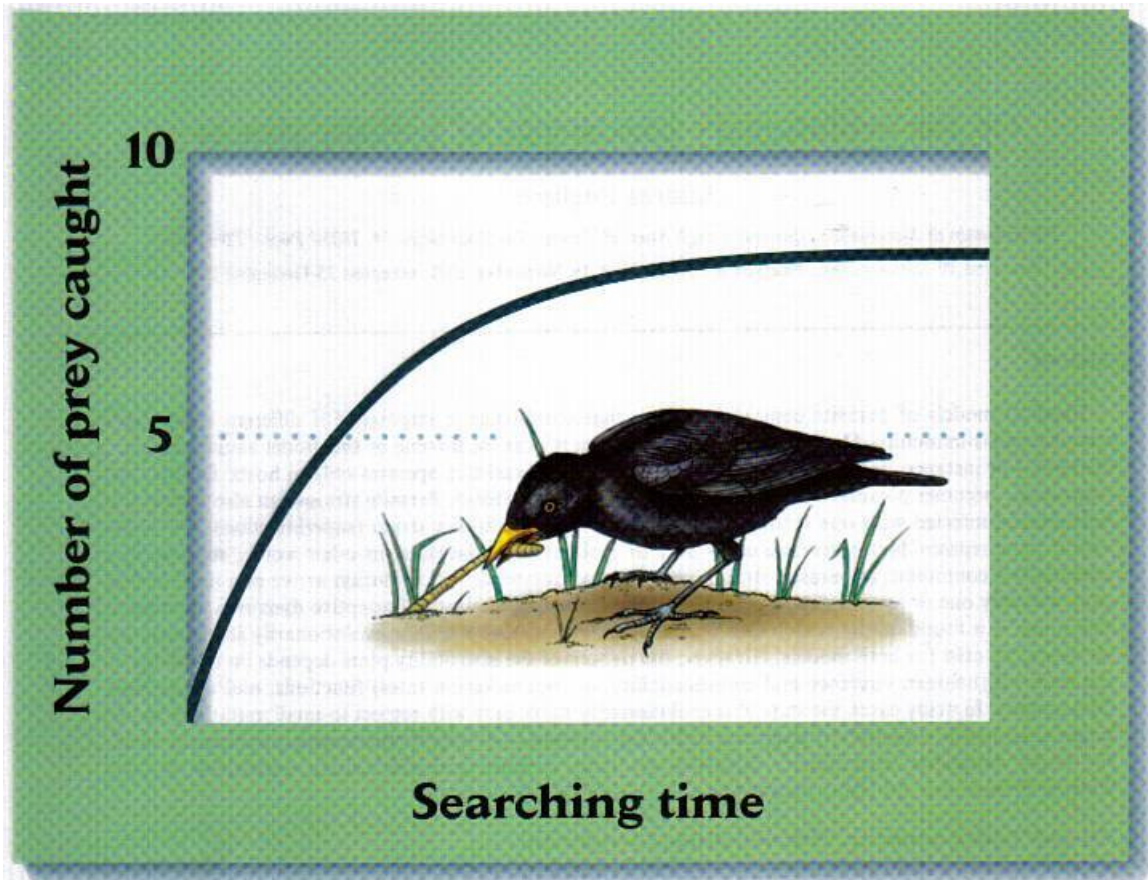


New Problem : Patch Exploitation



PATCH-RESIDENCE TIME

TRAVEL BETWEEN PATCHES

Individual Foraging: Functional Significance

Aspects of Foraging in patches (male mating behavior)

General Conceptual Significance:

“How much *time* per patch (per female)?”

“Marginal Value Theorem”

E.L. Charnov (1973)

Strategy Set (Time)

Constraints

Hypothesize Currency of Fitness

Deduce Predictions for Experimentation

Patch Exploitation with Diminishing Returns

Foraging: Food in Patches, Travel between Patches

Cycle: Travel Time (τ) + Residence Time (t)

Travel Time Fixed Constant (Constraint)

Residence Time (t) “Behavior to Optimize;”

How long should forager remain in patch?

As forager feeds in a given patch, food density declines

Prey removed by forager, or prey hide

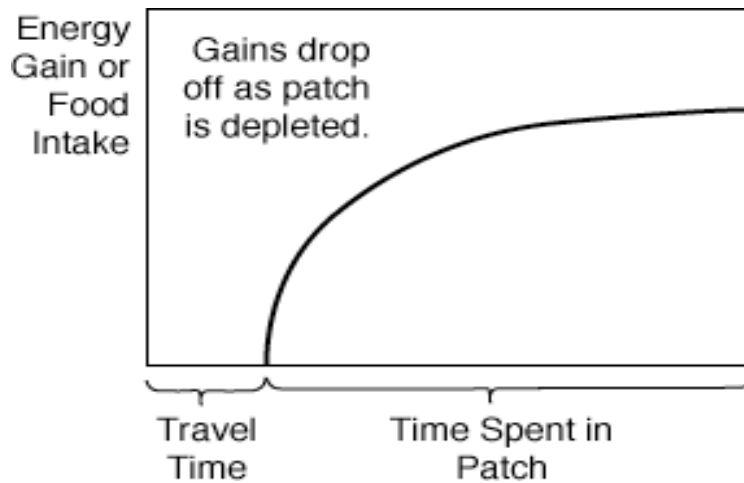
Residence time increases:

feeding rate in that patch declines

$G(t)$ Cumulative Gain Function

Total Energy Gain in Single Patch, f(residence time)

$G(t)$



Resource Depression: Gain Function Concave

Currency of Fitness:

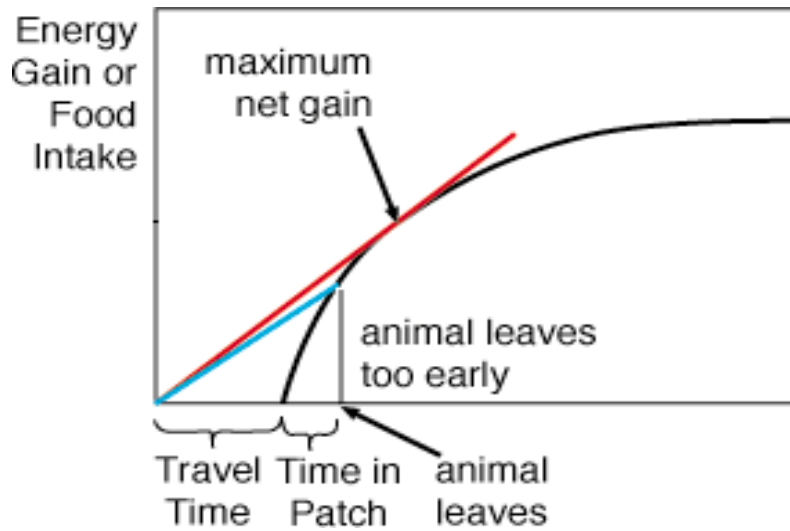
Hypothesize Action of Stabilizing Selection

Long-Term Rate of Energy Gain R

$R = \text{Energy Gain per Cycle} / \text{Cycle Length}$

$$R = G(t) / [\tau + t]$$

Solve: Draw the tangent to gain curve from τ



Optimal Residence Time Maximizes Long-term Gain Rate

Use Solution, Generate Testable Hypothesis

Increase Travel Time, Residence Should Increase

