

9.20 M.I.T. 2013

Lecture #16

Foraging

Anti-predation behavior

Scott ch 6, “Foraging behavior”

- 1) Does the level of foraging or hunting activity depend on the amount of hunger? Could it be independent of hunger? Contrast the picture painted by Scott with what we learned earlier from Konrad Lorenz, Paul Leyhausen and John Flynn.

Scott ch 6, “Foraging behavior”

1. Does the level of foraging or hunting activity depend on the amount of hunger? Could it be independent of hunger? Contrast the picture painted by Scott with what we learned earlier from Konrad Lorenz, Paul Leyhausen and John Flynn.

Scott’s textbook does not make it very clear that some innate foraging drives are separate from hunger.

Remember our discussion of the studies of cats by Konrad Lorenz and Paul Leyhausen, and also the brain stimulation studies of John Flynn.

— Text p 120: Role of social cues and of learning.

Why might an animal eat more when feeding with a group of conspecifics than it would eat if feeding alone? (Answered in the reading)

Scott ch 6, “Foraging behavior”

2. What is conditioned taste aversion (discovered in rats by John Garcia)? Is it really “a form of classical conditioning”?

(p 121-122)

Examples in class discussion

Critique of Scott’s discussion of CTA (box, p 122)

Critique of Scott's discussion of CTA (box, p 122)

(Also called the “poisoned bait effect”—discovered by John Garcia)

It's properties do not fit the descriptions of classical conditioning because:

- It is one-trial learning
- The illness (the unconditioned response) does not have to occur immediately
- The memory is unusually long-lasting. In humans it can last for many years.

- Why might Scott have written that "CTA is of course a form of classical conditioning..."?
 - Many learning theorists have tried to lump all learning into just a few categories. Many textbooks on learning are organized this way.
 - Many people, including scientists, also have believed that almost every behavior is learned (especially in America).

K. Lorenz called CTA "**an innate disposition for learning**"-- i.e., it shows strong evidence of a built-in program for a particular kind of learning. (Very adaptive)

Scott ch 6, “Foraging behavior”

3. How (and why) would you expect neophobia in feeding behavior to change with
 - (a) hunger level *decrease it*
 - (b) age? *Younger ones show more. Obvious in humans.*

See also p 123, which discusses a kind of social facilitation in capuchin monkeys faced with novel food.

- Note that the monkeys being studied saw the others eating only familiar food, and yet they still ate more novel food in the presence of the other monkeys.

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4. How can ospreys benefit from the hunting (fishing) success of neighbors although they don't share the booty?

See Scott's box, p 124-125: The osprey colony as a center of information transfer.

Other ospreys tend to fly in the direction of a bird that just returned with a fish. But this depends on the kind of fish. (Why?)

Note that this is not the case with black-headed gulls.

Black-headed gulls usually feed on more scattered prey, or at least they probably did earlier in their evolution.

Scott ch 6, “Foraging behavior”

5. Give two strong reasons why foraging in a group of herbivores may be better for an animal (like a bird) than foraging alone.

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5. Give two strong reasons why foraging in a group of herbivores may be better for an animal (like a bird) than foraging alone.
 - 1) Protection from predators:
 - Increased likelihood of detection of a predator
 - Decreased likelihood of being the one attacked
 - 2) Increased likelihood of detecting food sources
 - 3) In addition, social facilitation can result in greater food consumption (discussed by Scott).

American white pelicans foraging in groups



Courtesy of [TexasEagle](#) on Flickr. License CC BY-NC.

American white pelican group



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6. Does the same reasoning apply to carnivores in their hunting behavior? Explain.

Group hunting by carnivores:

- Increased likelihood of finding prey
- Increased likelihood of catching prey, because of advantages of cooperative hunting strategies
 - Examples:
 - Lions
 - Wolves
 - Wild dogs, African
 - Killer whales (Orcas)
 - Humpback whales: “bubble-cloud feeding” to trap herring fish

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Publications since 2000 include a number of theoretical models and simulations. Examples:

- “Raven scavaging favors group foraging by wolves” (2004)
- Computational model: group foraging (2006)
- “Effective leadership and decision making in groups on the move” (2005)

Please see:

Vucetich, John A., Rolf O. Peterson, and Thomas A. Waite. "Raven scavenging favours group foraging in wolves." *Animal behaviour* 67, no. 6 (2004): 1117-1126.

A computer simulation model,
especially relevant to Question 8 (on
the “ideal free distribution.”

Please see:

Roberts, Michael E., and Robert L. Goldstone.
"EPICURE: Spatial and knowledge limitations in
group foraging." *Adaptive Behavior* 14, no. 4 (2006):
291-313.

Please see:

Couzin, Iain D., Jens Krause, Nigel R. Franks, and Simon A. Levin. "Effective leadership and decision-making in animal groups on the move." *Nature* 433, no. 7025 (2005): 513-516.

Scott ch 6, “Foraging behavior”

7. What is meant by the term “optimal foraging”? What should a foraging animal optimize (in quantitative terms)?

Scott ch 6, “Foraging behavior”

7. What is meant by the term “optimal foraging”?
What should a foraging animal optimize (in quantitative terms)?

It means maximizing net energy intake: E/T

Thus, a foraging animal should optimize energy intake minus costs.

- *Why should a feeding animal move to another patch of food?*
- *How long should a dive last, for a diving bird or a sea mammal?*

Scott ch 6, “Foraging behavior”

7. What is meant by the term “optimal foraging”?
What should a foraging animal optimize (in quantitative terms)?

Examples, pp 129-138:

- Why do crabs choose to feed on intermediate-size mussels instead of the more meaty large ones? **p 131f**
- Why do large marine iguana feed sub-tidally, whereas small ones feed inter-tidally? **p 129-130**
- Why do foraging redshanks (birds) visit less productive patches in addition to their focus on the most productive areas for finding large worms on the ocean bottom?
 - **p 134-137** To get information about food availability and density at all nearby locations, as well as the number of others feeding at each location. See Q8.

Marine Iguana



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Marine Iguana



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Spotted Redshank



Courtesy of [Steve Garvie](#) on Flickr. License CC BY-NC-SA.

Common Redshank



Courtesy of [Tom Tarrant](#) on Flickr. License CC BY-NC.

Redshank group



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Scott ch 6, “Foraging behavior”

8. What is meant by “**the ideal free distribution**” in a description of foraging by groups of animals?

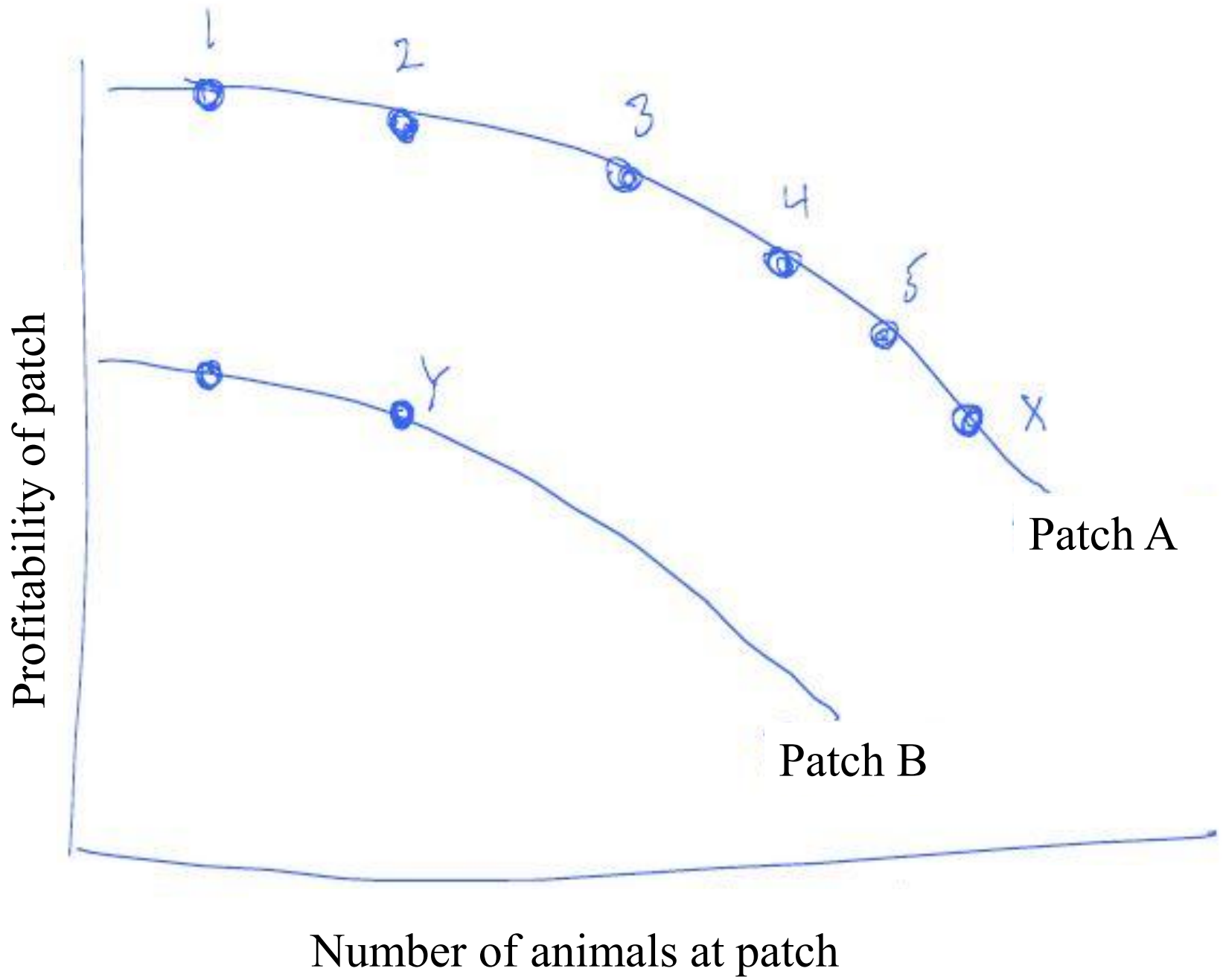
See [fig 6.9, p 139](#)

Scott ch 6, “Foraging behavior”

8. What is meant by “**the ideal free distribution**” in a description of foraging by groups of animals? See **fig 6.9**
- An animal will tend to go to a less rich food patch if joining a group of animals at a richer patch would reduce the amount of food per animal there to a point below what it can get at the less-rich patch.
 - Therefore, animals have evolved so that they will distribute themselves in an optimal way to avoid excessive competition.
 - Charnov’s “marginal value theorem” as he modified it in order to make it more realistic? p 135-136:

An animal samples all food sources in a region enough to know the average density of available food items. It changes its main foraging location when food density drops to (or below) the average density.

- An additional factor: Dominant animals may exclude subordinates. Hence, these two types will distribute themselves differently to optimize feeding success.



Scott ch 6, “Foraging behavior”

9. Conflict is frequently faced by a foraging animal. Describe an observed relationship between foraging or hunting behavior of a species and the presence of a predator of that species.

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Studies of hunting by two groups of fish:
sand gobies & black gobies (p 140-141):

- Feeding decreases if a predator is detected nearby.
- This effect is less for animals that are more hungry.
- It is also less for animals that are better camouflaged, as in the case of sand gobies.

Discussion:

Is the "Ideal Free Distribution", with prevention of group sizes that are too large for the most efficient foraging, related to population control in humans?

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Answer:

- No. The models do not attempt to extend to overall population control. That would be an extrapolation.
- About population control in animals:
 - Studies of overcrowding in rats:
 - Decreased fertility
 - Impaired immune system → more illness, more infections
 - Irritability and fighting
 - Sudden population declines
 - Such population declines have been observed in natural settings for small animals.
 - Lemmings: overcrowding → mass migrations, sometimes leading to mass drownings when they swim out to sea instead of across Fjords.

Further discussion (from question of former student):

Do animals ever murder each other as humans sometimes do? (This is a sociobiology question.)

- This rarely happens among animals. Fatal injuries sometimes occur in fights over dominance or territory, but in most cases, the vanquished animal is able to escape intact or with non-fatal injuries. Most aggressive encounters are settled before actual fighting occurs, as we have discussed.
- When asking why humans have genocidal wars, we have to look at other primates that are genetically closest to humans. Not many years ago, Jane Goodall discovered that chimpanzee groups occasionally plan and execute attacks on another group, and kill most of them, especially all the adult males.
- This finding gave startling evidence that humans may have inherited genocidal tendencies from ancestors we have in common with chimpanzees.
- However, this is very controversial.

Scott ch 7, “Avoiding predation”

1. Distinguish between **primary and secondary defense strategies** of prey animals. Give an example of each.

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1. Distinguish between primary and secondary defense strategies of prey animals. Give an example of each.

Primary: Decreasing the probability of being attacked.

Camouflage; hiding strategies

Timing of foraging activities

Group foraging

Warning calls from conspecific or from another species

Secondary: Decreasing the likelihood of success of an attack that has occurred.

Flight; speed; dodging movements

High endurance

Playing dead

(See the video, “Great Escapes”)

First we discuss primary defense strategies

Scott ch 7, “Avoiding predation”

2. What is “counter shading” and why would cephalopods need a counter-shading reflex? Describe this behavior.

p 145-146

Countershading and camouflage

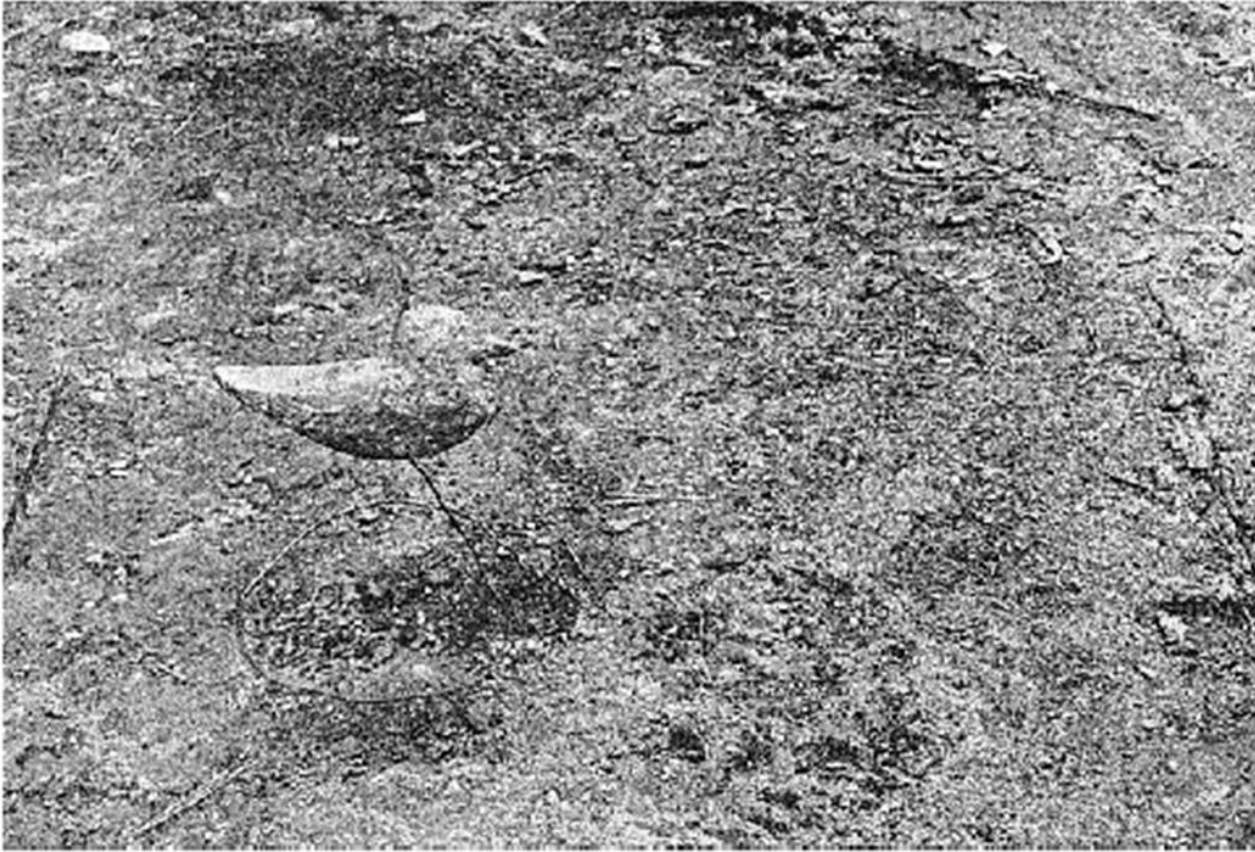


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Photo by Abbott Handerson Thayer, who wrote about protective coloration in *Nature* (1892). There are two bird models in the photo. One has countershading, the other is camouflaged.

How is a bird normally shaded? A fish?

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Scott ch 7, “Avoiding predation”

3. Many predators develop search images by perceptual learning.

- **Octopus and squid species can counter this ability. What do they do?**
- How is this related to mimicry as an evolutionary strategy?
- Give an example of Batesian or Mullerian mimicry.

p 147, 150-151

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9.20 Animal Behavior
Fall 2013

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