

Week 11 – Predator/Prey Signaling and Food Signaling

I. The phenomena

- A. Signals that Prey make in the presence of predators
 - i. To whom is the signal directed?
 - a) More formally: who's behavior varies with respect to the signal
 - ii. Why is the signal believed and sent?
- B. Signals that individuals make in the presence of food
 - i. Why are these made at all?
 - ii. And, if there is a reason to make them, why are they always honest?

II. Alarm calls – Two stories

- A. Aimed at other potential prey
 - i. I want to warn kin
 - ii. I want to sacrifice others instead of me
 - iii. I want to reduce the chance of a successful attack so the predator won't return
- B. Aimed at predators
 - i. I want to invite pursuit when the predator is not ready
 - ii. Deter pursuit
 - iii. Signal condition
 - iv. Confuse

III. Aimed at other prey

- A. The most obvious case of this is warning calls directed at kin
 - i. Common interest is generated by relatedness
 - ii. This makes me want others to know that a predator is present – even if it costs me something in individual fitness to do so
 - iii. But what about when a predator isn't present?
 - a) Great tits and other tropical birds use them to:
 - Disrupt extra-pair copulation
 - Secure resources
 - b) Why is signaling stable:
 - S&N say this is like mimicry, there is an appropriate ratio where it doesn't matter
 - One possibility is that the circumstance doesn't arise often enough, but this would require some argument
 - The benefit is relatively small
 - Another option is individual skepticism: if I get ignored when I lie, then I loose in situations where I want you to hide (because we're related). As a result, the repeated game effects maintain honesty
 - Punishment might work this way too
- B. Common interest may come about in other cases as well
 - i. None of us want the predator to come back, so perhaps we want to warn others so the predator fails and doesn't come back and get another
 - ii. Perhaps the confusion generated by everyone fleeing is sufficient to prevent attack altogether – Belding's ground squirrels.
- C. Food calls have similar problems. It's clear why I ought to respond, but less so why I ought

to call

- i. Kin selection
- ii. Safety from predation
- iii. Sexual selection (here honesty is a problem)
- iv. Prevents usurpation
 - a) If I share with n other individuals and we split equally, this might protect me against a single other individual displacing me

IV. Aimed at predators

A. Some problems:

- i. Freerider
- ii. Signal is inefficient
 - a) Too loud: babblers
 - b) Not of the right type: stotting
 - c) Constant: apostematic signals
- iii. Babbler behavior after the call is sent

B. Zahavi suggests this should be thought of as a signal to predators

- i. Partial overlapping interest.
 - a) If I see you, neither of us want a fight
 - b) If I'm really fast, neither of us want a fight
 - c) If I'm deadly, neither of us want a fight
- ii. Partial divergent interest.
 - a) If I don't see you, you want to chase me
 - b) If I'm slow, you want to chase me
 - c) If I'm tasty, you want to chase me

C. Here cost is relevant, but what is it?

- i. Increased predation risk.
 - a) Really, isn't the point that I'm decreasing it in equilibrium?
 - b) B&L suggest an outside predator
 - c) Zahavi says lying increases predation risk by the actual predator, but the mechanism is unexplained
- ii. Cannot be faked
 - a) some are tied directly to the predator: mobbing or calling out when it moves
 - b) stotting is like this

D. B&L's problem:

- i. If the cost of signaling is so high as to be equivalent with the cost of the chase, I don't want to signal anymore

V. B&L's model – The watchful babbler

- A. Two player model: signal from prey to predator
- B. Nature chooses whether a predator is present and then chooses an x (perceived risk of predation, say)
- C. Prey chooses to signal or not (signal has a cost)
- D. If the predator is present, he observes the signal and chooses to pursue or not
- E. If he pursues, he has probability t of catching the prey
 - i. t and x are drawn from a distribution F when predator is present

- ii. x is drawn from a distribution G when not
- F. When are there stable signaling system equilibria?
 - i. It must be the case that when high x is observed they are less likely to be caught than not (t & x must be negatively correlated in F)
 - a) Suppose x and t were positively correlated.
 - b) Signaling high x would be also be saying "I can easily be caught come get me"
 - c) Signaling low x would incur a cost when predators were not present, and thus have no gain
 - ii. x must also be correlated with predator presence
 - a) Otherwise I would signal often without predators incurring a cost for no gain
 - iii. Then there will be an \hat{x} where prey signals if $x > \hat{x}$ and not otherwise
- G. Features of this equilibria that have testable consequences:
 - i. If I'm aware of your presence I have a better chance of escaping (t & x are negatively correlated)
 - ii. Prey should signal more when predators are common than not (*certus paribus*)
 - iii. Increased pursuit costs will result in lower signal costs and vice versa
 - iv. When the predator is far away and not threatening (low t , high x), the prey should just sneak off rather than incurring the cost
 - a) This will help to differentiate kin selection explanations from handicap explanations because the opposite prediction occurs there