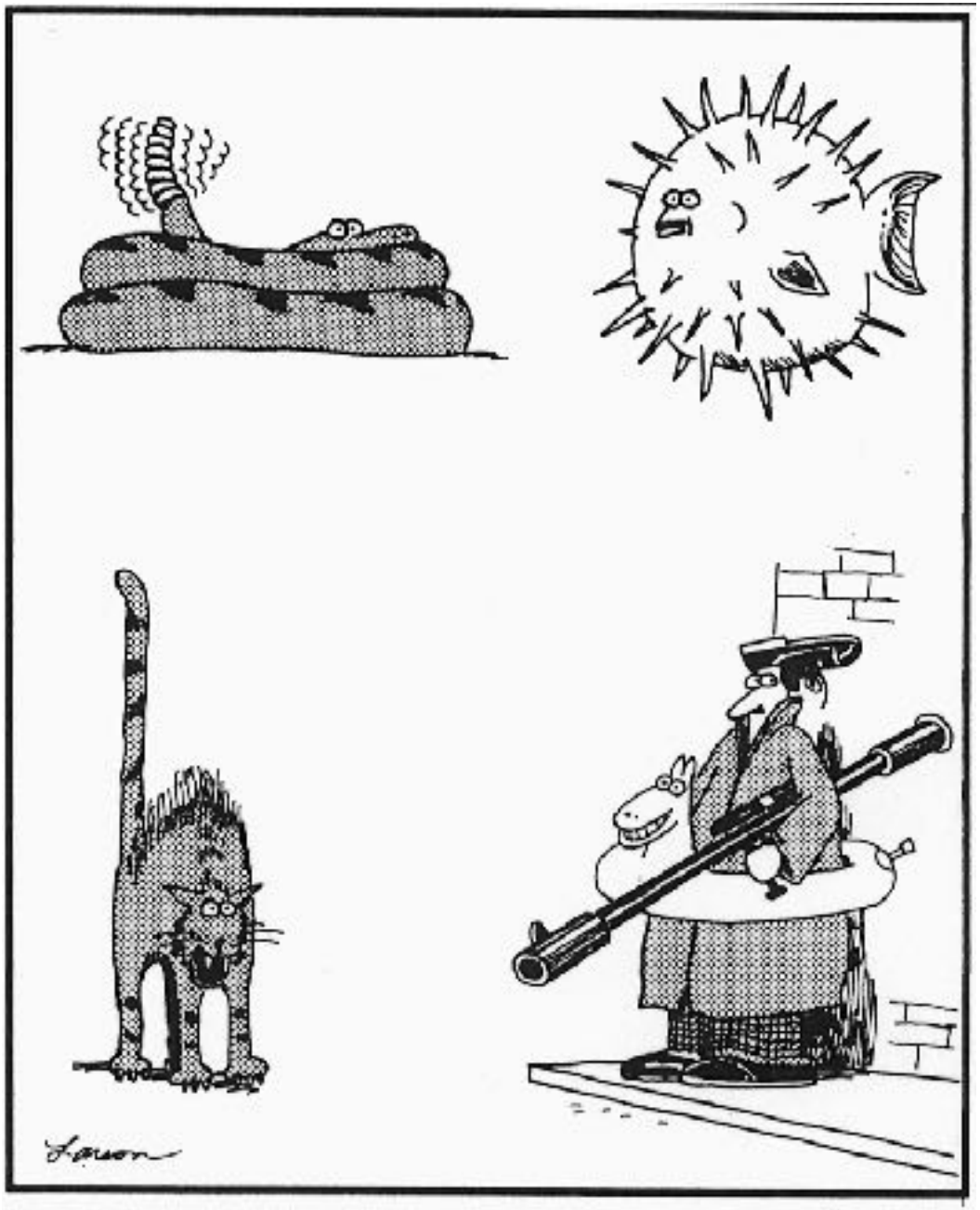
Antipredator behavior



How nature says, "Do not touch."

Prey adaptations to escape predators

To avoid detection or capture

1. Hide/Flee
2. Crypsis
3. Mimicry
4. Aposematism
5. Unprofitability advertisement
6. Social strategies

After detection or capture

1. Physical defenses
2. Chemical defenses
3. Deception
4. Alarm calls

Prey adaptations to escape predators

- To avoid detection or capture….
  (1) Hide or Run Away!
    - Be very fast, and flee
    - Stay near shelters

Prey adaptations to escape predators

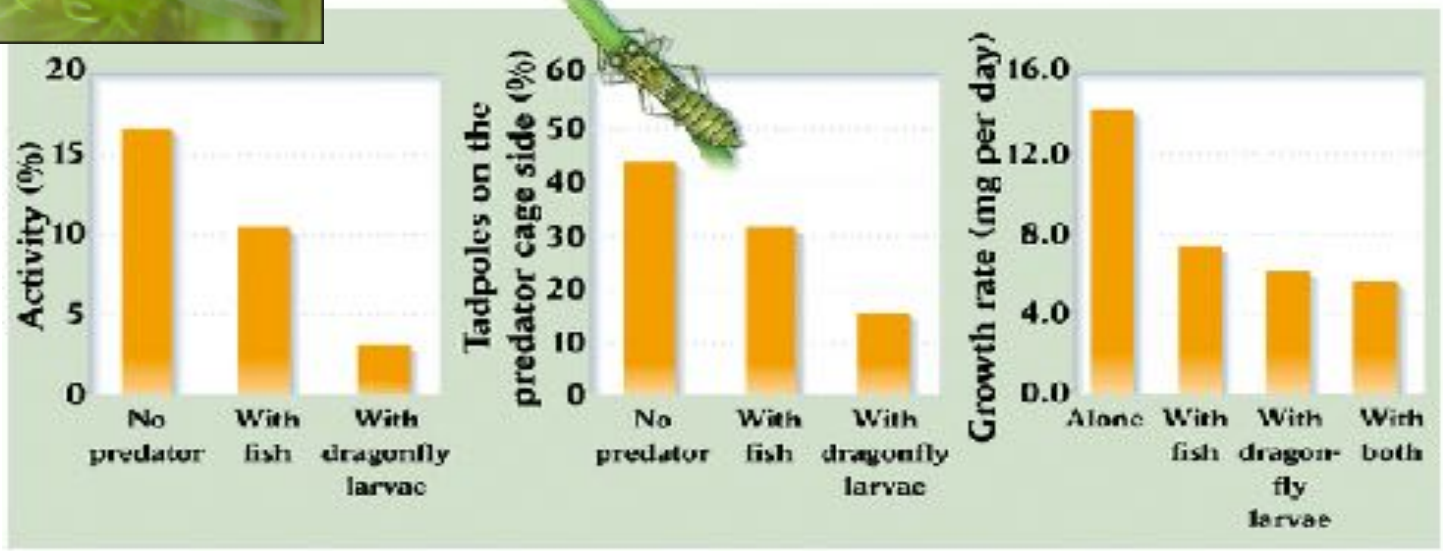
- To avoid detection or capture….

  (1) Hide or **Run Away**!

http://www.youtube.com/watch?v=XcxKIJTb3Hg

Running away

- Hiding/Running away can be costly
  - Tadpoles that spend less time foraging have reduced growth

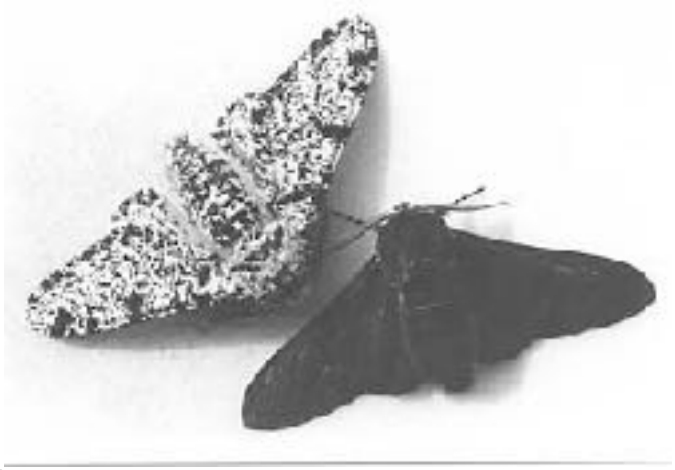


Prey adaptations to escape predators

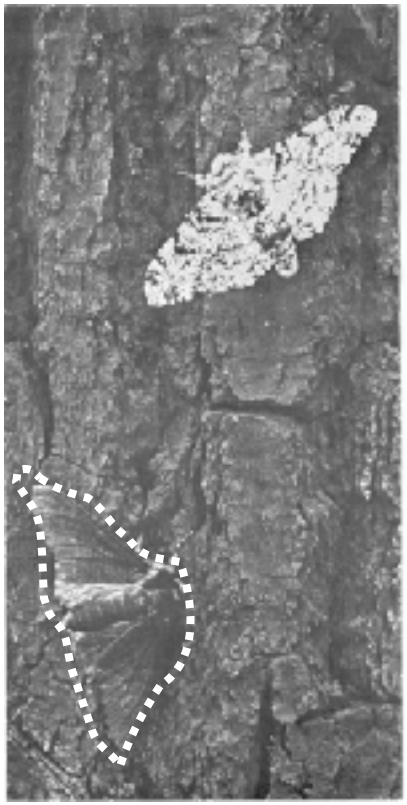
- To avoid detection or capture….
  (2) Crypsis
  - Resemblance of a palatable organism to its environment
  - Behavior often corresponds with appearance
    – ex leaf mimic swaying in wind

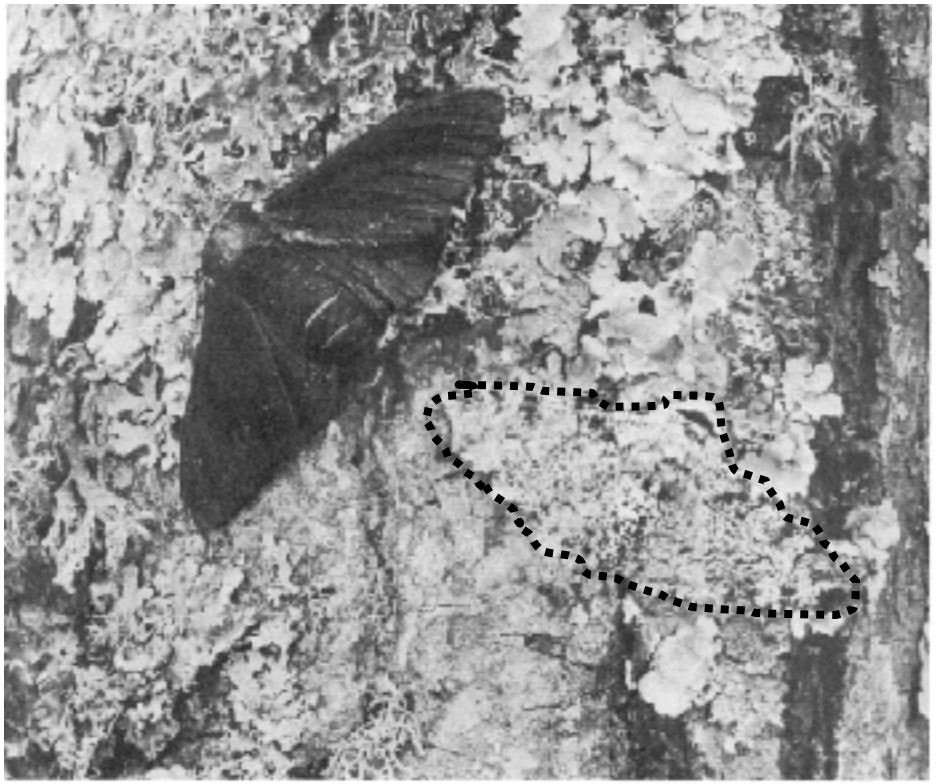
Prey adaptations to escape predators

Crypsis



- Peppered moth
  - Pre-industrial = white lichen on trees
  - Post-industrial = lichen dies, black bark
  - Clean air restored = white lichen returns





Crypsis

- Evidence that crypsis works
  - Captive blue jays don't detect moth if it is oriented head-up (but could detect it if moth's head pointed in other orientation)

Crypsis

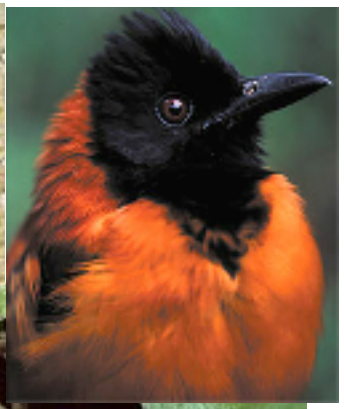
- Crypis gives rise to color polymorphisms
  - Polymorphisms are common in cryptic species
  - Selective response to predators forming ‘search images’
    - In slide projector experiment, Jays get better at seeing moth if they see the same morph over and over again

Prey adaptations to escape predators

- To avoid detection or capture….
  (3) Aposematism
  - Highly obvious visual, acoustical or chemical "appearance" of an unpalatable organism








Prey adaptations to escape predators

- To avoid detection or capture….
  (3) Aposematism
  - Highly obvious visual, acoustical or chemical "appearance" of an unpalatable organism

Aposematism

- How would aposematism evolve in the first place?
  - No RS benefit if animal is killed, even if results in predator becoming sick, so what are the benefits to being conspicuous?

Aposematism

- How would aposematism evolve in the first place?
  - No RS benefit if animal is killed, even if results in predator becoming sick, so what are the benefits to being conspicuous?
    - » Kin selection: kin may benefit from educated predators
    - » May cause immediate response and so allow prey to escape (i.e., non-deadly attacks)



Prey adaptations to escape predators

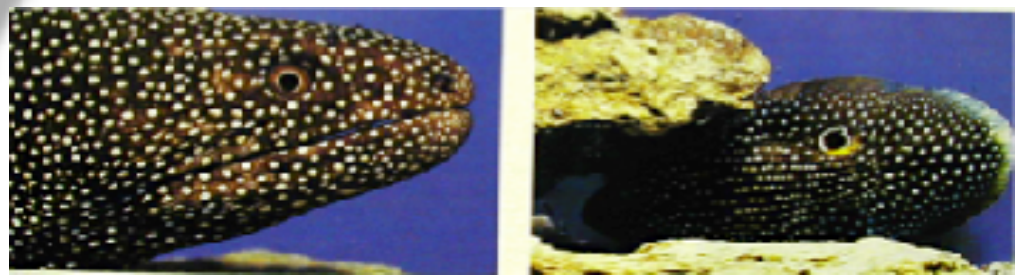
- To avoid detection or capture….

  (4) Mimicry

  - Presence of similar patterns or appearances in individuals of two or more species

Mimicry

- Types of mimicry: Batesian, Müllerian, and Aggressive
  - **Batesian:** resemblance of palatable organism (mimic) to an unpalatable/ dangerous one (model)
    - » Ex. Milk Snake and Coral Snake
    - » Ex. Viceroy and Monarch
    - » Necessary: # mimics << # models



Prey adaptations to escape predators

- Types of mimicry: Batesian, Müllerian, and Aggressive
  - **Batesian:** resemblance of palatable organism (mimic) to an unpalatable/dangerous one (model)
    - » Ex. Tephritid fly (t-fly) and jumping spider

Is the spider fooled?

- Test: Remove t-fly's striped wings, then replace with clear wings (from house fly) or with original wings
- Results:
  - -T-fly with clear wings were eaten
  - -T-fly with normal wings repelled spiders
  - -And: House fly given t-fly wings still eaten

Mimicry

- Types of mimicry: Batesian, Müllerian, and Aggressive

  Müllerian: resemblance of two or more unpalatable organisms to each other (is beneficial to 'tap-into' previously evolved/learned avoidance behavior of predators)

Mimicry

- Types of mimicry: Batesian, Müllerian, and Aggressive

  Müllerian: resemblance of two or more <u>unpalatable</u> organisms to each other (is beneficial to 'tap-into' previously evolved/learned avoidance behavior of predators)

Unlike Batesian, mimics do not need to be less common than models

Mimicry

- Types of mimicry: Batesian, Müllerian, and Aggressive

  Aggressive: resemblance of a predator to its prey/ mate/habitat/etc.

  - » Ex. Photinus vs Photuris fireflies
  - » Ex. spider mimic attractive part of flower to pollinators

*note: this form of mimicry does not help avoid predation

Prey adaptations to escape predators

- To avoid detection or capture….
  (5) Unprofitability advertisement (“Catch me if you can”)
  - Prey communicates that it cannot be easily captured (pursuit-deterrent signals)
    - Prey benefit = does not have to outrun predator
    - Predator benefit = saves time and energy
  - Ex. gazelles
    - When predator is detected, gazelles start to run
    - Often slow down so they can ‘stot’ (stiff-legged jump)

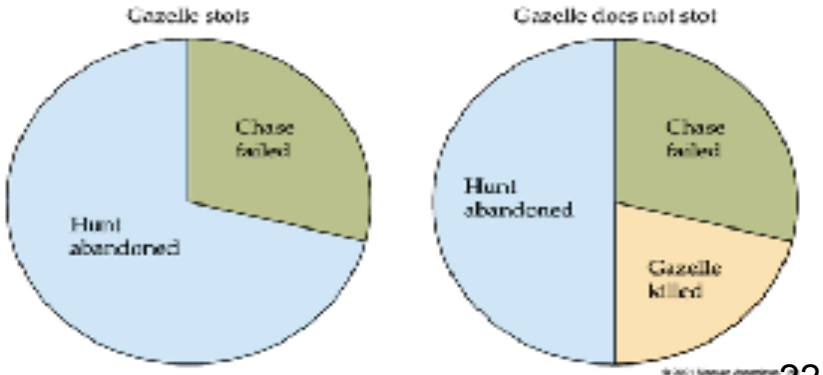
Prey adaptations to escape predators

- To avoid detection or capture….

  (5) Unprofitability advertisement ("Catch me if you can", or "I see you")

  - Prey communicates that it cannot be easily captured (pursuit-deterrent signals)
    - Prey benefit = does not have to outrun predator
    - Predator benefit = saves time and energy
  - Ex. gazelles
    - When predator is detected, gazelles start to run

Wild dogs more likely to abandon pursuit after stot



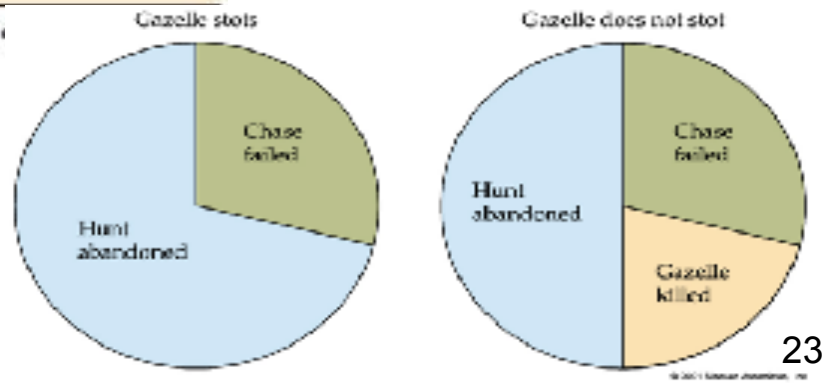
Unprofitability advertisement

- Alternative Hypotheses:
  - Alarm signal hypothesis = alert conspecifics of predator
  - Social cohesion hypothesis = coordinate group fleeing
  - Confusion effect hypothesis = distract predators

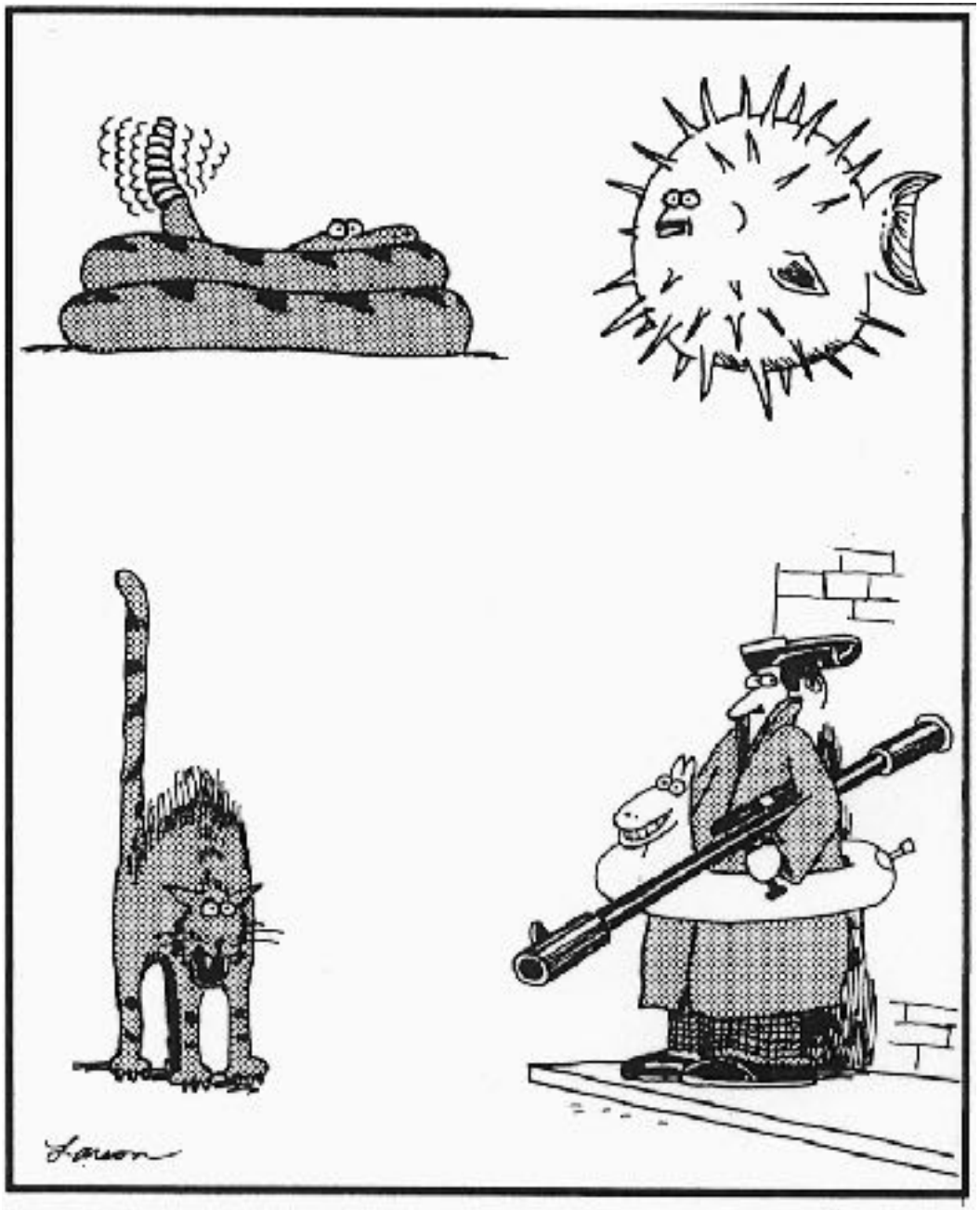
TABLE 2 Predictions derived from four alternative hypotheses on the adaptive value of stotting by Thomson's gazelle

	Alternative hypotheses			
Prediction	Alarm signal	Social cohesion	Confusion effect	Signal of unprofitability
Solitary gazelle stots	No	Yes	No	Yes
Grouped gazelles stot	Yes	No	Yes	
Stotters show rump to predator	No	No	Yes	Yes
Stotters show rump to gazelles	Yes	Yes	No	No

Wild dogs more likely to abandon pursuit after stot



Antipredator behavior



How nature says, "Do not touch."

At sunrise, a honey bee forager returns from a flower patch and performs a waggle dance with runs that occur at an angle of 30 degrees to the right (clockwise) of vertical. At sunset, the foragers are still dancing for the same food source. How are their dances oriented? Remember that the sun rises east of the hive and sets west of it.

A. Waggle runs occur at an angle of 30 degrees to the right of vertical

B. Since this food source was discovered previously, foragers perform round dances to indicate its location

C. Waggle runs occur at an angle of 150 degrees to the left of vertical

D. Waggle runs occur at an angle of 30 degrees to the left of vertical

E. Waggle runs occur at an angle of 150 degrees to the right of vertical

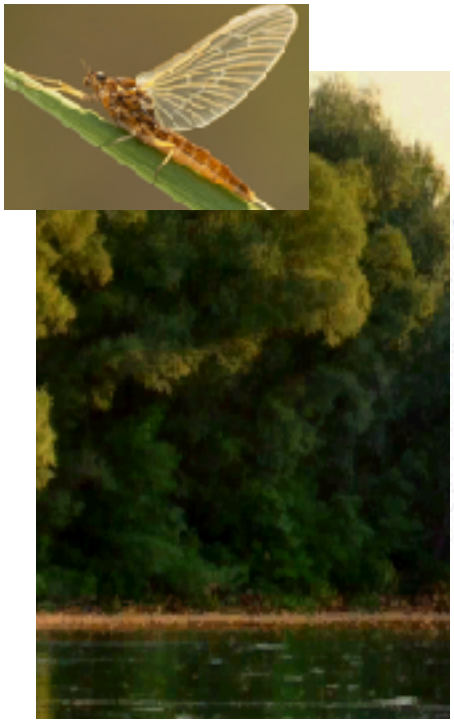
Prey adaptations to escape predators

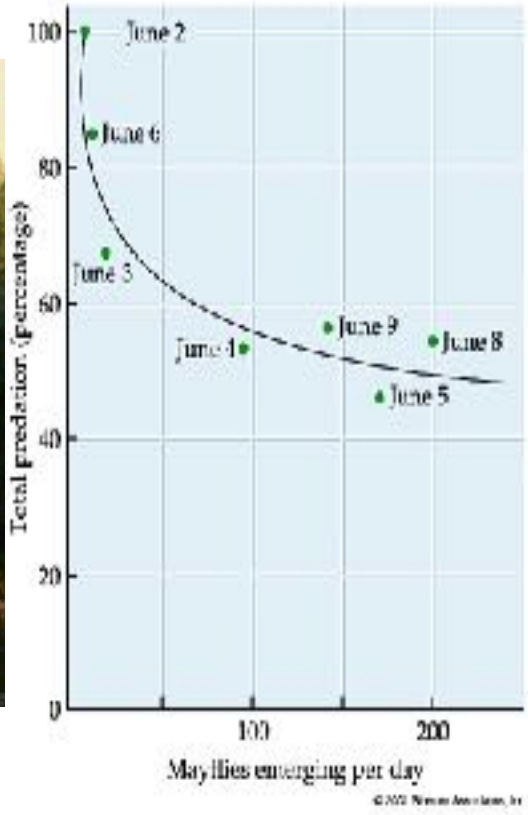
- To avoid detection or capture….
  - (6) Social Strategies
    - (a) Dilution effect = safety in numbers
      - – Chances of individual being selected is negatively related to group size
        - » Example: sea turtle emergence

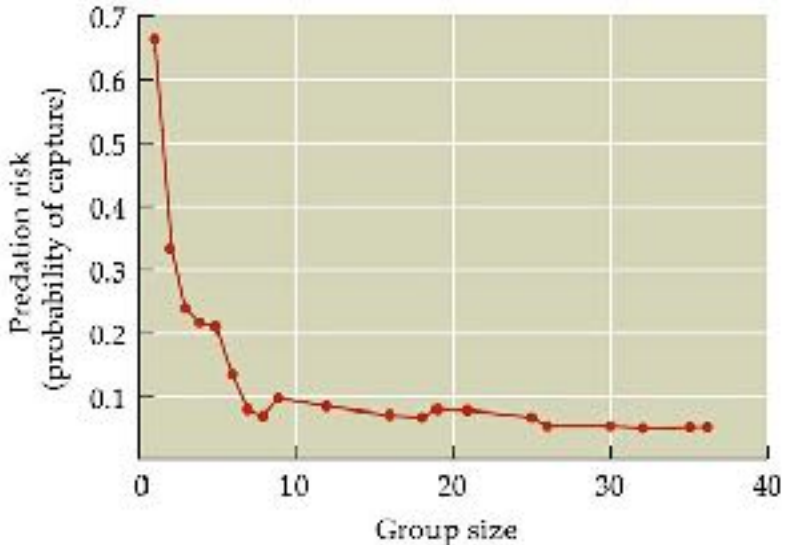
Assumes equal probability of capture for group members

Dilution

- Predators can't "keep up"
  - Synchronous hatching
  - Group foraging



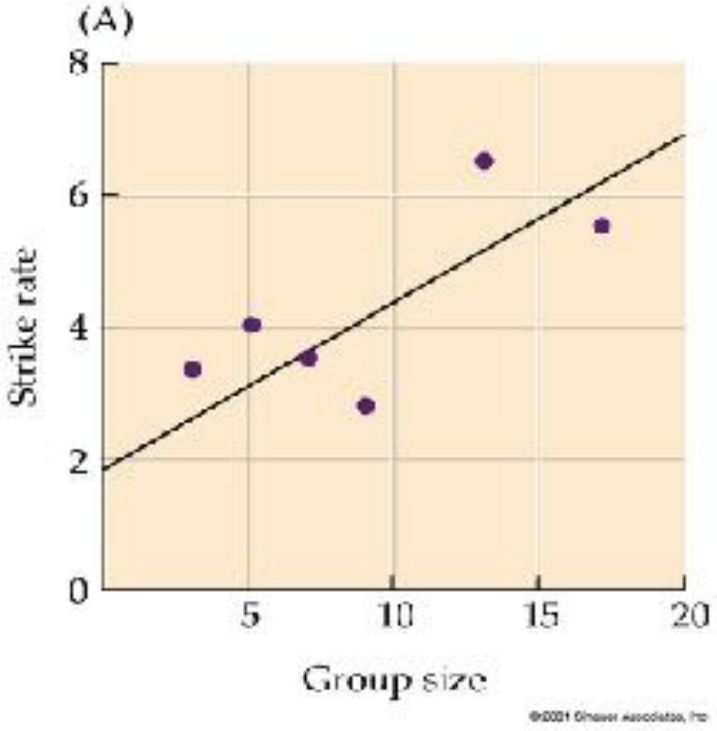


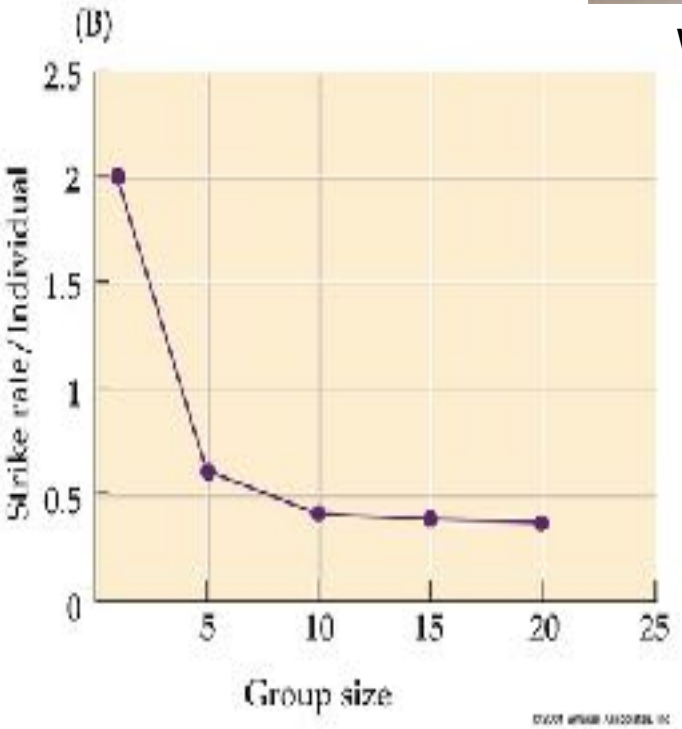


Dilution

- Individuals benefit despite greater visibility of groups

whirligig beetle





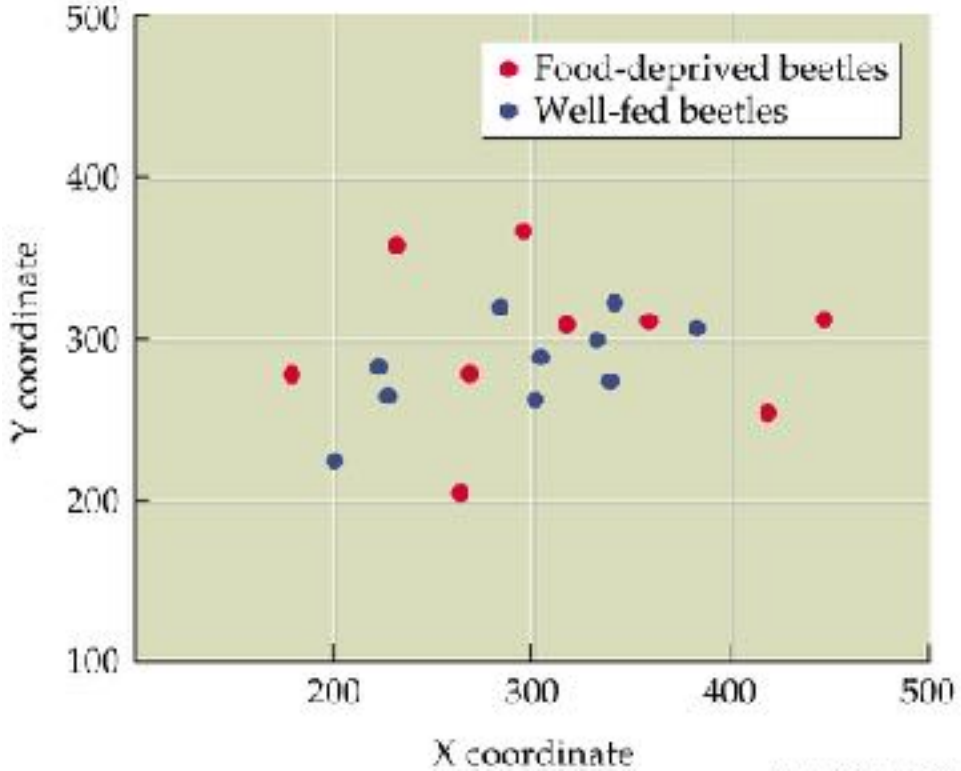
Prey adaptations to escape predators

- To avoid detection or capture….
  - (6) Social Strategies
    - (b) The selfish herd
      - – Find safe location so that predators will take the individual NEXT to you

Assumes **un**equal probability of capture for group members

Selfish herd

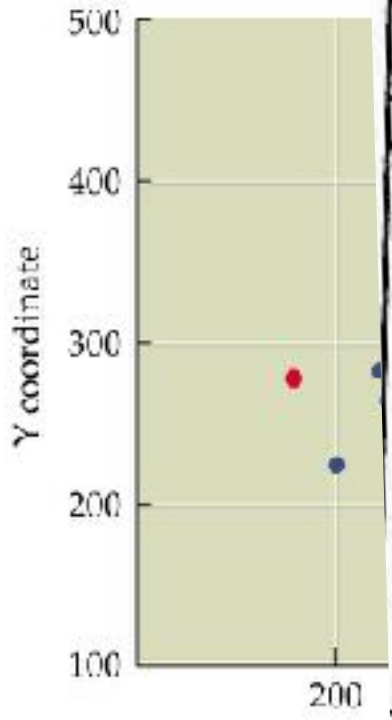
- To avoid detection or capture….
  - (6) Social Strategies
    - (b) The selfish herd
      - – Find safe location so that predators will take the individual NEXT to you
        - Lower condition individuals forced to perimeter of group

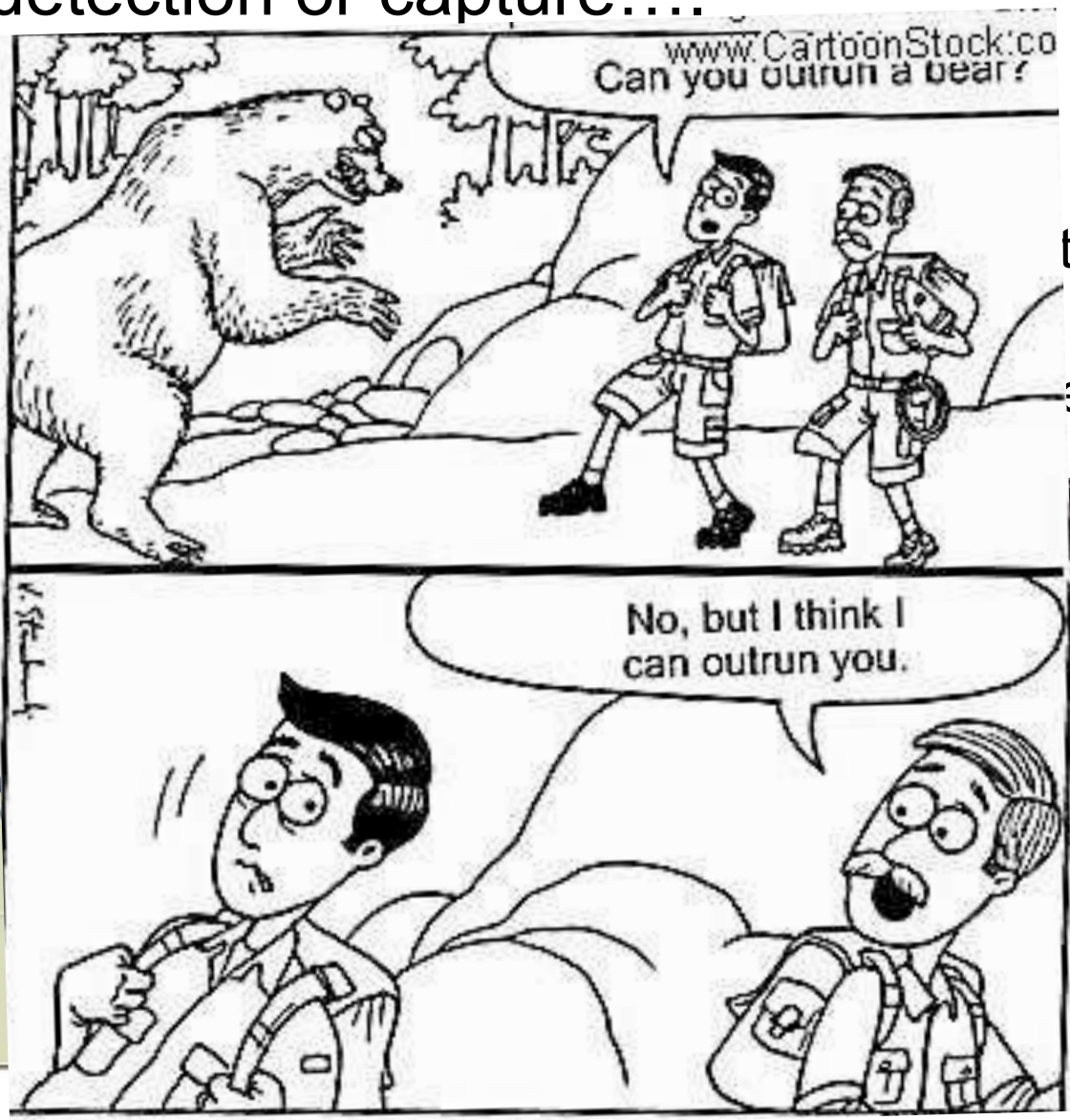


whirligig beetles

Selfish herd

- To avoid detection or capture….
  - (6) Social
    - (b) Th
      - – F … the in …
      - • L… …er of group

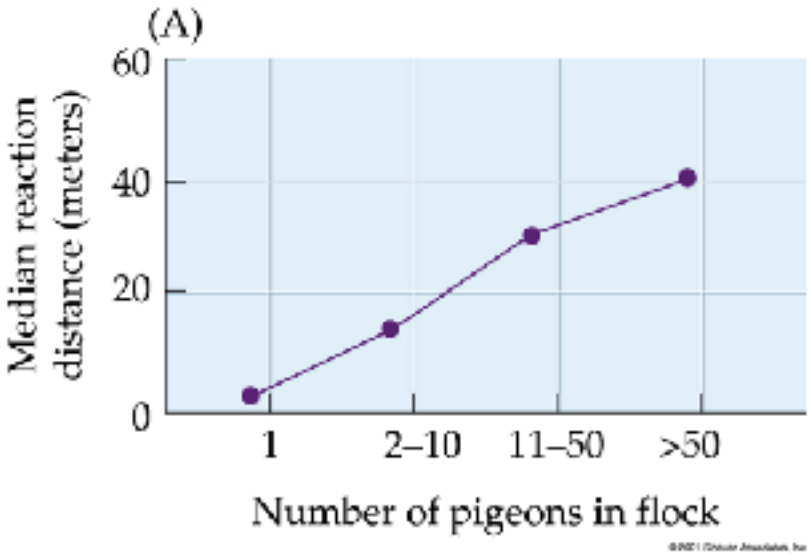


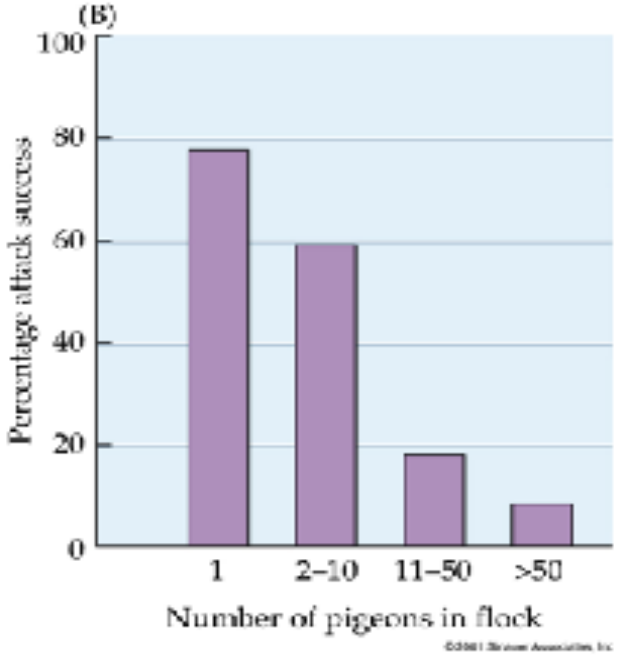


…eetles

Prey adaptations to escape predators

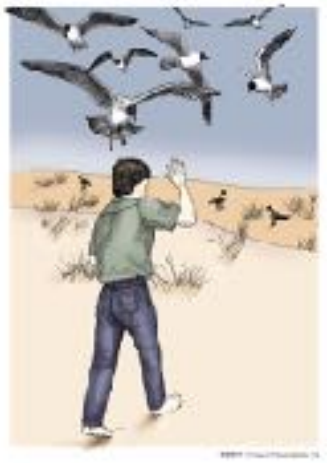
- To avoid detection or capture….
  - (6) Social Strategies
    - (c) The vigilance (many-eyes) effect
      - – More animals lead to increased detection of predators
        - » Example: goshawks and pigeons





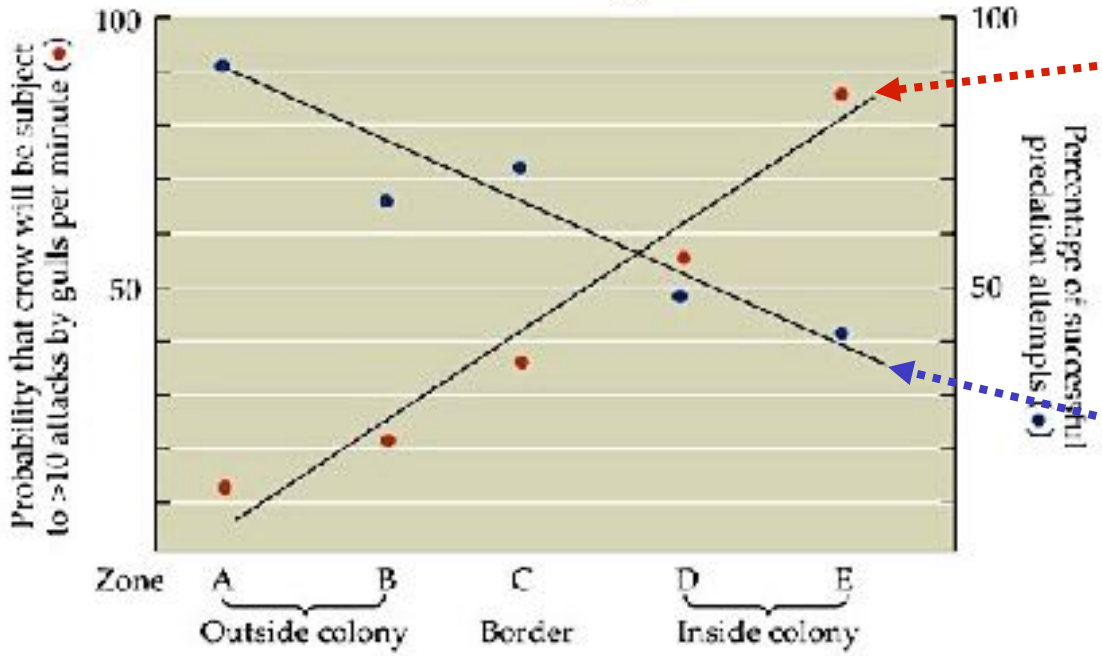
Prey adaptations to escape predators

- To avoid detection or capture….
  - (6) Social Strategies
    - (d) Group defense
      - – “mobbing”, often seen in ground-nesting birds (e.g., gulls)



Mobbing

- Is mobbing adaptive?
  - Experimental method
    - Hypothesis: mobbing reduces egg predation
    - Prediction: ↑ intensity mobbing close to eggs; ↓ eggs lost
    - Test: Chicken eggs placed inside/outside black-headed gull colony



More mobbing by gulls inside colony

Fewer successful attacks by crows inside colony

Prey adaptations to escape predators

- To avoid detection or capture….
  - (6) Social Strategies
    - (e) The confusion effect
      - – Can be difficult to select one prey item from a large group

starlings: 3:20-4:10

http://www.youtube.com/watch?v=XH-groCeKbE

Confusion

Prey adaptations to escape predators

To avoid detection or capture

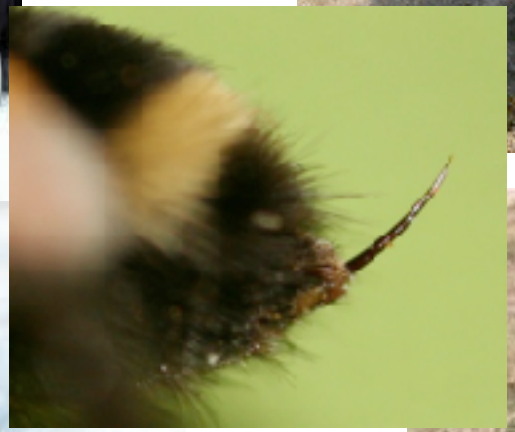
1. Hide/Flee
2. Crypsis
3. Mimicry
4. Aposematism
5. Unprofitability advertisement
6. Social strategies

After detection or capture

1. Physical defenses
2. Chemical defenses
3. Deception
4. Alarm calls

Prey adaptations to escape predators

- *After* detection or capture….
  (1) Physical defenses



Prey adaptations to escape predators

- *After* detection or capture….

  (2) Chemical defenses

http://www.youtube.com/watch?v=nFUIEuNeWw4

Sprays a hot, noxious liquid at 100°C with pinpoint accuracy!

Prey adaptations to escape predators

Bombardier beetles at home

Prey adaptations to escape predators

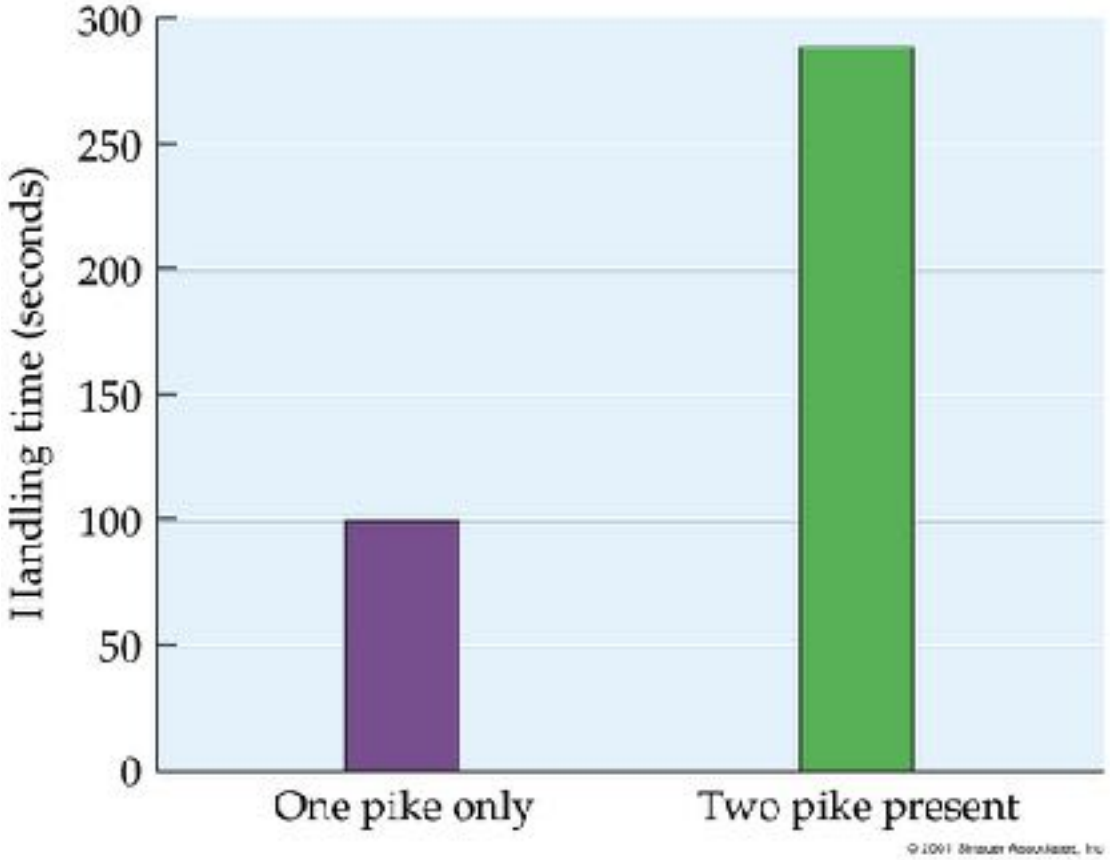
- *After* detection or capture….

  (3) Deceive, startle, confuse

  - Flash something to scare predator: eyepots
  - Autotomize to confuse predator
  - Give distress call (death scream) to bring in more predators

Death scream

- Use the predator's aggression against them
  - Fathead minnows use signal that attracts more pike



Prey adaptations to escape predators

- *After* detection….
  (4) Alarm Calls
    - Belding's ground squirrels
    - Vervet monkeys