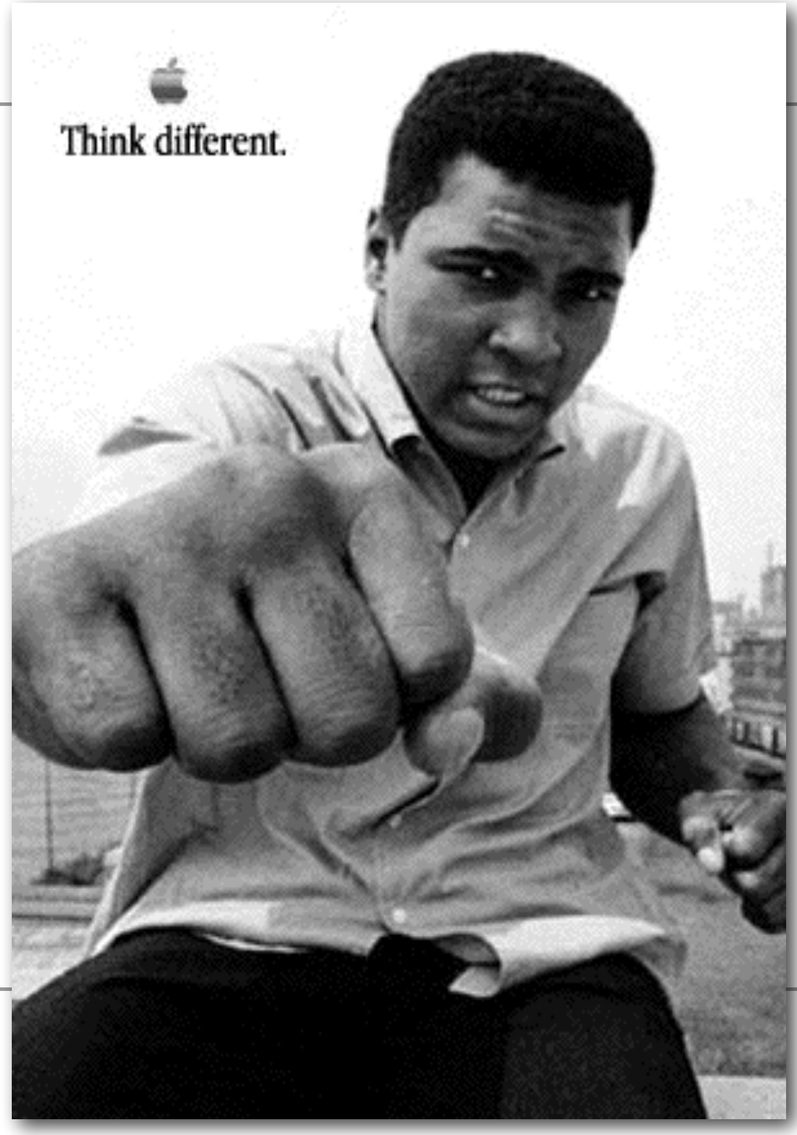
LB144-Lecture#1



1. **Pick up** Name Folder

- Pick up name folder and set it up at seat.

2. **Sit** with your group.

- laptops on outer perimeter (avoid distracting)

3. **Clicker** Attendance

- Launch your Top Hat, and get ready to click.

4. Fill out Index Card

- Front: NAME (pronounce, pronouns)
- Back: CAREER & want to learn?

LB144

YOU ARE HERE

Lecture course (3 cr.)

Wednesdays 10:20-11:40am Research Discussion (E-26A room, *in-person* lecture on the reading)

Wednesday-Monday Research Discussion (TopHat.com *online* lecture on the reading)

Lab course (1 cr.)

Mondays 10:20-11:40am "Lab Meeting" (E-26A room, *in-person* help your research project)

Wednesdays 12:30-3:30pm or 4-7pm "Lab & Field Experiments" (C-4 lab room, *in-person*)

Test your knowledge

- These pop quiz questions are designed to reward students who participated, e.g. prepared well for class

Hello

(IAmA, this is, these are, what to learn?)

Communication is important to your everyday life, allowing you to gather and distribute information. If you have used handwritten notes, email or a cell phone to exchange information with only certain people, you have probably experienced the potentially drastic consequences of a private exchange being intercepted by someone else. Imagine how much more difficult and dangerous life would be if the only way you had to communicate was to broadcast information on the Internet in hopes that the intended recipient got the message. That is what life is like for many species.

A milli staghorn coral (*Acropora millepora*) colony on the Great Barrier Reef. Attribution: Adona9 at the English language Wikipedia. This file is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license.

In Chapter 17, you explored several examples of information exchange between individual animals, plants, and bacteria. What happens when these communications are intercepted? Ecological systems are environments in which organisms live and interact with each other and with the nonliving components and they are teeming with information. Interactions between species, communications between individuals, and substances in the environment all contribute to the information in the system. In this chapter, you will explore how plants and animals exploit the information that they gather from their environment and prevent being exploited themselves. You will also see how sensitive an ecological system can be to the presence or absence of a single species and learn how to measure the effects of extinction or the introduction of species.

Wednesday: **Lecture1 - The LIVE in-person lecture**

Budgeting homework time (50 min): Ch. 18, section 18.1 (the first half on **crickets**) is approximately 1775 words in length. At what's considered slow reading speed, 200 words per minute, reading the first half of section 18.1 should take 9 minutes. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, if you focus (avoid distraction) it should take you approx. 50 minutes.

1. _____ For the first lecture, read the 1-page **Foreword** at the beginning of the textbook written by the very famous Dr. Bruce Alberts, review the Student Resources in **Chapter 0**, and then begin reading **Chapter 18: Information in the Environment** of our book, Integrating Concepts in Biology (ICB). Read the single Introduction page. You do not need to take notes on any of these pages.

2. _____ Then slowly read the section we will discuss most during lecture, section 18.1 "Have organisms evolved to exploit communication between individuals of other species?" As you read section 18.1 (the part on crickets, not frogs) on your computer be sure to **take handwritten notes on paper in your lecture notebook**. Handwritten notes lead to much greater learning[2].

3. _____ **Try to answer at least one Integrating Question (IQ) in each set**. As you read the ICB textbook always attempt to answer at least one of the yellow **Integrating Questions** each time you get to a set of them. It will help you test yourself to determine if you got the meaning, or not, while reading the last few paragraphs. Just like taking handwritten notes, this too will greatly increase your learning. If you desire a high grade in the course, try to answer more IQs.
   NOTE: Assume you will be asked a question in lecture which is directly from one of the IQs.

4. _____ **Trifecta**: **Prepare to explain (aloud) Figures 18.2, 18.3, 18.4 and Table 18.1 in class**. As you read a section from the ICB textbook always attempt to pause and study **each figure/drawing/table** that is discussed. Some of them are just pictures or drawings and may not require lots of thinking, but others are graphs or tables that contain actual data from research experiments. Spend more time looking at these. In class, during lecture, students will be randomly

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5. _____ **Advanced TIP reported from prior student**: "The way the textbook explained this figure did not make sense to me, so I scrolled down to the bottom of the page and clicked on link to the original paper and read about the same figure in that. The way the paper explained it made so much more sense and cleared up what I was confused about. Tell other students about this!"

Lecture #1

(male frogs in strangers movie co-op other's call)

Learning goals Information transfer, some intercept info

L.O.s
- Identify commonalities in communication
- Evaluate how info is used to exploit others
- Provide examples of adaptations to info passed

Communication signals are sent at some risk. Try to find a mate may become lunch. For example male fireflies double blink could attract mate or predators.

Vocab= resource = meal, natural enemy = predator/parasite host = victim

Cricket Songs are exploited

Male insects often vocalize (call) to attract mate. Mole crickets are nocturnal (+ stay underground mostly. Fly during mating season. Males + Females just Males call.

(Raj) Ulagaraj + (Tom) Walker Study #1 1973 Figure 18.2

Univ. Florida Dept. Entomology SCIENCE journal

Purpose: Test if calls are ~~specifics~~ species specific?

Methods: Animals tested - Southern + Tawney Mole Crickets
Recorded vocalizations + broadcast via speakers
Playback
Used three funnels, two with speakers, all with collecting jars
one speaker broadcast Southern call other Tawney call.
Adults captured -> back to lab, ID'ed, sex determined. (Controls)

Findings: Calls were predominately species specific

Figure 18.3

I.Qs – read + consider answer

Q: Ever try to find a cricket in your apartment at night?

Cricket calls are exploited

- Parasitic insects use crickets + grasshoppers as hosts for young.
  - quickly lay eggs, larva burrow in, live off host tissue.

Tachinid flies – look like small house fly

Harold Fowler 1987 Tachinid flies vs crickets

Study #2 UNESP Univ. Estadual Paulista Brazil J. New York Entomol. Soc.

Purpose: Would Tachinid be attracted to vocalizations?

Methods: Playback devices with speakers were set-up each night for a year. (spaced 50 meters apart)
"Phonotaxis" "synthesized" calls
(Playback) Played songs of the 3 species Southern, Tawney, Imitator In Brazil
Trapped flies that landed (HOW?) attracted to sound.
(Controls?) "sound traps" Fowler recorded # flies, vs species sticky traps playback call

Findings: Figure 18.4 – Time of year altered # flies captured related to mating periods Tawney call most also
Observed flies that landed deposited eggs + left in 3 seconds

Follow-up 18.1 Table

Purpose: Test if Changa + Northern (Mole cricket) calls would also draw insects (Tachinid). (control?)

Methods: Same but at peak mating period + just 10 nights

Findings – No response from parasitic flies to Changa + Northern ? + changed vocalizations cricket calls

Discussion – Why maybe flies + 3 are all from South America or maybe ↑ evolved resistance

18.1 Have organisms evolved to exploit communication between individuals of other species?

- Context: Some predators and parasites have evolved to perceive and respond to information transfer between individuals of the same species.
- Major themes: Non-heritable information is transmitted within and between biological systems, and imperfect information transfer produces variation.
- Bottom line: Some species intercept information transfer between members of another species.

Biology Learning Objectives

- Identify the commonalities between communication within a species and communication between species.
- Evaluate how information is used by organisms to find and exploit other species.
- Provide examples of adaptations of one species to the information passed between individuals of another species.

You learned about the mechanisms and purposes of communication between individuals of the same species in Chapter 17. You know that signals are sent into the environment with some risk. One risk in communicating to find a mate or to announce location is that another species could perceive and respond to the communication and use the communicator as a **resource,** say for a meal. For example, a risk to male fireflies when flashing their double pulse of light is that a predator could use the light to locate the male. The interceptors of the signals are **natural enemies** of the signaler and can be classified as either **predators** or **parasites.** Predators include lions, hawks, snakes and dragonflies. Parasites feed on **hosts** and cause harm to the individual by using them as a resource. Parasites include tapeworms, ticks, and mosquitoes. In this section, you will investigate the ability of predators to locate prey and parasites to identify hosts by intercepting communications.

Cricket songs are exploited by natural enemies

Prey and hosts of predators and parasites are often insects. Crickets, katydids, and grasshoppers are insects found in many areas around the world, being especially common in tropical, subtropical, and temperate zones (Figure 18.1). Males of many species of crickets and grasshoppers make vocalizations to attract mates, much like male fireflies flashed light to attract their mates. *{Connection: Communication between individuals of the same species is investigated in Chapter 17.}* You can hear them chirping all day and night at certain times of the year. Mole crickets are a particular type of cricket with large shovel-like forelegs adapted for burrowing into the ground (Figure 18.1, right). These crickets are nocturnal and spend much of their time underground. They are known to fly during the mating season, which is often the only time people ever see them. Both males and females can fly, but only males emit mating vocalizations. Several scientists have studied vocalizations of males and responses of females.

In one study, S. Ulagaraj and Thomas Walker studied two species of mole cricket, the southern mole cricket *(Scapteriscus borellii)* and the tawny mole cricket *(S. vicinus)* in Florida. They recorded male vocalizations of these two cricket species and broadcast the songs through speakers in a playback experiment. *{Connection: Playback experiments are introduced in Section 17.2.}* Each speaker was mounted in the center of a large funnel and faced skyward (Figure 18.2). One funnel contained a speaker playing southern mole cricket songs, another funnel contained a speaker playing tawny mole cricket

Section 18.1 Have organisms evolved to exploit communication between individuals of other species?

Biology Learning Objectives

- Identify the commonalities between communication within a species and communication between species.
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grasshopper (katydid) vs. mole cricket

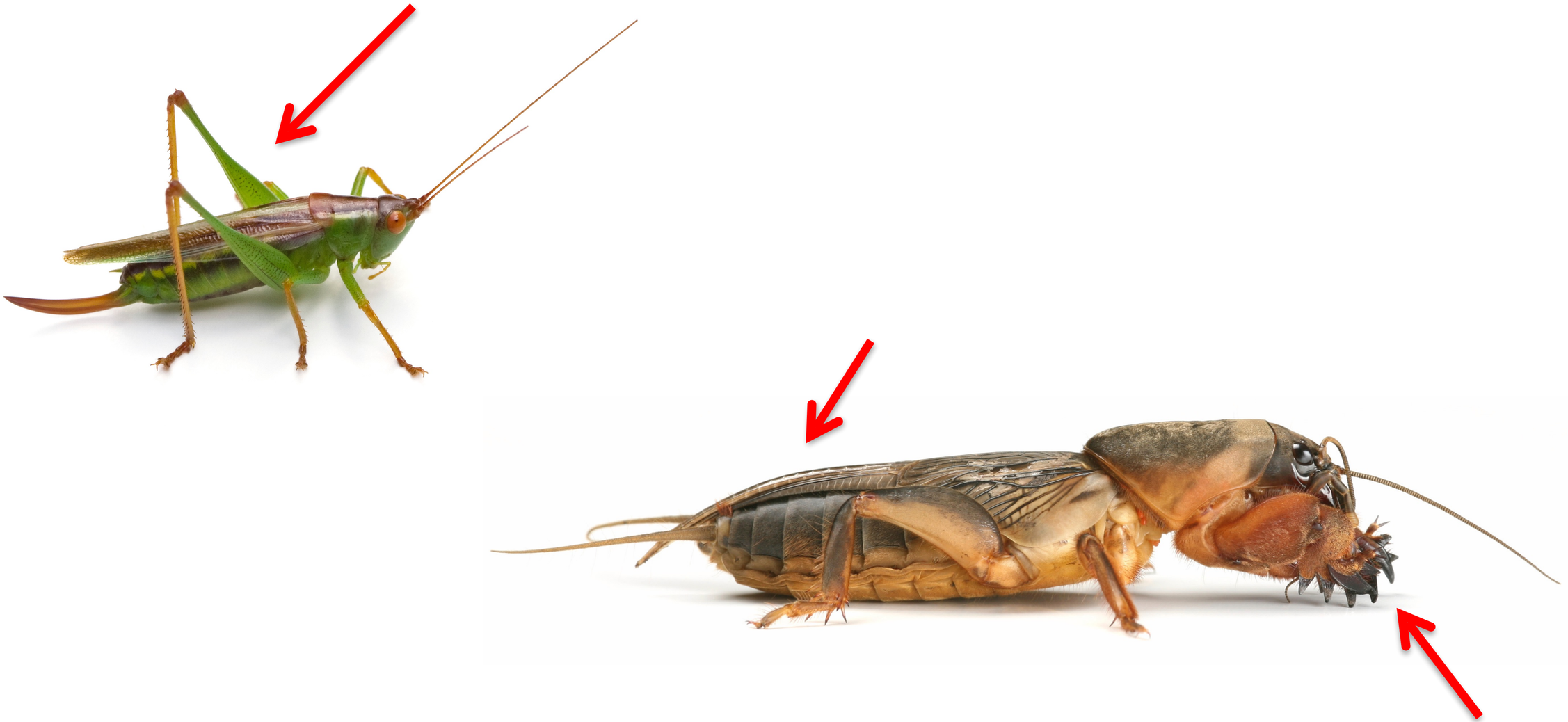
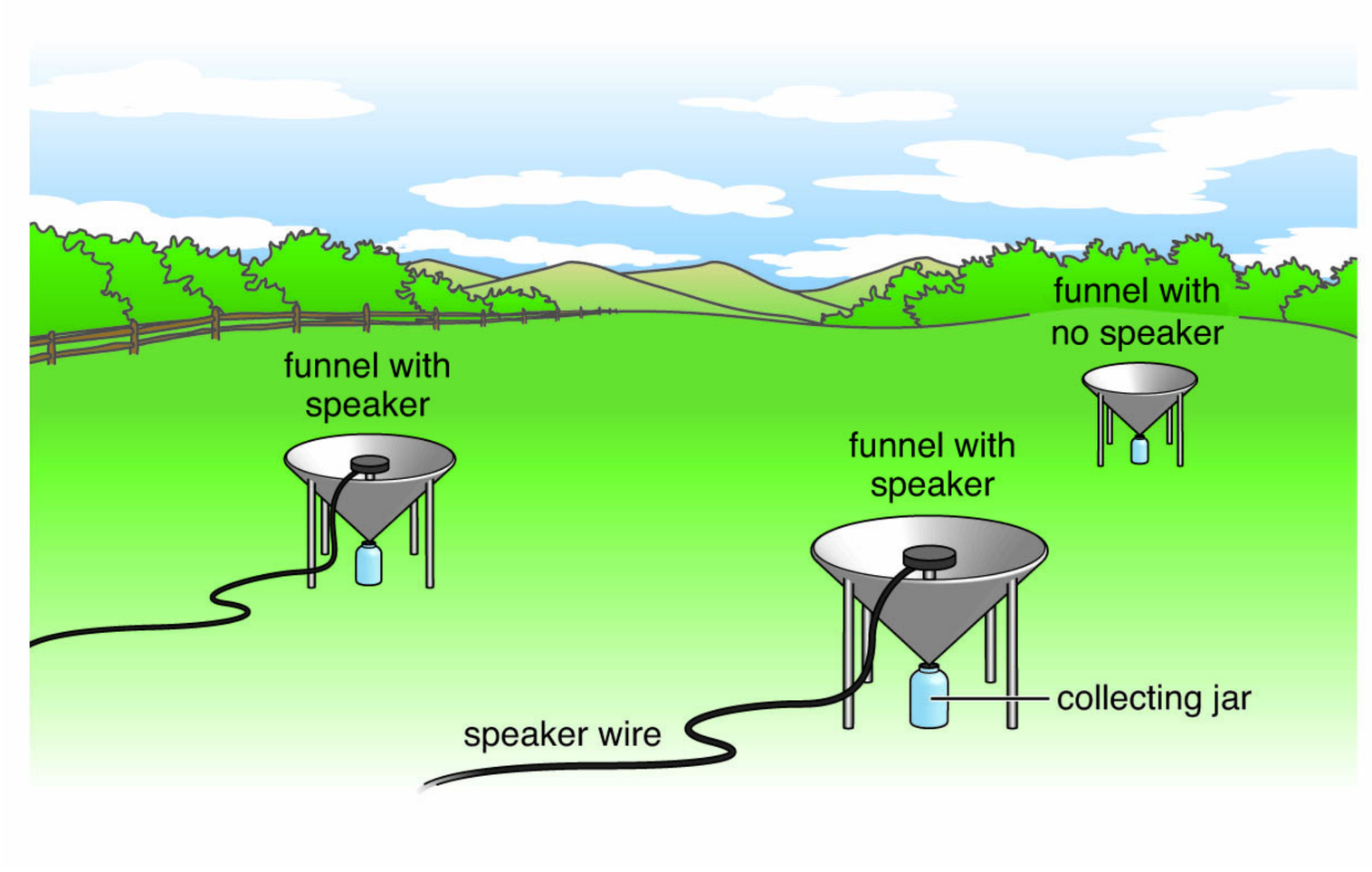


Figure 18.1

Trifecta?: Purpose, Methods

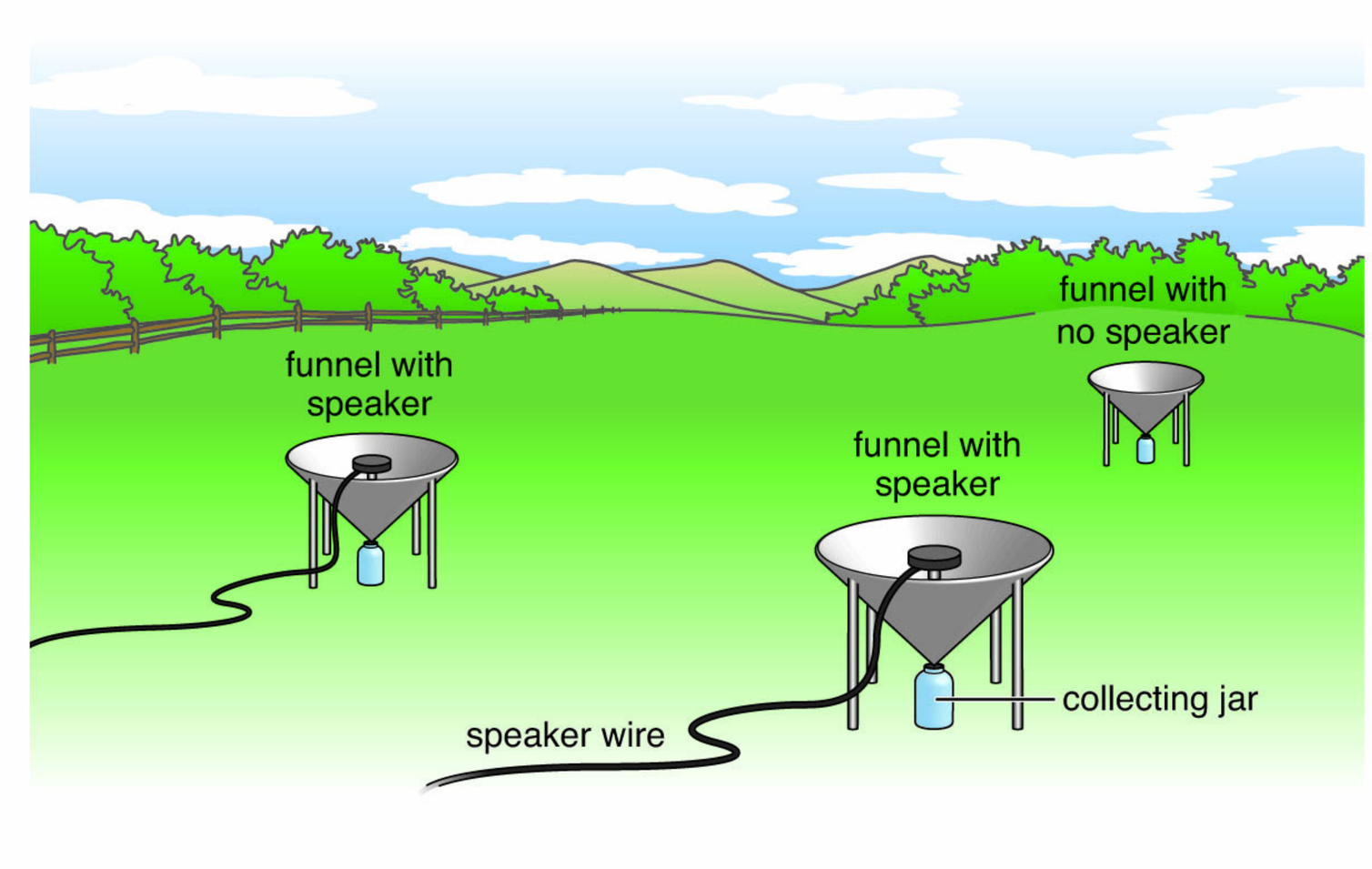


Describe experiment of Ulagaraj and Walker

Figure 18.2

Modified from Ulagaraj & Walker, 1973, Figure 1.

Testing mole cricket responses to vocalizations



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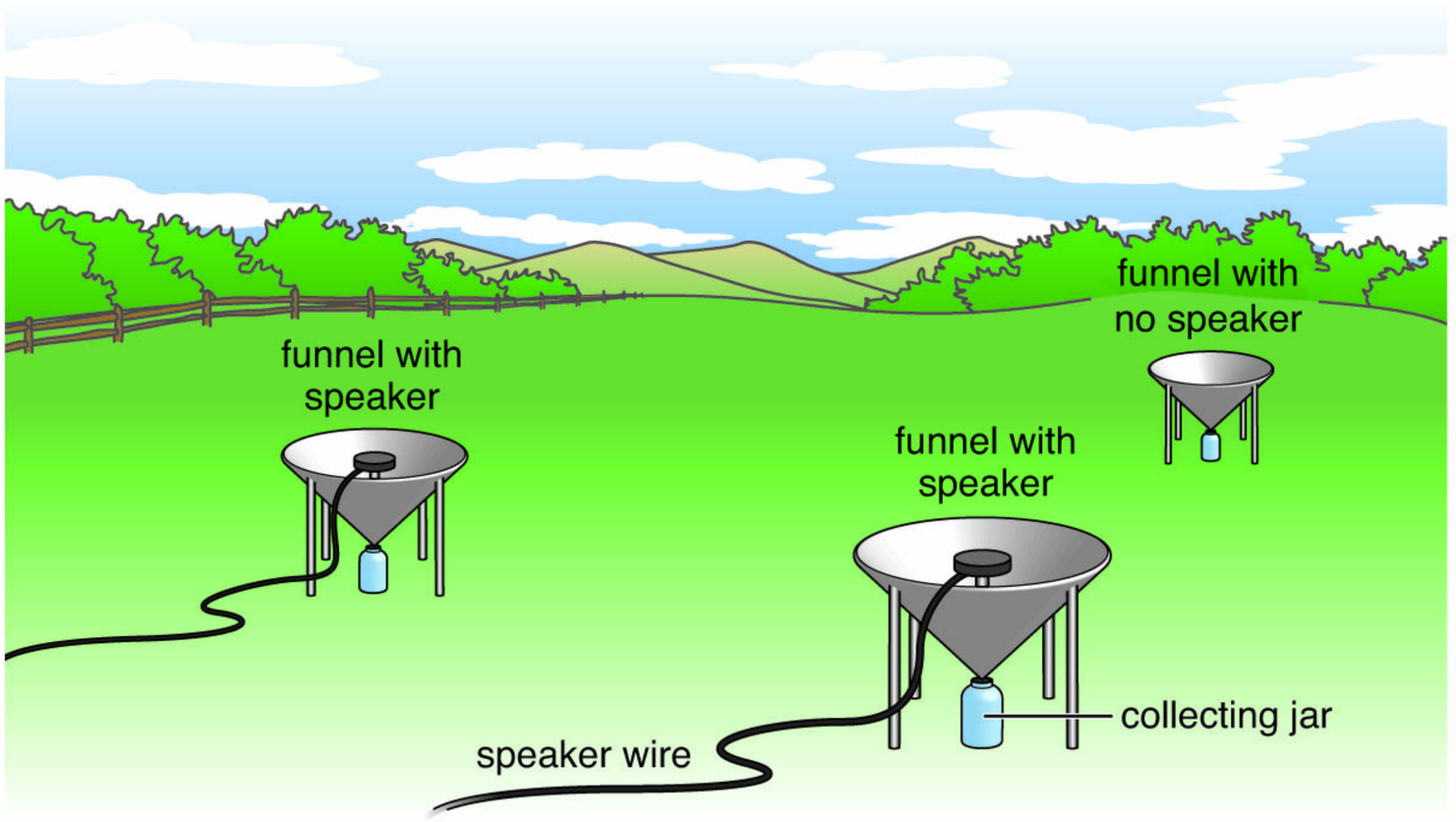
Why did the researchers include a funnel with no speaker?



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Trifecta?: Findings

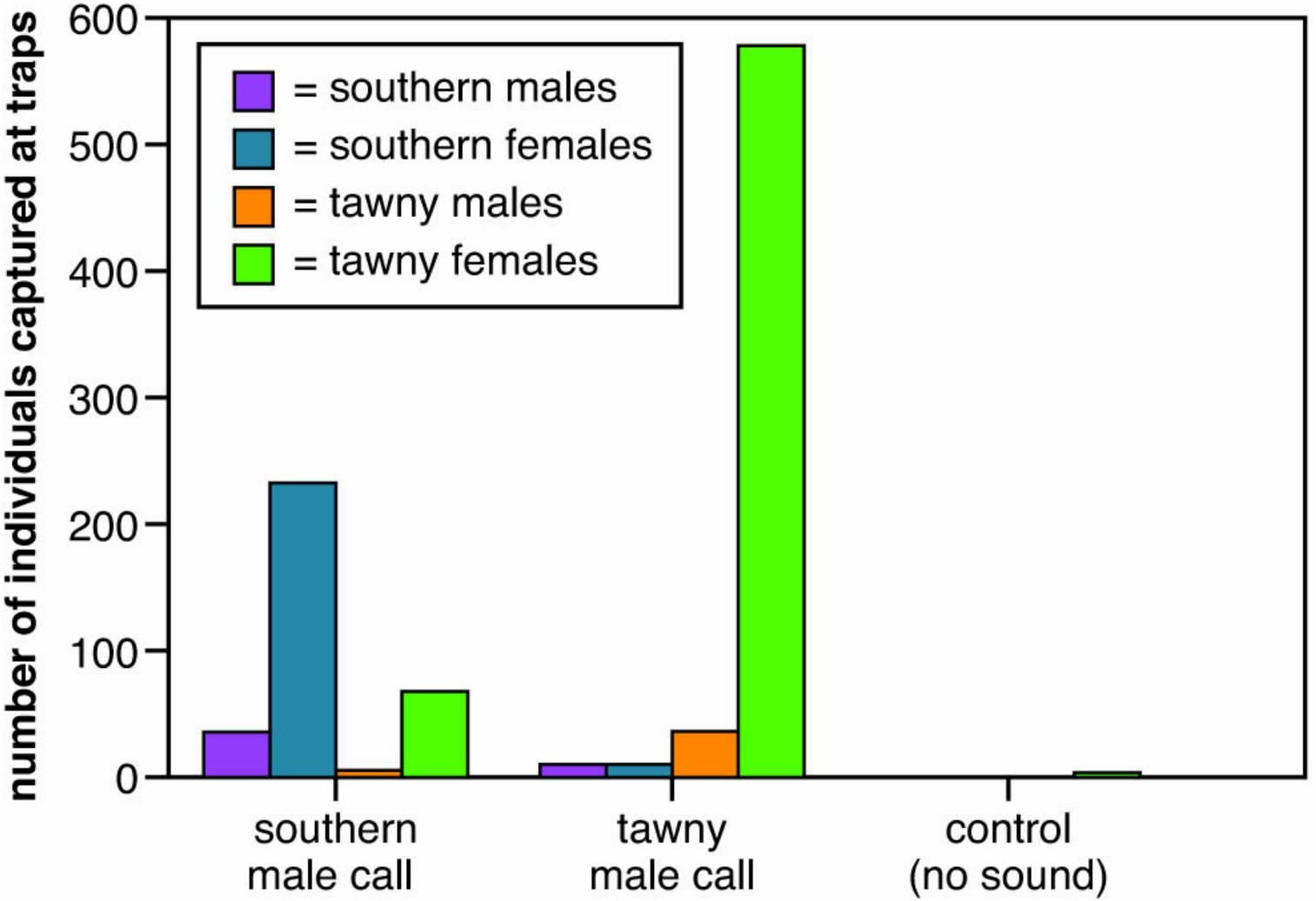
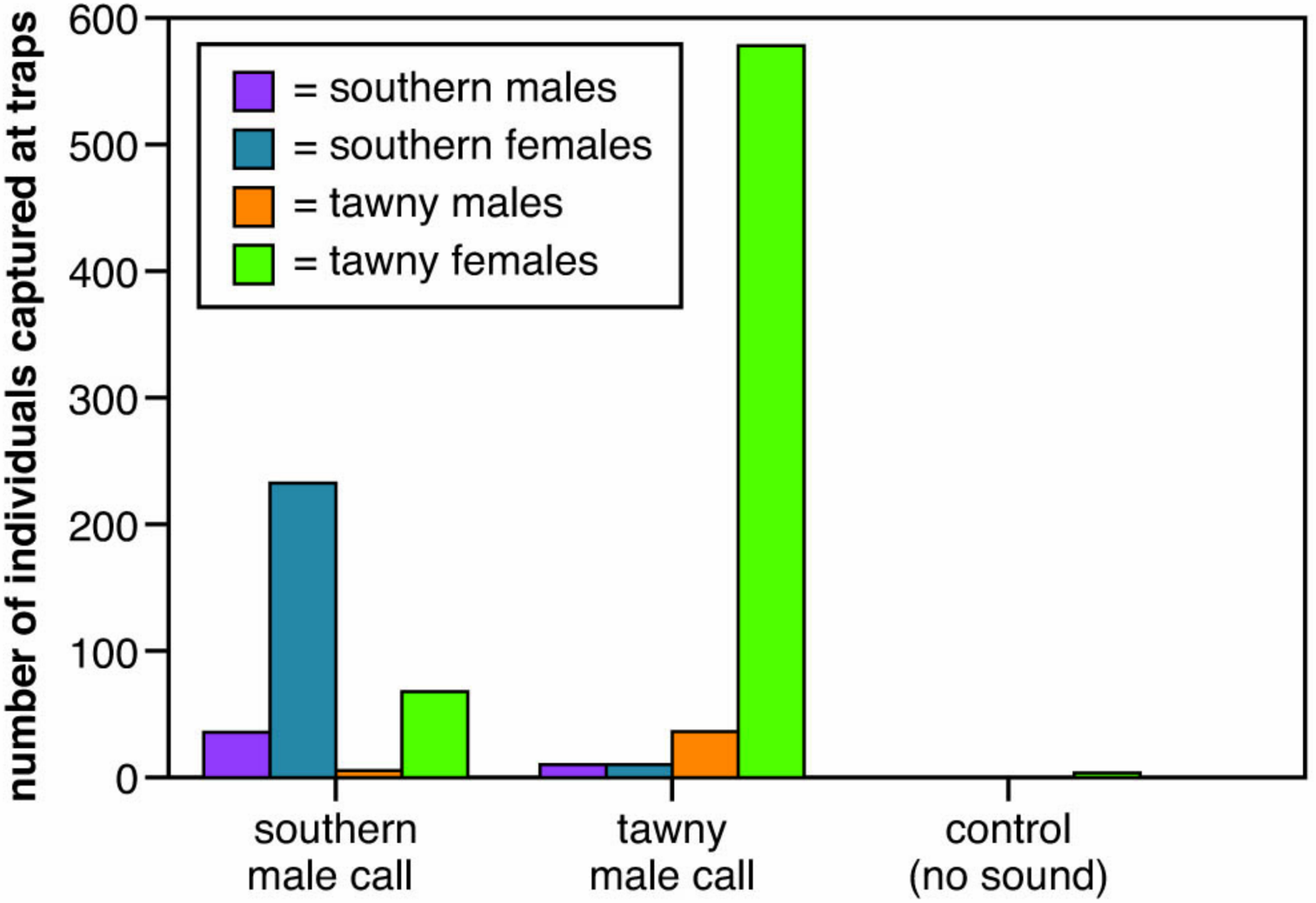


Figure 18.3

Modified from Ulagaraj & Walker, 1973, Figure 2a.

Responses of mole crickets to recordings of male calls



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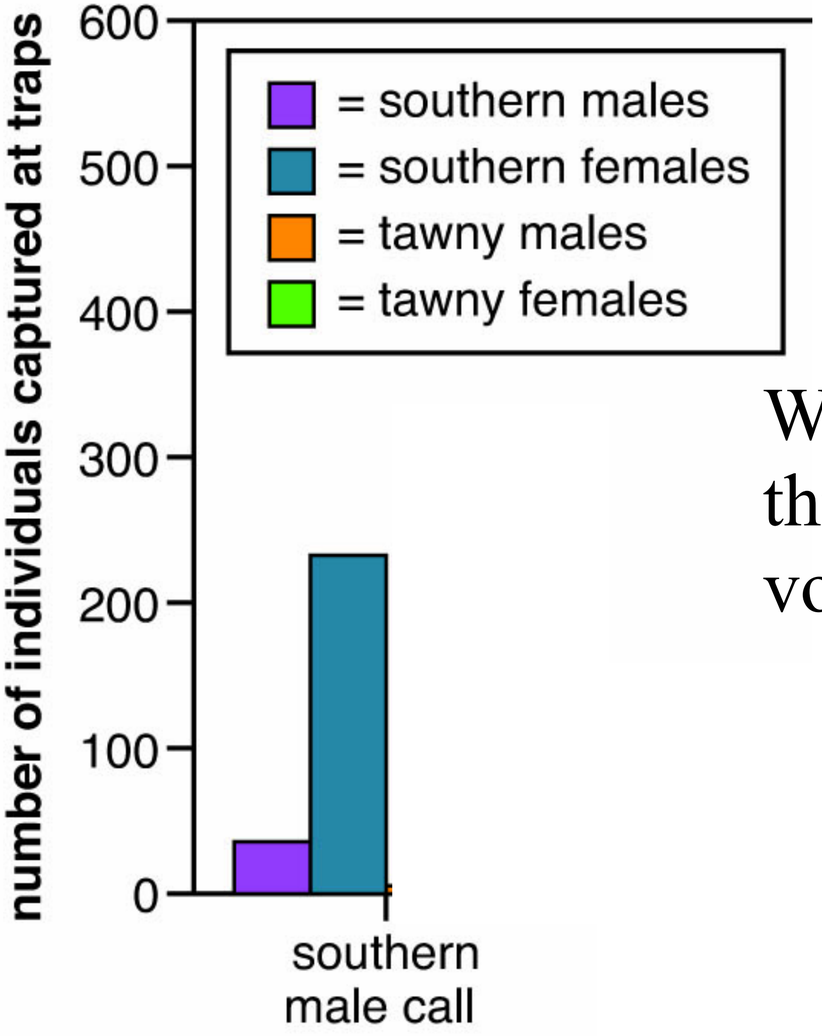

What can you conclude from this about mole cricket vocalizations?

Figure 18.3

Modified from Ulagaraj & Walker, 1973, Figure 2a.

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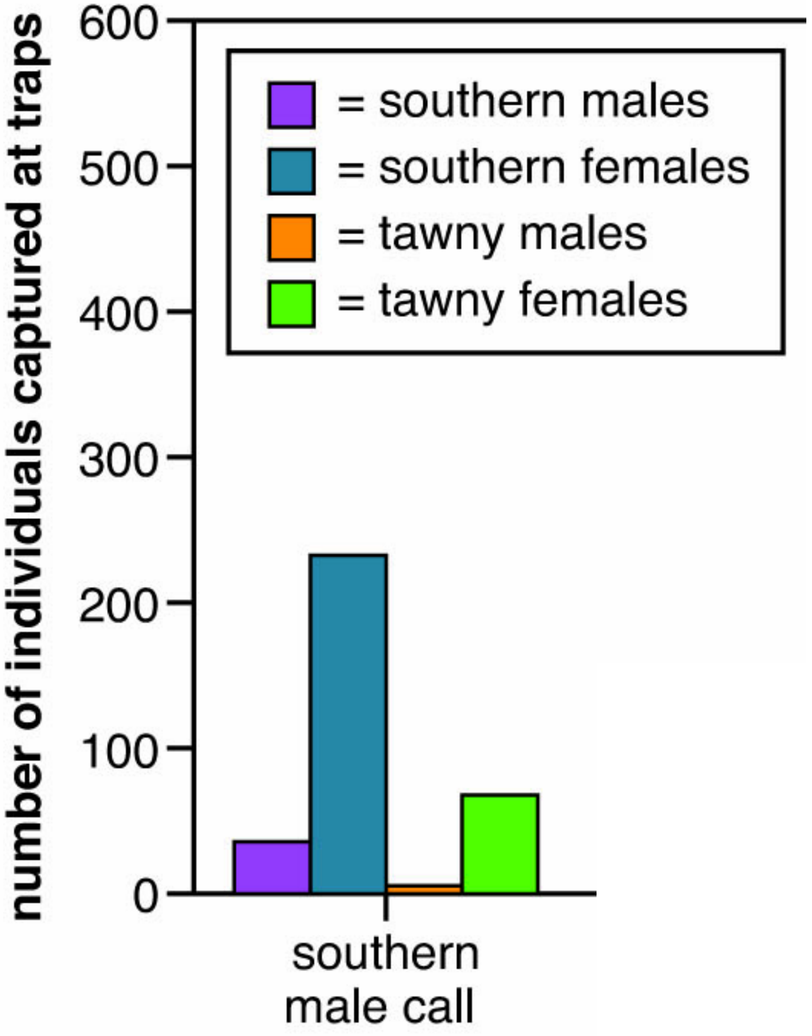
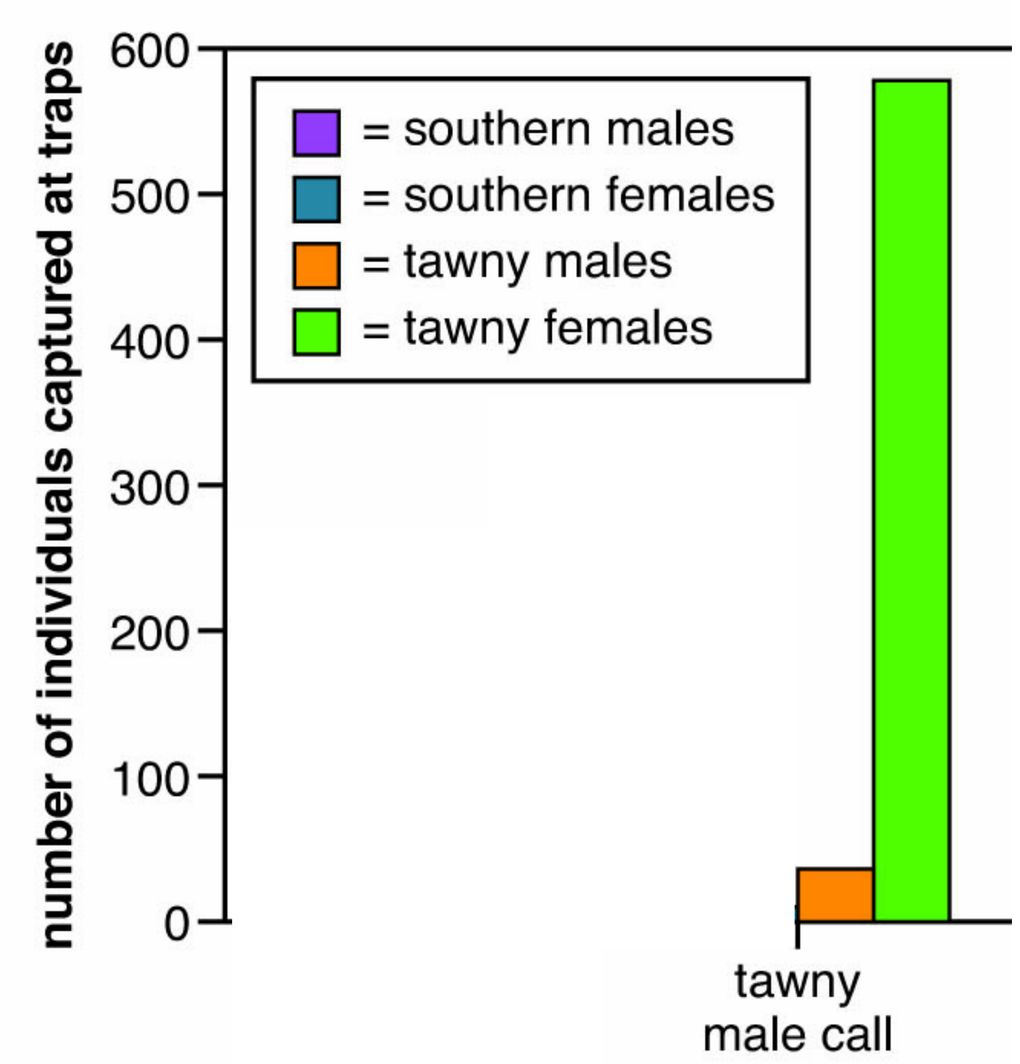


What explains the presence of tawny mole crickets in these traps?

Figure 18.3

Modified from Ulagaraj & Walker, 1973, Figure 2a.

Responses of mole crickets to recordings of male calls

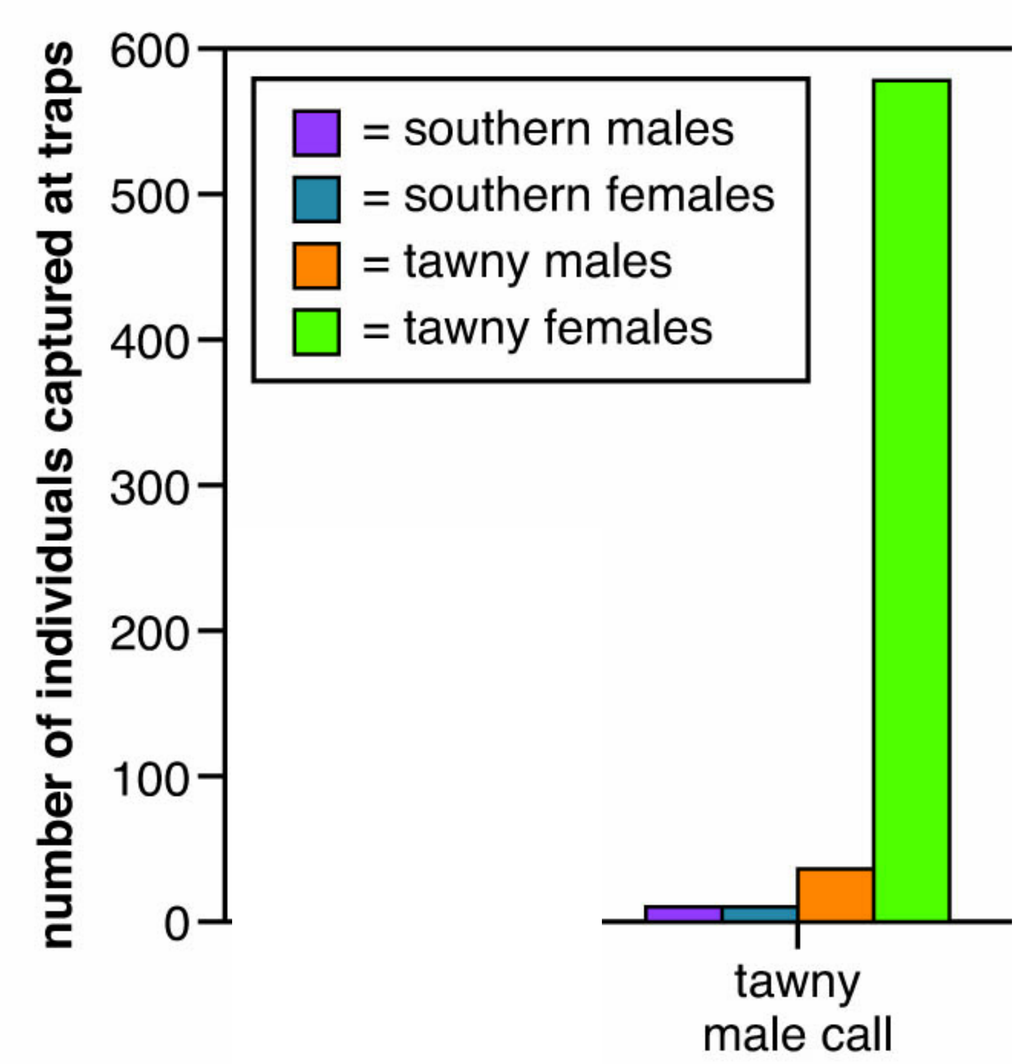


Hypothesize as to why male mole crickets are attracted to the vocalizations of other males.

Figure 18.3

Modified from Ulagaraj & Walker, 1973, Figure 2a.

Responses of mole crickets to recordings of male calls



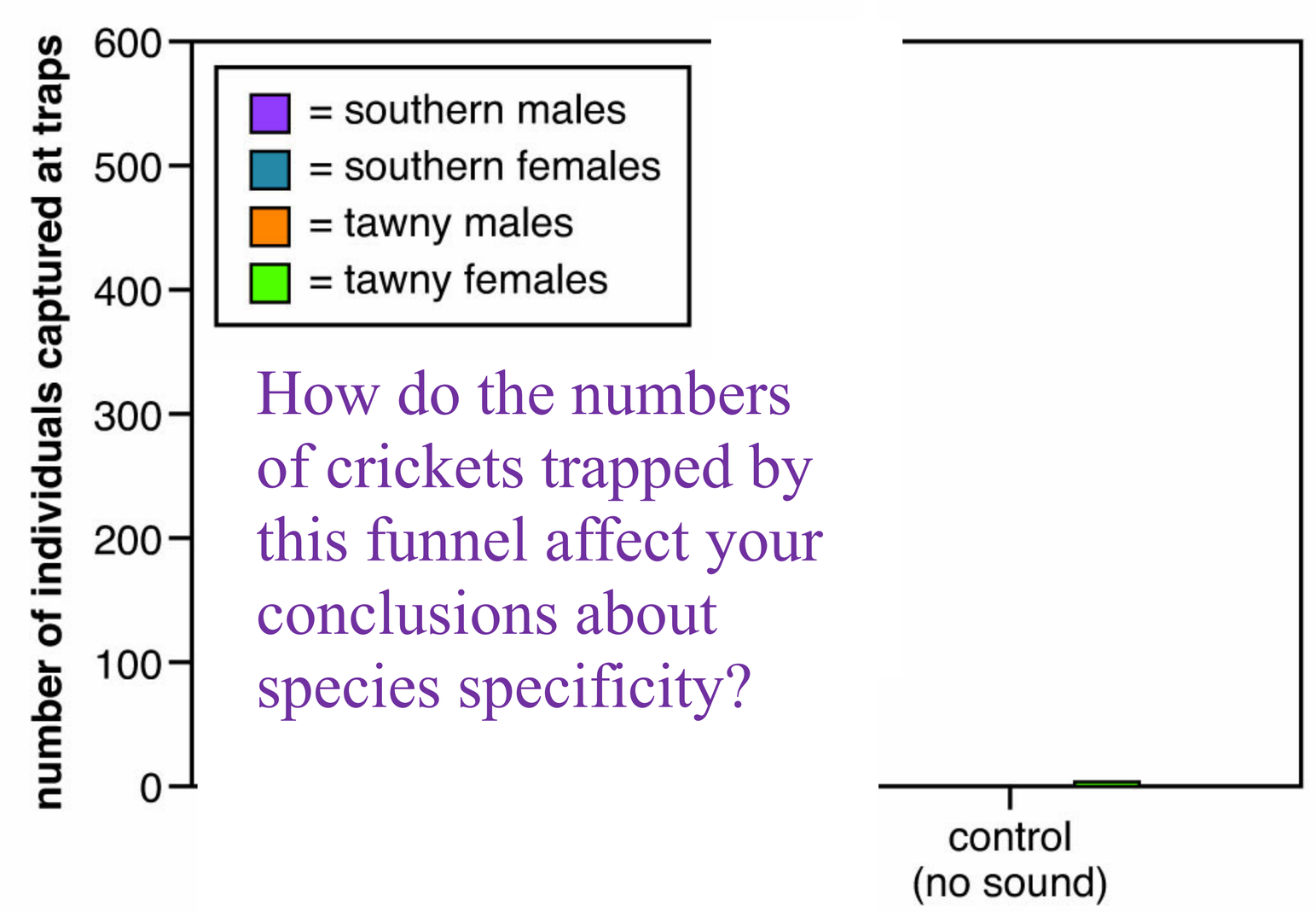
What can you conclude about the species-specificity of mole cricket vocalizations?

What explains the presence of southern mole crickets in these traps?

Figure 18.3

Modified from Ulagaraj & Walker, 1973, Figure 2a.

Responses of mole crickets to control



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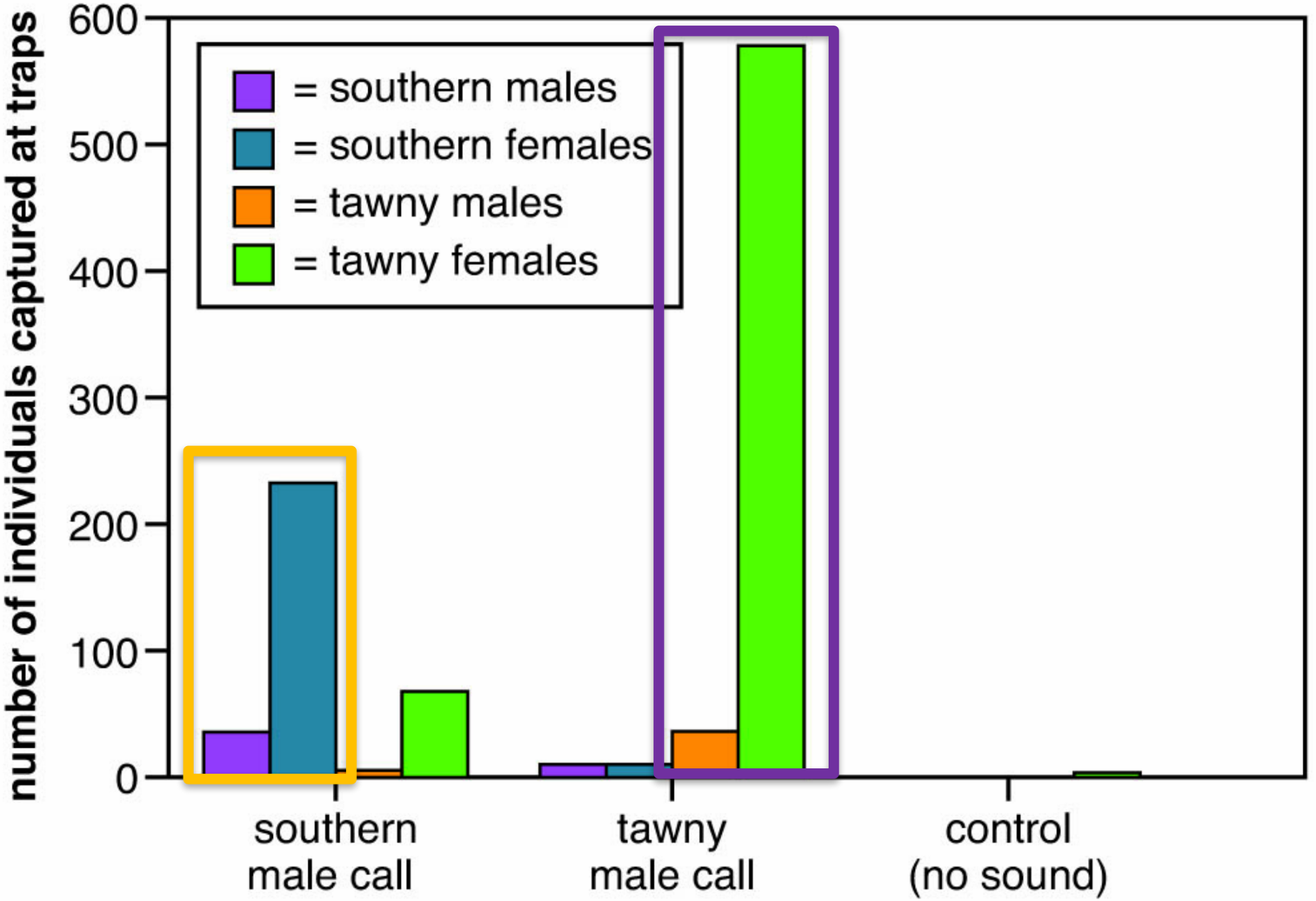

Figure 18.3

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Study #2 (Fowler 1987)

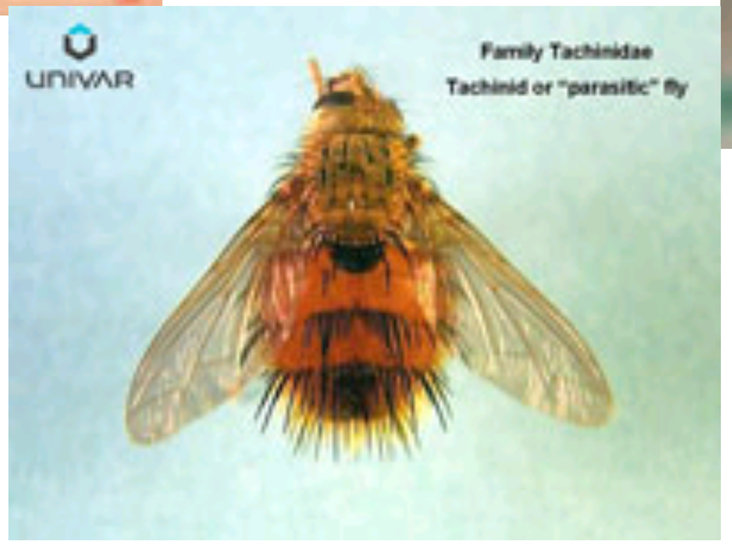
What about this experiment?

Tachinid, or parasitic flies

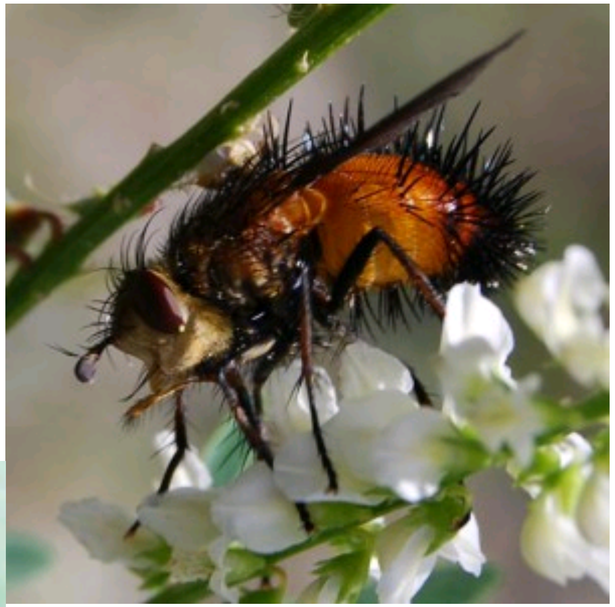
Tachinid fly vs. Tomato hornworm

Tachinid vs. caterpillar: http://www.youtube.com/watch?v=gxKoK4rnBbw

Tachinid, or parasitic flies



http://buginfo.com/article.cfm?id=81



[Tachinid vs. caterpillar: http://www.youtube.com/watch?v=gxKoK4rnBbw](http://www.youtube.com/watch?v=gxKoK4rnBbw)

http://www.oocities.org/brisbane_flies/TACHINIDAE.htm

http://www.whatsthatbug.com/2010/08/10/tachinid-fly-9/

Tachinid larvae that were living in a caterpillar

Study #2 (Fowler 1987)

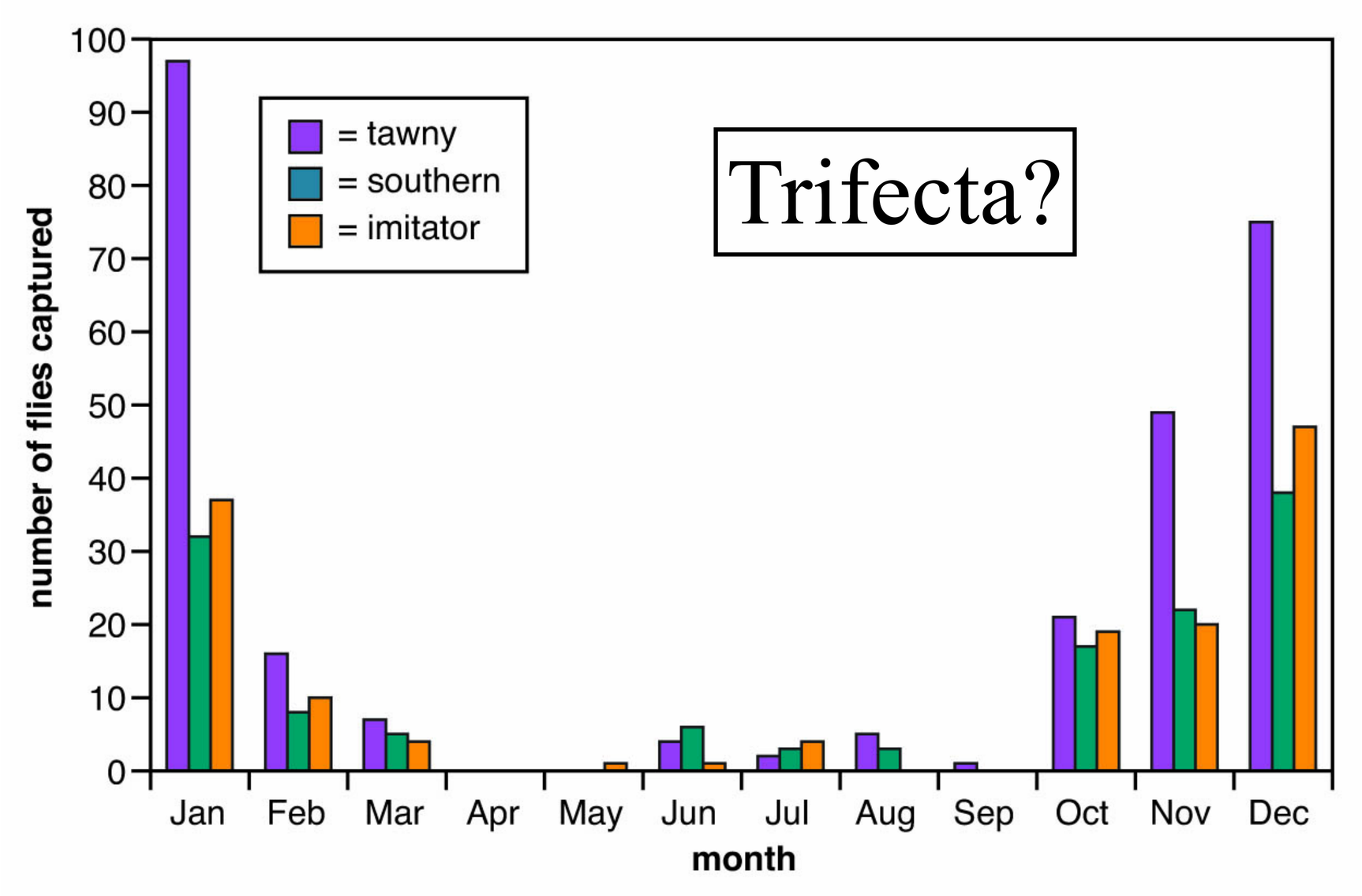
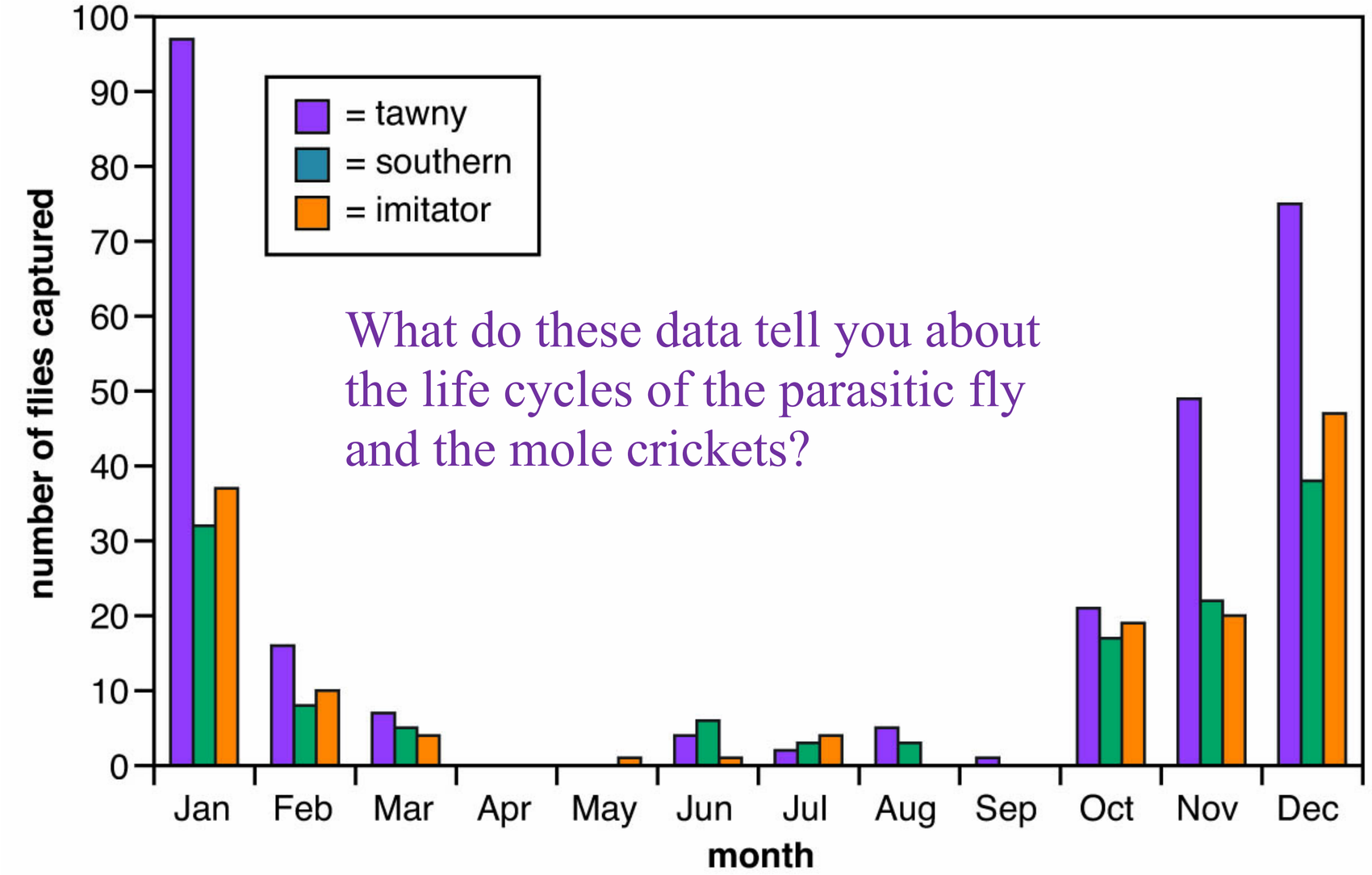


Figure 18.4

Data from Fowler 1987 Table 1.

Captures of parasitic flies at speakers playing male calls of three mole crickets



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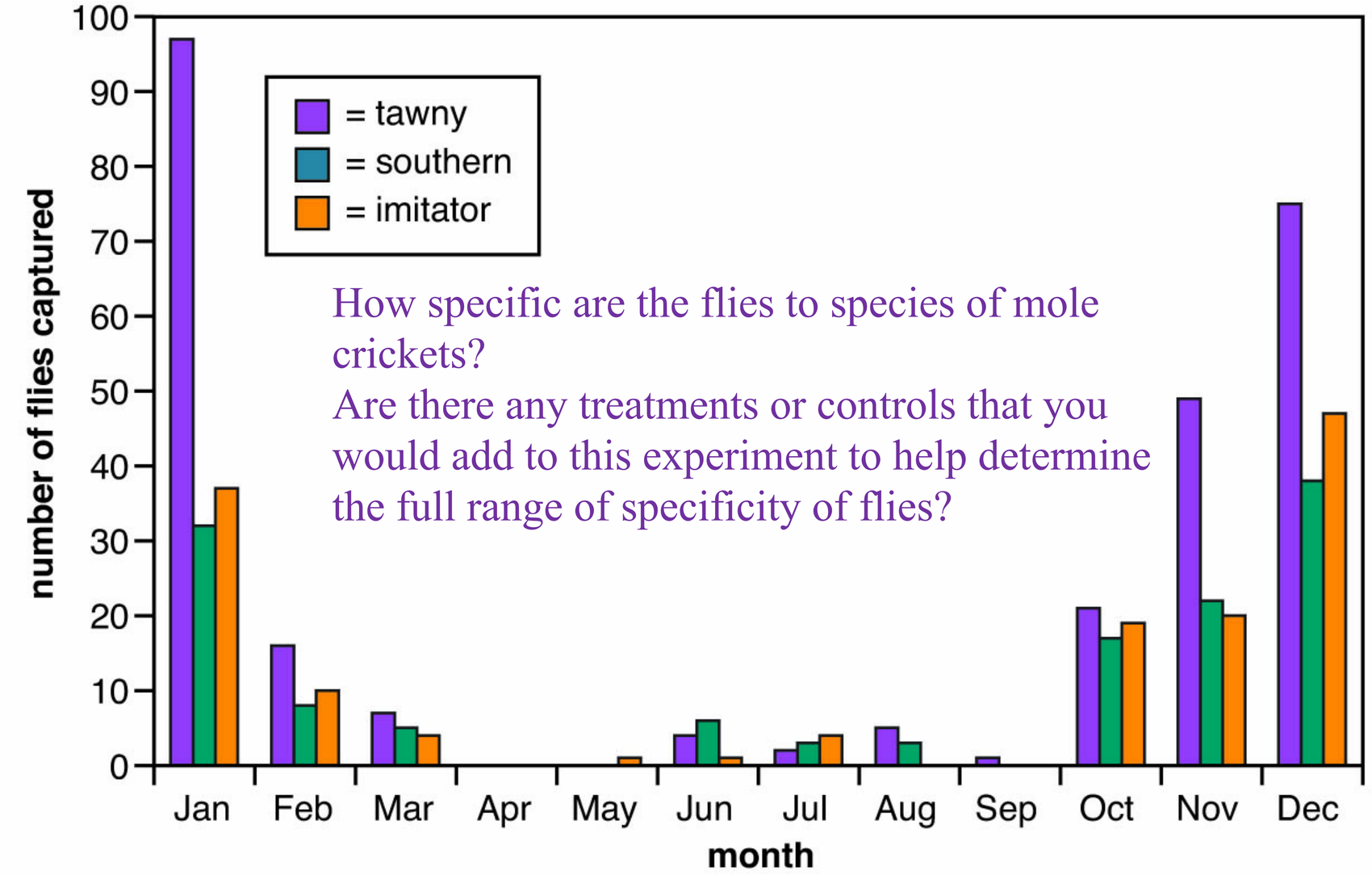

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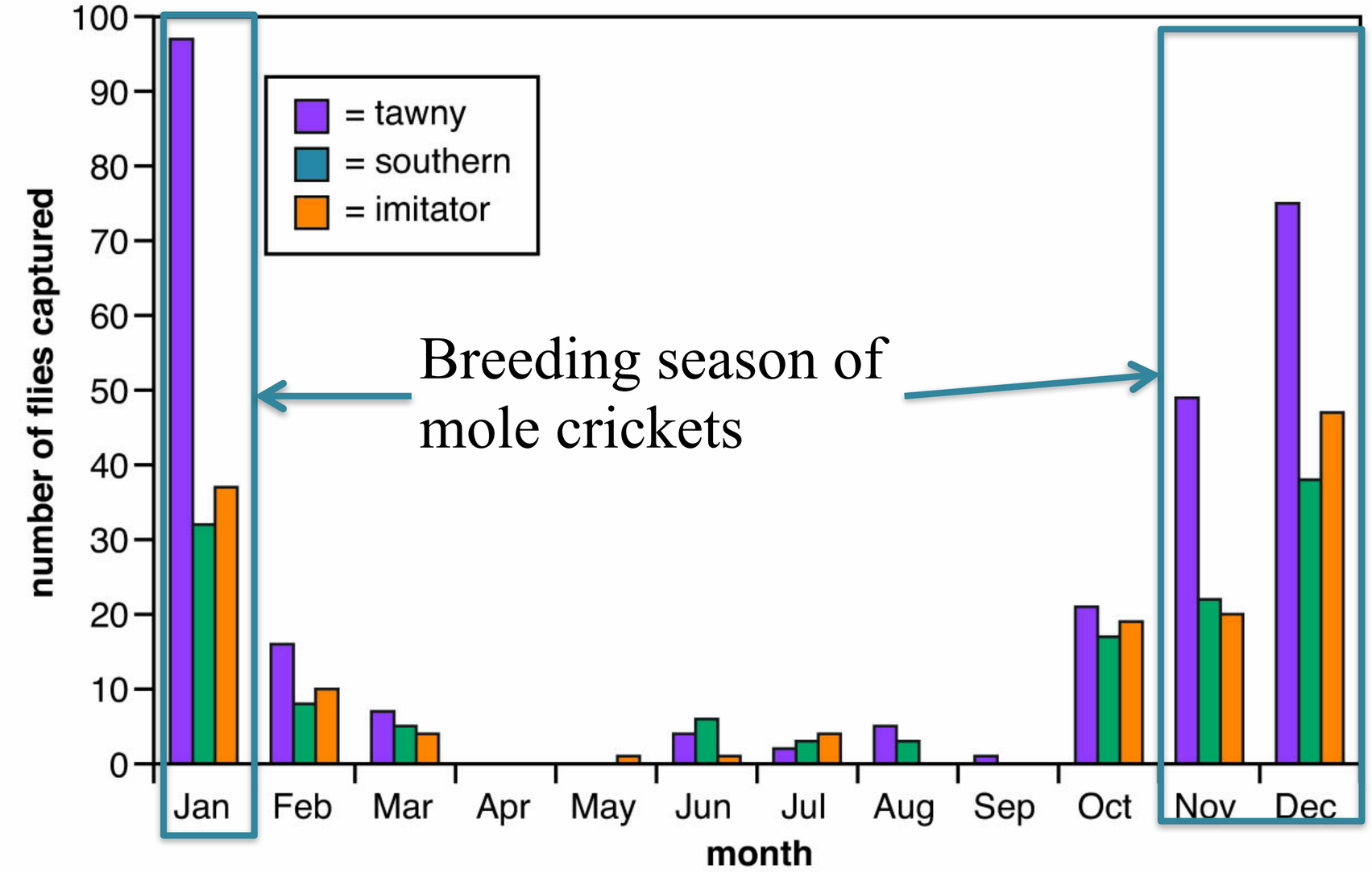

Figure 18.4

Data from Fowler 1987 Table 1.

Trifecta?

mole cricket call	number of tachinid flies
southern	24
tawny	51
imitator	33
changa	0
northern	0

Table 18.1

Data from Fowler, 1987, text p. 476.

Tachinid flies captured at traps playing vocalizations from 1 of 5 mole cricket species

mole cricket call	number of tachinid flies
southern	24
tawny	51
imitator	33
changa	0
northern	0

Table 18.1

Data from Fowler, 1987, text p. 476.

Tachinid flies captured at traps playing vocalizations from 1 of 5 mole cricket species

mole cricket call	number of tachinid flies
southern	24
tawny	51
imitator	33
changa	0
northern	0

Speculate as to why the parasitic flies have not evolved to recognize the vocalizations of all mole crickets

Table 18.1

Data from Fowler, 1987, text p. 476.

Announcements

1. **Lab1 today!** Everyone is invited to attend lab this afternoon.
2. catme.org: Complete survey ASAP (deadline Monday 5pm)
3. "To increase your learning... I'm now going to ask you a question”
4. **Distractions**: Alert LA when you cannot hear a fellow student speak.
5. **Opera**: start on time, doors close, then ushered in.
6. **Contracts:** Review the course *Contract* in syllabus, sign, hand in to Luckie. Due Friday.
7. **TopHat, Coursepack and Course website:** Have all the good stuff

Questions??