Trap your own insects: what's in your backyard?

2nd grade Entomology Unit - Lesson 1 of 4

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Big ideas: Classification and insect ecology
Main objective: Students will be able to design an insect trap that can successfully capture their insect of choice after presented with information about the insect and its ecology

Lesson Summary

Insects are essential for pollination of our crops and flowers, decomposition of plants and animals, and they perform many other necessary ecosystem services. This lesson will allow students to get an up-close, hands-on look at the insects in their own backyard using a trap they design and create themselves. Designs will be guided by an introduction to the behavior and sensory systems of the insect orders – students will use this information to build a trap and pick a lure (attractant) that will capture their chosen insect order. Traps will be placed outside during the spring or early fall to test their prototypes. To complete the engineering design cycle students should use this information to modify their traps to catch more (or the correct) insects.

Prerequisites

An overview of the diversity of local insects is required for this lesson. If students haven't been introduced to classification and insect orders this can be introduced before the lesson begins or during the lesson itself. Students should understand that insects are grouped into orders and this information can be used to help find and identify insects. Orders can be defined by common names (such as grasshoppers/katydids, true bugs, ants/bees/wasps, etc.) rather than scientific names (orthoptera, hemiptera, hymenoptera, etc).

Instruction Time

a. Lecture: 40-60 minutes
b. Building and trap design: 40-60 minutes
c. Reviewing trap catch: 15-20 minutes

Materials

Paper Resources
Required: • Trap Design Handout • Order Chart Optional: • Pollinatarium map

Technology & Multimedia Resources
This lesson requires a computer, projector, video capability, and the "lesson introduction presentation" power point. The "example trap setup" powerpoint is optional.

Physical Resources
Note: most of these resources were found at the I.D.E.A. store in Urbana, Illinois. For items like toilet paper roles and Styrofoam it is recommended to solicit recycling centers, big chain stores (e.g. for cardboard and packing materials), or parents. Overall cost will depend on access to resources, but many of our items were purchased for little to no real cost. The biggest cost came from bins to store the prototypes and the few items purchased full-price at stores. One recommendation is a recycling challenge – have students bring in a week's worth of *clean* recycling as additional building materials to supplement what you can find. **Suggested materials** Examples of inexpensive building materials: - pipe cleaner - saran wrap - sheer cloth or netting - binder clips - clear tape - scissors - funnel - plastic tubing - aluminum foil - rubber bands - yarn - duct tape - glue - coffee can - boxes, various sizes - plastic (Solo) cups

Suggested materials (continued)

Examples of lures

- graham crackers
- flower petals
- grass cuttings
- old banana
- orange peel
- vinegar
- molasses
- LED light
- light-up bracelet
- colored paper
- fake flowers
- nature stickers
- glow in the dark stickers/pompoms

Other materials

- trowel or shovel
- microscope (if possible)
- magnifying glass
- insect vials

NGSS Framework Alignment

Disciplinary Core Ideas

LS2.A: Interdependent relationships in ecosystems

- Plants depend on water and light to grow. (2-LS2-1)
- Plants depend on animals for pollination or to move their seeds around (2-LS2-2)

EST1.B: Developing possible solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people (secondary to 2-LS2-2)

LS4.D: Biodiversity and Humans

- There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

Science and Engineering practices

Planning and carrying out investigations

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question (2-LS2-1)
- Make observations (firsthand or from media) to collect data that can be used to make comparisons (2-LS4-1)

Connections to the nature of science

- Scientists look for patterns and order when making observations about the world (2-LS4-1)

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns (2-LS2-1)

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2)

Week 1 Lesson Plan (Part I)

45 – 60 minutes

Note for teachers: This lesson was fit into a 50 minute class period by dividing up tasks evenly between groups. Each group worked collaboratively to build one trap, and each student was able to contribute to the lure choices (by coloring and adding pre-made construction paper and lures to the pre-made traps). However, this meant a lot of prep time creating the traps, cutting out construction paper of the correct size, and placing the traps ourselves. It is recommended that students build the traps themselves if there is time in class. Further, if groups could place the traps with help of the teacher this will add ownership for the students and reduce work for the instructor. Even with 50 minutes we found engagement and excitement in the material. Students used the map and found their own traps with whatever insects were caught at their field trip and this also went well. Finally, when designing traps be sure the lids or funnels are tightly attached to the cup/bucket to avoid letting stinging insects out.

Teacher prep for a 50-60 minute class period:

Each individual gets to make ¼ of the trap their own, using groups of four. Instructor will assemble all trap parts and the students will design their own smelly and bright lures. We assigned each class one trap type and we reasoned through which insects would be best for each trap type during lecture.

- Pitfall traps – ants (move seeds)
    - Each trap will need the following supplies
        - 32oz clear Solo cup with lid (tall)
        - 1 small funnel (from the Dollar Tree – comes in packs of 3, each used in one trap type)
        - 4 popsicle sticks
        - 1 "lid" (plastic top that covers the cup)
        - 4 pieces of construction paper that fit on top of the cover (for decorating)

    - Cut the lid so the funnel fits snugly into it, with no space for insects to escape, and flush with the top of the lid.
    - Each student gets to design ¼ of the trap cover and choose a smelly lure

- Pollinator paradise (cup with funnel) – pollinators such as flies, beetles, and possibly bees
    - This is the similar to the “pitfall” trap in construction
        - 32 oz clear solo cup (no lid)
        - 1 medium funnel (will act as the lid to the cup, must be taped on as does not fit snugly)
        - Strips of yellow paper to fit in the middle of the funnel
            - Can attach this yourself, must not cover the funnel bottom
        - Construction paper cut into “petal” shapes to attach to the rim of the funnel

    - Each student gets one petal of their flower
        - They get to choose their color and shape
    - Each student gets to choose one lure
    - Each student will make a hypothesis about what insect(s) their lures will attract
- Panel trap – pollinators such as flies, beetles, and possibly bees
    - Materials needed
        - 8 pieces of thick paper or cardstock
            - 4 pieces will be used for the X-shaped middle of the trap
            - 4 pieces will be cut using the provided template and will make the top and bottom
        - 8 small pieces of string
            - To attach the top and bottom to the center panel of the trap
        - 1 long piece of string
            - To hang the trap from a tree
        - 1 large funnel

        - To be placed inside of the trap bottom before assembling the rest, the bottom of the funnel should be the only part showing, and this is what you will use to attach the cup
    - 32oz clear Solo cup with lid (tall)
        - Lid must be scored with a small X to push the funnel bottom through
    - 4 pieces of construction paper, cut to the size of one side of the middle panel
        - This is what the students will decorate
  - Each student will get a side to color and put a lure on
  - Panel trap will already be made, but will be white

1) Introduction (3 min)

- Students will be working in groups for the activity and discussions. Sort into groups before you begin the lesson (groups of 4 worked well for us).
- Ask the students to turn to their group and name 2 insects they learned/know about:
  - Answers may include ladybug, lightning bug, caterpillar, butterfly, etc.
    Prompts:
    - *What are some insects that fly around your head at night?*
        - *(Mosquitos, moths, fireflies)*
    - *What are some insects that crawl on plants and leaves?*
        - *(Caterpillars, beetles, bugs)*
    - *What kinds of insects can you find around a pond?*
        - *(Dragonflies, damselflies, butterflies, pond skaters)*
  - Each group will report back with one insect.
- Quickly review the diversity within and between the insect orders (use pictures and specimens if they are available), guiding the students to the conclusion that even in your own backyard there is a huge diversity of insects, but sometimes they are hard to find until you learn about them.
- Tell the students that today we are going to learn about some of the insects they might find (in Illinois) and they will use this information to engineer their very own insect trap!
- We will put their traps out at the Pollinatarium in the spring to see what insects they actually catch (to see if their hypothesis was correct). Alternatively, traps can be placed around your school during the spring and early summer.

2) What insects could you find? (5-10min) - introduce orders and classification prior to lesson or introduce directly prior to this section

- Introduce the ecology of each order, specific for how to find and catch each group (see poster pdf)

- Includes common/scientific name, as well as information specific to how to catch each insect. This will include behavior, physiology, and ecology.
- Do they fly or crawl?
- When are they active?

3) Introduction to traps (3-5 min)

- Ask the students "what do you think of when you hear the word 'trap'"?
  - (The game "mouse trap", bear trap, ant trap, etc)
  - Some of these might hurt the animals, but we want to keep our insects happy so we will catch and release them!
- Some common insect traps

Review the three types of live-traps in their handout: pitfall, panel, and "Pollinator paradise"

1. Panel trap
   - This is just like the traps that scientists use to catch beetles and other flying insects
   - What happens if an insect is flying along and hits the middle of the trap?
     - Insect will either fall down into the cup/bucket or try to crawl up
     - If they crawl up they will get stuck in the shielded top and probably will fall down into the bucket anyway
     - We try to make the panels slippery so they can't crawl up
   - Can the insect get out?
     - No, if they crawl up the side of the container they will either hit the top or the funnel
     - There is a *small* possibility that they will find the tiny hole of the funnel and fly out, but this is probably not going to happen and even if it does there are a lot more insects that will get stuck in the jar than will fly out
2. Pitfall trap
   - Catches insects that walk on the ground
   - Top of the cup is at the same level as the ground
   - Funnel keeps insects from crawling out
   - Roof keeps rain and dirt out and protects the insects from getting too hot by blocking the sun
3. Pollinator paradise
   - Similar to pitfall, but this will not be flush with the ground (we placed on the ground, but you might want to raise it up at the level of the flowers)
   - Catches pollinators, which are insects that visit flowers

        - The top of the trap is a funnel that will be decorated with bright paper; it will have a yellow center and pedal shaped pieces of paper on the outside to make it look like a flower
        - Funnel keeps insects from crawling out
- Ask students: “when you are designing a trap, what do you think is the most important part or thing you need to do to successfully catch an insect?”
    1. Possible answers include: keeping them from escaping, keeping them alive, knowing where to find them
    2. Getting our insects to find our traps is the first step, if they don’t care about or find the trap it doesn’t matter how good our design is!
    3. We have to put something they like in the trap so they will want to fly or crawl to it
- How do we know what insects will like?
    1. We use what we know!

4) We know that insects are really good at SMELLING. Do you know how they smell? Do they have noses?

No! They use their antennae! The long antennae on their heads are even better than our noses. They’re even better than dogs!

Do insects have eyes? Where are they?

Insect eyes are on their head too. What does that mean? Can they see you? How about brightly colored flowers?

- Does anybody know how flowers reproduce? They can’t walk around, so they have to get help from other animals like insects to spread their pollen to other flowers. How do they get insects to visit them? They make really strong smells and are brightly colored.
- BEES - - When a bumble bee or butterfly is flying by they can smell those sweet smells, and will fly towards them. The bee knows it’s the right flower because it has the right smell AND the right color. Bees fly from flower to flower and accidentally collect pollen while they are eating nectar.
- If we wanted to catch a bee, what would our trap need to have?
    - Flowers or floral smells
    - Brightly colored paper or stickers to guide them to the right place
- We probably don’t want to catch bees, because they can sting us. **What else can we catch?**

- ANTS - - When an ant is walking around they can use their antennae and eyes to find food. They work as a team and can walk in every direction around their nest, or their home, to find food. When one of them finds food they can tell the other ants where to find it and they will all work as a team to bring the food back to the nest. They can carry seeds of plants back to their nest. The seeds have a

delicious outer layer and then the middle is what the plant needs to survive. What else has a delicious outer layer and a seed inside?
    - Peaches, plums, etc.
    - That means we can help plants move their seeds, too!
- You will work with your group to make a trap that will catch ants – work together just like ants and figure out what colors they will like and what smells they will like.

5) Students should get out their worksheets (or pass out at this point) and spend 2-3 minutes filling it out

a. circle which insect their group will catch

b. circle the trap we will use (each group or class will be assigned a trap)

c. each group member will pick out a smelly lure from the list of options and design their own trap part.

Students loved smelling the different options, we brought in cinnamon chips, vanilla, vinegar, and smelly tea (Jasmine)

d. students should fill in their hypothesis, this is what they will test when the traps are put out at the end of the unit

6) Where in the natural area (e.g. Pollinatarium) can you put your traps? (5min)

Note: traps can be combined with a field trip or placed around the school during the summer months

- Each student will get a map of the Pollinatarium in their worksheet packet with each habitat type marked. (If needed, this can also be created by printing out a satellite map of your area and using highlighters or markers to mark off different habitats.) Students will circle where they want us to place their trap. Students will use the map to find their trap on the day of the fieldtrip.
- Students should also specify at what height the trap should be hung (except for pitfall)

7) Design (5 min)

- Provide students with supplies and guidance as they build or design their traps

If necessary, break the lesson and building into two days. Prompts for day 2:

Finish building: 10-25 min

- Tell the students to get out their completed worksheets and get back into their groups from last week
- One person remind us what a lure is, and one person remind us what our traps are for

- Tell the students they will get 25min to build their traps and we will give them a 5 minute warning before we must start to clean up

While they're building, ask orally and record for each group
What insect did you want to catch?
Do you know what a baby ____ looks like?
Do you think you could catch a baby _____ with this same trap?
What lures are you using?

Give 5min warning before building stops

9) Closing Remarks (3-5min)

Week 1 Lesson Plan (Part II: Identification of trap catch)

15 - 20 minutes

Prior to lesson:

- **Placement of traps**
  - Traps can be placed based on students' maps either by instructors, or have students place their traps if possible. If instructor places trap, photos can be taken of the trap in place to help students feel involved in the process. Make sure to secure traps well so that they are not impacted by wind or rain (if possible).
  - Traps should be left out overnight and checked the next day to ensure that insects are still alive in the trap.

1) Reviewing trap catch

Suggested materials:

- Jars with lids or collection vials
- Microscopes / magnifying glasses
- Field guides
  - Recommended:
    - Kaufman Field Guide to Insects of North America
    - Peterson Field Guide. A Field Guide to Insects: America North of Mexico
    - http://www.bugguide.net
    - For difficult to identify insects, can also ask: whatsthatbug.com

2) Identifying caught insects

- Insects can be identified to broad groups, for example families rather than species. Insects within a family are often very similar in their natural history and can provide broad but important information (e.g. pollinator/predator/herbivore).

3) Assessment and re-design

- Ask students to assess the success of their trap in terms of their original goals.
  - Did they catch what they set out to catch?
    - Why or why not?
  - Were any insects caught that were surprising?
- How would students re-design their trap to better meet their goals?
- Were there any factors that were not considered in original trap design?
- This is also a good time to address the seasonality of insects if appropriate. For example, if it is early Spring you can ask students why they may not have caught butterflies

- To complete the engineering design cycle students must assess their design and re-build their trap based on what they learned during testing. For example if the students aimed to catch a butterfly but the butterflies could not get into the trap they might need to make their opening bigger. Students must re-test their designs and observe what insects they catch.

Extension:

- What attracts house pests?
  - What happens when you leave sweet items or cheese out?
  - What kinds of traps do we use in our houses to get rid of pest insects?