

Coastal Unit 4

Fire Ants and the Future of Maui Wetlands

Overview

No ant species are native to Hawai‘i. However, more than 40 species of ants have been collected here. Many of these have become naturalized and are now part of the islands’ ecosystems.

Among the pest ants that have not yet been discovered on the island of Maui are two species, both of which are referred to as “fire ants.” One species, the “little fire ant” (*Wasmannia auropunctata*), is established on the island of Hawai‘i but has not yet been found on Maui. The other, the “red imported fire ant” (*Solenopsis invicta*), has been spreading across the continental United States since the 1930s but has not yet been discovered in Hawai‘i. Many people believe that the red imported fire ant is very likely to become the next severe pest invasion in Hawai‘i unless dramatic steps are taken to prevent its arrival and establishment.

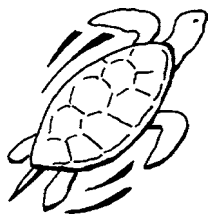
This unit engages students in efforts at early detection of these pest species on Maui, and challenges them to help minimize the potential threat to wetlands and endangered species here by developing a prevention and action plan.

Length of Entire Unit

Five class periods.

Unit Focus Questions

- 1) What threat could pest ants such as the red imported fire ant pose to native ecosystems once they become established on Maui?
- 2) What biological and behavioral characteristics make the red imported fire ant a potential threat?
- 3) How can people protect Maui and its natural areas from invasion by pests such as the red imported fire ant?



Unit at a Glance

Activity #1

Finding the Little Fire Ant

Students collect ants from their homes or other locations around the island. They use a simple key to identify ants that may be the little fire ant, which has not yet been discovered on Maui.

Length

One class period, preceded and followed by homework (the preceding homework assignment entails students collecting ants).

Prerequisite Activity

None

Objectives

- Collect and attempt to identify ants using a simple key.
- Describe the threat the little fire ant could pose to native ecosystems on Maui, humans and domestic animals.
- Explain why early detection is important for pest species such as the little fire ant.

DOE Grades 9-12 Science Standards and Benchmarks

LIVING THE VALUES, ATTITUDES, AND COMMITMENTS OF AN INQUIRING MIND: Students apply the values, attitudes, and commitments characteristic of an inquiring mind.

- HONESTY: Report findings accurately without alterations and draw conclusions from unaltered findings.

DOING SAFETY: Students demonstrate the importance of safety by applying safety skills in all activities.

- Apply school, classroom, laboratory, and field trip rules, as appropriate, to maintain a safe learning environment.

Activity #2

Red Imported Fire Ant Prevention and Quick Response Plan

Students research and develop an island-wide plan to prevent the red imported fire ant from becoming established on Maui and to respond rapidly to control the spread of any populations that are found.

Length

Three class periods, preceded by homework and interspersed with out-of-class research time.

Prerequisite Activity

None

Objectives

- Describe the potential threat the red imported fire ant poses to Maui wetlands and the endangered Hawaiian bird species that nest there.
- Research topics related to red imported fire ants to devise a plan for protecting Maui and Maui wetlands from invasion.

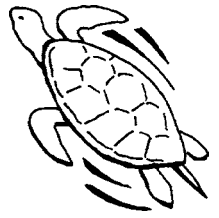
DOE Grades 9-12 Science Standards and Benchmarks

LIVING THE VALUES, ATTITUDES, AND COMMITMENTS CHARACTERISTIC OF AN INQUIRING MIND: Students apply the values, attitudes, and commitments characteristic of an inquiring mind.

- SELF-DIRECTED: Use research techniques and a variety of sources to complete a report on a project of one's choice.

RELATING THE NATURE OF TECHNOLOGY TO SCIENCE: Students use the problem-solving process to address current issues involving human adaptation in the environment.

- Evaluate alternative solutions for effectiveness based on appropriate criteria.



Activity #3

Race to the Wetlands Game

Students play a game that tests their knowledge of fire ants and ant prevention and control strategies.

Length

One class period

Prerequisite Activity

Activity #1 “Finding the Little Red Fire Ant”

Activity #2 “Red Imported Fire Ant Prevention and Quick Response Plan”

Objectives

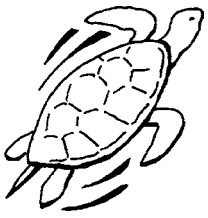
- Demonstrate knowledge of pest ants and strategies used to prevent their establishment or control their populations.

DOE Grades 9-12 Science Standards and Benchmarks

None

Enrichment Ideas

- Watch the video, *Ants: Little Creatures that Run the World* to become familiar with basic ant biology and behavior. (Video included with this curriculum, Alpine/Aeolian Unit 4 “Good Critters, Bad Critters.”)
- Research the native and migratory water birds that use Keālia Pond National Wildlife Refuge and other Hawaiian wetlands. One good place to start is the U.S. Fish and Wildlife Service Pacific Islands Ecoregion website. It includes information about threatened and endangered animals in the Hawaiian Islands at pacificislands.fws.gov.
- Extend the time available for students to develop their management plans, perhaps even over a period of several weeks. Require more in-depth research, and allow in-class time for students to share information and develop strategies. This will increase the likelihood that students will come up with useful and appropriate ideas for protecting Maui from the red imported fire ant.
- Put together one class proposal that draws together the best ideas from all of the small group plans. Present this proposal to the Ant Working Group. (Contact the Ant Working Group through Ellen VanGelder at 572-4472 or evangeld@hawaii.edu.)
- Implement student ideas. Students can design ways to evaluate how effective these ideas are once they are put into action.
- Create a public service announcement, poster, or other educational materials about the red imported fire ant.



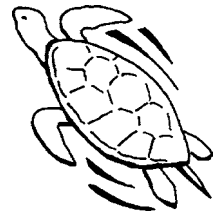
Resources for Further Reading and Research

Ants: Little Creatures that Run the World, a NOVA video with E.O. Wilson (Video is included with Alpine/Aeolian Unit 4 “Good Critters, Bad Critters.”)

California Department of Food and Agriculture,
“Red Imported Fire Ant Information” at
<pi.cdfa.ca.gov/rifa/newfact.htm>.

“Myrmecology” at <www.myrmecology.org>.
Includes general background on ants and the
study of ants as well as a variety of links to other
ant-related sites.

Hawai‘i Ecosystems at Risk, “Pest Ants in
Hawai‘i” at
<[www.hear.org/AlienSpeciesInHawaii/ants/
index.html](http://www.hear.org/AlienSpeciesInHawaii/ants/index.html)>.



Activity #1

Finding the Little Fire Ant

● ● ● In Advance *Collecting Ants*

Materials & Setup

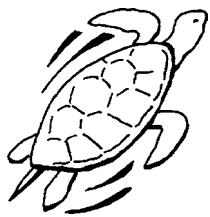
- Three (or more) clean disposable chopsticks
- Optional: Bright orange paint or felt-tip markers
- Peanut butter (the cheaper generic kind works best; the “natural” kind doesn’t work as well)
- A spoon
- Small paper cups
- Small self-sealing plastic bags, such as Ziplocs (sandwich size or the even smaller snack size)
- Sharp or mechanical pencils
- Specimen labels (see Student Page “Survey for Little Fire Ants,” p. 20)
- Optional: tongs or gloves if you do not want to pick up bait sticks without them and possibly get ants on yourself

For each student

- Student Page “Finding the Little Fire Ant” (pp. 12-15)
- Student Page “Survey for Little Fire Ants” (pp. 16-20)

Instructions

- 1) Several days before you start this unit, hand out the Student Page “Finding the Little Fire Ant.” Ask students to collect ants to bring to class on the day you will be starting the unit. The student page contains a list of materials students will need (those listed above).
- 2) Students may collect ants at home or another location of their choosing. With the help of the student page, they should be able to do the ant collections by themselves. You may want to walk students through the steps in the classroom or even take them out on school grounds to do a trial run.
- 3) This activity is part of an ongoing effort to monitor for the presence of the little fire ant on Maui. Because the information students develop may be used by researchers, students **MUST**:
 - Follow the ant collection instructions in the student page precisely, and
 - Be honest about where the ants were collected. Students may be tempted to share ants with each other and claim they were collected in different places. Make sure students understand that being dishonest about where ants were collected could interfere with efforts to eradicate little fire ants if your class discovers them.



● ● ● Class Period One *Little Fire Ant Identification Lab*

Materials & Setup

- Frozen ant specimens collected by students

For each student or lab groups of two to four students

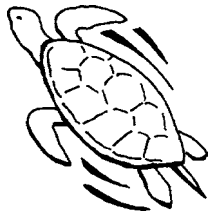
- A hand lens of at least 10x or a dissecting microscope (one for each lab group or student)
- Student Page “*Wasmannia* Identification Key” (pp. 21-22)
- “Color *Wasmannia* Key” (master, pp. 10-11)
- Ruler with mm markings

For each student

- Student Page “Finding the Little Fire Ant” (pp. 12-19)
- Student Page “Little Fire Ant Quiz” (pp. 23-24)

Instructions

- 1) Divide students into lab groups of two to four students each. Or allow students to work on their own if you have enough magnifying lenses or dissecting microscopes to go around.
- 2) Instruct students to keep each specimen with the appropriate bag and label. That way if there are questions about identification or if the specimen appears to be a little fire ant, the correct information about where it was collected will be readily available.
- 3) Hand out the Student Page “*Wasmannia* Identification Key” and the “Color *Wasmannia* Key.” Explain that students will be looking for ants that match the distinguishing characteristics of the little fire ant.
- 4) After your students (with your help, if necessary) have eliminated all ants they know are NOT *Wasmannia auropunctata*, gather all remaining specimens, put them in their bags with the correct label inside, and store them in the freezer. These specimens may include:
 - a) Ants you have identified as *Wasmannia auropunctata*, and
 - b) Ants that MAY be *Wasmannia auropunctata* (i.e., you are uncertain about the identification).
- 5) If there are specimens that you believe are or may be little fire ants:
 - Write your (the teacher’s) contact information on the back of the corresponding specimen label.
 - Put the label in the bag along with the ants and the chopstick. Seal the bag.
 - If there is more than one questionable collection, keep each in its own bag with its own label.
 - Mail the bags to: Ellen VanGelder; Research, Haleakalā National Park, P.O. Box 369, Makawao, HI 96768.A trained biologist will identify the ants and notify you if you have found a little fire ant.
- 6) Assign the Student Page “Little Fire Ant Quiz” as homework.



Journal Ideas _____

- Based on your experience collecting ants, what do you think it would be like to be a field researcher studying insects? Is this a job you think you would like? Why or why not?
- What safety precautions did you take while collecting ants? Why are precautions like these important for people who study insects?

Assessment Tools _____

- Participation in and conduct during the lab
- Student Page “Little Fire Ant Quiz” (teacher version, pp. 8-9)
- Journal entries

Some teacher-only resources have been omitted from the online document.

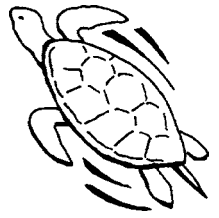
They are available as password-protected files at:

www.hear.org/hoike/teachermaterials

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They are available as password-protected files at:

www.hear.org/hoike/teachermaterials



Color *Wasmannia* Key

- 1a. Body (not including antennae) 2mm or more in length **NOT WASMANNIA**
- 1b. Tiny, body less than 2mm in length.....2



- 2a. Ant is all dark brown to black in color **NOT WASMANNIA**
- 2b. Ant is not all dark brown to black in color (e.g., red, yellow, or light brown).....3

Dark brown/black ants

Ants not all dark brown/black



Solenopsis papuana



Ochetellus glaber

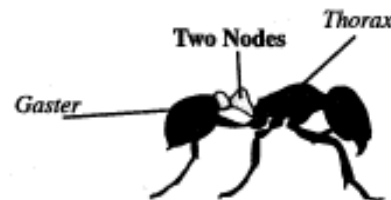
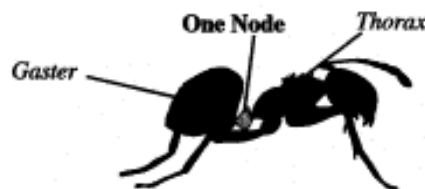


Wasmannia auropunctata
Color=light brown/
orange



Solenopsis geminata
Color=reddish

- 3a. One node on waist between thorax and gaster. **NOT WASMANNIA**
- 3b. Two nodes on waist between thorax and gaster.....4

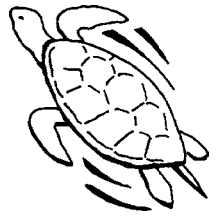


- 4a. Ant is bi-colored (e.g., gaster and/or head are a different color than rest of body) **NOT WASMANNIA**
- 4b. Ant is all one color (yellow, red, orange, light brown).....5

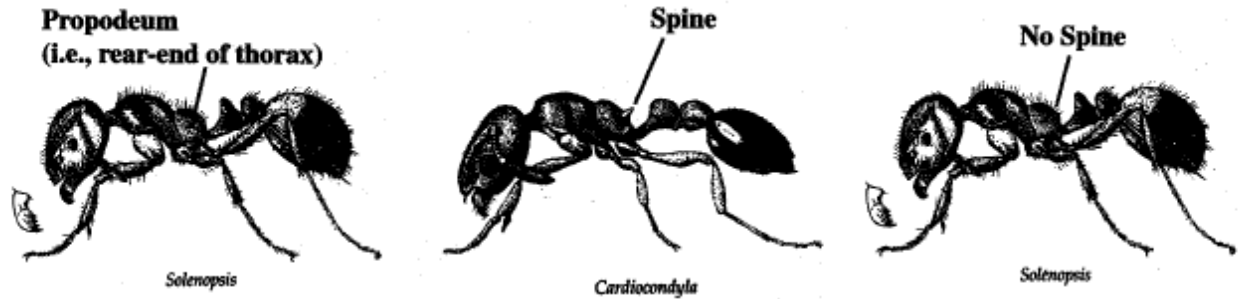
Bi-colored ant
Monomorium floricolor



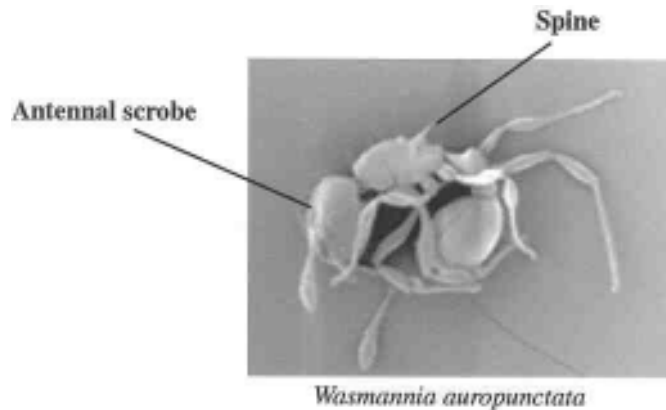
One-colored ant
Wasmannia auropunctata



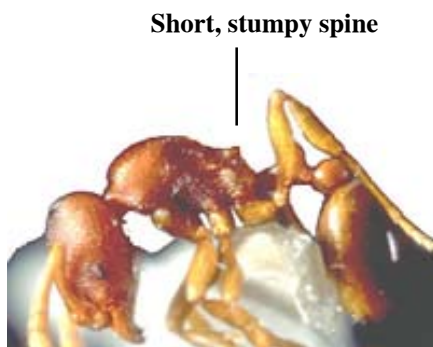
- 5a. Propodeum is smooth, no spines present **NOT WASMANNIA**
5b. Propodeum with a distinct pair of spines present.....6



- 6a. Antennal scrobe (groove) absent, propodeum spines short and stumpy *Tetramorium simillimum*
6b. Antennal scrobe (groove) present, propodeum spines long and pointy **Wasmannia auropunctata**



Wasmannia auropunctata



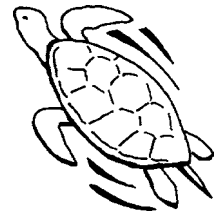
Tetramorium simillimum



Wasmannia auropunctata

Image Credits

- Walter Nagamine, *Hawai'i Department of Agriculture (1a/b Pheidole megacephala, Wasmannia auropunctata; 2b, 4b, 6b Wasmannia auropunctata)*
- Neil Reimer, *Hawai'i Department of Agriculture (2a Solenopsis papuana, Ochetellus glaber; 4a Monomorium floricolor)*
- Hirotami T. Imai and Masao Kubota (2b Solenopsis geminata)
- E. W. Huddleston, A. A. Laplante, and S. S. Fluker, "Pictorial Key of the Ants of Hawaii Based on the Worker Forms," *Proceedings of the Hawaii Entomological Society, Vol. 20, No. 1, 1968, pp. 71-79 (3a/b line drawings, color added)*
- M. R. Smith, *House Infesting Ants of the Eastern United States, Technical Bulletin No. 1326, Agricultural Research Service, U.S. Department of Agriculture, 1965, reprinted in Bert Holldobler and Edward O. Wilson, The Ants, Harvard University Press, Cambridge, Massachusetts, 1990 (5a Solenopsis)*
- M. R. Smith, "A Generic and Subgeneric Synopsis of the United States Ants, Based on the Workers (Hymenoptera: Formicidae)," *American Midland Naturalist, Vol. 37, No. 3, pp. 521-647 reprinted in Bert Holldobler and Edward O. Wilson, The Ants, Harvard University Press, Cambridge, Massachusetts, 1990, (5b Cardiocondyla)*
- Dennis Kunkel Microscopy, Inc., ©2001 (6b Wasmannia auropunctata)
- American Natural History Association (6a Tetramorium simillimum)



Finding the Little Fire Ant

No ants are native to the Hawaiian Islands, yet a total of 44 ant species have been recorded here. All of these species were accidentally introduced by humans. Some ants are especially good at “hitching a ride” with humans, expanding their range by traveling in goods and cargo being shipped around the world. These species are known, fittingly, as “tramp ants.”

Among the ants that have not yet made their way to Maui is one tramp species known as the little fire ant (*Wasmannia auropunctata*). The little fire ant is native to Central America and the northern part of South America. This species gets its name from its powerful sting that can feel fire-like to the person or animal on the receiving end of the sting. The little fire ant could be a big problem for three main reasons:

- It is very destructive to native ecosystems in areas that it has already invaded,
 - It is a serious nuisance to humans and domestic animals, and
 - It has a good chance of getting to Maui.
- Indeed, the little fire ant may already be here.



Scanning electron microscopy image of *Wasmannia auropunctata*
(Photo: © Dennis Kunkel Microscopy, Inc.)

Why we don't want the little fire ant on Maui

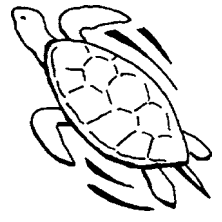
Effects on native ecosystems and species

The little fire ant has invaded several areas around the world. It is a destructive, pervasive, tramp ant species that occurs in very high densities. Little fire ants have a relatively powerful sting, will defend themselves and their nests, eat a wide variety of prey, and are extremely voracious predators of “invertebrates,” (animals without backbones).

The little fire ant wreaks havoc in the native ecosystems it invades. It often completely takes over an area, eliminating other ants and attacking and preying on native invertebrates, and even vertebrates such as reptiles and mammals. In the Galapagos Islands, for example, little fire ants have been reported to attack the Galapagos tortoise, a highly endangered species. The ants attack the tortoises' eyes and reproductive organs, damaging their vision and leaving them unable to

reproduce. On the Pacific islands of New Caledonia, this ant has dramatically decreased populations of several animals, including geckos and lizards. The little fire ant may also sting the eyes of mammals, perhaps because they are attracted to the moisture. Mammals with eye damage believed to be caused by little fire ants include elephants and domestic cats, both in Gabon (Africa).

Little fire ants eliminate or reduce populations of invertebrates and vertebrates either directly, by preying on them, or indirectly, by outcompeting them for resources (such as food, nesting habitat, or territory). Little fire ants



tend to have severe impacts on native invertebrate communities, eliminating some species, reducing the abundance of others, and reducing invertebrate diversity overall.

There are no native ants on the Hawaiian Islands, so as ant species make it to the islands and become established, they may pose a significant threat to our native ecosystems. Hawaiian native plants and animals have evolved over millions of years without having to defend themselves against the predatory abilities of ants like the little fire ant.

Effects on humans and domestic animals

The little fire ant has painful stings, a defensive nature, and the tendency to occur in dense populations. That adds up to bad news for humans and their domestic animals. It is difficult to enjoy being outdoors in areas where they have invaded. Little fire ants sting when they are rolled on or touched, or when people or animals come into contact with the plants in which the ants are nesting or feeding. People get stung while gardening, picking fruits or flowers, or enjoying other outdoor activities. An individual ant can deliver multiple stings, and often several ants attack at once. This ant is also known to move into homes in search of food, seriously annoying inhabitants with their stings. Different people react differently to this ant. Some people feel a painful sting followed by an

itch that goes away in a few minutes. With other people welts may develop on the skin where they were stung, and the itch may last for several days.

Why the little fire ant has a good chance of getting to Maui

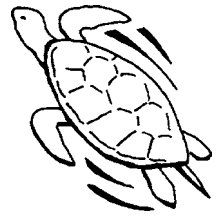
Like other tramp ant species, this ant often gets to new places by stowing away on goods (particularly nursery plants) that are shipped from infested areas. This species is currently “on our doorstep,” having recently become established on the island of Hawai‘i. The little fire ant became established in areas around Hilo by stowing away in nursery plants imported to the island from another country or possibly from Florida. Now, since nurseries on the Big Island often ship plants to neighbor islands, there is a good chance that the little fire ant could get to Maui.

In fact, the little fire ant may *already* be on Maui. It was not discovered on Hawai‘i until March of 1999. However, entomologists studying the little fire ant believe the ant may have been on the Big Island for as many as five or six years before it was discovered.

When the little fire ant was discovered on Hawai‘i, the Hawai‘i Department of Agriculture required that all nursery plants shipped from infested areas of the Big Island be inspected for the ant before being shipped. If the ants are found, the nursery stock is either treated with insecticide before shipping or not shipped at all. But if the ants have been on the island since around 1994, there is a chance that infested nursery stock was shipped from the Big Island without anyone knowing the ants were there. It is reasonable to think that the little fire ant could have made it to Maui by now, from its neighbor island or from another location.



Little fire ants sometimes congregate on plants. (Photo: Ellen VanGelder)



For this species of ant, as with many “pest” species, the key to avoiding its destructive effects on Maui is to prevent it from getting here in the first place. This is done through a series of precautions and inspections called “quarantines.” The Hawai‘i Department of Agriculture has instituted a little fire ant quarantine on agriculture and nursery items destined for uninfested areas of the state. However, if the ant already occurs on Maui (and right now, nobody knows if it does or not), it is very important to find it soon, before it develops large, well established populations. There is a much better chance of eradicating them or controlling their spread if we find them when populations are still small.

It is in the best interest of all of us to find out as soon as possible if the little fire ant has reached Maui—and if so, where it occurs. You can help find out. In this activity, you will collect ants near your school, home, or any place else you visit on the island. You will take these ants back to the classroom or laboratory to identify whether they

are (or might be) *Wasmannia auropunctata*, the little fire ant.

What you should know about the little fire ant

Before heading out into the field to survey for this species, you need to learn a little bit about the little fire ant (*Wasmannia auropunctata*).

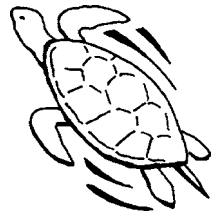
Here is a brief description:

- The little fire ant is a tiny (about 1.5 mm long) ant that is light orange in color.
- Little fire ants move very slowly compared to other ants, and with their small size it is sometimes even difficult to tell they are there — people mistake them for little specks of dirt.
- Little fire ant workers—the ants you are most likely to see and collect—are “monomorphic” (mono = one; morph = shape or type). That means they look alike. They are similar in size, shape, and color.

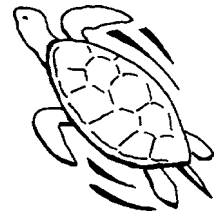


- This ant is both “terrestrial” (ground-dwelling) and “arbo-real” (tree-dwelling), and can survive in a wide variety of habitats. They nest almost anywhere, including on the ground (under logs, sticks, rocks, or debris) and in plants or trees (under the bark or in crevices of the plant).

Little fire ants gather on a bait stick. You’ll be collecting ants in this way. (Photo: Ellen VanGelder)



- Because the ants move very slowly, it is easy to avoid getting stung while surveying for them. In fact, little fire ants often stand relatively still, or simply fall off the bait stick when you disturb it (for example, by picking it up). Many other species, on the other hand, will frantically run up and down the stick if it is disturbed or picked up.
- As with many other “tramp” ant species, the way the little fire ant disperses naturally is via “budding.” This means that the newly mated queens travel on foot to a new location within a few meters of their birth colony. This makes the spread of their populations easier to track, and it makes the populations easier to control or eradicate than species that have queens that fly.



Survey for Little Fire Ants

It's Easy to Do Without Getting Stung!

Five Easy Steps

Your ant survey will be conducted in five easy steps:

- 1) Putting out bait for ants
(For the little fire ant you'll use peanut butter placed on a chopstick.)
- 2) Collecting the ants that come to the bait
- 3) Labeling the collection
THIS IS IMPORTANT!!
- 4) Freezing the ants to kill and preserve them
- 5) Taking your specimens back to the classroom so you can look at them closely in order to identify whether you have found any little fire ants

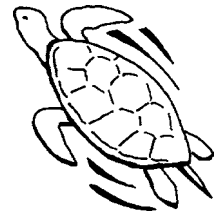
Materials Needed

For field surveys

- Three (or more) clean disposable chopsticks
- Optional: Bright orange paint or felt-tip markers
- Peanut butter (the cheaper generic kind works best; the "natural" kind doesn't work as well)
- A spoon
- Small paper cups
- Small self-sealing plastic bags, such as Ziplocs (sandwich size or the even smaller snack size)
- Sharp or mechanical pencils
- Specimen labels (in this student page)
- Optional: tongs or gloves if you do not want to pick up bait sticks without them and possibly get ants on yourself

For ant identification (in your classroom or laboratory):

- A hand lens of at least 10x or a dissecting microscope (one for each lab group or student)
- Student Page "Wasmannia Identification Key"
- "Color Wasmannia Key" (from your teacher)



Before You Begin—READ THIS!

If you are allergic, or suspect you may be allergic, to bee or wasp stings, please ask for help from your parents or friends. If you cannot get help, do not do this activity.

- Do not wear loose clothing, slippers, or a watch. The ants can get trapped and caught in this attire. Wear clothing with short sleeves, closed-toe shoes, and no watch or bracelet.
- Decide beforehand where you will place your baited chopsticks. Good places for sampling ants are beneath trees and shrubs, in or under potted outdoor plants, near garbage cans or buildings, or where you have seen ants before.

All locations are good to survey, but the best include those in the vicinity of current landscaping projects or ones that have been completed in the past five or six years. Landscaping projects often take place around parks, schools, resorts, shopping centers, and other new public facilities.

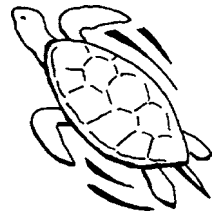
- If you want to go onto private property, be sure to obtain permission from the landowner first.

Procedure

- 1) Take three chopsticks and break them in half, so you have six sticks, each about four inches long. Then, if you think you'll have trouble finding the sticks after you've put them out, use paint or a magic marker to make one half of each stick bright orange. That way, you will be able to easily find them again in the field.
- 2) Take the following to the survey location: The six pieces of painted chopstick, a cup

with about one or two tablespoons of peanut butter in it, six self-sealing bags, six specimen labels, and a sharp pencil. You can also bring tongs or gloves if you are afraid of getting ants on you.

- 3) At the survey site, roll the unpainted half of one of the sticks in the peanut butter. Wipe excess peanut butter off on the edge of the cup. The stick should have just a light coating of peanut butter on the unpainted half, barely enough peanut butter to cover the stick's surface.
- 4) Place the stick on the ground, in a shady area—such as under or next to vegetation, next to potted plants or flowers, or at the base of a tree. These are good places to bait because little fire ants like to forage and nest on or around plants. Also, they don't like direct sun, so if the stick is fully exposed on a sunny day, the ants won't come to the peanut butter. In that case, your conclusion would be that there are no little fire ants at the location, when they may really be there!!
- 5) Place the next stick in a similar location, about 15 feet away from the first stick. Do the same until all six sticks are on the ground. We generally put sticks 15 feet apart because these ants move slowly and don't travel far, so you have to have several sticks in a small area if you want to detect a small population. However, if you choose to survey, for instance, in a recently landscaped area that is mostly lawn, with a few bushes spread far apart, you could also place one stick under each bush.
- 6) Let the sticks sit undisturbed (do not touch them!) for one or two hours. It's also important not to put your face close to the sticks during this time (like leaning over



trying to see if you have any ants)
because many ants will run away if you breathe on them. It is best to just leave the area and go do something else for an hour or two, then come back.

- 7) After the sticks have been out for one or two hours, it is time to collect your specimens! The first thing to do is to fill out labels for your specimens. Use **PENCIL** (Don't use regular pens! The ink will run and the information will not be readable!).

On each specimen label, write the following information:

- **Location of survey site** - Use as much detail as possible, so that someone else reading the label could find the location. Be sure to include the name of the town, because not all people know, for instance, that Olinda Rd. is in Makawao.
Example 1: 535 Olinda Road, Makawao, in garden at *makai* end of front yard
Example 2: Maui Community College, Kahului, along the side of the library building that is facing Ka'ahumanu Avenue
- **Date (month, day, year) and start time of survey** - **Example 1:** May 1, 2000, 1:00 p.m.; **Example 2:** April 30, 2000, 10 a.m.).
- **Your name**
- **Your teacher's name**
- **The name of your school**

Put a label inside each of your plastic bags.

- 8) Go to your first stick and **CAREFULLY** pick it up and drop it in your bag, then quickly seal the bag. Don't try to examine your ants while holding the stick! Some ants will frantically run about on the stick, and even onto YOU if you hold the stick. There are other stinging ants in Hawai'i besides the little fire ant, so you don't want to let any ants run onto you.

Words to the Wise

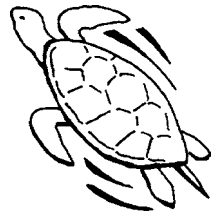
Remember, little fire ants move pretty slowly. So it is easy to avoid getting stung by this species. However, another ant that we have in Hawai'i, *Solenopsis geminata*, also stings, and tends to move very quickly when disturbed, so be careful. If you have very fast ants running on your stick, and you fear they might get on you, don't pick it up with bare hands. Instead, use tongs or gloves to pick up the stick, or simply leave the stick alone. Chances are, if the ants are running fast, they are not the little fire ant.

Also remember, little fire ants often stand relatively still, or simply fall off the bait stick when you disturb it (like when you pick it up). So again, be careful. If you pick up one of your sticks and see tiny little ants (which may just look like little specks) dropping off, you may have found the little fire ant!!

Also, don't open the bag again after you've sealed it. Use a new bag for each stick, so there is no chance of ants escaping from a previously sealed bag.

- 9) After all your sticks are collected and sealed in their plastic bags with their labels, take the bags back to school, or home, and put them in the freezer for a couple hours. This will kill the ants, allowing you to examine them closely.

Bring your ants to school with you on the day that your class will do its identification lab.

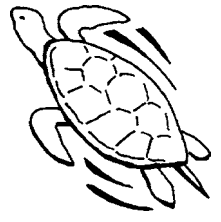


- 10) Take your ants out of the freezer and use the keys that your teacher will give you to determine if any of the ants you collected are little fire ants. If you are not sure about any of your specimens, ask your teacher for help. If you still cannot determine whether or not you have any little fire ants, give the specimen you are unsure about **AND ITS LABEL(!)** to your teacher so he/she can give it to a professional biologist to identify. The biologist will notify your teacher if you've found little fire ants.

- 11) If you've identified any of your specimens as little fire ants, have your teacher give them to a professional biologist for verification. The biologist will notify your teacher if you've indeed located a little fire ant.

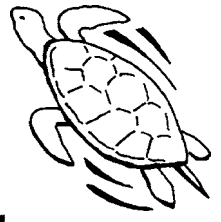
Didn't find little fire ants? Don't be disappointed!

Because "alien" (nonnative) little fire ants in Hawai'i are threats to our unique environment, we hope we do not find them here on Maui! Whether you found little fire ants or not, the information you have gathered is very important. You have contributed scientific data to an important conservation biology project. Thank you for your assistance!



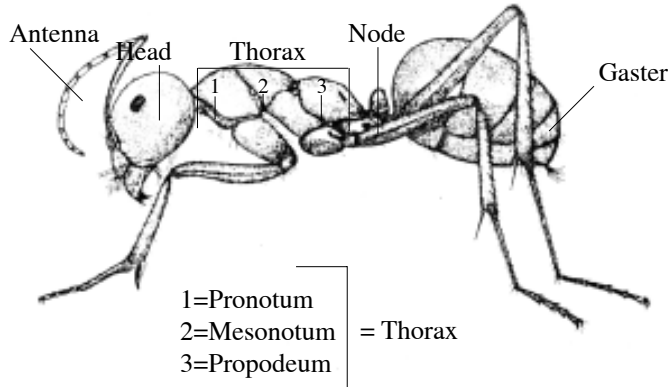
Specimen Labels

<p>Finding the Little Fire Ant Specimen Identification Label</p> <p>Location (detailed description):</p> <p>Date (month, day, year) and start time of survey:</p> <p>Your name:</p> <p>Your teacher's name:</p> <p>Your school:</p>	<p>Finding the Little Fire Ant Specimen Identification Label</p> <p>Location (detailed description):</p> <p>Date (month, day, year) and start time of survey:</p> <p>Your name:</p> <p>Your teacher's name:</p> <p>Your school:</p>
<p>Finding the Little Fire Ant Specimen Identification Label</p> <p>Location (detailed description):</p> <p>Date (month, day, year) and start time of survey:</p> <p>Your name:</p> <p>Your teacher's name:</p> <p>Your school:</p>	<p>Finding the Little Fire Ant Specimen Identification Label</p> <p>Location (detailed description):</p> <p>Date (month, day, year) and start time of survey:</p> <p>Your name:</p> <p>Your teacher's name:</p> <p>Your school:</p>



Wasmannia Identification Key

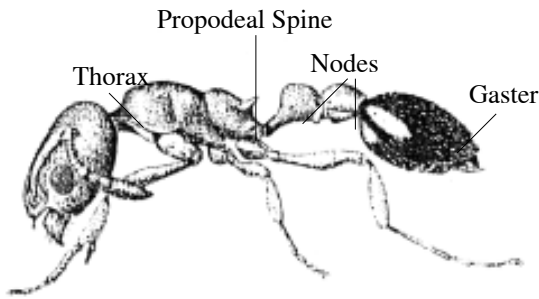
Introduction to Ant Anatomy



NOTE:

This ant has:

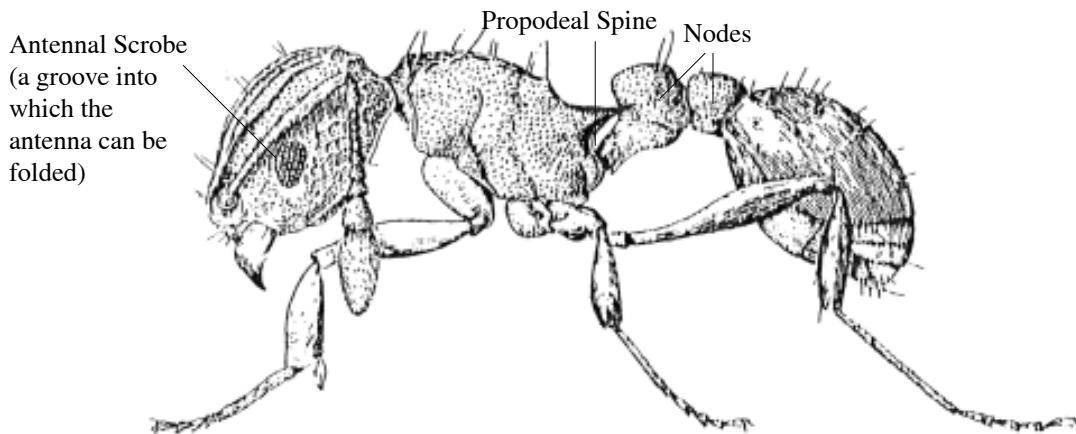
1. One node between thorax and gaster
2. Smooth propodeum (i.e., no spines)



NOTE:

This ant has:

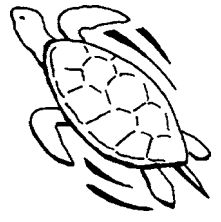
1. Two nodes between thorax and gaster
2. Pair of spines on propodeum (only one is visible in the diagram)



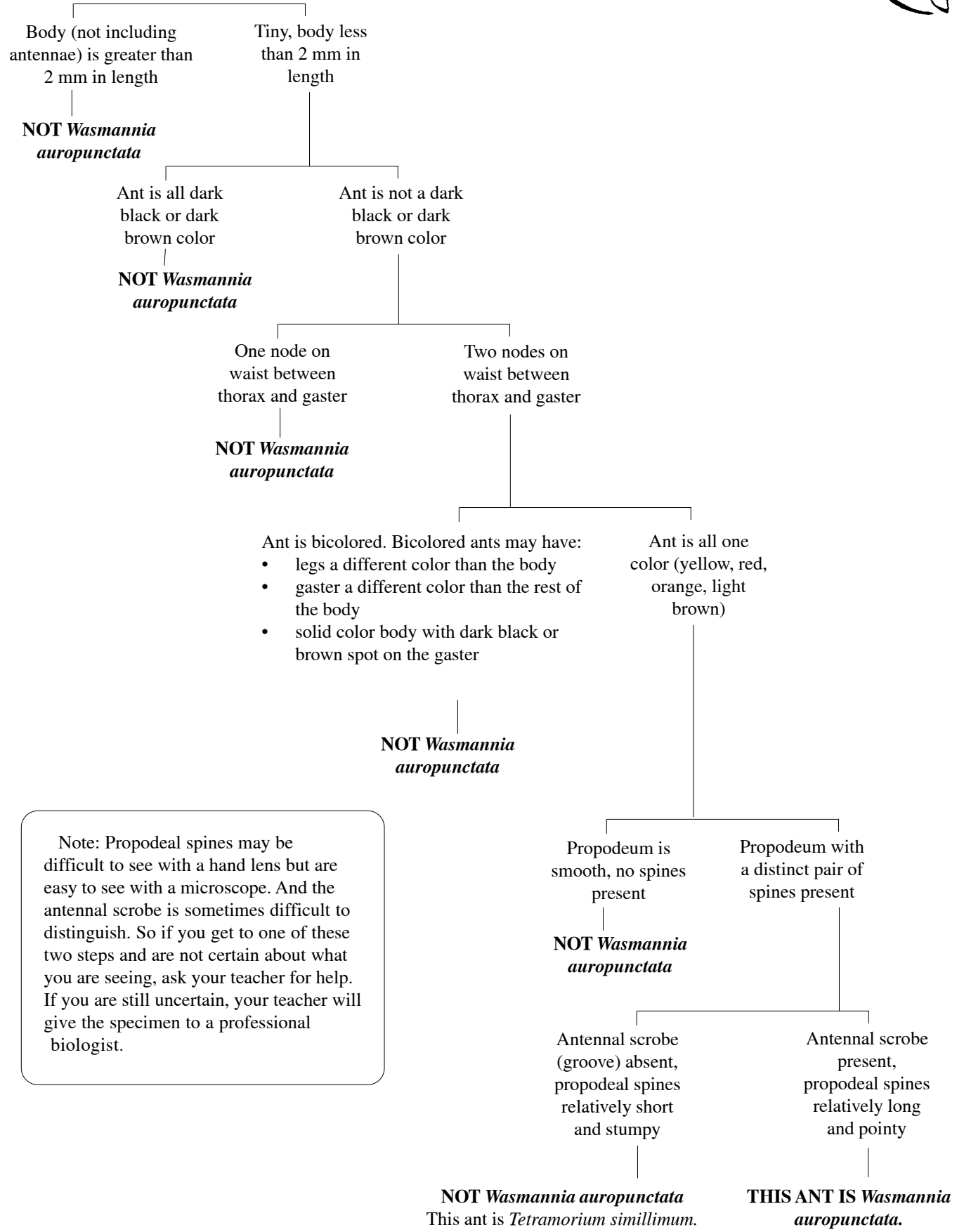
Wasmannia auropunctata



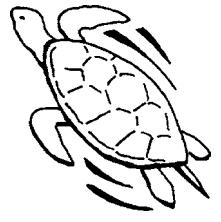
Illustrations: Top and bottom—M. R. Smith, "A generic and subgeneric synopsis of the United States ants, based on the workers (Hymenoptera: Formicidae)," American Midland Naturalist, Vol. 37, No. 3, pp. 521-647; Middle—CSIRO Entomology, reprinted in Bert Holldobler and Edward O. Wilson, The Ants, Harvard University Press, Cambridge, Massachusetts, 1990.



Wasmannia Auropunctata Key

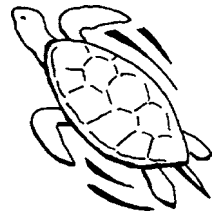


Note: Propodeal spines may be difficult to see with a hand lens but are easy to see with a microscope. And the antennal scrobe is sometimes difficult to distinguish. So if you get to one of these two steps and are not certain about what you are seeing, ask your teacher for help. If you are still uncertain, your teacher will give the specimen to a professional biologist.



4) How are people trying to prevent the little fire ant from getting to Maui on agriculture and nursery items?

5) Why is it important to know as soon as possible if the little fire ant is now on Maui?



Activity #2

Red Imported Fire Ant Prevention & Quick Response Plan

● ● ● In Advance *Research Preparation and Student Reading*

- Student research may go more quickly if you look through the “Research Resources” listing in the Student Page “RIFA Prevention and Quick Response Plan” (p. 31-33). Place an interlibrary loan order for some of the books and journal articles listed there, and put them on reserve in your school library or make them available in your classroom.
- Assign the Student Page “Endangered Water Birds Threatened by . . . Ants?!?” (pp. 27-30)

● ● ● Class Period One *Team Research Projects*

Materials & Setup

Available in the classroom or on reserve in the library

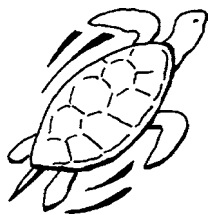
- One or more copies of the “Resource Packet on Red Imported Fire Ants” (included as an appendix to this unit)

For each student

- Student Page “Endangered Water Birds Threatened by . . . Ants?!?” (pp. 27-30)
- Student Page “RIFA Prevention and Quick Response Plan” (pp. 31-33)

Instructions

- 1) Divide the class into teams of four to eight students. Hand out the Student Page “RIFA Prevention and Quick Response Plan.” Each team will be responsible for developing a plan for the island of Maui. The plan’s purpose is to prevent the red imported fire ant (*Solenopsis invicta*) from becoming established on Maui as well as to respond rapidly to control the ants’ spread if it is discovered on the island. Students will be researching and developing their plans during this class period, on their own time, and during the second class period.
- 2) To jump-start students’ thinking, start the class off by reviewing the main points from the reading. Before the teams start their work, brainstorm a list of ideas with the whole class.
One question to brainstorm about is: “Where is the red imported fire ant most likely to be introduced to Maui?” Brainstorming places where entry is likely will help students think about how to target prevention and monitoring efforts.



Research may be done on the Internet, in local college libraries, and through interlibrary loan. See also the “Resource Packet” included as an appendix to this unit, which consists of pages downloaded from various Internet sites listed in the Student Page “RIFA Prevention and Quick Response Plan.” Students may want to check the webpages themselves for updated information.

Each team will produce an outline and rationale for its plan. Use the Student Page “RIFA Prevention and Quick Response Plan” as a guide. As the group works together, each student should take responsibility for doing a particular aspect of the research so that the work—and the learning—gets spread around. Use the four elements of the plan listed on the student page (p. 31) to divide responsibility. For groups of more than four students, have pairs of students work together.

Note

Allow several days between class periods one and two to allow teams time to work on their research and plans.

● ● ● **Class Period Two** *Research Team Meetings*

- 1) Allow student research teams to meet to finalize their plans and to prepare for their in-class presentations.

● ● ● **Class Period Three** *Team Presentations*

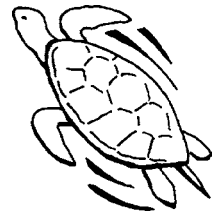
- 1) Student teams make five- to ten-minute presentations of their plans to the class.

Journal Ideas

- How can you help spread the word about the threat of fire ants? What do other people need to know?
- How big of a threat do you think red imported fire ants are to Maui native ecosystems, including wetlands? Explain your reasoning.

Assessment Tools

- Prevention and Quick Response Plans (see the Student Page “RIFA Prevention and Quick Response Plan” for a list of elements that will help you evaluate the plans)
- Team presentations



Endangered Water Birds Threatened by . . . Ants!?!?

In 1992, Keālia Pond National Wildlife Refuge was created from land donated to the government by the Alexander & Baldwin company. A primary purpose of the refuge is to protect habitat for three endangered Hawaiian water bird species: the *ae'ō* (Hawaiian black-necked stilt), *'alae ke'oke'o* (Hawaiian coot), *koloa* (Hawaiian duck).

These endangered species—and other native water birds—breed, nest, raise their young, and reside year round in wetland areas like Keālia Pond, scattered around the islands. All together, eight native species of water birds rely on wetlands, including the ones listed above and the Hawaiian gallinule or moorhen, Laysan duck, pied-billed grebe, fulvous whistling duck, and black-crowned night heron.

In the fall and winter, Keālia Pond and other Hawaiian wetlands come to life with an influx of migratory birds that head south from colder climes. Pintail ducks, Canada geese, sanderlings, and plovers (including the *kōlea*) join some 90 other species of water birds and an occasional gull or osprey blown in by winter storms.

But scientists predict the refuge won't be such a lively place if the red imported fire ant (*Solenopsis invicta*) gets to the Hawaiian Islands. And it's the native species that nest here that are likely to be hardest hit.

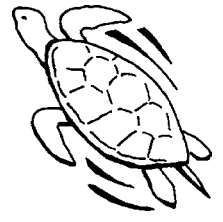
Invicta Means Invincible

Solenopsis invicta was so named by Dr. William Buren in 1972. The meaning of the Latin "invicta" is "invincible," which is an accurate description of the red imported fire ant. The red imported fire ant (or RIFA, as you'll see in much of the nonscientific literature about these ants) is a particularly aggressive invader, even overrunning areas that were once inhabited by another aggressive fire ant species, *Solenopsis geminata*.



Ae'ō in a pond
(Photo: Eric Nishibayashi)

RIFA colonies are extremely dense and grow rapidly, compared to other ant species. Individual colonies consist of hundreds of thousands of ants, and there can be 1500-3000 worker ants *per square meter* in infested areas. Imagine an eighth of a cup of rice grains running around in your bathtub and you get the picture. The red imported fire ant is aggressive, territorial, and predatory—with a powerful sting that makes it a danger to most animals.



Some ant species run away when their nest is disturbed or the object they are on moves. Not so for *Solenopsis invicta*. Thousands of these ants will swarm on and relentlessly sting anything that is unfortunate enough to disturb their colony. One researcher was stung over 250 times on one leg

Solenopsis invicta was unintentionally brought to Mobile, Alabama in the 1930s, probably in soil used as ship ballast. Since that time, it has invaded over 300 million acres in the United States, primarily in southeastern states. Since the red imported fire ant has been around the continental

***Solenopsis invicta* = red imported fire ant = RIFA**

U.S. for decades, scientists have had plenty of time to study the ants' effect on wildlife. Studies in wetlands have reported:

within ten seconds of inadvertently disturbing a nest. These ants are quick, each one can sting repeatedly, and the sting is exceptionally painful, usually turning into a white pustule by the following day.

- Water bird breeding success declines in areas inhabited by *S. invicta*. RIFA attack and prey upon pipped eggs and nestlings of several species of ground- and shrub-nesting birds including egrets, herons, spoonbills, cormorants, and gulls. There was a 92 percent overall reduction in water bird reproduction during the part of the breeding season studied. During one month, hatchling mortality was 100 percent in RIFA-infested areas, compared to 0 percent in non-infested areas (Drees).
- *S. invicta* attacks the nestlings of wood ducks and is thought to exclude wood ducks from natural cavity nest sites. In one study, RIFA destroyed 15 percent of clutches in wood duck nest boxes (Ridleyhuber).
- In RIFA-infested areas, chick mortality among endangered least terns is 27 percent higher than in noninfested areas (Lockly). Least terns nest on the ground.

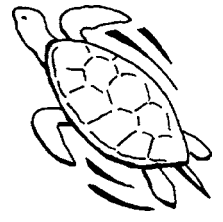
The red imported fire ant is an opportunistic feeder, taking advantage of whatever food source is at hand. They actively prey on invertebrates, vertebrates, and plants. Any animal that is relatively immobile and unable to run away from attacking ants is susceptible to RIFA predatory attacks. These ants are documented to have preyed upon a whole range of animals including birds, lizards, turtles, small mammals, and invertebrates. Human deaths have also been reported among individuals who are hypersensitive to *S. invicta* venom or who were bedridden and immobile.

Nestlings and “pipped” eggs (which have just started to hatch and have a hole broken in them), especially of ground-nesting birds, turtles, and lizards, are particularly vulnerable to predation. If *Solenopsis invicta* makes it to the islands, that fact could spell trouble for Hawaiian wetland birds.

***Solenopsis Invicta* in Wetlands**

The red imported fire ant is well adapted to wetland conditions. It is believed to be native to southern Brazil, in a region where seasonal flooding is the norm. RIFA is able to thrive in seasonally flooded habitats where other ant species are absent.

In Hawai‘i, wetland habitat is extremely rare, comprising only about three percent of the islands’ total land area. Degradation and loss of habitat have been primary contributors to the decline of native water birds. Invasion by red imported fire ants would undoubtedly cause further habitat degradation—a loss that species whose populations number as few as 1500 birds (in the case of the *ae‘o*) may not be able to withstand.



Other Fire Ant Concerns

Protecting endangered water birds is not the only reason people want to keep the red imported fire ant away from Hawai‘i. They are also concerned about what could happen to our quality of life and the future of the tourism industry if *S. invicta* establishes itself here. In some places it has invaded, it is impossible to sit in the grass or stand on a shoreline to fish without being stung. Hunting, ranching, and outdoor recreational activities can be affected by the presence of this ant. And, once it is established, the red imported fire ant has proven impossible to eradicate. In many places, control programs have reduced ant populations to bearable levels with repeated use of chemical pesticides. However, this approach works only for limited areas, and there are concerns about the threats widespread use of these toxicants would pose to water quality and the overall health of ecosystems such as wetlands.

In the 13 states and Puerto Rico where RIFA is found, it has been reported in virtually every crop. Because of its opportunistic feeding habits, including a predilection for seeds of all kinds, *S. invicta* has the potential to cause great damage to crops. It has also been known to cause damage to irrigation systems and cut down on the efficiency of agricultural operations as pickers and equipment operators adjust their work to avoid disturbing or running over nests.

Red imported fire ants also infest electrical equipment, chewing on insulation and causing short circuits or interfering with switching mechanisms. They sometimes nest in buildings and commonly nest in home gardens, landscaped areas, and nursery stock.

Some people point out that RIFA can have benefits, too. Researchers have found that RIFA can be beneficial in sugar cane and cotton fields where they prey upon pest species. And *Solenopsis invicta* predation may help control flea and tick populations. However, in a place

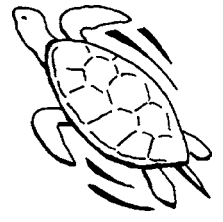
such as Hawai‘i, where native plants and animals evolved with no ant predators whatsoever and where working and playing outdoors is so important, it is difficult to conclude that the benefits of the red imported fire ants would outweigh the long list of negative consequences of its arrival here.



RIFA can be a threat to agricultural operations (Photo: Carol Gentz)

In 1998, the red imported fire ant was found in California. Since then, infestations have been discovered in several counties. Around the state, people are scrambling to determine the best way to minimize the impact of this species. Now that RIFA has gained a foothold in California, some people believe it is just a matter of time before these ants make it to Hawai‘i. With the large volume of goods shipped back and forth between Hawai‘i and California, as well as the numbers of people who use California as a departure point for their air travels to the islands, the ants may have plenty of opportunities to hitch a ride over.

The state Department of Agriculture does have a quarantine and inspection policy for products such as nursery stock shipped to Hawai‘i from infested areas. But *S. invicta* has successfully worked its way across the continental United States, despite the existence of a federal quarantine policy begun in 1958. Many researchers, agricultural operators, and resource managers



believe it will take much more than agricultural quarantine to protect Maui and the other Hawaiian Islands from this invader.

Joining forces as the “Ant Working Group,” they have begun putting together a prevention plan as well as a contingency plan for detecting and limiting the spread of red imported fire ants if they should arrive on the islands. Here are a few of their ideas for preventing RIFA from arriving on Maui:

- 1) Chemically treat goods before they are shipped from RIFA-infested areas.
- 2) Give Hawaii Department of Agriculture inspectors the authority to inspect non-agricultural items such as building materials.
- 3) Establish regular state reviews of first class mail from the mainland, looking for suspicious packages and then applying for federal warrants to inspect these packages.

Can you think of other ideas for preventing this dangerous invader from arriving on Maui—or for quickly responding to stop its spread once it gets here? *Your* idea could be one that ultimately protects Maui—especially its wetland areas—from the “invincible” *Solenopsis invicta*.

Sources

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Lockly, T., “Effect of Imported Fire Ant Predation on a Population of the Least Tern — An Endangered Species,” *Southwest Entomology*, No. 20, 1995, pp. 517-519.

Ridlehuber, K., “Fire Ant Predation on Wood Duck Ducklings and Pipped Eggs,” *Southwest Natur.*, No. 27, 1982, p. 222.

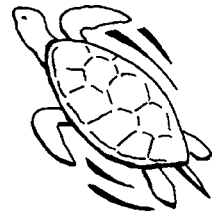
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VanGelder, Ellen, “HNIS Report on *Solenopsis invicta*” at <www.hear.org/hnis/index.html#HNISreportsavailable>.

_____, Personal communication and unpublished work plan for Proactive Protection of Hawaii’s Wetlands and Other Ecosystems from the Red Imported Fire Ant project, June 2000.

Vinson, S. “Impact of the Invasion of *Solenopsis invicta* on Native Food Webs,” in D. Williams (ed.), *Exotic Ants: Biology, Impact, and Control of Introduced Species*, Westview Press, Boulder, Colorado, 1994, pp. 241-258.

Weaver-Missick, T., “The Fire Ant Saga Continues,” *Agricultural Research*, September 1999.



RIFA Prevention and Quick Response Plan

Your team's assignment is to work together to develop a "Prevention and Quick Response Plan" for the red imported fire ant on Maui. You will present an outline and rationale for the plan to the class when you are finished. You may even want to pass some of your ideas along to the Maui Ant Working Group, a collaboration involving scientists and resource managers from around the island.

Goals

Like your team, the Maui Ant Working Group aims to:

- 1) Prevent the arrival of the red imported fire ant on Maui,
- 2) Monitor for its presence to detect it before it is well established, and
- 3) Respond rapidly and effectively to contain the spread of the red imported fire ant if it is found on Maui.

Research

Your plan needs to be backed up with factual information and a clear explanation of what each component is designed to accomplish. You will need to do some research in order to develop your plan. Your teacher has a collection of resources available for classroom use, and there are many other sources available through public and university libraries as well as on the Internet. See the "Research Resources" section of this student page for a beginning list of research leads.

Keywords for Internet searches include:

- red imported fire ant
- *Solenopsis invicta*

If you use the following search terms, double-check to make sure the information you retrieve is about *S. invicta* and not another ant species:

- fire ant
- pest ants
- pest ant control

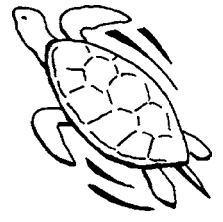
Outlining a Plan

Divide up responsibility for developing your plan among team members. Make sure everyone is responsible for part of the plan. Your plan should include the following elements:

- 1) A description of the problem, including potential threats to ecosystems and humans based on the problems encountered in other states;
- 2) A plan to prevent the ant's arrival;
- 3) A plan to monitor for its presence and detect it before it is well established; and
- 4) A plan to respond rapidly and contain the ant if it invades.

Support *each element* of the plan with:

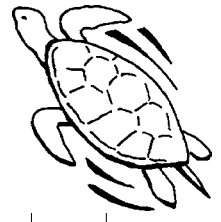
- 1) A description of your reasoning for this part of the plan and factual information that supports your plan;
- 2) Ideas about whom should be involved in implementing this part of the plan; and
- 3) Suggestions for containing costs (e.g., by forming creative partnerships, raising money locally, getting time and resources donated to the project, or involving students and other people who are not normally involved in work like this).



Starting Points

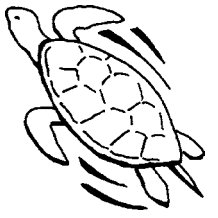
Here are some of the questions being asked by Maui Ant Working Group members as they consider what their plan will be. Use these questions as a starting point for your own thinking.

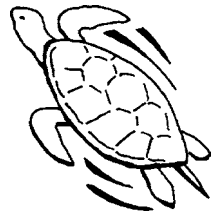
- What kind of information should Maui residents and visitors have about RIFA? What are the best ways to get that information to them? How can we get residents and visitors to pay attention to this threat?
- What is the basic ecology of RIFA—including its colony structure, how it reproduces, what makes it such a successful invader, suitable habitats, etc.? These characteristics affect how and how easily they may become established, how quickly they can spread, where they are likely to invade, and what kinds of controls are likely to work.
- Where is RIFA most likely to be introduced to Maui? In theory, it takes only one mated queen to establish a new colony, although there may be a much greater chance of survival if a whole or partial nest is moved. That is one reason nursery stock receives so much scrutiny, since ants and even nests can be moved in the soil they are shipped with. If RIFA came to Maui in nursery stock, where could it become established? What about other vehicles such as containers in which fruits or vegetables, soil, and other agricultural products are shipped? Airports? Cars being shipped from infested areas? Shipments of lumber and furniture? Where else might RIFA stow away?
- How does the current Hawai‘i and Federal RIFA quarantine system work? Has anything different been tried in other states or countries?
- What are the likely impacts/effects of the RIFA, should it ever become established on Maui or the Hawaiian Islands? Are there certain parts of the island or certain ecosystems that seem particularly threatened and of high priority for protection?
- What control mechanisms are currently being used and recommended in infested areas? What experiments are being tried with new methods such as “biocontrol” (using other insects or diseases to control populations of pest species such as the RIFA)?
- What kinds of permits would be needed to use some of the pesticides being used in other states, here on Maui in the places that are most likely to need protection? Should we be stockpiling pesticides so we can quickly respond if RIFA is found here?



Research Resources

	General Information	RIFA ecology	Control methods	Quarantine	Impacts of RIFA
Texas A&M University, Department of Entomology, "Imported Fire Ant" at <fireant.tamu.edu>.	•	•	•	•	•
VanGelder, Ellen, "Hawai'i Non-Indigenous Invasive Species (HNIS) Report on <i>Solenopsis invicta</i> " at <www.hear.org/hnis/index.html#HNISreportsavailable>.	•	•	•	•	•
California Department of Food and Agriculture, "Red Imported Fire Ant Information" at <pi.cdffa.ca.gov/rifa/newfact.htm>.	•				•
University of Arkansas, Arkansas Cooperative Extension Service, "Red Imported Fire Ant" at <www.arnatural.org/fireants/default.asp>.	•	•	•	•	•
Lockley, T. C., University of Minnesota Integrated Pest Management Program, "Imported Fire Ants" at <ipmworld.umn.edu/chapters/lockley.htm>.	•	•	•		•
County of Los Angeles, Agricultural Commissioner/Weights & Measures, "Red Imported Fire Ant" at <acwm.co.la.ca.us/scripts/RIFA.htm>.	•				•
National Park Service, "National Park Service Integrated Pest Management Manual—Fire Ants" at <www.colostate.edu/Depts/IPM/natparks/fireants.html>. <i>Includes a brief section on monitoring</i>	•		•		
Vinson, S., "Impact of the Invasion of <i>Solenopsis Invicta</i> on Native Food Webs," in D. Williams, (ed.), <i>Exotic Ants: Biology, Impact, and Control of Introduced Species</i> , Westview Press, Boulder, Colorado, 1994, pp. 241-258.		•			•
Drees, B., "Red Imported Fire Ant Predation on Nestlings of Colonial Waterbirds," <i>Southwest Entomology</i> , No. 19, 1994, pp. 355-359.					•
Lockly, T., "Effect of Imported Fire Ant Predation on a Population of the Least Tern — An Endangered Species," <i>Southwest Entomology</i> , No. 20, 1995, pp. 517-519.					•
Ridlehuber, K., "Fire Ant Predation on Wood Duck Ducklings and Pipped Eggs," <i>Southwest. Natur.</i> , No. 27, 1982, p. 222.					•
Weaver-Missick, T., "The Fire Ant Saga Continues," <i>Agricultural Research</i> , September 1999.			•		•
Moulis, R., "Predation by the Imported Fire Ant (<i>Solenopsis invicta</i>) on Loggerhead Sea Turtle (<i>Caretta caretta</i>) Nests on Wassaw National Wildlife Refuge, Georgia," <i>Chelonian Conservation Biology</i> , No. 2, 1996, pp. 433-436.					•
Tschinkel, W., "The Fire Ant (<i>Solenopsis invicta</i>): Still Unvanquished," in B. McKnight, (ed.), <i>Biological Pollution: The Control and Impact of Invasive Exotic Species</i> , Indiana Academy of Science, Indianapolis, 1993, pp. 121-136.	•	•	•	•	•





Activity #3

Race to the Wetlands Game

● ● ● Class Period One *Race to the Wetlands Game*

Materials & Setup _____

For each group of six to eight students

- One die
- “Race to the Wetlands Game Board” (included with this curriculum)
- “Race to the Wetlands Instruction Card” (master, p. 36)
- “Race to the Wetlands Game Cards” (master, pp. 37-61)
- Six to eight player pieces (master, p. 62)
- Six to eight pennies

Instructions _____

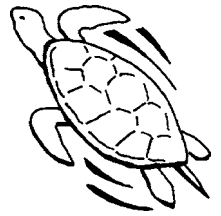
- 1) Divide students into groups of six to eight. Conduct the game. Use the game materials provided with the curriculum and the instruction card. This game is based on the ant collection activity and student reading assignments. Students will be “tested” on what they have read as well as learn new facts.

Journal Ideas _____

- Compare the game version of the race between ants and humans to the real-life efforts that people are making to prevent the arrival and establishment of red imported fire ants on Maui.

Assessment Tools _____

- Participation in the game



Race to the Wetlands

Instruction Card

Object of the Game

In this game, you are either a red imported fire ant or a human. The object is for all members of either species to get to Keālia Pond first. If all the people get to Keālia Pond first, they win and can stop the ants from threatening the native wildlife there. If all the ants get there first, they win and establish a population too large and too widespread for people to eradicate.

Rules

- Out of six to eight players, half are ants and half are people. Roll the die to determine who goes first, and proceed in a clockwise direction.
- Move your player pieces by the roll of the die, answering questions, and/or following instructions given on the game cards.
- Each player rolls the die only once per turn and draws only one card per turn.
- Keep each type of card in a separate pile. Once you have used a game card, put it on the bottom of the pile it was drawn from.
- When you land on a space, follow the symbol. Here's what happens:

✓ = **Hazards and Opportunities**

Another player draws a card and reads you the instructions on it. Follow them.

▼ = **Red Imported Fire Ants**

★ = **Prevention and Control**

◆ = **General Knowledge**

✕ = **Little Fire Ants**

Another player draws a card and reads the question on it. You answer the question.

Movement

Correct answer = Move forward 3 spaces.

Incorrect answer = Move back 1 space.

● = **Cooperation Opportunity**

Work together with your teammates (fellow ants or humans) to answer two questions from your choice of the four question categories

(▼★◆✕).

Movement

Answer both questions correctly = Each player on the team moves forward 3 spaces from where they are.

Get 1 answer wrong = Each player on the team moves backward 3 spaces from where they are.

To Win

Each player who reaches Keālia Pond (the endpoint of the game board) can help their team members (ants or people) answer questions until either all the ants are at the pond or all the people are at the pond. The first team with all members at Keālia Pond wins, and the game ends.

Some teacher-only resources have been omitted from the online document.

They are available as password-protected files at:

www.hear.org/hoike/teachermaterials

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