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PART FIVE. HABITATS TASK LIST

This is the list of tasks for Part Five. Habitats

Check them off as you complete them.

TASKS

- 5-1 ☐ Understanding Mosquito Habitats
- 5-2 ☐ Identifying + Mapping Local Habitats
- 5-3 ☐ Surveying Local Vegetation Habitats
- 5-4 ☐ Analyzing Community Surveys (Habitats)
- 5-5 ☐ Debriefing Habitats

In this part, the team will focus on researching where mosquitoes live and breed in the community. Research of man-made and natural habitats will be conducted.




5-1 Understanding Mosquito Habitats

Welcome to Part Five: Habitats, and Task 5-1. In Part Four you learned more about how the mosquito spreads diseases. Now, the team will begin learning more about the specifics of where mosquitoes like to live and breed in your community.

Objective

In this task, the team will be focusing on the following question from the question map.

- Where do mosquitoes live and breed?

Mosquitoes can live and breed in a variety of human and natural habitats. A habitat is the home or environment of an animal, plant, or other organism. The first step is understanding all the different types of habitats and breeding sites of mosquitoes. Then, in Task 5-2, you can start looking for these habitats and breeding sites in your local community. This information will be useful when creating your management plan at the end of your research.

1. Go to the Task 5-1 folder and get the Habitat Bingo game. There is only one version of this task.
2. To get familiar with different mosquito habitats, go through each so the team knows what they are. These are places where mosquitoes may live and lay their eggs.
3. Play a few games of Zika Zapp Bingo.
4. As a team, discuss the following questions.

- Which habitats from the bingo game do you think might exist in your research site or community?
- How does understanding which habitats exist in your community help when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?

Hooray! You completed Task 5-1. Check it off the task list. *Go to Task 5-2!*

5-2 Identifying and Mapping Local Habitats

In this task, the team will identify potential mosquito habitats in and around your research site. The team should look for both human and natural potential habitats. Opportunities to engage in the Citizen Science program GLOBE Mosquito Habitat Mapper are provided. Participate if you can.

Objective

In this task, the team will be focusing on the following questions from the question map.

- Where do mosquitoes live and breed?
- What influences this?

1. Go to the Task 5-2 folder and get the Identifying and Mapping Local Habitats instructions and GLOBE. You will also need your research map from Task 2-1. There are two versions of this task. Mosquito A involves collecting data by hand. Mosquito B involves using the Citizen Science GLOBE Mosquito Habitat mapper app. Choose the version that works for you. It might also be helpful to do both if you can. In that case, start with Mosquito A and then do Mosquito B.
2. As a team, read the Meet the Team reading.
3. Conduct a research site evaluation.
4. As a team, discuss the following.

Citizen Science Tip

If your team has access to technology, such as a smart phone or tablet, consider how you could use the GLOBE Mosquito Habitat Mapper app to share your local data with scientists around the world.

- How could your habitat survey of your research site be useful when thinking about where mosquitoes live and develop in your local community?
- How could this information be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?
- How could this information be useful when developing solutions to manage mosquitos in your local community?
- Changes in habitats can affect mosquitoes in your local area. How could you monitor habitat changes in your research site in the future? How could this information be useful to address the problem question in the future?

Continue to Task 5-3

5-3 Surveying Local Vegetation Habitats

In Task 5-2, the team learned more about different human and natural potential mosquito habitats in your research site. Another factor that can influence the presence of mosquitoes in your area is the vegetation. Vegetation is a term used to describe all of the plants found in a particular area or habitat. Many mosquitoes, eggs, and larvae will use the natural vegetation (the plants) in and around your research site as habitats or places to live, breed, and develop. Other types of vegetation can help keep mosquitoes away and can be useful for mosquito management.

Objective

In this task, the team will survey the vegetation in the area to understand how it could affect the mosquitoes living in your research site.

In this task, the team will be focusing on the following questions from the question map.

- Where do mosquitoes live and breed?
- What influences this?

1. Go to the Task 5-3 folder and get the Vegetation Survey form. There are two versions of this task. Mosquito A involves collecting data by hand. Mosquito B involves using some additional technology. Choose the version that works for you. It might be helpful to do both if you can. In that case, start with Mosquito A and then do Mosquito B.
2. As a team, conduct the vegetation survey in and around your research site.
3. If you're able, collect leaf or plant samples to create a research site vegetation book. Use the plant collection instructions in the task folder as needed.
4. As a team, discuss:

- Based on your habitat and vegetation survey of your research site, how could this information be useful when thinking about where mosquitoes live and develop in your local community?
- How could this information be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?
- How could this information be useful when developing solutions to manage mosquitos in your local community?
- Changes in vegetation can also affect mosquitoes in your local area. How could you monitor vegetation changes in your research site into the future? How could this information be useful to address the problem question into the future?

Continue to Task 5-4

5-4

Analyzing Community Surveys (Habitats)

In Task 2-3, the team surveyed people in your local community about mosquitoes.

Objective

In this task, you will do the same analysis you did during Tasks 2-4 and 3-6, and 4-6. Now you will focus on the community survey results only for Part Five: Habitats. The team will analyze the other parts of the survey in future tasks, so keep the survey results in a safe place.

In this task, the team will be focusing on the following questions from the question map in Task 1-10.

- What do people in our local community think and know about mosquitoes and mosquito-borne diseases?
- How can we effectively share and communicate mosquito-borne disease evidence with the community?

1. Go to the Task 5-4 folder and get the survey analysis instructions and questions. Choose the Mosquito A or Mosquito B task from the task folder.
2. As a team, determine how to compile the community survey results for Part Five from all team members. You will want to analyze the compiled data from the entire team. Develop your own method for compiling the data for Part Five, or use one of the methods in the instructions.
3. Create some graphs about this compiled community survey data. Use the instructions and examples in the task folder.
4. Use the graphs and data to answer these questions:
5. What interesting patterns do you see in the data from Part Five questions?
6. Which questions did most people in the community agree on?
7. Which questions did people in the community have different responses to?

Research Tip

As you may have noticed, the survey is broken into the same parts as this research guide. Analyze only the results from that part of the survey while working on that Part of the guide to make the analysis more manageable.

5-4

8. Discuss how this survey evidence could be useful when thinking about the question: What do people in our local community think about mosquitoes and mosquito-borne diseases?
9. Discuss how this survey evidence could be useful when thinking about the question: How can we effectively share and communicate mosquito-borne disease evidence with the community?
10. Discuss how this survey evidence could be useful when thinking about the problem question: How can we ensure health for all from mosquito-borne diseases?
11. Select one or two survey questions, write a claim, and provide the supporting evidence for the claim based on the question and evidence collected

Examples:

- The local community does not have a good understanding of where mosquitoes live and breed.
- Many local residents have standing water around their home that must be addressed when managing mosquitoes in the community.

12. Explain how the data evidence from the community survey supports your claims.
13. As a team, share some claims you created and the evidence that supports that claim.

Hooray! You completed Task 5-4. Check it off the task list. *Go to Task 5-5!*

5-5

Debriefing Habitats

This is the last task of Part Five: Habitats.

Objective

In this task, we will debrief Part Five: Habitats. This is good to do before we move on to the next part. The objective is to think about and discuss helpful information that was gathered during this part.

1. Remember the team norms.
   - Recognize the benefits of listening to a range of different perspectives and viewpoints.
   - Be open to new ideas and perspectives that challenge your own.
   - Be willing to cooperate with others to change things for the better.
2. Remember to use your meaningful conversation starters as needed throughout this discussion.
   - I agree with _____ because…
   - I disagree with _____ because…
   - I'd like to go back to what _____ said about …
   - I'd like to add_____
   - I noticed that …
   - Another example is …
3. Remember when you are making claims from evidence to use the following sentences.
   - I think this claim is best supported because …
   - I do not think this claim is best supported because …
   - I think this piece of evidence supports this claim because …
   - I do not think this piece of evidence supports this claim because …

5-5

4. Go to the Task 5-5 folder to get Debriefing Transmission instructions. There is only one version of the debrief.

5. Follow the instructions in the task folder to complete the five sections of the debrief.
   - Question Map Analysis
   - Community Partners
   - Perspectives
   - Identity
   - Problem Question

Hooray! You completed Task 5-5 and Part 5. Check it off the task list.

Congratulations! You have completed Part Five of your research. Give yourself a pat on the back.

You now know more about how and where mosquitoes live and breed. You also know more about factors that can affect where mosquitoes live and breed.

Keep this research easily available. Think about how it could help with your final project.

The next part of your research will focus on understanding different strategies to manage mosquitoes in your community.

Continue to Part 6: Management.

Notes:

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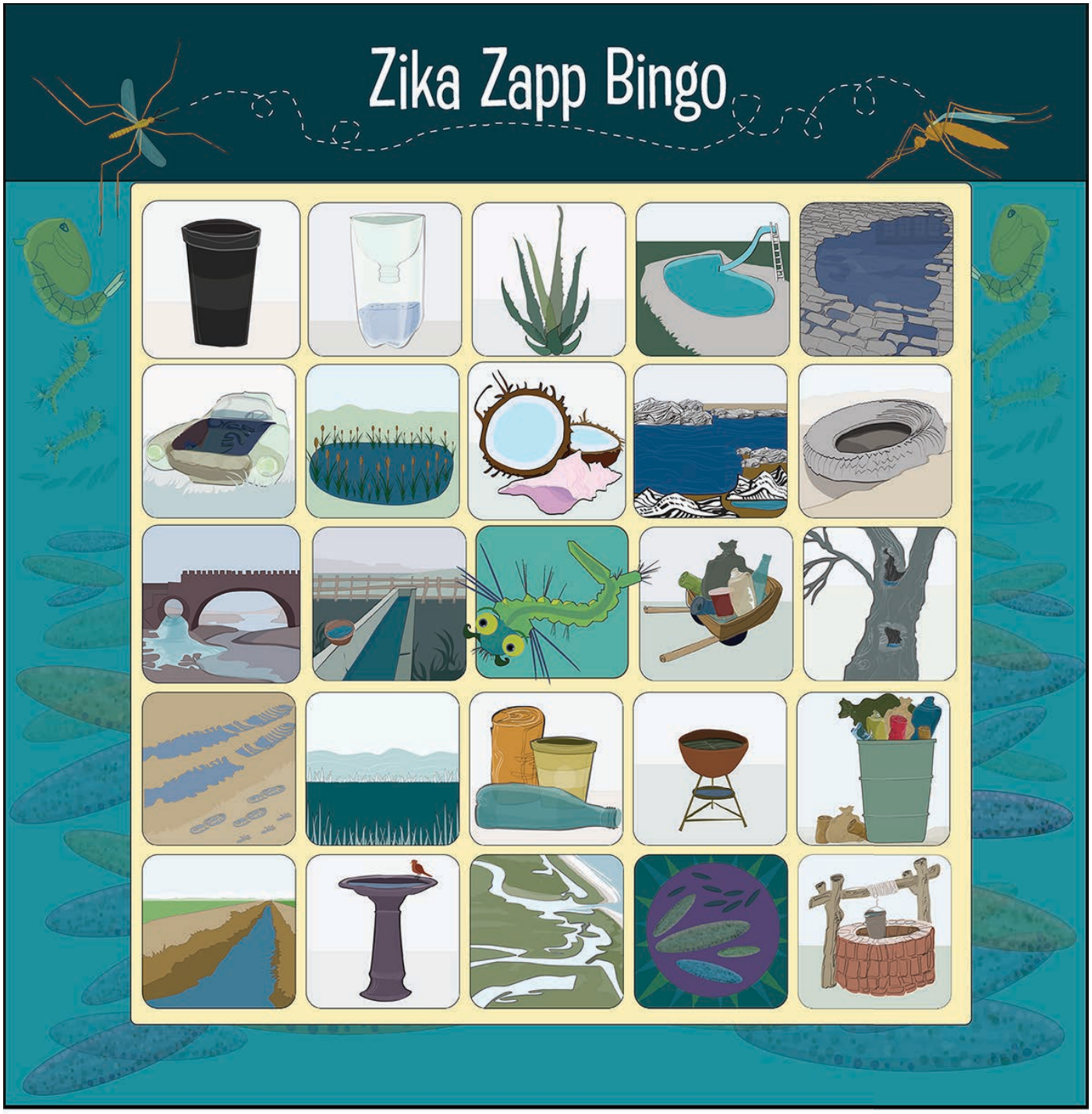
ZIKA ZAPP BINGO

40

Zika Zapp Bingo



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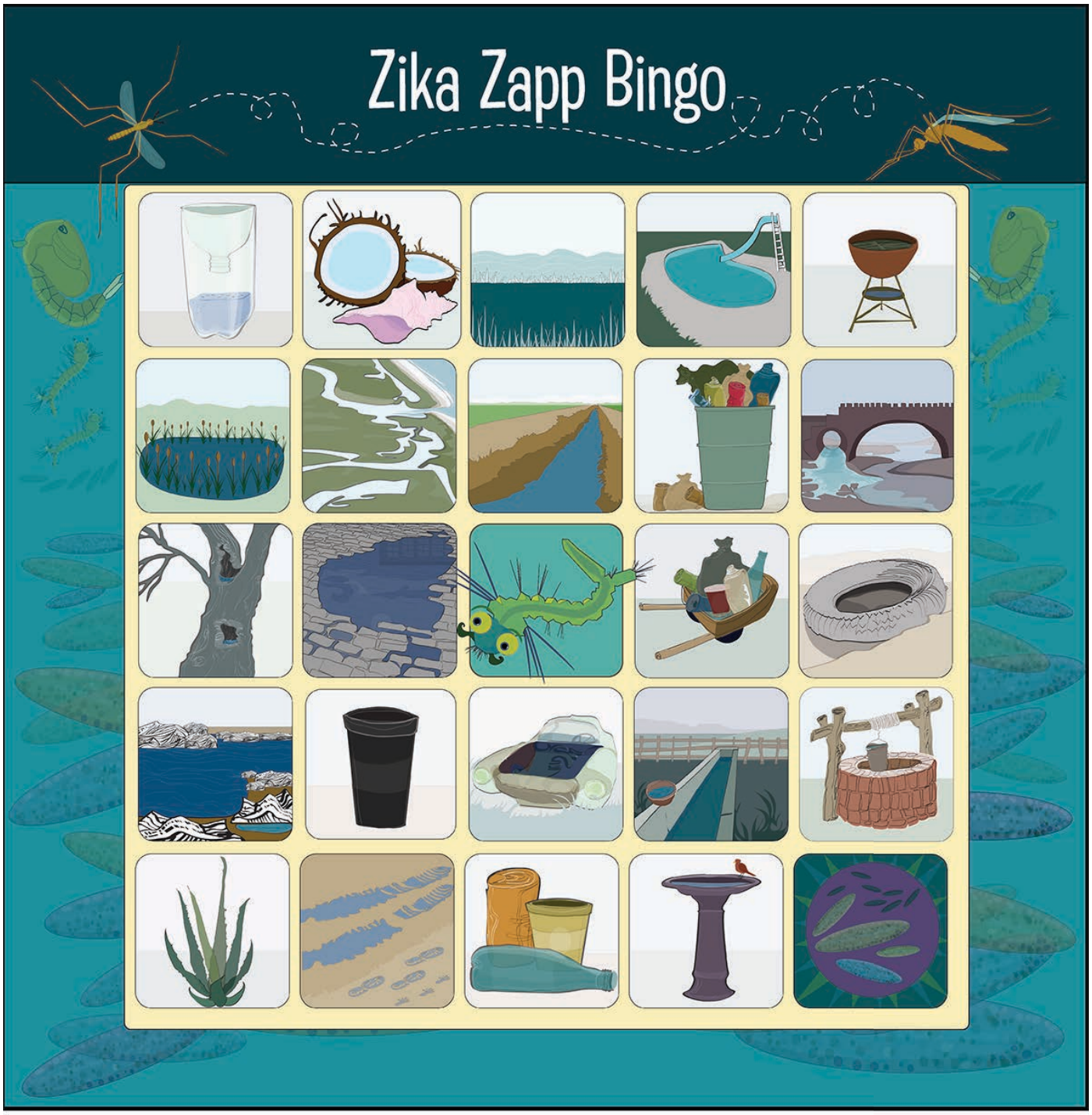

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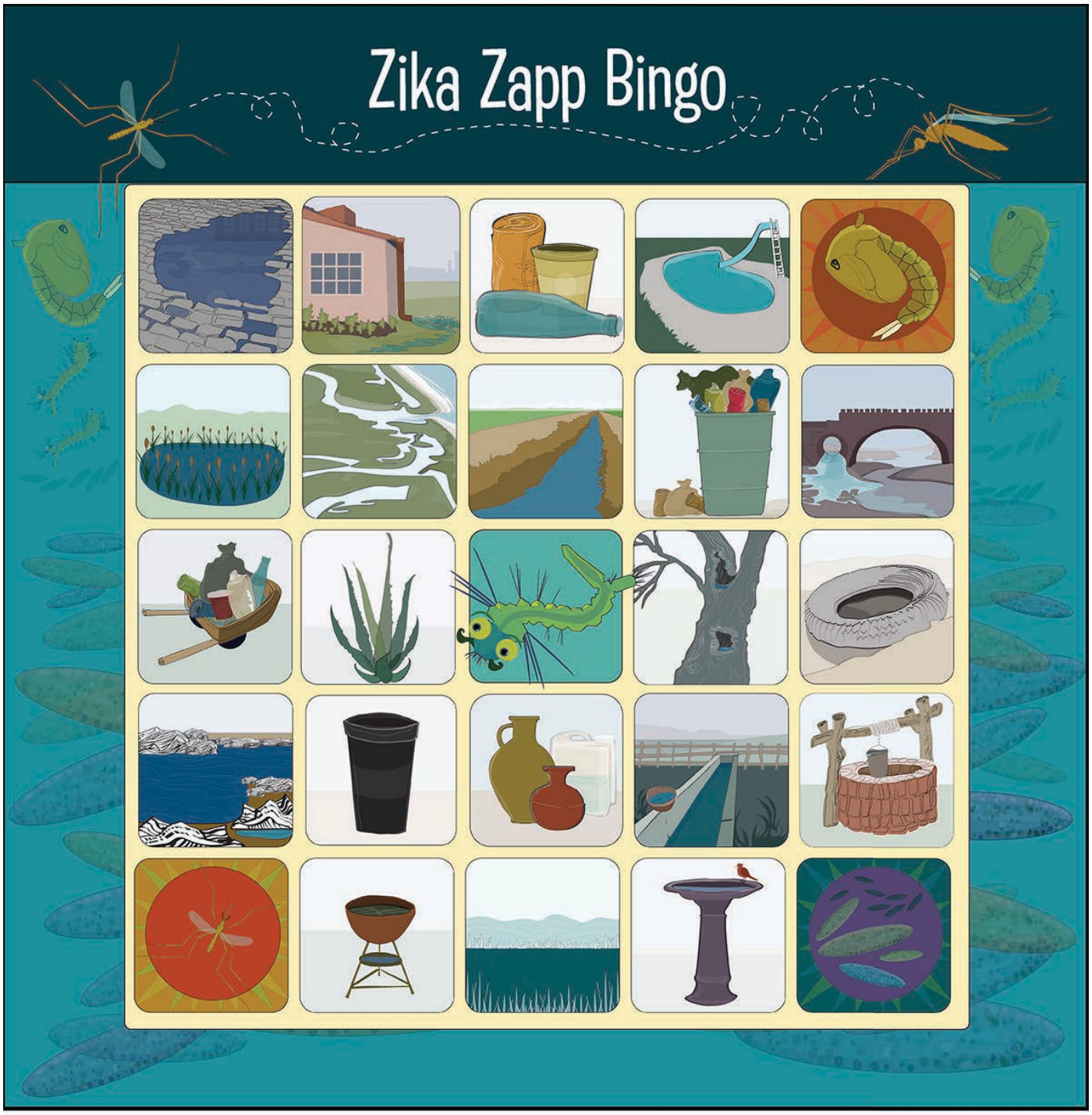

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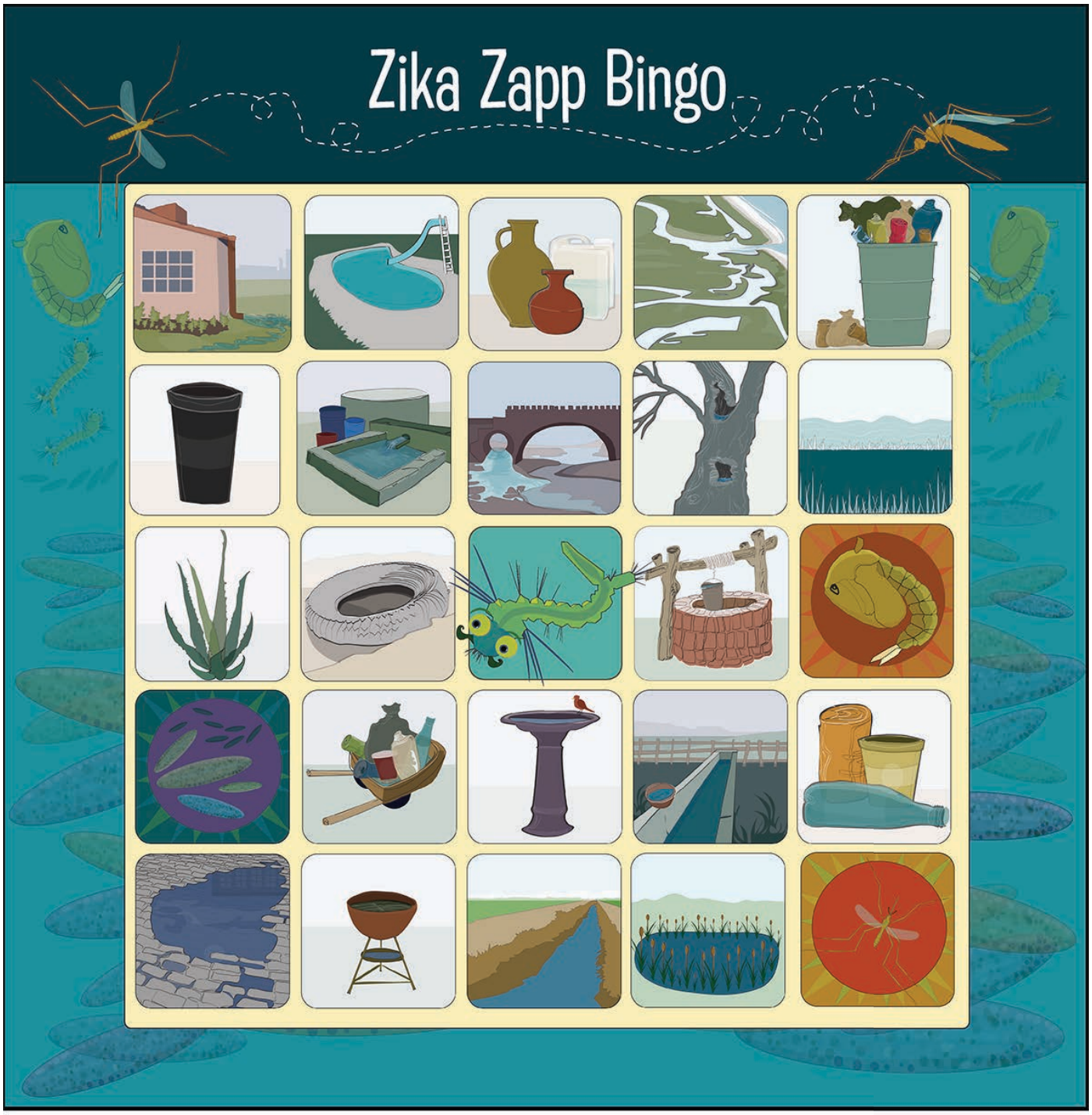

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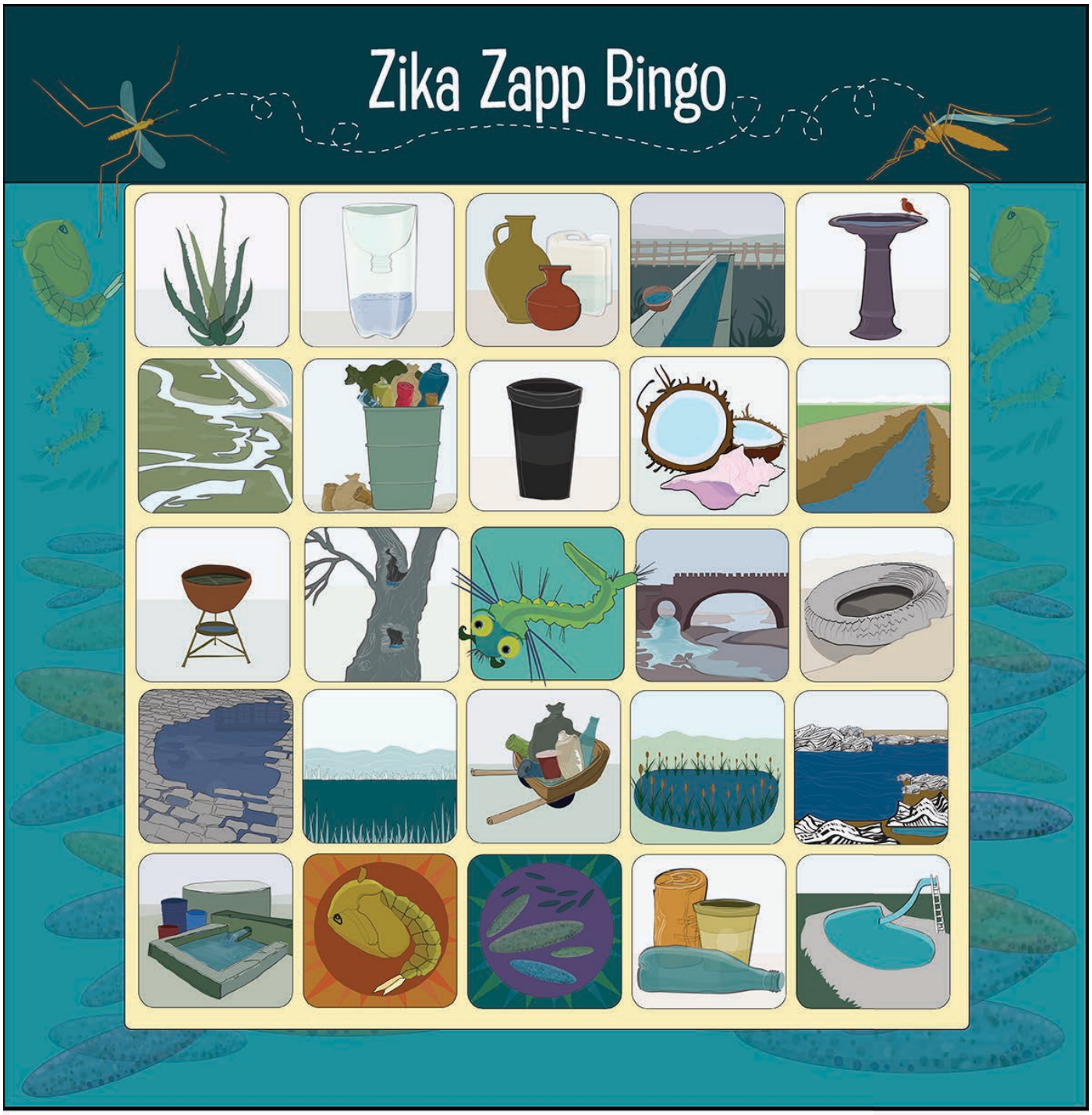

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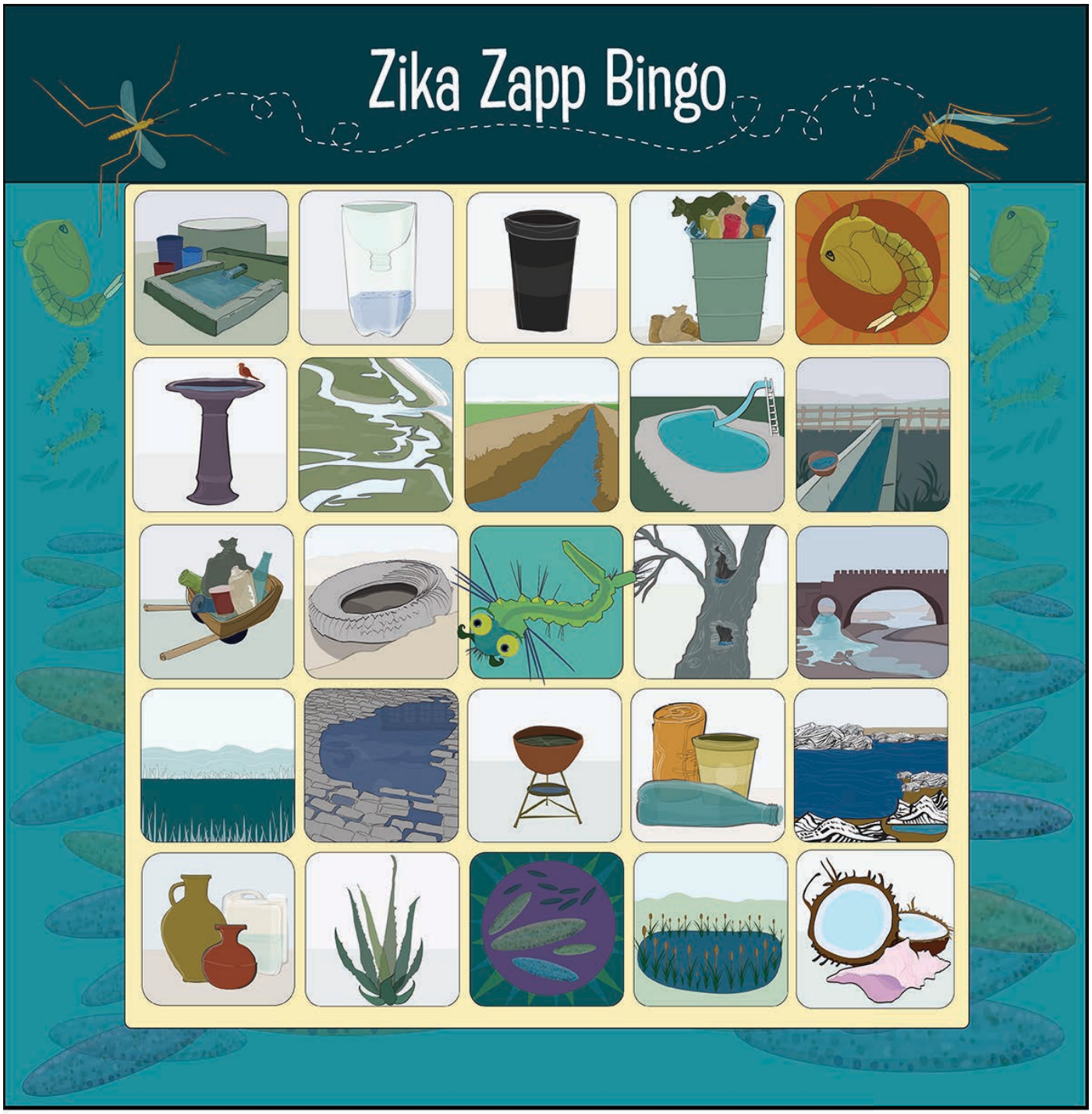

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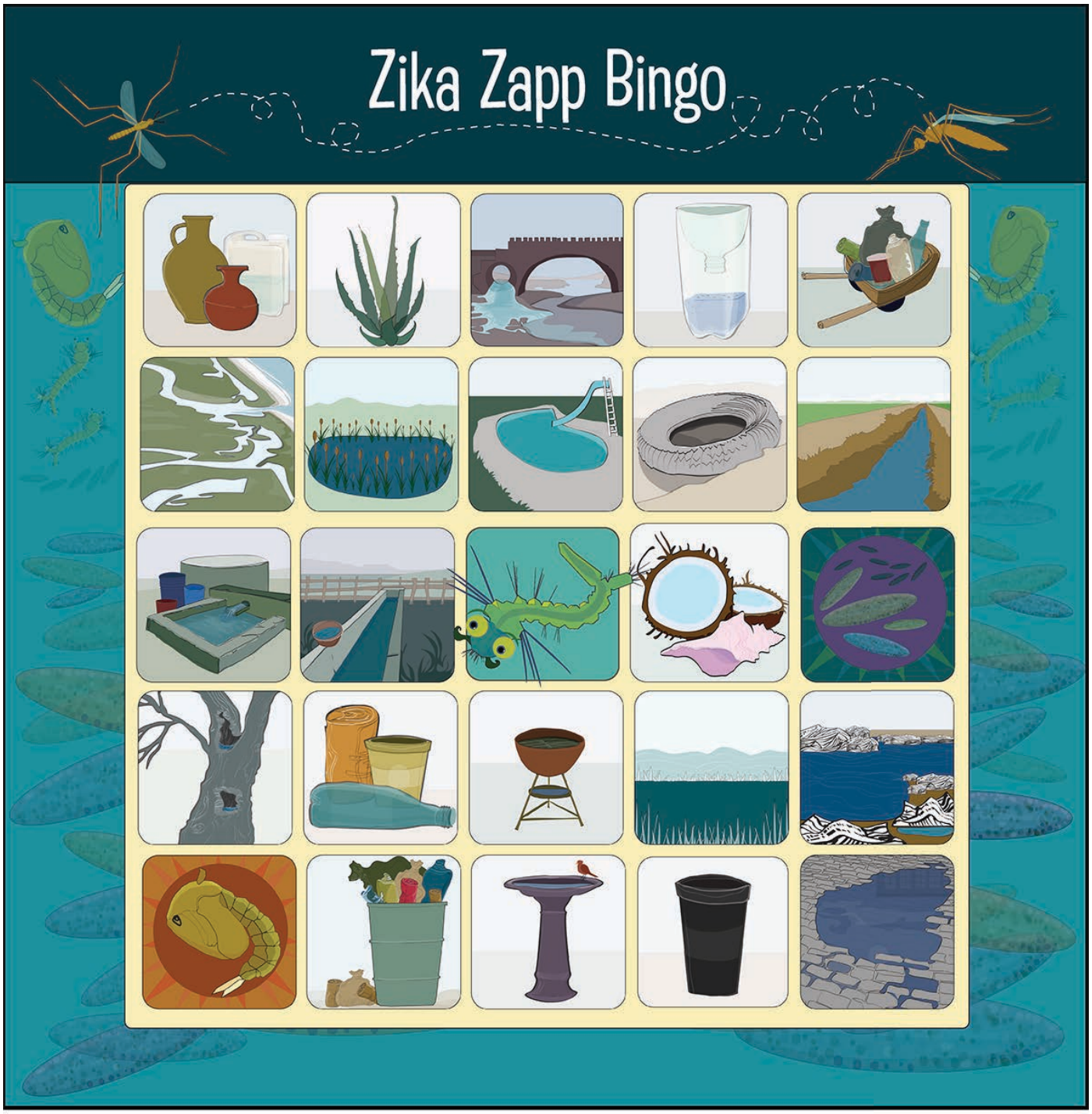

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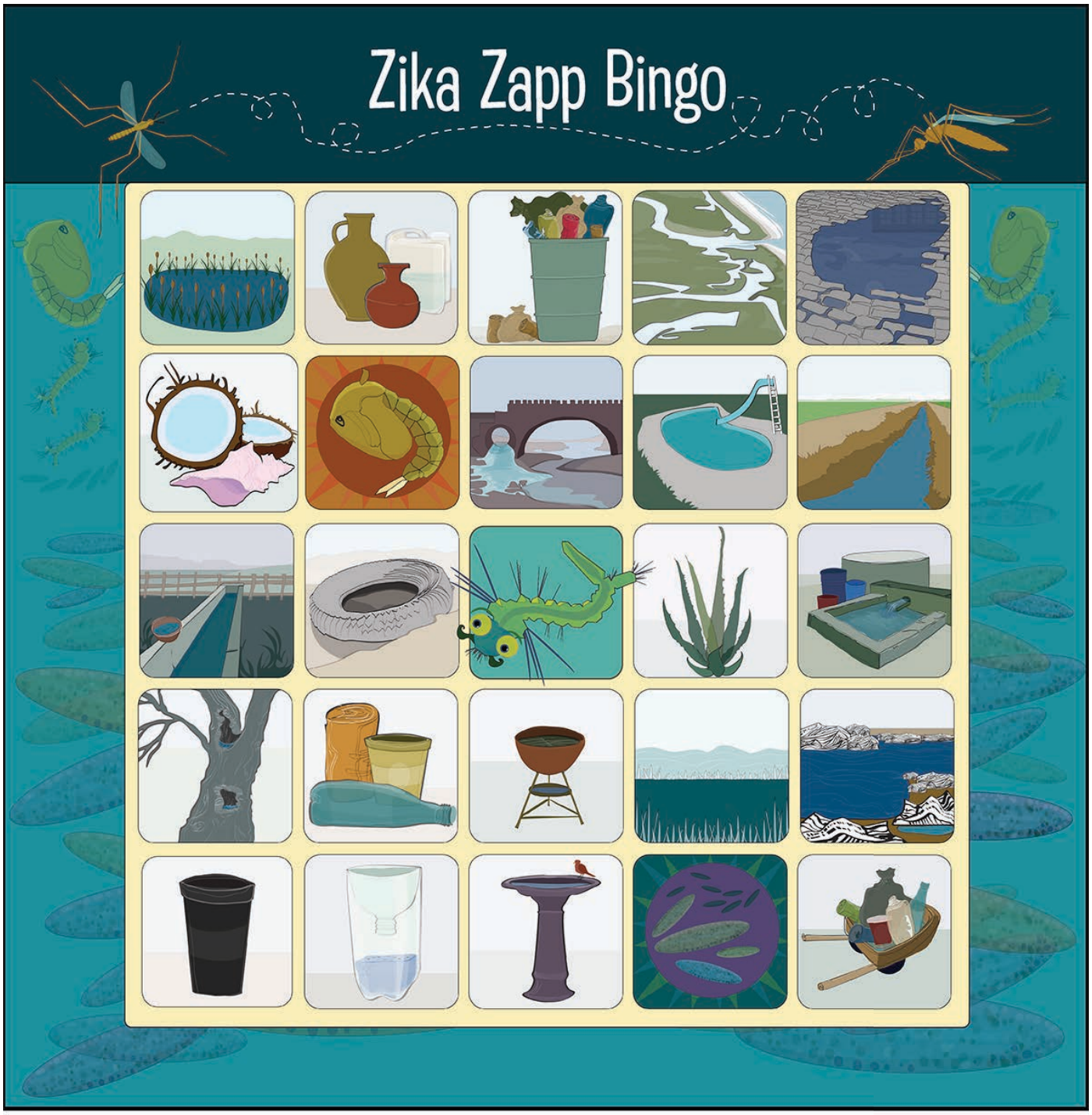

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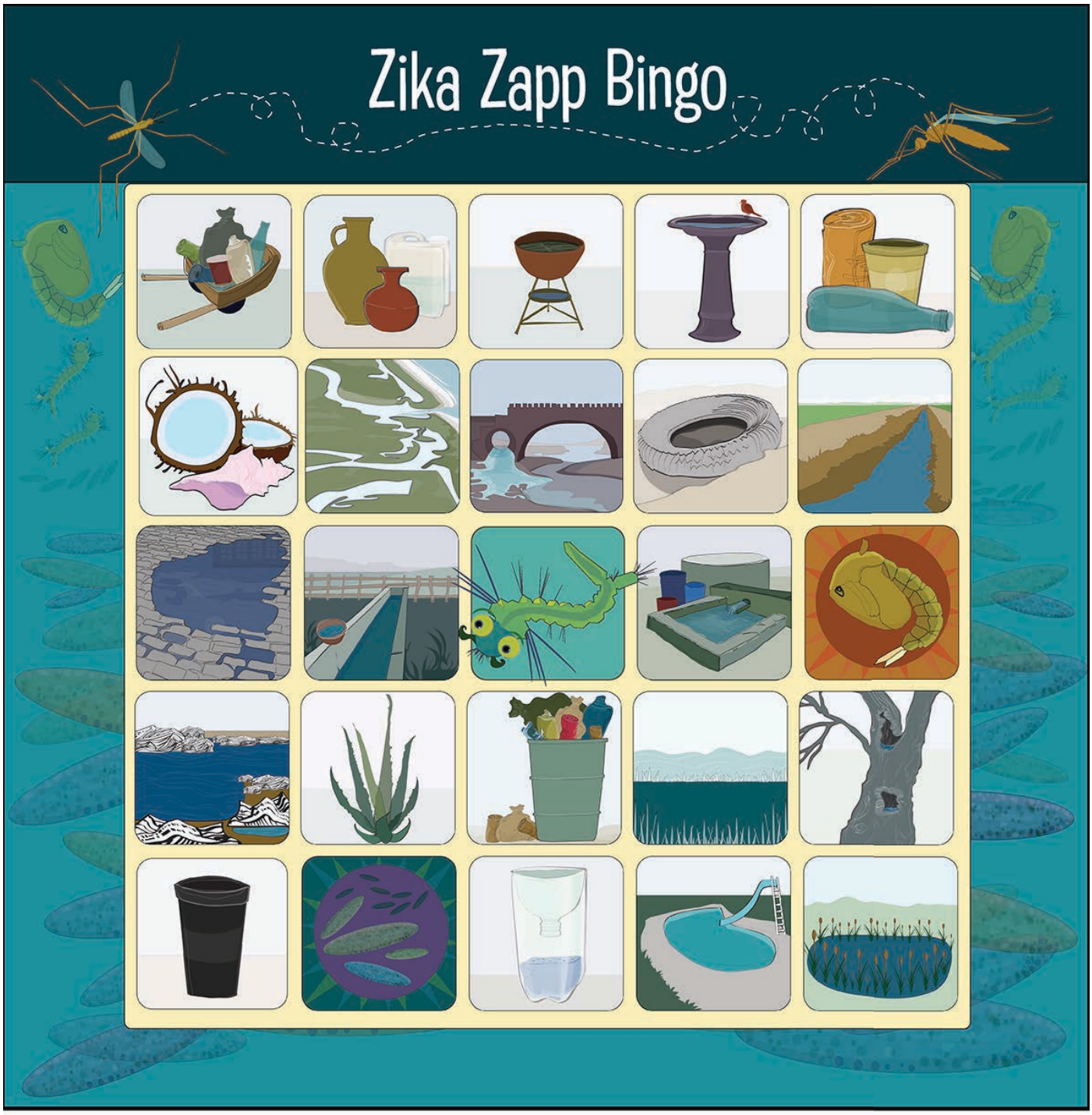

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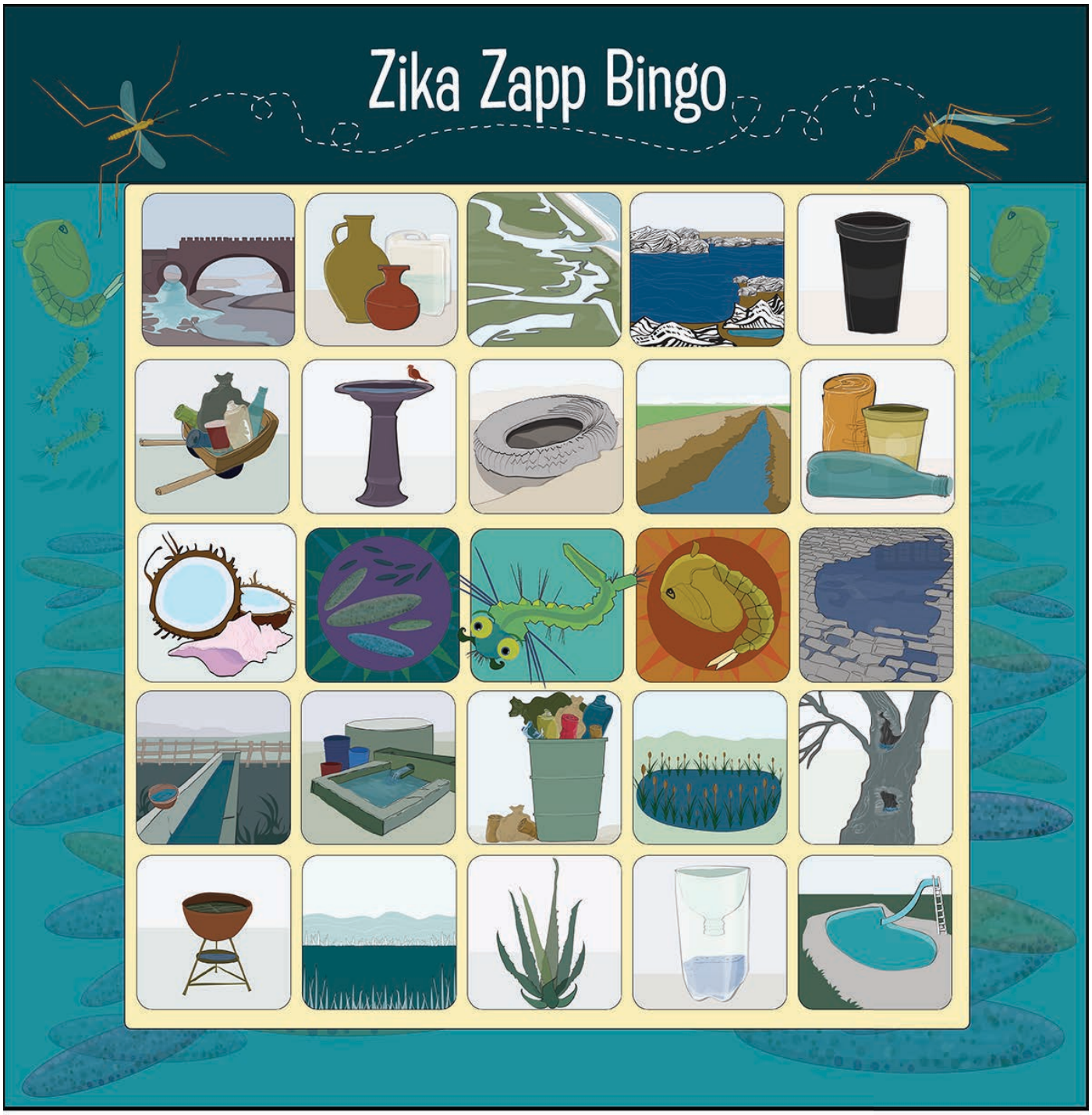

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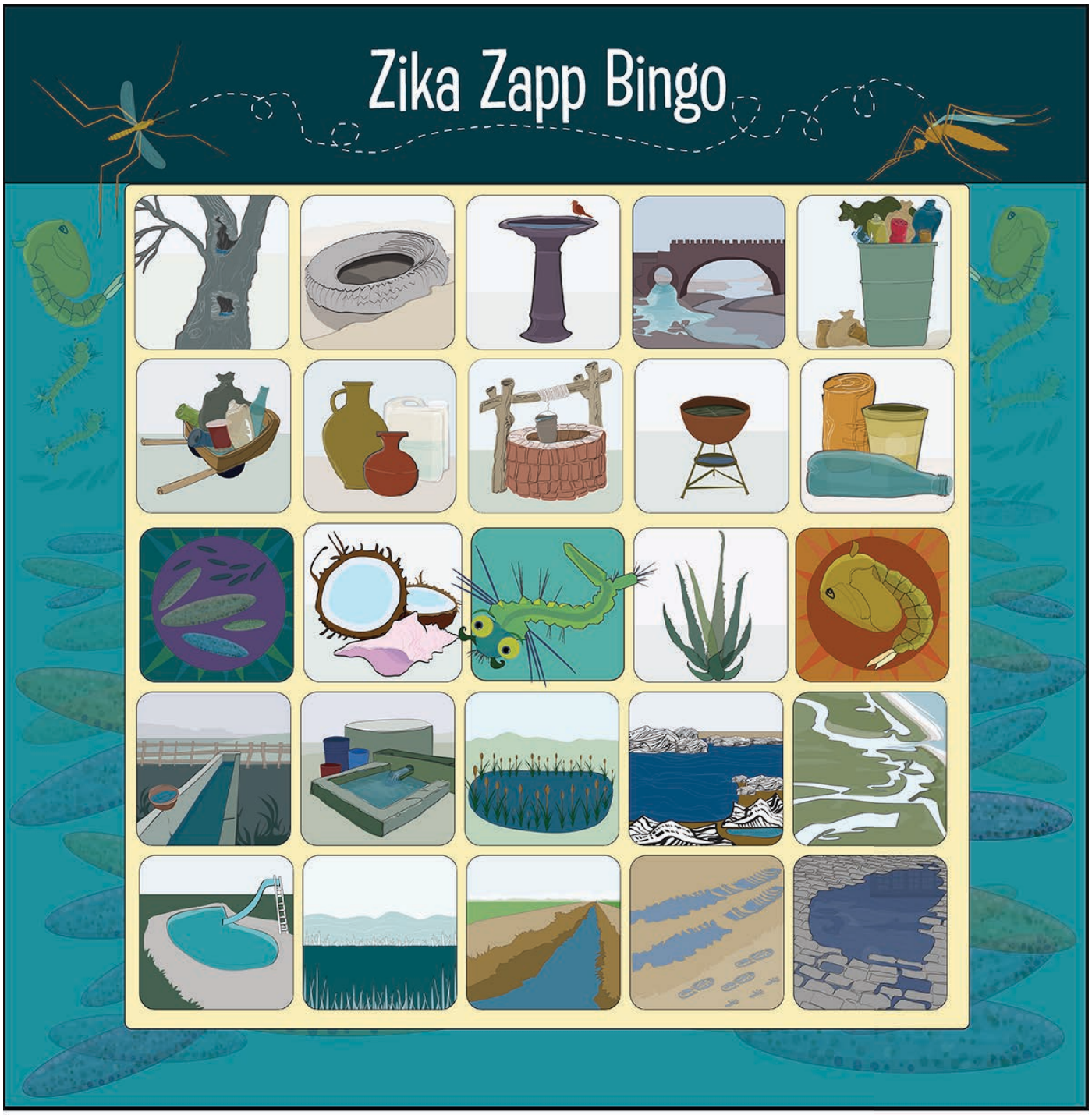

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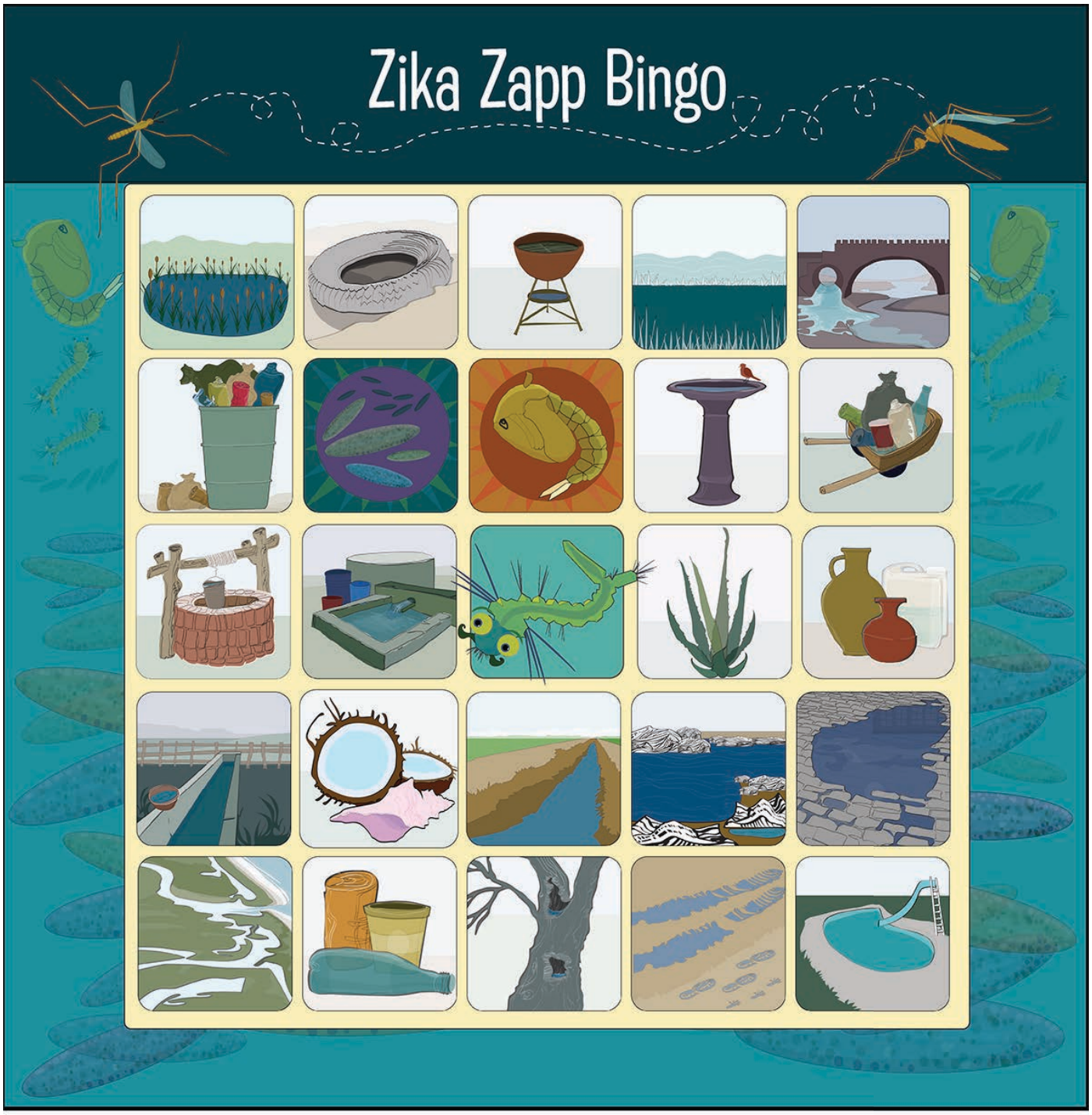

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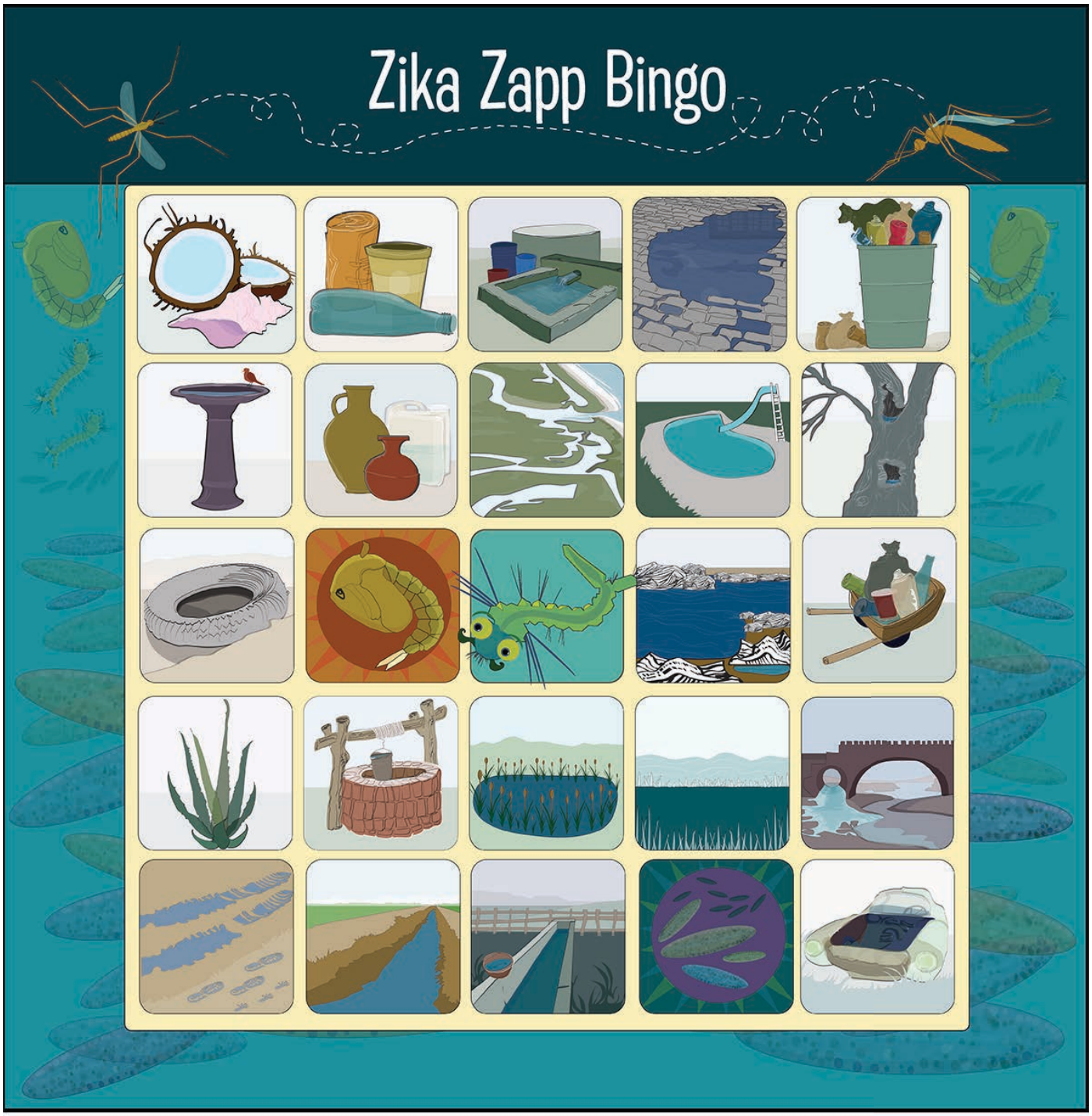

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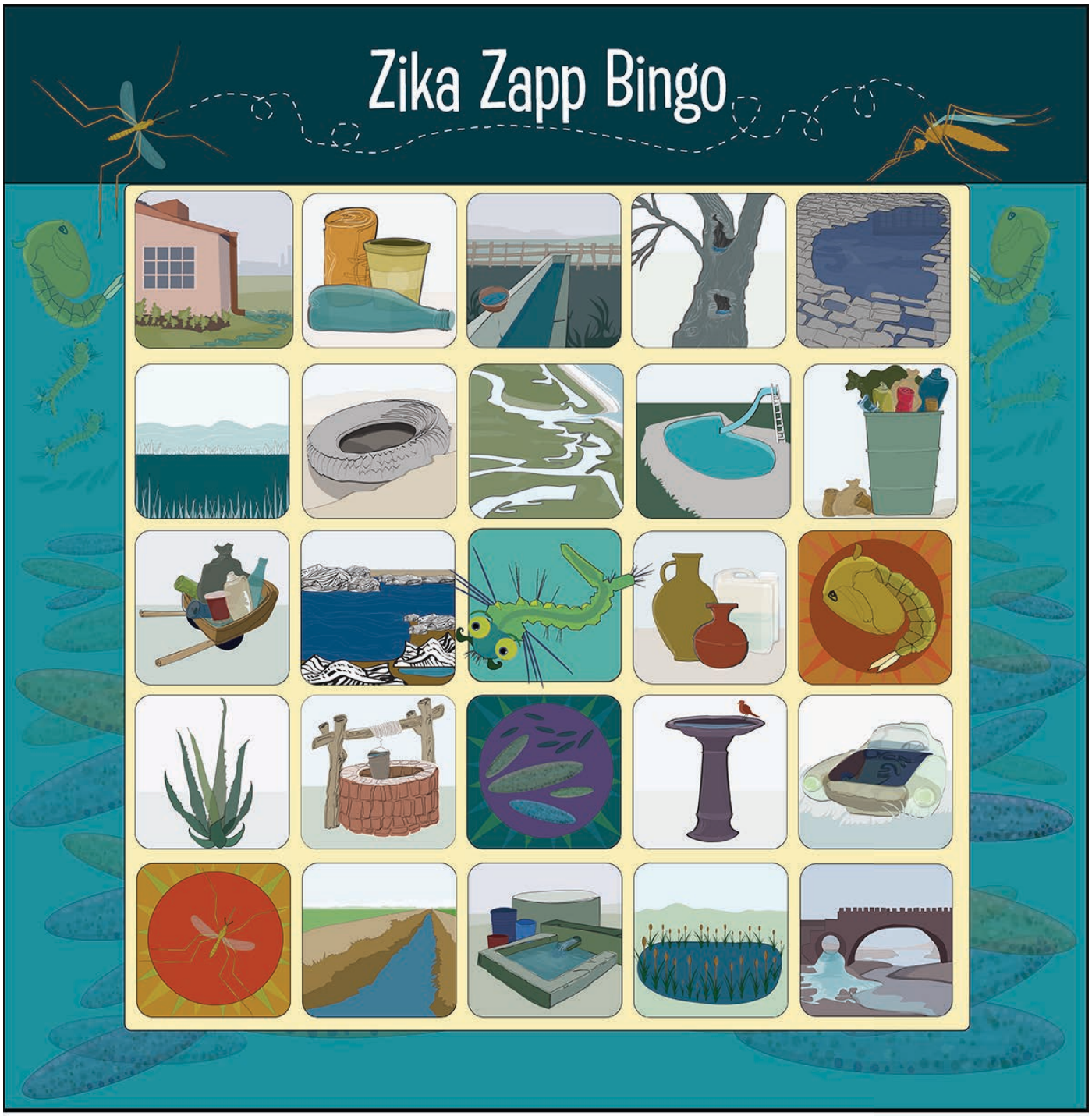

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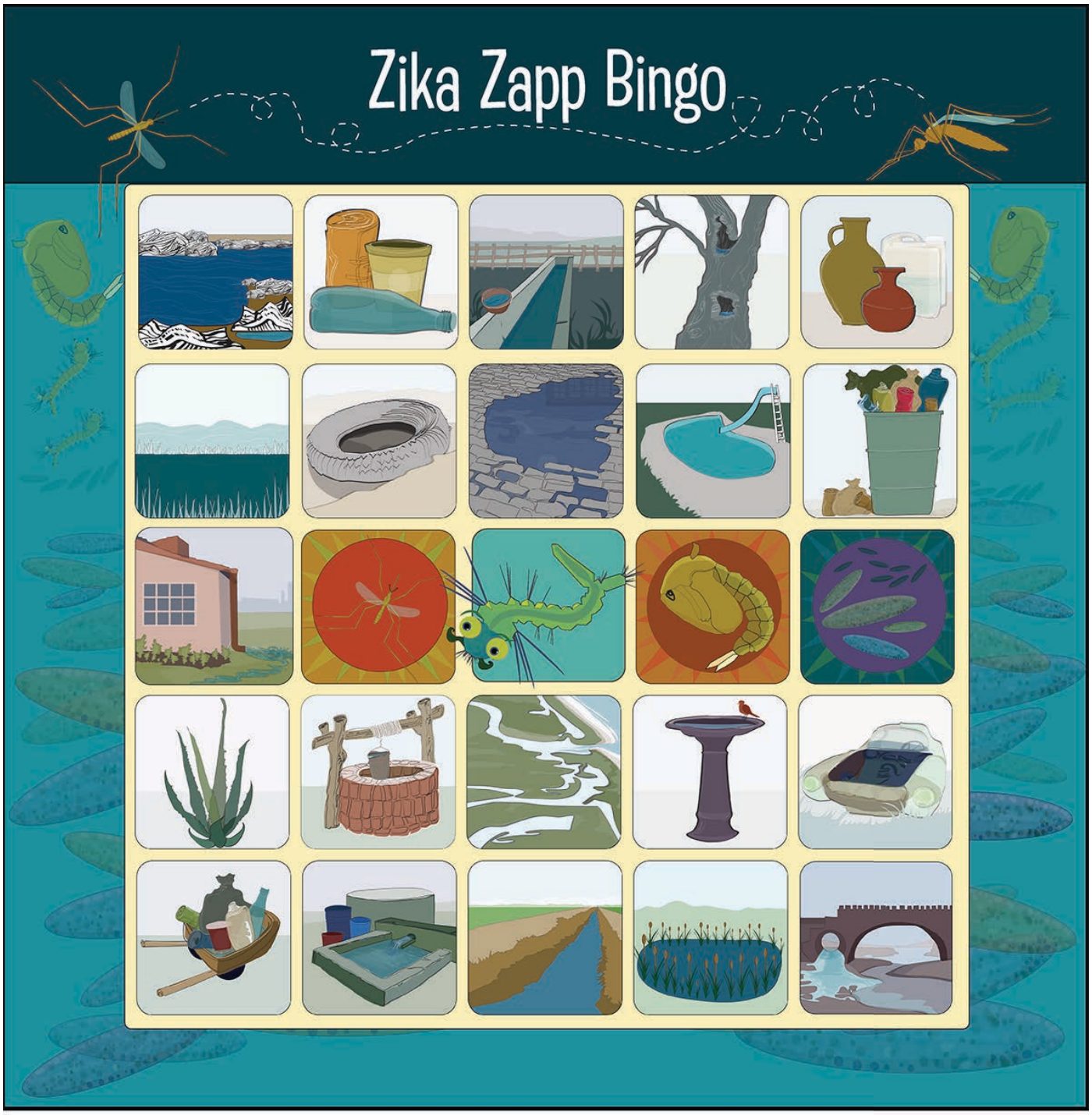

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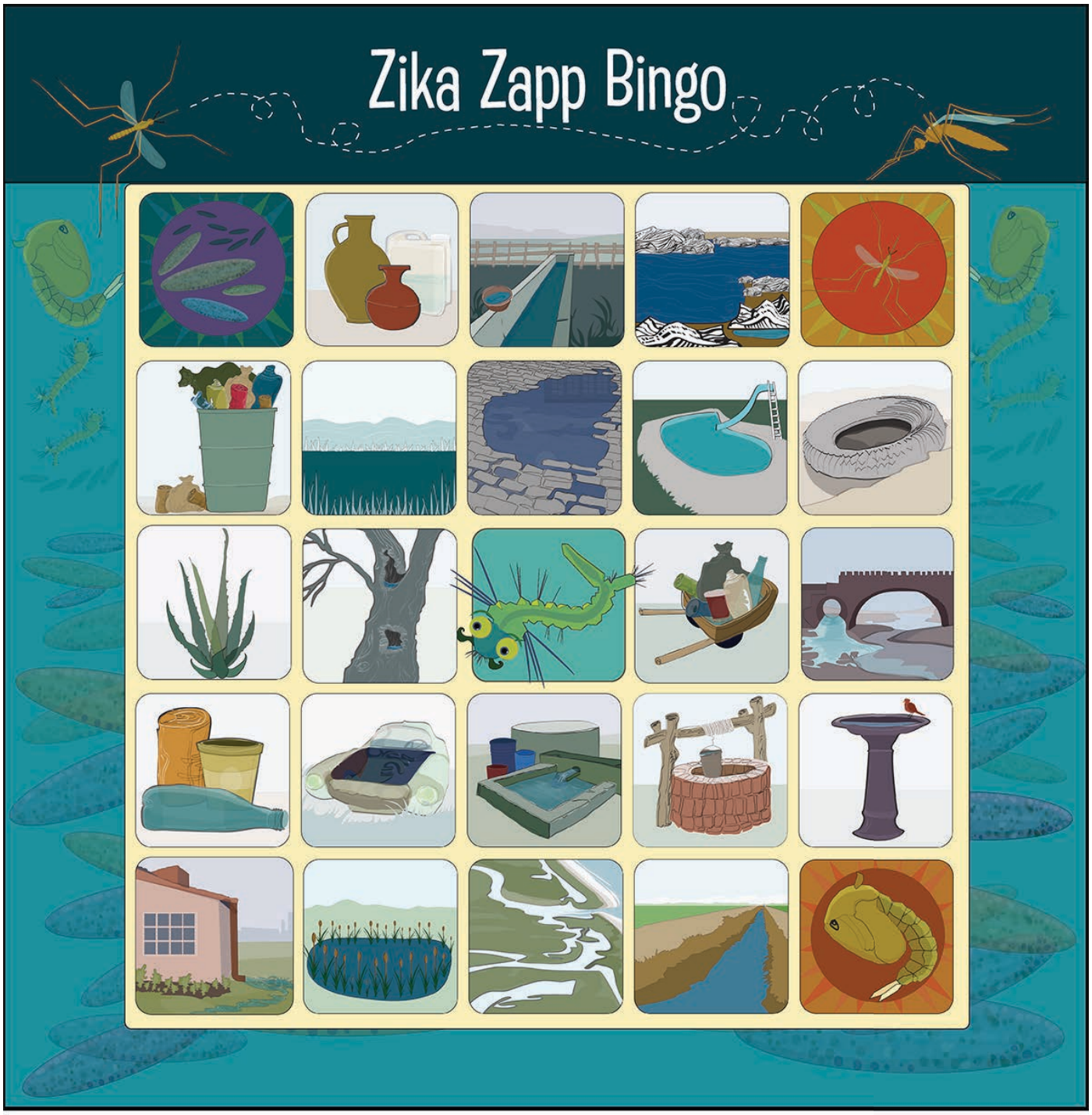

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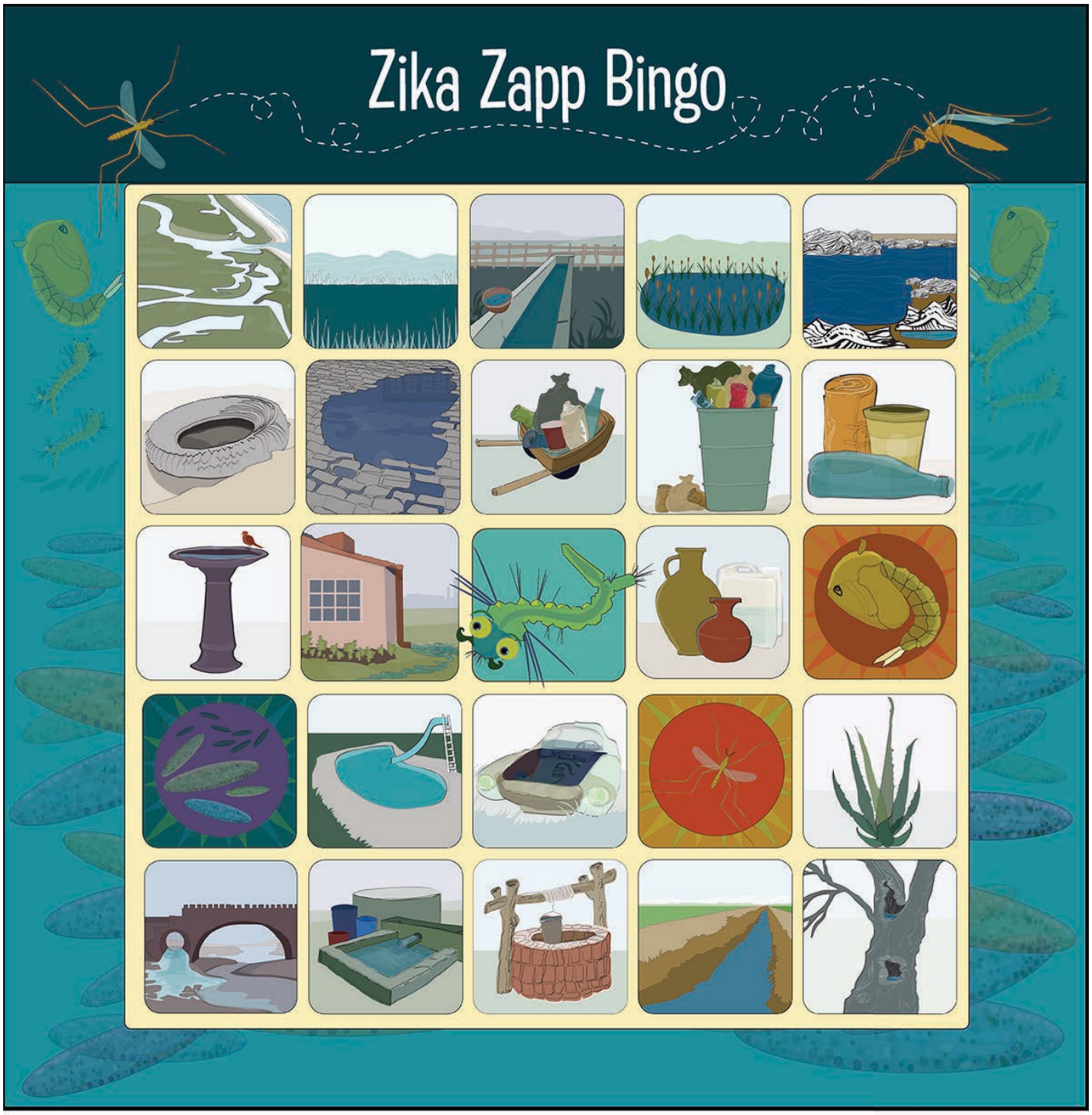

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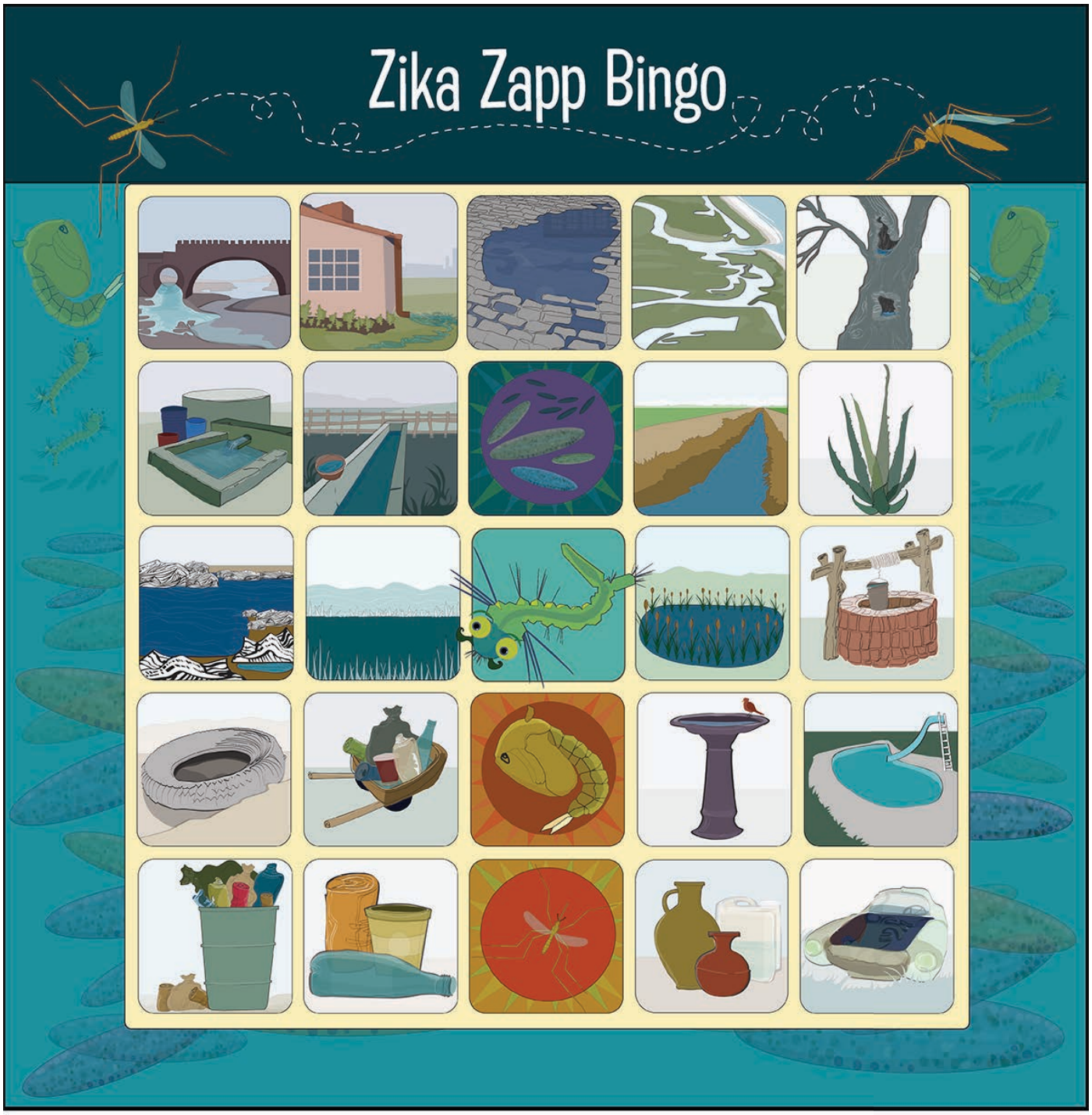

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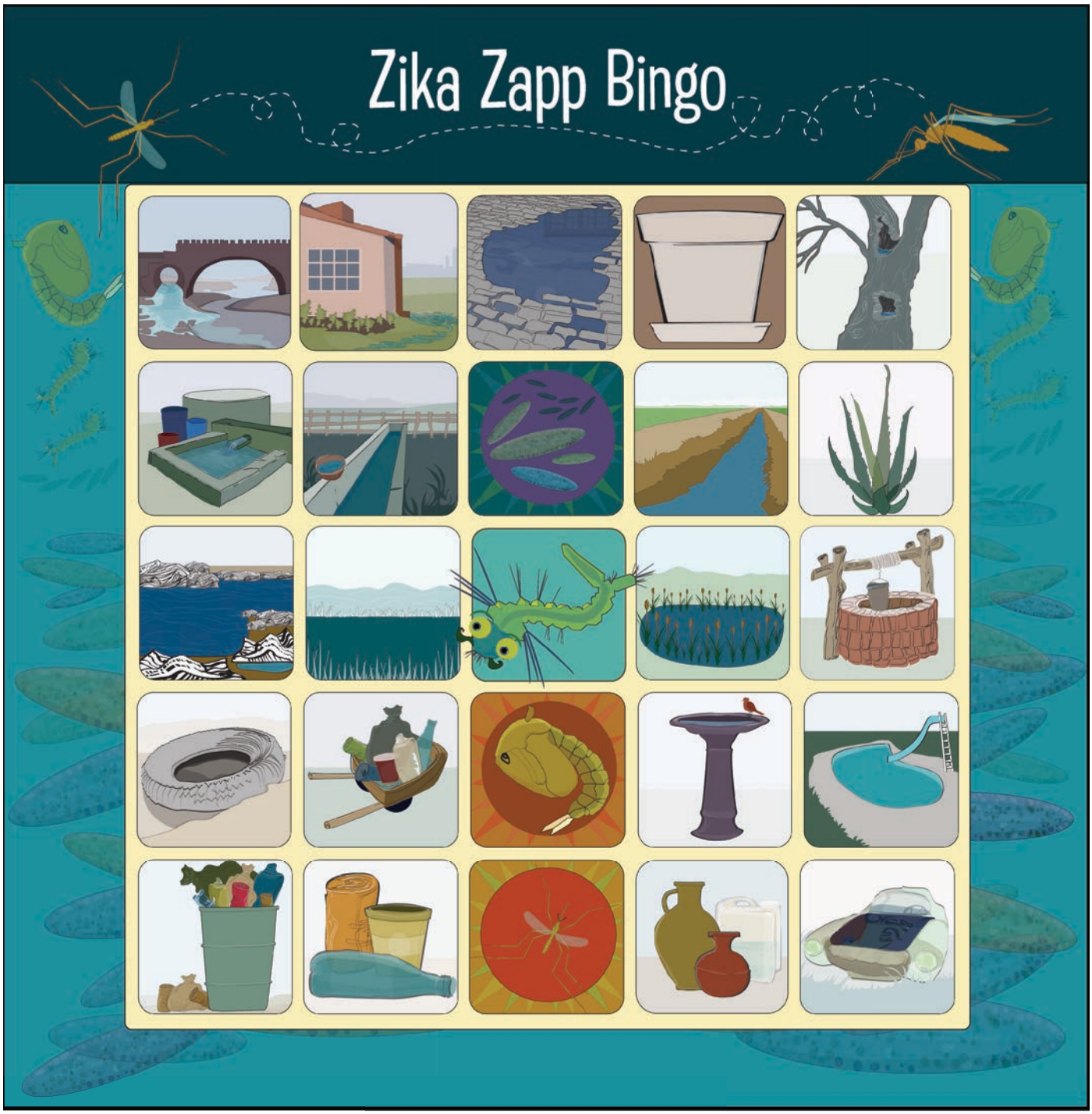

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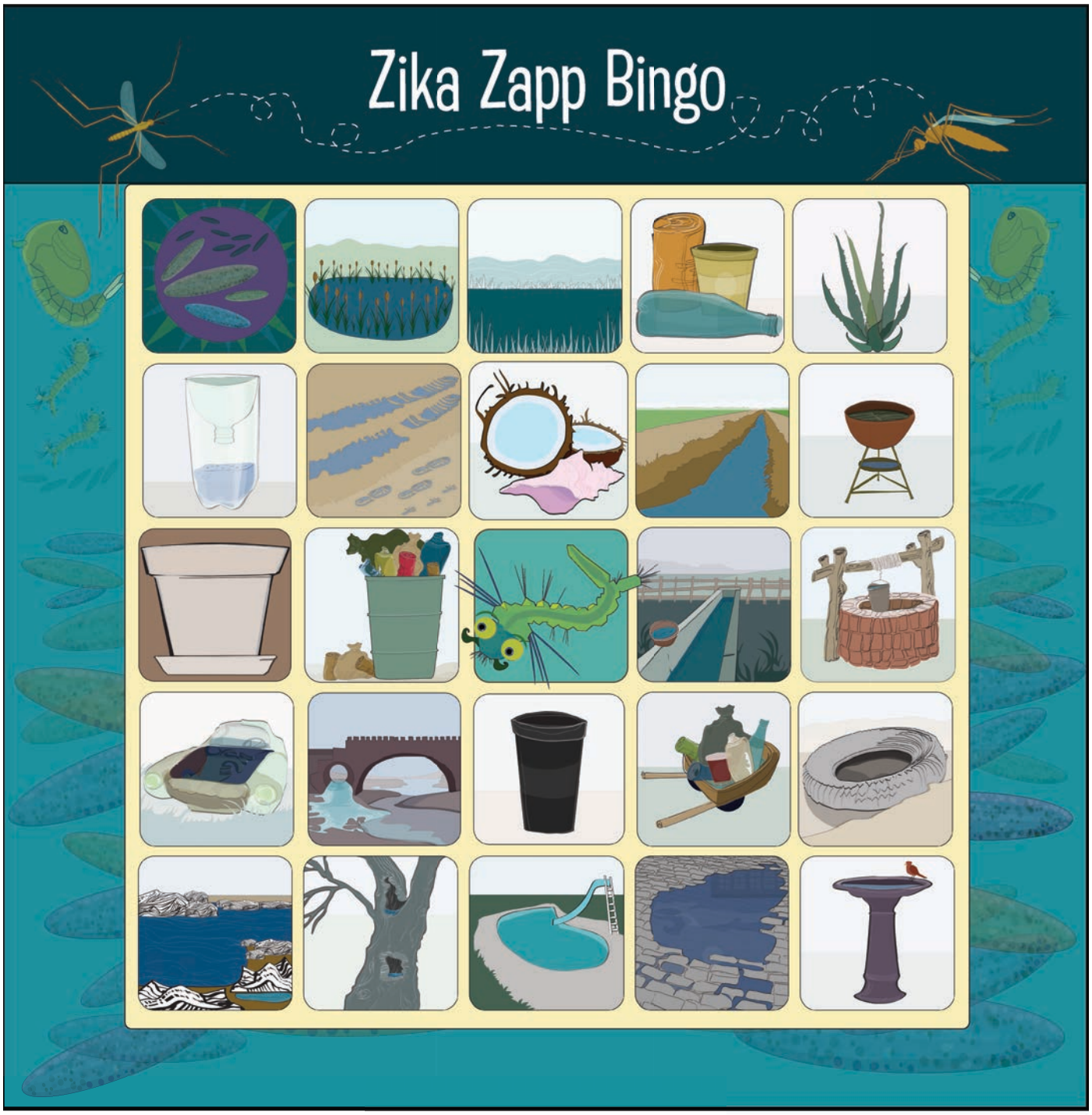

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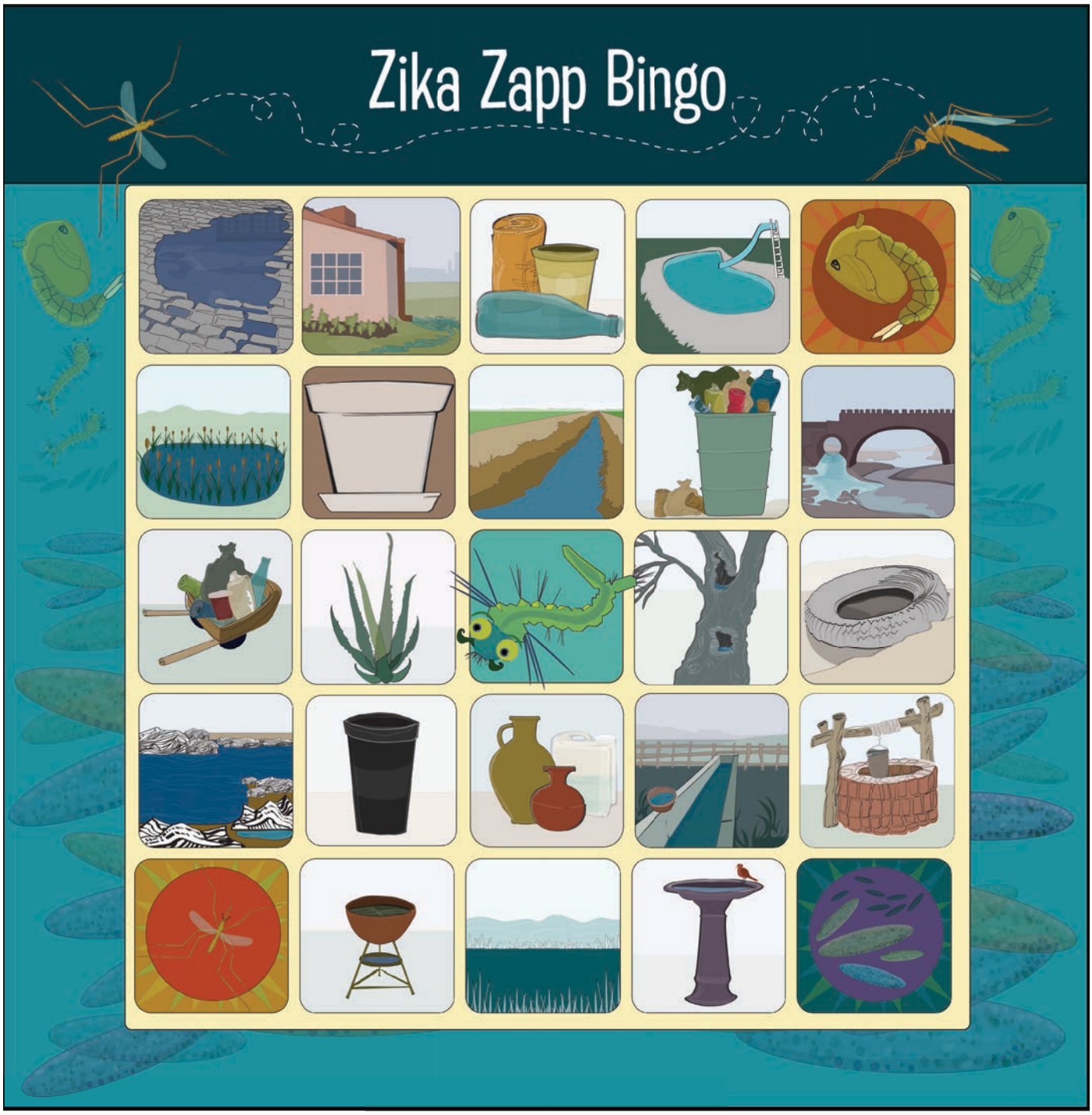

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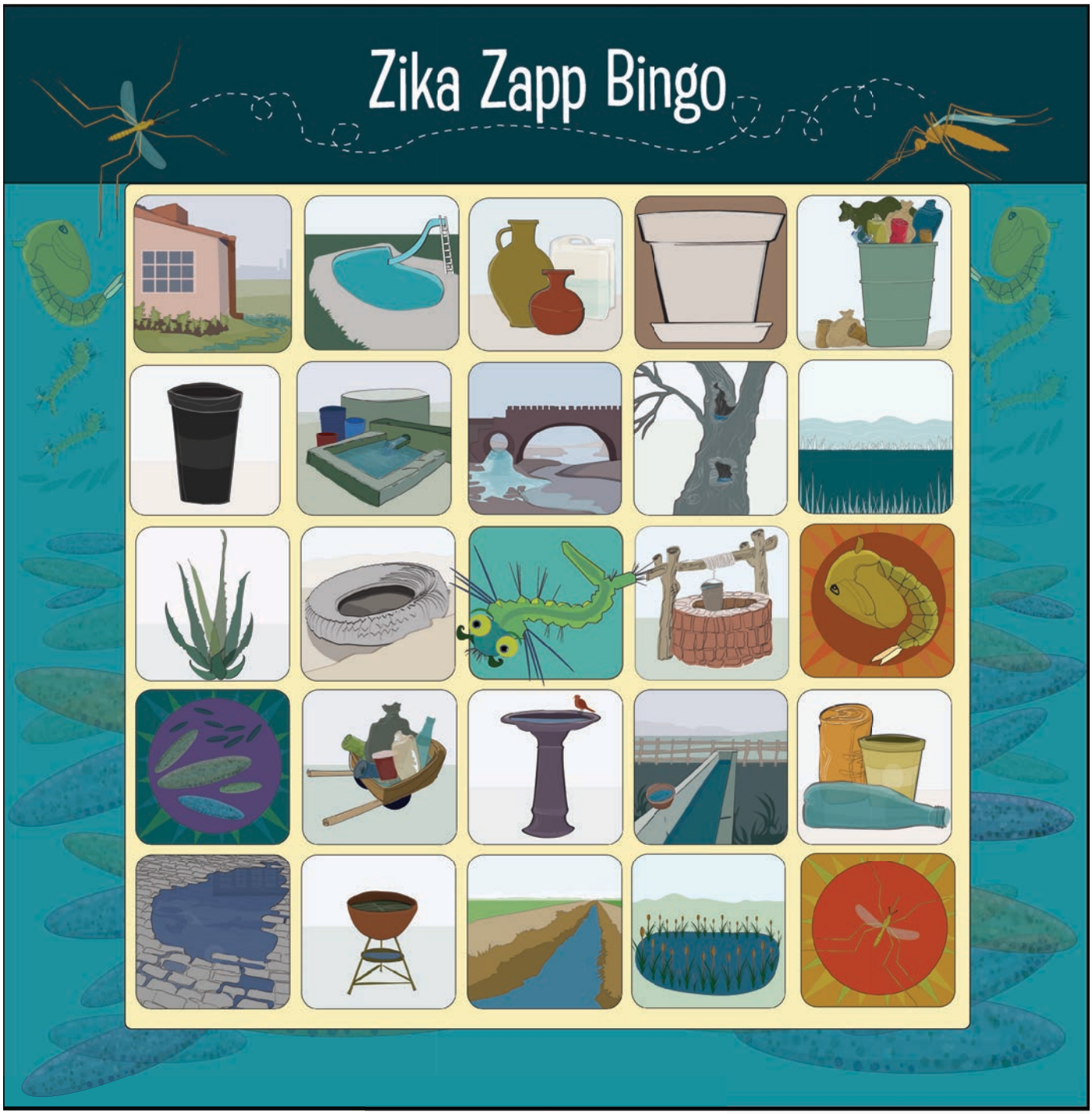

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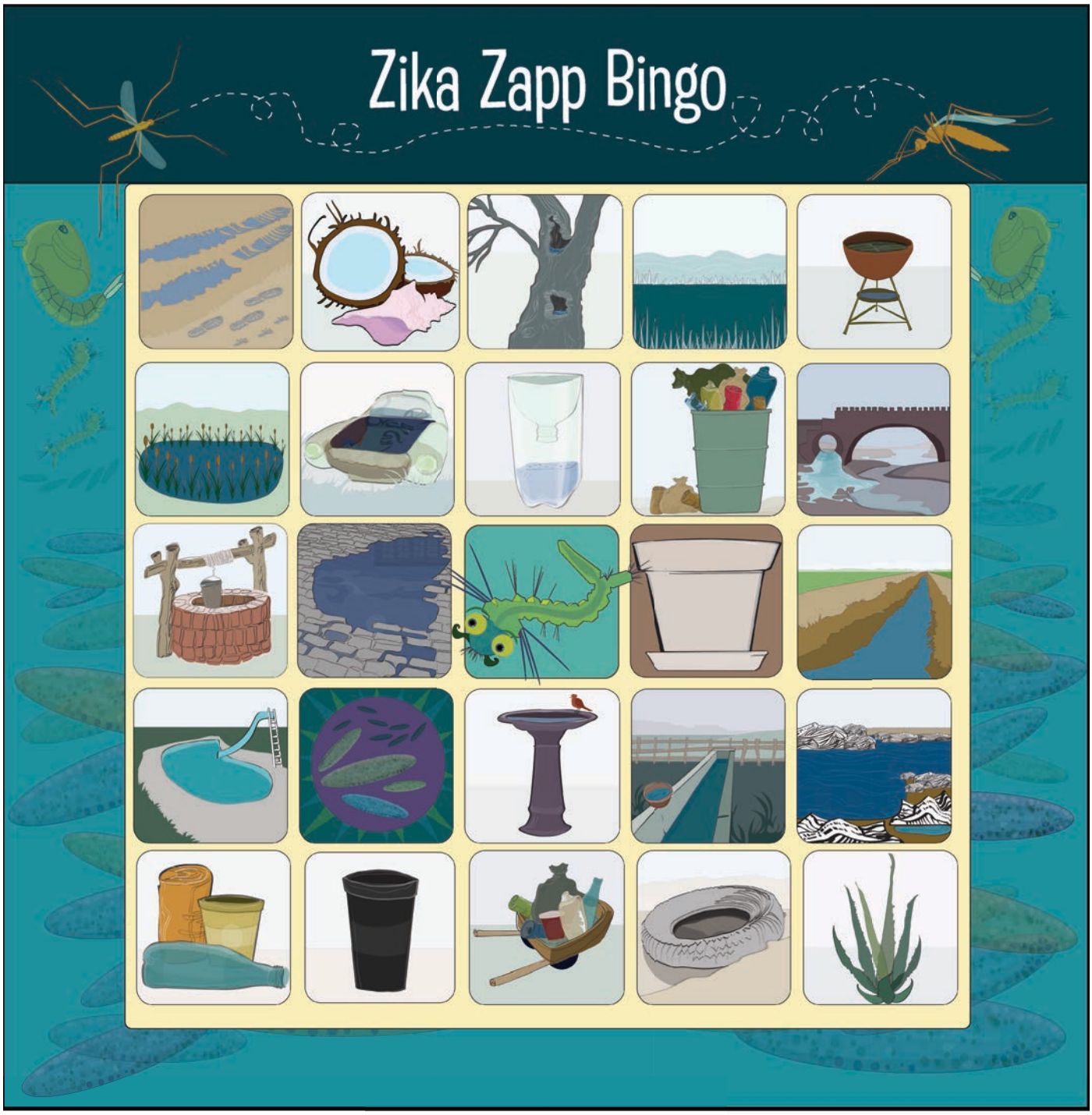

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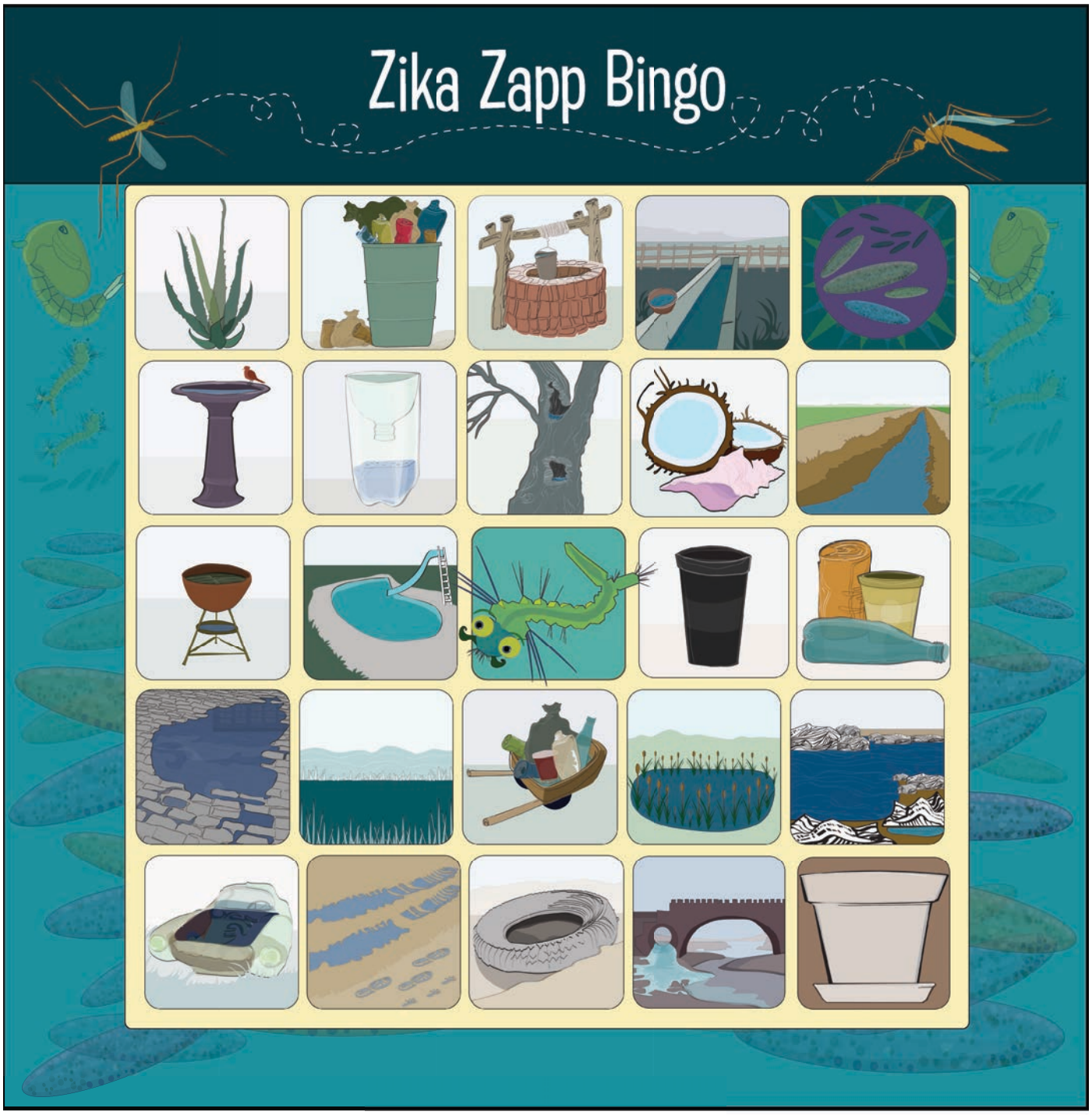

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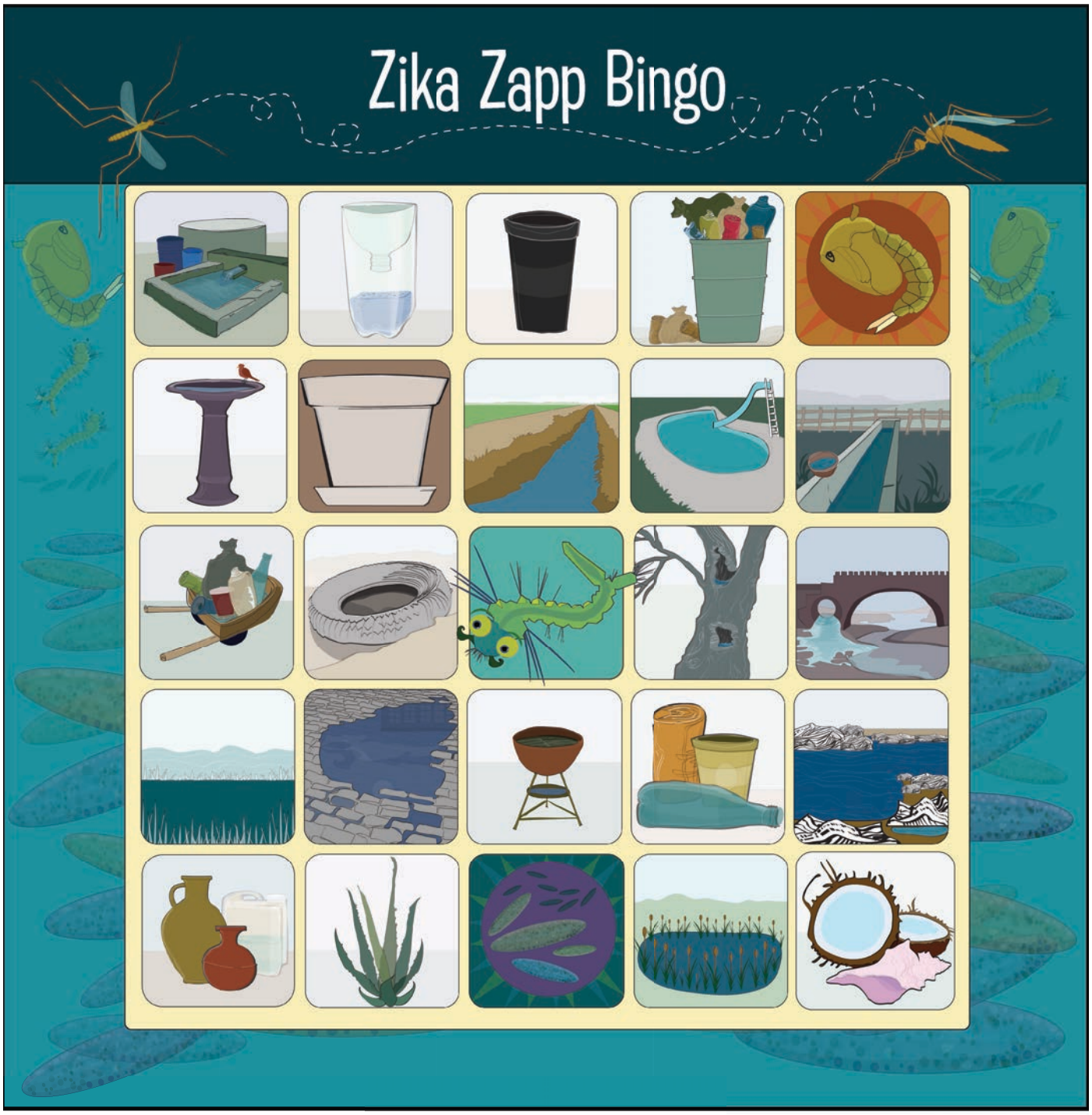
INSTITUTE for GLOBAL ENVIRONMENTAL STRATEGIES

The GLOBE Program

COMBATING ZIKA AND FUTURE THREATS
A GRAND CHALLENGE FOR DEVELOPMENT



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INSTITUTE for GLOBAL ENVIRONMENTAL STRATEGIES · The GLOBE Program · COMBATING ZIKA AND FUTURE THREATS A GRAND CHALLENGE FOR DEVELOPMENT

Zika Zapp Bingo Game

LEARNING OBJECTIVES

Build awareness of

1. The many different breeding habitats used by container mosquitoes. There are 30 categories used in the GLOBE Observer Mosquito Habitat Mapper App.

2. The 4 life cycle stages of a mosquito (egg, pupa, larva and adult). The Mosquito Habitat Mapper focuses on the larval stage, but asks when taking a sample if mosquito eggs, pupae or adult mosquitos are also found in the sample or nearby.

PREPARE:

- Print out different Zika Zapp bingo cards for each learner or team, plus one call sheet (images of mosquito breeding sites and life cycle stages with names)
- Cut up the call sheet and put individual pieces into a container (e.g., bowl, box, bag, or hat).
- If playing in small teams (e.g., 2-3 players per team), divide the group into teams.
- Collect or create markers (xx per player or group) – these could be pennies, small rocks, or other markers for players to use (see also template that can be used to create markers) For paper markers, there could be printed or pasted onto cardboard before cutting out to make them sturdier.

PLAY

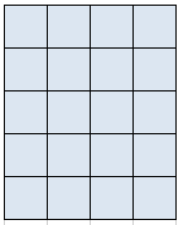
- Hand out a different card to each learner or team
- The center square is a "free" space – players should mark.
- The "caller" draws one of the mosquito habitat sites or life cycle stages and says the name.
- Players place the marker over the image for the habitat or life cycle stage if it is on their card.

WINNING

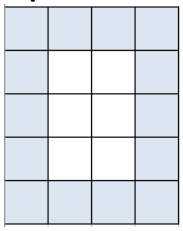
- A player or team covers a row of spaces in any direction (vertically, horizontally, or diagonally) and calls out "ZikaZapps." (see also variations on next page)
- The caller checks the card and if they are correct they win the round, if not, they are disqualified from that round (or continue to play?)
- Continue until a specific number of winners have called "ZikaZapps" (e.g., a round can have 1 or more winners)

VARIATIONS

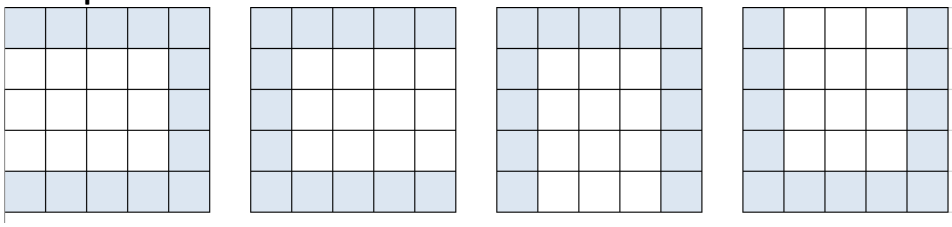
Blackout – Cover all the squares on a playing card.



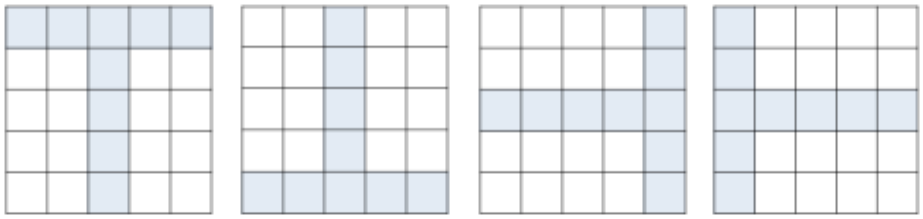
Square – Fill all 4 outside rows - top, right, bottom, and left)



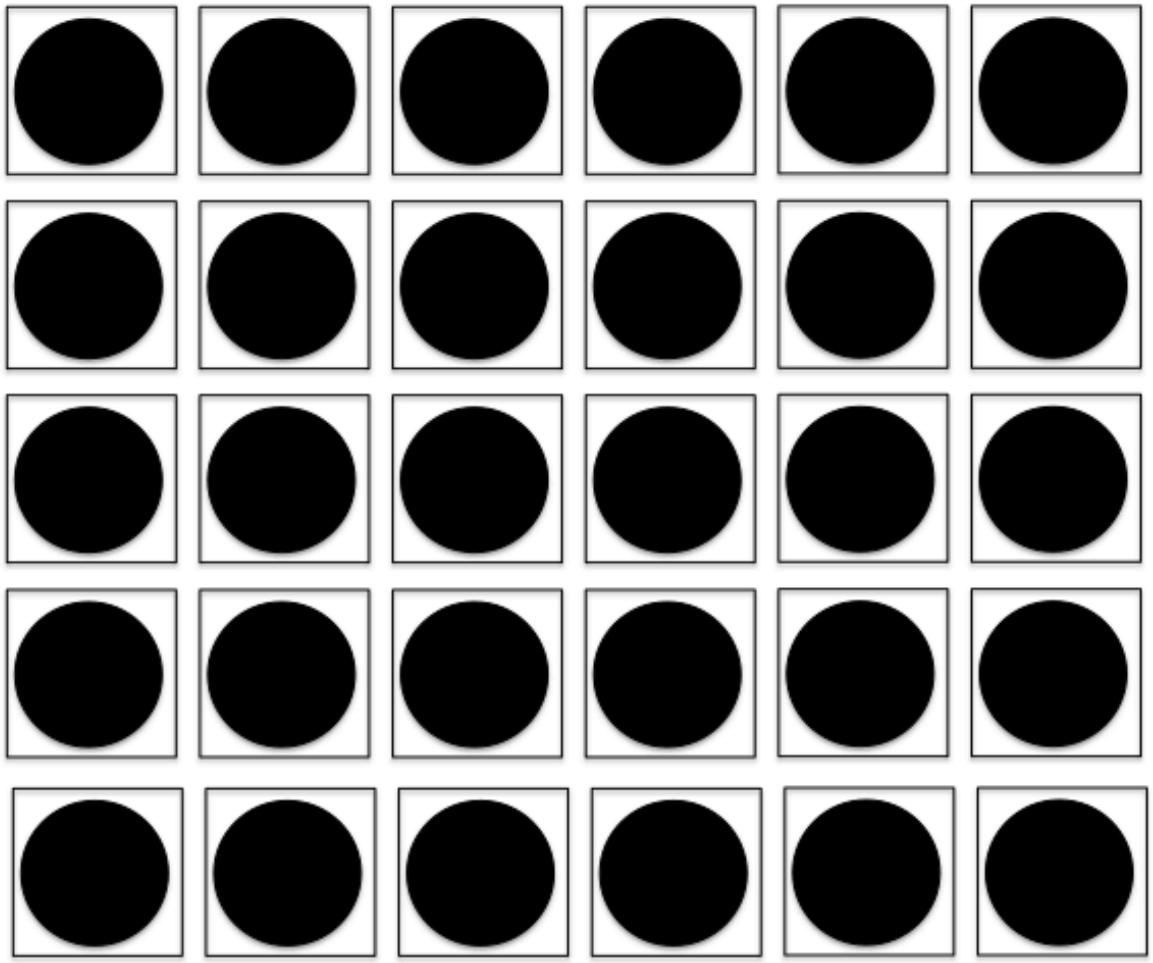
U-Shaped – Cover 3 outside rows to form a letter "U"

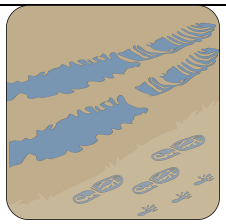
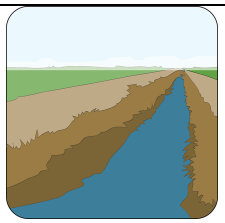
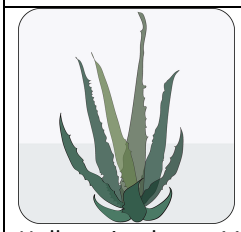
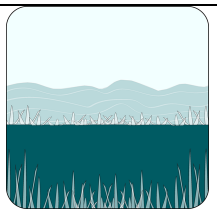
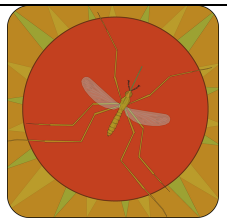
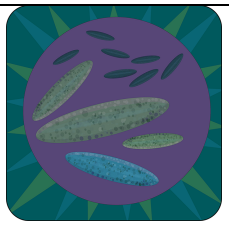
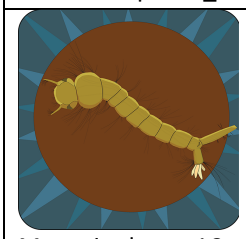
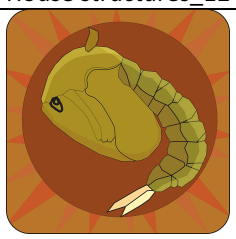
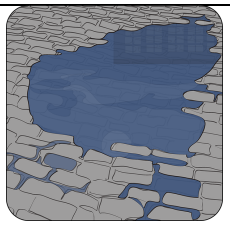
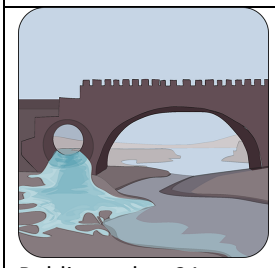
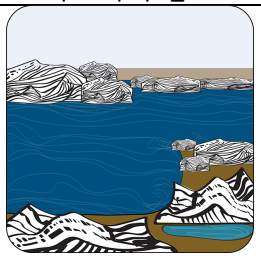
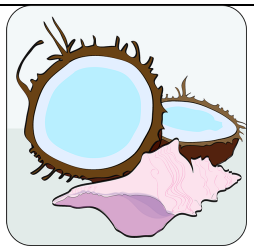
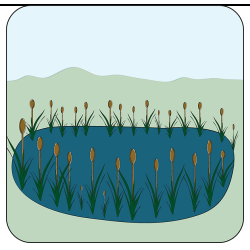
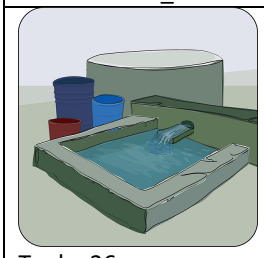
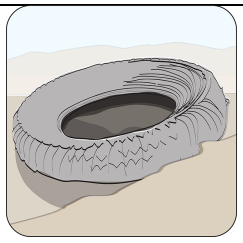
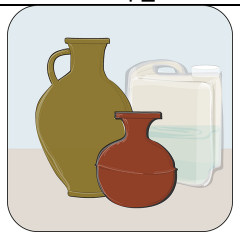
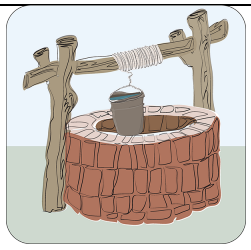


T-Shaped – Cover spaces in the shape of the letter "T" – right-side-up, left, right or upside down

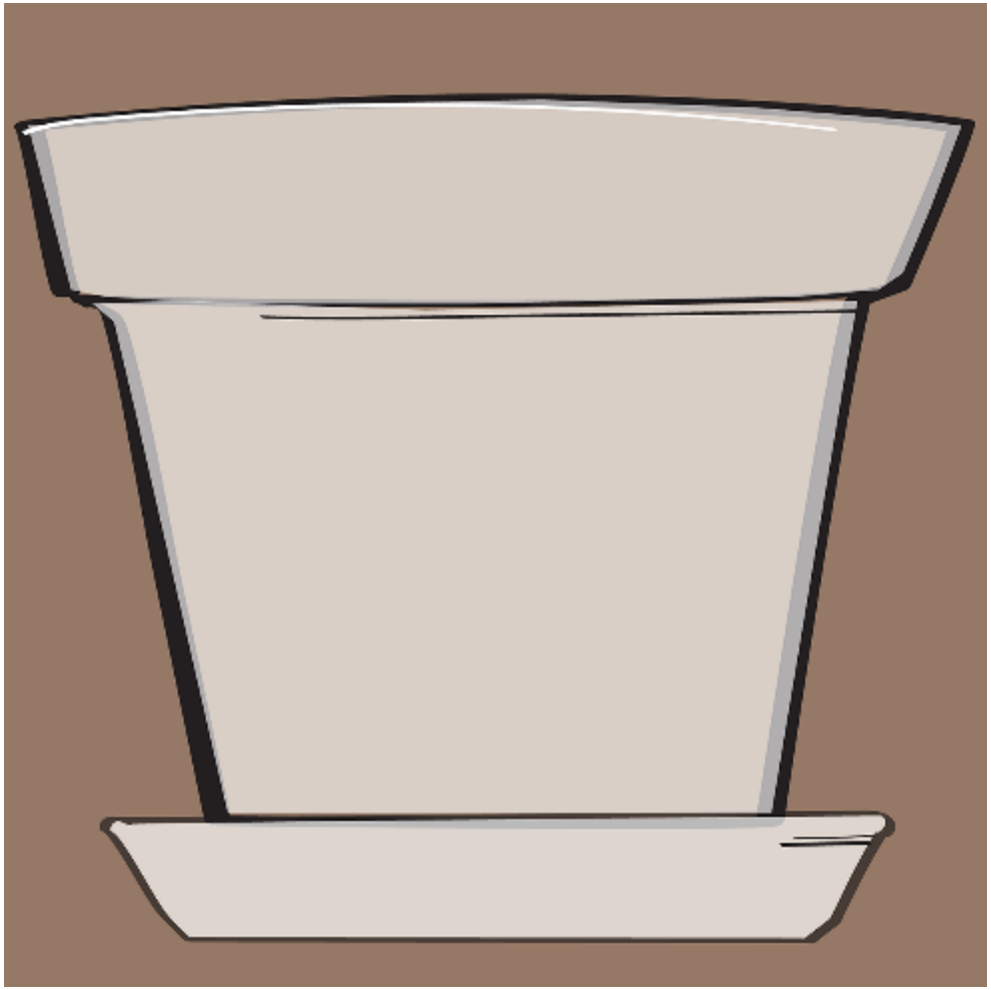


Marker Templates

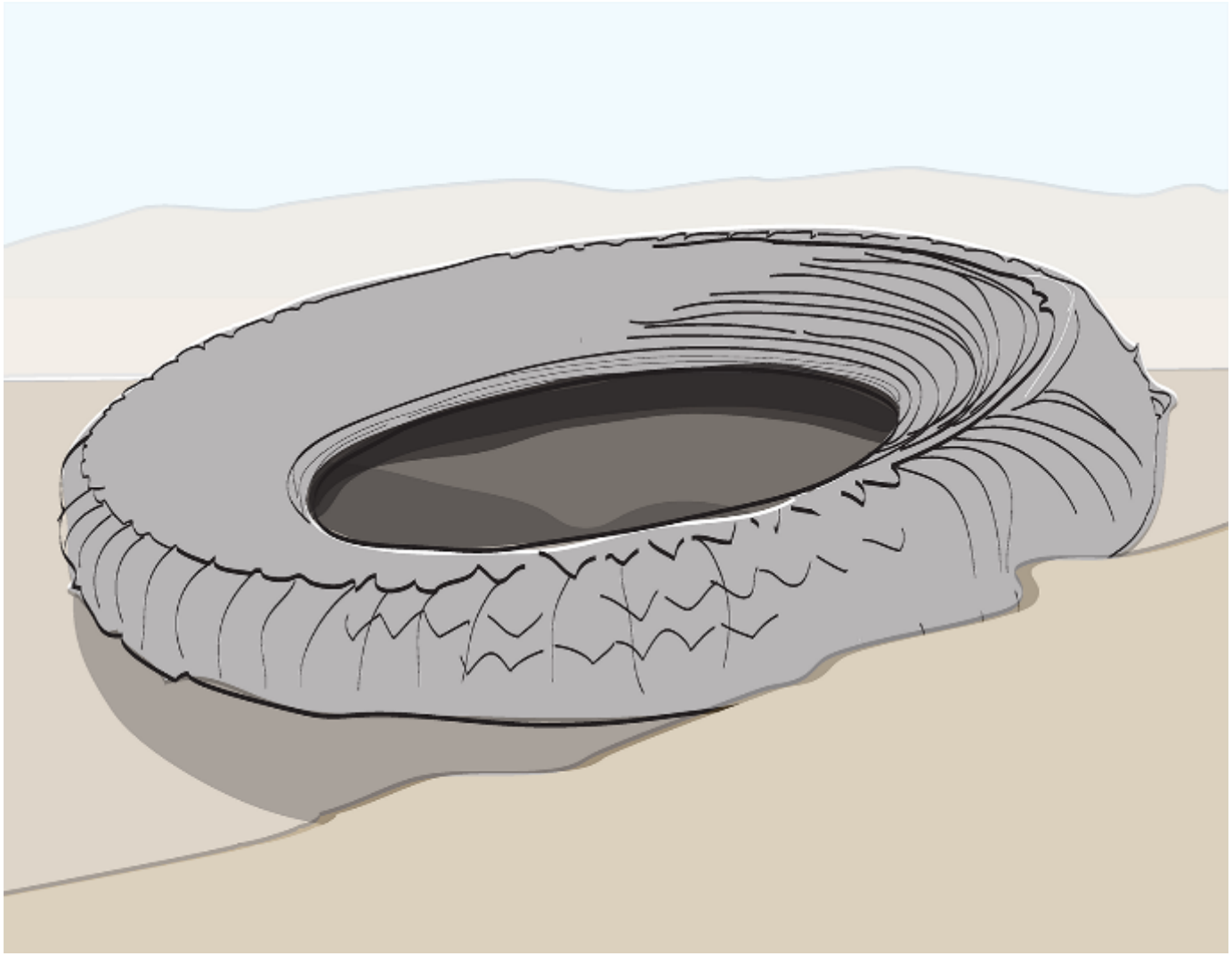


 Abandoned car_1	 Animal Tracks_2	 Animal Trough or dish_3	 Birdbath_4	 Can, bottle or cup_5
 Discarded objects / trash_6	 Ditch_7	 Estuary_8	 Grill_9	 Hollows in trees_10
 Hollows in plants_11	 House structures_12	 Lake or pond_13	 Mosquito adult_14	 Mosquito eggs_15
 Mosquito larva_16	 Mosquito pupa_17	 Ovitrap_18	 Pool _19	 Puddle_20
 Public works _21	 River / stream edge_22	 Shells_23	 Stadium cup_24	 Swamp_25
 Tank _26	 Tire_27	 Trash container_28	 Water storage jars_29	 Well or cistern_30
 Plant pot _26				

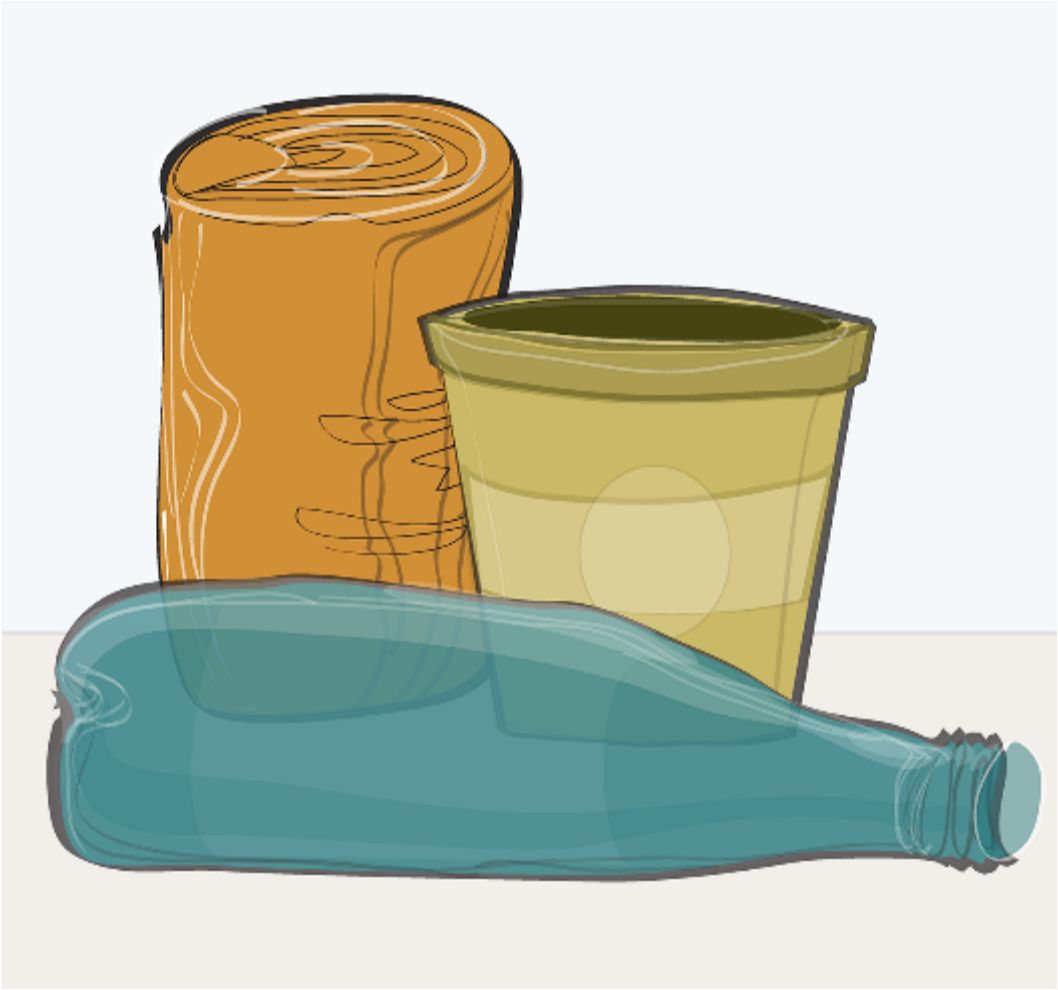
- Before playing game, mix up the order of the slides!



Flower pot or other container



Discarded tire

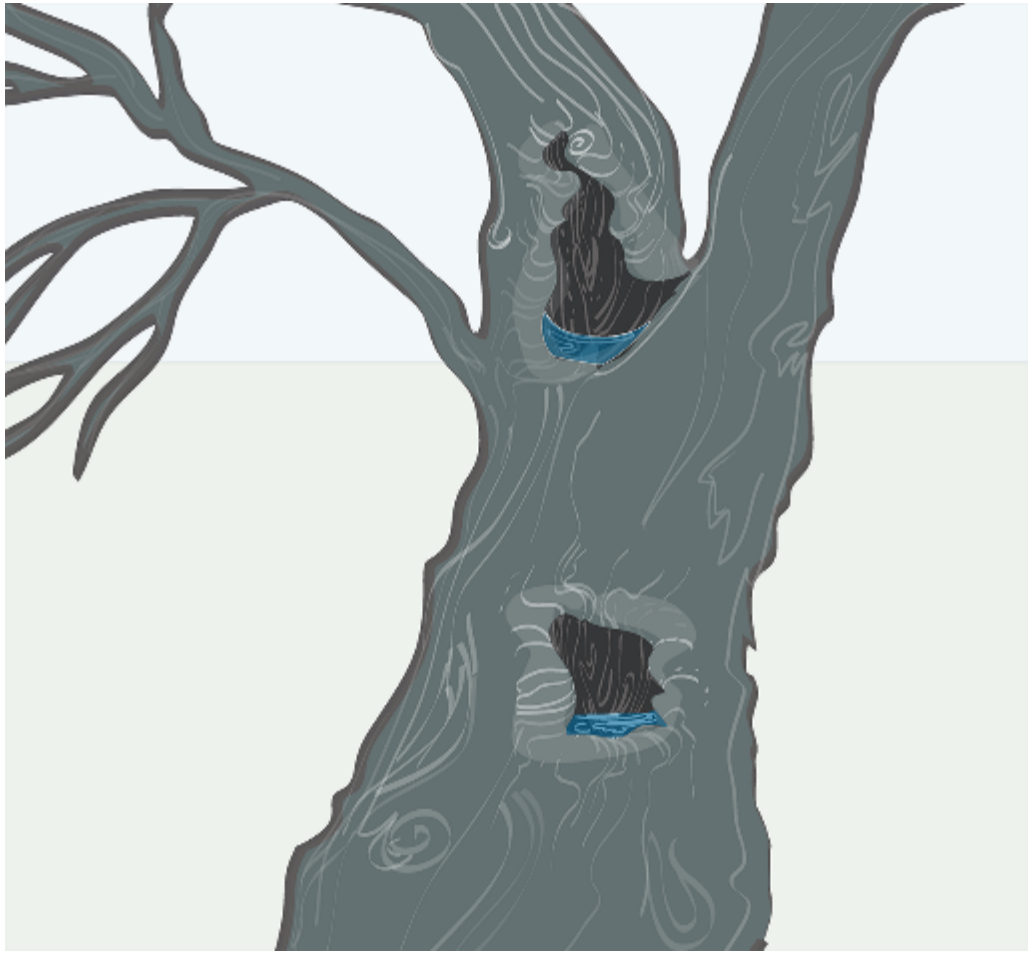


Can or bottle

Water storage container

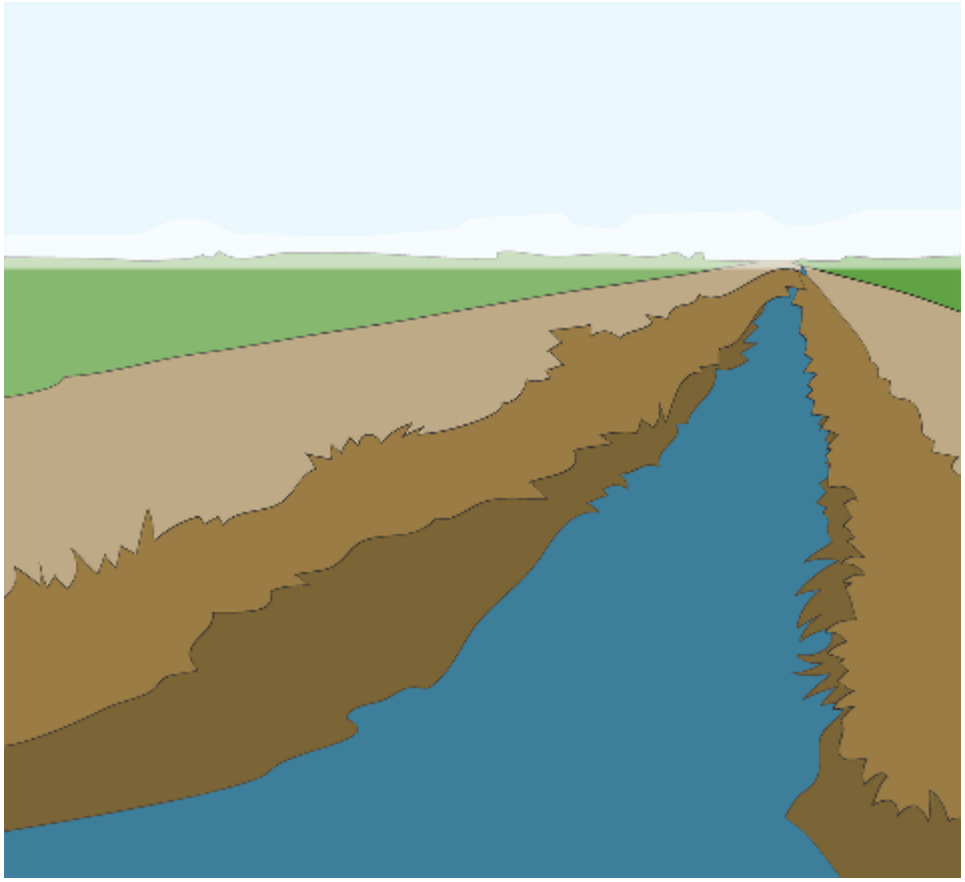
Stagnant water on plant, such as bromiliad, bamboo, puddle on leaf

trash can

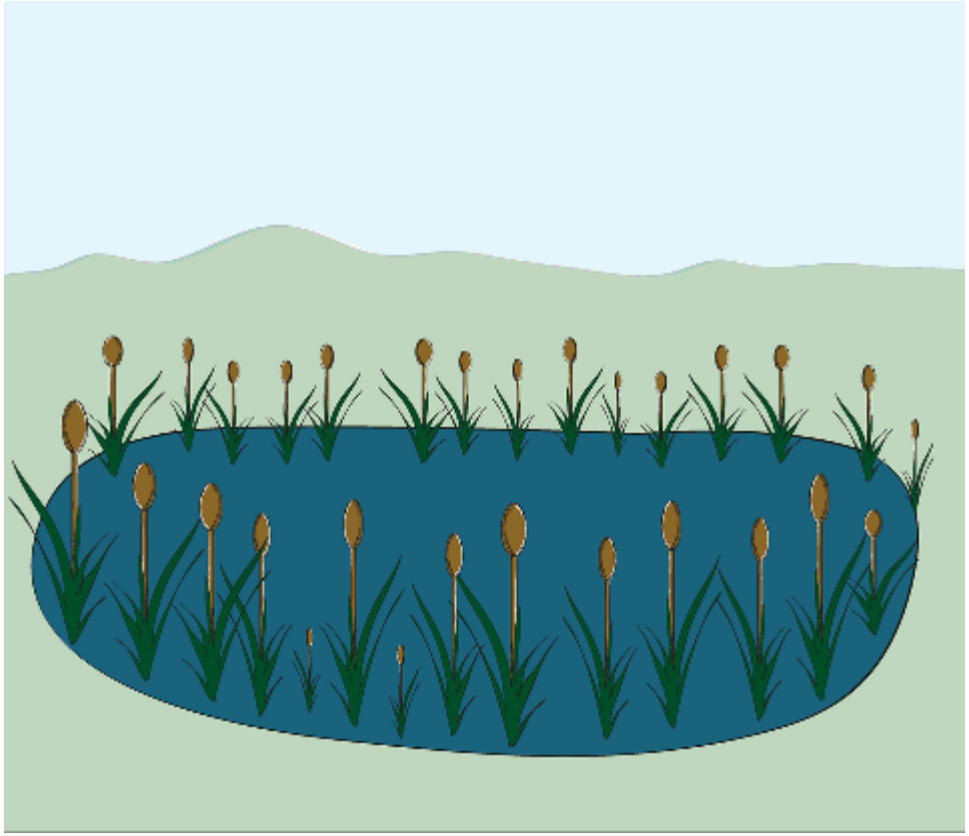


Tree holes or natural hollows in wood

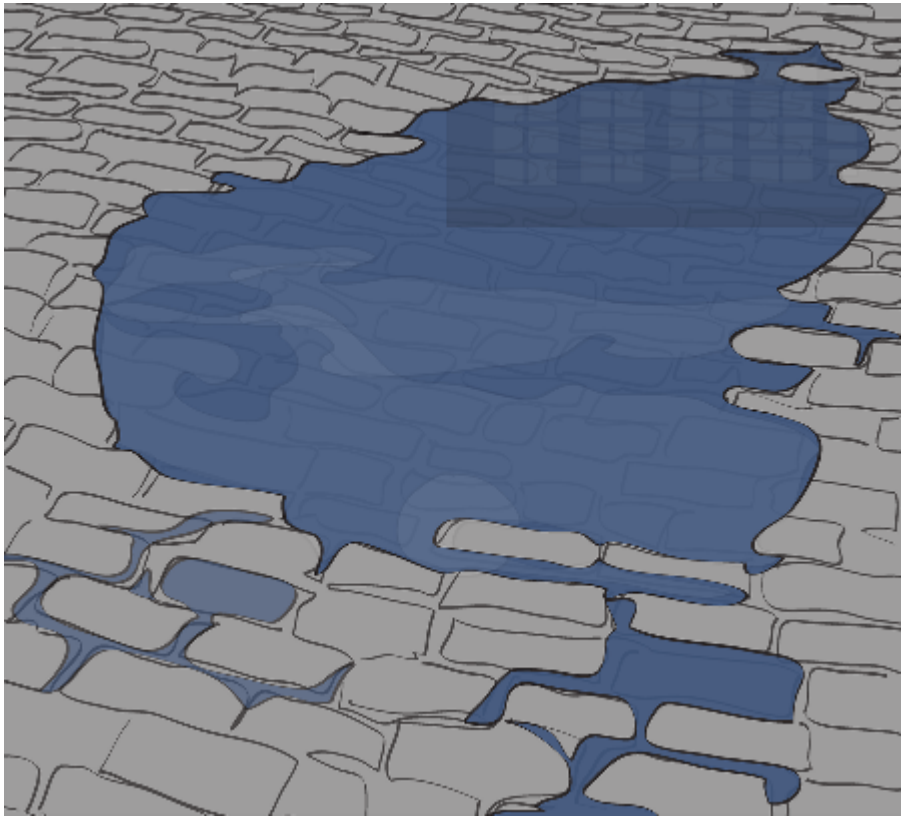
Mosquito trap- adult mosquito trap



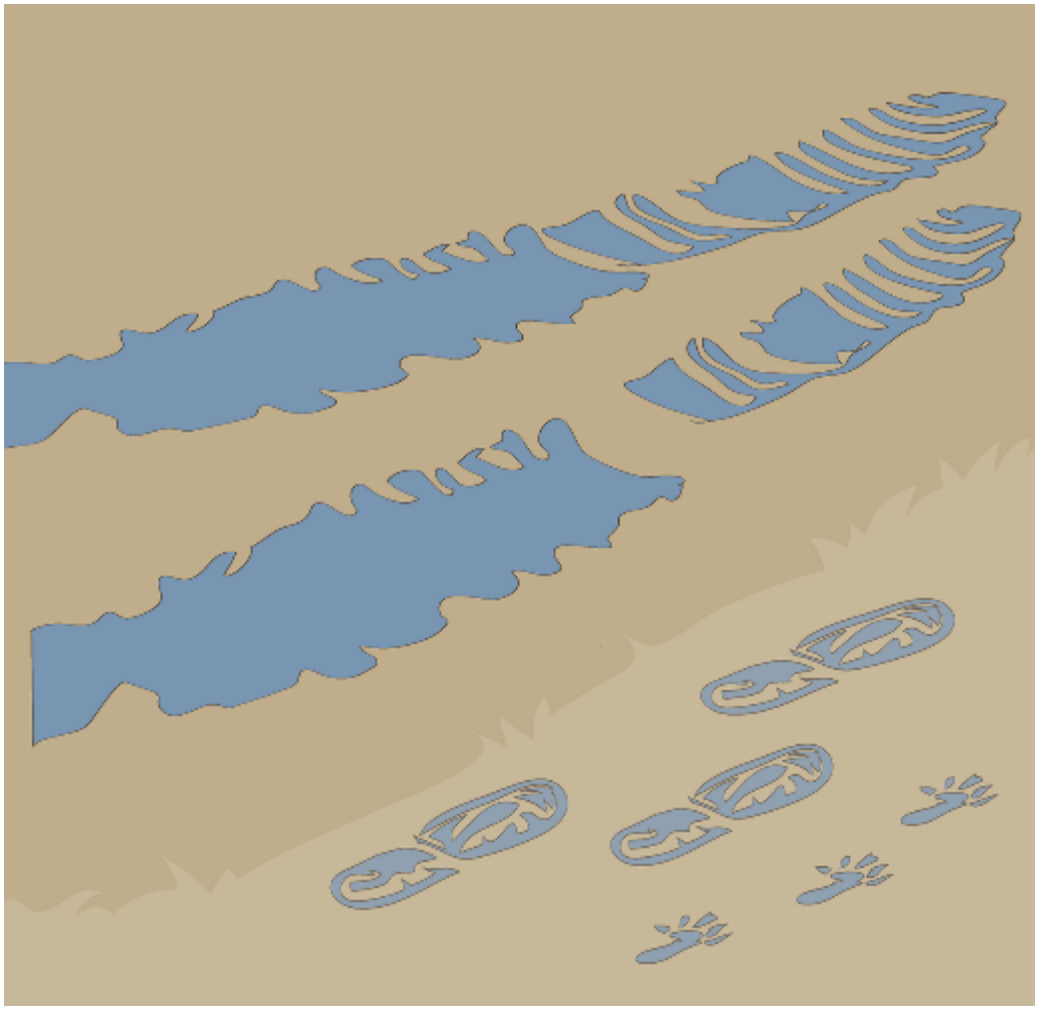
curbside or irrigation ditch in field



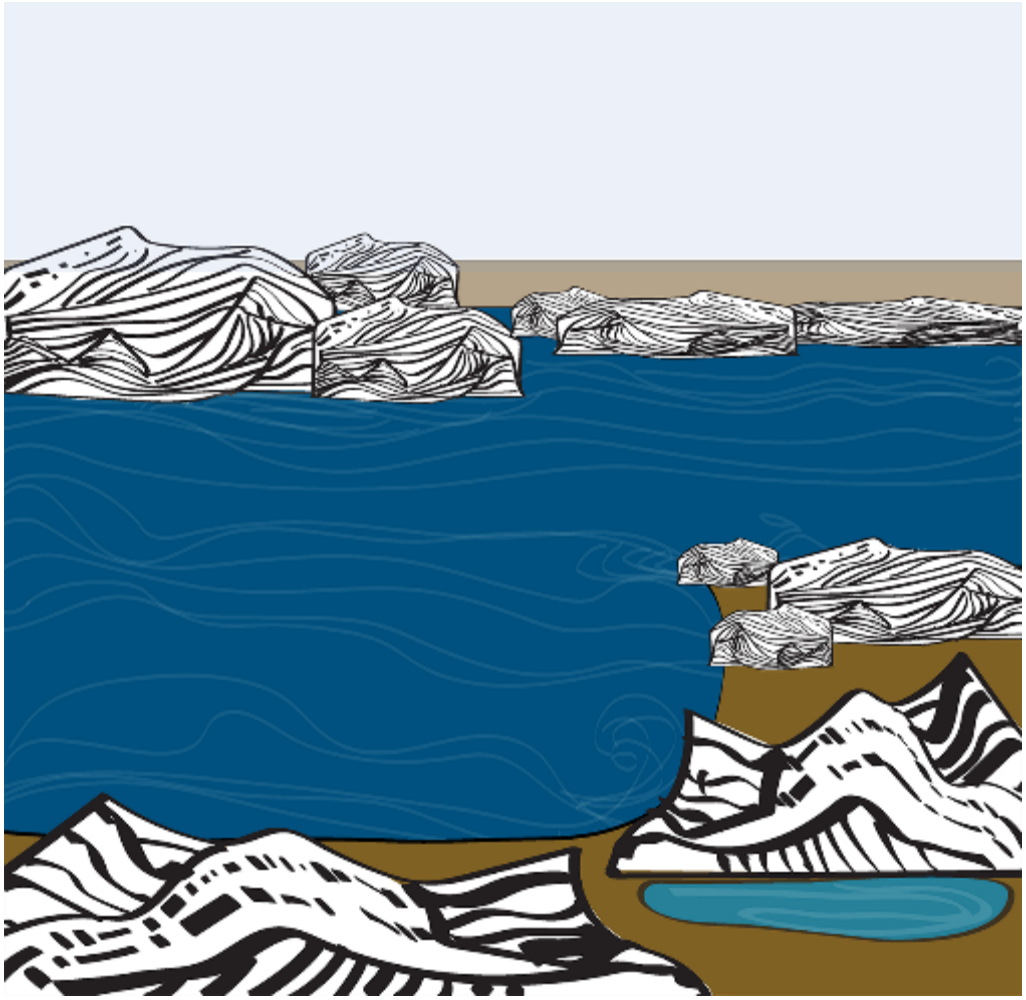
Wetland or swamp



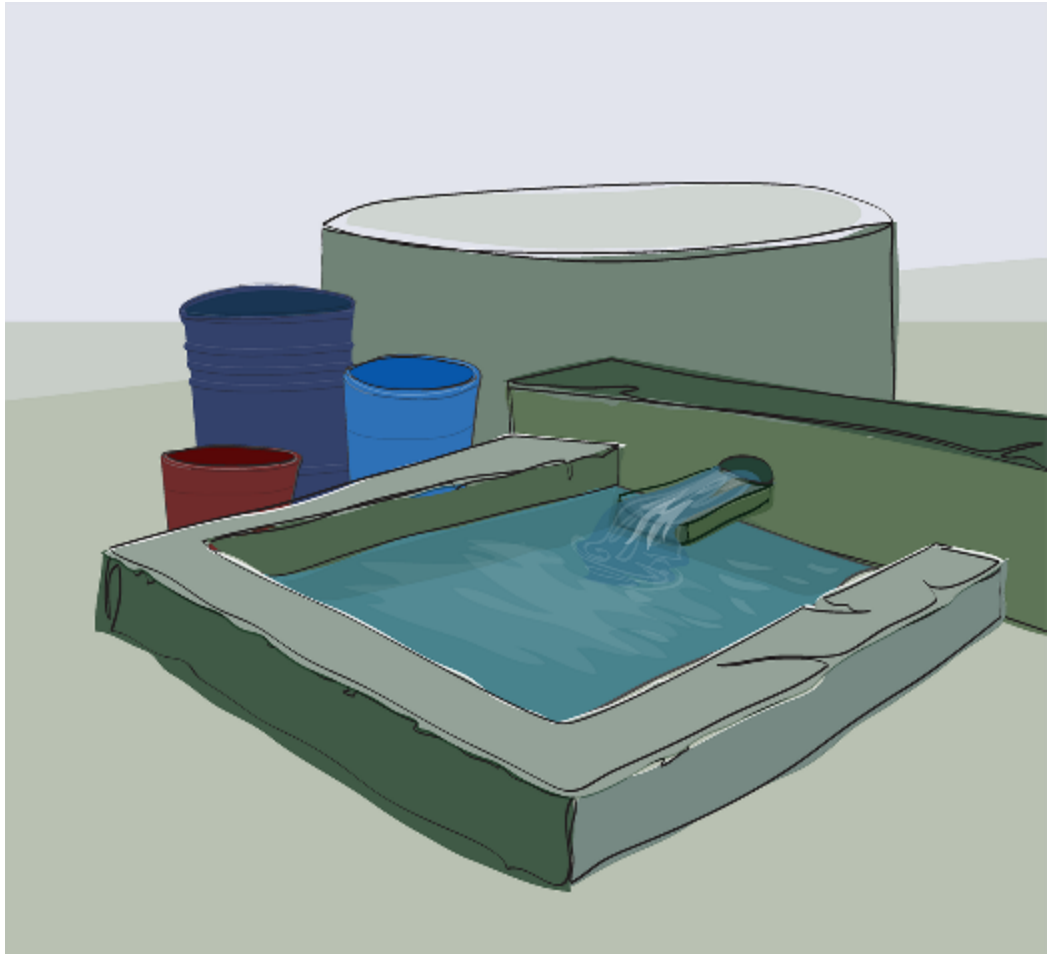
puddle



Animal, people or tire tracks

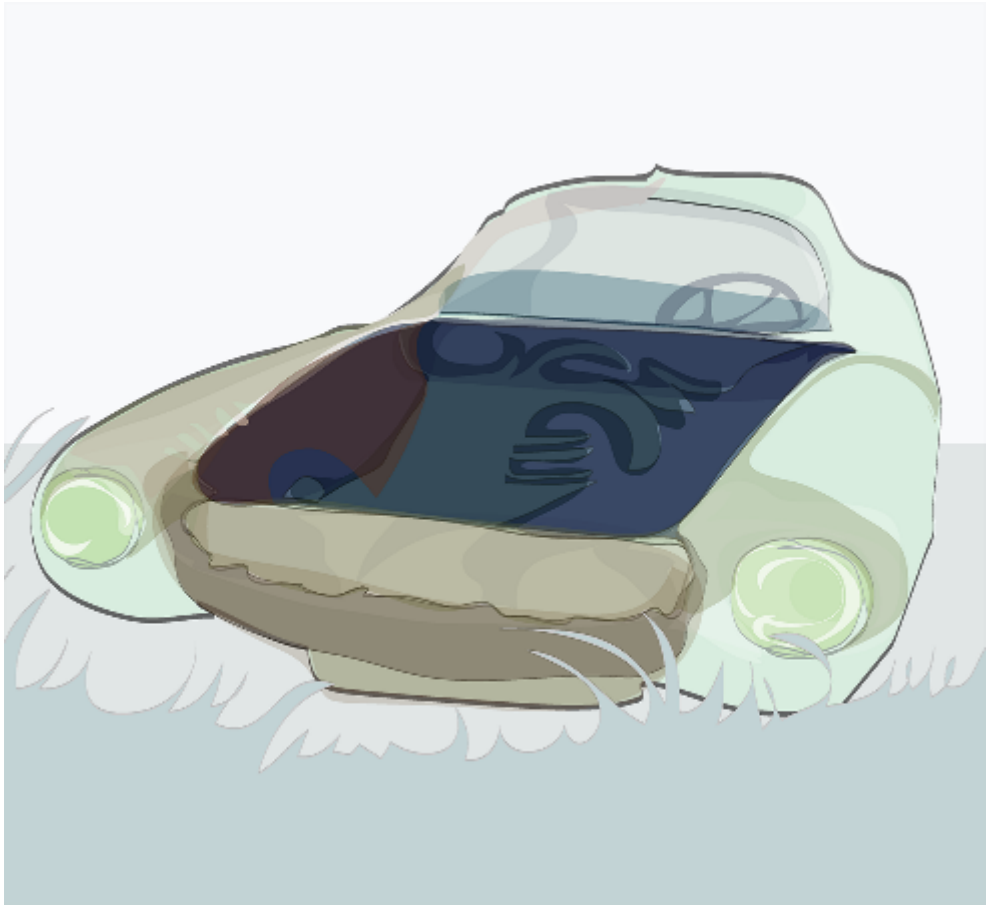


Pooled still water next to flowing stream

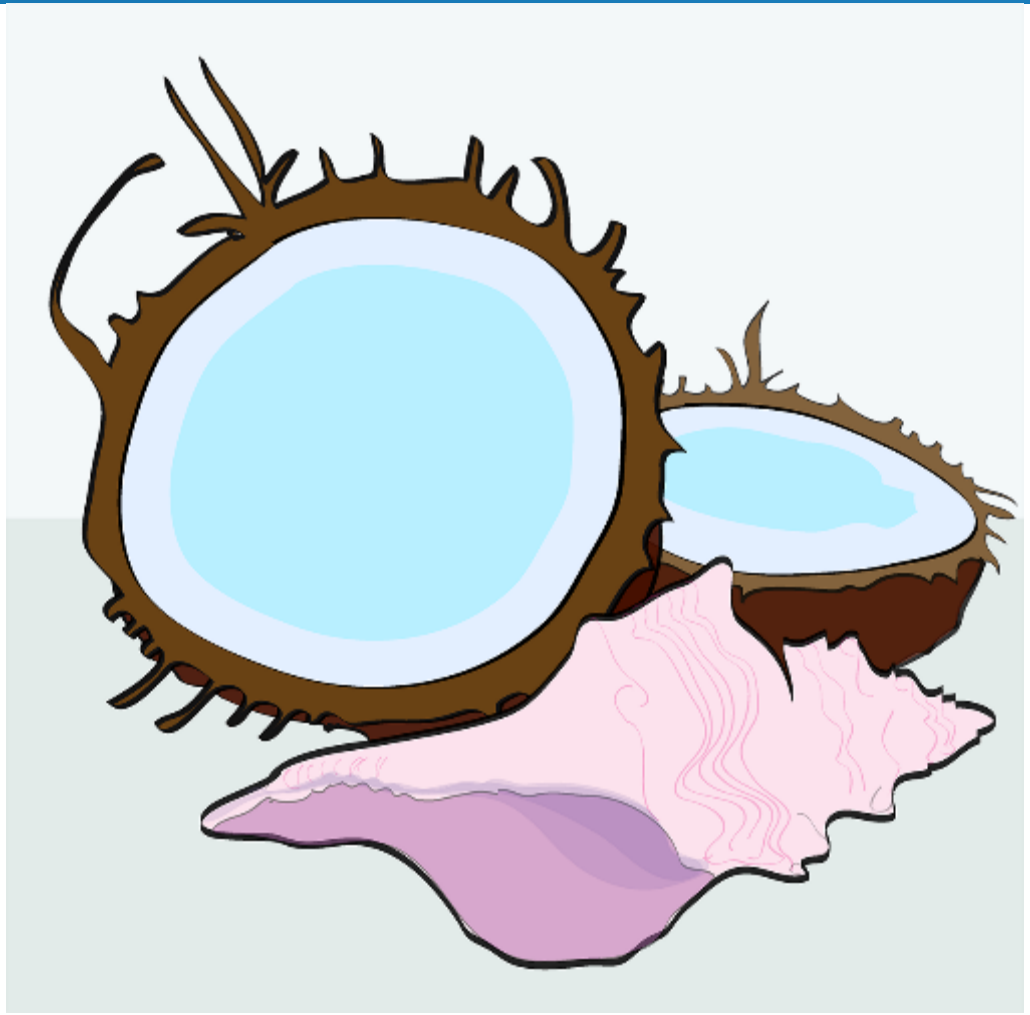


Cistern or built water storage

trash

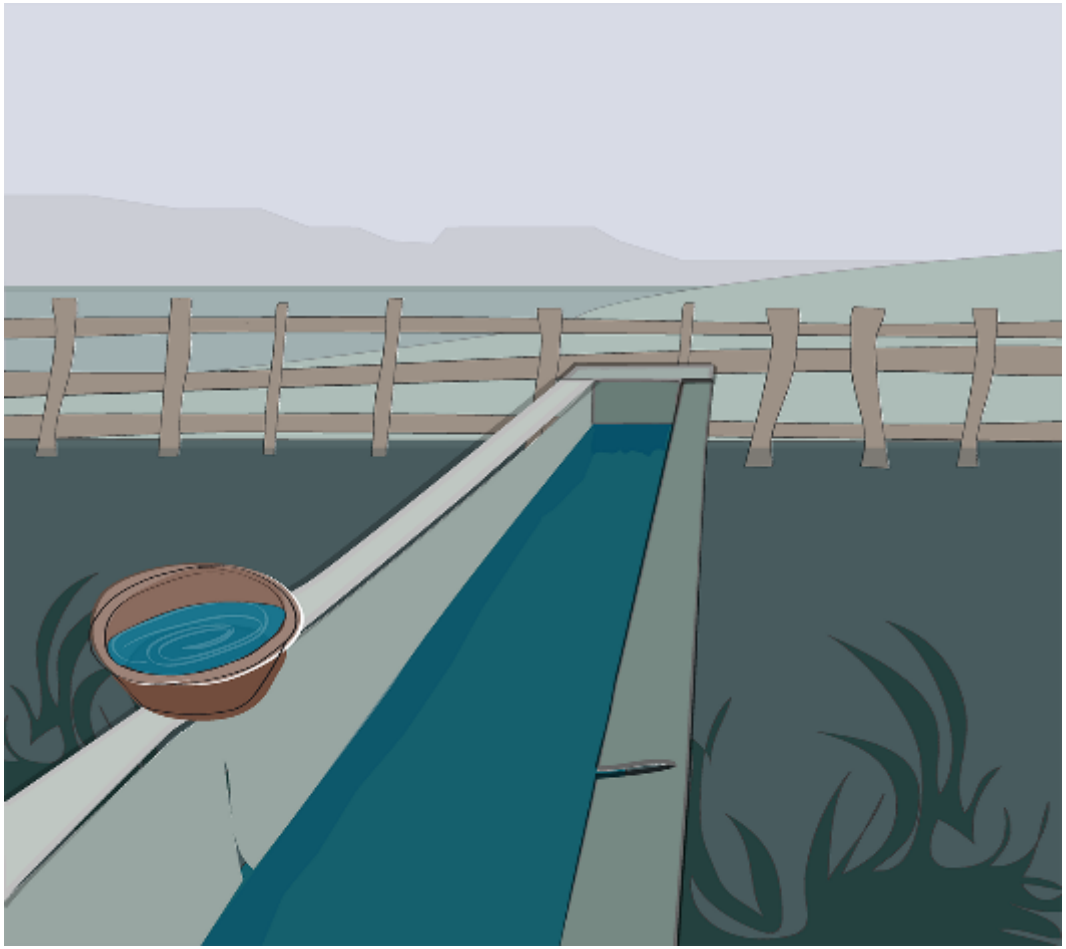


Abandoned vehicle, like a car or boat

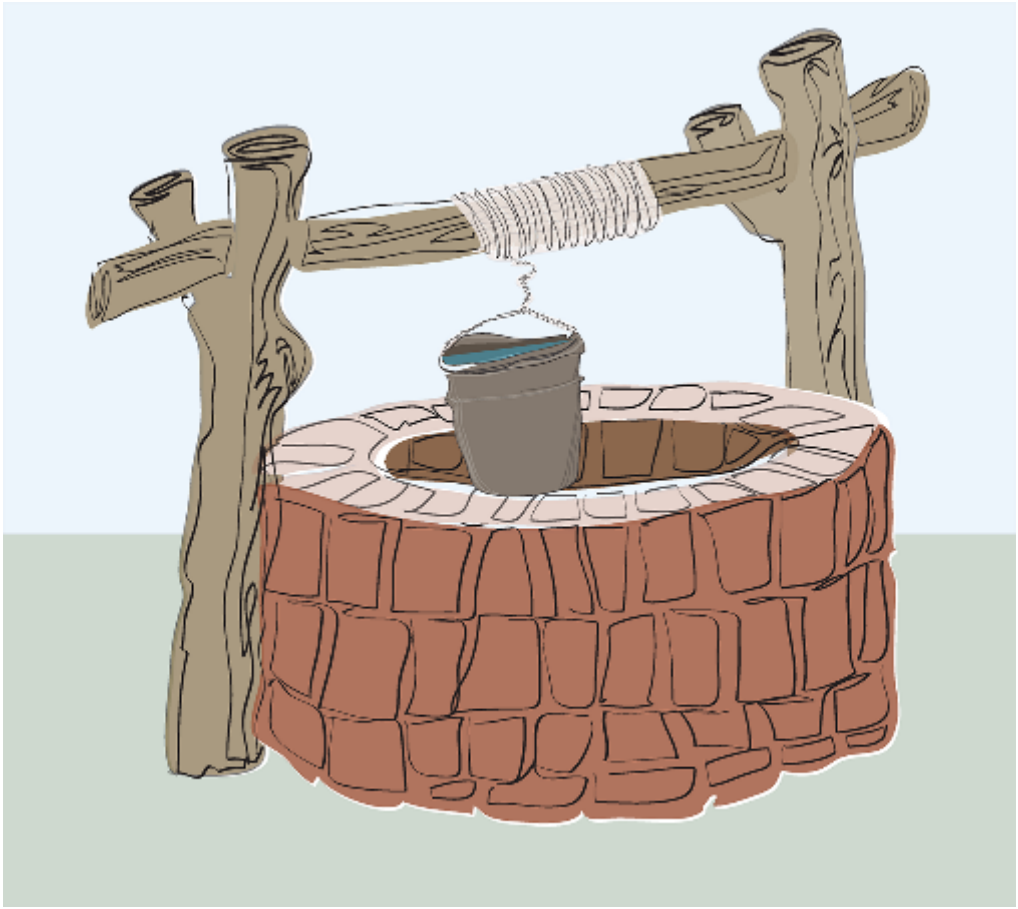


plant or animal shells

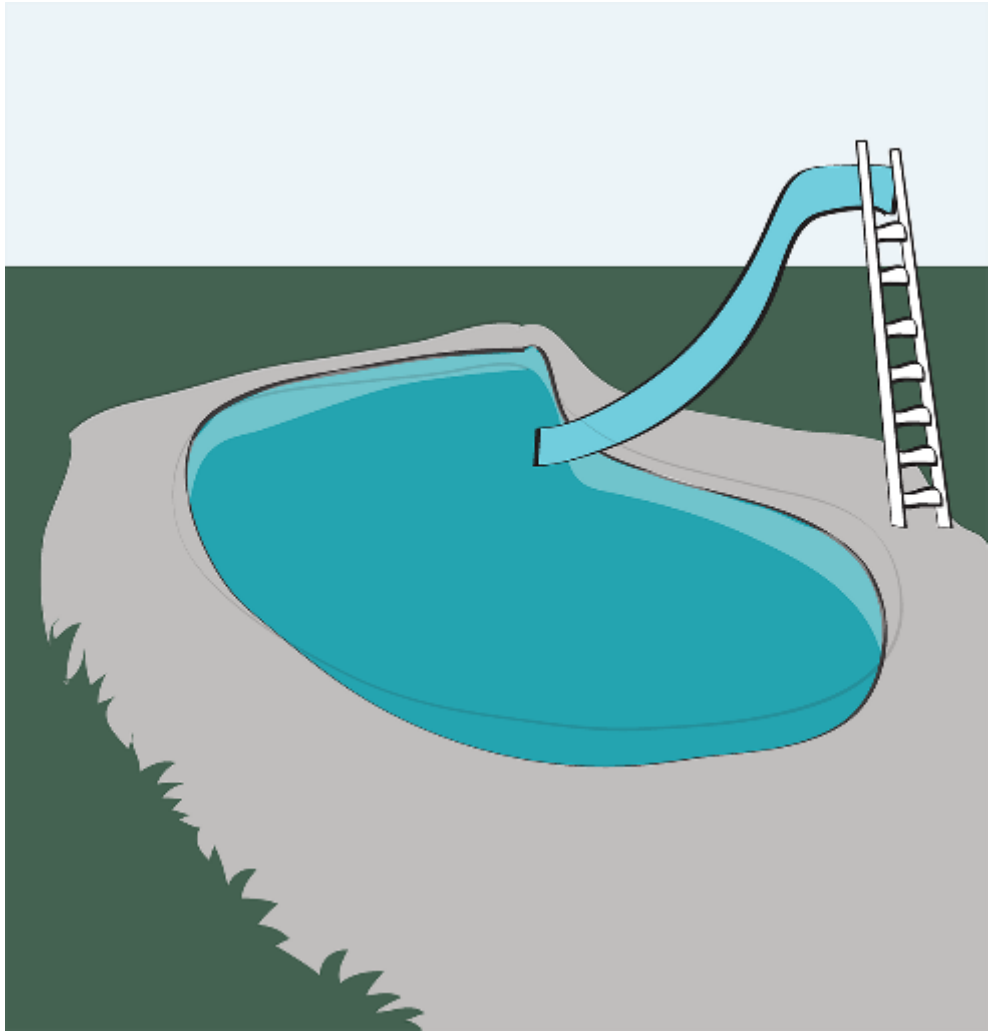
birdbath



Animal trough or water bowl

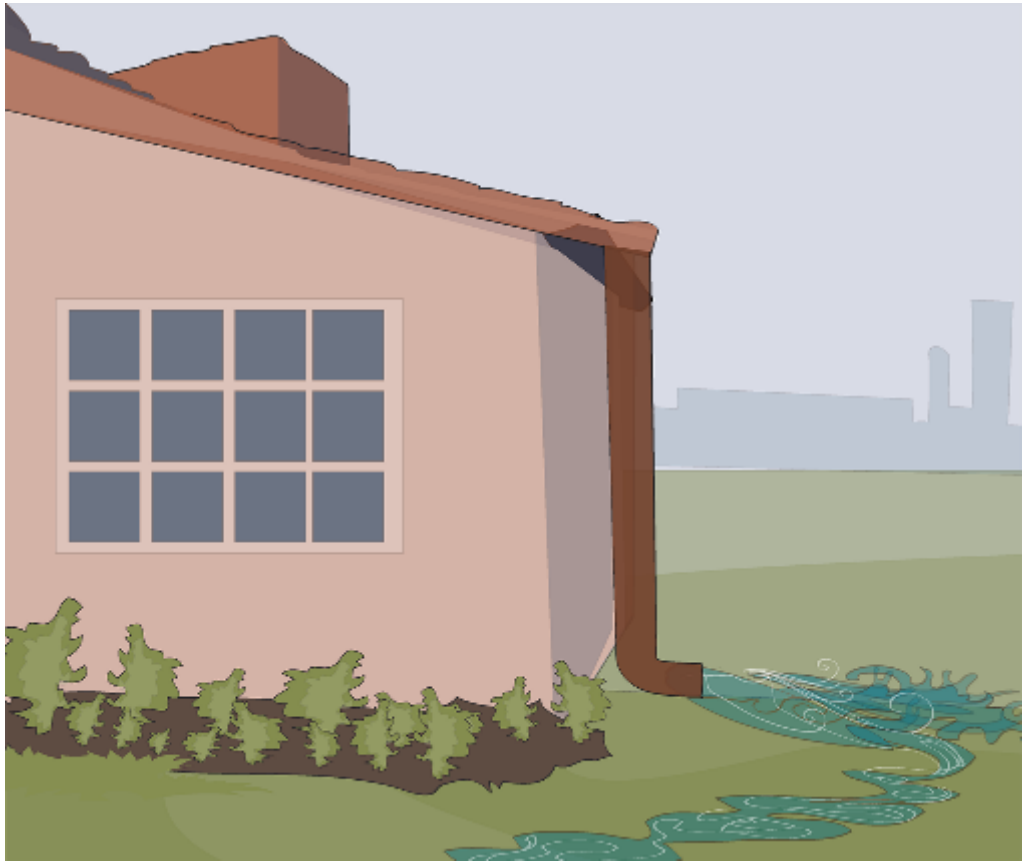


well



Pool

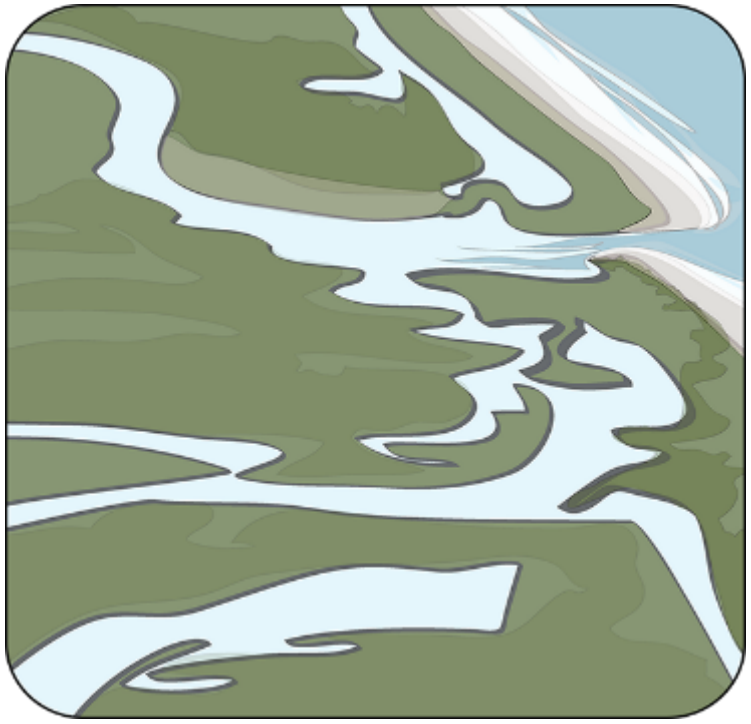
Bridges, culverts, public works structures



Gutters, downspouts

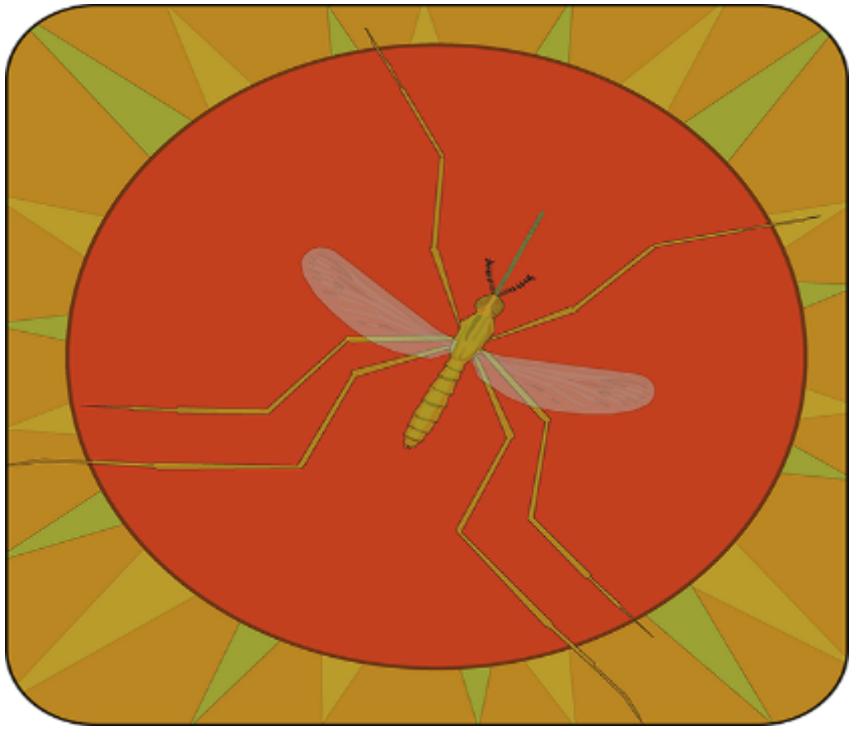
Grill, outdoor appliance

ovitrap

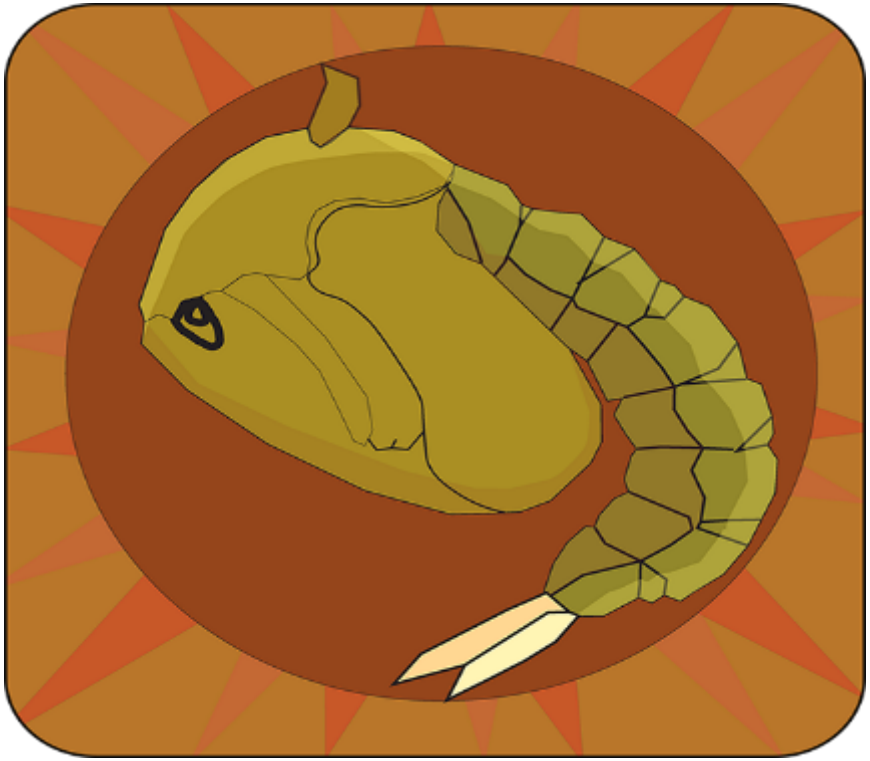


estuary

Mosquito eggs



Mosquito adult



Mosquito pupa

Acknowledgements

The **GLOBE Observer Mosquito Habitat Mapper** is a NASA-sponsored project that is the result of the combined efforts of an extended team that includes the Institute for Global Environmental Strategies (IGES); NASA Goddard Space Flight Center, Langley Research Center, and Jet Propulsion Laboratory; Space Science Applications, Inc. (SSAI); the GLOBE Implementation Office (GIO), GLOBE DIS and Brooklyn College.

The **Mosquito Challenge Community Campaign (MCCC)** is focused on demonstrating the usefulness of citizen science data collected using the GO Mosquito Habitat Mapper for combating Zika in Brazil and Peru. MCCC is led by IGES in partnership with the University Corporation for Atmospheric Research (UCAR), and leverages the NASA App, and the GLOBE Program networks of scientists, teachers, students, and citizen scientists. The MCCC project is made possible through the generous support of the Combating Zika and Future Threats Grand Challenge through the United States Agency for International Development (USAID).

This presentation was prepared by the Institute for Global Environmental Strategies (IGES) and does not necessarily reflect the views of the NASA or USAID. For more information, contact the MCCC Principal Investigator, Dr. Russanne Low:

Rusty_low@strategies.org

www.globe.gov

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The GLOBE Program

COMBATING ZIKA AND FUTURE THREATS
A GRAND CHALLENGE FOR DEVELOPMENT

GLOBE Observer
mosquito habitat mapper

Task 5-2 Tutorial

Mosquito Habitat Mapper

INSTITUTE for GLOBAL ENVIRONMENTAL STRATEGIES

The GLOBE Program

COMBATING ZIKA AND FUTURE THREATS
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Overview

This presentation:

- Provides background information to prepare citizen scientists to use the GLOBE Observer Mosquito Habitat Mapper

- Provides the step by step instructions for obtaining a mosquito sample for analysis

Overview

Learning Objectives

After reviewing these slides, you will be able to:

- Recognize potential mosquito breeding sites
- Sample water for mosquito larvae
- Identify mosquito larvae and differentiate between *Aedes, Anopheles*, and *Culex* larva.
- Understand the importance of removing extraneous containers with standing water from around your neighborhood and community

GLOBE Observer is an international network of citizen scientists and scientists working together to learn more about our global environment, including our changing climate and its impacts.

Mosquito Habitat Mapper

GLOBE Observer is part of The GLOBE Program. Data collected by citizen scientists through GLOBE Observer encourages student research, strengthens science education, and supports the work of scientists.

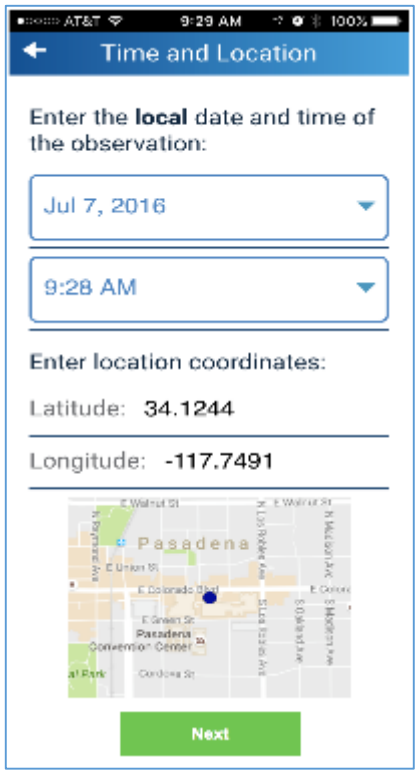
GLOBE Stats

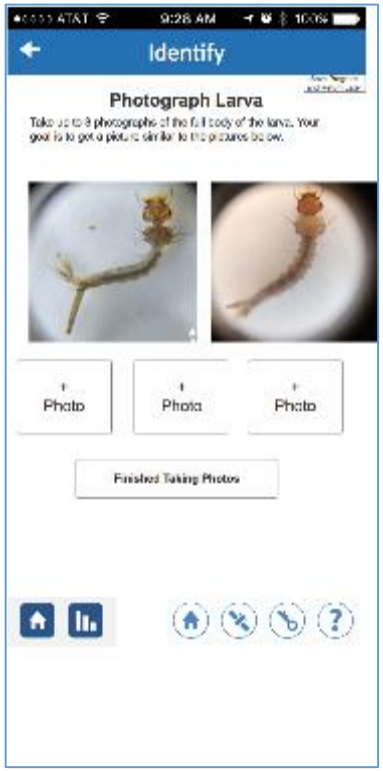
117	Countries
30,776	Schools
28,193	Teachers
141,856,866	Measurements
518,056	Measurements this month

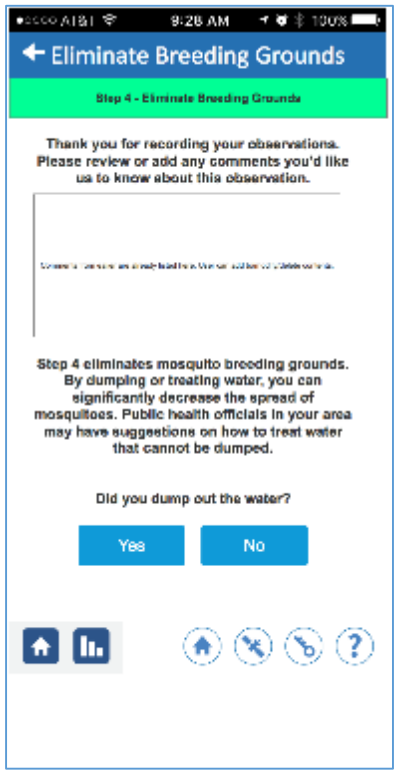
- **The goals of the MHM app are to SEE increased mosquito awareness and decreased mosquito-borne disease risk through:**
- **Scientific data collection and analysis**: Identifying locations of mosquito taxa of interest to participants, communities, public health authorities
- **Empowerment**: Actively reducing mosquito risk- by dumping containers and monitoring environment
- **Education:** Learning opportunistic breeding habits used by *Aedes aegypti/albopictus* in human built environments and about vector borne disease risk communities

Our investigation focuses on mosquito larvae- an immature developmental stage that lives in water, doesn't bite and doesn't pose a health hazard to humans!

The Mosquito Habitat Mapper supports you through **4 data collection steps:**





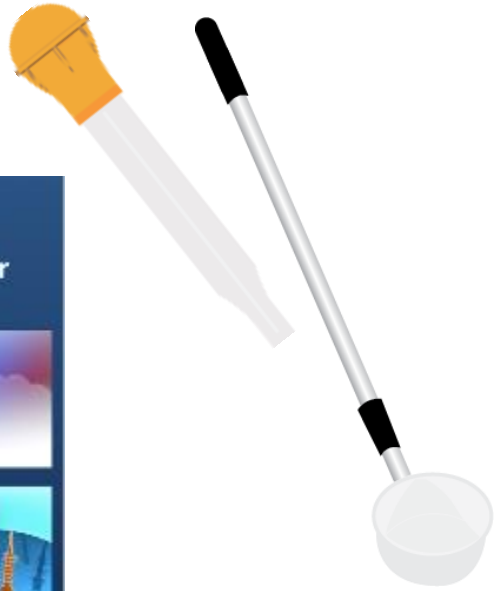


Locate → **Sample/Count** → **Identify** → **Decommission**

1 **2** **3** **4**

Equipment Needed for habitat mapping and sampling:

- **GO Mosquito Habitat Mapper on a mobile device (e.g., phone or tablet)** for recording and submitting data.

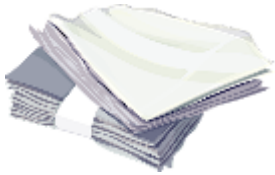


- **Mosquito dipper, ladle, cup or bulb syringe (or a net, bucket, and wash bottle)** for sampling. (Contact your local mosquito control authority for any recommendations)

- **Plastic bag and marker** for saving or transporting water samples with larvae and labeling the bag.

Equipment needed for Identification

- **Macro lens** attachment for mobile device (35x) or microscope. (Some features can be seen with a good magnifying glass.)
- **Toothpicks, tweezers or forceps** to move larvae for viewing
- **White plastic or paper plate**
- **Paper towels**
- **Ethanol** for euthanizing specimens or preserving samples (optional)
- **Plastic or glass vials** for specimen storage (optional)



Citizen Scientist Safety

Note: most mosquitoes do not transmit pathogens to humans or cause disease.

- **Protect against mosquito bites:**
  Wear long sleeves, pants, socks and shoes.
  Apply an effective insect repellent to exposed skin.

- **Protect from polluted or unsafe water:**
  Wear gloves and/or goggles.

- **Avoid sampling on private property:**
  Sample in your own yard or in public areas. Do not take samples on private property unless you have obtained permission.

✓Recommended: goggles and gloves for safety

Data Collection using the GO Mosquito Habitat Mapper

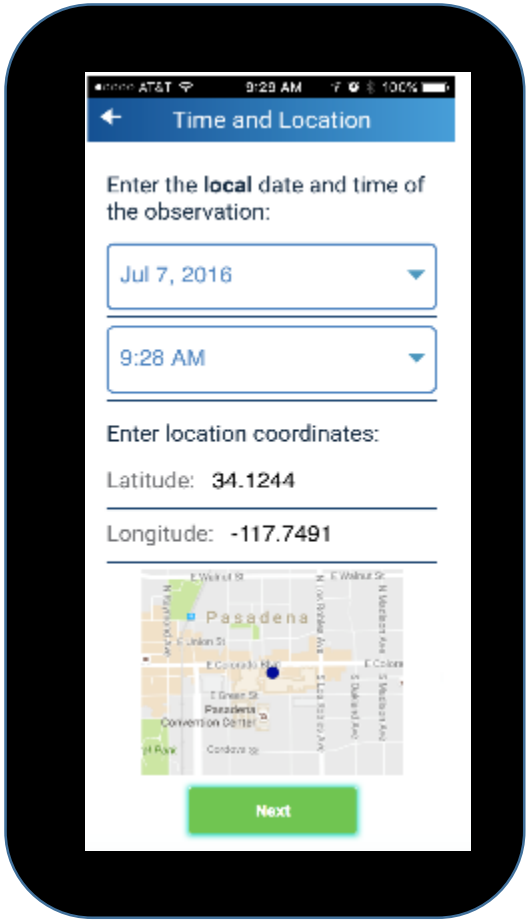
Step 1. Locate Breeding Sites

Open GLOBE Observer Mosquito Habitat Mapper.

The app will automatically download the date, time and the latitude / longitude of your location.

You will be able to verify the location by the map that is provided.

Note: You can use the app whether or not there is Wi-Fi at your sampling location. All recorded data will automatically be sent when Wi-Fi becomes available!



Locate sources

Locate sources of standing water. Check the surface of the water for mosquito larvae.

Indoor containers

Outdoor containers

Step 2: Sample and Count

Use your sampling tool (whether a cup, syringe, dipper, net/wash bottle) to obtain a water sample containing larvae.

Protocols for gathering samples vary according to the tool used. Use the one that works best for your situation.

Importance of taking multiple dips

But no matter which tools you use, GLOBE recommends sampling each source 5 times. Because the larvae are not evenly distributed on the surface, so you may need several dips to obtain a sample with larvae in it.

Wait a couple minutes between each dip. Why? When you disturb the surface of the water, the larvae will swim below for safety. However, they will soon return to the surface because they have to breathe.

Technique for using a net or a mosquito dipper in a small pond

Sampling Method 1: Bulb Syringe

This method is appropriate for all environments and sampling sites.

Steps:
1.Press and collapse bulb.
2. Place syringe tip near the top of the water surface.
3. Release bulb so bulb inflates and water enters the syringe.
4.Transfer sample to plastic bag by holding tip and then releasing the sample into the bag.

Sampling Method 2: Dipper

You can use a mosquito dipper, a soup ladle, or even a plastic cup when sampling either a container or a non-container site.

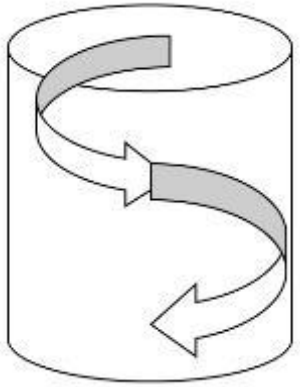
Steps:

1. Skim the upper most surface of the water with the dipper at an acute angle with respect to the water surface.
2. Transfer your sample to a sample bag. (You can put all your samples in the same bag.)

Sampling Method 3: Net sample from large container

Large water containers are those that hold 500 L or more of water. Examples include large water jars, water pools, and cement tanks.

Steps:
1. Dip the net in at the surface of the water.
2. Start at the top of the container by swirling the net around the edge.
3. Continue to the bottom in a swirling motion- sampling all edges of the container.



Sampling Method 4. Net sample from small container

Steps:

1.Pour water from the container holding the sample througha collection net into a separate bucket.

2. Use a squirt bottle filled with water to wash any trapped debris into the bucket.

3. Pour sample from bucket into a plastic bag(s).




Handling Samples

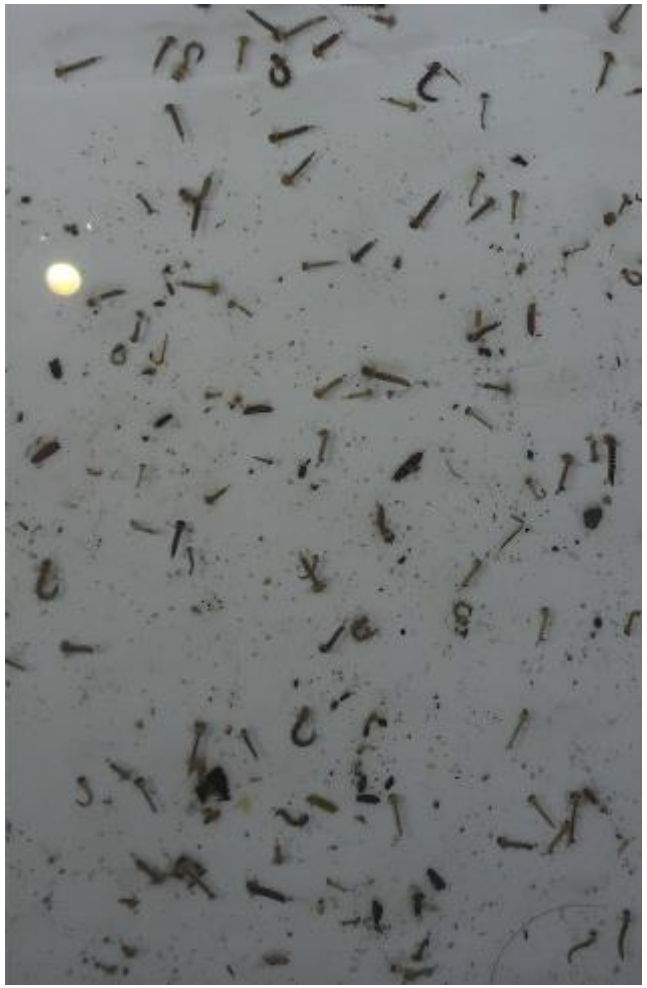
- You may want to take your sample inside to identify your specimen
- Leave air in bags so that larvae can breathe.
- Keep bags cool and in the shade (overheating will kill larvae).
- Identify the larvae soon after collection. If left overnight, any pupae in the sample may become adult flying mosquitoes.
- If you find adult mosquitoes in your sample bag, shake the bag to drown the adult mosquitoes and dispose of the sample by pouring all contents on the ground.

Step 2: Sample and Count

Count the number of larvae in your sample. You can provide an exact number or an estimate.

For example, in the sample to the right, the larvae count is estimated to be 75-100.

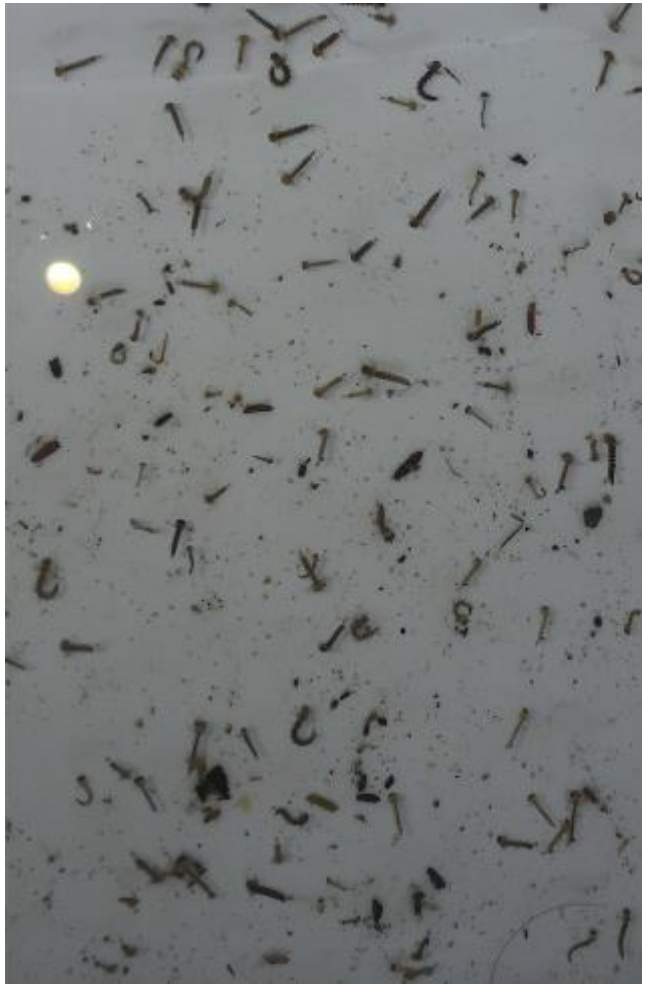
Using this same sample photo, it is important to note that not all of the larvae look the same. Why do you think they are different?



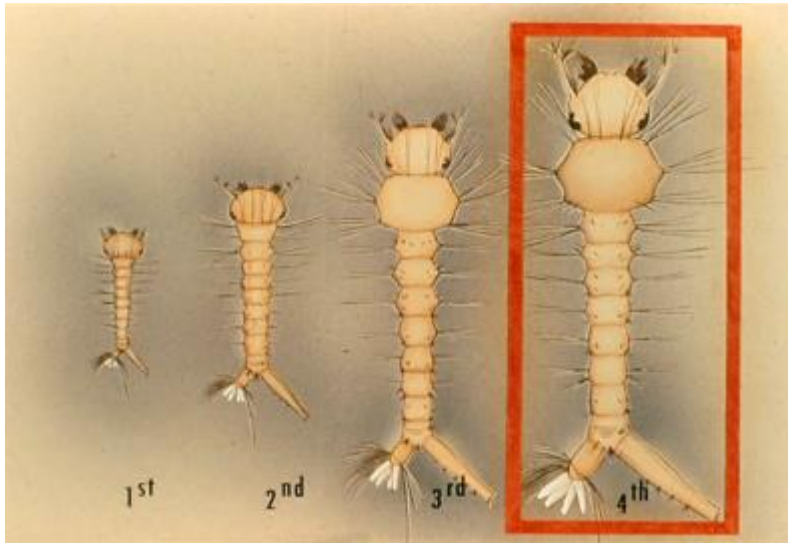
(Answer)

This sample has larvae from different stages of development.

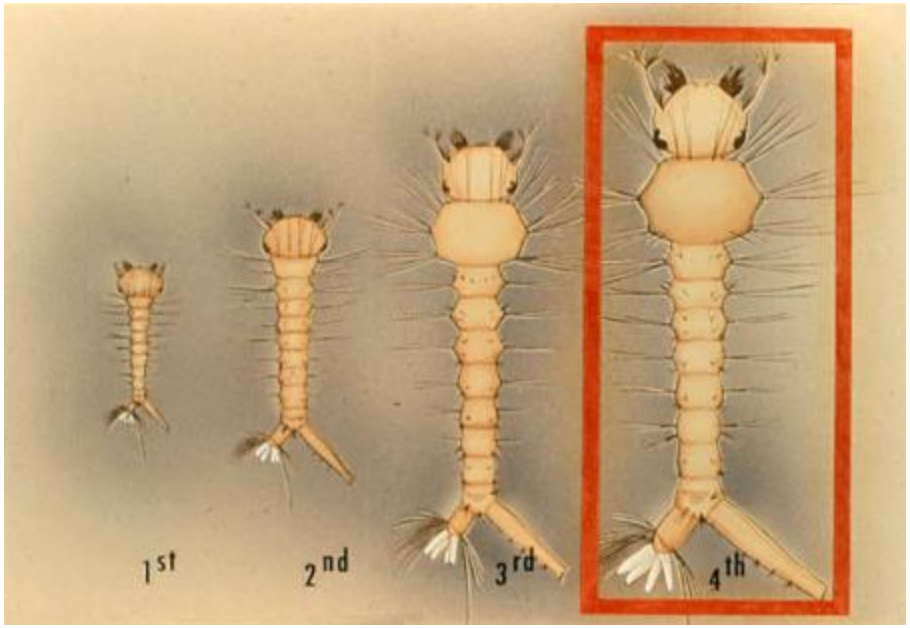
We will show you what we mean in the next few slides.



After hatching from its egg, the larva is in its first **instar** (stage between molts). It eventually outgrows its exoskeleton and molts (loses its outer covering) to become a second instar. It does this two more times to reach the fourth instar. The fourth instar is the larval stage that is most visible, reaching a length of one-half inch.



The features used to identify your specimen are seen on the **4th instar larva**- so look for the biggest larvae in your sample.
If you can't distinguish any features, it is possible that the larvae are still in an earlier instar stages. If that is the case, you can count your larvae, but you will not be able to identify features.



The 4th instar will molt to become a pupa, another stage in the lifecycle of a mosquito. Pupa are distinguished by their appearance- they look like a comma. You may find pupae in your sample.

Step 3. Photograph and Identify-1

In order to examine and photograph the larvae, they must be removed from the bag.

To begin:

- Pour part of the sample containing larvae onto a white tray or plate.

Photograph and Identify-2

- Use a dropper or spoon to isolate one larva.
- Make sure each larva is suspended in a small drop of water.

Photograph and Identify-3

It is important that the drop of water just covers the larva. Too much water will allow the larva can swim- making it difficult to examine and photograph.

You can remove most of the water by blotting it up using the corner of a paper towel.

If the larva is still moving too fast to see, you can euthanize it with a drop of alcohol.

Photograph and Identify-4

- Use a probe or toothpick to position the larvae so you can see the diagnostic features.

Photograph and Identify-5

- Attach a macro lens to a mobile device so that you can take a picture and upload it to the app.

Photograph and Identify-6

- Clip the macro lens over the lens of the camera and line it up so that you see a perfect circle of light on your phone screen.

Photograph and Identify-7

- Line up the lens so that the specimen is in the circle of light on the viewer.

Photograph and Identify-8

Note that many clip-on devices have a clear collar on them at the end of the lens. You can rest the collar of the lens on your plate.

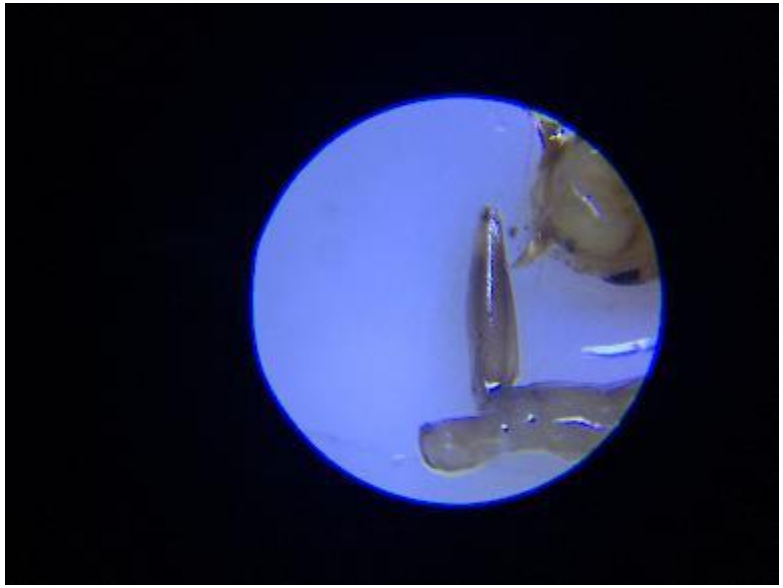
The collar helps you find the focal length that is ideal for looking at your specimen.

Photograph and Identify-9

Once you have a mosquito larva in view, closely examine the diagnostic features.

Now you are ready to identify your specimen. Use the MHM app or a local mosquito larva key to determine the types of mosquitoes in your sample.

Submit photograph and identification to MHM, following instructions in the app.



Photograph and Identify-9

If the larvae you found are “other,” it is probable you have found one of the many mosquitoes that play an important role in the ecosystem. These mosquitoes are occasionally referred to as “nuisance” species, with respect to humans, but they also serve as food for other organisms and as pollinators for plants.

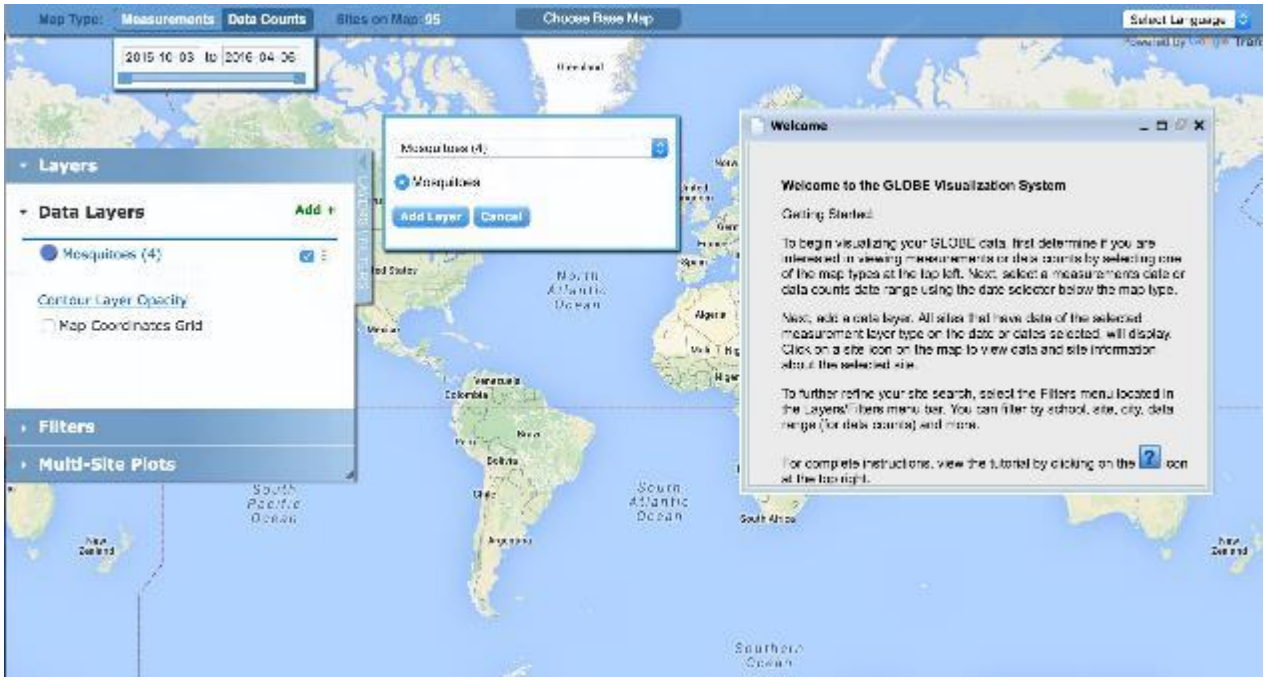
Step 4: Decommission the breeding site

Where possible, decommission (eliminate) container breeding sites by:

- Tipping the container and tossing the water
- Covering the container
- If you locate a breeding site that you can't or shouldn't decommission by yourself, contact a public health official.
- Don't worry about removing a breeding site from use unless it is a natural or artificial container. Birds, frogs and other living things will thank you!

Visualize and Retrieve Data-1

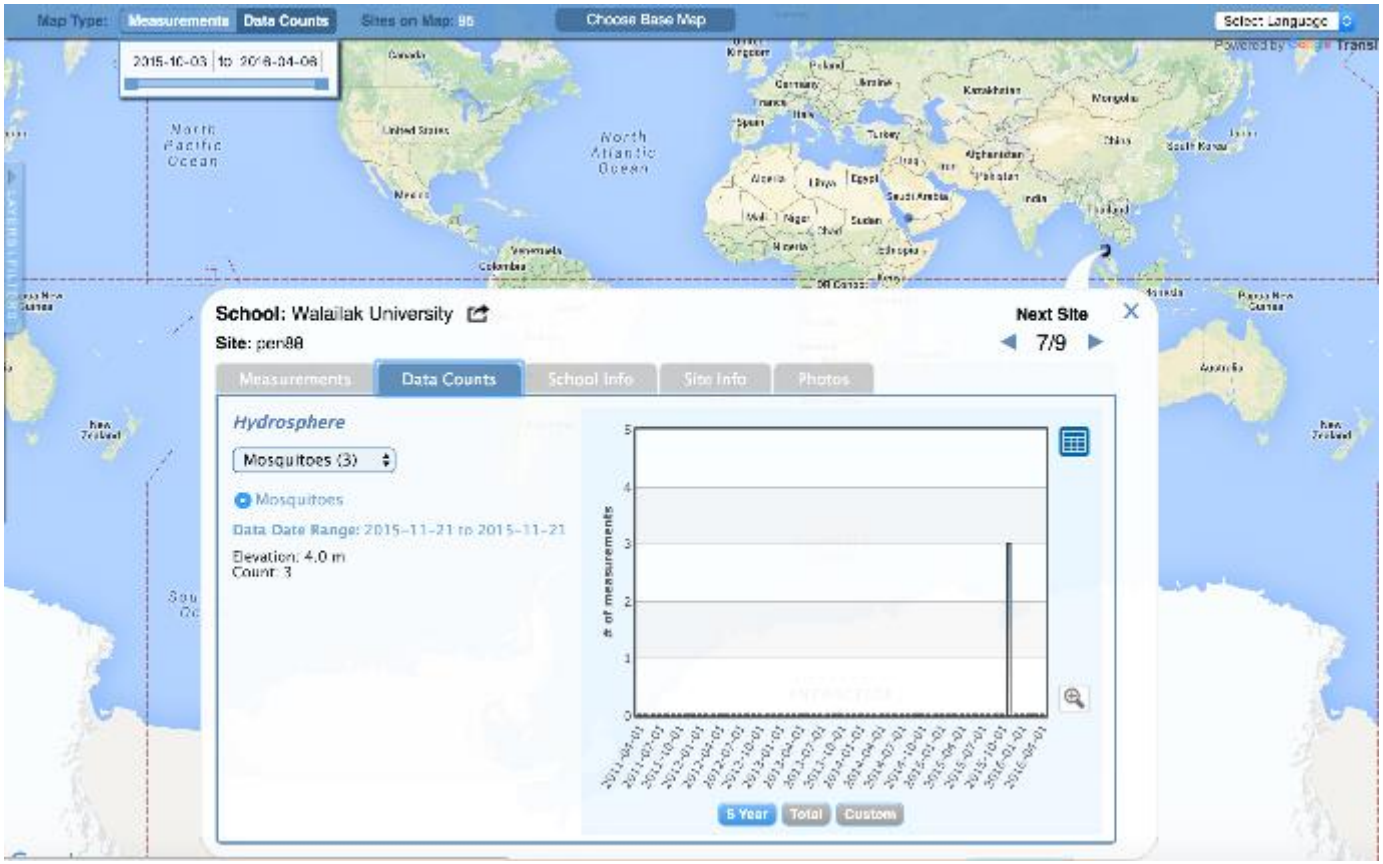
GLOBE provides the ability to view and interact with data measured across the world. Use our visualization tool to map, graph, filter and export data that have been measured across GLOBE protocols since 1995. The Mosquito Protocol is new- so we look forward to seeing your data!



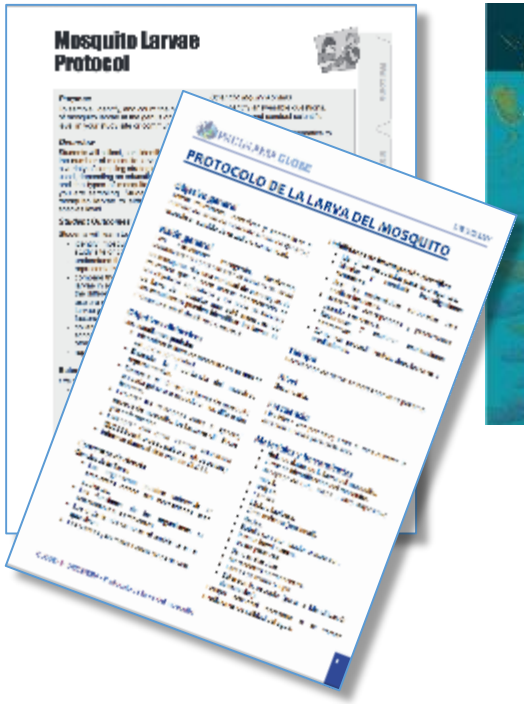
Link to step-by-step tutorial on using the GLOBE Data Visualization Tool

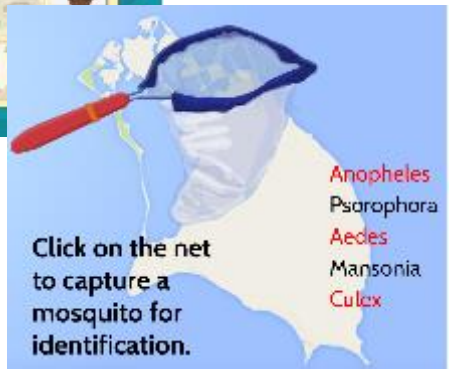
Visualize and Retrieve Data-2

Select the date for which you need pH data, add layer and you can see where data is available.



Additional educational materials for formal and informal education contexts





Educational Resources

Training Protocols

Games

Frequently Asked Questions (FAQs)

What is the mosquito life cycle?

It is variable, based on species and environmental conditions- so this is approximate!
Adult → eggs (2 -3 days) → larvae (4 -5 days) → pupae (1- 2 days) →Adult

How do you differentiate between the *Anopheles*, *Aedes* or *Culex* larvae (identify with unaided eyes)?

We can see the characteristics of mosquito larvae: In the water, *Anopheles* larvae cling parallel with the water surface. On the other hand, *Aedes* and *Culex* larvae cling at an angle of 45° with the side of the container. *Aedes* larvae have shorter siphons, *Culex* larvae tend to have have longer siphons. However, there are 3,500 species of mosquitoes, so you should consult a key for your area to be sure.

What do adult mosquitoes feed on?

Adult mosquitoes feed on any sugar source, including flowers, fruit, nectar and other insects. Some mosquitoes are important pollinators, like bees!

At what time of the year are greater percentages of mosquito larvae found?

Most often they are found in the rainy season or shortly after the end of the rainy season.

Frequently Asked Questions (FAQs-2)

When should I use the GLOBE Observer App or the GLOBE Data Entry App to enter my data?

If you are going to also conduct water quality measurements at the same time or return to the same study site periodically, you will want to follow the GLOBE Mosquito Larva Protocol and GLOBE Data Entry App. This will allow you to look at mosquito density and population change in conjunction with other environmental variables at your GLOBE Hydrosphere study site.

The GLOBE Observer Mosquito Habitat Mapper is designed to support identification of breeding sites around your neighborhood and school, especially those that are in containers. Where possible you will be removing the opportunistic breeding site from use by dumping the container and removing trash. This reduces risk of disease in communities. For some sites, you may be returning to the site- such as a water storage container or drain- but these sites do not need to be identified as GLOBE Hydrosphere study sites.

Acknowledgements

The **GLOBE Observer Mosquito Habitat Mapper** is a NASA-sponsored project that is the result of the combined efforts of an extended team that includes the Institute for Global Environmental Strategies (IGES); NASA Goddard Space Flight Center, Langley Research Center, and Jet Propulsion Laboratory; Space Science Applications, Inc. (SSAI); the GLOBE Implementation Office (GIO), GLOBE DIS and Brooklyn College.

The **Mosquito Challenge Community Campaign (MCCC)** is focused on demonstrating the usefulness of citizen science data collected using the GO Mosquito Habitat Mapper for combating Zika in Brazil and Peru. MCCC is led by IGES in partnership with the University Corporation for Atmospheric Research (UCAR), and leverages the NASA App, and the GLOBE Program networks of scientists, teachers, students, and citizen scientists. The MCCC project is made possible through the generous support of the Combating Zika and Future Threats Grand Challenge through the United States Agency for International Development (USAID).

This presentation was prepared by the Institute for Global Environmental Strategies (IGES) and does not necessarily reflect the views of the NASA or USAID.

Educators: If you modify these slides for your own use, please retain this last slide and put your name and contact information below, thank you!

For more information, contact the MCCC PI, Dr. Russanne Low, IGES, rusty_low@strategies.org. www.globe.gov

INSTITUTE for GLOBAL ENVIRONMENTAL STRATEGIES

The GLOBE Program

COMBATING ZIKA AND FUTURE THREATS
A GRAND CHALLENGE FOR DEVELOPMENT

Task 5-2 Identifying and Mapping Local Habitats—Mosquito A

Instructions

- Listed below are some places where you might find mosquito eggs, larvae, and/or pupae in your research site.
- Look in your research site for each item in the list and check it for water. If you find any water, describe it and then collect what you find for research purposes, or dump it out so the mosquito eggs, larvae, and pupae cannot grow there.
- Document on your research map the location of each mosquito habitat.

Habitat	Number found	Found water in habitat (yes or no)	Description of water clarity (clear to dirty)	Description of water movement (still or stagnant to fast-moving)	Habitat exposure (sun, shade, semi-shade)	Found eggs, larvae or pupae in water
Cans, bottles, jars						
Pots and containers for flowers or plants						
Old tires						
Bird baths						
Roof gutters						
Drainage pipes around buildings						
Trash						

Tarps, plastic bags						
Old cars						
Boats, canoes						
Dripping outdoor faucets or window air conditioners						
Wheelbarrows						
Garbage cans, recycling bins, other barrels						
Low spots on ground						
Tree stumps						
Tree holes						
Rain barrels						

Go back to Research Guide now

Task 5-2 Identifying and Mapping Local Habitats—Mosquito B

Citizen Science Project Instructions

- Below are some resources to help you take part in the GLOBE Mosquito Habitat Mapper app citizen science project. You will need a smartphone or tablet to do this. Use the resources in the Learning Lab task folder to learn more about the app, how to use it, and how to collect data about your research site.
- Look in and around your research site for various potential mosquito habitats and check it for water. If you find any water, describe it and then dump it out so the mosquito eggs, larvae, and pupae cannot grow there. Follow the instructions in the app.
- If you're able, identify any mosquito larvae found.
- Document on your research map the location of each mosquito habitat.

GLOBE Mosquito Habitat Mapper App Resources

To get the GLOBE Observer app (includes mosquito habitat mapper):

https://observer.globe.gov/about/get-the-app

Look over the GLOBE Mosquito Habitat Mapper App Overview and Instructions PowerPoint.

View the video resources about the GLOBE Mosquito Habitat app in Learning Lab:

http://learninglab.si.edu/q/ll-c/RW29tFCHPHv9tjDB

Go back to Research Guide now

Mosquito! Task 5-2 Identifying + Mapping Local

The Importance of Local Mosquito Monitoring

Rusty Low - Senior Earth Scientist - Institute for Global Environmental Strategies

I have focused on many different things in my research and career. However, there has been a theme throughout. This theme concerns how humans and societies address the impact of and are impacted by the environment and climate change.

I am interested in how the climate is changing. We are now learning that mosquitoes and other disease vectors are responding to these climate changes. Climate changes are causing mosquitoes to expand their habitats. It is also causing them to invade new areas. Many of these are areas they have not been found in before.

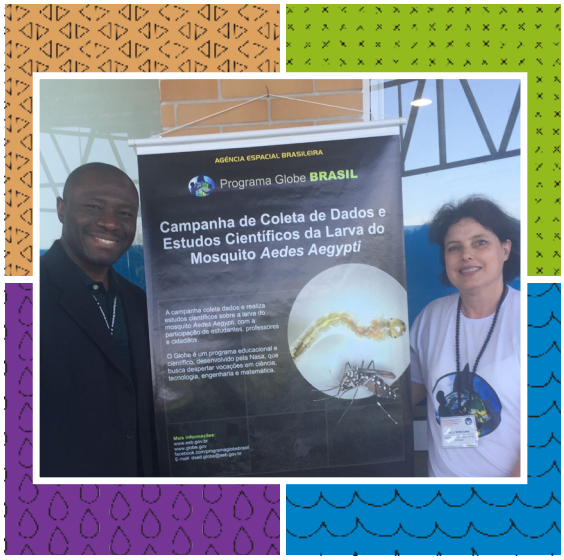
I read about the history of mosquitoes and the efforts to eradicate disease in places like the United States at the turn of the century. There are many success stories, all before we had pesticides to kill mosquitoes. So I wondered if we could use the power of the "crowd in the cloud" to better get a handle on the transmission of diseases like Zika and dengue.

There are not enough pesticide to cover the entire world. We are also learning about pesticide resistance. In many places we have already tried managing mosquitoes, with serious consequences to the environment. So I wondered if local monitoring could have a role in better identifying areas prone to disease.

I know that cities with many resources have mosquito control teams. Many of these teams do a terrific job of monitoring their community. However, I was wondering about the areas that do not have the money, people, or resources. Many of these communities are not prepared or do not have the money for mosquito control. Many times these places have had mosquito problems before.

So we started to build the GLOBE Observer Mosquito Habitat Mapper app. It is an app for smartphones and mobile devices. The app allows kids and adults to locate sites in their community that mosquitoes might like. People can share this information with one another. Then they can find out if the mosquitoes are the type that transmit diseases. The data are shared with the science community to help make decisions around the world. It is a fun way to use science to make a difference locally!

Building the app has been interesting work. I like working on a team. Our core team includes scientists in Colorado, Kansas, and New York City. We have program managers at NASA and computer programmers to build the app in California. We then work with communities in Brooklyn (New York) and New Orleans, USA, and in Barbuda to test the app concept. Then we work with communities in Brazil and Peru to test the app in the field.



Be creative and think about how you could use this technology to help your community, now and into the future!

Videos for Task 5-2

GLOBE Mosquito Habitat App Overview Video
Description:
This is a good overview video of the citizen science project using the GLOBE Mosquito Habitat App.
https://youtu.be/CupKTlql1vc

GLOBE Mosquito Habitat App - Classroom Example
Description:
This video shows a team working together using the GLOBE Mosquito Habitat App to collect information about their research site and share it using the app. Watch this to get ideas for how you can engage in this citizen science program if you have the resources.
https://youtu.be/ENoalx26LIk

NASA Using Satellite Data
https://www.nasa.gov/feature/goddard/2017/using-nasa-satellite-data-to-predict-malaria-outbreaks

Task 5-3 Conducting Mosquito Habitat Vegetation Survey—Mosquito A

Use the following form to survey the vegetation in your research site. For plants that potentially repel mosquitoes, see the list below the table.

Name:

Date:

Survey start time:

Survey end time:

Weather:

- Clear
- Scattered clouds
- Complete cloud cover
- Rain
- Wind: calm, breezy, gusty

Air temperature:

Vegetation Survey Table

Type of plant	Total # of plants of that type	Notes (include any other helpful information about location of plants in research site)
Grass		
Flowers		
Bushes or shrubs		
Trees		
Ground cover (not grass)		
Fungus, moss, and lichen		
Plants that potentially repel mosquitoes		

Plants that might potentially repel mosquitoes (not all are scientifically verified; more research still needs to be done).

- Artemisias (mugwort, wormwood, sagebrush)
- Basil
- Citronella grass
- Common lantana (big sage, white sage, tickberry)
- Lavender
- Lemon balm
- Lemon grass
- Lemon thyme
- Lime basil
- Stone root (horsebalm, richweed, ox-balm)

Go back to Research Guide now

Task 5-3 Conducting Mosquito Habitat Vegetation Survey—Mosquito B

Using Technology to Identify Plants and Build a Local Field Guide

Use the following technology resources to help you identify plants and build a local field guide.

Leafsnap: http://leafsnap.com/

PlantNet Plant Identification: https://identify.plantnet-project.org/

FlowerChecker: http://www.flowerchecker.com/

iPflanzen: http://www.ipflanzen.ch/pages/en/home.php?lang=EN

Research Site Vegetation Survey

Use the following form to survey the vegetation in your research site. For plants that potentially repel mosquitoes, see the list below the table.

Name:

Date:

Survey start time:

Survey end time:

Weather:

- Clear
- Scattered clouds
- Complete cloud cover
- Rain
- Wind: calm, breezy, gusty

Air temperature:

Vegetation Survey Table

Type of plant	Total # of plants of that type	Notes (include any other helpful information about location of plants in research site)
Grass		
Flowers		
Bushes or shrubs		
Trees		
Ground cover (not grass)		
Fungus, moss, and lichen		
Plants that potentially repel mosquitoes		

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- Artemisias (mugwort, wormwood, sagebrush)
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- Lavender
- Lemon balm
- Lemon grass
- Lemon thyme
- Lime basil
- Stone root (horsebalm, richweed, ox-balm)

Go back to Research Guide now

Task 5-4 Analyzing Community Surveys (Transmission)—Mosquito A

Compiling Survey Data Options

First we must compile the answers from the community surveys to all of the questions from Part Five: Habitats. The team will look at the other parts in later tasks.

Here are some options for compiling the answers to the survey questions. But, as always, if you have different method you prefer, do that!

Option 1

Hand out a survey to each person.

Go through each question and team members can raise their hands to vote for the answer they prefer. Some team members can count up the votes and others can write down the totals for the team.

Option 2

Have questions on a board, paper, or computer where tallies can be compiled. Tally the responses and share the results.

Option 3

Digital survey: If you did the survey digitally, you should be able to see the results for each question.

Option 4

Create your own way of compiling survey data.

Graphing Survey Data

How could you graph parts of these survey results?

Which questions could you graph?

If you have the resources, pick some questions to graph that you think would be useful.

How would these graphs be useful when supporting claims with evidence?

Community Survey—Mosquito A

Use this survey to compile data.

Part 5: Habitats

Where do mosquitoes breed? (check all that apply)				
Still, stagnant water	Moving water	Drains	Water storage containers	Garbage
Trash containers	Old tires	Old cars	Old boats	Holes in trees
Animal shells	Other	Not sure		

Do you have any containers holding water, or low areas with standing water around your home?		
Yes	No	Not sure

Go back to Research Guide now

Task 5-4 Analyzing Community Surveys (Transmission)—Mosquito B

Compiling Survey Data Options

First we must compile the answers from the community surveys to all of the questions from Part Five: Habitats. The team will look at the other parts in later tasks.

Here are some options for compiling the answers to the survey questions. But, as always, if you have different method you prefer, do that!

Option 1

Hand out a survey to each person.

Go through each question and team members can raise their hands to vote for the answer they prefer. Some team members can count up the votes and others can write down the totals for the team.

Option 2

Have questions on a board, paper, or computer where tallies can be compiled. Tally the responses and share the results.

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Option 4

Create your own way of compiling survey data.

Graphing Survey Data

How could you graph parts of these survey results?

Which questions could you graph?

If you have the resources, pick some questions to graph that you think would be useful.

How would these graphs be useful when supporting claims with evidence?

Community Survey—Mosquito B

Use this survey to compile data.

Part 5: Habitats

Where do mosquitoes breed? (check all that apply)				
Still, stagnant water	Moving water	Drains	Water storage containers	Garbage
Trash containers	Old tires	Old cars	Old boats	Holes in trees
Animal shells	Other	Not sure		

Do you have any containers holding water, or low areas with standing water around your home?		
Yes	No	Not sure

Go back to Research Guide now

Task 5-5 Debriefing Habitats

Question Map Analysis

1. Look at your team question map from Task 1-10. Are there any questions on your map that were addressed in Part Five: Habitats?
2. What evidence did you collect during Part Five that could be useful to answer any questions on your question map?
3. How could this evidence or information be useful to develop a solution to the problem question: How can we ensure health for all from mosquitoes?

Take time to rearrange, update, or modify any questions on your question map at this time.

Community Partners

1. As a team, look over the list of community partners you created in Task 2-5.
2. As a team, decide if there are any community partners you could contact to get more information about these research questions you identified on your question map from Task 1-10.
   - Make a plan as a team to communicate with these partners
   - Create a list of questions you would like to ask the partners
   - Email, phone, or write to each partner with your questions.
   - If the team decides it's appropriate, invite the community partner to meet with the team. Use your list of questions to have a conversation with them.

Perspectives—Perspective Continuum

1. Use the research perspective opinion continuum activity setup from Task 1-8 to discuss each perspective statement.
2. Consider each perspective statement as individuals or in small groups. If done in small groups, each group sends one representative to the continuum.
3. Remember, pose each statement, take a minute, and let each team member or group think about their position on that statement. Explain the next step, so team members can choose where to stand along the continuum.

- Remember, the continuum goes from one side or corner of the room to the other; from "strongly agree" to "strongly disagree." "Not sure" is in the middle.
- Explain that relative location is also important; that is, standing closer to the strongly agree or disagree side of the room means you feel very strongly about this statement. If you agree or disagree only slightly, then being closer to the midpoint is a physical way of stating the degree to which you think or feel a certain way about the issue.

Social: People in our local community should be more involved and work together to monitor and share more information about mosquito habitats.

Ethical: I think it is okay for some people to be exposed to more mosquito habitats than others in our community.

Environmental: Changes in the local environment, such as temperature, precipitation, and urbanization, should be monitored and regulated more by local government.

Economic: Local government should create a mosquito tax on builders of local developments or other types of urbanization within the community.

Move to a whole team discussion.

- Remember, team members must back up opinions with information and other team members must listen carefully to one another.
- Can individual team members explain to the team the reasons for their position on the continuum?
- How many team members changed their positions after hearing people talk during the whole team discussion?
- What led you to change your mind?
- Ask team members on both sides of the issue to identify what they believe to be the strongest arguments and reasons they heard from the *opposing* side.

Identity

- Look at your personal and team identity maps from Tasks 1-1 and 1-4. What aspects of your or your team's identity might influence your opinions on the perspective continuum?
- How might your decisions be influenced by these parts of your identity?
- Have any parts of your identity map changed?

Problem Question

- Is there anything you learned in this part that would be useful when thinking about the problem question: How can we ensure health for all from mosquitoes?

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