Exploring Tropical Ecology:
A Creative Learning Activity Guide

Designed by:
Emily L. Towers
Texas A&M University

Dominica Study Abroad 1998

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Purpose

To develop an education guide of creative activities to teach students about the unique ecosystem of Dominica.

Introduction

I created this guide to target two vastly different audiences: Texas children who may never see a tropical island, and Dominican children, who may not have been exposed to these types of education methods. Through each activity, I hope to familiarize both groups with specific tropical island organisms, as well as convey underlying concepts of biodiversity and community structure.

Discussion

Each activity in this guide pertains to specific components of Dominican and other tropical island ecosystems. The Tropical Island Crossword Puzzle serves as an introductory activity, presenting the concept that tropical islands encompass more than just rainforest habitat. In addition, the puzzle provides definitions of possibly unfamiliar names and terms that will be elaborated in other activities. The Tropical Bird Mobile reinforces the prevalence of birds on tropical islands. Through the Agouti Supper Word Find, students learn about the vast range of edible plants found in Dominica, including plants both familiar Texas students and ones they many not know. The bat game not only illustrates basic concepts of echo-location, but also emphasizes bat's roles in such unusual habitat and adaptational moth defense mechanisms. The Where Am I? Bingo Game familiarizes students with some of the most common Dominican organisms, and presents the concepts of habitat diversity and transition zones. The Amazing Termite Mound introduces students to the unusual relationship between tropical ants and termites.

Acknowledgements

Special thanks to all those who offered advice and shared expertise, especially Dr. Jim Woolley, Dr. Tom Lacher, Marsha Reimer, Alyssa Kubiak, and Clint Talbert.

Sources

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Tropical Forest Crossword Puzzle

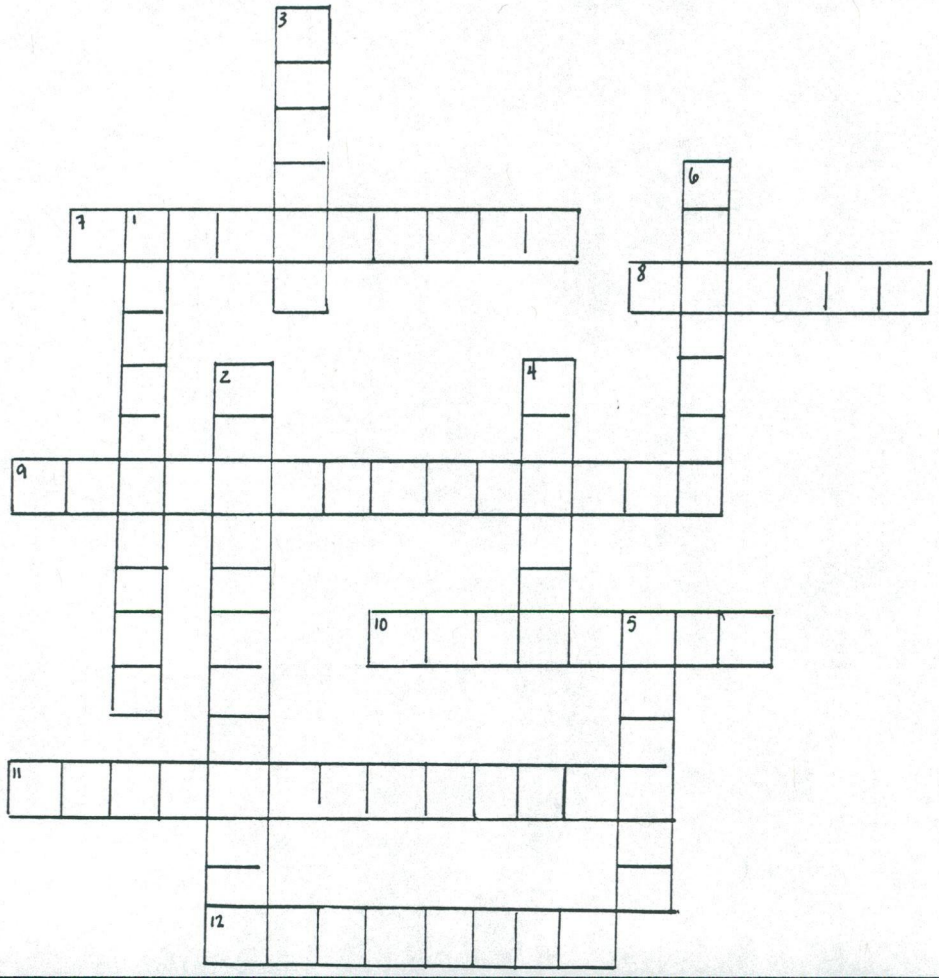
Choose words from the word bank below that best fit each clue. Write those words in the puzzle boxes with the number that matches the clue number. Not all words in the word bank will be used.

Word Bank:

Agouti	Coffee	Jungle	Opossum	Termites
Bromeliads	Elfin Forests	Minerals	Photosynthesis	Twelve
Buttresses	Ferns	Mosses	Rainforest	
Cloud Forests	Iguana	Mushrooms	Ten	

Clues:

1. A nonseasonal forest, with common and abundant rainfall is called a ___.
2. Tropical forests covered in mist for at least a part of each day are known as ___.
3. A common rainforest crop used to make a popular caffeinated beverage is___.
4. Days in the tropics, near the equator, last exactly ____ hours.
5. Common fruit-eating rainforest rodents, who look like a cross between a deer and a mouse are called ___.
6. ___ are lizards found in nearly all rainforest habitats.
7. ___ are planst that grow on trunks and tops of rainforest trees.
8. A rainforest disturbed by a hurrican, lightening strike, or human activitiy, is called a ___.
9. Tropical rainforests accomplish more ___ than any other natural terrestrial ecosystems on earth.
10. Rainforest soils help cycle various ___.
11. Rainforest trees often have large, flaring ___ at their bases, which are a type of root.
12. ___ are insects common to most rainforests, who build nests on tree trunks and branches.



Agouti Supper Word Find

Many delicious edible plants grow in Dominica. Pretend you are an agouti and hunt through the puzzle below to find fruit for your supper. Circle all the items that are fruits or roots, and put a line through those items that are used as spices or for flavoring. Put a star next to your favorite food, and a box around an item that you've never eaten before but would like to try someday.

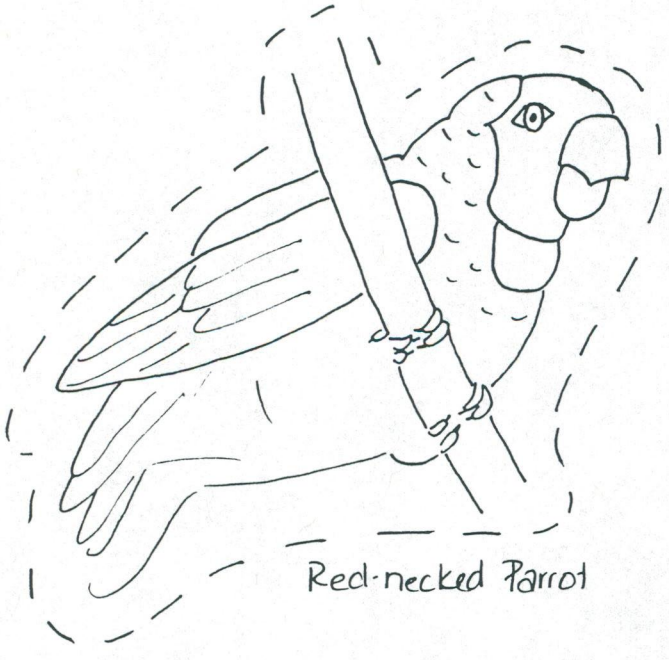
Arrowroot
Avocado
Banana
Breadfruit
Cashew
Cinnamon
Cocoa
Coconut
Dasheen
Ginger
Grapefruit
Guava
Lime
Mango
Nutmeg
Orange
Papaya
Pineapple
Sweet Potato

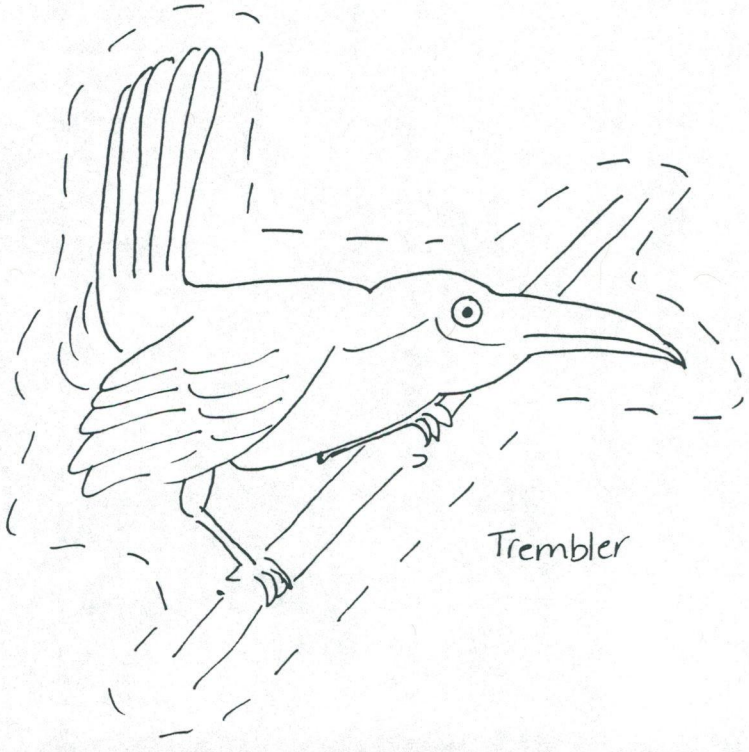
N R E B A Y S L O I T O D A C O V A M E
B G I N G E R P A Y R I F O I D C R S A
D R O S L O R A N G E M C B N L I R E P
S A E G N I B F Q A P O H K N E X O L N
J P D A R C K O S L A R V Y A D U W P O
A E M V D A S H E E N F D I M Z G R P L
C F B E Q F I B L P M U A R O B Y O A E
D R S M O U R H I B K Y T E N L D O E M
P U A I J F N U M O G N A M I O S T N A
E I S L Y P A S I R D K H O E F N U I Z
L T A O T A T O P T E E W S R G T E P N
K U B N C O C O N U T A V L H U S O D I
M E B A N A N A R V K W E H S A C L Y A
D H L Q O S Y B F I L P A E H V L O N T
P A P A Y A E M R Y A D B L I A T S U V

Tropical Bird Mobile

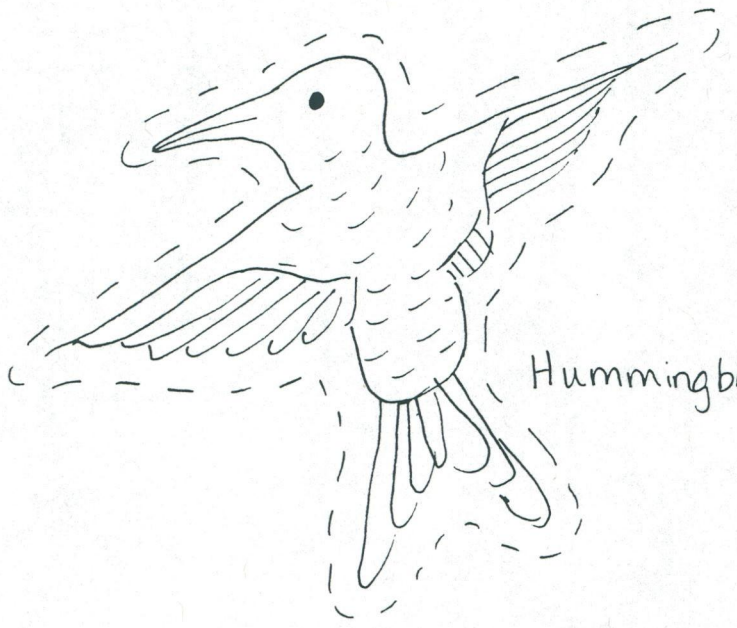
Numerous unusual and colorful birds make their homes in Dominica. The Red-necked Parrot is an endangered bird endemic to Dominica. Tremblers exhibit a strange shaking behavior scientists still have not fully explained. Bananaquits and hummingbirds fly around numerous flowering and fruiting plants.

Directions:
Choose three birds from the following drawings. Color TWO of each bird you picked (to make front and back) and cut them out along the dotted lines. Staple the drawings together, leaving a hole between the two. Stuff soft paper into this hole to give the birds shape, then staple the hole shut. Attach string of different lengths to each bird, then hang the birds from a drinking straw or stick. Attach another string to the center of the straw so you can hang your mobile at home or school.

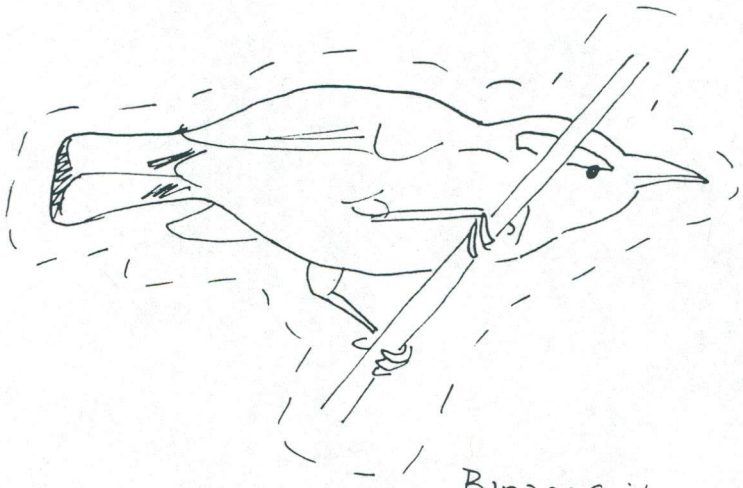




TROPICAL BIRD MOBILE CON'T.



Hummingbird



Bananaquit

The Amazing Termite Mound

In the rainforest, termites build large, dark mounds on tree trunks, fallen trees, and other shadowed places. Large tac-tac ants also live in these mounds. Scientists have speculated that the ants protect the termites, but the ants may also prey upon their termite hosts. To protect themselves, the termites have soldiers with long snouts who squirt a nasty substance at the ants, effectively keeping them away.

Directions:
Help the tac-tac ant at the start of the maze capture the queen termite without getting squirted on by the soldiers.

The Bat Game

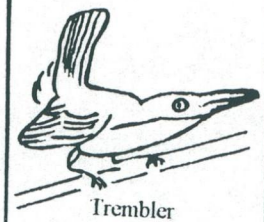
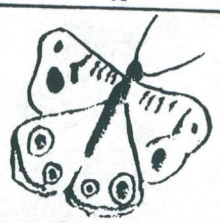
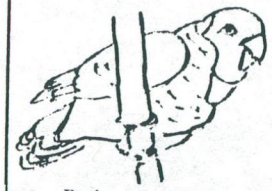
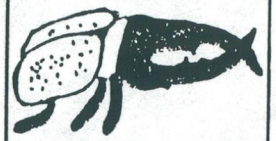
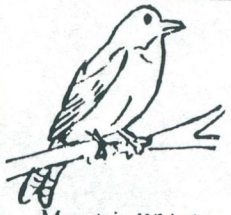
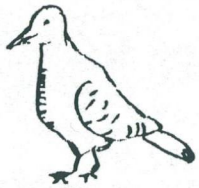
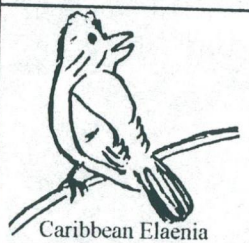
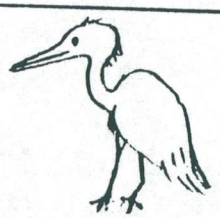
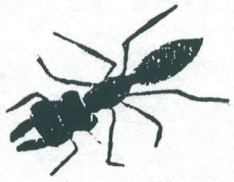
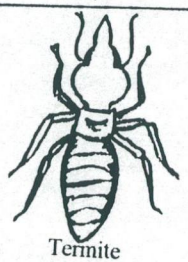
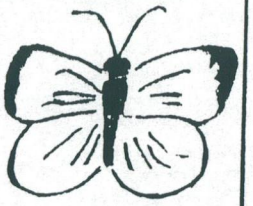
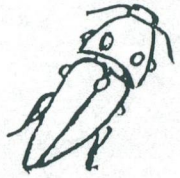
Bats use an unusual system of searching for food and navigating the night sky. They emit high-pitched sonar pulses which bounce off objects. The bats measure how long it takes for the sound to return, and can determine what the object is from the sound. Many bats are insectivores, meaning they eat insects like moths and mosquitos. Some moths in the rainforest can hear bats, and when they do, they drop straight down to the ground to avoide being eaten.

Supplies:
*Bandanas or blindfolds of some sort for one-fourth of the group playing
*large open playing area

Directions:

Divide students into four equal groups: bats, trees, moths and mosquitos. The objects of the game is for each bat to capture a moth or mosquito without running into a tree. Each student in the bat group gets blindfolded. The bats walk around, making high-pitched "eep" noises. Students who are trees must stand still the entire game, and make tree noises (creaking or wooshing) when the bats emit their sonar noises. The mosquitos make a buzzing noise when the bats call, and can run from the bats. Students in the moth group make a beeping noise, and can sit on the ground when a bat gets too close (when the moth is on the ground, the bat cannot capture it. Moths cannot stay on the ground for more than five seconds).

The game proceeds Marco Polo style, with the trees, mosquitos and moths making their noises every time the bats "eep". The bats must capture a mosquito or moth without bumping into a tree. The game ends when every bat has either captured an insect or hit a tree.

 Agouti **A**	 Tree Gecko **T, E**	 Trembler **A,E**	 White Crab **U,R**	 Blue-Headed Hummingbird **N,A**
 Caribbean Buckeye Butterfly **E**	 Red-necked Parrot **A**	 Orion Butterfly **A,E**	 Hercules Beetle **A**	 Mountain Whistler **N,A**
 Mountain Chicken **T**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**	FREE	 White Peacock Butterfly **E**	 Iguana **A,T,U**
 Zenaida Dove **N,T,E**	 Caribbean Elaenia **T,E**	 Tree Lizard **A,T**	 Little Blue Heron **U**	 Bessbug **N,A**
 Ground Lizard **T**	 Tac-tac Ant **A,T,U,E**	 Termite **N,A,T,U**	 Sulfur Butterfly **T,U,R,E**	 Bioluminescent Click-Beetle **N,A**

Where Am I?
Bingo Game

Pretend you are hiking through Dominica. As your teacher calls out animal names, place a marker on the ones you have on your bingo card. When you get a row covered horizontally, vertically, or diagonally, you have a bingo. Count the number of N's, A's, T's, U's, R's, and E's you have in your covered row. Whichever letter you have most of corresponds to the habitat you're in (i.e.- if you have most A's, you're in the rainforest) Look below to find out which letters represent which habitats. If you have a tie between two letters, you're in a transition zone, or area between the two habitats.

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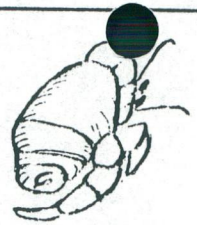
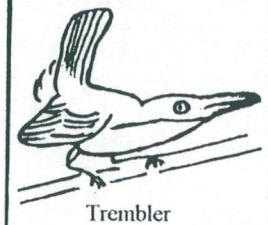
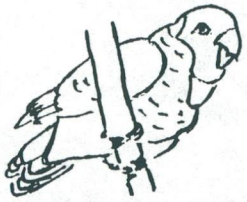
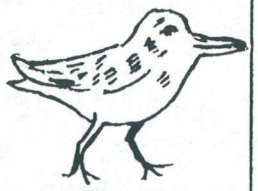
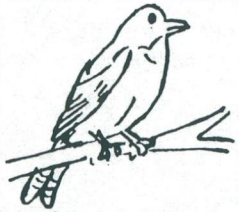
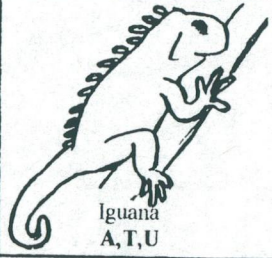
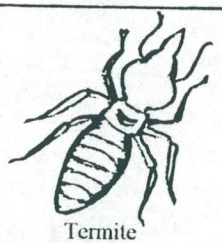
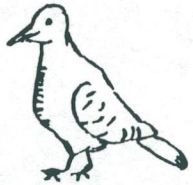
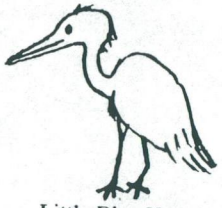
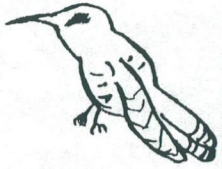
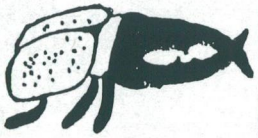
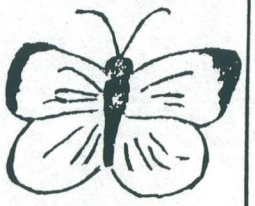
 Hermit Crab **T**	 Tree Gecko **T, E**	 Trembler **A,E**	 White Crab **U,R**	 Ground Lizard **T**
 Caribbean Buckeye Butterfly **E**	 Red-necked Parrot **A**	 Orion Butterfly **A,E**	 Spotted Sandpiper **U, R**	 Mountain Whistler **N,A**
 Mountain Chicken **T**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**		 White Peacock Butterfly **E**	 Iguana **A,T,U**
 Tree Lizard **A,T**	 Termite **N,A,T,U**	 Zenaida Dove **N,T,E**	 Little Blue Heron **U**	 Bessbug **N,A**
 Blue-Headed Hummingbird **N,A**	 Hercules Beetle **A**	 Caribbean Elaenia **T,E**	 Sulfur Butterfly **T,U,R,E**	 Bioluminescent Click-Beetle **N,A**

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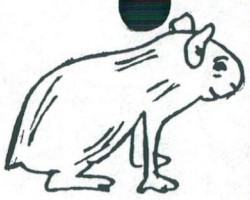
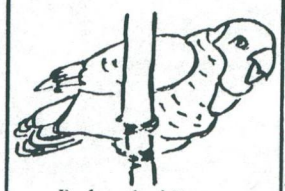
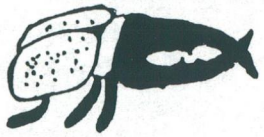
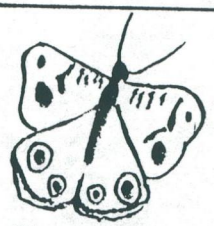
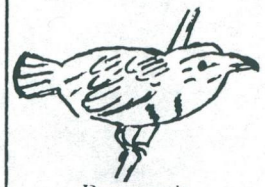
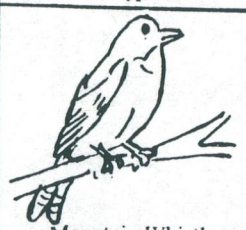
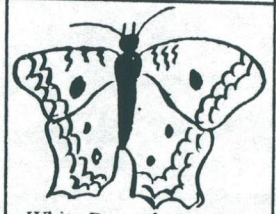
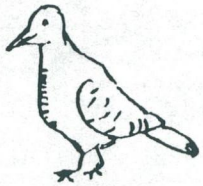
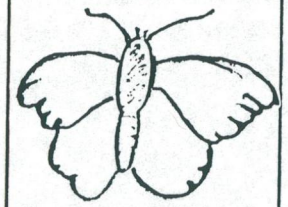
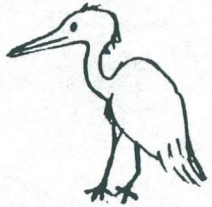
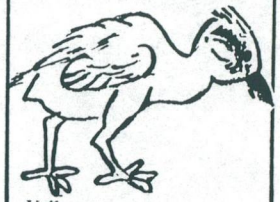
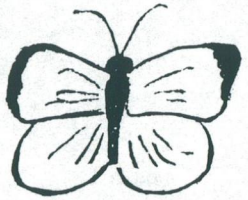
 Agouti **A**	 Red-necked Parrot **A**	 Caribbean Elaenia **T,E**	 White Crab **U,R**	 Hercules Beetle **A**
 Caribbean Buckeye Butterfly **E**	 Tree Gecko **T, E**	 Smooth-billed Ani **A**	 Bananaquit **N,A,T,U,R,E**	 Mountain Whistler **N,A**
 Bioluminescent Click-Beetle **N,A**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**	FREE	 White Peacock Butterfly **E**	 Firefly **A,U,E**
 Zenaida Dove **N,T,E**	 Great Southern White Butterfly **N,A,T,U,R,E**	 Tree Lizard **A,T**	 Little Blue Heron **U**	 Bessbug **N,A**
 Ground Lizard **T**	 Tac-tac Ant **A,T,U,E**	 Termite **N,A,T,U**	 Yellow-Crowned Night Heron **A,R**	 Sulfur Butterfly **T,U,R,E**

Where Am I?
Bingo Game

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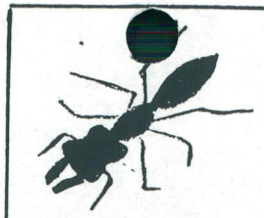
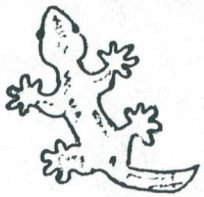
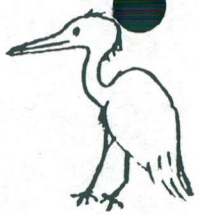


Tac-tac Ant
A,T,U,E



Tree Gecko
T, E

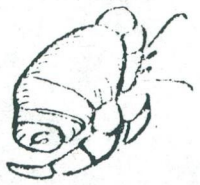
Smooth-billed Ani
A



Little Blue Heron
U

Ground Lizard
T

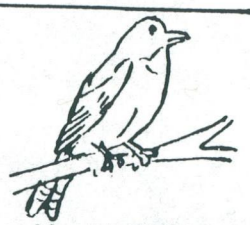
Caribbean Buckeye Butterfly
E



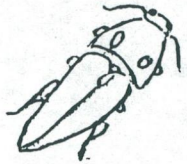
Hermit Crab
T

Orion Butterfly
A,E

Bananaquit
N,A,T,U,R,E



Mountain Whistler
N,A



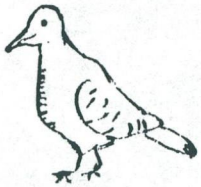
Bioluminescent Click-Beetle
N,A

Mexican Funnel-Eared Bat
N,A,T,U,R,E

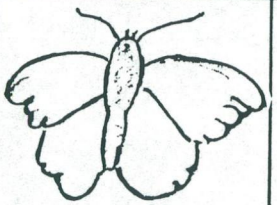
FREE

White Peacock Butterfly
E

Hercules Beetle
A

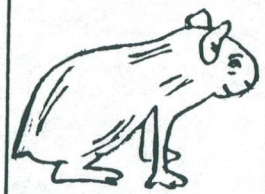


Zenaida Dove
N,T,E



Great Southern White Butterfly
N,A,T,U,R,E

Tree Lizard
A,T

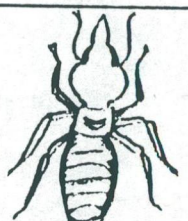


Agouti
A

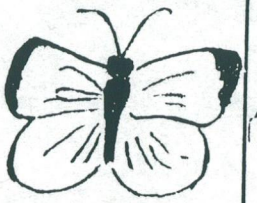
Bessbug
N,A

Blue-Headed Hummingbird
N,A

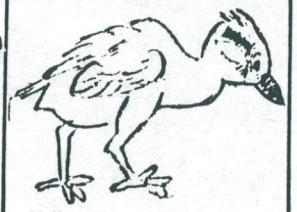
Firefly
A,U,E



Termite
N,A,T,U



Sulfur Butterfly
T,U,R,E



Yellow-Crowned Night Heron
A,R

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Bingo Game

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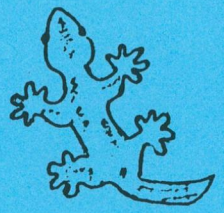
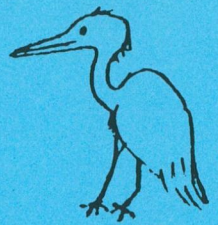
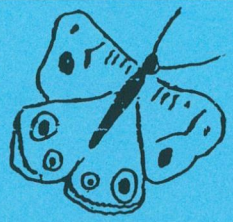
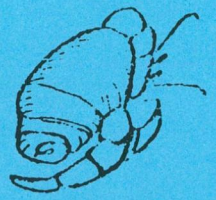
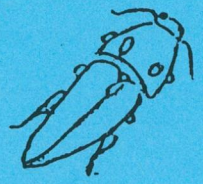
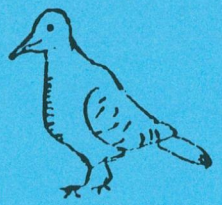
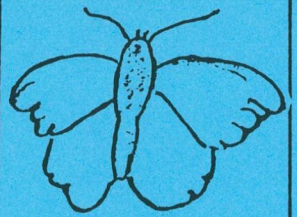
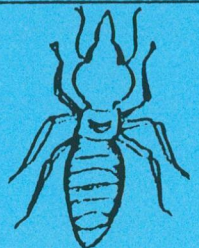
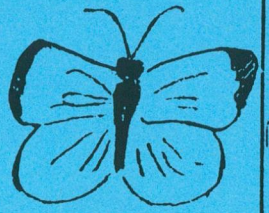
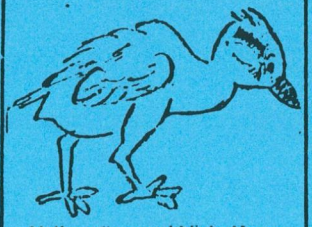
 Tac-tac Ant **A,T,U,E**	 Tree Gecko **T, E**	 Smooth-billed Ani **A**	 Little Blue Heron **U**	 Ground Lizard **T**
 Caribbean Buckeye Butterfly **E**	 Hermit Crab **T**	 Orion Butterfly **A,E**	 Bananaquit **N,A,T,U,R,E**	 Mountain Whistler **N,A**
 Bioluminescent Click-Beetle **N,A**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**	 FREE	 White Peacock Butterfly **E**	 Hercules Beetle **A**
 Zenaida Dove **N,T,E**	 Great Southern White Butterfly **N,A,T,U,R,E**	 Tree Lizard **A,T**	 Agouti **A**	 Bessbug **N,A**
 Blue-Headed Hummingbird **N,A**	 Firefly **A,U,E**	 Termite **N,A,T,U**	 Sulfur Butterfly **T,U,R,E**	 Yellow-Crowned Night Heron **A,R**

Where Am I?
Bingo Game

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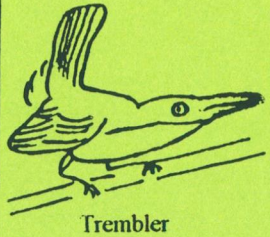
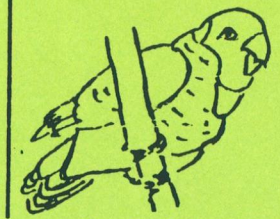
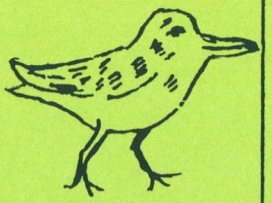
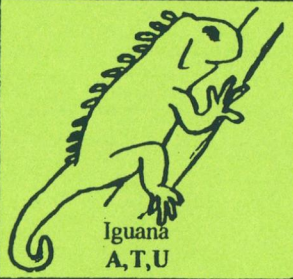
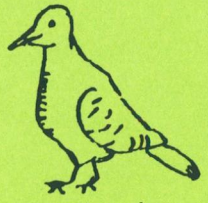
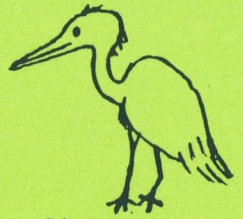
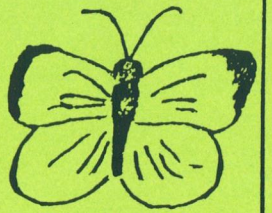
 Hermit Crab **T**	 Tree Gecko **T, E**	 Trembler **A,E**	 White Crab **U,R**	 Ground Lizard **T**
 Caribbean Buckeye Butterfly **E**	 Red-necked Parrot **A**	 Orion Butterfly **A,E**	 Spotted Sandpiper **U, R**	 Mountain Whistler **N,A**
 Mountain Chicken **T**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**		 White Peacock Butterfly **E**	 Iguana **A,T,U**
 Tree Lizard **A,T**	 Termite **N,A,T,U**	 Zenaida Dove **N,T,E**	 Little Blue Heron **U**	 Bessbug **N,A**
 Blue-Headed Hummingbird **N,A**	 Hercules Beetle **A**	 Caribbean Elaenia **T,E**	 Sulfur Butterfly **T,U,R,E**	 Bioluminescent Click-Beetle **N,A**

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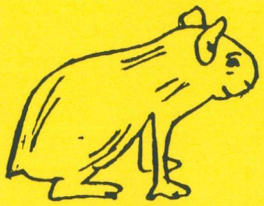


Agouti
A

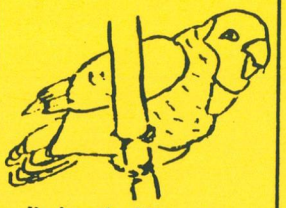
Tree Gecko
T, E

Smooth-billed Ani
A

White Crab
U,R

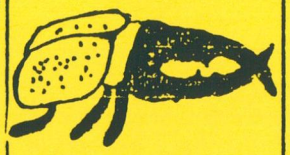
Ground Lizard
T

Caribbean Buckeye Butterfly
E



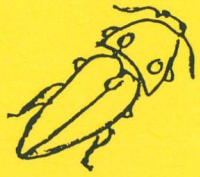
Red-necked Parrot
A

Orion Butterfly
A,E



Hercules Beetle
A

Caribbean Elaenia
T,E

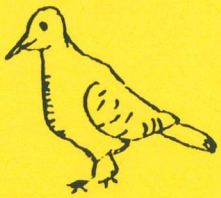


Bioluminescent Click-Beetle
N,A

Mexican Funnel-Eared Bat
N,A,T,U,R,E

White Peacock Butterfly
E

Bananaquit
N,A,T,U,R,E



Zenaida Dove
N,T,E

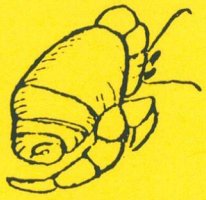
Great Southern White Butterfly
N,A,T,U,R,E

Tac-tac Ant
A,T,U,E

Firefly
A,U,E

Bessbug
N,A

Blue-Headed Hummingbird
N,A



Hermit Crab
T

Termite
N,A,T,U

Sulfur Butterfly
T,U,R,E

Yellow-Crowned Night Heron
A,R

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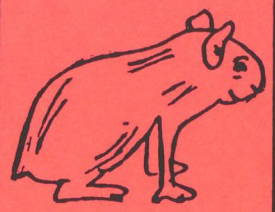
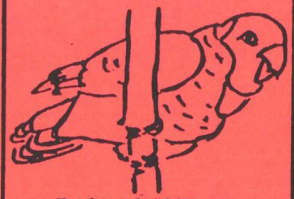
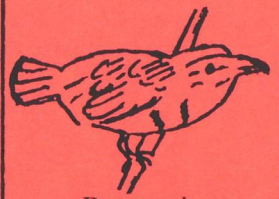
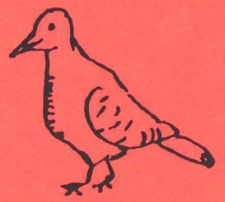
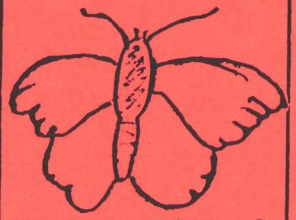
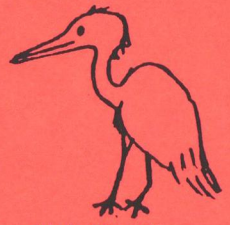
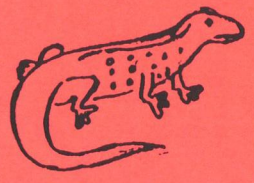
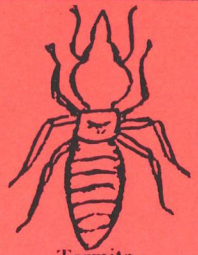
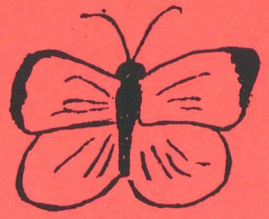
 Agouti **A**	 Red-necked Parrot **A**	 Caribbean Elaenia **T,E**	 White Crab **U,R**	 Hercules Beetle **A**
 Caribbean Buckeye Butterfly **E**	 Tree Gecko **T, E**	 Smooth-billed Ani **A**	 Bananaquit **N,A,T,U,R,E**	 Mountain Whistler **N,A**
 Bioluminescent Click-Beetle **N,A**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**	FREE	 White Peacock Butterfly **E**	 Firefly **A,U,E**
 Zenaida Dove **N,T,E**	 Great Southern White Butterfly **N,A,T,U,R,E**	 Tree Lizard **A,T**	 Little Blue Heron **U**	 Bessbug **N,A**
 Ground Lizard **T**	 Tac-tac Ant **A,T,U,E**	 Termite **N,A,T,U**	 Yellow-Crowned Night Heron **A,R**	 Sulfur Butterfly **T,U,R,E**

Where Am I? Bingo Game

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N- Elfin Woodland and Montane thicket
A- Rainforest
T- Coastal Woodland and Dry Forest
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R- Coastal Beach and Cliff
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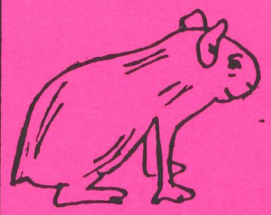
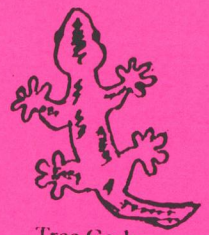
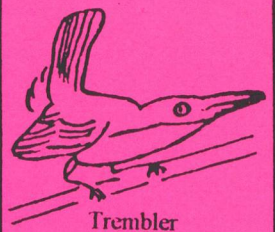
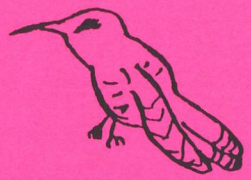
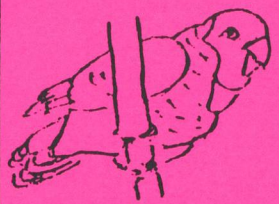
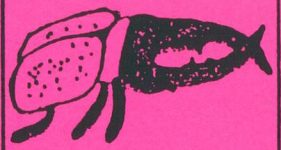
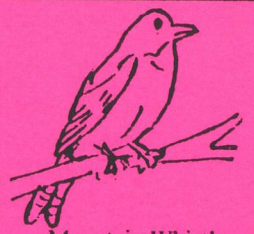
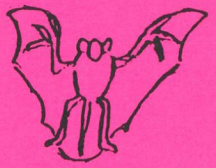
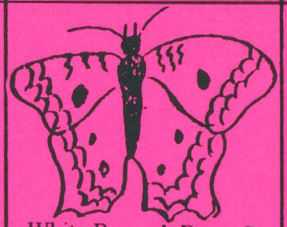
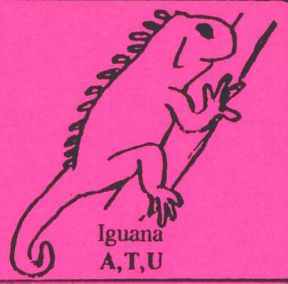
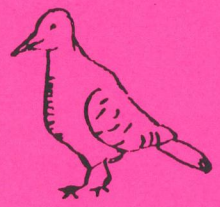
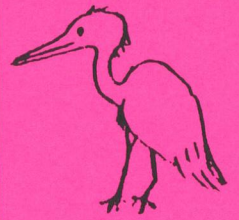
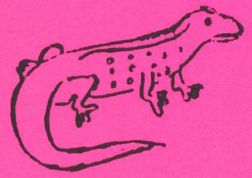
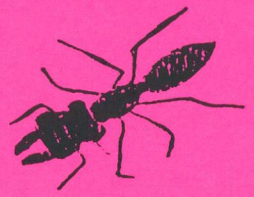
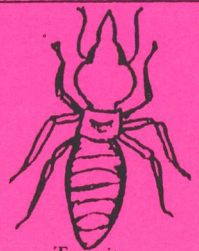
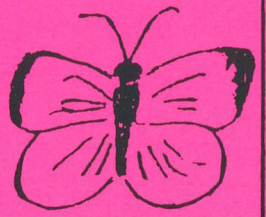
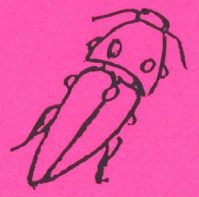
 Agouti **A**	 Tree Gecko **T, E**	 Trembler **A,E**	 White Crab **U,R**	 Blue-Headed Hummingbird **N,A**
 Caribbean Buckeye Butterfly **E**	 Red-necked Parrot **A**	 Orion Butterfly **A,E**	 Hercules Beetle **A**	 Mountain Whistler **N,A**
 Mountain Chicken **T**	 Mexican Funnel-Eared Bat **N,A,T,U,R,E**	FREE	 White Peacock Butterfly **E**	 Iguana **A,T,U**
 Zenaida Dove **N,T,E**	 Caribbean Elaenia **T,E**	 Tree Lizard **A,T**	 Little Blue Heron **U**	 Bessbug **N,A**
 Ground Lizard **T**	 Tac-tac Ant **A,T,U,E**	 Termite **N,A,T,U**	 Sulfur Butterfly **T,U,R,E**	 Bioluminescent Click-Beetle **N,A**

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Laura M. Worsham
Texas A&M University
Field Research Study Abroad
7 June 1998

Comparing Methods of Macroinvertebrate Collection to Determine Water Quality

Introduction:

During my research on the group project, "Comparative Analysis of Water Quality Based on Benthic Macroinvertebrates", I was inspired to study further different collection techniques of invertebrates in rivers and streams. Utilizing the kick net and D net in the above project, collecting the specimens individually by hand proved both time consuming and challenging. This year, upon our arrival at SCEPTRE, I discovered several larval traps which would facilitate me in pursuing this study and which might provide an effective alternative to the time consuming methods used in the group project.

Hypothesis:

Collecting macroinvertebrates by means of larval traps will prove as effective and thorough in quality and quantity as collecting specimens by hand, reducing length of time involved and effort required.

Methods:

Larval traps were placed at the same six sites in the Check Hall River and Springfield stream as in the group project, enabling accurate comparisons to be made upon retrieval. Each larval trap consists of nine, 3" x 3", square pegboard plates connected by a screw with dividers in between, allowing space for the settling of larvae. The head of the screw is laced with rope that was secured to rocks or branches near the aquatic environment, enabling the traps to be immersed in the water as near as possible to the riffles in which the group collections were taken. After nine days, the traps were collected. Each trap was disassembled and the individual plates rinsed with a wash bottle into a tray. The contents was observed closely, and all moving invertebrates were collected into a holding vial. Once all organisms were accounted for, they were examined under the microscope for identification, followed by placement into a clean, site labeled, glass vial with 70% ethanol.

Next, the Biotic Index (BI) of each site was calculated and compared to the BI's determined in the group project. Also, the number and types of organisms collected by the larval traps were compared to those collected by hand methods.

Results and Discussion:

It is important to state that the traps at Sites 3 and 6 were not ultimately accounted for in this study and for this reason will not be included in the comparison. However, equivalent traps at Sites 1 and 4, and Sites 2 and 5, are included and provided data sufficient to support the results of this study. Upon collection and comparison of the larvae traps, I immediately noticed a decrease in the quantity of macroinvertebrates collected as opposed to those collected by hand. However, those organisms visible from the larvae trap site collections did have representatives of the same species found in the group data, but in smaller numbers. Thus, the results calculated for the Biotic Index of each site were in the same ranges as the results calculated by the group, indicative of the same water quality as previously determined. The exception to this is at Sites 4 and 5. In the group project, the BI was 7 for both sites interpreted as a clean stream with lack of habitat diversity on the Check Hall River as compared to larvae traps with a BI of 3 for Site 4 and a BI of 4 for Site 5, interpreted as moderately polluted (See Figure 1). A different species of Mayfly was discovered in the larval trap collections, *Baetidae*, along with the *Caenidae*, as in the previous data.

Figure 2 displays the differences quantitatively in the amount of macroinvertebrates by species found at each site by the two different methods. At Site 1, the larval traps collected more of each species there, except the by hand method resulted in one segmented worm that was not collected by the larval trap. Of those specimens found in common by the two methods at Site 2, more of each species were collected by hand than the larval trap. The exceptions are one biting midge collected by hand and not by the larval trap, and one beetle larva and mayfly (*Baetidae*) collected by the trap and not by hand. Also, more midges were collected by the trap than by hand. Site 4 exhibited differences in collections, with many more species collected by hand. Among the same species that were collected by both methods here, the by hand method gathered a much

greater number. There were fourty midges collected by the traps at Site 5, and none collected by hand there. Again, the diversity in species collected by hand at this site was larger than by the larval traps, with some species in common between the two collections. Overall, 140 specimens and nine different species were collected using the kick net and D nets, and a total of 83 specimens containing seven different species collected by the larval traps.

By comparison of the results from the two different methods, the kick net and D net by hand collections prove more effective in trapping a larger quantity of the macroinvertebrates dwelling in the aquatic environments, than the larval traps. Hence, the by hand collections also prove better indicators of water quality as based on macroinvertebrate populations according to Beck's index for classification, modified by Kimmel and Sharpe (1975).

In the event there was a lack of time for collection of macroinvertebrates, these larval traps would provide sufficient information to draw conclusions on water quality in an area, but based on the results of this study, the by hand technique with the kick net and D net are recommended.

Future Research:

A possibility for continuation of studying different methods of collection is to repeat this project using other types of nets and traps that are left for an extended period of time in the area, then evaluating the species collected and comparing them to the by hand collection results, in search of a more efficient method of collection that produces an equivalent accuracy of water quality as the by hand technique.

Works Cited

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Lee, Richard. 1980. Forest Hydrology. Columbia University Press, New York. pp. 258-259.

Terry, Mark. 23 March 1992. "The Diversity and Distribution of Benthic Communities in the Check Hall River: Dominica,West Indies". State University of New York College of Environmental Science and Forestry, Syracuse, New York.

Figure 1

Biotic Index

$BI = 2n(\text{Class I}) + n(\text{Class II})$

where n is the number of different orders of a given class found in the stream.

Class	Numerical Value
I	2
II	1
III	0

Classification	
Clean	$BI \geq 10$
Moderate pollution	$1 \leq BI \leq 6$
Gross pollution	$BI = 0$

Note: $7 \leq BI \leq 9$ is rarely encountered and generally indicates a clean stream with lack of habitat diversity.

BI Site Information for Kick net and D net:

Springfield stream:
Site 1 = 2(2) + 1=5
Site 2 = 2(2) + 2=6

Check Hall River:
Site 4 = 2(2) + 3=7
Site 5 = 2(2) + 3=7

BI Site Information for Larval Traps:

Springfield stream:
Site 1 = 2(1) + 1=3
Site 2 = 2(2) + 1=5

Check Hall River:
Site 4 = 2(1) + 1=3
Site 5 = 2(1) + 2=4