The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Sunnburne Street
Conanicut Island
R.I. 02835 U.S.A.

For 1991

Dr. Henry Jarecki
Byewood
Timber Trail
Rye, NY 10580

Dear Henry:

Here, at last, is my "annual" report. I have held off because I was waiting for a copy of the Puerto Rico Symposium proceedings (statedly published in 1991) - which finally arrived. However, with scientists' month in October it seems reasonable that it will take me until April to produce a good report. I will plan on a "preliminary" report again in November or December.

Scientific production is up and exciting. Even discounting Lianna's and Fred's symposium contributions (not really a part of my original program, although funded through TCA), the termite hydrocarbon paper (original in preliminary report of 26 Nov. '91), Chipley's quail-dove paper, and my own on the herpetofauna constitute very important contributions. As always, we have some excellent material in press and/or MS: Chipley and Mayer's bird biogeography paper and Becker and Miller's butterflies. Note that these papers are about Guana Island's fauna; with the exception of the termite paper, they focus on the island and do not just include Guana data in a larger context.

Here is a reader's guide to what follows:

* * * * *

I am enthusiastically looking forward to the second flamingo lift along in June or July; and more news on Lianna's marine program and July plans; and, of course next October.

All the best,

Skip

B I S H O P M U S E U M

1525 BERNICE STREET • P.O. BOX 19000-A • HONOLULU, HAWAII • 96817-0916 • (808) 847-3511 • FAX 808 841-8968

April 4, 1991

Dr. James D. Lazell
1140 Monroe Street
Jackson, MS 39202

Dear Skip:

Report for 1990: Here is my report for my October-November 1990 Guana Island field season. This report covers "general entomology" activities of Tina Kuklenski and I. Margaret Collins continued her investigations of termite faunistics, biology, and behaviour; she will be submitting a separate report to you. Ven Samarita conducted investigations of biting flies (mosquitoes and sand flies); I assume he has reported either to you or Henry Jarecki.

As in previous seasons, our activities concentrated on Lepidoptera (moths and butterflies), followed by Coleoptera (beetles), and then other insects and arthropods as time allowed. This was my first opportunity to sample in the fall and we obtained many species we had not during the previous July trips. Vitor Becker was able to collect briefly following the hurricane in November 1989, but we now have ample samples from this period.

Over 4000 insects and related arthropods were collected. As noted above, many of these represent new island records. Most of these specimens have already been mounted and labeled. They are now being distributed to specialists as appropriate.

Vitor Becker and I are incorporating the moths into our previous list of Guana Island species (I reported the general progress on the 400+ species in a June 1990 letter to you). Marc Epstein and I recently published on the Virgin Island moth Heuretes picticornis (sent previously). Additional moth publications are in progress by Sam Adams, David Adamski, Vitor Becker, Don Davis, Scott Miller, Gene Munroe, Mike Pogue, and others.

The beetles continue to flow into the Virgin Islands beetle project coordinated by Mike Ivie. Progress has been delayed by Mike's temporary appointment as a rotating Program Officer at National Science Foundation. But we expect a series of publications to appear soon on Virgin Islands beetles which will include a great many records from Guana Island, including some new species.

Planning for 1991: Because I have sampled several times in July and also need time to finish working on material already collected, I do not need to return to Guana Island in July 1991. If possible, I would like to visit the island briefly (one week would be fine) in spring 1992. Having sampled July and October-November, I would like to supplement our seasonal coverage in springtime. I realize that this is tourist season, so I am flexible about dates, although I would prefer whatever month the climate is most different from July and November (this probably means March?).

For July 1991, I would like to take the opportunity to send an ant specialist. Ants have emerged as an important area of lack of knowledge because: (1) as highly organized social organisms, and often voracious predators, ants have a major role in shaping ecosystems; (2) some ants are major food items for reptiles; (3) ants have important interactions with termites that shape termite distributions and lifestyles; (4) it appears that the BVI ant fauna may be changing due to introductions of alien species; (5) sampling ants is difficult and requires special knowledge to find many of the rarer species; and (6) it appears that at least one species has become a nuisance in biting or stinging hotel guests on White Bay flats. Information about ants has been requested by the reptile projects, as well as Margaret Collins. While I have made general collections of common ants, I did not have the time or expertise to properly sample the ants.

Roy Snelling is eager to sample Guana Island ants. He is one of the most talented and productive ant taxonomists in the world, and has been working on the Puerto Rico fauna already. He is also talented in the study of Hymenoptera (bees and wasps) in general and would diversify knowledge of the Guana fauna. I have forwarded my Guana general ant collections to him, so he already has a start on the fauna. I strongly recommend that you offer Roy the opportunity to collect on Guana for 1-2 weeks. He will need room and board and airfare from Los Angeles.

Please communicate directly with him about plans. His address: Roy R. Snelling, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007; 213-744-3365.

I hope that this information is useful to you. If you need additional information, please let me know.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

February 15, 1992

Dr. James D. Lazell
The Conservation Agency
6 Swinburne Street
Conanicut Island, RI 02835

PROGRESS REPORT ON GUANA ISLAND ENTOMOLOGICAL STUDIES

Dear Skip:

Here is a general review of entomological activities. I assume that you have received separate reports from Margaret Collins (termites), Roy Snelling (ants, bees, and wasps), and Peter Chabora (fruit flies and their parasites).

Butterflies: Vitor Becker and I have submitted a manuscript on butterflies of Guana Island to the Bulletin of Allyn Museum. It has essentially been accepted for publication, pending approval of the plant data from George Proctor. We document 31 butterfly species on Guana. Only 30 are known from Tortola and 41 from all the Virgin Islands. I have also provided data on butterflies of the other BVI to David Spencer Smith and the Allyn Museum for their studies on West Indian butterfly biogeography.

Moths: Vitor Becker and I are making progress on a series of manuscripts documenting some 400 moth species on Guana. Specialists like Eugene Munroe have been helping with problemic groups. The manuscript on the first set of families should be ready for review soon. Vitor hopes to be able to visit the Smithsonian and Bishop Museum this summer, which will allow us to finish many of the remaining identification problems.

Beetles: Now that Mike Ivie has finished his administrative post at National Science Foundation, he is returning to Virgin Island beetles. He has a grant proposal pending that would speed up the process greatly. Among the more recent findings, Paul Johnson (Dept. of Entomology, Univ. of Wisconsin, Madison, WI 53706) has recognized a click beetle (Elateridae) from Guana which differs greatly from any known relatives in the New World.

Bee Flies: Neal Evenhuis and I finished our initial review of bee flies (Diptera: Bombyliidae) of the Virgin Islands, but have just received additional material collected last fall by Roy Snelling. We expect to produce a short manuscript in the near future.

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Other groups: I continue to try to interest specialists in working with the Guana Island material. Recent shipments outside the groups discussed above include mantidflies (Neuroptera: Mantispidae) to Kevin Hoffman, Clemson University, South Carolina, and parasitic wasps to Gary Gibson, Agriculture Canada, Ottawa.

I have recently received all the identifications back on the specimens collected from potted plants imported from Florida in October 1990. I will submit this information in another letter.

Future: I had hoped to visit Guana Island this spring, but I will have to postpone because I will be in Papua New Guinea for the month of April. I hope I can visit the island in spring of 1993.

Please let me know if you need additional information.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

cc: R.R. Snelling

B I S H O P M U S E U M

1525 BERNICE STREET • P.O. BOX 19000-A • HONOLULU, HAWAII • 96817-0916 • (808) 847-3511 • FAX (808) 841-8968

July 7, 1991

Dr. David Spencer Smith
Hope Entomological Collections
University Museum
Parks Road
Oxford OX1 3PW
ENGLAND

Dear Dr. Smith:

I was pleased to see your publication on Calisto anegadensis (Bull. Allyn Mus. 133, 1991). I am very happy to see that my original specimen has been properly followed up with your detailed research.

Although I have not been able to return to Anegada since my 1985 trip there for The Conservation Agency (TCA), TCA staff are actively working on conservation issues on the island (especially the iguanas and flamingos). With this in mind, I am disappointed that your publication omitted the acknowledgement of TCA that I requested in my October 24, 1988, letter to Lee Miller (enclosed). Also please note that the specimen was collected July 17, 1985, not "July 1986".

I would like to learn more about your work on Puerto Rican Bank butterflies, and I would appreciate any of your reprints on West Indian butterflies that are still available. Please keep in mind that fair collections of BVI butterflies have accumulated at the Smithsonian, Bishop Museum, and in the collection of Vitor Becker (Brazil). Although our BVI fieldwork has focused on moths, we have sampled butterflies whenever convenient. I enclose an old list of butterflies of Guana Island, as sent to Lee Miller last year.

Vitor Becker and I have a variety of papers in preparation on moths, especially of Guana Island (where TCA fieldwork has been based). Marc Epstein and I recently published on the moth genus Heuretes (enclosed).

If we can be of assistance in your research, please let me know. All we ask is that publications benefiting from TCA's BVI activities include an acknowledgement of fieldwork having been "supported by The Conservation Agency through a grant from the Falconwood Corporation." [The old Mocatta Corporation changed its name to Falconwood recently.]

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

encl: letters (2)
Heuretes reprint

cc: James Lazell, TCA
Numi Goodyear, TCA
Greg Mayer
Lee Miller
Vitor Becker

BISHOP MUSEUM
CELEBRATING A CENTURY OF DISCOVERY

July 29, 1991

Dr. Lee D. Miller
Allyn Museum of Entomology
3621 Bay Shore Road
Sarasota, FL 34234

Dear Lee:

Thanks for your letter of July 15th, which was awaiting my return from the mainland. I am enclosing a copy of my letter of 24 October 1988 about the Anegada Calisto, so you will have one for your files. I do not have any response from you in my files, so perhaps you did not receive it! It is unfortunate it disappeared, but it is not a real problem.

There was no inconvenience to me. My main concern is seeing that The Conservation Agency receives recognition for its activities, since this is important to its future funding.

Looking forward to seeing you at the Lepidopterists Society meeting.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

encl.
cc: David Spencer Smith
James Lazell

BISHOP MUSEUM
CELEBRATING A CENTURY OF DISCOVERY

February 15, 1992

George R. Proctor
Natural Resources Specialist
Dept. of Natural Resources
P.O. Box 5887
Puerta de Tierra, Puerto Rico 00906

Dear George:

The manuscript on butterflies of Guana Island has been returned by the other reviewers and is now ready for publication. I need your approval to use your plant information before I can proceed.

I look forward to receiving your comments.

Thanks again for your help.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

bcc: J. Miller, Allyn Museum
J. Lazell
V. Becker

BISHOP MUSEUM
CELEBRATING A CENTURY OF DISCOVERY

April 1, 1992

Dr. James Lazell
The Conservation Agency
6 Swinburne St.
Conanicut Island, RI 02835

Dear Skip:

I'm one hour from leaving for Papua New Guinea and running late again, but here's your stuff.

The draft on BVI agricultural pests is enclosed. Please let me know what you think.

I think I will have to skip Guana in October, but would like to try again for March/April 1993. I'm sorry my New Guinea trip prevented it this year.

I suggest that you invite Dr. Michael Ivie, Dept. of Entomology, Montana State University, Bozeman, Montana 59717; 406-994-4610 to work on beetles in October. He is coordinating the Virgin Islands beetle project and a beetle specialist is the next logical thing to add to Guana Island entomology.

I enclose some electronic mail messages from Paul Johnson and Mike Ivie regarding Guana Island beetles.

Tina says hello ... she's waiting for another lizard hunt!

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

encl.
cc (with encl.): Greg Mayer

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Skip: Please review the following about introduced species and the need for inspection/quarantine policies in the BVI.
(1) If you feel it is appropriate, please forward it to Henry Jarecki for his approval. I do not want to cause any troubles with this letter.
(2) Who in the BVI government should it be sent to? Dept. of Agriculture, National Parks Trust, etc.? Presumably a copy to Louis Potter?
(3) I can also adapt the report into a note for Caribbean Journal of Science or the University of Puerto Rico Journal of Agriculture.
(4) Aside from the economic issues, this issue is far more important than collecting permits and other things to the conservation of native invertebrates on islands!
(5) Sorry for the delays in this ... it unreasonably long to extract identifications out of the specialists.

Dear ...

I have been studying British Virgin Islands insects since 1984 under the sponsorship of The Conservation Agency. My current job for the Bishop Museum includes management of various programs related to conservation of native insects and eradication of introduced pest insects on islands, especially the Hawaiian Islands. With this background, I am concerned about the potential for introduction of pest invertebrates into the BVI.

Introduced insects and snails present great problems to agriculture, human health, and conservation management, with resultant economic consequences. The BVI government should create and implement policies for the inspection of agricultural materials entering the BVI, including provisions for fumigation and quarantine as necessary. Several agencies, including the U.S. Department of Agriculture, CAB International, and the state agriculture departments of Florida and California, could provide assistance in defining appropriate policies.

I realize that effective control of commerce from neighboring islands is difficult and may not be cost effective. At the very least, the BVI should require inspection of shipments from Florida. As a center of agricultural commerce, Florida is subject to infestations of large numbers of exotic pests, most of which could spread to the BVI if given the opportunity. Adequate protection from Florida pests might be as simple as requiring that shipments be certified by the State of Florida to be pest free (this is routinely done for shipments between Hawaii and California).

I have attached a report on an incident of pest movement in landscaping plants imported to the BVI from Florida in 1990. It appeared at the time that all applicable BVI procedures were followed. I am not trying to point to any individual wrongdoing, but to demonstrate the movement of new pests and new genetic

stock of established pests.

Aside from the agricultural, health, and economic considerations, this is an important conservation issue. The main problem facing native invertebrates on islands, other than outright habitat desctruction, is predation from or competition with exotic invertebrates. I hope that the BVI do not have to repeat the ecological disasters that have occurred on other islands (fire ants on Galapagos, for example). Well designed and implemented pest exclusion practices are the best protection. Although I have focused on invertebrates, pest exclusion practices should extend to plant weeds and vertebrate diseases as well.

If I can be of assistance in providing further information, including addresses of specialists in the agencies noted above, please contact me. I am eager to do anything I can to help preserve the beautiful environment of the BVI.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

DRAFT

On October 26, 1990, Greg Mayer, Tina Kuklenski, and Scott Miller sampled invertebrates from a large shipment of potted plants being unloaded at Guana Island, British Virgin Islands (BVI). The plants, including many specimens of several species of palms, were being imported from nurseries in southern Florida for landscaping. The importers had apparently met all BVI regulations and had checked in with government authorities in Tortola before the barge proceeded to Guana Island. The shipment was infested with large numbers of insects and snails, some of which have been identified as follows:

Cockroach (Blattodea: Blaberidae)
Pycnoscelus surinamensis (Linnaeus), Surinam cockroach

Mealybug (Homoptera: Pseudococcidae)
Dysmicoccus brevipes (Cockerell), Pineapple mealybug

Ants (Hymenoptera: Formicidae)
Brachymyrmex obscurior Forel
Hypoponera opaciceps (Mayr)
Odontomachus ruginodis Wheeler
Paratrechina longicornis (Latreille), Crazy ant
Paratrechina pubens (Forel)
Pheidole morerens Wheeler

Snails (Mollusca)
Lamellaxis gracilis (Hutton)
Polygyra cf. P. cereolus (Muhlfeld)
Praticolella griseola (Pfeiffer)
Succinea cf. S. luteola floridana Pilsbry

Although some of these species are native to the Puerto Rican Bank, most are introduced species that are now widespread in the Caribbean region, including southern Florida (Godan, 1983). Most are known from the Puerto Rican Bank (Wolcott, 1950-1951). Several major agricultural pests are included, such as those with common names listed. The presence of this many invertebrates on this shipment indicates the ease of dispersal of agricultural pests.

Introduced insect pests are a major problem for North American agriculture (Dowell & Krass, 1992; Sailer, 1978, 1983). In addition to being agricultural pests, introduced insects and snails appear to be the primary cause of extinction for native invertebrates on islands (e.g., Howarth, 1990). Vectors of human disease, such the Asian tiger mosquito, can also be spread by commerce (e.g., Francy et al., 1990). The recent spread of two giant African snails to Martinique is a stark example of the problem of continued pest dispersal (Mead & Palcy, 1992).

Given the threat that introduced insects and snails present to agriculture, human health, and conservation management, and potential economic consequences of such introductions, island governments should create and implement policies for the inspec-

tion of agricultural materials, including provisions for fumigation and quarantine as necessary.

Identifications were made by K. Emberton (Academy of Natural Sciences of Philadelphia, snails), D.R. Miller (Systematic Entomology Laboratory, U.S. Dept. of Agriculture, mealybug), R.R. Snelling (Natural History Museum of Los Angeles County, ants), and J. Strazanac (Bishop Museum, cockroach). Voucher specimens retained by specialists, except snails.

Literature Cited

Dowell, R.V. & C.J. Krass. 1992. Exotic pests pose growing problem for California. California Agriculture 46(1): 6-8, 10-12.

Francy, D.B. et al. 1990. A new arbovirus from Aedes albopictus, an Asian mosquito established in the United States. Science 250: 1738-1740.

Godan, D. 1983. Pest slugs and snails: biology and control. Springer-Verlag, Berlin.

Howarth, F.G. 1990. Hawaiian terrestrial arthropods: An overview. Bishop Museum Occasional Papers 30: 4-26.

Mead, A.R. & L. Palcy. 1992. Two giant African land snail species spread to Martinique, French West Indies. Veliger 35: 74-77.

Sailer, R. I. 1978. Our immigrant insect fauna. Bulletin of the Entmological Society of America 24: 3-11.

Sailer, R. I. 1983. History of insect introductions, pp. 15-38 in C. L. Wilson & C. L. Graham (eds.), Exotic plant pests and North American agriculture. New York: Academic Press.

Wolcott, G.N. 1950-1951. The insects of Puerto Rico. The Journal of Agriculture of the University of Puerto Rico 32: 1-975.

Date: Wed, 26 Feb 92 10:37:51 -0600
Message-Id: <9202261637.AA20566@calshp.cals.wisc.edu>
To: scottm@uhunix.uhcc.Hawaii.Edu
Subject: Re: Guana Island

16

Scott,

Gosh golly, that was one of the most garbled messages that I've seen.

Basically, I was noting that the click beetle from Guana I has been confirmed to be undescribed by Ed Becker and Christine von Hayek. Apparently, Mike Ivie has collected this critter in numbers elsewhere in the Virgin Is, and had submitted some specimens to Ed and Christine some time ago. I was not aware of this previously, and apparently Mike has all the material from the USNM and CNC, hence nothing for me to see on my visits to those institutions. Ed has recently returned some of your specimens that I sent prior to my conversation with Mike, and provided that same observations that Mike noted.

The species is evidently related to Aeolus granulatus Candeze, describedfrom "St. Dominique." However, there are several important structural traits that distinguish these two species.

I will be acquiring the material that Mike has, as well as some specimens of granulatus, including the type that should be in BMNH. Since the description of this new species would be of value to both the Guana I project, and Mike's broader Virgin Is project, and since it is such an interesting beast, there seems justification for separate publication. I will begin such as soon as I can free myself from a few other items, including a Simodactylus mss and another on Dioxypterus. Also, with my thesis completion coming up, the latter must take priority.

Hopefully, this message will be received in better condition; if not, let let me know again, and I will redo and fax it to you.

Paul

REPLY:

Paul: Your message came through fine this time. Thanks for the news. If you need a place to publish, consider "Caribbean Journal of Science" published by Univ. Puerto Rico. I don't think that they have page charges. I have the editorial guidelines around here somewhere. Scott

17

Date: Thu, 20 Feb 92 09:36:06 -0700
Message-Id: <9202201636.AA27041@terra.oscs.montana.edu>
From: ueymi%msu.dnet@mtsunix1.BITNET (MICHAEL A. IVIE)
To: TERRA::"scottm@uhunix.BITNET"
Subject: RE: Guana Island beetles

Scott,

I have just finished the LACM material from Guana, which added 4 more species. The total is 163 so far. This is considerably less than I would expect for the size, elevation, and intact vegetation of the island. I am sure an experienced beetle collector, in the wet season could add at least 50 more species, and I would be suprised if I couldn't add another 100. Whole suites of taxa are missing. So far, you have predominantly common, widespread taxa. [by the way, the elaterid that Paul has is the most abundant clicker in the VI. It is an undescribed Aeolus]. However, THERE are several species known only from Guana so far, all but one singletons, and at about the same rate as singletons from the other islands, so I doubt it means anything about uniqueness.

Hope all is well

Mike

17

November 6, 1991

Roy R. Snelling
Dept. of Entomology
Natural History Museum
900 Exposition Blvd.
Los Angeles, CA 90007

Dear Roy:

As you requested, I am sending all the British Virgin Islands aculeate Hymenoptera that I can find here. These specimens are from my trips in July 1987, July 1988, and October/November 1990. A few BVI specimens might have escaped in the general collection, but I think I found most of them.

We have another half drawer or so of parasitic wasps that I am not sending.

I am enclosing copies of the only two papers I know of that mention Guana Island Hymenoptera: Menke, 1986 and Marsh, 1988. I am also enclosing a printout of a working file I maintain on publications that are informative about Virgin Islands insects. This is not intended to be complete, just potentially useful references I have noted.

I hope that these specimens are helpful. Please feel free to keep duplicate specimens of whatever you need. The BVI material is of greatest value here as an identified reference collection, so I would rather have more taxa and less specimens than the other way around.

Specimens I collected in July of 1984, 1985, and 1986 are at the USNM. I assume that they are all intermixed into the general collection and would be difficult to access.

If I can provide further assistance, please let me know.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

encl: copies
loan form
cc: J.D. Lazell

The State Museum of Natural and Cultural History
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NATURAL HISTORY MUSEUM
of Los Angeles County

900 Exposition Boulevard
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12

November 25, 1991

Dr. Scott E. Miller
Department of Entomology
Bishop Museum
1525 Bernice St.
Honolulu, HI 96817-0916

Dear Scott:

Thanks for the specimens and additional info. I've finished identifications on everything except a few halictine bees. I will return the bulk of your stuff in January, minus only the halictine bees (10 specimens) and a few duplicates. The halictines will be sent to George Eickwort at Cornell for his use.

Incidentally, the female Psorthaspis being returned is apparently undescribed. It's a real beauty; I got one also and there is another from Puerto Rico that I found in the collection at Rio Piedras.

I also picked up two females of an apparently undescribed Hylaeus (Colletidae), but can't be sure without males. Well, maybe next time.

I hope there is a next time. I'd like to go back with 2 or 3 malaise traps. Should also do some night work (my head-lamp crapped out on the 3rd day).

See you in December!

Sincerely yours,

Roy R. Snelling
Entomology

RS/tr

Entomology: Hymenoptera

SHIPPING INVOICE

13

BISHOP MUSEUM
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Responsible Person: Dr. Roy R. Snelling
For use by: Dept. of Entomology
Institution: Natural History Museum
Mailing address: 900 Exposition Blvd.
Los Angeles, CA 90007

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Date shipped 8 Nov 1991
Loan due date Nov 1993

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(BPBM In-Loan No.)
Owner's Invoice No.)

Loan at your request XXX
Loan at our request

Exchange for
Other

Open Exchange
Gift

Authorized by Keith Arnold Registrar Janet Ness

QUANTITY	SPECIMEN NAME	LOCALITY	COLLECTOR/SOURCE	ID. NO.

Hymenoptera: British Virgin Islands aculete Hymenoptera

138 pinned spms
2 spms in vial

Total 140 spms

/ / continued on additional sheet(s)

LOANS: Extension of the loan period should be requested through the Registrar's Office. All specimens and parts thereof must be returned except those that Bishop Museum authorizes you to keep. All primary type material designated from specimens on loan to you must be deposited at Bishop Museum. No destructive procedure, conservation, or photography may be conducted without specific permission. Any damage or loss must be reported immediately. Additional conditions may be specified on an attached sheet. Primary types must be returned by registered air mail. Please return material to Department of ENTOMOLOGY attn: Collection manager.

Other instructions:

Please **SIGN** and **RETURN** this sheet promptly to

1 REGISTRAR'S OFFICE
Bishop Museum
P. O. Box 19000-A
Honolulu, HI 96817-0916 USA

Accepted in good condition *(exceptions should be noted above)*:

SIGNATURE Roy R Snelling

DATE 14 Nov 1991

Reg Form 101A Effective Aug. 1986; replaces Feb. 1980

20

NATURAL HISTORY MUSEUM
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900 Exposition Boulevard
Los Angeles, California 90007

14

January 8, 1992

Dr. James Lazell
The Conservation Agency
6 Swinburne St.
Jamestown, RI 02835

Dear Skip:

About time I got around to writing. Things get hectic around here near year's end. Happy New Year to you and Wenhua!

Hey! Thanks for the greetings from the Guana crew. I'm a tad amazed anybody seemed to think I was grumpy: I am merely a calm and reflective person. Please pass on my regards to Cory and Numi (I don't have an address for either).

I am still assessing the material collected on Guana, not only mine, but that collected by Scott Miller. In addition to that little bee that may prove new when the male becomes available, there is a spider wasp that may also prove to be new; it's really a beaut! I got one on Guana, as did Scott. A third apecimen (from Puerto Rico) turned up in the collections of the Department of Natural Resources at Bayamón. If I am offered a chance to return to Guana, I will come loaded for bear! Will bring a couple of malaise traps and mayhap some other gear; I would hope also to spend some time doing night collecting.

On the return I spent a week in Puerto Rico, of which two days were in Guánica Forest and 2½ days on Mona Island. The latter was productive despite the brevity of my visit and I added a few things to the list of critters known from there. The iguanas there are doing very well and seem pretty generally distributed over the island. On the second night there watched a hawksbill come ashore to deposit her eggs. I suppose that's pretty tame fare for herpetologists, but I was delighted. Greens use the same beach but apparently a little earlier. Mona is neat and I hope to get back for a longer stay.

The beetles from Guana were all sent to Mike Ivie at Montana State; maybe he'll find something of interest.

Let me know how things fare with you and Wenhua.

Sincerely yours,

Roy R. Snelling
Entomology

RS/tr

SHIPPING INVOICE

BP — 12216 15

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P. O. Box 19000-A
Honolulu, HI 96817-0916 USA
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For use by: Dept. of Entomology
Institution: Natural History Museum
Mailing address: 900 Exposition Blvd.
Los Angeles, CA 90007

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Loan at your request
Loan at our request

Exchange for
Other

Open Exchange
Gift X

Authorized by S. Miller Registrar Janet G. Hess

QUANTITY	SPECIMEN NAME	LOCALITY	COLLECTOR/SOURCE	ID. NO.

HYMENOPTERA: Formicidae:

ca. 25 undetermined specimens in 1 vial from Guana Island: intercepted from potted plants imported from Florida. 26.X.1990, S.E. Miller & G. Mayer, Colls.

/ / continued on additional sheet(s)

LOANS: Extension of the loan period should be requested through the Registrar's Office. All specimens and parts thereof must be returned except those that Bishop Museum authorizes you to keep. All primary type material designated from specimens on loan to you must be deposited at Bishop Museum. No destructive procedure, conservation, or photography may be conducted without specific permission. Any damage or loss must be reported immediately. Additional conditions may be specified on an attached sheet. Primary types must be returned by registered air mail. Please return material to Department of , attn: .

Other instructions:

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1 REGISTRAR'S OFFICE
Bishop Museum
P. O. Box 19000-A
Honolulu, HI 96817-0916 USA

Accepted in good condition (exceptions should be noted above):

SIGNATURE Roy Snelling

DATE 10 Feb 1991

NATURAL HISTORY MUSEUM
of Los Angeles County

16

900 Exposition Boulevard
Los Angeles, California 90007

January 13, 1992

Dr. Scott E. Miller
Department of Entomology
B. P. Bishop Museum
1525 Bernice Street
Honolulu, HI 96817-0916

Dear Scott:

The enclosed invoice is for the perverted amusement of your captive "bean counter".

For the delay in reporting on the material described on said invoice, my apologies (admittedly neither profound nor notably sincere). Sole justification for such a lapse lies in the nature of the material: both (1) uninteresting and (2) inconclusive. To wit:

Hypoponera opaciceps (Mayr)
" sp. (3 unidentifiable males)
Odontonachus ruginodis Wheeler
Pheidole moerens Wheeler
Brachymyrmex obscurior Forel
Paratrechina longicornis (Latreille)
" pubens (Forel)

These species all range from southern Florida through much of the Caribbean. Sorry 'bout that. Even so. BVI foks should be more insistent on setting up some sort of inspection/quarantine procedure. Of course, they may not care. After all, ants are ants. Whatever.

Happy New Year!

Sincerely yours,

Røy R. Snelling
Entomology

RS/tr

NATURAL HISTORY MUSEUM
of Los Angeles County

17

900 Exposition Boulevard
Los Angeles, California 90007

February 10, 1992

Dr. James Lazell
The Conservation Agency
6 Swinburne Street
Jamestown, RI 02835

Dear Skip:

I have submitted a trip report to SPHECOS - this will probably see publication later this spring. SPHECOS is a newsletter.

In the meantime I'm sending herewith a list of Hymenoptera collected on Guana. Perhaps this will be of some use in your annual report. Most of the things that have not been specifically identified belong to groups that are outside my specialty and/or the Caribbean fauna is too poorly known to permit even an educated guess.

Within the Formicidae, Camponotus undescr. sp. is one of two that a colleague and I will be describing from material we collected on Puerto Rico. I expect to finish that manuscript sometime early summer.

No. 39 - Hylaeus (Hylaeana) sp. is the little bee I was so interested in last year. It is almost certainly a new species: it's certainly none of the three I described from Jamaica several years ago, nor is it like any of the species of subg. Hylaeana from northern South America. But, I still need males before I'd consider doing anything with it!

Sincerely yours,

Roy

Roy R. Snelling
Entomology

RS/tr

HYMENOPTERA (BEES, WASPS, ANTS) OF GUANA ISL., BVI

Evaniidae
1. Brachygaster pygmaeus (Fabricius) ?
2. Hyptia poeyi (Guerin) ?

Tiphiidae
3. Myzinum haemorrhoidale (Fabricius)

Scoliidae
4. Campsomeris dorsata (Fabricius)

Formicidae
5. Leptogenys pubiceps (Emery)
6. Pheidole fallax Mayr
7. Monomorium ebininum Forel
8. " floricola (Jerdon)
9. Solenopsis geminata (Fabricius)
10. " sp.
11. Crematogaster steinheili Forel
12. Cyphomyrmex minutus Mayr
13. Wasmannia auropunctata (Roger)
14. Dorymyrmex antillana Forel
15. Brachymyrmex obscurior Forel
16. Camponotus sexguttatus (Fabricius)
17. " undescr. sp.
18. Paratrechina longicornis (Fabricius)

Vespidae
19. Pachodynerus atratus (Fabricius)
20. Mischocyttarus phthisicus (Fabricius)
21. Polistes crinitus (Felton)

Pompilidae
22. Pepsis rubra (Fabricius
23. Psorthaspis sp. (poss. new)
24. Aporus prolixus Bradley

Sphecidae
25. Liris labiata (Fabricius)
26. " luctuosus dahlbomi (Cresson)
27. " sp. 1
28. " sp. 2
29. " sp. 3
30. Cerceris sp.
31. Ectemnius craesus (Lepeletier & Serville)
32. " sp.
33. Hoplisoides ater (Gmelin)
34. Tachytes chrysopyga (Spinola)
35. " tricinctus (Fabricius)
36. Tachysphex alayoi Pulawski
37. Stictia signata (Linne)
38. Bicyrtes spinosa (Fabricius)

Colletidae
39. Hylaeus (Hylaeana) sp. (prob. new)

Halictidae
40. Lasioglossum (Dialictus) sp.
41. Augochloropsis sp. 1
42. " sp. 2

Megachilidae
43. Megachile (Pseudocentron) sp. (poss. undescr.)
44. Coelioxys abdominalis (Guerin)

Apidae
45. Apis mellifera Linne
Anthophoridae
46. Exomalopsis sp.
47. Anthophora tricolor (Fabricius)
48. Centris lanipes (Fabricus)
49. " haemorrhoidalis (Fabricius)
50. Xylocopa mordax (F. Smith)

Parasitic Hymenoptera (Ichneumonoidea, Chalicidoidea)
Braconidae - 3 species
Ichneumonidae - 2 species
Chalcidoidea - 4 species

In some genera it is not now possible to identify to species because they have not been recently revised.

NATURAL HISTORY MUSEUM
of Los Angeles County

20

900 Exposition Boulevard
Los Angeles, California 90007

March 9, 1992

Dr. James Lazell
The Conservation Agency
6 Swinburne Street
Jamestown, RI 02835

Dear Skip:

This is a follow-up to my last letter. The beetles that I collected were sent to Dr. Michael A. Ivie at Montana State University, Bozeman. He returned them to me this week, with the following identifications:

BOSTRICHIDAE
Melalgus femoralis (Fabricius)
Xylomeira tridens (Fabricius)

BRENTIDAE
Exopleura monilis (Fabricius)

BRUCHIDAE
Acanthoscelides sp.
Ctenocolus crotonae (Fahraeus)

CERAMBYCIDAE
Anelaphus nanus (Fabricius)
Ataxia alboscutella Fisher
Curtomerus flavus (Fabricius)
Eburia quadrimaculata (Linne)
Elaphidion irroratum (Linne)
" pseudonomon Ivie
Methia necydalea (Fabricius)
Neocompsa cylindricollis (Fabricius)
Neostizocera vanzwaluwenbergi (Fisher)

CHRYSOMELIDAE
Chalepus sanguinicollis (Linne)

CICINDELIDAE
Cicindela trifasciata (Fabricius)
" suturalis (Fabricius)

CURCULIONIDAE
Anchonus suillus (Fabricius)
Monoetius curvipes (Fabricius)

DERMESTIDAE
Cryptorhopalum quadrihamatus Beal

ELATERIDAE
Aeolus sp. nr. granulatus
Conoderus delalaoneyi Fleutiaux & Salle

HISTERIDAE
Omalodes laevigatus (Quensel)

OEDEMERIDAE
Oxycopis desecheonis (Wolcott)

SCARABAEIDAE
Ligyrus cuniculus (Fabricius)
Omorgus suberosus (Fabricius)
Strategus talpa (Fabricius)

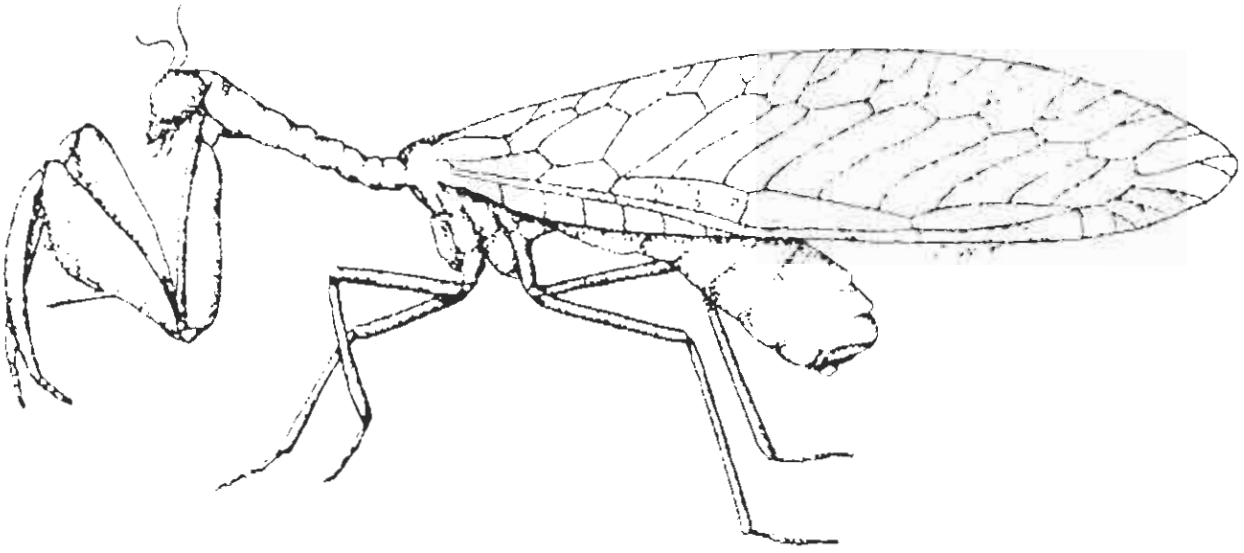
TENEBRIONIDAE
Gnathocerus curvicornis (Champion)

Hope this will be of some interest to you.

Sincerely yours,

Roy R. Snelling
Entomology

RS/tr



A MANTISPID

Mantispids are smaller than iguanas, but more carnivorous than wolves. The adults are predators, but the young are parasites, just as with many humans. They undergo hypermetamorphosis: the hatchlings run around actively but metamorphose into rather sedentary grubs. These then metamorphose into flying, grabbing, voracious adults.

College of Agricultural Sciences
DEPARTMENT OF ENTOMOLOGY

CLEMSON UNIVERSITY

26 June 1991

Dr. Scott E. Miller
Department of Entomology
Bishop Museum
1525 Bernice Street
P.O. Box 19000-A
Honolulu, HI 96817-0916

Dear Dr. Miller:

Thank you for your letter of 14 June concerning your mantispids from the British Virgin Islands. I am currently revising the subfamily Mantispinae for North, Central, and South America and would like to examine these specimens and any other mantispids you may have from these areas. As per your loan policy, please make the loan out to my major advisor, Dr. John C. Morse.

I've seen your specimens in the Smithsonian, and they belong to the same undescribed species Mike Ivie collected in the U. S. Virgin Islands. I've also seen specimens of this species from Puerto Rico and Dominica.

Concerning your mantispid material from Southeast Asia, I do plan to work on mantispids from this region in the next 3 - 5 years. About all I could do at present would be to provisionally assign them to genera. There are approximately 150 described species from the region and the diagnostic characteristics are so poor for these that most species can not be confidently identified. The entire mantispid fauna of the Pacific region (except for Australia) needs revising, and I know of no one else who's working on them at this time. I'll be sure to contact you when I start working on Asian mantispids in earnest.

Thank you in advance for your time and efforts.

Sincerely,

Kevin M. Hoffman

Kevin M. Hoffman
Ph.D. Candidate

114 LONG HALL • CLEMSON, SOUTH CAROLINA 29634-0365 • TELEPHONE 803/656-3111

Entomology: Mantispidae

SHIPPING INVOICE

24

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P. O. Box 19000-A
Honolulu, HI 96817-0916 USA
Phone (808) 847-3511

BP — 14733

SHIPPED TO
Responsible Person: Dr. John Morse
For use by: Mr. Kevin Hoffman
Institution: Clemson University
Mailing address: Clemson, SC 29634-0365

office use

SHIPPING INFORMATION
Shipped via AIRMAIL
Contained in One parcel
Permit controlled
(BPBM CITES No. US 24)

Date shipped 3 July 1991
Loan due date July 1993

SHIPPED AS
Return of your material
(BPBM In-Loan No.
Owner's Invoice No.)

Loan at your request XXX
Loan at our request

Exchange for
Other

Open Exchange
Gift

Authorized by [signature] Registrar Janet G. Mesa

QUANTITY	SPECIMEN NAME	LOCALITY	COLLECTOR/SOURCE	ID. NO.
	Mantispidae undet. (Neuroptera)			
78	Neotropics			

/ / continued on additional sheet(s)

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Honolulu, HI 96817-0916 USA

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SIGNATURE

DATE

31

B I S H O P M U S E U M

1525 BERNICE STREET • P.O. BOX 19000-A • HONOLULU, HAWAII • 96817-0916 • [illegible]

July 2, 1991

Mr. Kevin Hoffman
Dept. of Entomology
Clemson University
Clemson, SC 29634-0365

Dear Kevin:

Thank you for your letter of June 26th regarding mantispids. I am sending, on loan to John Morse, all our New World mantispids. I hope that they are helpful in your research.

We have about three drawers of mantispids, most from the Old World. About half a drawer worth are out on loan to Tim New, but most of the rest have not been studied.

You should have a good series of the new West Indian species with all the Bishop and USNM Guana Island specimens. If possible, we would appreciate an acknowledgement in your final publication something to the effect that "collection of Guana Island was supported by The Conservation Agency, with a grant from The Falconwood Corporation."

If we can be of further assistance, please let me know.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

encl: loan form

bcc: Shpeizell

UNIVERSITY OF NEW HAMPSHIRE

College of Life Sciences and Agriculture
Department of Entomology
Nesmith Hall
Durham, New Hampshire 03824-3597
(603) 862-1707

26

8 April 1991

Dr. Scott Miller
Department of Entomology
Bishop Museum
P. O. Box 19000-A
Honolulu, Hawaii 96817-0916

Neal
dept
Lazell
me

Dear Dr. Miller:

Neal Evenhuis asked me to respond as soon as possible with an identification of the series of Tabanidae from the British Virgin Islands. The shipment of specimens arrived safely, and I was able to examine the BVI series last Friday. Below is the information associated with these specimens. Extensive comments, however, also are in order, as the identification was not as straight-forward as I initially had hoped.

Tabanidae from Guana Island (British Virgin Islands)

Stenotabanus (Aegialomyia) barahona Fairchild, 20♀, 1♂

9 - 23. vii. 1987, Coll. S. E. Miller & V. O. Becker, 10♀

12. vii. 1988, Coll. S. E. Miller & C. O'Connell, 3♀

14 - 15. vii. 1988, Coll. S. E. Miller & C. O'Connell, 1♀

17. vii. 1988, Coll. S. E. Miller & C. O'Connell, 1♂

27 - 28. vii. 1988, Coll. C. O'Connell, 2♀

24 - 31. x. 1990, Coll. S. E. Miller & T. Kuklenaki (?sp), 2♀

1 - 5. xi. 1990, Coll. S. E. Miller & T. Kuklenaki (?sp), 1♀

Comments. I would feel much better if this series of specimens had exhibited less variability. Perhaps this is common in insular faunas. There was not quite enough variation for me to suspect 2 different species, but considerably more than is indicated in the original description and discussion of this species by Fairchild in 1980. This species was described from a female collected in the Dominican Republic (Province of Barahona), and a paratype female collected from the same province.

The first couple of specimens I examined from your series agreed very well with the original description, and I rather cockily and quickly examined the others. The more specimens I examined, the more variation I observed, so that after looking at all the specimens, I re-examined them, noting principal variant features which are discussed below.

About 1/3 of your female specimens have the relatively broad frons (index about 3.5) characteristic of the typical *barahona*. The rest have a somewhat narrower frons (index 4 to 5), and lack the distinctive bare ocellar patch. The frons index is less than 6, so your specimens clearly belong in the subgenus *Aegialomyia*. The wing pattern of all your specimens seems to fit *barahona* well.

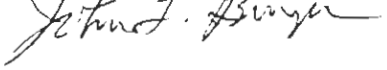
The type of *barahona* has an ashy gray mesoscutum and scutellum. Some of your specimens fit this very well, but others have a much darker brownish cast to the mesoscutum and scutellum, obscuring the paler longitudinal stripes on the mesoscutum. The pleurae of some specimens also are darker gray. There is some variation in the stoutness of the maxillary palpi, but this seems well within the range of variation expected. The leg coloration of all your specimens agrees well with the original description.

Another troubling source of variation is in the abdominal pattern. About 1/3 of your specimens agree well with the original description, having the characteristic "comma-shaped" submedian dark markings on the abdominal tergites. However, some of your specimens show much more extensive dark markings, forming complete bands near the posterior margin of some tergites, with paler centers correspondingly reduced. A few specimens, however, have the abdomen extensively grayish pollinose, with the dark markings on tergites reduced to small submedian streaks. The ground color of the abdomen of some specimens is distinctly brownish. The genus *Stenotabanus* is notorious for its variable abdominal color patterns, so perhaps this is not surprising.

Finally, I am not entirely happy with observed differences in the eye color pattern seen in your specimens, compared to the type. Fairchild observed 2 narrow purple bands on the greenish background, as well as the purplish ventral margin. Your specimens seem to have only 1 purple band, but otherwise are similar. Your specimens are so close generally to *S. barahona*, that it seems unlikely that they might be a different species. To be certain, however, I am sending 2 specimens representing the extremes of variation to Sandy Fairchild for examination, to confirm the identification. I hope this is OK with you.

The male of *S. barahona*, is, I believe, not previously collected. Therefore, if your series is, indeed, *barahona*, your male specimen would be the first recorded for this species. I'll return these specimens to you as soon as I get confirmation from Sandy Fairchild. I hope it is OK for me to keep a couple of duplicates. If you have any questions about these specimens, please let me know.

Sincerely,
John F. Burger



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1525 BERNICE STREET • P.O. BOX 19000-A • HONOLULU, HAWAII • 96817-0916 • (808) 847-3511 • FAX (808) 841-8968

Neal
dept
Lazell
me

April 12, 1991

Dr. John Burger
Dept. of Entomology
Univ. of New Hampshire
Durham, NH 03824-3597

Dear John:

Thank you for your letter of April 8th regarding Stenotabanus barahona from Guana Island. I appreciate your prompt (and extensive) comments on this.

Please feel free to keep some duplicate specimens. The species is quite common on Guana Island. There are probably more specimens from my earlier (1984-1985) trips to Guana Island at the USNM. There may also be specimens from other islands in the British Virgin Islands (e.g., Tortola, Virgin Gorda, etc.) both here and at USNM. Please let me know if you want additional records.

If you publish on these specimens, we would appreciate an acknowledgement something to the effect that they were collected in fieldwork sponsored by The Conservation Agency under grants from The Falconwood Corporation.

For the record, the correct spelling of one of the collectors is T. Kuklenski. This was a useful reflection on "quality control" of our labels. I think we have resolved the problem of label clarity.

Thanks again.

Sincerely,

Scott E. Miller
Chairman
Dept. of Entomology

cc: Dr. James Lazell, The Conservation Agency

UNIVERSITY OF NEW HAMPSHIRE

College of Life Sciences and Agriculture
Department of Entomology
Nesmith Hall
Durham, New Hampshire 03824-3597
(603) 862-1707

cc - Neal
- Skip
Lazell
- dept
file

29

30 April 1991

Dr. Scott E. Miller, Chairman
Department of Entomology
Bishop Museum
P. O. Box 19000-A
Honolulu, Hawaii 96817-0916

Dear Dr. Miller:

Enclosed is a revised list of species of Tabanidae recently sent by Neal Evenhuis. Note that your specimens from the British Virgin Islands (Guana Island) are *Stenotabanus (Aegialomyia) stigma* (Fabricius), **not** *S. barahona* as I had originally supposed. I was somewhat suspicious of the variation observed. Sandy Fairchild has examined representatives, and has identified them as *S. stigma*. I have retained 4 ♀♀ of the *Stenotabanus*. I hope this is agreeable with you.

Under separate cover, I am returning the lot of Tabanidae (and 1 odd Syrphidae). These are being packed up today, and should reach you soon. If you ever get any more specimens of *Neobolbodimyia nigra*, from New Guinea, I'd love to get my hands on one for my reference collection. Sorry I could not do much with your *Cydistomyia* species. They need to be in mint condition to be identified accurately. If you have any questions about the specimens, please let me know.

It's interesting that at the time I was examining your specimens, I was also looking at a lot of species collected as part of "Project Wallace" from Sulawesi, in the Carnegie Museum, which included a series of *Tabanus (Pseudobolbodimyia)*, which were originally described also in the genus *Neobolbodimyia*, but which are clearly different.

Sincerely,

John F. Burger
Associate Professor

Enc.

Bishop Museum Tabanidae

North America:

Tabanus kesseli Philip - 1♀
Tabanus punctifer Osten Sacken - 1♀

New Guinea:

Cydistomyia spp. 4♀♀, 1♂
Neobolbodimyia nigra (Ricardo) - 1♀
Tabanus denticulatus Ricardo - 1♀
Tabanus yulensis von Röder - 1♀

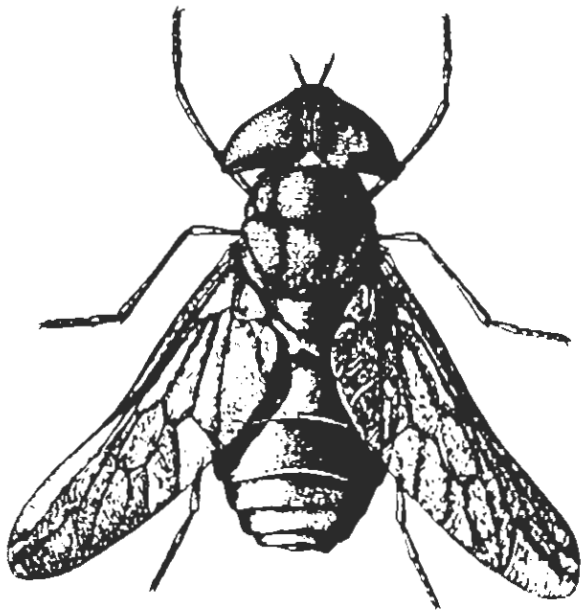
British Virgin Islands:

Stenotabanus (Aegialomyia) stigma (Fabricius) - 20♀♀, 1♂
[Retained 4♀♀; 9-23.vii.1987, S. E. Miller & V. O. Becker]

I had Sandy Fairchild check the determination of this species as I was not at all happy with the variation, compared to his original description of *S. barahona*. He has identified your specimens as *S. stigma*. My reference collection of this genus is very poor, so determinations are difficult without comparative material.

Syrphidae: 1 specimen

29 April 1991



Abstract : for National Conference on Urban Entomology, Feb. 1991

CARIBBEAN TERMITE SURVEY : II. BRITISH VIRGIN ISLANDS

A survey of the Caribbean termite fauna is now under way as a joint effort involving a number of different investigators and organizations. This report on the fauna of the British Virgin Islands, with special reference to Guana , is part of that effort.
Guana and neighboring islands of the BVI complex are part of the Peurto Rico Bank, a broad plateau variously dry land or submerged during geological history, depending upon the state of glaciation. The rocks date back to the Cretaceous.

During historical times, members of the island complex have been subjected to timbering operations; establishment of goats, sheep, pigs, rats and cats ; agricultural operations such as sugar production ; destruction of native vegetation ; importation of exotic plants ; and invasion by "weeds". One of these islands, Guana, has retained an extraordinarily diverse fauna for its size (850 acres). It has been designated as a wildlife sanctuary, and is so maintained by the Jarecki family. The termite survey there is part of the on-going effort by the Conservation Agency of Rhode Island to document the impressive diversity of the island. Additional near-by islands have been screened.

Knowledge of the termite fauna of the Caribbean Islands can provide information on movement of pest species and threats to structures and goods in near-by continental areas. The distribution of a second species of Coptotermes , with habits similar to the enormously destructive C. formosanus, is of special importance. Recent material entered through the survey on Guana indicate that this species has reached Cuba, a near neighbor of the United States.

Basic biological information emerging from this study can provide data pertinent to the resolution of significant problems : taxonomy of the Kalotermitidae is of special significance. Descriptions and extant taxonomic keys for termites of the region are of varying utility, suffering from the use of too-small samples to permit appreciation of the range of variability inherent in the taxon. In the Kalotermitidae, soldier size and relative proportions of taxonomically-useful features vary with age and nutritive status of the colony. In addition, many species of the genus Incisitermes of this area show alternative head forms in the soldiers. It is possible that small-sample collecting in the past has led to species descriptions based on "long-headed" or "short-headed " soldier forms. This seems especially true for Incisitermes snyderi Light, an ecologically-versatile dry-wood termite found in southern USA, Mexico, Central America, and islands of the Caribbean.

Resolving the question of validity of species possibly erected on the basis of one or two individuals of one or the other head form in soldiers will require careful morphometric studies of adequate samples, as well as establishment of cuticular hydrocarbon profiles. This combined approach is being utilized in the Caribbean survey; implications for designation of endemicity exist as well.

Changes in our appreciation of faunal richness of islands of the Caribbean developing since Snyder's 1956 summary will be illustrated.

Margaret S. Collins, Dept. of Entomology, Smithsonian Inst.

Michael I. Haverty, U.S Forest Service, USDA
(will be corrected)

National Museum of Natural History · Smithsonian Institution
357-1856, 1857
WASHINGTON, D.C. 20560 · TEL. 202-

NHB - 557
MS- 165

Dr. James Lazell, President
The Conservation Agency

Dear Skip,

Here's the illustrated version of the short course in termite biology I have designed for the group on Tortola. I think I could get by with 2 microscopes for the first offering unless the group was too large. I will welcome your reactions to this. It is also being run through the National Pest Control Association again, they provided helpful comments for the first version.

I am sending also some material describing the Caribbean termite survey we are getting under way. Several papers have been published on this already, am going to try to get abstracts copied to include. Any help you can give us will be welcome. Having trained collectors on the several islands will be a big plus for us ; also, having trained eyes around should help spot early invasion of species of Coptotermes . We have lots of C. formosanus (the "Condominuim Eater") in this country already ; C. havilandi is on Barbados and may be moving north.

The study we are engaged in is important, combining as it does classical taxonomy and the new techniques involving cuticular hydrocarbon analysis, karyotype analysis and description of allozyme patterns. Termites are not the easiest animals to study taxonomically, but, paradoxically, we know more about their taxonomy and phylogeny than we do for any other insect group of comparable size. Checking established concepts with data obtained using modern techniques is interesting and important.

Now we need to clarify environmental contributions to hydrocarbon arrays, if any ; the changes in composition with age, if any ; and the factors influencing variability between colonies and populations of the same species.
* 1991 session, Guana & Tortola
I am enclosing pertinent portions of a report presented at a recent conference on biodiversity in Hawaii; it is being readied for publication in a mainland journal.

I am waiting for further word from Miguel in Cuba, he is very excited at the prospect of joining us.

Bambi and I should have the nodule paper finished shortly.

Good luck, good wishes, and watch out for fanatics !

Sincerely,

Margaret

SHORT COURSE : BIOLOGY OF CARIBBEAN TERMITES

MARGARET S. COLLINS

THE CONSERVATION AGENCY, 6 SWINBURNE STREET

CONANICUT ISLAND, RHODE ISLAND 02835

and

DEPARTMENT OF ENTOMOLOGY

SMITHSONIAN INSTITUTION

WASHINGTON, D.C. 20560

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INTRODUCTION TO THE TERMITES OF THE WEST INDIES

Lecture/Demonstration Schedule

I. Termites as Social Insects :

A. Characteristics of Insects; social insects ; organization of the termite colony; castes ; body form, functions, key characters of the imago, soldier, worker and immature functioning individuals of termite colonies found in the area; construction of an identification key

B. Biology of Caribbean termites

1. Families : feeding habits, nest structure, colony size, role in ecosystem ; symbiotes
2. Formation of new colonies : flight times and patterns ; climatic factors of importance; enemies
3. Some things to be discovered about the West Indian termite fauna

II. Beneficial and Destructive Activities of Termites

A. Beneficial Activities

1. Termites as recycling and soil-improving agents
2. Termites as food for other animals
3. Uses of termite nest materials as fertilizer, building material and mosquito repellent

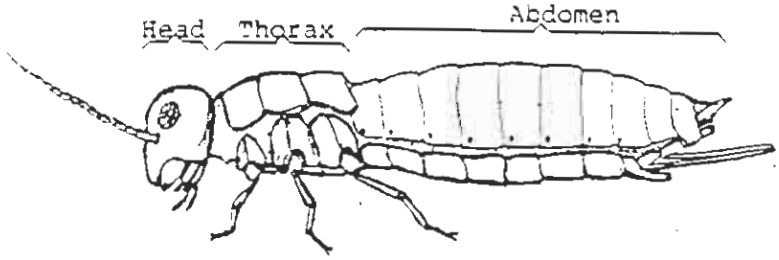
B.Destructive Activities

1. Damage to structural timber ; detection, identification,avoidance or reduction of damage; recognizing new invaders
2. Damage to agricultural products

SUMMARY : Role of termites in the Ecosystem

I. Termites as Social Insects

Insects may be defined as ARTHROPODS with three pairs of legs, up to two pairs of wings, and bodies divided into three regions, head, thorax and abdomen. See figure to compare body types of insects and other types of Arthropods (animals with external skeletons and jointed appendages):



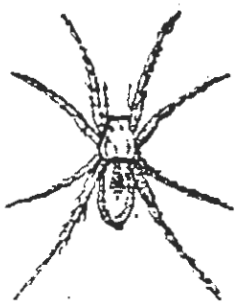
1. Primitive Insect Pattern

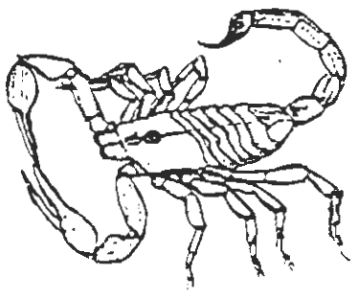
Other Arthropods :

2. Millipedes

4. Centipedes

3. Lobsters, Crabs, Shrimps, Crayfish





5. Spiders, Scorpions

Arthropods are the most numerous kind of animal living today.

Social Insects may be defined as insects in which the offspring remain with one or both parents and aid in rearing successive generations of young, forming societies that may persist for one or more years.

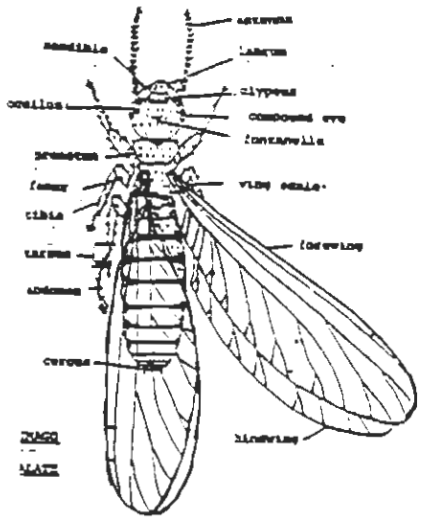
Termite colonies are potentially very long-lived, and may come to contain millions of individuals.

Termite colony organization involves individuals of different body types, specialized in different directions, and capable of performing different functions, the CASTES. The most specialized termites we have in the BVI possess three adult castes, the winged reproductives, or Imagoes (Kings and Queens)(also Alates or Swarmers); Soldiers ; and, most numerous, the Workers. The larger dry-wood and furniture termites are less specialized and have only two adult castes, the reproductives and the soldiers. The main work of the colony is done by young stages, the Pseudoworkers or Pseudergates; these may later develop into either reproductives or soldiers, depending upon conditions in the colony.

II. Characteristics of the Adult Castes in Termites

A. The IMAGO is deeply colored, brown to black, with compound and simple eyes; two pairs of wings of approximately equal length, provided with a breakage suture near the point at which the wing joins the body ;comparatively strong legs ; chewing mouthparts; and relatively simple antennae.

After flight from the nest, the wings break off at the suture, and the wingless imago, called a dealate, spends the rest of its life without flight. Females become increasingly swollen with egg-producing structures as they become older. Male reproductives become slightly enlarged with age, but never as much as the old females (called "Queens").



6. Termite imago (alate, winged form)

Unlike ants, bees and wasps, termite societies usually consist of about equal numbers of males and females.

The reproductives are responsible for three chief functions :

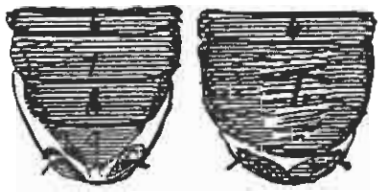
1. Dispersal to new places to live
2. Founding new colonies and providing chemical organization factors
3. Increasing colony size

During their lifetimes, the reproductives produce chemicals (called pheromones) that help regulate the number of other individuals in the colony. These substances are spread through food exchange and mutual grooming.

Alates are produced in colonies after they reach a certain population size, and are released in flights at times characteristic of the species. Some termite flights occur during the day; imagos of such species tend to be darker in color than those that fly only at night. Some primitive termites produce imagos throughout the year or growing season; others produce them under highly-specific conditions at set times during the year.

Male and female reproductives pair after short flights, and, after discarding wings, the male and female select a site to start a new home. Both work together in excavating a chamber under tree bark, or in a break in dead wood or in soil. Mating may not take place until several weeks after pairing and starting the new home.

How can we tell males from females ? Examination of the under surfaces of the ends of the abdomen will show that males have more sections, or plates, (9) than females (7). Further, the shapes of the plates differ:



7. Male Female

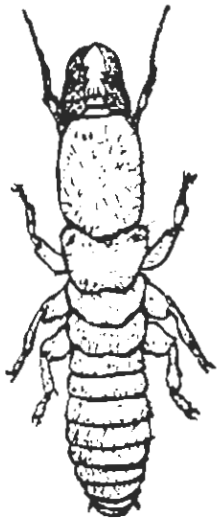
B. The SOLDIER is the second adult caste to evolve in termites; the main function is defense of colony or foraging groups.

Soldiers and workers (to be described later) show many of the characteristics of immature termites :

1. Relatively pale body color
2. Delicate legs
3. Poorly-developed or missing eyes and wings
4. Inability to reproduce except under special circumstances

Special features evolving in soldiers are shown best in head form. These features are used extensively in identification, so collections should contain several soldiers whenever possible.

Termite soldiers of the more primitive families have large heavy jaws used in biting attackers. More specialized termites have soldiers that produce poisonous liquids or gases, or squirt a sticky glue that may be either toxic or repellent, or both. The most specialized termites have lost the soldier caste altogether; in this group, workers carry out defensive functions.



8. Primitive soldier

9. Specialized squirting soldier

Soldier termites have to be fed by the workers or working young, the pseudergates, so caring for them is one of the major tasks of this last group. Colonies of some types have very large numbers of soldiers (30% or more in the squirting soldier types). How the colony could "afford" to support and care for the soldiers was a question until it was discovered that soldiers can "fix" atmospheric nitrogen (needed for plant and animal growth) in significant amounts, and thus care for at least a part of their nutritional needs. The ability to fix nitrogen is an important one, found in legumes such as beans and alfalfa and a few other organisms. It is a result of the action of special bacteria that live free in soil or in nodules on the roots of legumes, or in the guts of termites. Recently, a bacterium that can both break down the main wood component, cellulose, and fix nitrogen has been discovered. Bacteria such as these enrich soils and make growth of green plants possible, and indicate the importance of termites as re-cyclers and soil improvers.

Soldier termites usually lack eyes, traces of wings, and the ability to reproduce. Exceptions are known, always among the more primitive , or "lower" families of termites . Here, some groups have soldiers that may be fertile, and these and others may have wing buds ; other groups may have soldiers with colorless or pigmented small eyes.

These observations indicate that evolutionary losses of different structures or capacities may proceed at different rates in different parts of evolving organisms. The most specialized soldiers have lost eyes, wings, reproductive capacity and even functional jaws, while less specialized ones may retain one or more of these features in reduced condition.

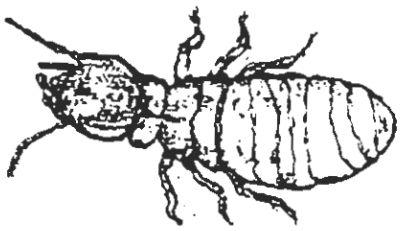
The functions of this caste include defense, pheromone secretion regulating production of other soldiers, communicating alarm and recruiting help when under attack, and nitrogen fixation.

C. The WORKER is the third caste to develop in termites, the group that carries on tasks associated with colony housing,growth and maintenance ; care of reproductives, soldiers and young, and sometimes defense.

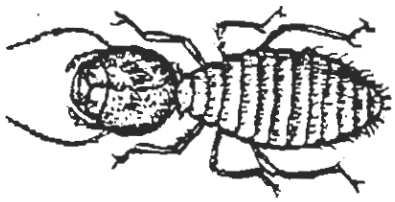
The term "worker" is reserved for individuals of immature body form (no wings, eyes or the ability to reproduce) that are incapable of further change, known only in the most specialized termites. In the less-specialized groups, colony needs are met by individuals that retain an immature appearance for long periods of time, but are capable of differentiation into soldiers or reproductives when colony growth or other circumstances provide a developmental signal . Such individuals are termed "pseudoworkers" or "Pseudergates".

In time, we hope to be able to identify workers or pseudergates of different species even when collected without soldiers or winged forms, based on the arrangement of parts of the digestive tract.

Such individuals have a yellow-brown, cream or dirty-white skin color, a plump abdomen, slender legs, and neither eyes nor wings. Chewing mouthparts permit them to function importantly in feeding and nest construction.



10. Pseudergate



11. Worker

III. Taxonomic characters used in identifying termites (area of BVI)

There are several kinds of termites living in this area, differing in nest pattern, body size, life history, and other details. These groups will be treated separately, by family, with common representatives listed.

A. Kalotermitidae, the Dry-wood termites

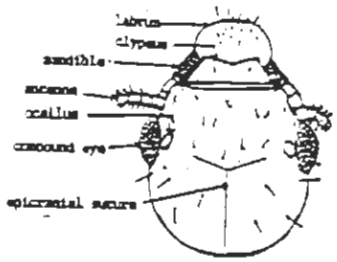
Common BVI representatives : Incisitermes snyderi, Cryptotermes brevis, Procryptotermes corniceps

These termites live in fairly-small colonies in galleries excavated in wood. The pseudergates and soldiers are typically larger than those of more specialized termites. Two adult castes are present, the imago and the soldier; work functions are performed by pseudergates.

IMAGO

Head :

Clypeus simple
Ocelli present (2)
Antennae with fewer than 22 articles (sections, segments), usually 14-18
No fontanelle
Epicranial suture present



12.

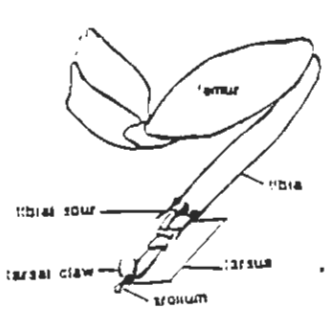
13.

Left mandible with an apical and two large, closely-spaced marginal teeth

14.

Base of wing with 3 or more sclerotized (dark) veins (counted at suture edge of wing margin)

No spines on tibial shaft
Tibial spurs 3:3:3
Tarsi 4-segmented



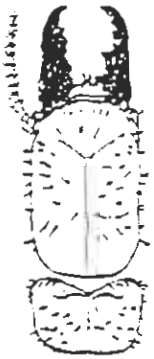
15.

Cerci 2-segmented (see fig. on page 2)

SOLDIER

Head robust, long or truncated and plug-shaped
Fontanelle absent
Antennae with 10-20 articles, some with highly-modified 3rd article
Eyes present but rudimentary; sometimes pigmented

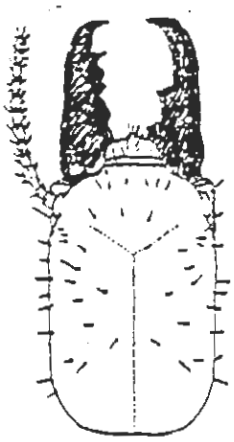
Epicranial suture present
Mandibles usually robust



16.

17.

Mandibular dentition variable : left mandible with 1 apical and 3 marginal teeth (may be reduced); right mandible with an apical and 2 marginal teeth in most representatives

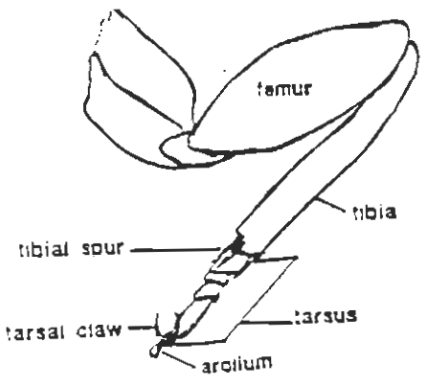


18.

Pronotum as wide or wider than head

19.

Tarsi 4-segmented



20.

B. Rhinotermitidae, the subterranean termites

Common BVI representatives : Heterotermes species ; maybe Coptotermes

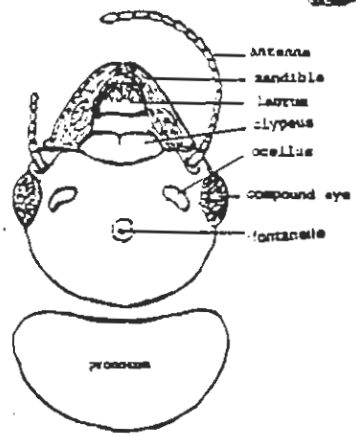
Termites of this family develop large, sometimes enormous colonies, usually penetrating wooden structures from underground nests by way of inconspicuous or concealed runways.
Two adult castes, the imago and the soldier, are present in our representatives; colony work is done by pseudergates, which are generally quite small compared to the dry-wood termites. Some extremely destructive termites, easily capable of moving into different countries or islands, belong to this group.

IMAGO

Head :

Clypeus 2-lobed (sometimes inconspicuously)
Mandibles : left mandible with one apical and 2 marginal teeth above a molar plate ; right mandible with an apical and 2 marginal teeth and a molar plate ; second marginal tooth broad, nearly as broad as molar plate
Fontanelle present
Ocelli present (2)

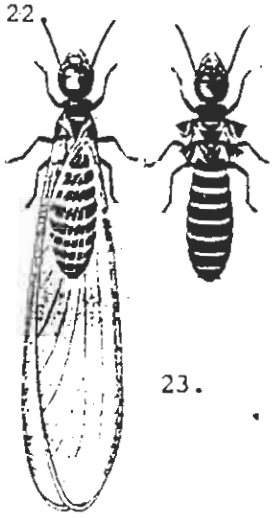
21.



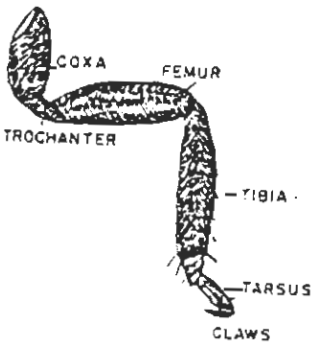
22.

Thorax :

Pronotum about as wide as head, rather flat
Forewing scale considerably longer than hindwing scale, usually overlapping it at base
Wings translucent or transparent, pigmented or colorless
Tibial spur count 3:2:2 or 2:2:2
Tarsi 4-segmented



23.



24.

SOLDIER

Head :

Mandibles smooth, lacking teeth or serrations in outer portions
Antennae with 14-18 articles
Eyes absent
Fontanelle present ; may be small and inconspicuous (Heterotermes) or large and forwardly-directed (Coptotermes)

25.

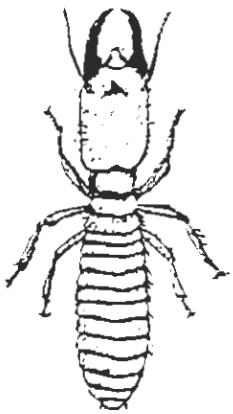
26.

Pronotum flat in lateral view, without anterior lobes; usually narrower than posterior margin of head

Tarsi 4-segmented

Tibial spur count 3:2:2

Cerci very short, 2-segmented



27.

C. Termitidae, the carton-nest building and subterranean termites

Common BVI representatives : Nasutitermes species ; Parvitermes

Termites of this family develop large to enormous colonies. In those species that build nests of chewed vegetable fragments (carton), the large nests on trees may constitute an important element of the landscape.
True workers, incapable of differentiating into other castes, appear here. Some species have two sizes, large and small workers, which may belong to a single sex. The question of caste determination is interesting and complex, and deserves further consideration at a later time.

Colony defense techniques are very diverse in this group : some genera have soldiers with jaws that cut or crush ; more specialized genera have soldiers with reduced jaws, that produce a sticky glue that can be shot out of the fontanelle, gluing up the legs and antennae of attacking insects such as ants. In still more specialized genera, there is no soldier at all ; instead, the workers either vomit up a lot of fluid, or "explode", releasing gut contents into the combat area and causing a speedy retreat of attacking organisms.

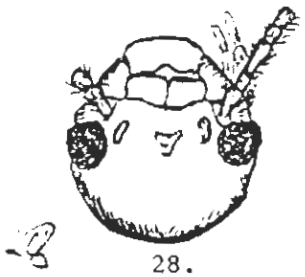
The Caribbean fauna, inhabiting a chain of islands of diverse history and distance from continental land masses, may be restricted or rich, depending upon the history of the island. Our fauna thus far seems to consist only of the glue-squirters. Some are pests, but most are not ; instead, the ability of these termites via the bacteria that live in their guts to "fix" atmospheric nitrogen to a state usable by living organisms places them in the category of VERY IMPORTANT TO THE PERSISTENCE OF THE ECOSYSTEM. Breaking down wood and releasing the contained nutrients, a re-cycling process, is also very important.

In the BVI, we have some glue-squirters that build large, obvious nests above ground, attack wooden structures, and may be regarded as pests.In addition, we have smaller species that live inconspicuously underground, eating only dead vegetation, and never attacking buildings. They are easily distinguished by the shape of the nasus, or "nose" of the soldiers.

IMAGO

Head :

Clypeus divided into two parts by a medial suture
Ocelli present
Fontanelle present
Mandibular teeth as in figures (N. or P.)



28.

Base of wing with 2 sclerotized veins at suture edge of wing scale
Forewing scale short, not reaching to base of hind wing
Wing venation reduced
Tarsi 4-segmented

29.

Tibial spurs usually 2:2:2

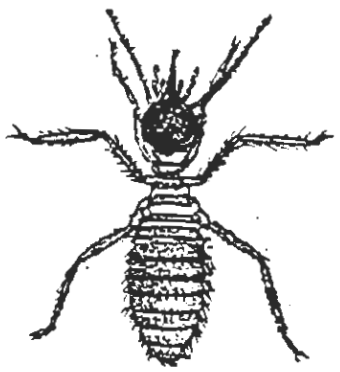
Cerci reduced, 2-segmented

30.

SOLDIER

Head :

Nasus prominent
Fontanelle present, at end of nasus
Eyes absent
Mandibles vestigial



31.

Thorax :

Pronotum saddle-shaped, with anterior lobes

Tarsi 4-segmented

Tibial spur count 2:2:2

Abdomen :

Cerci reduced, 2-segmented

From the information given in the preceding section, please prepare a table showing the physical features of soldiers of the kinds of termites living in the BVI ; samples of the several species will be available for study. The species are assigned numbers, as follows :

1. Incisitermes snyderi
2. Procryptotermes corniceps
3. Heterotermes tenuis
4. Nasutitermes nigriceps
5. Parvitermes discolor

	1.	2.	3.	4.	5.
Head form					
Jaws, dentition					
Fontanelle					
Number of antennal articles					
Eyes					
Epicranial suture					
Pronotum width/ Head width					
Pronotum shape					
Tibial spines					
Tibial spurs					
Cerci					

After completing the descriptions, proceed to the directions for using a taxonomic key ; then, construct a key for the listed termites.

Notes :

The technique we will use in identifying the KIND of termite we are considering involves the use of a KEY. A key is the means of identification of unknown organisms that employs alternative descriptions of characters. Identification keys are described as synoptic, or dichotomous. They present alternative descriptions of body parts and number guides to direct the user to the correct answer.
Final alternatives are marked : *

Review : characteristics of Arthropods and Insects

ILLUSTRATIVE SAMPLE KEY TO ORDERS OF INSECTS

1. a. Insects with wings 2
   (If true, go to 2 ; if not true, go to b .
   b. Insects without wings at any stage of the life cycle.....End *

2. a. 2 pairs of wings present.....3
   b. Only one pair of wings present, the FORE (front) wings, on the second thoracic segment..... ORDER DIPTERA , the flies. *

3. a. Wings membranous in texture, both pairs about the same length.....4
   b. Forewings of different texture than the hind wings.....5

4. a. Wings can be folded down thw back when at rest; smaller insects..ORDER ISOPTERA, the termites *
   b. Wings held outstretched, not capable of being folded down the back when at rest ; larger insects..... ORDER ODONATA, Dragon flies*

The features you have recorded in the table can be used to construct an identification key for our termites. UNDERSTAND how the key, above, works. Then , using the features you listed in the table, construct a key to the families of soldier termites in the BVI. You need to use only those features that permit separation of the groups.

NOTES :

1. The termites of the Caribbean are a varied, multi-source assemblage comprising representatives of one primitive and two specialized families of the order Isoptera, Kalotermitidae, Rhinotermitidae, and Termitidae.

2. We have at present only an inadequate survey of, and identification keys for, the termite species found on the several islands of the Caribbean. Exhaustive collecting and preparation of detailed descriptions of termites using the powerful tool of the scanning electron microscope, in addition to traditional tools will permit improvement in the available keys based on morphological features.

3. Information on present-day distributions can contribute to our understanding of dispersal routes.

4. Survey of the termite fauna of islands left after submergence of low-lying connecting areas, such as the Puerto Rico Bank can provide information about the effects of isolation and reduction of habitat on species diversity.

5. Critical to the establishment of dependable keys and appraising the variability developing in isolated populations is a detailed picture of cuticular hydrocarbon profiles. Obtaining reliable profiles in even difficult groups like the nasute termites by increasing the sample size will allow us to achieve this information for all three of the termite families of the area. Samples of the same species should be obtained from each island on which it occurs.

6. A practical benefit accrues from precise knowledge of the indigenous termite fauna : this permits ready recognition of an invading group, hopefully before a pest species could become established.

7. Instructional activities on the several islands could increase the number of competent collectors , inform residents of the vital role termites play in the ecology of the island, and secure assistance in facilitating work of visiting entomologists.

8. Liasons with control companies, and provision of up-to-date information on avoidance of damage and the ecological and physiological characteristics of potential pest species should be effected.

9. Collecting, describing and providing dried material for cuticular hydrocarbon analysis could be a cooperative venture, shared by termite specialists with access to a desired island or habitat.

The number of islands subject to close scrutiny is growing : Trinidad, Turks and Caicos, Guana and neighboring small islands have been surveyed. Many have worked on Puerto Rico, but this large and diverse island may require much further sampling. Hispaniola, Jamaica and members of the Lesser Antilles group should be studied further. Vieques and Mona Islands are of exceptional interest, and one of us (MSC) has access to both. Pooling resources from interested investigators (Darlington, Su, Scheffrahn, Thorne, Collins) will permit adequate coverage.

Tasks associated with this project include : collection and preservation of reference material, along with pertinent ecological information ; preparation of scanning electron micrographs and good illustrations of important taxonomic characters ; updating and improving available taxonomic information and descriptions; collecting, sorting, drying and forwarding samples of termites for cuticular hydrocarbon analyses ; performing cuticular hydrocarbon analyses and circulating the results ; conducting information programs and training future collectors on target islands ; establishing liasons for exchange of specimens and information with pest control operators in desired areas ; and coordinating efforts of separate investigators.

Individuals interested and qualified to participate in this study so far include :

Dr. Joanna Darlington, University of the West Indies, Trinidad
Dr. Michael Haverty, Pacific Southwest Forest and Range Experiment Station, USDA, Berkeley, California
Dr. Rudolph Scheffrahn, Ft. Lauderdale Research and Education Center, Ft. Lauderdale, Florida
Dr. Nan-Yao Su, also at Fort Lauderdale
Dr. Barbara Thorne, Department of Biology, Harvard University, Boston, Mass.
Dr. Margaret S. Collins, Smithsonian Institution and the Conservation Agency, Conanicut, Rhode Island

DISTRIBUTION OF CARIBBEAN TERMITES

The fauna of the Caribbean is divided into three broad zoogeographic groups. The Northern component, mainly in Florida and the Bahamas, is circumscibed to the North by areas with temperate climates, although there is a limited connection to Central America arround the shores of the Gulf of Mexico. The Western component, found on the Greater Antilles but derived originally from Central America, is the richest of the three. The Southern component, derived from South America by migration northward into the Lesser Antilles, is the most recent addition and is spreading actively.

FLORIDA AND THE BAHAMAS

The Bahamas and the Turks and Caicos Islands are the emergent parts of a large lowlying area of limestone, now mainly submerged, which is geologically continuous with Florida. The land area was formerly much greater, perhaps continuous, but the islands now remaining are so small and low that their fauna and flora are limited.

The Bahamas

These are the closest Caribbean islands to the mainland US and have frequently been visited by collectors, but their termite fauna has not been systematically surveyed. Termites known to occur there were listed in Snyder 1956.

Turks and Caicos Islands

A recent survey of termites on two islands of the group, Grand Turk and Providenciales, recorded twelve species including two recent introductions (Scheffrahn et al, in press).

THE GREATER ANTILLES

The Greater Antilles include four large islands: Cuba, Hispaniola, Puerto Rico and Jamaica (in decreasing order of size) and many smaller islands associated with them. The main islands have been land for something like 100 million years (although Jamaica at least has been submerged since then) and may have been part of a land bridge connecting North and South America in the Cretaceous. Later, they apparently had closer connections to Central America than they do now. When sea levels were lower, Cuba may have been linked (perhaps by a chain of small islands) to the Yucatan Peninsula in Mexico. Similarly Jamaica may have been linked to Nicaragua and Honduras when the now submerged Nicaraguan Rise was exposed. Thus their fauna and flora were initially rich, and they have also been isolated for long enough to have evolved some endemic species. The present land area is probably much less than in the past (Donnelly 1988).

Cuba

Because of its large size and diversity of habitats, Cuba has probably attracted more scientific interest than any other Caribbean island. Not much has been published about the termites although a number of species were described from Cuba eg Snyder 1922, 1924a, 1925, 1929. Collections of termites belonging to the Cuban Academy of Sciences and the Smithsonian Institution in Washington were borrowed in 1978 by Dr. Krecek in Czechoslovakia who was planning to write a monograph on Cuban termites, but unfortunately this valuable work has not yet been completed. An unidentified collection from Cuba is still held in the termite collection at the American Museum of Natural History in New York.

YOUNG

Recently it has been reported that an unidentified species of Neotermes is attacking teak trees in Cuba. This is an unusual problem, since teak wood is generally considered to be resistant to termite damage in the Caribbean. said to be "Neotermes castaneus" - but we need both preserved ♀♀ and ♂♂ and samples dried for hydrocarbon analysis

Hispaniola

Some records of termites exist from both the Dominican Republic and Haiti (eg Wolcott 1927, Snyder 1956). The Government of the Dominican Republic has recently expressed interest in having overseas scientists make surveys of the fauna of the island.

Jamaica

Early reports of Jamaican termites were published by Hubbard 1877 and Andrews 1911. No systematic collection has ever been made, and only a small number of termite samples have been collected incidentally by residents and visitors. These are scattered through various museum collections, and a number of species have been described or recorded from them (eg Emerson 1943, Snyder 1929). Recently some work has been done on the chromosomes of some Jamaican termites (Luykx 1987).

Two postgraduate projects on termites have recently been carried out by students of the University of the West Indies in Jamaica. One was on the ecological role of termites in mangrove swamps (D. Jackson), the other on nest populations of Nasutitermes spp.(P. Clarke).

Puerto Rico work planned for Puerto Rico (ME) (M.C.) Some alcohol-preserved material and material dried for particular hydrocarbon analysis have been obtained.

Termites have always been important agricultural pests in the island, especially of sugar cane (Wolcott 1921, 1939, 1948). New species were described from Puerto Rico by Snyder 1923, 1924b and 1924c. A survey of the insects of the neighbouring Mona Island (Ramos 1947) included several termites, and Neotermes mona was described from there (Banks 1919).

The Virgin Islands and nearby small islands (the Caminos, Scrub, Beef) and the larger island of Tortola

Guana Island has recently been surveyed by MS Collins ~~and~~ AJ

manuscript list of species is available.

THE LESSER ANTILLES

The Lesser Antilles are a classical island arc of mainly volcanic islands, formed along the edge of the Caribbean tectonic plate. The islands are all moderately to very small, separated by sea passages of only tens of miles or less. They thus act like stepping stones for the migration of plant and animal species northward from the South American mainland. Migration is hastened by the seasonal flooding of the Orinoco River in Venezuela, which enters the sea at the south end of the island arc. When the river is in spate, floating islands of vegetation are carried out to sea and may become stranded on the islands, bringing mainland species of plants and animals ashore. Some immigration will also have taken place from the Greater Antilles to the North. All the volcanic islands are geologically recent, around 25 million years old. The most easterly islands (eg Barbados, Antigua, Anguilla) are not volcanic but consist of coral limestone raised up from the sea bed, and are somewhat older than the volcanic islands. All the islands seem to be oceanic and have been colonised entirely by sea (driftwood, floating islands) or air (flying, or carried by birds and bats or by the wind) or more recently by human agency.

Guadeloupe

In August 1989 a preliminary survey was made of the termite fauna of Guadeloupe, at the invitation of the Institute National de la Recherche Agronomique in Guadeloupe, and with financial support from the French Embassy in Trinidad (Darlington & Chaboo 1989). The number of termite species recorded from the island was increased from four (Snyder 1956) to twelve, including what appears to be an undescribed species of Cryptotermes. Most of the new records are of species in the family Kalotermitidae. Some economic problems are experienced from Nasutitermes damaging fruit trees, and from subterranean termites in some field crops, besides the usual pests of structural timber.

Barbados

Termites were collected in the 1930s and 1940s by the Government Entomologist R.W.E. Tucker. Tucker (1939) found that the most serious timber pest was Coptotermes havilandi, believed to be of Asian origin, with an infestation centered in the docks but spreading rapidly in the capital, Bridgetown. Cryptotermes brevis was more widespread but caused less damage. Tucker found that economic damage to sugar cane was caused by Nasutitermes costalis, a normally arboreal species which in the treeless cane fields apparently nested on the ground. He examined consignments of wallaba wood imported as fuel from Guyana, and found that several termite species not present on the island were being imported along with the wood.

Grenada

Grenada was formerly an important producer of high quality cocoa. The cocoa estates have been neglected for several decades, but attempts are now being made to bring them back into production. The old cocoa trees are heavily infested by a termite Neotermes sp. which enters through damaged bark and eats its way into the heartwood, weakening the limb so that it becomes susceptible to wind damage. The termite is associated with a wet-rot fungus that further weakens the wood. The Grenada Cocoa Association and the Cocoa Research Unit of the Faculty of Agriculture, University of the West Indies, Trinidad are collaborating on research aimed at managing the problem.

Neotermes sp. was first collected in 1905 in the Botanic Gardens in Grenada. In 1913 it was named as Calotermes (Neotermes) balloui by Kurt Baron von Rosen using type material collected from the heartwood of a Pithecalobium tree in the Botanic Garden in St. Vincent. In 1913 H.A. Ballou found it attacking cocoa trees in Grenada. In 1928 R.W.E. Tucker collected it in Barbados but did not record the host plant. The specimens were later re-identified as Neotermes wagneri (Desneux), known only from Rio de Janeiro Province, Brazil, by R.M.C. Williams of the British Museum (Natural History).

Adamson (1948) recorded a Neotermes sp. from Grenada, St. Vincent and Barbados, and reported that in Grenada it was believed to injure live cocoa trees. He quoted Emerson's conclusion that it was a new species, neither of them apparently being aware of the earlier identifications. Emerson's collection contains two other probably undescribed species of Neotermes from Grenada.

A very similar problem involving a Neotermes sp. attacking cocoa trees in New Guinea was reported by Smee 1962 and Smith 19??. As in Grenada, the termite is intimately associated with a wet-rot fungus. Reference to the termite collection at the British Museum showed that this termite had later been identified as N. papua (Desneux). Since the earliest West Indian reports were from the Botanic Gardens, it seemed possible that this might be the same species accidentally introduced. However, comparison of specimens in the BMNH showed that although the soldiers were similar in size and build, they were not the same species. It is still possible that the termite was introduced from Brazil, because it is not known from Trinidad or Venezuela.

TRINIDAD AND TOBAGO

Trinidad

Trinidad is a continental island which has only been separated from the South American mainland since the end of the last glaciation. Its flora and fauna are very similar to those of the mainland, but are comparatively species poor because of the limited range of habitats available on this small land area. Some animal groups do contain apparently endemic species, but our

interpretation is limited because the fauna of the adjacent mainland of Venezuela is very poorly known.

Sporadic collections of termites have been made by applied entomologists since the turn of the century. From 1934 to 1945 A.M. Adamson collected extensively in Trinidad, and occasionally in Tobago and the Lesser Antilles, and published several papers (Adamson 1937, 1938, 1940, 1946 and 1948). After his death his collection was donated to the American Museum of Natural History in New York. Several new species have been described from it, and some of his locality records have been published (e.g. Krishna 1961, 1962a, Krishna & Emerson 1962, Bacchus 1987). The bulk of the collection, including several undescribed species, is held at the American Museum of Natural History in New York, but remains uncatalogued. This collection of over 4000 specimens represents the most thorough survey of termites on any Caribbean island to date, but more work needs to be done on it to extract all the information it contains.

This is worth funding alone!

Termites are major pests of structural timber, and minor pests of tree and field crops on the island. Recent attempts to bring abandoned citrus orchards back into production are hampered by damage done to the tree bark by arboreal nests of Nasutitermes spp. during the years of neglect, which has allowed drywood termites to colonise the exposed heartwood.

Tobago

Tobago is not a continental island, but it is so close to Trinidad and the South American mainland that it has acquired a rather rich flora and fauna. The origin and geological history of the island are still in dispute, but it is probably older geologically than most of the Lesser Antilles (Donnelly 1988). The termite fauna is very little known, but apparently resembles that of Trinidad.

SOUTH AMERICA

In northern and coastal areas the only site that has been studied in detail is Kartabo, in primary rain forest of lowland Guyana (Emerson 1925). The site was later selectively logged. Some recent work has been done in same area (Collins and Prestwich 1988, Prestwich and Collins 1981). The Caribbean coasts of Venezuela and Colombia are virtually unknown. Snyder (1959) listed the termites recorded from Venezuela. Several active taxonomists are working in Brazil, and Mathews (1977) study on the southern Amazon basin is marginal to our area.

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Krishna K & Emerson AE 1962 New species of the genus Glyptotermes Froggatt from the Papuan, Oriental, Ethiopian, and Neotropical Regions (Isoptera, Kalotermitidae). Amer. Mus. Novitates No. 2089, 1-65. (Glyptotermes adamsoni, Trinidad, Tobago; G. parvoculatus, Trinidad; G. tuberifer, St.Vincent).

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LIST OF TERMITE SPECIES IN THE CARIBBEAN ISLANDS

Sn = Snyder 1956
Ad = Adamson 1940 or 1948

ANTIGUA

Cryptotermes havilandi (Sjöstedt)			JD
Procryptotermes corniceps (Snyder)			JD
Coptotermes havilandi Holmgren			JD
Heterotermes tenuis (Hagen) ?			JD
Nasutitermes costalis (Holmgren)		Sn Ad	JD

BAHAMAS

A=Andros, B=Bimini, E=Eleuthera, N=Nassau, SS=San Salvador

Cryptotermes cavifrons Banks	N	Sn
Incisitermes schwarzi (Banks)	N	Sn
Incisitermes snyderi (Light)	B	Sn
Neotermes jouteli (Snyder)	A	Sn
Heterotermes cardini (Snyder)	A N	Sn
Heterotermes tenuis (Hagen)	A N	Sn
Nasutitermes nigriceps (Haldeman)	SS	Sn
Nasutitermes rippertii (Rambur)	A B E N	Sn
Parvitermes brooksi (Snyder)	B	Sn

BARBADOS

Cryptotermes brevis (Walker)	Sn Ad
Cryptotermes havilandi (Sjöstedt)	Sn (Ad)
Cryptotermes pyrodomus Bacchus	Bacchus 1987
Incisitermes incisus (Silvestri)	Sn (Ad)
Neotermes castaneus (Burmeister)	Sn (Ad)
Neotermes wagneri (Desneux)	(Ad)
Coptotermes havilandi Holmgren	Sn Ad
Heterotermes convexinotatus (Snyder)	Sn
Heterotermes tenuis (Hagen) ?	Ad
Rhinotermes marginalis (Linnaeus)	Ad
Nasutitermes costalis (Holmgren)	Sn Ad

BERMUDA

Cryptotermes brevis (Walker)	Bacchus 1987
Cryptotermes cavifrons Banks	Sn
Incisitermes bequaerti (Snyder)	Sn
Incisitermes snyderi (Light)	Sn
Kalotermes approximatus Snyder	Sn

CUBA

Cryptotermes brevis (Walker)	Sn
Cryptotermes cavifrons Banks	Sn
Glyptotermes posticus (Hagen)	Sn
Incisitermes bequaerti (Snyder)	Sn
Incisitermes schwarzi (Banks)	Sn
Incisitermes snyderi (Light)	Sn
Neotermes castaneus (Burmeister)	Sn
Neotermes cubanus (Snyder)	Sn
Neotermes jouteli (Snyder)	Sn
Heterotermes cardini (Snyderi)	Sn

JD – Johanna Donlevy
Ad – Adamson
Sn – Snyder
MC – Margaret Collins

Heterotermes convexinotatus (Snyder)	Sn		
Prorhinotermes simplex (Hagen)	Sn		
Anoplotermes schwarzi Banks	Sn		
Nasutitermes costalis (Holmgren)	Sn		
Nasutitermes hubbardi Banks	Sn		
Nasutitermes lividus (Burmeister)	Sn		
Nasutitermes rippertii (Rambur)	Sn		
Parvitermes brooksi (Snyder)	Sn		
Parvitermes discolor (Banks)	Sn		
Obtusitermes aequalis (Snyder)	Sn		
Termes hispaniolae Banks	Sn		
CURACAO			
Cryptotermes brevis (Walker)	Sn		
Nasutitermes nigriceps (Haldeman)	Sn		
DOMINICA			
Cryptotermes brevis (Walker)	Sn		
Neotermes castaneus (Burmeister)	Sn		
Heterotermes tenuis (Hagen)	Sn		
Nasutitermes costalis (Holmgren)	Sn	Ad	
GRENADA			
Cryptotermes brevis (Walker)	Sn	Ad	
Kalotermes sp		Ad	
Neotermes wagneri (Desneux)		(Ad)	
Neotermes sp		(Ad)	
Coptotermes testaceus (linnaeus)		Ad	
Nasutitermes costalis (Holmgren)	Sn	Ad	
GUADELOUPE			
Cryptotermes brevis (Walker)	Sn		
Cryptotermes havilandi (Sjöstedt)			JD
Cryptotermes sp ? nov			JD
Incisitermes incisus (Sylvestri)			JD
Incisitermes tabogae (Snyder)			JD
Neotermes sp			JD
Procryptotermes corniceps (Snyder)			JD
Heterotermes tenuis (Hagen)	Sn	Ad	JD
Rhinotermes marginalis (Linnaeus)			JD
Nasutitermes costalis (Holmgren)	Sn	Ad	JD
Nasutitermes ephratae (Holmgren)	Sn		JD
Termes sp			JD
HISPANIOLA			
Cryptotermes brevis (Walker)	Sn		
Cryptotermes cavifrons Banks	Sn		
Glyptotermes posticus (Hagen)	Sn		
Neotermes castaneus (Burmeister)	Sn		
Heterotermes cardini (Snyder)	Sn		
Heterotermes convexinotatus (Snyder)	Sn		
Heterotermes tenuis (Hagen)	Sn		
Rhinotermes marginalis (Linnaeus)	Sn		
Anoplotermes meridianus Emerson	Sn		
Anoplotermes spp.	Sn		

Nasutitermes costalis (Holmgren)	Sn		
Nasutitermes lividus (Burmeister)	Sn		
Parvitermes flaveolus (Banks)	Sn		
Parvitermes pallidiceps (Banks)	Sn		
Velocitermes antillarum (Holmgren)	Sn		
Velocitermes toussainti (Banks)	Sn		
Microcerotermes arboreus Emerson	Sn		
Termes hispaniolae (Banks)	Sn		

JAMAICA

Cryptotermes brevis (Walker)	Sn		
Cryptotermes cavifrons Banks	Bacchus 1987		
Cryptotermes hemicyclius Bacchus	Bacchus 1987		
Glyptotermes liberatus (Snyder)	Sn		
Glyptotermes posticus (Hagen)	Sn		
Incisitermes milleri Emerson	Sn		
Incisitermes schwarzi Banks	Sn		
Neotermes castaneus (Burmeister)	Sn		
Neotermes sp.	Sn	AMNH	
Procryptotermes corniceps (Snyder)	Krishna 1962b (Sn)		
Coptotermes havilandi Holmgren	Sn		
Heterotermes convexinotatus (Snyder)	Sn		
Heterotermes tenuis (Hagen)	Sn		
Prorhinotermes simplex (Hagen)	Sn		
Nasutitermes costalis (Holmgren)	Sn		
Nasutitermes hubbardi Banks	Sn		
Nasutitermes nigriceps (Haldeman)	Sn		
Termes hispaniolae (Banks)	Sn		
Termes sp.		JD	

MARTINIQUE

Heterotermes tenuis (Hagen)		Ad	
Rhinotermes marginalis (Linnaeus)	Sn		
Anoplotermes meridianus Emerson	Sn		
Nasutitermes costalis (Holmgren)	Sn	Ad	

MONA

Incisitermes incisus (Silvestri)	Sn		
Incisitermes snyderi (Light)	Sn		
Neotermes mona (Banks)	Sn		
Procryptotermes corniceps (Snyder)	Sn		

MONTSERRAT

Cryptotermes brevis (Walker)			JD
Cryptotermes longicollis Banks			JD
Glyptotermes sp.			JD
Incisitermes sp.			JD
Neotermes castaneus (Burmeister)	Sn		
Procryptotermes corniceps (Snyder)			JD
Heterotermes tenuis (Hagen)	Sn		JD
Copotermes havilandi Holmgren			JD
Nasutitermes costalis (Holmgren)			JD
Nasutitermes ephratae (Holmgren)	Sn		JD

PUERTO RICO

Cryptotermes brevis (Walker)	Sn		
Cryptotermes cavifrons Banks	Sn		
Glyptotermes pubescens Snyder	Sn		
Incisitermes snyderi (Light)	Sn		
Neotermes castaneus (Burmeister)	Sn		
Procryptotermes corniceps (Snyder)	Krishna 1962b		Sn
Heterotermes convexinotatus (Snyder)	Sn		
Heterotermes tenuis (Hagen)	Sn		
Prorhinotermes simplex (Hagen)	Sn		
Anoplotermes meridianus Emerson	Sn		
Nasutitermes costalis (Holmgren)	Sn		
Nasutitermes nigriceps (Haldeman)	Sn		
Parvitermes discolor (Banks)	Sn		
Parvitermes wolcotti (Snyder)	Sn		
Microcerotermes arboreus Emerson	Sn		

St.KITTS

Cryptotermes brevis (Walker)	Sn		
Nasutitermes costalis (Holmgren)	Sn	Ad	

St.LUCIA

Calcaritermes temnocephalus (Silvestri)	Krishna 1962a		
Cryptotermes brevis (Walker)	Sn	Ad	
Neotermes sp		Ad	
Nasutitermes costalis (Holmgren)	Sn	Ad	

St.VINCENT

Calcaritermes temnocephalus (Silvestri)	Krishna 1962a		(Ad)
Cryptotermes brevis (Walker)		Ad	
Glyptotermes tuberifer Krishna & Emerson 1962		(Ad)	
Kalotermes sp		(Ad)	
Neotermes wagneri (Desneux)		(Ad)	
Heterotermes tenuis (Hagen)		Ad	
Nasutitermes costalis (Holmgren)		Ad	

TOBAGO

Cryptotermes brevis (Walker)	Sn	Ad	
Cryptotermes dudleyi Banks		(Ad)	JD
Glyptotermes adamsoni Krishna & Emerson			JD
Neotermes holmgreni Banks	Sn	Ad	JD
Coptotermes testaceus (Linnaeus)	Sn	Ad	JD
Armitermes holmgreni Snyder			JD
Heterotermes tenuis (Hagen)	Sn	Ad	JD
Nasutitermes costalis (Holmgren)	Sn	Ad	JD
Nasutitermes ephratae (Holmgren)	Sn	Ad	JD
Nasutitermes gaigei Emerson			JD
Nasutitermes guayanae (Holmgren)			JD
Subulitermes sp.			JD
Microcerotermes arboreus Emerson	Sn	Ad	JD
Termes hispaniolae (Banks)	Sn	Ad	JD

TRINIDAD

Calcaritermes nigriceps (Emerson)	Sn	Ad	JD
Calcaritermes temnocephalus (Silvestri)	Krishna 1962a		(Ad)

Nasutitermes nigriceps (Haldeman)			RS
VIRGIN ISLANDS			
Cryptotermes brevis (Walker)	Sn		
Glyptotermes posticus (Hagen)	Sn		
Incisitermes bequaerti (Snyder)	Sn		
Incisitermes snyderi (Light)			MC
Procryptotermes corniceps (Snyder)			MC
Heterotermes convexinotatus (Snyder)	Sn		
Heterotermes tenuis (Hagen)		Ad	
Nasutitermes nigriceps (Haldeman)	Sn	Ad	
Parvitermes discolor (Banks)			MC

43 fax to Gazell 64
then call him

American Museum of Natural History

Department of Entomology

January 31, 1992

cc GJ

Dr. Henry G. Jarecki
Falconwood Corporation
4 World Trade Center
New York, New York 10047

Dear Dr. Jarecki:

I am a curator in the Entomology Department here at the AMNH and am interested in the possibility of collecting certain kinds of insects on Guana Island. If this is feasible, all I need is some information on how to get there (presumably from Tortola), and where to stay.

The research I am doing is sponsored by the National Science Foundation, and deals with the evolution of various species of flies in the Caribbean (their morphology, distributions, classification, and paleontology). Specifically, I am comparing these species with extinct close relatives fossilized in the Oligo-Miocene amber (c. 25 million years old) from Mexico and the Dominican Republic. We need much more information on the living species, and where they are found. I have done extensive collecting thus far in Central America and on Hispaniola, and intend to collect in the Virgin Islands on an upcoming trip and eventually in Puerto Rico. The Virgin Islands are of interest because they (sans St. Croix) lie on the Puerto Rican bank: during periods of lowered sea levels, Puerto Rico and the Virgin Islands were amalgamated. Thus, indications thus far are that the VIs have a biota that is much more like Puerto Rico and the Greater Antilles than is found in the Lesser Antilles. I will be on St. Thomas, St. John, and Tortola from Feb. 25 to 5 March and, if possible, would like to visit Guana Island from 5 March to 11 March. Collecting here would make my geographic sampling more complete.

The collecting is non-destructive and requires hand nets and a few baited and non-baited traps. The specimens would eventually reside here at the AMNH, and the results (including new species descriptions) published in scientific journals. Preliminary results are intriguing: some groups have gone extinct from the Caribbean, and a few others formerly in the Caribbean are even extinct from the entire New World.

I look forward to hearing from you, and possibly even meeting you at the upcoming Trustees Dinner this coming Wednesday.

Sincerely,

David Grimaldi

Dr. David Grimaldi
(212) 769-5615, -5233
FAX

The Conservation Agency

65

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

12.11.92

6 Swinburne Street
Emmanuel Island
R.I. 02885 U.S.A.

Dr. David Grimaldi
Department of Entomology
American Museum of Natural History
Central Park West at 79th Street
New York, New York 10024-5192

Dear Dr. Grimaldi:

Henry Jarecki forwarded your letter re Guana on to me. I direct scientific operations there. We have an extensive entomology program, and thousands of specimens are already in collections.

Scott Miller, Bishop Museum, Honolulu, generally oversees entomological efforts. Specimens collected are there at Bishop, or at USNM, except for special groups. For example, Roy Snelling has Hymenoptera (and some other - representative material) at LACM. Peter Chabora and Roberta Koepfer, at CUNY, have a lot of Diptera and their parasitoids.

The best thing to do is contact Scott and Peter and see what they already have. Then you could estimate how much, if any, time you need to round out the material you want. Then let me know when you want to go.

In 1992, scientists' month will be October. That means we provide room and board for visiting scientists at that time. There are usually about a dozen, plus a dozen assistants, grad students, etc. There will also be a marine program in July: more primitive because there is no regular hotel staff on the island then. You could probably go then if October does not suit you. (October is generally better: end of rainy season rather than beginning.) Other times of year are not impossible, but not easily arranged because of tourist presence.

I'll expect to hear from you soon. If you run into my old buddy François from the Oiseau Department, give him my regards.

Best Wishes,

Skip Lazell

James Lazell, Ph.D.

THE UNIVERSITY OF KANSAS
MUSEUM OF NATURAL HISTORY

MISCELLANEOUS PUBLICATION NO. 71

May 8, 1981

Late Pleistocene Herpetofaunas From Puerto Rico

The Caribbean sea and the thousands of islands and cays composing the Greater and Lesser Antilles are among the most biologically complex areas of the world. Some understanding of this complexity has been achieved in recent years by the application of modern techniques and principles of population genetics, ecology, and island biogeography. To this end, amphibians and reptiles are particularly instructive subjects, but their usefulness in addressing biological problems in the Antilles has not been fully appreciated. Many of the urgent questions remaining about their origins and systematic relationships bear directly on the evolution of the West Indian biota.

GREGORY PREGILL

Right On!

(Whereas the marine life is singularly dull and uninformative....)

The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Vanderbilt Street
Conanicut Island
R.I. 02835 U.S.A.

November 12, 1991

Dr. C.K. Dodd
U.S. Fish & Wildlife
412 N.W. 16th Ave., Rm. 250
Gainesville, FL 32601

Dear Ken:

I'm back from travels in Asia and the Caribbean, and settled in here for awhile. I was delighted to see your RRT paper and agree with nearly every bit of it.

It does seem Burke could reasonably take umbrage re your slanted view of what he actually said, but of course he is dead wrong re invaders being distinct from translocated endangereds "only in terms of human" values. There is a huge average difference in edificarian adaptation. Most invaders are clearly edificarian weed species abundant at home and preadapted to "new" areas because we generate the same old home habitat. Translocated endangereds are usually the exact opposite: going away because of what we do to their habitats. You should hammer him for that misunderstanding.

I, on another hand, take extreme umbrage at your continued use of "Cyclura". I have now repeatedly sunk that name in the peer-reviewed literature. People who cling to it are mostly pet fanciers who have commercial reasons for retaining it. No character or combination of characters ever reported in the literature will separate "Cyclura" as an entity from Iguana iguana and I. delicatissima. I. delicatissima belongs to a superspecies (or set of subspecies) including pinguis, stejnegeri, and cornuta (at least). You should show a little respect for the honest work of an old friend who has known, caught, pickled, skeletonized, and fostered iguanas since 1957.

Iguana pinguis has fairly exploded on Guana Island. A sumposium paper is in press with P.R. DNA (Jorge Moreno). Goodyear and I will do a follow-up for something like Biol. Conserv. next year.

The Geochelone carbonaria on Guana were also translocated (repatriated?). We started with six: one from St. Thomas and five from Water Island (3 males, 3 females). Two adults are known dead. Two are known to survive. Two (2) hatchlings have been found alive and well trucking about the bush. So, all your caveats hold in that case.

Can you send two reprints and a copy of the TASSE '89, End. Sp. Upd. 6 (11-12): 6 paper you cite. Just what the hell did Tasse say about my Hawaiian rock wallabies?

All the best,

Slip

James Lazell

JL/rld

STATUS Y DISTRIBUCION DE LOS REPTILES Y ANFIBIOS DE LA REGION DE PUERTO RICO

Jorge A. Moreno
(Editor)

Publicación Científica Miscelánea No. 1
Departamento de Recursos Naturales de Puerto Rico

1991

THE HERPETOFAUNA OF GUANA ISLAND: DIVERSITY, ABUNDANCE, RARITY, AND CONSERVATION

James Lazell[1]

INTRODUCTION -- The island of Guana, in the British Virgin Islands (BVI) lies just 480 m N of the eastern end of Tortola and, following Morris et al. (1977), would have separated from Tortola ca. 6200 yr Before Present (BP). Guana, at 340 ha and 246 m elevation, would have a predicted herpetofauna of four species following MacArthur and Wilson (1967). In fact, there are certainly 13 native terrestrial species. Only one of the three potential *Eleutherodactylus* frog species has been found, but circumstantial evidence hints that a second, *E. schwartzi*, may occur in the special *Bromelia pinguin* habitat near the south end in Pinguin Ghut (Figure 1). The distinctive, two-note, "bo-peep" call has been reported and this species is known from the even smaller island of Great Dog (33.2 ha; UPR-RP 5517-8: Heatwole et al. 1981).

Because Guana is so well preserved ecologically (Lazell 1989a), lacking goats and mongooses, I believe it to be a fine site for attempts to restore species probably present but extirpated in the past. Among reptiles these include the rock iguana, *Iguana*[2] *pinguis*, and the tortoise, *Geochelone carbonaria*. Because these sorts of restorations or outright introductions are controversial, I give special consideration to each case below.

The history of herpetological investigation on Guana is relatively long and provides cautionary tales for biogeographers. Grant (1932) first reported on the island, claiming eight species, but with specimens of only five. Heatwole et al. (1981) added a third snake, *Typhlops richardi*.

I first visited Guana in 1980 as part of an overall survey of the fauna of the British Virgin Islands (Lazell, 1980). I returned in 1982 and did quantitative sampling for some species and added more, bringing the vouchered herpetofauna to eight species (Lazell 1983). Regular annual herpetological investigations began in 1984, notably including Gregory Mayer and a staff of up to five field assistants. The known fauna was expanded to 15 by the restorations (Lazell 1986) and additional captures (Mayer and Lazell 1988).

SPECIES ACCOUNTS

Eleutherodactylus antillensis -- There were reports of frogs occasionally seen or heard on Guana but no actual specimen was collected until 8 November 1984 when Tricia Giovannone secured one of about six males heard calling (MCZ 107528). We know now the species to be egregiously abundant, with literally thousands calling on suitable nights. The generally dry decade from about 1976 to 1987 made optimal conditions rare. Since then, rainfall has been more normal and frogs are heard regularly from July to November. Claims are often made that *Eleutherodactylus* have been introduced to an island with suitable ecology and within the expected range of the genus (Censky 1989). Such cases should be critically evaluated. Unless one were present at Guana at just the right time, one could easily assume the absence of *Eleutherodactylus*. Even when frogs of four species were calling on Tortola, none were heard on Guana. Certainly months, and possibly years, go by with no evidence of these frogs even when they are present in sudden demonstrably profusion.

Chelonia mydas -- The only definite nesting record is for North Beach, 22 July 1987. This species continues to be harvested for the restaurant trade in the BVI. The killing of sea turtles should be immediately halted and outside pressure should be put on the British government to comply with internationally held positions on these endangered species.

Chelonia imbricata -- I follow Simpson (1961) and Van Gelder (1977) in regarding interbreeding species as congeneric. In this specific case see Lazell (1986b). Recent nesting records are 7 July 1987 and 6 July 1988. Ornithologists E. J. Fisk drew pictures of hatchlings (clearly this species in head squamation) emerging

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1 The Conservation Agency, 6 Swinburne St., Jamestown, RI 02835.

2 Controversy exists regarding the appropriate generic designation for this species, *Cyclura* or *Iguana* (ed.)

from their nests between 28 January and 2 February 1958. Adults and juveniles are regularly seen at all seasons in Guana waters. My remarks on the continued slaughter of sea turtles in the BVI under *C. mydas*, above, apply with equal force to this species.

Geochelone carbonaria -- The status of these attractive tortoises as native or introduced has never been resolved (Lazell 1980, Censky 1988). It may be analogous to the situation in *Iguana iguana* reported by Lazell (1973) and MacLean (1982) where some populations are native and others are introduced. Five adults from Water Island, U.S. Virgin Islands, and one from St. Thomas (3 males and 3 females) were released on Guana in 1985. Two adults have been found dead. One was lost and the other, a female, is vouchered as MCZ Z-.38017. Young tortoises were only found in February 1988. Occasional wild-caught specimens have been found on Tortola and Virgin Gorda. A pair are living in the Botanical Garden at Road Town, Tortola (R. Norton, pers. comm., April 1990). J. Moreno reports a wild-caught specimen from Rio Piedras, Puerto Rico (pers. comm., July 1989).

Hemidactylus mabouia -- A common species first collected in 1980. It is found both in the woods and edifices.

Sphaerodactylus m. macrolepsis -- An extremely abundant species whose numbers were estimated at White Bay at 2600 per hectare, and at North Bay at 1600 per hectare. Guana *Sphaerodactylus* have been the subject of physiological studies by MacLean (1985, 1986).

Anolis cristatellus wileyae -- The most conspicuous on Guana Island. A hectare plot was laid out in April 1984 in general scrub, the most common vegetation cover on Guana, to estimate population densities (Figure 1). On smaller plots within this area, we used various multiple catch and removal methods to estimate densities of all three *Anolis* species. The point estimators for *A. c. wileyae* were between 4000 and 7200 per hectare.

Anolis stratulus -- This species is also extremely abundant and seen though not collected by Grant (1932). Within our hectare plot, far from optimal habitat for this tree species, densities were estimated at 3000 to 5400 per hectare.

Anolis pulchellus -- This is the least common of the three anoles, but frequent in the scrub vegetation, more frequent at edges, and common to abundant in cutover fields. Within the hectare plot, fairly good habitat for this species, we estimated 1000 to 1800 per hectare. Grant (1932) collected one.

Iguana pinguis -- Grant (1932) claimed iguanas were present on the island but gave the species as *I. iguana*. Oscar Chalwell, who still works on Guana, reports (pers. comm.) that no iguanas were still surviving in 1935. I believe the original species was *I. pinguis* and Grant was reporting hearsay. Based on my belief that iguanas did occur here, and that these were *Iguana pinguis*, I began transport of individuals in 1984. In all, eight were stocked: four males and four females from Anegada. At time of writing (April 1990). *I. pinguis* is regularly seen on the Island and reproduction is apparent because small juveniles have been seen annually since November 1985. A large individual, possibly one of the original eight, occupies an area which includes part of our hectare plot, and a juvenile seems to live wholly within it. *Iguana pinguis* on Guana will be the subject of ongoing research and a separate paper in the future. A male is shown on the cover.

Ameiva exsul -- These large, terrestrial, diurnal lizards are ubiquitous. Additional studies of geographic variation among populations on islands of the Puerto Rico Bank are needed. No population estimates have been made on Guana.

Mabuya sloani -- The "slipperyback" is regularly seen on Guana and museum vouchers are available (Mayer and Lazell 1988). No population estimates have been attempted.

Amphisbaena fenestrata -- This fossorial form was unvouchered from Guana until March 1984 (Mayer and Lazell 1988). However, I knew it was present because O. Chalwell (pers. comm., March 1982), on being

shown a *Typhlops*, said: "There is another kind of that here too. It has rings and it bites." Amphisbaenas were regarded as extremely rare until Thomas Sinclair came to Guana as a field assistant in July 1988. He found this species regularly, several per day, in a zone around the island at 160-185 m. While most common there, it is notable that several have been collected at sea level and the first, MCZ 166995, was collected in our hectare plot. This is an example of a species which seems rare and possibly endangered until its optimal habitat is discerned; then it moves into the ranks of the common.

Typhops richardi subsp. -- These snakes are ubiquitous. Usually fossorial, they have been collected well off the ground in *Nasutitermes* nests. I used the method of Herklotts (1951) and sampled measured plots 1 cm deep as well as grids of holes 35 cm deep. Both methods independently gave point estimates ca. 580 per hectare. The taxonomic status of this population is undetermined, but I note Hedges (this volume) has done the work necessary to separate *T. richardi* from the Puerto Rican *T. platychephalus*, and thus restore the subspecies in the Virgin Islands to validity.

Epicrates monensis granti -- This small boa was among the first species listed for Guana by Grant (1932), but to date no voucher specimen exists. There are occasional sight records. One was killed ca. 1975 inside D House, the western corner of our hectare plot, when it entered the building and ate two caged finches. I believe this species is naturally rare except in very local situations. It turns up regularly on Tortola (Mayer and Lazell 1988). I do not believe it is endangered or threatened. Relief from legislation restricting its collection (at least at the scale of one voucher per island) would answer the numerous questions about its occurrence on Guana, Great Camanoe, Jost Van Dyke, Necker, and Virgin Gorda. This is a species that remains little-known because we are prohibited from learning about it.

Liophis portoricensis anegadae -- I previously discussed the generic status of this snake and all *Alsophis* (Lazell 1983). My views were based directly on those of Maglio (1970) who admitted that he retained generic names he could not justify. I have since examined many specimens, including skeletons, and find no way to separate *Alsophis* from *Liophis*. The snake is common on Guana. A mark-recapture study in 1984 gave a point estimator of 650 with confidence limits of 101 to 3000 for the island. The status of the nominal subspecies of *L. portoricensis* needs clarification. Numerous specimens lie outside the diagnoses given by Schwartz (1966).

Liophis e. exiguus -- The generic comments above apply equally to this species. At comparable sizes, *L. exiguus* cannot be separated from *L. portoricensis* by scale pits as claimed by MacLean (1982), because these are standardly absent in young *L. portoricensis*. Apart from size, the two species are very similar. This snake is rather rare on Guana, but now that field personnel have become accustomed to its Gestalt, it is found regularly. I suggest this species is likely to be present but rare on many small islands where *L. portoricensis* is common. It seems most common where its congener is absent (MacLean 1982).

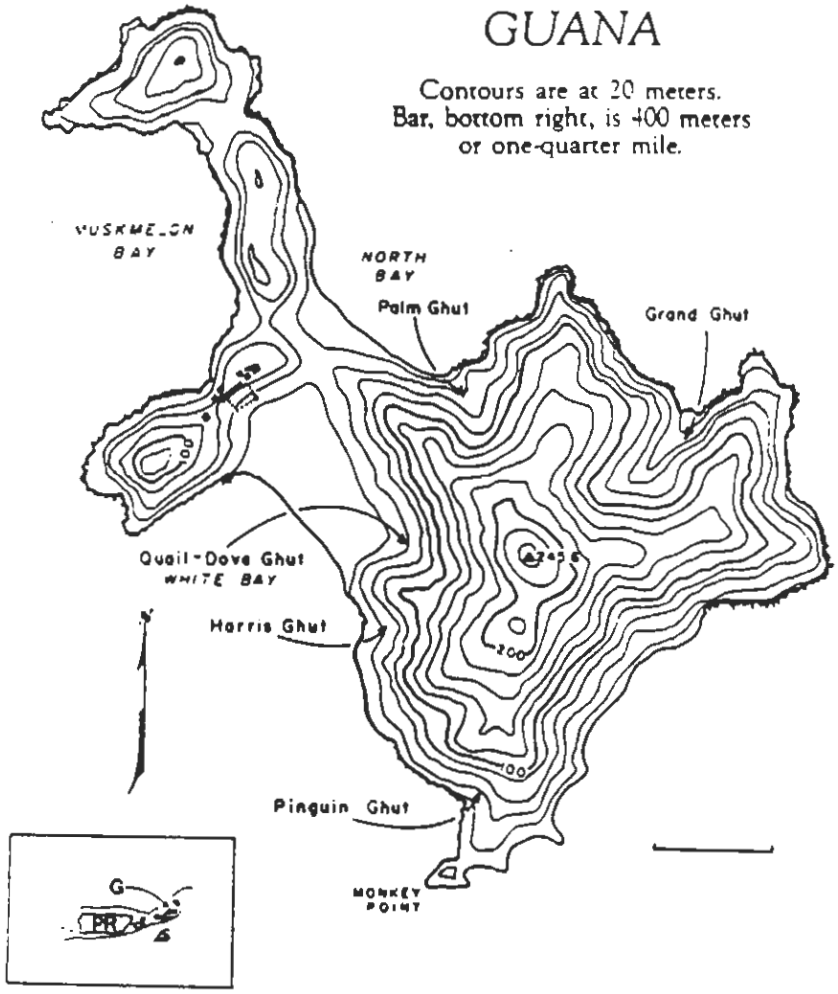
CONCLUSIONS -- Small island biotas are often more diverse than even good field herpetologists may be inclined to believe. Guana provides three examples of different sorts of species that may escape collectors literally for years. *Eleutherodactylus antillensis* is so cryptic for such long periods of time that we believed it was very rare or absent. Given the right conditions - a rainy spell - it reveals its true abundance. *Amphisbaena fenestrata* turns out to be quite common when searched for in a narrow altitudinal band around the island in microhabitats with appropriate sun:shade regime and soil conditions. Predictably, Guana is a better island than most to search for this species because it is relatively well-wooded, erosion has been minimal and shady woodlands prevail at the critical elevation. *Liophis exiguus* seemed very rare or non-existent on Guana until the last few years. Possibly the end of a decade of drought brought this snake out into our vision. More likely, I believe, acquainting our field crews with the snake heightened their search images. It now seems regular, not rare.

It is a fact of biogeographic interest that every terrestrial species known to occur on Guana has been found, at one time or another, within our hectare plot of undistinguished scrub habitat. Some, like *Iguana pinguis*, could not possibly maintain populations in an area so small. Others, like *Amphisbaena fenestrata*, may occur in this habitat only as dispersers from more optimal areas. Still, the diversity is remarkable.

Systematic problems continue to plague us. Geographic variation in *Ameiva exsul*, *Typhlops richardi*, and *Liophis portoricensis* requires further study. We may recognize too many forms or too few.

Iguana pinguis appears to be successfully established (or reestablished) on Guana. However, N.C. Goodyear (pers. comm.) reports the species continues to decline on Anegada. The reasons need further study. A proposed addition to the BVI National Park System, with removal of goats and other feral livestock, might reverse this trend. If so, then I believe *I. pinguis* will soon become only threatened. I believe it may soon be possible to restock this magnificent species to other islands within its historical range. Suitable sites should combine three features: no mongooses, no goats and no other species of iguana.

Effort should be focused on the British government to protect sea turtles within the Crown Colony of the BVI so as to plug this sink for turtles from BVI and surrounding extra-territorial waters. The continued slaughter of sea turtles in the BVI is unconscionable.



RESUMEN – La isla de Guana, una de las Islas Vírgenes Británicas, esta situada 480 m N de la punta este de Tortola. En base a Morris et al. (1977), Guana se separó de Tortola aproximadamente 6200 años antes del presente. MacArthur y Wilson (1967) hubieran predicto que Guana, con un área de 340 ha y 246 m de elevación, debía poseer cuatro especies de reptiles y anfibios. Sin embargo, ocurren por lo menos 13 especies nativas. En este trabajo resumo el estado y distribución de cada una de estas especies.

Por estar Guana tan bien preservada ecológicamente (Lazell 1989a), sin cabros ferales ni mangostas, yo creo que es un lugar apropiado para re-introducir especies extirpadas en el pasado. Entre otras, se pueden mencionar la iguana *Iguana* (*Cyclura*) *pinguis* y la tortuga terrestre *Geochelone carbonaria*. Se realizan esfuerzos para re-introducir a *I. pinguis*.

Entre las especies presentes en la isla, pienso que *Epicrates monensis* no esta amenazada y se debe permitir la colección de un individuo por isla.

El gobierno británico debe intervenir para brindar más protección a las tortugas marinas de las Islas Virgenes Británicas.

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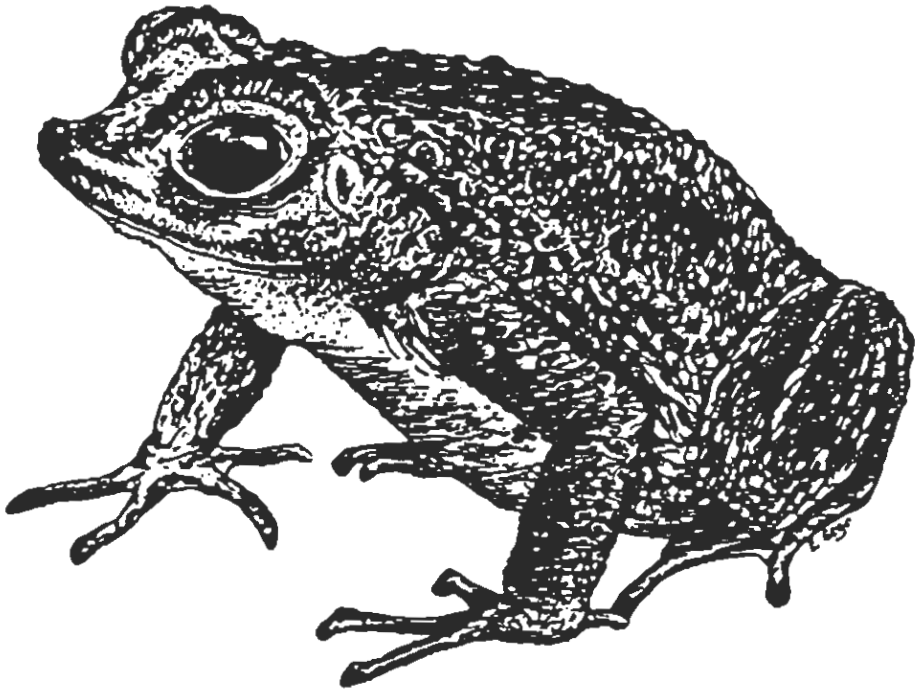

THE QUESTION

OF

ANTILLEAN EVOLUTION

by

James Lazell

The Conservation Agency, 6 Swinburne St., Jamestown, RI 02835

Has anyone ever previously posited The Question--the great, enigmatic question--about the biogeography and evolutionary history of terrestrial life in the Antilles (West Indies)?

WHAT HAPPENED IN THE MORE THAN 50 MILLION YEARS BEFORE THE PLEISTOCENE?

A plethora of fossil and subfossil bone evidence points to great faunal changes during the Pleistocene--the last million years. Much of this, going back to Auffenberg's Barbuda material, Ray's Barbados stuff, and coming along to Steadman and Pregill's stuff, argues for great changes even before human contact. (Although I still believe Amerindians achieved monstrous alterations in species composition before post-Colombians began their devastating works.) The notion that "it all could have happened in the Pleistocene" is explicit in my own work on Anolis. The repeated, radical rises and falls of sea level in the last million years could account for most of what we see today, even speciation in Solenodon. Of course, those rises and falls do not need to account for it all. There were tens of millions of years before the Pleistocene, Antilles in position, waifs adrifting.

Indeed, amber evidence indicates that the standard Antillean herps like Anolis, Sphaerodactylus, and Elentherodactylus have been in place too, all these millions of years. So

does recent biochemical evidence. For example, Chris Schneider reckons on subspecies of Anolis marmoratus may be 14 million years old. Pleistocene? Bah!

If it all happened in the Pleistocene (what a triumph for MacA-W Turnover theory), then who was there for the preceeding 50 million years?

Has it always been the same? Just minor intrageneric or intraspecfic adjustments of anoles, ameivas, boas, iguanas, sphaeros, eleuths....? With a few old-timers like Solenodon and Crocodilus hanging on, and a few new-comers like Hemidactylus drifting in? (What a disaster for both MacA-W Equilibrium and Tunover theories: little islands with big faunas, and big islands with little faunas--virtually the same faunas on each, respectively--forever.)

And what of situations like those we see on the Puerto Rico Bank in Anolis, Mabuya, Typhlops. Amphisbaena, and Eleutherodactylus? Looked at as closely as I am able, there really does seem to have been a lot of action in the last million years. The most distinctive New World Mabuya is on Carrot Rock, disjunct for a few thousand years, sympatric with a really well-differentiated Anolis (and an undifferentiated Sphaero: The Rule of Three). Are these relics stranded from millions of years past? No way, say I: Recent, rapid, in situ, classic, peripheral speciation. And what of Anolis cristatellus wileyae and integrading A. c cristatellus? Or Mabuya s. sloanii and integrading M. s. nitida? Well, they could have been right there, doing their thing, forever. They could have been panmictic, integrading, geographic, ecotypic subspecies even better during a glacial maximum than they are now.

How do you feel about brand-new, radically distinct, full species arising from within a field of ancient, stable, perpetual, gene-exchanging, geographic variation? It would gag Willi, but it doesn't upset me.

I am beginning to suspect the Antilles have always been about the way they are. I think North and South America underwent far more radical changes about four million years ago, when the Panama Land Bridge rose, than the Antilles ever underwent from their arising from the sea until human arrival.

If you want to see real long-term species composition stability and incredible species diversity per unit area, look at some little oceanic island no people have screwed up yet.

1 December 1991

13.XII.1991

Dear Skip,

It always seems to take me so long to gather my thoughts following trips to the Caribbean. I guess it's just a lack of discipline. Nevertheless, I am finally sitting down to reflect on the collecting.

This year we certainly found some interesting things out about the burrowing reptiles. The thing that surprised me most was the collecting of a specimen so far out of my theoretical altitude range. Finding an Amphisbaena while just about standing in the water on Great Thatch certainly blew my opinion that they are found higher up on the slopes.

I started reading on Amphisbaenians upon my return and am including a copy of page 11 from Smith and Smiths' "Synopsis of the Herpetofauna of Mexico. Volume V" which describes collecting animals after a rain shower. As you no doubt recall, we were most successful in our collecting in upper Palm Ghut on days following rain.

Although there were three examples this trip which were collected extralimitally, at least to my hypothesis, I am still convinced that I can almost predictably find specimens at 500-700' under rocks in that open forest type situation.

I hope that next year we can arrange to get a trip to St. John for the purpose of securing specimens from there. Additionally, I feel it is quite important to gather specimens in January and April to complete life-history information. Is it possible that Henry would consider covering three or four bed nights for the two of us during those time frames? I could possibly work on covering the airfare myself for both of us.

Summarizing the Amphisbaena collecting I would say that with the capture of fourteen more specimens including one new island record and one new voucher specimen that we are almost at the point where a significant paper on this animal could be written. I feel that the life history issue and the specimens from St. John are critical to this end.

Coincidental to the collecting of Amphisbaenas we also found some new and interesting data on Typhlops richardi. Included in our specimens were two newly hatched juveniles and a fully developed clutch of two eggs. This is also the second year where two individuals were found under the same rock. Perhaps this is an indication of a breeding season. This all fits nicely with the gravid female that I collected in July of 1988 which contained three eggs. Again, I continue to feel that the ranges and preferred habitats of these two animals is pretty much the same.

I hope to hear from you regarding the possibility of the two short trips to Guana. I also would like to go back to Little Jost Van Dyke to retrieve my field catalogue!

I am including two snapshots which I think you will appreciate. Best holiday wishes to you and Wen Wah (spelling?) from Robin and me. Keep in touch and I will continue trying to arrange a trip to NE Georgia to collect Plethodontids.

Regards,

TOM

Tom
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AMPHISBAENIA

Introduction

All members of the suborder Amphisbaenia now known from Mexico belong to the genus Bipes. Four species are recognized, although others almost certainly occur (see account for the genus Bipes). The genus is limited to Mexico and is by all odds its strangest reptile group. Seldom are specimens encountered by design, for efforts to find them must ordinarily coincide with rarely favorable conditions in order to be successful. The animals are apparently limited to sandy soil in the vicinity of moisture, although that moisture need not be visible, as in the form of a stream, although often it is. Edward H. Taylor, one of the greatest and perhaps the greatest of all herpetological collectors, and I found them after protracted rainstorms under rocks on the side of a hill 50 feet above the nearest valley and at least 150-200 feet above and a quarter of a mile from the nearest surface water (the Rio Balsas). The ground was not supersaturated when we found the animals, although it may have been so for a brief time as the preceding rains fell. Nevertheless supersaturation itself is not likely to have driven the amphisbaenids to the ground surface, for it is to be assumed that they, like most other reptiles, could survive at least several hours fully submerged under water. It is likely that they regularly merely avail themselves of the expanded limits of vertical range resulting from heavy rains that temporarily unite surface and subsurface zones of moisture. Such a reaction presumably would importantly augment resources for finding food.

The maximal depths to which Bipes may burrow, presumably in times of drought, are unknown. However, Gans (1968, no. 1642: 346) notes that the species of Bipes are non-pigmented and therefore pink in color in life, or are weakly pigmented, and that the extent of pigmentation in amphisbaenids in general is roughly correlated with the depth of burrowing. Obviously, the species of Bipes burrow relatively deeply, if this correlation is valid, as it appears to be. Therefore, when not drawn to the surface of the ground by surface moisture, the animals are likely to be buried several feet deep, accessible only by heroic measures such as the excavation that often accompanies road-building.

Thus populations may exist unknown except to local residents for many decades; they constitute one of the major challenges for the herpetologist in Mexico. On the other hand, local residents are a powerful tool for their discovery, as noted by Kim et al. (1976, no. /2248.17: 121), who "rediscovered" the exceedingly rare species B. tridactylus, of which only the type-specimen had been known since 1894, by the simple expedient of enlisting the aid of residents at

August 2, 1991

James D. Lazell, Ph.D.

First please forgive my tardiness at sending you this information. I returned home to a slight change in my job responsibilities at Ciba-Geigy where I work as a toxicologist in neurobehavioral science, and also an increased work load at the raptor rehabilitation center - Hawks, where I do my field research (mainly with owls) due to an extended vacation by my two mentors and owners of Hawks. I realize the inconsistency with my work situation, but for now, one pays the bills and one is my passion, though I continually attempt to direct my career toward the later. The underlying drive for my field work is my interest in communication behaviors and vocalization patterns in predators. I have had the great pleasure of working extensively with cougars while a graduate student at the University of Wisconsin in Milwaukee. I did research at the Milwaukee Zoo and at P.A.W.S., a private reserve where I also worked with bobcat, timber wolf, arctic fox, and African serval. This interest inadvertently led me to birds of prey.

Enclosed is a copy of my Masters thesis completed in December, 1990. This work represents three years of field work on this particular barred owl. My field work continues with this bird. Also enclosed is a bird list from Guana Island, to the best of my abilities and limited knowledge of birds. My strengths lie with raptors and predatory mammals. Please feel free to correct any latin names that I may have erroneously used, as I have found some discrepancies among reference material that I browsed for information. My short time on Guana was spent getting to know the island and its varied habitat; this habitat type being unfamiliar to me. I tried to visualize where this owl might set up its territory

as well as what its diet might be. I searched for any substantial evidence; pellets, feathers, heavy white wash areas, roosting sites, and cavities, that might indicate the presence of the owl on the island. I regret to say that I came up empty handed. I certainly welcome the opportunity to investigate further the possibility of this owls' existence on Guana, and I am thrilled to be included in the scientific month this October. I have two weeks of vacation left in 1991 and October would be the better month for me, more specifically October 20 to November 3, 1991 (since I have a wedding to attend on October 19). Then October 10 to October 24, 1991 would be the next time slot preferred. I will let you know the exact dates that I will be heading to Guana as soon as I know for sure.

Presently I am gathering information on the Puerto Rican screech owl from sources and contacts that I have here, as well as a contact on Puerto Rico that Liana Jarecki put me in touch with. When I receive the pellets from Greg Mayer, I will analyze and send you my report. Would you be able to identify lizard jaws (most with teeth intact) found in the pellets - there are many collected in these pellets. I also feel it would be helpful to learn more about the kestrels on Guana, as far as diet, home range, nesting, and pellet analyses. This would give us a clearer picture of possible habitat use of the owls.

I'll be in touch soon.

Christina Lynne Leahy

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GUANA ISLAND - B.V.I. BIRD LIST APRIL 20 - 25, 1991

Location: Building sites

- Yellow-breasted Bananaquits (Coereba flaveola)
  - many seen daily
- Green-throated Carib (Sericotes holosericeus)
  - seen almost daily at flowering trees
- Rock Dove (Columba livia)
  - one banded individual seen on 4/21-22/91 near pump house
- Zenaida Dove (Zenaida aurita)
  - vocalizations and many sightings daily
- Caribbean Elaenia (Elaenia martinica)
  - seen often around buildings
- Black-faced Grassquit (Tiaris bicolor)
  - a few seen along road from White Beach to buildings on 4/25/91 early A.M.
- Antillean Crested Hummingbird (Orthorhyncus cristatus)
  - seen daily at flowering trees
- Gray Kingbird (Tyrannus dominicensis)
  - seen daily, around building and along road from White Beach
- Scaly-naped Pigeon (Columba squamosa)
  - seen and heard often around buildings
  - seen along road up from White Beach on 4/24/91
- Northern Oriole (Icterus galbula)
  - seen by L. Jarecki the day after a violent storm
- Pearly-eyed Thrasher (Margarops fuscatus)
  - many seen daily, often feeding on fruit on the tables

Location: Salt pond

- Long-billed Dowitcher (Limnodromus scolopaceus)
  - one to two seen daily
- Little Blue Heron (Egretta caerulea)
  - one seen on 4/20-21/91
- White-cheeked Pintail (Anas bahamensis)
  - eight seen on 4/20/91, eighteen seen on 4/24/91
  - a small flock seen daily
- Black-necked Stilt (Himantopus mexicanus)
  - one to two seen daily

Location: Field

- Smooth-billed Ani (Crotophaga ani)
  - vocalizations heard at Quail Dove Ghut on 4/21/91
  - two seen at plantation on 4/22/91

Location: Field (cont.)

Yellow-breasted Bananaquits (Coereba flaveola)
many seen daily all over the island
many nests located in large cactus plants; one observed active nest found in same plant along summit trail prior to Sugarloaf peak up from North Beach on 4/23/91

Brown Booby (Sula leucogaster)
a few seen flying around White Beach cove daily
eighteen observed flying low over the water at Crab Cove on 4/25/91 and also several perched on the rocks

Green-throated Carib (Sericotes holosericeus)
seen at high points feeding on nectar of small barrel cactus and flowering trees at Palm Point on 4/23/91

Mangrove Cuckoo (Coccyzus minor)
vocalizations heard at Sugarloaf summit on 4/22/91

Bridled Quail Dove (Geotrygon mystacea)
two seen at Quail Dove Ghut on 4/21/91
five to six seen at Quail Dove Ghut on 4/22/91
three seen at Palm Point with vocalizations on 4/23/91

Common Ground Dove (Columbina passerina)
five to six seen at White Beach on 4/24/91

Zenaida Dove (Zenaida aurita)
vocalizations heard all over the island
several seen at Palm Point with vocalizations on 4/23/91

Magnificent Frigatebird (Fregata magnificens)
one seen at White Beach on 4/22-23/91
one observed at Crab Cove on 4/25/91

Black-faced Grassquit (Tiaris bicolor)
one male seen with vocalizations along road up from North Beach to the buildings

Laughing Gull (Larus atricilla)
seen flying along beach areas, and off the points at Grand Ghut, Palm Ghut, and the pyramid, also perched on rocks at Crab Cove on 4/25/91

Antillean Crested Hummingbird (Orthorhyncus cristatus)
seen at points and tops of ghuts

American Kestrel (Falco sparverious)
a few seen daily flying along coast at White Beach around the pyramid and North Beach on 4/22-23/91, two at Crab Cove on 4/25/91, vocalizations heard at Sugarloaf summit on 4/22/91
old nest found near Harris Ghut on 4/21/91

Caribbean Martin (Progne dominicensis)
four to five seen at Sugarloaf summit the day after a violent storm

Brown Pelican (Pelecanus occidentalis)
many seen daily at all points on island

Least Tern (Sterna albifrons)
seen daily in flight or perched on rocks
vocalizing at Palm Point on 4/23/91

Roseate Tern (Sterna dougallii)
several seen flying and perched on rocks on White Beach side of the island

Pearly-eyed Thrasher (Margarops Fuscatus)
many seen daily all over island

January 31, 1992

Hello Skip,

What is new? Enclosed you'll find a copy of my short-eared owl report (Guana Island, October/November 1991). I sent this to R. Norton at the address that you provided, with a cover memo describing The Conservation Agency's science month on Guana Island, and the purpose of my work there. I also indicated my credentials and experience in raptor research. I provided my address and telephone numbers if further contact is necessary.

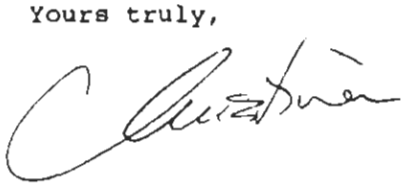
This will be followed by my bird list during my stay on Guana, and a computer file printout of my field notes.

I have yet to hear from Greg Mayer again, expecting some response by now. He stated that his samples are at Harvard, and that he would try to retrieve them for me to dissect, analyze, and include - in a report - with samples I received from you. Have you any further knowledge of this?

Also, regarding the two feathers (I got your postcard - nice place), although it would be nice to have tangible evidence of this little guy, I still know what I saw (I've been doing owl work now for five years) - a very dark short-eared owl. Finding differences under the microfiche between the feathers found on Guana compared to the feathers taken from a short-eared owl at the Mews, does not worry me, in that of course it was a chance that those feathers were from the owl seen on Guana, we could never be sure that this is a fact. Even if we never got a positive identification of those feathers, could we be sure. I am still very anxious to get these identified, for they still are owllike in appearance. I am hopeful that there is some answer and reason to differences between the feathers, and that maybe they are from the short-eared owl. Any leads on having the lady at the Smithsonian identify them for us? My people know of her and showed me an article about her - she sounds like a good bet. Maybe Margaret knows her. I am collecting more feathers from our short-eared owl here at the Mews, and will do further comparisons. Could there be differences, occurring over time, with small sample populations i.e. a tropical race per se - although these guys are heavy duty migrators. Any references you might have on tropical owls (short-eared, barn owl), also on the screech owl (you had mentioned that you had a couple), I'd surely appreciate.

What's happening with the flamingos? Any news on the parrot project or white-crowned dove project? Let me know if I can be of some help - I'd love to be involved.

Yours truly,



P.S. My horse is recovering nicely!

SHORT-EARED OWL ASIO FLAMMEUS SIGHTING ON GUANA ISLAND

Report by Christina L. Leahy, M.A.L.S.

Sighting by Christina L. Leahy, M.A.L.S., and Cory Flagg Brayton, D.V.M.

Location: Guana Island, British Virgin Islands

Sighting Dates: October 26 - 27, 1991

On October 26, 1991, Dr. Brayton and I left Sugarloaf summit at approximately 7:30 A.M. following the trail to Grand Ghut. At 8:12 A.M. just north of the South East End trail, a large dark bird flew silently toward me from the northwest and perched in a low branch about 100 feet to the left of my position on the trail. Dr. Brayton was behind me and when I saw the bird I motioned for her to stop. Dr. Brayton could not see where I was pointing. We both attempted to get cameras out of the packs without flushing the bird. I got a clear view of the bird when it perched and identified it as a short-eared owl of very dark plumage. The facial disk was very round and dark in color, the concentric rings were lighter than the body color, the eyes were yellow. The owl spread its wings and lowered its head upon perching, than bobbed its head up and down from side to side.* The owl remained three to four minutes before turning on the perch and flying southwest toward the direction from which we had come. The perch on which the owl was identified and the location on the trail at which the owl was first seen were both marked with a strip of white plastic bag, noting the species, date and time of day at first sighting. The color of the plumage was very dark brown/black with little mottling or barring, especially on the back and wings. The wing width was wide and the tail was short in length. Dr. Brayton and I tracked the owl and flushed it again. The owl flew back to where we had first located it. We followed that short flight flushing the owl again, and it flew further northwest of its original position. These flights could be characterized as short low flights perch to perch under the canopy. Dr. Brayton described her first sighting of the bird through the trees from approximately 35 feet: dusky brown and larger bodied than the dove species on the island. Dr. Brayton described the flight as silent, straight and low to the ground (personal correspondance dated January 10, 1992). We tracked the owl until after 9:00 A.M., hiking toward the summit, approaching from the north. Dr. Brayton sighted a large dark bird just off the trail above the summit rock outcropping. The bird flew toward the area the owl was first seen. Definitive identification was not possible through the undergrowth. We continued along the trail toward Grand Ghut completing a circuit to the summit. Dr. Brayton located a feather very owllike in appearance as far as texture and arrangement of the rachets. The color was dark brown tipped with a lighter tan bar, matching the owl's coloration.

On October 27, 1991, Dr. Brayton and I departed at 5:30 A.M. and reached Sugarloaf summit at 6:15 A.M. The sun rose at approximately 6:30 A.M. and we left the summit at 7:05 A.M. Just prior to the five-way intersection east of the summit, we both heard a clear "bow-wow" vocalized once, at 7:17 A.M. Although not noted as a highly vocal species, this is a documented vocalization of a short-eared owl. We proceeded along the trail where the owl was sighted on the previous day. We split up, Dr. Brayton headed northeast down the hill and I

headed northwest up the hill staying south of her position. Just prior to 8:00 A.M. Dr. Brayton flushed a large dark bird with silent flight. The bird flew up the hill west of her position. At approximately 8:00 A.M. I heard a branch fall. I sighted a dark short-eared owl (probably the same individual as sighted on October 26, 1991) flying directly toward me from below my position. The bird veered off to the north as it flew past me. The owl flew a short distance and perched. I sighted the owl with my binoculars and got a good look at its dark back and short tail. Then the owl flew northwest into thick vegetation. We searched the immediate area that the owl had last been seen until about 9:30 A.M. We did not locate the owl again on this morning.

On October 28, 1991, Dr. Brayton and I returned to the summit, arrived at 6:18 A.M., departed the summit at 6:30 A.M., and arrived at the owl sight prior to 7:00 A.M. Again we split up, Dr. Brayton going downhill and I going uphill, each moving northward every 10 - 20 minutes. Between 7:00 - 8:00 A.M. Dr. Brayton sighted a large dark bird in the same general area as seen on the two previous days. No positive identification was made. Meeting again at 8:00 A.M., we split up searching the immediate area until 9:30 A.M. We did not flush the owl again on this morning.

On October 31, 1991 I located one feather on the east side of the flats under a tree with adequate perching branches. The feather is similar to the one Dr. Brayton found at the owl sight, only larger and more distinct. The feather is owllike in appearance, dark brown in color with a lighter tan band across the tip. The feathers were both collected and brought to the states for further identification.

I hiked the ridge trail from 5:47 - 8:00 A.M. on November 1, 1991, approaching the owl sight from the north. No sightings were recorded, no vocalizations were heard.

On November 2, 1991 L. Jarecki and I hiked up Quail Dove Ghut at 6:10 A.M. We found the remains of a bridled quail dove (Geotrygon mystacea) just off the trail. We noted a concentration of quail dove feathers with no other remains found. The diet of a short-eared owl would be expected to include small avian species. We reached the owl sight at 7:17 A.M. L. Jarecki stayed on the trail while I hiked uphill. No sign of the owl was recorded. No vocalizations were heard. We met on the trail at 8:15 A.M. and continued north along the trail at 8:20 A.M. A short distance past the location at which the owl was first sighted we found the remains of a pearly-eyed thrasher (Margarops fuscatus) on the trail. This was a fresh kill (within the last 24 hours; remains not noted on November 1, 1991 at 8:00 A.M.) and only a substantial amount of feathers remained. The kill site was on a trail along an open airway which would allow easy access for an owl in flight. The kill site was photographed for further evidence.

Note *: Although this behavior is typical of a barn owl, species identification was determined based on the yellow eye color and the round facial disc.

Habitat Description by F. Kraus (November 2, 1991):

Most common trees:
- Acacia muricata - Leguminosae Family
- Amyris elemifera - Rutaceae Family

Other dominant vegetation:
- Exostema caribbaea - Rubiaceae Family
- Bourreria succulenta - Boraginaceae Family
- Krugiodendron ferreum - Rhamnaceae Family
- Reynosia guama - Rhamnaceae Family
- Eugenia biflora - Myrtaceae Family
- Eugenia ligustrina - Myrtaceae Family
- Capparis cynophallophora - Capparaceae Family
- Guapira fragrans - Nyctaginaceae Family
- Pisonia subcordata - Nyctaginaceae Family
- Myrciaria floribunda - Myrtaceae Family

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Notes on the Biology of the Bridled Quail-Dove (*Geotrygon mystacea*)

ROBERT M. CHIPLEY

The Nature Conservancy, 1815 N. Lynn St., Arlington, Virginia 22209

ABSTRACT.—The biology and breeding behavior of the Bridled Quail Dove (*Geotrygon mystacea*) was studied on Guana Island, British Virgin Islands, during the summers of 1984-1987. This Caribbean endemic is a relatively common and easy-to-observe resident of dry evergreen forest on the island, where it forages exclusively on the forest floor, feeding mostly on fallen fruits. At night birds roosted in trees 3.5-7 m from the ground. Three nests were discovered during four field seasons; these were stick platforms 2.5-6 m from the ground. Courtship and copulation were observed at a nest under construction; both male and female participated in nest building. Home ranges were 2-9 ha with an average of 4.4 ha.

INTRODUCTION

Except for the work of Skutch (1949) on the Ruddy Quail-Dove (*G. montana*), little has been published on any species of the neotropical genus *Geotrygon*. This genus is found from central Mexico to Argentina and includes some 15 species. It is well represented in the West Indies, with six species, including five endemic to the region.

Among the Caribbean endemics is the Bridled Quail-Dove (*Geotrygon mystacea*); according to the American Ornithologists' Union (1983), it is resident in Puerto Rico (including Vieques and probably Culebra islands), in the Virgin Islands (except Anegada), and in the Lesser Antilles (from Saba and Barbuda south to St. Lucia).

Of the 15 species of *Geotrygon* only 4 are markedly sexually dimorphic. In *G. mystacea*, the female seems slightly smaller than the male and with the iridescent colors somewhat muted; Garrido (1986) reports that *G. caniceps* and *G. chrysia* also display a similar very slight sexual dimorphism. The difference with *G. mystacea* does not allow reliable sexing of individuals in the field.

STUDY AREA AND METHODS

The study was conducted on Guana Island, British Virgin Islands. The island lies 3 km off the north coast of Tortola and is about 300 hectares in size, with a peak elevation of 245 m. It has no permanent residents but is home to the Guana Island Club. There are few trails and guests rarely venture onto most parts of the island. Since 1982 it has been the site for several scientific studies sponsored by The Conservation Agency, of Jamestown, Rhode Island, USA. The island is a *de facto* nature reserve, due to the owner's interest in conservation. The present observations were made 11–26 July 1984, 8–23 July 1985, 11–29 July 1986, and 8–29 July 1987.

Birds were captured in nets placed at several locations at low elevations on the western slope of the mountain occupying the eastern part of the island, on either side of Quail-Dove Ghut (Fig. 1). All the birds were caught in the lower shelves of the net. Captured birds were marked with color bands to allow individual recognition. A strip of yellow adhesive tape was affixed along the length of a tailfeather to facilitate identification of marked birds at a distance. In 1985, 6 birds were caught (one died in the unattended net); in 1986, 15, but in 1987, only 2. All doves were caught in the late morning (earliest at 1030) or afternoon, although nets were generally open by 0800.

Radio transmitters were attached to doves in 1985, 1986 and 1987. Four transmitters were available for use each year. Weight of the radios was approximately 7 grams. During the first two years radios were attached beneath the tailfeathers and during the last year to the upper back, in both

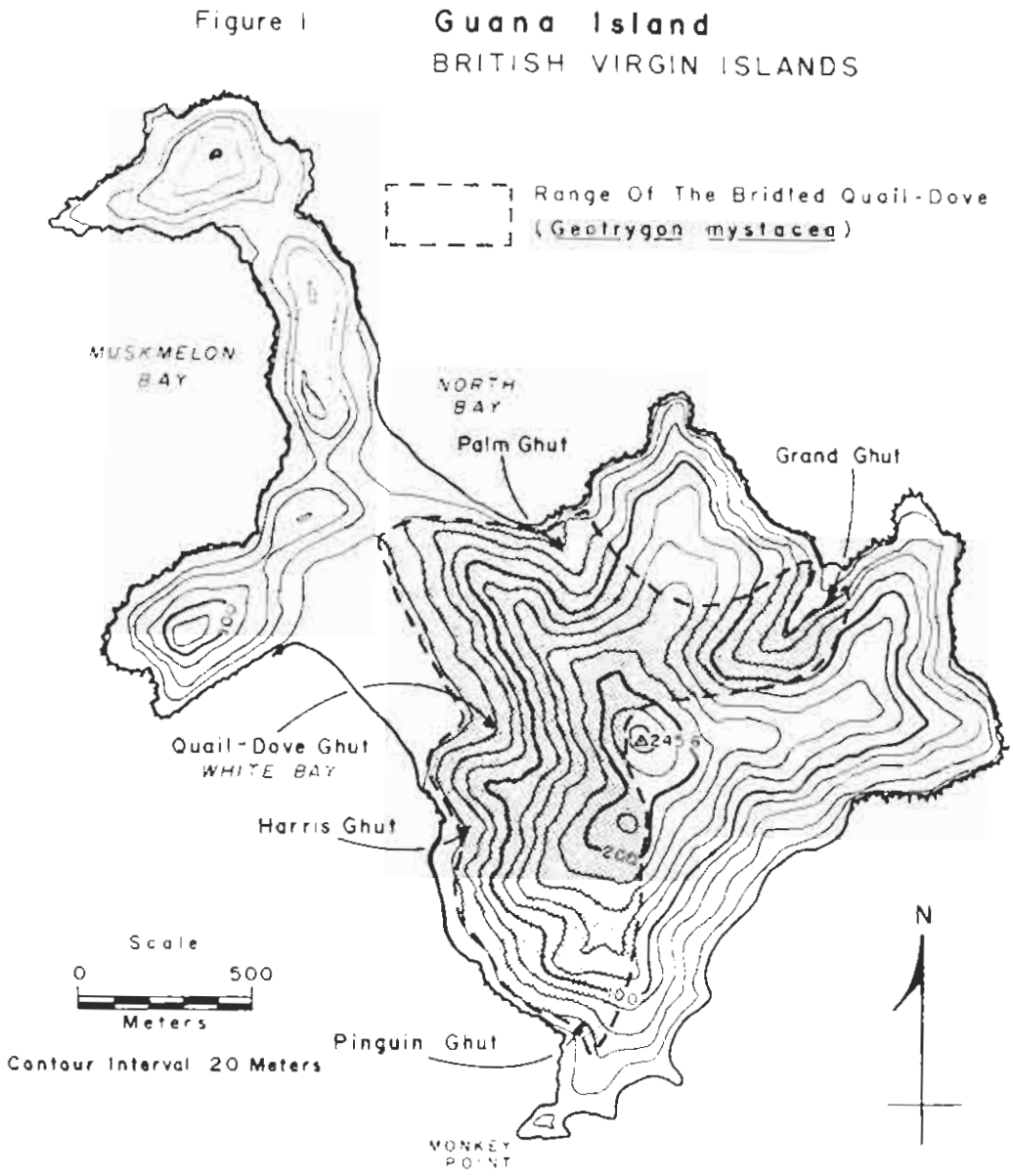

FIG. 1. Distribution of the Bridled Quail-Dove in Guana Island.

instances using quick-drying epoxy glue. Radios did not impede birds from flying, as birds with transmitters were observed in flight on several occasions. A 3-element Yagi receiving antenna and a CE-12 receiver were used. Readings were taken at all times of day from several stations; every two days the birds were tracked down to make sure radios were still attached. Whenever a signal disappeared, readings were taken from the highest point of the island, where presumably radio signals would be heard not only from all points of the island but also on facing parts of two adjoining islands, 3 or 4 km away.

Of 11 birds to which transmitters were affixed, three had disappeared by the following morning and signals were never again heard nor were the birds ever again observed; two transmitters apparently failed; four fell off but were relocated, having remained attached for 6–12 days; and two were still transmitting when fieldwork ended for the season. The range of period of signals from attached transmitters was 1–13 days; the average was five

days. Radio transmitters allowed the location of two of the three nests I discovered and permitted locating roosting birds at night; they also allowed some determination of home range.

Results and Discussion

Habitat.—On Guana Island, the species is confined to dry evergreen forest. It occurs particularly in and near ravines. This community is characterized by a canopy 6–10 m (with a few emergents to 14–15 m), mostly *Bursera simaruba* and *Pisonia subcordata*, with *Spondias mombin*, *Acacia muricata*, *Citharexylum fruticosum*, and *Myrcianthes fragrans* (the tallest tree on the island) at the higher elevations, and *Ocotea coriacea* at lower elevations. The open undergrowth is dominated by *Eugenia*, of which 7 species are found on the island (Proctor, pers. comm.). The bird is seen rarely in marginal habitat (sea-grape woods near beach and dry evergreen thicket near a salt pond only a few meters from woodland), but not in the more arid cactus thorn scrub. Suitable habitat for the quail-dove covers about a third of the island (Fig. 1). The birds were easiest to find and observe in or near two ghuts (ravines) easily reached by foot, Quail-Dove Ghut and Harris Ghut. A few were seen in Palm Ghut, and the species has been reported for Grand and Pinguin Ghuts (Lazell, pers. comm.).

General Behavior.—The Bridled Quail-Dove forages exclusively in the litter of the forest floor, feeding mostly on fallen fruits (particularly berries of *Eugenia* spp.), sometimes using its bill to stir up litter, even occasionally throwing leaf litter into the air with a sideways motion of the head. If disturbed, it walks or runs away from an intruder, occasionally making short flights and alighting on a low limb or rock, where it bobs its body. It often preens from the top of a rock. The birds in this study area allowed approach routinely to within 5 m and occasionally to within 1 m. It seems a sedentary species; I observed it to take only relatively short and low flights. In addition I never saw one fly above the canopy nor perch higher in a tree than 7 m, nor did I ever see one outside the woodland. Behavior and ecology of this species closely match what has been written of other members of the genus: forest-inhabiting terrestrial birds, they forage for seeds and fruits on the forest floor, are generally solitary or found in pairs, and most are shy and inconspicuous.

Vocalizations.—The usual vocalization is a two-part *hoo hoooooo*, given up to 12 times a minute and sounding rather like blowing over the top of an empty bottle. The first part is lower in volume and of short duration, apparently sometimes omitted or probably often not audible from a distance; the second note rises in the middle and then falls. The bird sings most often from a perch, but also from the ground and, on two occasions noted in the study, from the nest. A second vocalization is associated only with courtship. It is a guttural croaking call which rises and then falls, followed by several rapid low staccato notes on the same pitch. It is of lower volume and does not resemble the usual vocalization.

Roosting.—Five birds were located on their roosts at night. They roosted on branches near the trunk of a tree, from 3.5–7 m off the ground. One individual roosted in the same general area for at least six consecutive days.

Courtship and Nesting.—In the genus *Geotrygon*, nests are platforms of sticks placed in vines, bushes, stumps or trees at low or medium elevations, with a clutch size of one or two eggs (Wetmore and Swales, 1931; Skutch, 1949; Seaman, 1966; Lack, 1976; Meyer de Schauensee and Phelps, 1978).

Three nests of *Geotrygon mystacea* were located during this study. Each nest represented a different stage in the nesting cycle.

The first nest, at an elevation of 190 m, was approximately 2.5 m on top of a dead stump well concealed within a tangle of vines and bushes and overhanging branches of another tree. This was the only nest which allowed close inspection. When discovered it contained two light buff eggs; at the end of 11 days of observation it contained one young. The second, at an elevation of 100 m, was at 5 m on a horizontal limb and contained a juvenile about to fledge. The third, at 120 m elevation, was

at 6 m on a horizontal branch and was watched for 16 days, from nest construction through egg-laying and approximately 10 days of incubation; in this nest the egg or eggs (fragments of which were found on the ground) probably fell victim to a predator.

Courtship observations were made only in connection with a pair at the third nest. These observations fall into two categories; those made at the nest, in particular, the displays given when one bird returned to the nest while the other was sitting on it, and those away from the nest, much of which occurred in the afternoon and following morning after the nest had been depredated.

All courtship activities away from the nest occurred on branches or vines, 2–7 m above the ground. Courtship maneuvers include bobbing of the head and allopreening, particularly the back of the neck. Allopreening has also been observed in courtship in *G. montana* (Lill, 1969) and is typical of Columbiformes (Goodwin, 1983). The most characteristic courtship maneuver consists of raising both wings, or less frequently one wing, outstretched, above the back, always accomplished by the courtship call. Both sexes performed this display.

This pair was seen copulating once, on the fifth day after the nest was discovered. Copulation was preceded by mutual allopreening around the face and then rapid head-bobbing by the male. The male then mounted the female, which crouched down and lifted her wings. Afterwards both birds gaped and the male gave the distinctive courtship call.

With the single nest observed under construction, nest building took place only in the morning. Although Skutch (1949) states that original construction of the nest of *G. montana*, as for the pigeon family in general, is performed by the male, in this case both unbanded birds were observed bringing sticks for nest building before incubation apparently began. However, the bird presumed to be the male did most nest construction.

Nest construction followed a general pattern. After searching the ground near the nest for a suitable twig and rejecting one or more, the bird generally chose a twig about six inches long. It always followed the same route to the nest. First, it walked to a particular rock, hopped to the top, turned 90 degrees to face the nest, then flew to a particular branch where it paused briefly, and then flew about 10–12 m to the nest. The sitting bird, when aware that its mate was about the arrive, usually lifted its wings slightly so that the tips moved up and approximately twice per second. This maneuver was not accompanied by vocalizations, nor did it appear in courtship activities observed away from the nest. Occasionally when the presumed male was the sitting bird, it would raise its wings completely above its back as in courtship, and give the courtship-related call. The arriving bird usually placed the twig beneath or near the sitting bird's head. This was often followed by the arriving bird head-bobbing and then preening the head and neck of the sitting bird. During most active nest-building, the male brought twigs to the nest at a rate of up to 20 trips per hour. Nest construction had stopped by the fourth day but then resumed on the 13th through 16th days. This occurred during incubation, which presumably began on the sixth day, when the sitting birds showed signs of brooding such as frequent turning on the nest and the cessation of long absences from the nest during the afternoons. In this resumed period of nest construction, the female made 15 trips to the nest with nesting materials and the male one.

Active nest construction occurred only when one or the other of the pair was sitting on the nest. At one point, after the nest had been depredated but the female had returned to the nest, the male approached with a twig. As the male got to its last perch, at which point it usually flew to the nest, the female left; the male stayed briefly on the perch, dropped the twig, and left. This was the final time I saw either of the birds at the nest, although they remained nearby for at least two days.

Associated with switching positions at the nest, the bird arriving at the nest to take up incubation brought a twig. Skutch

(1949) observed that both sexes of *G. montana* also brought contributions to the nest (usually a leaf) when switching positions at incubation; he did not, however, observe aspects of courtship activity associated with this exchange at the nest. Some differences in behavior between the sexes were noted; when the male was incubating and the female arrived with a twig, the male greeted her with aspects of courtship activity including wing-lifting or wing-raising occasionally accompanied by the distinctive courtship call; the female never gave this call except away from the nest.

At the first nest observed, an incubating dove remained at least 6 hours, from 1020 to 1620; at the third nest, the male remained at the nest 6 hours on one day and 6.5 hours on a subsequent day. Twice, when the male replaced the female at the nest, the female then displayed nest-building behavior by returning to the nest with a twig several times before leaving the area.

Nest Defense: The first time I climbed up to look into the first nest I discovered, the sitting bird merely flew away; at this time the nest contained 2 eggs. The second time, when one young bird was in the nest, the sitting bird defended the nest by flapping at my hand with its wing, then leaving the nest but returning immediately, raising both wings and flapping at my hand again; both times it uttered a low cry.

Plumage: The one fledgling observed was about ⅔ the size of an adult and had dark rather than red eyes; the white stripe below eye was present. The bill and the cere were both pinkish, as opposed to the pinkish-red cere and yellow bill of the adult. Instead of creamy buff breast feathers, its breast and abdomen feathers were a dark chestnut brown, as were the back feathers; it lacked the iridescent greenish-purplish hue of the adult's upper back and nape. In the nestling of *G. montana*, Skutch (1949) noted differences in plumage, eye-color and bill color from the adult.

Home Range.—There was no evidence for defense of territory by foraging birds. Individuals ranged throughout all elevations on the island, from sea level to 210 m, except on the peak, where there were no trees. Among the birds to which I affixed transmitters, there was virtually complete intersection in individuals' home ranges.

Using minimum polygon defined by the points of location determined by radio tracking, I measured the home ranges of 6 birds for which there were at least 8 locational readings. Home ranges were from 2–9 ha, with the average 4.4 ha.

Acknowledgments.—Work on Guana Island was supported by The Conservation Agency through grants from the Falconwood Corporation. I wish particularly to acknowledge Dr. Henry Jarecki, whose interest in and commitment to the conservation of the biota of Guana Island have made this and other projects possible, and Dr. James Lazell, who suggested the project and organized the yearly expeditions to the island. Thanks also to Abigail Chipley, Michael Gibbons, Paul Howey, Liao Wei-Ping, Greg Mayer, John Prince, George Proctor, Bill Seegar, Mary Randall, and Paula Selby.

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**Bermuda Aquarium,
Natural History Museum
and Zoo**

P.O. Box FL 145, Flatts,
Smith's FL BX, Bermuda
(809) 293-2727

Roger Downing
Vice Chairman
National Parks Trust
P.O. Box 162
Road Town
British Virgin Islands

25th November 1992

Dear Mr. Downing,

Thankyou for the copy of Ms Lianna Jarecki's paper "Hypersaline Pond Ecology in the British Virgin Islands" which was passed on for my attention by BAMZ Principle Curator Mr Richard Winchell.

The arrival of the paper followed an informal conversation I had with H.E. Mark and Betsy Herdman during which the re-introduction of captive-bred Caribbean Flamingos (*Phoenicopterus ruber*) to the British Virgin Islands (BVI) was discussed.

After reviewing Ms Jarecki's paper on the ecology of the various ponds in the BVI I confirm that BAMZ is still very interested in the possibility of cooperating on a re-introduction project for Caribbean Flamingos.

Before BAMZ can whole heartedly embrace the project I feel that there are a number of issues that need be discussed. Listed below is a summary of items (some of which were communicated to Dr. H. Jarecki by Richard Winchell in a letter dated 04 Feb 1991);

Conservation:

To insure that the re-introduction project is successful it will be necessary for your Scientific Advisor to provide a written project proposal addressing conservation, husbandry, re-introduction sites and times, legal protection of birds and/or sites, monitoring procedures etc.

Political/Economic:

The people and Government of the BVI must be in full support of this re-introduction and written confirmation of support must be received from both the BVI Minister of the Environment (or equivalent) and the National Trust.

Administrative:

The legal documentation for the transport and subsequent release (CITES, Health, Import, authorization for release etc.) must be organized in good time.

Financial:

Because of the considerable cost that will be incurred in the transportation of the birds and the benefits of a re-introduction program to the BVI, BAMZ is willing to donate up to 20 birds (which have a present zoological surplus value of $1,500.00 each = $30,000.00 total) to the project FOB Bermuda. However the co-ordination of air transport and related expenses need to be carefully worked out.

Husbandry:

At the request of the Principal Curator (to ensure the best chance of survival and acclimation of the birds) a BAMZ Zoo staff member and our Government Veterinarian should accompany the birds to BVI and remain on site for a week to 10 days. Airfare would be the responsibility of BAMZ, however I would be grateful if arrangements could be made to cover their food and housing expenses.

Not withstanding the above comments, I and BAMZ are very eager to get this project started and hopefully be in a position to ship birds next year.

Unfortunately BAMZ has had little "hard" information of the status of the original 8 birds shipped to and released on Guana Island in November 1986. In fact the paper by Ms. Jarecki contains the first documented information received. If the progress of these birds are to used as a basis for further releases then some sort of standardized reporting is needed.

Please find enclosed a Specimen Release Data Questionnaire. I would be most grateful if you could arrange to have it completed for the 8 birds that were originally sent to Guana Island and returned to me either by fax or air mail.

The information gained from the completed questionaire will be entered into a data base being compiled on West Indian re-introduction projects. In addition similar data will be required, plus yearly updates, on any subsequent releases of BAMZ supplied birds.

In closing I would like to propose a second project that is of interest to BAMZ and could also benefit the BVI.

I am particularly interested in the husbandry and breeding, for eventual re-introduction, of *Iguana (cyclura) pinguis*. I would like to discuss the possibility of acquiring 2 mature pairs of *I. pinguis* as a start for this program at BAMZ. If you considered this a viable proposition I will be most happy to forward a specific proposal in due course.

Wishing you, your family and the Trust a prosperous and joyous Christmas and New Year.

Your Respectfully

James Conyers
Zoo Supervisor
BAMZ

cc. R. Winchell
N. Goodyear

FLAMINGO RESTORATION:
BRITISH VIRGIN ISLANDS

by

James Lazell

January 24, 1992

It is a primary goal of this Agency, working with the Guana Island Wildlife Sanctuary and the National Parks Trust of BVI, to re-establish a viable population of flamingos, Phoenicopterus r. ruber, in the BVI. Phase I of the project involved bringing a few birds (eight) to Guana Island in 1986. We needed to see if local people would appreciate the birds and not attempt to kill them. This was a great success, resulting in general enthusiasm for flamingos. The birds lived on both Guana and Tortola. They were not molested, and were a source of pride locally.

Phase II should involve bringing enough birds to breed, settling the majority of them on Anegada, where the largest (only?) breeding population originally was. We believe the potential propagule should consist of some pinioned birds, because the flying birds tend to remain with the non-flyers, rather than dispersing in search of a larger flock. Additionally, we believe some known pairs of proven, successful nesters should be included.

The Anegada Salt Ponds National Park would seem ideal for the birds today. Dr. N.C. Goodyear, of this Agency, has worked with Anegada residents for over three years now on their National Park and its fauna (especially Iguana pinquis). The people want the birds and will accept the responsibility of monitoring and protecting them. While we cannot guarantee that a breeding population will become established, we cannot envision any reason why it should not.

We will also place a few birds, including some pinioned individuals, on Guana Island. It is not impossible that they would breed on Guana (see attached materials), and they

can be very carefully and constantly monitored there. Guana Island is also far more readily accessible to most local people, school groups, etc. Therefore, there is good PR in having some visible on Guana Island.

We believe success depends in large part on numbers. We hope to settle at least 12, with at least four known breeding pairs, on Anegada, and no more than eight on Guana. We hope to move the birds in February of 1992 so that there is at least a possibility of nesting in their first year on Anegada.

We need a veterinary certificate for the birds explicitly stating that they are free of exotic Newcastle Disease.

FAX TRANSMITTAL SHEET

The Conservation Agency
97B Howland Avenue
Jamestown, Rhode Island 02835

Date: r F : 01) 23- 66 Phone or Fax: (401) 423-0866

To: Henry and Gloria

Fax number of recipient:

From: Numi

Number of pages including cover:

If there are any problems with this transmission, please contact us at (401) 423-0866. Thank you.

Dear Henry and Gloria:

I just spoke to James Conyers at BAMZ about flamingo feeding and care. I wasn't sure how we would know if they were hungry unless they were facing heavenward. Since the food is really easy to get, and so little is required to feed them, I think we should make a routine of feeding them daily. Further, to my delight, James really thinks they could breed on Guana as well as Anegada!! (Dunno if he told you this?) Since healthy birds have more time for fun, the food may be a good investment. Did he talk to you about mirrors? If we get serious about this breeding thing, we may want to put some up in their hangout at the far end of the pond. Mirrors already inspired one small population to breed...

Linford is my vote for flamingo man. Could Everton take it on L's days off?

PROPOSED GUANA ISLAND FLAMINGO FEEDING SCHEDULE

1. At 4 pm daily (except Sunday) Linford or Everton adds 3 gallons of fresh water to a clean shallow washtub (ca. 4" x 24" x 24 "*) placed at the generator house shoreline. This seems like it is a good time for Linford (just before heading home) and is about when Bermuda feeds its birds.

2. Since the Bermuda Zoo has a routine these birds recognize, it might be a good idea to follow their feeding regimen as closely as possible until the birds get used to Guana. The feeder should put about 3 cups of flamingo food in a yellow bucket and whistle to the birds like dogs as the dry food is added to the water in the tub. The guy at the zoo whistles up repeatedly like a chorus of spring peepers (or the first syllable of wolf-whistle several times fast).

3. The feeder should mix the food into the water forming a slurry then retreat from the area.

4. It might be a good idea for Linford to feed then take about 15 minutes after feeding to sit under one of the palms quietly, with a pair of binoculars, and simply watch the birds. This way he will begin to get a feel for what "normal" behavior is. The hope is that if one begins to act strangely in the future, due to illness, he will pick it up and we can act quickly to help the bird. Linford has an excellent eye for patterns in animal behavior and the signs of sickness might be subtle. With him on the case, with direction to inform management of suspicious behavior, I feel we have the safest environment for your birds.

5. If the flamingos are acting abnormally, the management can call James Conyers or Neil Burnie at 809 273 2727 (work) or 292 2129 (J.C.'s home). If Conyers or Burnie feel it's appropriate the staff should contact Dr. Joe Ryan (w: 52451; h: 46697) or Dr. Clinton George on Tortola. Please also have them contact you and me, or Skip. If it is obvious that something is really wrong with the heath of one or more of the birds, they should call the vet first and get him underway to Guana - then try to get hold of Conyers.

In case you want to fax it to Guana as the official directive - I have made a simplified version of the feeding/observation schedule (without rationale).

Last, Glenn and I had the best week we can remember. Thank you for being so sweet about letting him stay on with me. Also sometime I'll tell you how bad those preliminary flamingo meetings on Anegada were. Simply saying that they were negative does not begin to give you the picture. I am not sure if you know how much of a coup you pulled off - I'll tell you if we ever get a moment.

Love and thanks, N.

* a cut-off plastic garbage can would work well, or a new oil changing bin (avail. at autoparts stores)

GUANA ISLAND FLAMINGO CARE

1. At 4 pm daily (except Sunday) clean a shallow wash tub at the generator house and carry it to the shore of the pond.

2. Using a hose, add 3 gallons of fresh water to the tub.

3. Put 3 cups of food in a bucket and carry it to the pond.

4. As you add this mix to the water, whistle to the birds to call their attention.

5. Stir the tub to make a slurry then return the hose to the generator house.

6. Choose a shady spot (under the palm trees) from which you can watch the birds. Using a pair of binoculars, observe the birds for 15 minutes. Try to get to know how they normally act - you will then be able to tell us when they are acting strangely!

7. If at any time you see flamingos that look poorly - drooping, stumbling, or doing something that does not seem normal or healthy - tell Walter or Beverly immediately. They will call for help.

Dr. Joe Ryan, Government Veterinarian: 52451 (business hours)
46697 (home)

Flamingo Caveat

As of this writing, 2 April 1992, all seems to be going well with the flamingos on Guana (and only one lost on Anegada). However, I anticipate problems when four more birds are added to Guana's flock.

Several years ago, I took maps of all the dozens of salt ponds on Bonaire that support flamingos, all the counts of birds per pond, measured pond areas on Numi's magic computer, and calculated birds/hectare. I submitted my results (and some details), but now hereby restate my conclusion: in hard times, Guana's pond can only support two flamingos.

With eight (8) birds on the pond, I predict hard times will come soon. Then the birds will have to be artificially fed.

Unless a through-flushing, downstream feeding area is set up and plumbed, flamingo food will get into the pond.

If flamingo food gets into the pond, the pond will sooner or later become <u>eutrophic</u>: a rich soup of algae and bacteria unable to support the aquatic arthropods the flamingos need to both survive and stay pink.

If this happens, the flamingos might survive as zoo birds, but the rest of the diverse life of the salt pond would dwindle away. This is to be avoided.

Therefore, I strongly urge that immediate construction take place NOW on the sort of downstream, flow-through, feeding area planned and diagrammed by Numi more than a year ago.

NATIONAL MUSEUM of
NATURAL HISTORY
SMITHSONIAN INSTITUTION

07 November 1991

James D. Lazell
Box 32 Road Town, Tortola
Guana Island Wildlife Sanctuary
British Virgin Islands

Dear Mr. Lazell:

This letter is to acknowledge receipt of one skeleton of Anas bahamensis. Thank you very much for this valuable addtion to our skeleton holdings. You will receive a more formal "Thank You" later when the end of the year accessions are done.

Again, thanks for the specimen.

Sincerely,

Carla J. Dove

Carla Dove
Division of Birds
when the end of the year accessions are done.

The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Sunnyburne Street
Conanicut Island
R.I. 02835 U.S.A.

31.iii.92

Dr. James E. Childs
Department of Immunology and Infectious Diseases
School of Hygiene and Public Health
Johns Hopkins University
Baltimore, MD 21218

Dear Dr. Childs:

I read with true joy your cat-rat article in Nat. Hist. 6/91. At last I have a published reference I can cite for the seemingly insane view I have held and proclaimed for years.

I enclose a portion of a report I wrote on a singularly attractive island in the British Virgins that is (at least slightly) blemished by rats. There are feral cats too, but we strive to eliminate them. This has not increased the rat population, but is has not reduced it either.

Do you have views on methods of Rattus removal? Would you like to examine our situation and make recommendations? October is scientists' month on Guana, and we provide room and board for visiting scientists. Please let me know if you are interested and I will fill you in on details.

Do you have reprints of other papers on the cat-rat relationship? We would much appreciate more references.

With sincere regards,

Skip Lazell

James D. Lazell, Ph.D.

Excerpt from:

Lazell, J. 1982. Natural History on Guana Island. Typescript report, The Conservation Agency: ii + 144 pp.

Rats and mice: family Muridae. -- We will probably never know for sure where the various species of rats and mice now so integrally a part of the human environment originally came from. They were quite unknown in the New World until post-Columbian Europeans brought them. In fact, their pre-Columbian absence from, for example, Amerindian midden sites is one of the best lines of evidence against pre-Columbian expeditions to the New World. If Scandinavians or Phoenicians -- or whoever -- really got here, how come they didn't bring rats and mice, quite by accident, in their vessels, the way every ship beginning with the Nina, the Pinta, and the Santa Maria did?

The species involved are three: the house mouse, Mus musculus, possibly of temperate European origin; the black or fruit rat, Rattus rattus, possibly of Mediterranean origin; and the brown or Norway rat, Rattus norvegicus, strangely enough probably of Chinese origin. Only the first two are known to occur on Guana, and I saw only Rattus rattus, which is common. Not only do Rattus live around human habitations, but they have colonized the wilds, too. The large stick nests in the bat caves yielded Rattus rattus to my snap traps.

Rattus rattus carries bubonic plague, Rattus norvegicus rarely does so, and Mus musculus seemingly never. It may now be impossible to wipe out

Rattus and Mus from our habitations except by wiping the habitations and ourselves out too. But almost everyone thinks you can wipe them out; everyone seems to immediately have the same thought: get a cat.

Well, that has never, ever, anywhere worked yet. Nowhere. Rats and mice occur absolutely everywhere cats occur in the world, and are never wiped out by them. Why, confronted with an entire planet chock-full of evidence to the contrary does anyone still persist in believing cats will eliminate rats and mice?

The first, most elementary Rule of ecology codifies predator-prey relations: No Predator that has Evolved in Sympatry with its Prey can Eliminate that Prey Species. Just like No Disease Organism Kills its Natural Host. Of course not. Those are rules, so someone may be able to find a weird, rare, bizarre exception, but I will bet every exception involves some artificial, third-party, human interference.

Anyway, Eurasian rats and mice and Eurasian house cats evolved in sympatry -- together. So, the cat, as predator, will merely hone the rat or mouse population to a fine edge: the rats and mice will be sharper, stronger, better adapted in general. At first, while the unfit are being harvested, one may notice a nice drop in the prey population. But not in the long run. Soon, the prey species returns to its optimal number for the habitat, and the predator settles down for an easy life of skimming off the surplus who would just die anyway. Most individual prey animals that natural predators harvest are the very young, unfit ones, or the senescent old.

Buck Island, south of Tortola, was, when I was there in April, 1980, the best example I've ever seen of the cat-rat relationship. It was almost impossible to imagine so many cats and rats in one small area. Cats cause

healthy, fecund rats. Charlie Darwin pointed out exactly how that works in 1859.

Wourms (1981) studied the predator-prey relationship of house mice, Mus musculus, and house roaches, Blattus germanicus. House mice are vigorous predators on insects and other small animals. 26 mice in Wourms' study attacked roaches 170 times in 31 trials. But European mice and European roaches evolved together. The former isn't going to seriously diminish the latter. Indeed, 78 percent of Wourms' roaches escaped.

Of course, introducing a novel predator into an environment where its potential prey species have evolved in its absence can be very different. The mongoose has done vast damage to native island species of birds and small mammals since its introduction from Java a century ago. House cats -- and even rats, which are very carnivorous when they have the chance -- have devastated the faunas of many small islands, including those in the West Indies. In summary, introduced exotic predators, such as cats, rats, and mongooses in the Antilles, never do what you want them to do, and do all sorts of other horrible things instead.

The best ways to control rats and mice are on a very local, small scale: traps and species-specific poison. I believe covered poison-bait stations would work well in the garden plots, although poisoned rats will head for water, so the cisterns must be effectively protected. Snakes and kestrels can handle house mice, which probably accounts for their relative scarcity. Snakes can also probably effectively raid rat nests and consume the young. The only native predators which can handle adult Rattus are the red-tailed hawk and maybe the owl. A limiting factor for these birds on Guana may be lack of nest sites. I will say more about that under Birds and Prospects for Future Work, below.

And the Cat Shall Lie Down with the Rat

Garbage heaven is a peaceable kingdom for two legendary enemies

by James E. Childs

Four cats and three large rats were feeding side by side from an overturned trash can in a dimly lit, filthy alley in one of Baltimore's worst neighborhoods. It was 1:00 A.M., and any people out that late would have heard me muttering disjointed sentences into a tape recorder or chortling with joy at discovering a malodorous rat in one of the traps I had carefully placed under a rotting mattress or next to a mountain of waste-filled plastic bags.

Because I have made cats and rats the object of serious study, many people regard me as a trifle touched. Even fellow biologists look askance at me when I show slides of my study sites at scientific meetings. Aren't cats pets and rats little more than city pigeons with fur? What can they offer in terms of ecological insight?

This is an attitude I understand. I have not always been an urban ecologist, but only turned to this environment after my plans to investigate foraging behavior in pollen-feeding bats were dashed by limited funding. At the suggestion of my Ph.D. adviser, Edwin Gould, I looked into the possibilities of studying urban cats. To my astonishment, a perusal of the literature on their ecology revealed almost nothing. Until relatively recent studies by Jane Dards, formerly of England's University of Bradford, and Carol Haspel, of New York's LaGuardia Community College, urban cats were forgotten or ignored animals, in part because of their unglamorous surroundings.

I began roaming the streets to observe how free-ranging cats—feral cats and strays, as well as house cats allowed to wander freely—make a living in a city. Because cats are active at night, I was mostly involved in nocturnal study and immediately found myself confronting another common denizen of the city's seamier places, the brown, or Norway, rat. My interest was piqued when I watched these mythical enemies feed peacefully from the same garbage heap, drink from one puddle, and nonchalantly pass each other on well-worn, shared paths. Here was the potential to study the interactions of two species usually cast in a predator–prey struggle. This had the makings of a classic ecological drama, but with a twist—it was played on grim city streets and starred little-known actors.

James E. Childs

On a Baltimore street, an indifferent cat looks the other way as a large rat passes by.

Both cats and rats hold prominent positions in human mythology and history. As guardians of the grain stores, domesticated cats were sacred in ancient Egypt. Norway and black rats, on the other hand, have been credited with causing more human deaths as carriers of disease than all the world's wars and revolutions combined. The cat's role in suppressing such villains was well worth investigating; its public health significance added to its ecological interest.

As the epitome of predator and prey, the pair have been inextricably linked in history and fable. In the eighteenth century, Frederick the Great of Prussia required a levy of cats from conquered towns to protect his grain stores from rodent vermin. In the nineteenth century, the British Post Office allotted a portion of its budget to maintaining cats on its premises to control mice and rats.

The cat's legendary abilities as a rat catcher have not been universally accepted, however, and only in the last forty years or so have scientists begun to study the relationship between these animals. In 1953, British ecologist Charles Elton reported that farm cats would not necessarily clear a farm of existing rat infestations, but that they could keep buildings free

from rat reinfestations once the existing rat populations had been eliminated by some other means, such as poison. Elton's conclusions were only inferential, however. He compared rates of reinfestation on farms with and without cats. In 1957, biologist David E. Davis, of Johns Hopkins University, found that barnyard cats on Maryland farms delayed the spring increase in rat numbers (associated with renewed breeding activity after a winter lull) and hastened the population decline in the fall (when reproductive activity again slowed down). In 1951, another Johns Hopkins scientist, William B. Jackson, examined cat feces for rat remains and concluded that individual urban cats removed an average of twenty-eight rats per year off the streets—at most, 20 percent of the number needed to keep rat populations under control.

Thus, for all the storied fame of cats killing, eating, and otherwise abusing rats, scientists had little to say on the subject; outside of the laboratory, few people had described natural encounters of cats and rats, much less the act of predation. I was determined to see for myself cat and rat interactions in the alleys of Baltimore.

First I had to pinpoint places where both species existed in large enough numbers to make my observations meaningful. I visited the Baltimore City Animal Shelter to find out where shelter wardens removed the most dead cats from the streets. With what I hoped was a map of hot spots for free-ranging cats, I drove through those alleys and streets at all hours of the night counting the cats I saw. Not only did the map serve admirably in leading me to locations with large numbers of cats; to my surprise it was equally suitable for predicting where the most rats were to be found. Only later did I come to appreciate how opportunistic both species

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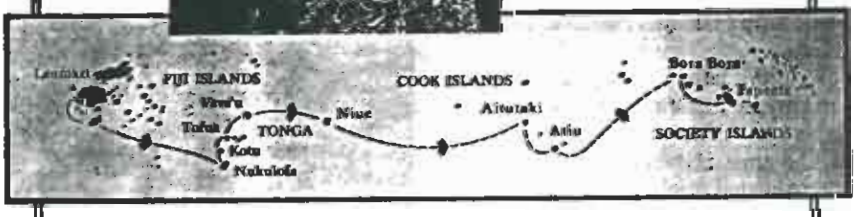
- Niue, a picturesque island with breathtaking sheer limestone cliffs along its coast.
- The Cook Islands, including rarely-visited Atiu, a beautiful raised coral atoll.
- Bora Bora, where sparkling blue lagoons and jagged peaks ablaze with hibiscus make it one of the most spectacular islands on earth.
- Tahiti, a famous tropical paradise and site of the glorious and sacred Marae of Arahurahu.



For further information contact:

American Museum of Natural History
Discovery Cruises

Central Park West at 79th Street
New York, NY 10024-5192
(212) 769-5700 in New York State or
toll-free (800) 462-8687

are, living almost exclusively off the bounty of human refuse.

At night, I used my car as a blind to watch for interactions between cats and rats. By parking near street lights, I could accurately record whatever happened within about fifty feet. Witnessing cats killing rats turned out to be remarkably difficult, and in more than a thousand hours of watching cats and rats together, I saw only five kills. I also needed to study the victims, but capturing them turned out to be equally trying; cats often took off with their prey when they saw I was interested. After prolonged chases on foot, I recovered only three rats.

Then I realized that a large number of people in the neighborhood with a soft spot for the down and out were feeding free-ranging cats. (Later, in a door-to-door survey, I found that approximately 16 percent of city residents do.) Because cats sometimes reward their benefactors with fresh kills, I enlisted the support of neighborhood cat fanciers who were willing to collect and save the odd pieces of rat that showed up on their doorsteps.

I knew that in the process of weaning, when the litter is about four weeks old, cats bring prey to the nest to introduce kittens to solid foods. I located the dens of several feral cats and added to my collection of rat samples in this way. Because many of the victims consisted only of inedible leftovers, such as heads, feet, and tails, I trapped live rats to establish criteria for sizing and aging my growing collection of rat parts. I could compare these trapped rats with those killed by cats.

The results of the data from my prey collections were unequivocal. Yes, cats did prey on rats, but exclusively on small rats that weighed less than seven ounces. My trapped population of rats from the same alleys averaged almost fourteen ounces, and some weighed in at more than a pound and a half. About one in ten weighed less than seven ounces, and they were juveniles, too young to have reproduced. Removing a small number of them would have a minimal impact on rat populations.

With this information, I decided to expand my studies of rat ecology to parks in Baltimore. Although within the city limits, the areas chosen for detailed studies approximated rural settings because they were not frequented by people, nor was refuse available. Perhaps these results would bear out the traditional view that cats control rat populations. With fellow Johns Hopkins researchers Greg Glass and George Korch, I trapped live rats in both habitats; then examined, measured, and tagged them before releasing them where they had been captured. Later, when we recaptured marked rats, we computed and compared growth rates.

The results showed that a rat's size at a given age depends upon where it lives. Inner-city rats are relative giants; males and females weigh an average of 40 percent more than, and grow twice as fast as, their parkland cousins. Rats of identical weight in inner-city and park areas are of very different ages because park rats take a much longer time to reach a given size. We also calculated rat longevity from recaptured, tagged animals and found that life expectancy is nearly identical for rats from both habitats.

We also discovered something else when we examined the reproductive characteristics of rats: sexual maturity depends on size rather than age. Females can become pregnant once they reach a weight of about 7 ounces, regardless of how old they are and whether they live in alleys or parks. Male rats also showed sexual maturation upon reaching 7 ounces. This means that park rats reach reproductive maturity later than those in the streets. Females weighing between 7 and 10.5 ounces have litter sizes of eight, while females weighing between 14 and 17.5 ounces average thirteen young. (The very largest females, weighing more than 18 ounces, produce litters of ten, which indicates that reproductive capacity probably tapers off with size and age.)

Well-provisioned rats in inner-city locations with lots of high-energy garbage are huge compared with those from park locations with poorer pickings. As early as 1949, Davis raised rats from both urban and rural environments in his laboratory and found that given equal rations, individuals grew at identical rates and reached comparable adult size. In documenting size variation in natural populations, we confirmed Davis's studies, showing that differences depend upon habitat and not genetic variation.

The suitability of garbage as a food source for urban rats was explored in 1950 by Martin Schein and Holmes Orgain, of the Johns Hopkins School of Hygiene and Public Health. This pair collected more than 45,000 pounds of garbage from one

The Granger Collection

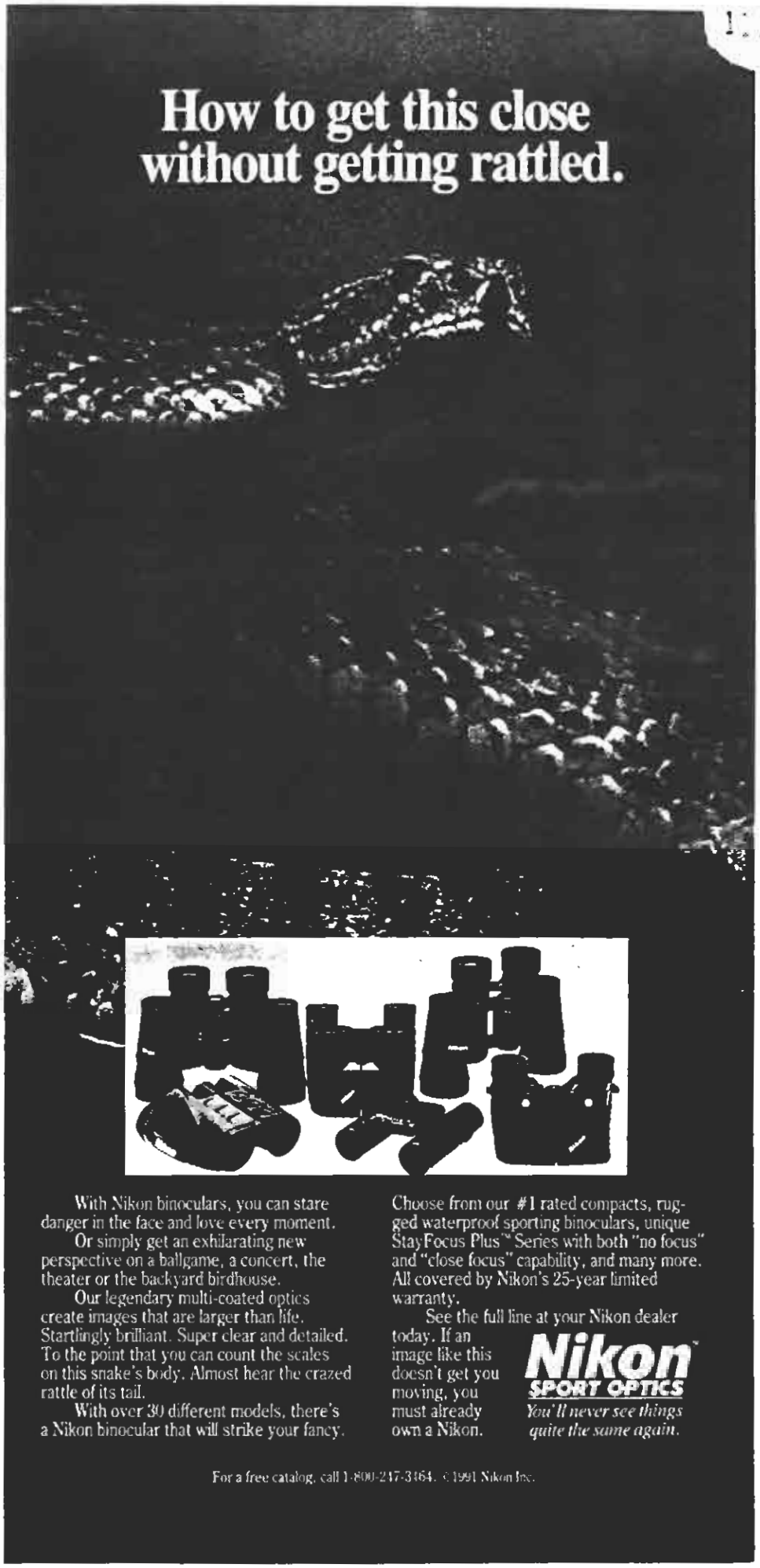
In Gustave Doré's 1868 wood engraving, the cat maintains its legendary role as rat catcher.

residential block over a five-month period. They then sorted the trash into manageable samples and established that more than 30 percent of the material, by weight, was potentially edible by rats. City rats were then trapped by the investigators and offered samples of fifty of the most common items found in the garbage. The rats preferred such garbage food items as scrambled eggs, macaroni and cheese, cooked corn kernels, and virtually any of the raw vegetables to standard laboratory rat chow. The authors concluded that the amount of edible and available garbage was well in excess of the needs of the street rats. Although the garbage preferences of feral cats have not been studied in such a rigorous fashion, recent studies have shown that cats esteem garbage as a source of food as much as rats do.

So what are the implications for free-ranging cats and their traditional role as rat catchers? If cats kill rats only within a limited size range, then a parkland rat that takes six months to reach seven ounces has a considerably greater risk of being eaten than does an inner-city rat that reaches this size in three months. In addition, the faster-growing city rats will begin reproducing earlier and produce more young over a given life span. Thus, cats are probably far more effective in controlling rural rat populations.

We can hypothesize that over the course of human history, the role of the cat in controlling rats has changed dramatically. In the agrarian past, Norway rats presumably resembled the smaller rural animals of today, and their populations would have been more readily limited by cat predation. With urban development, the rat has grown fat off the excesses of human refuse and therefore is increasingly protected from the influences of predation. In addition, an energy-rich, constantly replenished food supply has provided the urban cat with an irresistible alternative to the hard life of a predator. Like bears that have become addicted to garbage in tourist areas of national parks and forests, inner-city cats have become dependent on refuse. Although we regard the problem of garbage accumulation and disposal as an environmental dilemma, we might also consider, if only in passing, its effect on a legendary predator–prey relationship.

James E. Childs is an associate professor in the Department of Immunology and Infectious Diseases at the Johns Hopkins University School of Hygiene and Public Health, where he studies diseases that cats, rats, and other animals transmit to humans.

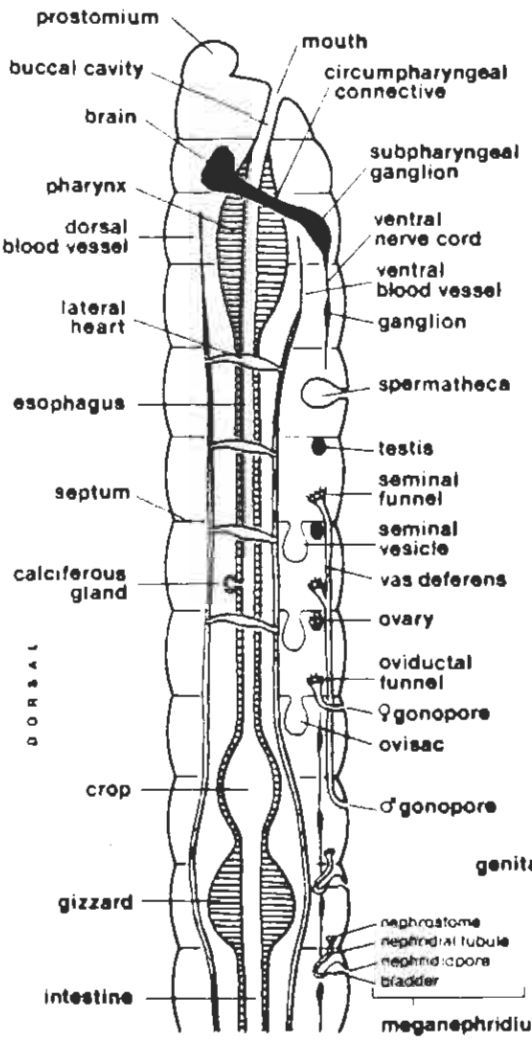


- WORMS -

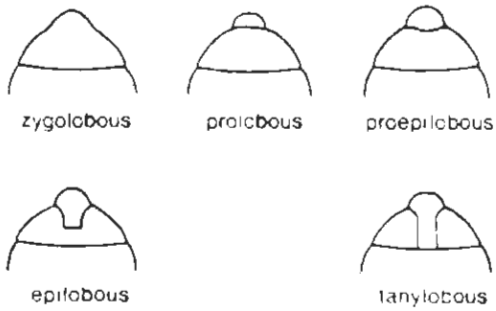
OLIGOCHAETA

crayfish parasite

(lateral)



prostomium (dorsal)



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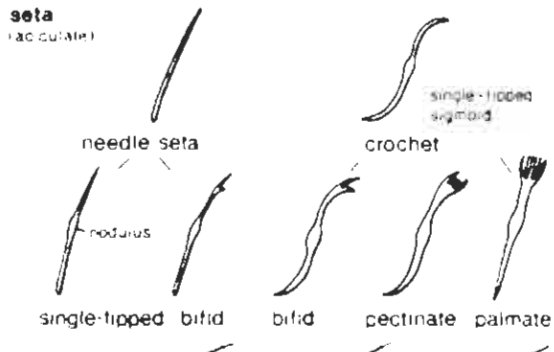
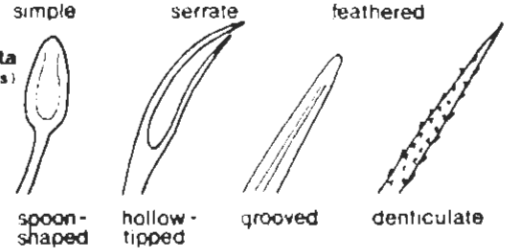
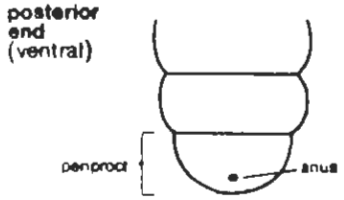


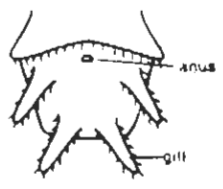
hair seta

genital seta

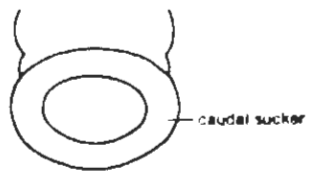


posterior end (ventral)





branchial fossa



(crayfish parasite)

Sam James, Dept. of Biology
MIU, Fairfield, Iowa 52557-1056
515-472-1146 or 472-7594

April 17, 1992

Dear Skip,

Sorry this took so long. I had totally lost any knowledge of your needing a progress report, or I would have had it in somewhat earlier. Things have been frantic here. I sure wish I had a research-only job, but who doesn't?

Here are the results so far:

Guana Island: *Trigaster intermedia*, *Pontodrilus bermudensis* (?), unidentifiable Glossoscolecidae

Virgin Gorda: *Trigaster calwoodi* (?), *T. intermedia* (?)

Tortola, Carrot Bay site: *Trigaster intermedia*

Tortola, Mount Sage site: *Trigaster intermedia*

Eustatia: *Trigaster* sp.

The interesting information comes in two parts, pertaining to the systematics of *Trigaster* and to the ecology of *Pontodrilus bermudensis*. With the collections made in the British Virgin Islands I will be able to settle an old but little-known controversy about the division of Virgin Islands *Trigaster* into three species rather than the original one. I may be able to demonstrate that the variability used to separate the above two species is intraspecific rather than interspecific. With the other material from the type locations on St. Thomas, I may be able to demonstrate that the type species of *Trigaster*, *T. lankesteri*, does not have gizzards in segments 7-9, but rather 5-7 as in the other Virgin Islands species. If this is so, the three "species" may be better lumped as one modestly variable species. Previous work has been based on a total of five individuals.

Pontodrilus bermudensis belongs to a genus previously thought to be confined to saline beach environments, such as a collection site I made in St. Johns, just above the high water mark but clearly affected by storms. However, on Guana, this species or a close relative (the material was all juvenile or nearly adult) was found well above sea level in Quail Dove Ghut. As far as I can tell, this is the first record of a member of the genus in an exclusively fresh water situation. I did not encounter any such worms in any other Virgin Islands locations except in the usual saline environments.

Proposal for next year: I would like to have a week or so to more thoroughly comb the British Virgin Islands, including high elevation areas of Virgin Gorda, east and west ends of Virgin Gorda, and several of the medium-sized islands, such as Jost Van Dyke, Cooper, Norman, Salt, Peter, and Great Camanoe. This could be done in three or four days of boat use. I would also like to spend some time on Guana estimating the population density of earthworms in the forested areas. Methods could be tested/developed/applied (the last on a limited basis) in another 4 or 5 days. This adds up to 8-10 days of work. All of these goals will be best served by some rainy weather before and during my visit. If 1992 Scientists' month is any drier than 1991, it could be tough to get any useful data or good specimens.

Please let me know as soon as you can when the scientists have the run of Guana, and what the boat situation likely will be during that time. I should need no other resources than a boat and what I will bring myself.

I really enjoyed the stay on Guana Island last year, not only for the scientific opportunities but also for the excellent company and congenial atmosphere. I hope to be back in 1992.

Sam James

Fairchild Tropical Garden
11935 Old Cutler Road • Miami, Florida 33156
(305) 667-1651
Fax: (305) 661-8953

James D. Lazell, Ph.D.
President
The Conservation Agency
6 Swinburne Street
Conanicut Island, R.I. 02835

November 5, 1991

Dear Dr. Lazell,

Thank you very much for mailing us the seed of *Cordia rupicola* collected by Fred Kraus on Anegada Island. They arrived in good condition and are now being propagated in the nursery. We are very pleased to have additional germplasm of that particular rare species for our conservation collection of endangered plants from the Puerto Rican archipelago.

Fred Kraus has been doing some very worthwhile work on Guana Island and environs. I wish that the Caribbean had more good, active scientists like him. Since I am no longer sure about Fred's whereabouts (I believe that he has already left Guana), would you please let him know that I received the seed and am very grateful for the time he spent collecting for us.

I am curious about your agency's work on Anegada and in the British Virgin Islands. If you have any informational publications pertaining to this, I would appreciate receiving copies.

And, of course, if you find yourself in the Miami area, please plan to arrange for a visit to Fairchild Tropical Garden!

Sincerely,

Carol Lippincott

Carol Lippincott
Curator of Endangered Species

printed on recycled paper

Center for Plant Conservation

Puerto Rico/Virgin Islands Task Force Meeting

by Marie M. Bruegmann, Conservation Projects Coordinator

On September 17-19, 1991, the Puerto Rico Department of Natural Resources hosted the second Puerto Rico/Virgin Islands (PR/VI) Priority Region Task Force meeting in San Juan in cooperation with Fairchild Tropical Garden and the Center for Plant Conservation (CPC). Thirty-three people from 23 organizations working in Puerto Rico and the Virgin Islands attended the meeting, including Peggy Olwell, the CPC manager of conservation programs, and myself.

Puerto Rico is one of the five priority regions of the CPC. The varied habitats of these regions make them home to the broadest diversity of plants. For this reason, CPC is focusing on Puerto Rico, along with Florida, Texas, California, and Hawaii, for its conservation efforts.

Three of the people attending the Task Force meeting represented 130 years of combined experience in Caribbean botany: George Proctor of the Puerto Rico Department of Natural Resources, Roy Woodbury, an eminent teacher of botany, and Henri Alain Liogier of the University of Puerto Rico Botanic Garden. These distinguished scientists shared their vast store of knowledge with the next generation of Caribbean botanists at this meeting. It was also exciting to see the flow of information from botanists working in other regions to botanists who have spent more time in Puerto Rico.

The meeting reviewed the list of priority species compiled at the first PR/VI Task Force meeting in 1989 and assessed the biological priorities for rare plant species in Puerto Rico and the Virgin Islands. Of the 62 species previously identified as priority A, which could possibly go extinct within the next five years, 48 were determined to still be priority A at this meeting. Eighteen species were added to the priority A list.

Some species have become more rare since Hurricane Hugo hit the islands shortly after the last meeting in 1989. Other recurring threats to rare plants are development, mining, low plant population size, and lack of regeneration of many populations. The results of this meeting will be used to assist CPC to set priorities for adding species to the National Collection. CPC will also make recommendations to various government agencies and institutions to do more studies on the lack of regeneration of many of the plant populations and to do further surveys to determine more accurate distributions of these species.

The third day of the task force meeting was devoted to a field trip to Guajataca Gorge in the Isabela area. Here we got a wonderful view of the northern coast of Puerto Rico and saw some beautiful coastal forest on the limestone cliffs. We saw some of the important species discussed during the meeting, including *Ottoschulzia rhodoxylon*, which is no longer known to set seed.

During the trip Peggy Olwell had several meetings with local university and government institutions to work on cooperative relationships. Currently Fairchild Tropical Garden in Miami is collecting and maintaining specimens of some of the top priority Puerto Rican species for the CPC National Collection. The Center, Fairchild, and the botanists of Puerto Rico agree that this collection should be housed in Puerto Rico, and Peggy was searching for institutions to work with CPC.

The week following the meeting George Proctor and Roy Woodbury led Carol Lippencott of Fairchild Tropical Garden, Richard Moyroub of Gemini Garden, and me to locations of several priority species. We were amazed that George and Roy were able to guide us unerringly to the spots where these plants grow, although in some cases they had not visited the site for over thirty years. Of the twenty species Carol was interested in collecting for the Center's National Collection, we failed to find only three. For example, neither George nor Roy knew of a current location for *Cordia rupicola*. Our trip to Puerto Rico was a very successful meeting and collecting trip, made so by the expertise and cooperation of all the people who attended.

Mark Richardson, curator of living collections at the Australian National Botanic Gardens in Canberra, visited the Garden at the end of September as part of a tour of the U.S. On September 27 he gave a lecture at the Kemper Center on "Diversity and Conservation of the Australian Flora." Richardson is a co-founder of the new Australian Network for Plant Conservation, a national program modeled on the Center for Plant Conservation here at the Garden. Left to right: Don Falk, director of CPC; Mark Richardson; Steve Cline, manager of the Kemper Center.

125

The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Swinburne Street
Conanicut Island
R.I. 02835 U.S.A.

August 1, 1991

Dr. Gillian Cambers
Ministry of Natural Resources
Government of the BVI
Roadtown, Tortola
BRITISH VIRGIN ISLANDS

Dear Dr. Cambers:

Enclosed a paper on Anegada butterflies. I have sent two copies to Louis Potter--one for the library. I can get more.

The beautiful new Calisto butterfly was first discovered by Dr. Scott Miller on a Guana--sponsored trip. Both endemic species are from the area we hope will be designated a National Park. They add greatly to the potential value of conserving this part of Anegada in a natural state (or returning it to that condition as much as possible).

I hope to return for our annual scientists' month on Guana on or about 4 October. My time last year was cut short by my mother's death and my father's need for my presence and care. He is happily in England now with our cousins.

I hope we can get together in October and discuss many topics relative to the future of this Agency's involvement in science and conservation in the BVI. I admit that I do not understand the Government's (or the people's) view or programs in this area. I do not know what your role or goals are. I do not know what is happening with the Community College... Of course I cannot expect to know these things from afar, but I had hoped Lianna Jarecki would make more contract and find out more on my (this Agency's; all the Guana-sponsored scientists') behalf. Maybe she will yet.

I have perhaps overly optimistic hopes that this Agency will synergistically combine efforts with a dynamic College on the one hand and an effective National Parks Trust on the other--and do grand things. However, I am now 52 and have

spent a great deal of time over the last decade on the BVI relative to other projects (and a huge amount on the Antilles as a whole since 1957). Compared directly to the results of my much lesser efforts in China, Indonesia, and the Philippines, and Hawaii, my achievements in real conservation in the BVI have been small indeed. I have not succeeded in changing anything relative to exotic species removal--the cornerstrone of my 1980 recommendations--or significantly increased parks and protected areas (so far I regard Anegada as the signal failure), or managed to get any endangered species protection legislated, or even seen any significant improvement in enforcement of the paltry laws that already exist.

Except for Guana, because it is privately owned, I see no significant progress at all. If I can single out any reason for this--some factor which makes the BVI different from other places--it is the presence in all those other places of universities, scientific institutions, and--therefore--colleagues. There being no significant conservation issues at stake on Conanicut Island (where I legally reside), I shall forever be a foreigner wherever I go and attempt to pursue my profession. That includes all the interesting and valuable conservation "hot spots" on Earth, including the BVI. So, I have to forge ties to some individuals or groups within local communities. How can I do this in the BVI? Would the rest of my life's efforts not be better spent elsewhere?

Would you be interested in coming to Guana for a day or two--including perhaps an overnight--to discuss "The future of biological conservation in the BVI"? Perhaps we should invite Louis and Mr. Shirley and others--make a regular conference of it.

I look forward to seeing you again in October and perhaps hearing from you meantime.

With best wishes,

Jim Lazell

James D. Lazell, Ph.D.

JL/rld

The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Swinburne Street
Conanicut Island
R.I. 02835 U.S.A.

August 1, 1991

Mr. Louis Potter
Ministry of Natural Resources
Government of the BVI
Roadtown, Tortola
BRITISH VIRGIN ISLANDS

Dear Louis:

Enclosed are two copies of an important paper that should help with the Anegada National Park project. The beautiful new Calisto butterfly was discovered by Dr. Scott Miller on a Guana-sponsored trip. Both of the new species--found nowhere on Earth except Anegada--are known only from the proposed Park area. I am sending another copy to Dr. Cambers. Please give one of these to the library. I have (or can get) more copies if you need them. You can xerox all you want too, but the photos do not come out so well.

I feel out-of-touch with events, and look forward to getting back in early October. I had to rush away on 9 November last year, and have cared for my invalid father, 87, since that time when my mother died. Now he is in England with our cousins there, so I can get back in the field again.

What has become of the Community College? That is a rhetorical question--no need to write--I'll find out when I get there. All the Guana scientists are interested in working with the College staff to one degree or another. Perhaps 1991-2 will be the year to get something going.

I look forward to getting back on or about Friday, 4 October.

All the best,

James D. Lazell, Ph.D.

JL/rld

Received at TCA, RI,
29.xi.91

Dear Henry and Gloria,

While you were on Guana during science month, you (Henry) asked me if I would write up a description of what I thought "Science Month" should be like. I have thought at length about this, and I have talked to Skip regarding his goals for science on Guana. Skip and I are in general agreement that Guana has immense potential for scientific research as well as for conservation and education, and we would both like to see this potential developed to its fullest. However, within the constraints of science month as it has existed for the past several years, there is little further that could be done here without further support from both you and others involved in running the hotel. Skip and I disagree on some specifics but, all in all, I believe compromises would not be difficult. Some of the present limitations of Science Month reflect Skip's inability to spend more time on it than he does. I would be willing to dedicate much of my time to developing scientific/ conservation/ educational activities on Guana. It is likely that I will have the opportunity to live and work on St. John for the next couple years; in which case, I will be able to spend my weekends on Guana continuing research, conservation, and education efforts and developing new programs. Your interest in continuing your strong support for such activities on Guana will be a major deciding factor in whether I accept or reject the job I have applied for at the National Park on St. John (if, in fact, I am offered it). If I am not offered this job, I would still like to implement some of the programs I have in mind, although I will not be able to commit as much time to Guana as I would if I were working in St. John.

Following this letter is an outline of problems, changes, and additions that I feel would greatly benefit the scientific program on Guana, as well as some questions regarding the future of the Guana Island Wildlife Sanctuary. Many of these changes are reactions to problems experienced either by Skip and other scientists involved in science month, problems experienced by Fred and me during our tenure, or problems that you and/or Gloria have expressed about scientists and their activities. I did not describe specific programs that could be developed on Guana, as those chosen will depend upon mutual priorities.

I. Problems with Science Month and their potential solutions:

a. Not enough diversity of subjects studied; there is a disproportionately large number of herpetologists and their assistants

suggestions:

Constraints imposed by HJ: # people # bedrights

1. Expand the marine program; encourage ecological/behavioral studies (see problem c.).

2. Field assistants should not be brought in just for specific projects, but instead should help with all projects, if possible, and they should be encouraged to view the experience as educational experience.

b. Many individual projects do not seem to be well planned or goal-oriented. I make this judgement based only on my impressions, which may be biased by insufficient communication or cohesiveness among Science Month participants, resulting in ignorance of each others research plans. However, the judgement is also based on the paucity of published scientific papers dealing specifically (not tangentially) with research done on Guana.

suggestions:

1. Individual research projects should be formalized: principle investigators should be required to write proposals for their work on Guana indicating specifically what will be needed (in terms of time, equipment, transportation to other islands, etc.), how long the study will take, and what will be accomplished. This will give us a means to maximize efficiency of research here; i.e. it will eliminate the need to wonder whether some scientists are here on vacation or not.

2. All participants working on a particular project should give a presentation or slide show during Science Month describing their work on Guana. This will help communication between participants in that many will be looking out for critical observations for each others work, and this can greatly enhance success. In general, greater communication will strengthen cohesiveness and cooperation among participants, and perhaps even between managers/staff and participants.

c. There are too many museum-based scientists (specimen collectors) working on Guana. I have no objection to some museum-types, and I am personally very interested in systematics (the field most museum scientists are in). However, I feel that collection for systematic and biogeographical purposes should be limited to those groups that are highly diverse and as yet not well known, such as insects. I discourage further emphasis on herp (reptiles and amphibians) collecting, as they have been collected extensively from Guana for the last ten years, and they are one of the least diverse groups present. Recently, further collection has seemed to serve only the purpose of spreading specimens to more museums.

suggestion:

Encourage ecological and behavioral projects.

problem:

Ecological and behavioral studies generally need to be conducted over long time periods, usually involving varying times of the year.

solution:

1. Extend science month to three months (whole summer), if possible.

2. Create opportunities for individual scientists involved in Science Month(s) to conduct research on Guana for short periods at other times of the year. A resident scientist (see section II) should be able to collect some data for ongoing studies other than his/her own.

3. Assign a room to serve as a permanent science laboratory (see section II) on Guana to provide facilities for year-round research.

d. Prior to Fred's and my tenure, conservation efforts were aimed at species re-introduction rather than protection and management of the existing native habitat. This is the reverse of logical order; the protection and maintenance of existing native habitat should be given priority over species re-introduction.

suggestions: Because Guana's habitat is already in fairly good condition, harmful exotic eradication and species re-introduction could occur at the same time, but:

1. Harmful exotic eradication should be given priority: sheep, invasive exotic plants, cats, and rats should all be the focus of serious, long-term eradication efforts, although each can be approached as individual projects.

2. The introduction of exotics should be terminated. If it is **absolutely** necessary to bring in exotic plants for horticultural or agricultural purposes, then the species brought in should be **non-invasive** and should be planted only in cultivated areas (e.g. not along the path to Ralph's house or behind North Beach).

Planting of exotics should be kept to a minimum and should eventually be replaced by planting native species cultured in the native plant nursery.

3. All re-introductions of animals or plants should be preceded by a thorough investigation into the behavior and ecological interactions of the introduced species, and a protocol for re-

establishment should be drawn up with the advice of experts in the husbandry of the particular animal or plant.

4. All re-introductions of animals or plants should be followed by marking the parent individuals and offspring, if possible, and by tracking their behavior, distribution, and ecological effects on Guana and also on other islands if and when they disperse.

5. Build a permanent nursery for rare and native plants on Guana. This nursery will serve the horticultural needs of the hotel as well as reforestation needs in overgrazed or sensitive areas in Guana's forest. It could include all rare plants native to the Puerto Rico-Virgin Island bank, including those species that are not known from Guana. These rare plants can be increased in number, thus increasing the chances of species survival, by planting them both on Guana and other islands. We may also consider donating cultivated native plants to reforestation efforts initiated by the BVI government in their parks. George Proctor has expressed willingness to collect seeds from rare plants in P.R. and surrounding islands for this nursery if it were established, and Gary Ray has expressed willingness to oversee its construction/ development and maintenance. Fred, time permitting, would be most willing to donate his time and expertise to helping establish such a nursery. For day to day maintenance, either a gardener, resident scientist, or both would have to be responsible for watering and weeding, etc.

e. Some scientists involved in Science Month are not good field workers. This may be a harsh criticism, but one can't deny that younger, agile, dedicated naturalists get a lot more work done than older, less ambitious naturalists. Also, I feel that the practice of drinking alcoholic beverages every evening is not only unnecessary but unproductive.

suggestions:

1. Invite a mix of younger scientists and older ones, but be sure that they are physically able to do the work they propose. I have very specific examples of the right and wrong people for Guana's science month, but I don't want to get too personal. I particularly object to inviting certain people for "political" reasons. Graduate students are generally good targets for younger, more energetic and ambitious additions to Science Month.
2. Discontinue open bar service. Provide alcohol for group parties,

such as on Saturday nights or special occasions. This form of alcohol availability will discourage habitual drinking and encourage infrequent social drinking, and an occasional party will enhance group spirit.

f. During active science months, the recent managers have attempted to run Guana as a hotel rather than as a research facility.

suggestions:

1. Serve meals at times convenient for scientists; e.g. earlier breakfast to maximize productive daylight hours.
2. Vehicles, phone lines, etc. should be available for scientific business when needed.
3. In general, managers should recognize that the scientists are on Guana to work and need their support. The attitude that scientists are only here as an excuse to be on vacation and are a burden to the hotel creates a very unproductive environment in which to work.

g. Guana's scientists do not interact enough with the BVI government.

suggestions: Establish programs for the BVI through Science Month.

1. Form a heritage program in cooperation with the U.S.-based Nature Conservancy.
2. Push the protection of Muskmelon and White bays and cooperate with coral reef monitoring programs implemented by the conservation office (I have already started doing this).
3. Create an intern program during Science Month in which a couple Tortolan students, preferable at the college level, can be exposed to field research and assist in a variety of projects.
4. Pursue international grants for conservation in the BVI, as suggested recently by Peter Chaboura.

h. Scientists on Guana are taking more than they are giving.

suggestions: There are many ways that scientist can benefit, or give something back to, Guana and the BVI in general. Most scientists are quite willing, if not eager, to do so, but they lack the proper channels. We should establish programs in which there are obvious and convenient ways for visiting scientist to donate their time and knowledge for the benefit of Guana and the BVI. For example:

1. Participants with connections to educational/research facilities may be able to donate books and/or equipment to Guana's museum and science laboratory (Margaret and Skip have already donated such materials)
2. Core scientists should be used as a resource for information about the ecological impact of hotel/human activities on Guana

and elsewhere in the BVI.

3. Participants can present demonstrations created in the travelling display program (proposal submitted previously) to schools on Tortola.

4. Science Month participants as a group can participate in conservation efforts when massive manpower is needed. This occurred during October when many participants helped carry buckets of water into the forest to water the parched *Sida* saplings.

5. Participants who photograph wildlife can contribute to the natural history slide collection, which I am in the process of compiling and categorizing.

6. Each year, participants can give a one-day symposium, arranged by the National Parks Trust, to the general public (this has been done in previous years, and L. Potter and G. Cambers expressed interest in having one next year)

7. Scientists publish papers relating to Guana...obviously this is already the main goal of science month, but I included it for completeness.

8. Scientists can conduct biological surveys of B.V.Islands to establish a heritage program (see problem g., suggestion 1).

9. Scientists should be asked to write keys to particular groups of organisms on Guana for use in species identification. They should also write up summaries of their studies and results, so that a "proceedings of Science Month" can be included in the library (akin to the Guana Report, but more comprehensive and for general review).

II. Resident scientist and permanent laboratory

A competent, well-rounded, and physically active resident scientist with good communication skills would be an indispensable asset to science/conservation activities on Guana. A position for such a person on Guana should be established with adequate funding for his/her research and for maintaining ongoing science programs, and we should seek to keep this position filled at all times. The resident scientist could care for the museum, library, and scientific equipment, oversee the daily care of the native plant nursery, coordinate visiting scientists, interact with the BVI government, collect essential data for ongoing research projects throughout the year, lead hikes or other naturalist activities for guests, conduct

her/his own research or conservation project, and maintain an active science laboratory for the use of all visiting scientists.

III. Questions I have about the future of science and conservation on Guana:

a. Do you plan to continue support of science and conservation on Guana indefinitely?

b. Do you wish to eventually develop a year-round scientific field station/educational laboratory on Guana?

c. How much more building will occur on Guana, and will building be restricted to the club hill?

d. Will you commit to protecting Guana's natural resources? E.g. stop mining sand from North Beach.

e. Will you ensure long-term legal protection of Guana?

I hope I haven't turned you off by being excessively demanding, trying to establish rules and illicit promises, etc. In some instances, I found it impossible to be unbiased and open-minded. Much of it involves my personal opinions or other people's personal opinions, and many points can and should be argued. I in no way mean to imply that the work that has so far been accomplished on Guana or the efforts towards conservation have been unimportant, but I do feel that, at present, science is Guana Island Hotel's hobby. Although this is certainly the more monetarily profitable situation, I firmly believe that it is in the Jarecki family's best interest to run Guana as a wildlife Sanctuary and second residence of family members, with the hotel business as a hobby. I could expound at length the benefits of managing Guana as a *bona fide* wildlife sanctuary, but this article is perhaps too lengthy already. I also realize that many of my suggestions for documentation and follow-up research of conservation projects may seem unnecessary and time-consuming. However, Guana Island has the potential to conduct conservation programs at a level of sophistication and efficiency well beyond that of many other islands and mainland parks. For this reason, I feel that proper documentation and research in our programs is absolutely necessary so that others can follow our example, learn from our mistakes, etc. In effect, we will be leaders in the field of conservation, particularly in the Carribean, and we will be discovering knowledge that can only be passed on through proper documentation and publication. That is, we should function to inspire a scientific community beyond the confines of Guana Island and the influence of Science Month participants.

Liana

Skip 127

December 4, 1991

Dr. Henry Jarecki
Byewood, Timber Trail
Rye, NY 10580

Dear Henry:

Skip showed me Lianna's letter to you re. Science Month. Skip showed me his responses as well but I wanted to add comments about subjects he didn't address. I agree with much of the substance of Lianna's letter though she sounds somewhat disillusioned by things which don't bother me. I think her ideas concerning increased information transfer between scientists are good. I do not believe increasing restrictions on scientists will improve the environment or productivity, however. I feel that most are not taking advantage of the situation; I think they just enjoy their work and the chance to socialize with their peers.

I was not in agreement with the "old and slow" comments. Not to sound overly loyal to any old-timers I might care about but, these folks are frequently walking encyclopedias: an inspiration to younger workers. Let the golden retrievers of the science world bound ahead, and circle back with what they've found. Bringing results to the older, more experienced and, granted, more sedentary biologist often generates exactly the type of interchange of ideas Lianna is looking for. Further, as I recall, one "old sage" has recommended most of the programs that the younger set is feverishly undertaking.

Skip did not address the comment I felt most strongly about, however. Lianna notes (p. 2) a "paucity of published scientific papers dealing specifically (not tangentially) with...Guana." Having been accused of being an "Anegadaphile" (someone truly not dedicated to research on Guana) I would like to suggest that lack of specificity may be a healthy thing. Restricting research efforts to Guana will not undermine "discovery-phase" projects (e.g. entomology or botany where new species are still being found on the island), or self-confessed small-scope studies (e.g. anecdotal ecological observations or localized terrestrial or marine experiments). A policy of decreasing or eliminating our ability to compare island systems, however, will decrease the relevance, utility, and significance of any documents generated.

Biogeography, for example, is an old and still highly-active branch of ecology. It has based its tenants on inter-island comparisons of hertepological community structure. If you had to list the five biggest topics in Ecology over the past thirty years this would be one. If we limit research to Guana-based projects we would no longer support biogeographic research. Gee, I really think we should keep our hand in. We may have to tolerate a few "museum-types" however.

In my particular case, should I have limited my work to iguanas to on Guana Island, my results would have been irrelevant to conservation and preservation of iguanas on Anegada where there is a problem with declining numbers. The life history of the two populations is completely different: they do not eat the same things or live in the same places. Because I was able to *compare* their natural histories, however, I found evidence that stock animals compete with iguanas on Anegada. Further, by comparing Guana iguana response to Anegada iguana dietary items this fall I've determined that the diets of iguanas on Anegada are low-quality. Working on either population alone, I would still be guessing what the problem was. In large part it was the comparative study which is yielding the management plan for the BVI's iguana.

One of the good things about the long-term support scientists have received from the Guana Island Sanctuary is that we have the time and ability to work on and say something about the Virgin Islands, not just one cay. Limiting our ability to study the VI archipelago will limit the significance of our work. This will, in the end, work against the goal of increasing our involvement with other BVI scientists who will regard us, predictably, as too insular.

Yours,

Numi C. Goodyear, Ph.D.
Research Biologist

The Conservation Agency

Exploration, Education, and Research

President
James D. Lazell, Ph.D.
401-423-2652

6 Shinnecock Road
Conanicut Island
R.I. 02835 U.S.A.

Dr. Henry Jarecki
Byewood, Timber Trail
Rye, NY 10580

Dear Henry:

Lianna's undated letter of late November to you and Gloria is utterly different in tone and substantially different in content from her conversation with me on Guana in October. While I strongly agree with most of what she says therein, it is apparent that she simply knows little or nothing of the history of the project or the constraints put upon me.

To wit:

- Restriction to about 400 bednights.
- Termination of my marine project for reasons of insurance.
- Roles and accomplishments of field assistants
- Existing administrative procedures and policies (which Fred and Lianna sought to short cut).
- The value of herpetological research; the reasons for its disproportionate value; and the enormous amount that remains to be done.
- Seasonal restrictions placed on our research.
- The fact that it was me, published in 1980 and continuing ever since as loudly as possible, who advocated removal of sheep, cats, and other exotics. Fred and Lianna may have finally persuaded you, but they did not bring the light of new logic and wisdom. They are Johnny-come-latelies to the problems of habitat conservation and exotic removal.
- The facts that every planned species restoration has always involved exactly what Lianna implies is missing: planning by the foremost experts - except some of the plant introductions carried out by Fred and Lianna.
- The fact that I have tried repeatedly to adjust mealtimes, and succeeded under Mary and Paula.
- The fact that an intern program has traditionally existed, but could not during the time (October) when school is in session.

I intensely dislike being put in a defensive role, but given the facts that almost all of what I say and do gets

forgotten from year to year, I do feel I have to set the record straight.

I firmly believe Lianna is my basic ally in advancing science on Guana, but I think she has an enormous amount to learn in practical terms about funding, administrative time, inter-personal relations, the processes of converting scientific data to published papers, and what I actually do when not on the island.

See You Saturday.

All the Best,

James Lazzell

The Conservation Agency

Exploration, Education, and Research

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6 Swinburne Street
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15 March '92

Sara Oldfield
The Old Plough
2 Caxton Road
Great Gransden, Nr. Sandy
Beds SG19 3BE, UK

Dear Sara:

The Conservation Agency, in cooperation with the National Parks Trust of the British Virgin Islands and the Guana Island Wildlife Sanctuary, has made signal advances in the last few months.

James Lazell, reporting in the Puerto Rico Departmento de Rucursos Naturales Publicacion Cientifica Miscelanea No.1 (1991) claims successful reintroduction of the stout iguana (Iguana pinquis) to Guana Island, where the species had been extirpated by 1930. The present Guana population is thriving and hatchlings have been documented annually now since 1985 (see also BBC Wildlife Magazine vol. 4, no. 12, p. 622, 1986).

The Bermuda Aquarium, Natural History Museum, and Zoo, has donated 20 Caribbean flamingos (Phoenicopterus r. ruber), including several proven nesting pairs, for restoration efforts for this species no both Guana and Anegada Islands. The flamingo lift, requiring chartering of a private jet aircraft, was completed in March 1992. The flamingo release featured a celebration presentation with representatives of all the conservation organizations involved and BVI government dignitaries.

World Wide Fund for Nature (WWF)-UK has funded The Conservation Agency to work with the BVI National Parks Trust to develop a real National Park on Anegada - with iguana and flamingo as centerpiece species - and manage for both wildlife and ecotourism. Anegada harbors nesting populations of several rare birds, including snowy plover and several terns, several endemic plants, and two newly described, endemic butterflies: Calisto anagadensis and a tawny skipper Copaeodes eoa (Smith, et al, 1991. Bulletin of the Allyn Museum 133).

Restoration plans for white-crowned pigeon, West Indian whistling duck, and Puerto Rican woodpecker to the British Virgin Islands are in progress.

All the best,

James Lazell

FORUM NEWS

CONSERVATION NEWS 6 NGO FORUM FOR THE UK DEPENDENT TERRITORIES FEBRUARY 1992

PROTECTED AREAS SYMPOSIUM IN BRITISH VIRGIN ISLANDS

A Regional Symposium on Public and Private Cooperation in National Park Development was held in Tortola, British Virgin Islands, in August 1991. Mrs Rosamund DeRavariere, the recently appointed Director of the National Parks Trust sent this account of the meeting:

The BVI National Parks Trust celebrated its thirtieth anniversary in 1991. Over the years the Trust has managed, conserved and promoted designated natural and cultural areas, terrestrial and marine, in ways that contribute to the improvement of the quality of life in the British Virgin Islands. With more parks and protected areas either being declared or proposed and the increased need for the ecotourism product to be developed and marketed in a sustainable manner, the focus of the thirtieth anniversary celebrations was education and public awareness.

In this context the regional symposium to plan a strategy for involving the private sector in parks development was held. The symposium allowed many respected Caribbean conservationists and environmentalists to share their successes as well as their thoughts on the promotion, protection and management of the green heritage.

The programme was very successful in meeting its objectives which were:

- to share information regionally on public and private cooperation in National Parks;
- to promote awareness locally and regionally of national parks and particularly those of BVI;
- to initiate a strategy for encouraging public and private cooperation in park development in the sub-region.

40 people participated in the symposium and papers were presented on parks in a regional context, marine parks, economic aspects of park development, case studies in park management and parks in the British Virgin Islands. Symposium organisation and administration was carried out by Dr Gillian Cambers, Conservation Officer, BVI. The project was jointly sponsored by the British Virgin Islands and Canadian Governments. Proceedings of the symposium are available (see *Recent Publication*).

RECENT PUBLICATION

Proceedings of the regional symposium on public and private cooperation in national park development. BVI, National Parks Trust. Price US$15 plus postage.

This report is a useful compilation of papers on various aspects of protected area conservation. Based on experiences within BVI and other Caribbean islands, the papers provide studies and general reviews which will have much wider application. Practical aspects of marine park management are covered alongside policy issues. Several papers look in detail at the ecology and biodiversity of important site within BVI. A paper by Fred Kraus, for example, describes a conservation project on Guana Island. This involves the removal of exotic, introduced species, and survey and re-introduction of endangered plant species - a local example of island conservation priorities which apply throughout the world. The proceedings are strongly recommended to all involved in island conservation.

The proceedings may be obtained from the BVI National Parks Trust, PO Box 860, Road Town, Tortola, BVI.

Richard Milner
and
Natural History

Gloria got Richard and me together, discussing an article on Guana, and a trip to Guana for Richard. We talked at length and decided the iguanas themselves make the best focus, and scientists' month in October the best time.

Natural History does not do conservation stories, so the flamingos will be mere trimming on the edges of any story we do. I have written an outline, and Richard wants part phased out and part expanded. Basically, he is most interested in evolution, speciation, and biogeography, less interested in ecology and behavior. Suits me fine.

Photographs will be critical. The idea would be to have me (author), Richard (editor), and photographer(s) on the island at the same time in October. Jan Soderquist, who did my original 1982 Guana photography, and her husband Gareth have applied for the job. Gareth is an excellent nature photographer. Jan specializes in close-up work. I think it all looks like a winning proposition.

Numi and I are planning radio-tracking, mark-recapture, and a morphological (scale count) study of Guana's 'guanas in October anyway. As plans progress I will keep you posted.

SODERQUIST
Photography

289 Essex Street
Beverly, MA 01915
508•922•2528

March 14, 1992

Skip Lazell
6 Swinburn St.
Jamestown, RI 02835

Dear Skip:

I understand that your team of scientists will be conducting their research on Guana Island this year during the month of October. You also mentioned that you have been approached by Natural History Magazine to write an article about iguanas and that there will be a need for professional photographs to accompany the article. Both my husband, Gareth, and I would love to get involved with the project!

As you already know, I have had an established photography business for about six years and have recently had several of my photographs published internationally. In fact, one of the publishers, a Swiss poster company, has invited Gareth and me to Switzerland in June to do some private sittings.

Gareth, as you are also aware, is an accomplished professional photographer with over ten years of experience. His photographs have appeared in numerous British publications, and over the years he has provided a significant body of work to Kodak and various stock agencies. His primary interest is in landscape and natural habitat photography. You have seen the quality of his work and have often commented that he could produce beautiful photographs of Guana Island. If Henry and Gloria would like to see samples of Gareth's work, he would be happy to send them some slides.

We would both be delighted to have an opportunity to work on Guana for about ten days. We would be able to provide our own round trip air fare. Our purpose would be to photograph extensively, Guana Island's wildlife and natural habitats, with special attention to its iguanas. Obviously, a selection of our work would be made available to both you and the Jareckis.

Hope to see you soon.

Regards,

Jan

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