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**ANNUAL PROGRESS REPORT  
WILDLIFE RESEARCH WORK UNIT  
DENVER WILDLIFE RESEARCH CENTER**

**Calendar Year 1968**

**WORK UNIT DF-103.3: Mammal Damage Control Research--Vampire Bats**

**PRINCIPAL INVESTIGATORS: Samuel B. Linhart, Raúl Flores Crespo,  
Richard J. Burns, and James R. Tigner**

**ABSTRACT: Personnel assigned to the Palo Alto station are Station  
Leader Linhart, Biologists Burns and Flores Crespo, Secretary M.  
Guadalupe Higuera, and Laboratory Assistant Luis Huerta.**

The station was activated in June 1968, and efforts during the subsequent several months were largely devoted to completion of office, laboratory, and animal facilities, acquisition of equipment, and planning. A large backlog of bat literature was reviewed, indexed, and information punched onto retrieval cards. A colony of vampires was established, a reference collection of study skins was begun, and a number of bats were shipped to the Denver Center for basic studies. Appropriate catalogs and forms were devised for future retrieval of data.

Contacts were initiated or maintained with the American Embassy, the Instituto Nacional de Investigaciones Pecuarias, the Departamento de Conservación y Propagación de la Fauna Silvestre, the UNDP-FAO group located at Palo Alto (also involved in rabies research), representatives from the WHO Oficina Sanitaria Panamericana, and other individuals and cooperators.

Appropriate safety precautions were drafted, approved, and put into effect. All personnel received safety instruction, immunizations, and X-rays.

Ten field trips, representing 109 man-days in the field, were made for orientation, to acquire familiarity with habitat and roost preferences of vampire bats, to gain proficiency in the use of collecting equipment, and to secure bats for the animal colonies at Palo Alto and Denver.

Four research studies were started; one was completed. The first, now in manuscript, tested the weight-lifting capacity in preparation for use of radio transmitters. We hope radio telemetry will help us gather data on movement, feeding behavior, and roost selection of vampire bats. The second and third studies relate to application of vampire control agents directly on livestock. The last deals with age determination and population dynamics of vampire bats.

One manuscript was prepared and submitted to Denver for editing and approval.

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## INTRODUCTION

The Vampire Bat Research Station, located at the Instituto Nacional de Investigaciones Pecuarias, Palo Alto, Mexico, was activated in June 1968. The objective of this station, supported by the Agency for International Development, is the testing and development of new techniques for controlling vampire bats, the principal vector of rabies ("Derriengue") in livestock throughout Latin America.

Activities during the period June-December 1968 included employment of personnel, construction and purchase of facilities and equipment, planning and coordination, field work, and initiation of four studies.

### Personnel

Station Leader Linhart arrived at Palo Alto on June 14. Biologist Raúl Flores Crespo and assistant Luis Huerta had previously been employed through arrangements with the Instituto. Biologist Richard J. Burns arrived from Denver on September 12, and M. Guadalupe Higuera was employed as secretary on September 9. No further additions to the staff were made during 1968.

### Facilities, Equipment, and Planning

Activities during the first several months largely involved completion of facilities, purchase of equipment, and planning. A large shipment of office furniture, laboratory equipment, and supplies was on hand upon Linhart's arrival. A second shipment was received 2 months later. Laboratory equipment was set up and calibrated. A fume hood, sink, and hot water heater were purchased and installed, and expendable laboratory equipment purchased. Stands and cages were constructed for the animal room and wall tiles and an electric heater were installed. A one-way mirror was placed in one wall to observe vampire behavior and activity. A cattle corral was modified for temporary use and an adjacent observation room was constructed to permit observations on the movement and feeding behavior of captive vampires. Eight Criollo x Cebu cattle were purchased for use in these and future studies. A 7-meter-square building was designed for holding cattle and vampires. Upon completion, this structure will serve as a bat flight room for observations of the feeding behavior patterns of vampires, and as a testing facility for use prior to limited field trials. Also included in this facility are a corral, a work shop, and a storage

area for trailers and livestock feed. A glass chamber was designed and ten of them were constructed to determine the feasibility of applying bat control agents directly onto livestock. Vampires will be made to crawl across treated strips of cowhide within the chamber to reach their feed, permitted to groom, and later killed to determine the quantity of chemical substances ingested.

A large backlog of bat literature was processed. Information was typed onto subject and author cards and appropriate subject breakdowns punched into subject cards to permit rapid sorting by genera and some 54 specific categories. The station library now contains 70 reprints dealing with vampires, an additional 554 reprints dealing with various aspects of bat behavior, ecology, taxonomy, etc., and approximately 1,200 subject and author cards representing individual references. Abstracts in English or in Spanish were also prepared for a number of pertinent papers.

All captive vampires in the animal colony were banded with BSW bands and pertinent data recorded in a master catalog. All mounted and preserved bats in the station's study collection were tagged with permanent labels and cataloged. A form and catalog were prepared in which to record various data relating to vampire densities, micro-climate, and collecting localities. Subsequent use of these data will enable us to arrive at the rates at which vampire colonies return to former density levels after control or disease outbreaks.

One hundred vampire bats, 90 alive and 10 in dry ice, were air freighted to Denver after obtaining the necessary export papers and customs clearance.

Three detailed study outlines were prepared by Biologists Burns and Flores Crespo. Considerable emphasis was placed on overall research problems, methodology, and assignment of priorities to specific study proposals.

Progress was delayed somewhat during July and August due to lack of funds.

#### Cooperators and Coordination

Considerable time was spent at the American Embassy making arrangements for importation of equipment from the States, obtaining information relative to personnel allowances, mail, health recommendations, and discussing pertinent matters with AID personnel.

Numerous discussions were held with the Director of the Instituto concerning personnel, maintenance and utilities for our facilities, and acquisition of equipment and supplies. Reimbursement to the Instituto for salaries paid to Mexican employees was a major problem due to uncertainty of administrative procedures for international reimbursement. It now appears that we must have an agreement between the Mexican Government and AID/Mexico. Dr. Pedro Solana, Instituto Director, and Station Leader Linhart are drafting the proposal. The desirability of contracting for a project consultant was also discussed.

Several meetings were held with the UNDP FAO group at Palo Alto regarding coordination of the two projects with respect to rabies research. An "Agreement of Cooperation" was drafted, approved, and signed by the Director of the Instituto, the FAO Project Manager, and the AID Station Leader.

A courtesy visit was made to Dr. Hernández Corzo, Director General of Wildlife, Department of Conservation and Propagation of Wildlife. Dr. Hernández Corzo was given a copy of our proposed studies and collecting permits were later obtained from this Department.

Discussions were held with three representatives from the WHO Oficina Sanitaria Panamericana. Dr. M.L. Kuns of that organization, located at the Centro Panamericano de Zoonosis in Argentina, is presently conducting research dealing with vampire bat ecology and control methodology.

A search for suitable field study areas was initiated late in the year. One ranch, owned by Mr. Malcolm Niven, is located near Ciudad Valles, State of San Luis Potosí, and appears promising as a site on which to conduct radio-telemetry studies. The area is free of rabies, has excellent facilities, a suitable topography, and the owner is keenly interested in research inasmuch as his cattle are constantly attacked by vampires.

### Safety

Detailed safety procedures were prepared as to the use and handling of chemicals and toxic agents, hazards associated with handling potential rabid animals in the animal colony and in the field, and the dangers of cave work and associated diseases. This information, along with a BSFW booklet on general safety practices, was translated into Spanish and incorporated into a notebook which was

read by all project personnel. An immunization record was compiled for each employee showing the date shots were taken, results of skin tests for histoplasmosis, and results of X-rays for evidence of the same disease. Appropriate bilingual signs were placed outside the animal room and chemical cabinet. The laboratory assistant was instructed in safety practices relative to the feeding and handling of captive vampire bats.

### Field Work

Ten field trips, representing 109 man-days in the field, were taken to the States of Morelos, Hidalgo, Puebla, Veracruz, Guerrero, Mexico, Oaxaca, and San Luis Potosí. These field trips were for the purpose of:

- (1) Orientation as to the general topography, vegetative types, and overall problems with respect to the rabies problem in Mexico and the development of control techniques.
- (2) Gaining familiarity with specific habitat and roost preferences of vampire bats.
- (3) Acquiring a working knowledge of various collecting techniques.
- (4) Collecting bats for the Palo Alto laboratory and for subsequent shipment to Denver.
- (5) Locating specific study areas in which to conduct short- and long-term field investigations.

Three general orientation trips were taken; one to the State of Veracruz on the Gulf Coast, a second to the State of Guerrero on the Pacific Coast, and a third south to the State of Oaxaca. During these and subsequent trips ranches experiencing vampire predation were visited, bitten cattle were observed, and a number of bats were collected.

The collection of vampire bats was concentrated in the State of Morelos, near the city of Cuernavaca, the site closest to Palo Alto where vampires are numerous and can be collected easily. Approximately 300 vampires have been collected for various studies or for shipment to Denver. Other species of bats were collected, at no additional effort, for the station's study collection or for use by cooperators. All field personnel have now acquired considerable experience in cave work and the use of the various techniques for collecting bats.

## RESULTS AND DISCUSSION

Four research studies were initiated during 1968:

1. Load lifting capacity of the common vampire (*Desmodus rotundus*).

This pilot study was designed to determine whether miniature radio transmitters could be placed on bats for studies of movement, feeding patterns, and roost locations of wild vampires. We studied the load-carrying capacity of vampires to guide the development of radio transmitters being built by electronic technicians at the Denver Center. The study has been completed and a manuscript prepared and submitted to Denver for editing and approval.

2. Feeding behavior of captive *Desmodus rotundus* and extent of body grooming after feeding.

The objective of this study is to determine whether application of vampire control agents to cattle offers potential as a control technique. We hope that sufficient quantities of a control agent can be made to adhere to the bat as it feeds upon cattle, and effective doses will be ingested by the bat during subsequent grooming. Data to support this theory include observations of: (a) movement of the vampire upon its prey, before, during, and after feeding, and (b) the extent of body grooming after a blood meal. The preliminary data are few and improved methodology must be developed before this study is resumed. The use of television cameras, sound-proof chambers, and conditioned animals is planned and should improve the quality of the data. Preliminary observations indicate that vampires thoroughly groom themselves during the interval between blood meals.

3. Recovery of fluorescent particles (FP) from the gastro-intestinal tract of vampire bats (*Desmodus rotundus*).

This study's objective is to use a fluorescent material to determine whether application of vampire control agents to cattle is feasible. Considerable time will probably elapse before receipt of potential vampire control agents from Denver for advanced testing. During the interim period, we hope to determine: (a) if FP, combined with certain carriers, can be made to adhere to vampire and later ingested while grooming, (b) the concentrations needed to insure that sufficient quantities are ingested, and (c) resistance of carrier agents, once applied to cattle, to weather and abrasion under field

conditions. We hope to find methods for quantitating FP and to develop techniques for recovery of FP from the gastro-intestinal tract of the vampire. Thus far, efforts at recovering and quantitating FP have been inconsistent and continuation of the study awaits further assistance from Denver-based chemists.

#### 4. Growth and age determination of vampire bats (*Desmodus rotundus*).

We are studying the growth rate of captive vampires and are looking for criteria which can be used to distinguish between juvenile and adult animals. At a later date, we will try to develop techniques for determining additional age or year classes. This information is needed to determine the rate at which vampire populations are able to maintain their numbers and the rate of recovery after control application. These facets of population dynamics will help us understand the epizootiology of the disease and define the success of control programs.

Additional data regarding tooth irruption, weaning, weight, lactation, and general health, have been recorded. Such information may provide criteria for age determination and may also permit comparisons between growth and development of captive young and those captured in the wild. Thus far, individual cases of abortion, suspected cannibalism, and twinning have been recorded. Twinning has not been previously reported in the literature.

#### PUBLICATIONS

Publications during 1968 were related, for the most part, to research conducted prior to activation of the Palo Alto station. They include:

Burns, R.J. 1967. Some related factors affecting a population of Uinta ground squirrels: 2. Agressive behavior. Bull. Ecol. Soc. Amer. 48:58.

Flores Crespo, R. 1968. Colección y estudio de *Solanum Schenckii* Bitt: su confirmación como verdadera especie. Agricultura Técnica en Mexico II(8):374-375.

Flores Crespo, R. 1968. Adelanto de la Ciencia Agrícola en Mexico. Informe de Labores del INIA. SAG 360-363/368-369.

Linhart, S.B. 1968. Dentition and pelage in the juvenile red fox (Vulpes vulpes). J. Mammal. 49(3):426-428.

Linhart, S.B. 1968. Review of R. Burrows, "Wild Fox." Submitted to the J. Wildl. Manage.

Linhart, S.B., H.H. Brusman, and D.S. Balser. 1968. Field evaluation of an antifertility agent, Stilbestrol, for inhibiting coyote reproduction. Presented at the 33rd N. Amer. Wildl. and Natural Resources Conf., Houston, Texas, March 11-13, 1968.

In addition, the following papers were presented at the Sixth Annual Reunion of the Instituto Nacional de Investigaciones Pecuarias, Palo Alto, Mexico, December 18-20, 1968:

Burns, R.J. 1968. Observaciones preliminares sobre el problema del control de murciélagos vampiros (Desmodus rotundus).

Flores Crespo, R. 1968. Experiencias preliminares sobre diferentes pesos que pueden soportar envuelo los murciélagos vampiros y su uso en radio-transmisores.

Linhart, S.B. 1968. Objetivos del Proyecto USAID "Investigacion de Vampiros."