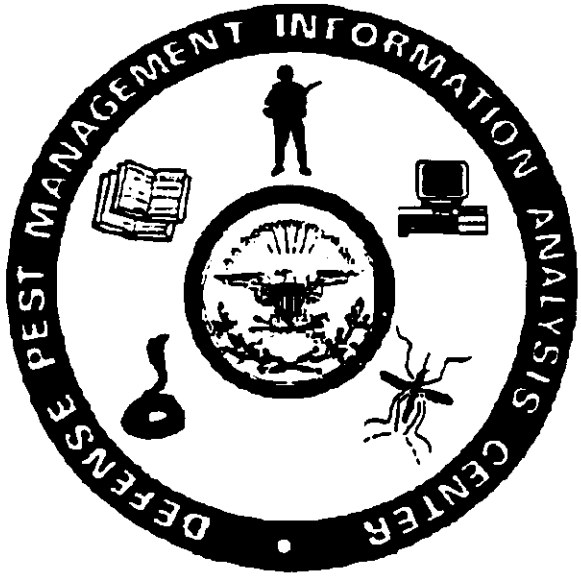
DISEASE VECTOR ECOLOGY PROFILE



HONDURAS

JULY 1992

ARMED FORCES PEST MANAGEMENT BOARD

DEFENSE PEST MANAGEMENT INFORMATION ANALYSIS CENTER

FOREST GLEN SECTION, WRAMC

WASHINGTON, DC

20307-5001

FOR OFFICIAL USE ONLY

PREFACE AND ACKNOWLEDGEMENTS

Disease Vector Ecology Profiles (DVEPs) are concise summaries of vector-borne and other militarily significant diseases that occur in specific countries. DVEPs focus on vector-borne diseases and emphasize essential epidemiology, vector bionomics, behavior, and pesticide resistance. Selected bibliographies of pertinent disease and disease vector literature are included.

DVEPs are not meant to serve as scientific documents but rather as synopses of relevant entomological and arthropod-borne disease information. They are complied from unclassified scientific literature, and are intended to provide a historical profile of arthropod-borne disease epidemiology in the recent past for selected geographical areas. The epidemiology of arthropod-borne disease is dynamic, and incidence and prevalence are constantly changing. This is especially true for Third World countries which are undergoing rapid development and ecological change, and those areas experiencing migrations of large refugee populations as a result of civil strife. These documents should be supplemented with recent information on foreign public health status and medical developments. Component medical department activities may have updated regional information for their areas of responsibility. Current disease risk assessment and additional information on other parasitic and infectious diseases, and other aspects of medical intelligence can be obtained from the Armed Forces Medical Intelligence Center, (AFMIC) Fort Detrick, Frederick, MD 21701 (301-619-7574, DSN 343-7511). Additional information can be obtained form the Navy Preventive Medicine Information System (NAPMIS), which maintains up-to-date Disease Risk Assessment Profiles (DISRAPs) and Disease Risk Assessment Profiles (VECTRAPs) on most countries of the world. DISRAPs and VECTRAPs can be obtained by contacting the Navy Environmental Health Center (NEHC) (804-444-7575 extension 456, DSN 564-7575 ext 456).

DVEPs are designed to complement documents obtained from AFMIC and NEHC. Every effort is made to make them as accurate as possible. Individuals possessing additions, corrections, or suggestions are encouraged to communicate this information to Chief, DPMAIC, for incorporation into future revisions. In addition to DVEPs, DPMAIC can provide bibliographic literature searches of its extensive database on pest management, medical entomology, pest identification and pesticide toxicology. DPMIAC can also conduct online computer searches of other worldwide biomedical databases. DPMAIC (301-295-7479, DSN 295-7479).

Acknowledgments: Individuals who have made significant contributions to this DVEP include CPT Leon Robert (data collection), Dr. Bruce Harrison (review), Dr. Edward Rowton (review), Dr. Richard Gorham (technical editing), CDR James Trosper (synthesis), Ms. Charlene Young (production), Mrs. Ola Tilghman (typing), and LTC John Gingrich (final formatting and rewriting).

TABLE OF CONTENTS

Introduction ---- 1

Map of Honduras ---- 2

Disease Risk Summary ---- 4

Malaria ---- 6

Dengue ---- 11

Venezuelan Equine Encephalitis ---- 14

Cutaneous/Mucocutaneous Leishmaniais ---- 15

Visceral Leishmaniais ---- 19

Filiariais ---- 22

Chagas' Disease ---- 23

Checklist of Mosquitoes ---- 28

Checklist of Sand Flies ---- 31

Arthropods of Medical Importance ---- 32

Plants of Medical Importance ---- 34

Hazardous Snakes ---- 35

Insecticide Resistance Data ---- 36

Personal Protective Measures ---- 37

Chemical Control of Pests/Vectors ---- 38

Selected Reference ---- 39

July 1992

HONDURAS

The Republic of Honduras, one of the five Central American countries, is roughly triangular in shape with an Atlantic coastline of 459 miles on the north. It is bounded on the northwest by Guatemala and southwest by El Salvador, on the south by 77 miles of the Pacific Ocean, and the south and east by Nicaragua. The total area is 43,277 square miles, making it the second largest of the Central American countries.

Honduras also has insular possessions, including the Bay Islands (Islas de la Bahia on maps), formed by the summits of a submerged mountain range. The Bay Islands consist of Roatan, Utial, Guanaja, Barbareta, Santa Elena and Morat and form one of the 18 departments of the country. One the Pacific Coast, 288 islands border part of an excellent harbor in the Gulf of Fonseca. Ampala, the former Honduran Pacific port, is located on El Tigre Island San Lorenzo is the current deep water port on the Pacific Coast.

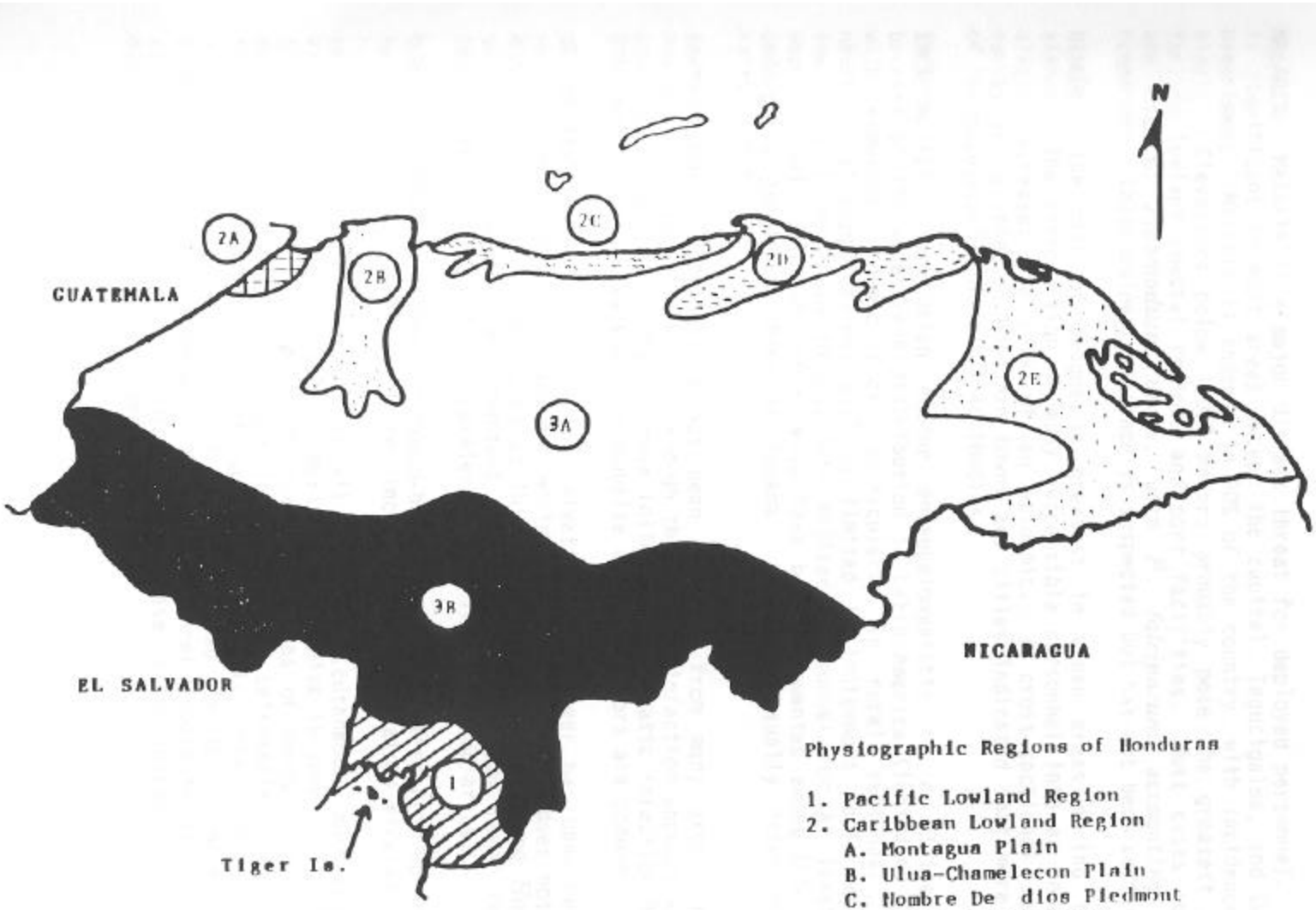
The topography is rugged and the most mountainous in Central America. The country is crossed from east to west by the Central American Cordillera. The only lowlands are the northern coastal plains, a very narrow southern coastal plain and the river valleys. The principal rivers such as the Ulua are in the north, and flow into the Caribbean. The Choluteca, Goascaran and Nacaome flow into the Pacific.

The population is approximately 5,261,000, with most people located in rural areas. The economy is based upon agriculture, most production being small-scale operations.

The climate varies with altitude. The average temperature in the coastal lowlands is 31˚C, at altitutdes of 1,000-2,000 feet, 29.4˚C, and at higher altitudes, 23˚C. Both mountain and coastal areas experience a wet seasons from -mid-April through October and a dry season from November through April. The northern coastal area and adjacent mountain slopes receive 175-250 cm of rain annually. Most rain comes in December and January along the Caribbean Coast.

About 45% of the country is covered with forests. In the eastern part of the country, swamps and lagoons are ringed with mangrove and palm forests, while inland there are extensive, open pine forests.


Honduras
International boundary
Departamento boundary
National capital
Departamento capital
Railroad
Road
0 25 50 75 100 Kilometers
0 25 50 75 100 Miles
Caribbean Sea
TURNEFFE ISLANDS
BELIZE
Belize City
Belmopan
Dangriga
Glover Reef
Big Creek
Punta Gorda
Gulf of Honduras
Isla de Roatán
Roatán
Isla de Guanaja
ISLAS DE LA BAHIA
Isla de Utila
Puerto Castilla
Trujillo
Puerto Cortés
Puerto Barrios
Tela
La Ceiba
Balfate
Tocoa
GUATEMALA
Puente Mendez
Los Amates
Gualán
San Pedro Sula
El Progreso
San Lorenzo
Olanchito
Pueblo Viejo
San Esteban
Dulce Nombre de Culmí
Puerto Lempira
Nuevo Arcadia
Santa Rosa de Copán
Santa Bárbara
Yoro
Salama
Juticalpa
Catacamas
Ausubila
Gracias
Siguatepeque
Cedros
Comayagua
Nueva Ocotepeque
Metapán
La Esperanza
La Paz
La Virtud
Concepción
Lepaterique
Tegucigalpa
Danlí
Benanza
Puerto Cabezas
San Salvador
EL SALVADOR
San Vicente
San Miguel
Sensuntepeque
Yuscarán
Santa Clara
Dipilto
Ocotal
Siuna
NICARAGUA
La Libertad
Usulután
La Unión
Nacaome
Pespire
Choluteca
Cholusecа
Condega
San Sebastián de Yalí
Prinzapolka
El Triunfo
Somotillo
Estelí
Jinotega
Potosí
El Sauce
Matagalpa
Río Blanco
Nuevo Amanecer
NORTH PACIFIC OCEAN
Chinandega
Corinto
León
Boaco
ATLANTIDA
COLON
COMAYAGUA
FRANCISCO MORAZAN
EL PARAISO
OLANCHO
GRACIAS A DIOS
CAYOS MISKITOS
LEMPIRA
INTIBUCA
LA PAZ
VALLE
CHOLUTECA
COPAN
SANTA BARBARA
YORO
COLON
Boundary representation is not necessarily authoritative.



Physiographic Regions of Honduras

1. Pacific Lowland Region
2. Caribbean Lowland Region
   - A. Montagua Plain
   - B. Ulua-Chamelecon Plain
   - C. Nombre De dios Piedmont
   - D. Aguan- Negro Plain
   - E. Mosquito Coast
3. Serrania Region
   - A. Northern Cordillera
   - B. Southern Cordillera

HONDURAS
DISEASE RISK SUMMARY

MALARIA: Malaria is a major disease threat for deployed personnel. The risk is significant in most areas except the Capital, Tegucigalpa, and Ocotepeque Department. Malaria is endemic in 90% of the country, with incidence varying widely. Elevations below 1,000 meters probably pose the greatest risk and include lowland coastal regions and port facilities. Most cases (over 90%) are due to *Plasmodium vivax,* with *P. falciparum* accounting for the remainder. Chloroquine resistance is suspected but has not been confirmed.

DENGUE: The risk of dengue is greatest in urban areas during the rainy season. The introduction of many susceptible personnel into an endemic area always increases the risk of an epidemic. A cross-sectional serological survey in 15 selected Honduran towns and cities indicated that more than 50% of the populace had dengue 1 antibodies.

ENCEPHALITIS: Venezuelan equine encephalomyelitis is a military threat because of its widespread distribution in Latin America (including Honduras), with numerous endemic foci, particularly in rural settings. Although neurological complications will be limited in indigenous adult populations, the acute illness can incapacitate military personnel for at least 1 to 2 weeks. Small outbreaks of disease have been documented among U. S. soldiers undergoing jungle training in Panama. Outbreaks usually occur during the rainy season.

Eastern equine encephalitis has been isolate from many areas in Central America including Honduras. Although the risk of infection appears to be very low, the overall case-fatality rate following symptomatic infection may exceed 50%, and serious nervous system sequelae among survivors are common.

YELLOW FEVER: Neither urban nor sylvatic yellow fever has been reported in recent years in Honduras, and the World Health Organization does not consider Honduras to be an endemic area at this time. However *Aedes* and *Haemagogus* spp. Mosquito vectors are abundant in Honduras. A yellow fever vaccination certificate is required for travelers coming from infected areas.

OTHER ARBOVIRUSES: Other arthropod-borne viruses isolated from Honduras which may produce mild febrile illnesses include Nepuyo and Patois viruses.

LEISHMANIASIS: Leishmaniasis in all its forms (cutaneous, mucutaneous and visceral) is present in Central America and the risk in some parts of Honduras is high. The El Paraiso and Patuca River areas of Honduras are considered hyperendemic areas for cutaneous leishmaniasis. Leishmaniasis can be a very focal disease associated with specific sand fly infestations in limited areas. Cases of leishmaniasis have occurred in U.S. forces stationed elsewhere in Central America. Medical personnel should be aware of chronic clinical signs of several forms of the disease, since suspected cases may not be identified until after a deployment

CHAGAS' DISEASE: Chagas' disease is a serious threat to indigenous populations in many rural areas of Honduras. The risk of infection can be greatly reduced by avoiding wattle, dab or adobe type construction with straw or palm thatch roofs which harbor the vector. The risk of infection in most military settings should be low.

RICKETTSIAL DISEASES: Epidemic louse-borne typhus has been a major cause of rickettsial disease in the highlands of neighboring Guatemala, and may be present in limited foci in Honduras. Sporadic cases of Rocky Mountain spotted fever and flea-borne (murine) typhus have been reported throughout Central America but are probably not significant disease threats.

FILARIASIS: Mosquito-borne filariasis is not a risk in Honduras. Infections with fly-borne *Mansonella* species may occur, but the course of infection is generally benign.

GASTROENTERIC DISEASES: Diarraheal diseases, caused by contamination of food of water with *Shigella*, *Salmonella*, *Campylobacter*, *Giardia lamblia* (giardiasis), *Entamoeba histolytica* (amebiasis and) and enterotoxigenic *Escherichia* coli, are the most important infectious disease threats. Poor sanitation increases the likelihood for acquisition of these infections. Filth flies may contribute to the transmission of these pathogens.

OTHER INFECTIOUS DISEASES OF POTENTIAL MILITARY IMPORTANCE: These include typhoid and paratyphoid fevers, acute respiratory diseases, menigococcal meningitis, sexually transmitted diseases, hepatitis A and hepatitis B, leptospirosis, tick-borne relapsing fever, acute hemorrhagic conjunctivitis, and tuberculosis. Details on these and other infectious diseases should be obtained from sources described previously.

MALARIA

INFECTIOUS AGENTS: *Plasmodium falciparum, P. vivax*. Mixed infections are not infrequent.

RESERVOIR: Man is the only important reservoir of human malaria, although higher apes may harbor *P. malariae* (this species doesn't occur in Honduras).

MODE OF TRANSMISSION: Bite of an infective female *Anopheles* mosquito, or blood transfusion from an infected person. Stored blood can remain infective for weeks.

CLINICAL FEATURES:

Incubation Period - Generally 12 to 14 days. Some temperate strains or *P. vivax* may have protracted incubation period of 6-10 months.

Symptoms - Acute febrile illness characterized by chills, fever, headache, sweating, muscular ache, and general malaise. Symptoms with *P. falciparum* malaria may be severe and include severe anemia, jaundice, renal failure, shock loss of orientation, convulsions, and coma. The case fatality rate for *P. falciparum* malaria may exceed 10% among untreated children and nonimmune adults. Relapses are common with improperly treated P. vivax and may occur irregularly for years. Chloroquine-resistant *P. falciparum* is suspected, but has not been confirmed

SEASONAL INCIDENCE: Malaria transmission occurs throughout the year.

GEOGRAPHIC DISTRIBUTION: Malaria is present throughout the country, including urban areas.

Figure 1 shows the risk of *P. vivax* malaria by health region in Honduras. The areas of highest incidence of *P. vivax* malaria occur in Health Region III (in the north) and Health Region IV (in the south). There is a moderate incidence of vivax malaria along the remainder of the Atlantic Coast (Health Regions VI and VII), and a low incidence of malaria in Health Regions I and II (southwestern Honduras). Malaria is rare in Health Region V, located in the extreme western part of the country. Based on malaria cases reported by the Honduran Ministry of Health, and the greatest risk of *P. vivax* malaria appears along both coasts and in the Nicaraguan border area.

Figure 2 shows the risk of *P. falciparum* malaria by health region in Honduras. In contrast to the incidence of *P. vivax*, the incidence of *P. falciparum* is greatest in Health Regions I and IV. The geography of these two areas is characterized by large mountain ranges with numbers fertile valleys. There is a moderate risk of *P. falciparum* malaria in Health Region VII. This region is sparsely populated and the health care system is the poorest in Honduras. The risk of P. falciparum malaria is low in Health Regions M* II, III, IV and V.

* Metropolitan Health Region includes the cities of Tegucigalpa and Comayaguela. The cases of malaria recorded from this region are believed to be imported. Natural transmission of malaria in this area is believed to be rare.

PREVALENCE/INCIDENCE: During 1988 a total of 421,474 Honduras were examined for malaria infection; 29,737 people were found to have parasites in the bloodstream. This represents 14% prevalence in the individuals examined. Only 405 people (1.4% of malaria cases diagnosed) were found to have *P. falciparum* or mixed infections. Reliable malaria incidence rates in Honduras are not available, due to the lack of active surveillance in the general population. Generally, malaria infections are identified in symptomatic people at health clinics or by vector control personnel. The following table shows the number of cases of *P. vivax* and *P. falciparum* infections in each health region in 1988:

HEALTH REGION	POPULATION	*P. vivax*	*P. falciparum*
M*	729,585	68	0
I	427,771	1,115 286	
II	342,213	977	23
III	1,366,789	10,971	16
IV	533,706	8,302	12
V	418,002	175	8
VI	537,058	4,549	242
VII	261,022	3,580	149

PRIMARY VECTOR:

Anopheles albimanus

Larval habits - Breeds in sunlit water impoundments including pools, lakes, lagoons, and small rain-filled depressions (hoofprints, wheel ruts). Frequently associated with floating vegetation, algal mats in unshaded margins of slow moving streams. Occasionally breeds in brackish water.

Adult habits: - Zoophilic and moderately anthropophilic. A significant proportion of females enter houses to feed on man. Resting sites include houses, sheds, rockpiles, and walls, bridge abutments and tree holes. Females are active throughout the night with biting activity peaking during crepuscular periods. Flight ranges normally about 1.6 km.

The inspect repellent DEET is relatively infective agaisnt this important malaria vector.

SECONDARY VECTORS:

Anopheles pseudopunctipennis

Larval habits - Commonly found breeding in pools of drying stream beds with surface vegetation. Usually occurs in mountain valleys above 200 m elevation.

Adult habits - Feeds on man and animals outdoors during the evening and night and indoors on man. Seeks shelter at dawn in houses and other resting sites. Observed flight range up to 6 km.

Anopheles darlingi

Larval habits - Breeds in shaded bodies of still water, reservoirs, ponds irrigation canals, swamps, rice fields, and stream margins.

Adult habits - Strongly anthropophilic and feeds readily indoors. Peak indoor biting activity occurs from 2400 to 0200 hours. Observed flight range 1.5 km.

PREVENTION/CONTROL: A combination of drug prophylaxis (chloroquine/primaquine in highly endemic areas according to recommendations of preventive medicine personnel) and anti-mosquito measures (such as bednets, permethrin-treated uniforms and DEET insect repellent) will prevent nearly all malaria where U.S. forces are deployed. Source reduction of mosquito vectors should also be practiced in cantonment areas.

FIGURE 1. RISK OF VIVAX MALARIA BY DEPARTMENT

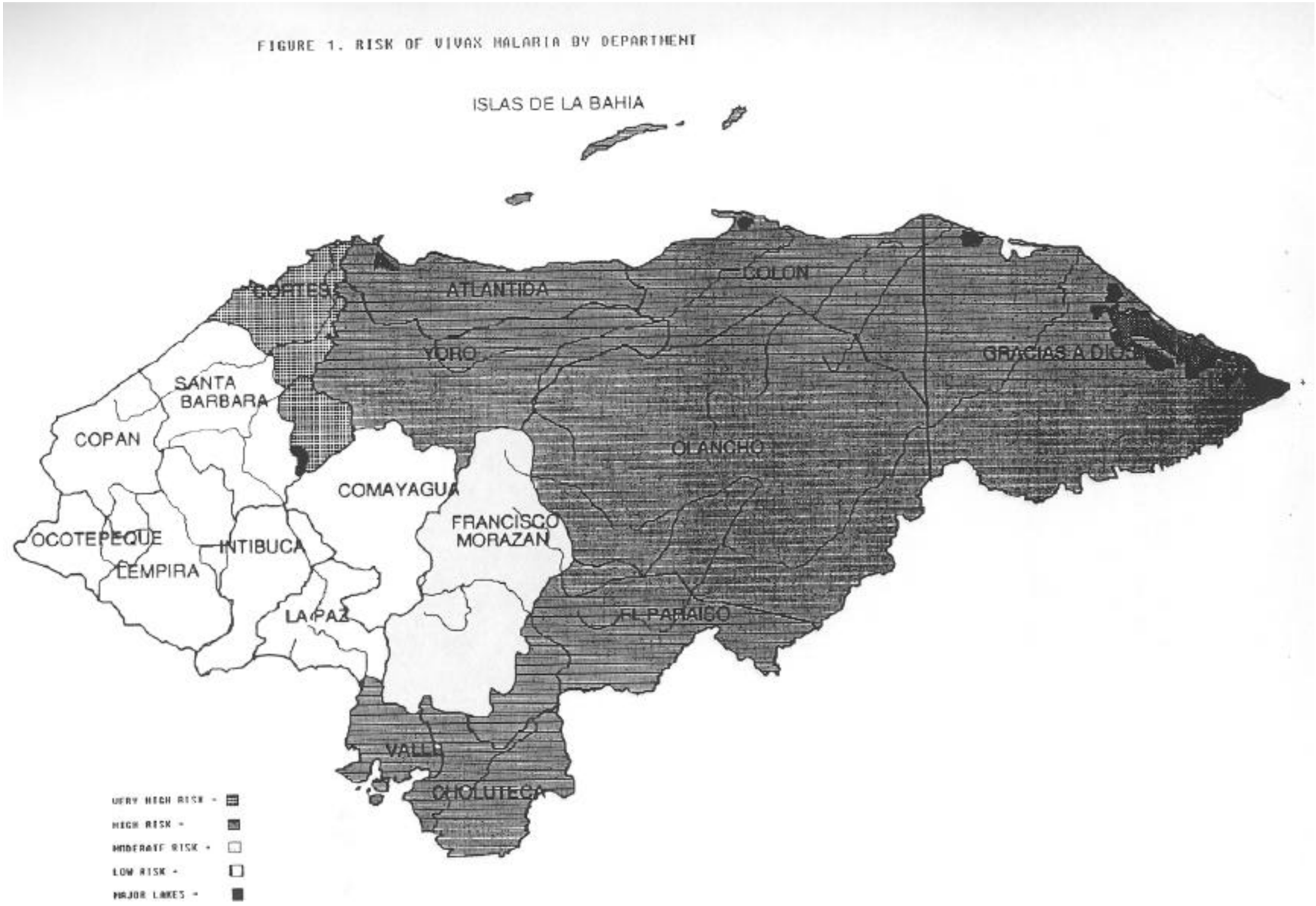
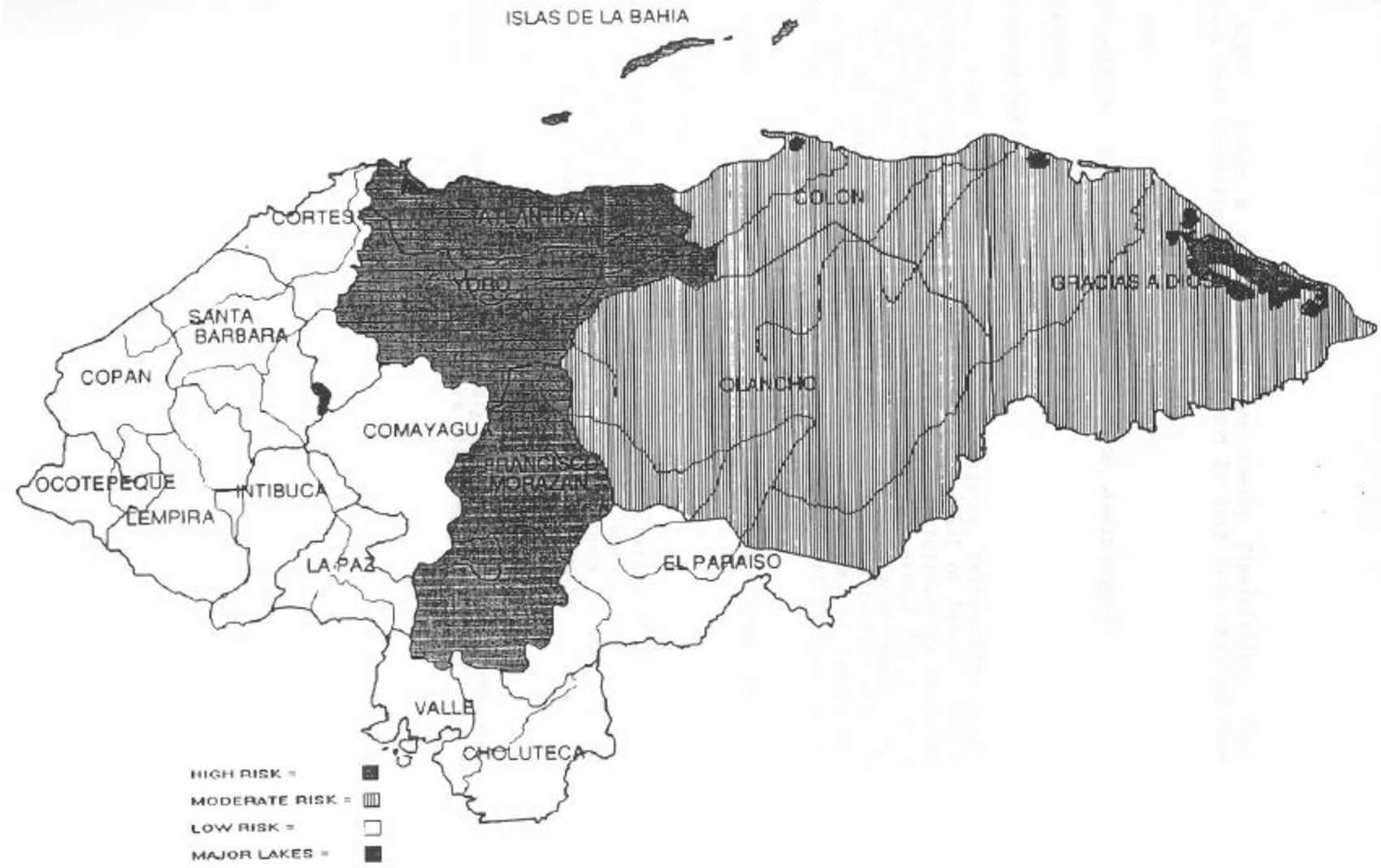


FIGURE 2. RISK OF FALCIPARUM MALARIA BY DEPARTMENT



DENGUE

INFECTIOUS AGENT: Group B arbovirus of the family Flaviviridae. Four serotypes have been identified. Types I, II and IV have been reported from Honduras.

RESERVOIR: Man.

MODE OF TRANSMISSION: Bite of infective mosquito, *Aedes aegypti*.

CLINICAL FEATURES:

Incubation period - 4 to 6 days.

Symptoms - Acute and sudden fever, intense headache, retro-orbital pain, joint and muscle pains, and rash (3 to 4 days after onset of fever). Dengue is a debilitating disease lasting up to several weeks, followed by prolonged fatigue and depression. Mortality is low (less than 2%) except for a severe and often fatal form of the disease, dengue hemorrhagic fever/dengue shock syndrome. DHS/DSS occurrence appears related to sequential infection with one or more serotypes of dengue; its incidence in Honduras may be increasing. Vaccines for the four strains of dengue are under development but are not yet available.

SEASONAL INCIDENCE: The incidence of dengue is greatest during the rainy season.

GEOGRAPHIC DISTRIBUTION:

Dengue is usually associated with urban areas, primarily in the coastal cities. The cities of La Ceiba, San Pedro Sula, Choluteca, and Isla de la Bahia have experience outbreaks in recent years. Figure 3 indicates the regions of Honduras at greatest risk for future dengue epidemics.

INCIDENCE/PREVALENCE:

The incidence of dengue fluctuate widely each year. During some years dengue is epidemic; in 1987, 8,300 cases were diagnosed. The number of cases is usually underreported.

VECTORS:

Aedes aegypti

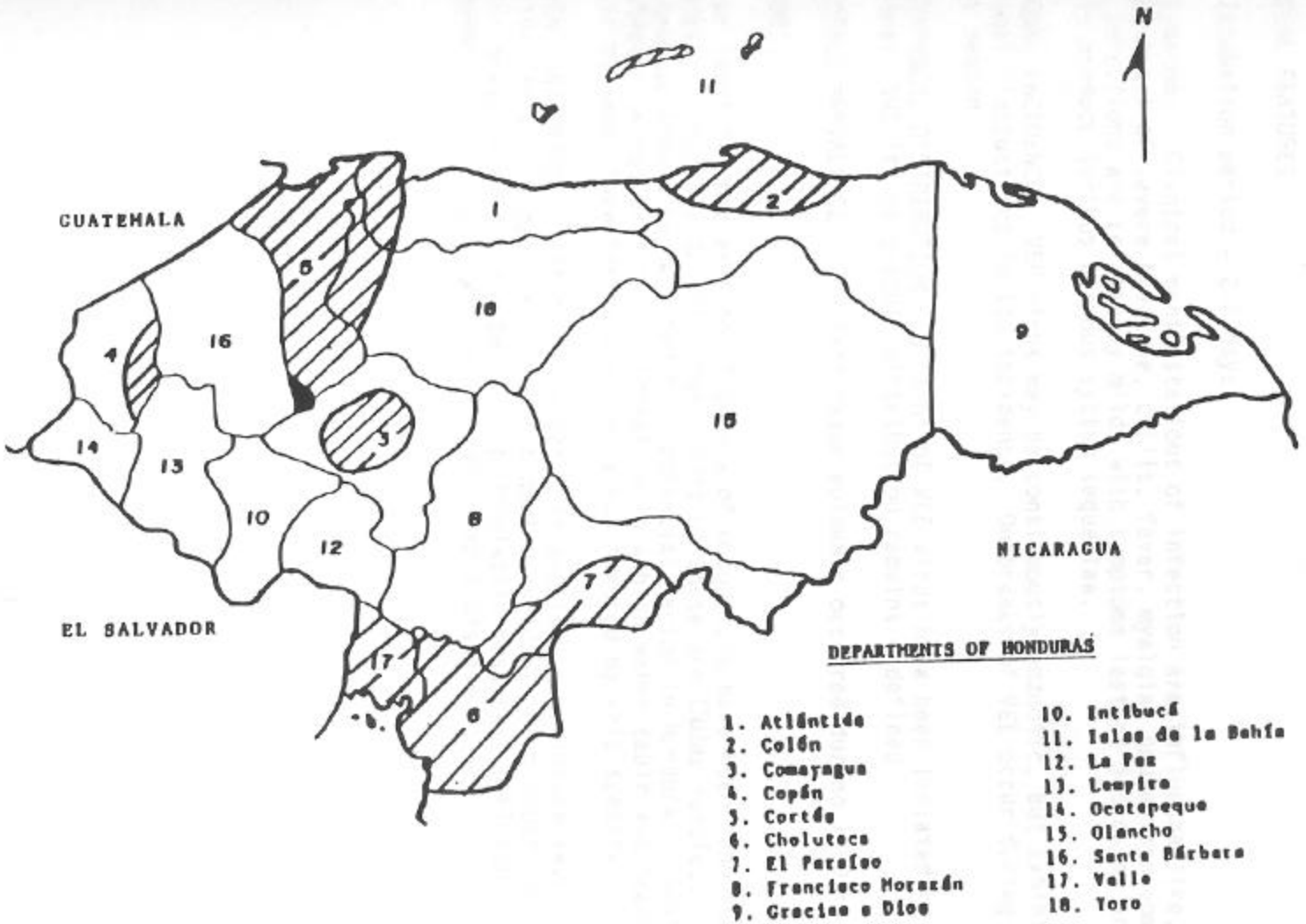
This is the most important vector of dengue because of its peridomestic habits and feeding preference for man. Secondary vector species have not been identified.

Larval habits - Breeds primarily in artificial containers in urban areas. In villages that lack piped water, the population may store water in drums, jars or tanks. These are common breeding sites.

Adult habits - Prefers to feed on humans but will engorge on dogs, cats and other domestic animals. There are two peaks of biting activity; in the early morning just after daybreak and in the late afternoon. The flight range of adults rarely exceeds 100 meters. The entire life cycle, therefore, may take place in or near human dwellings.

PREVENTION CONTROL: Anti-mosquito measures are the only effective control means available at present. Effective measures include source reduction of breeding habits, use of DEET repellents and wearing of permethrin-treated uniforms.

Figure 3. Areas of recent Dengue outbreaks in Honduras.



VENEZUELAN EQUINE ENCEPHALITIS (VEE)

INFECTIOUS AGENT: Alphavirus of the family Togaviridae.

RESERVOIR: Small rodents and birds appear to maintain the virus in nature. Vampire bats have been found infected and studies have shown that cattle, swine and dogs may develop viremis sufficient to infect mosquitoes. Horses develop severe, often fatal, infections and are the primary amplifiers of the virus.

MODE OF TRANSMISSION: Bite of infective mosquito.

CLINICAL FEATURES:

Incubation period - 2-6 days.

Symptoms - Clinical manifestations of infection are influenza-like, with abrupt onset of severe headache, chills, fever, myalgia, nausea and vomiting. Most infections are relatively mild with symptoms lasting 3-5 days, and rarely produce serious nervous system sequellae.

SEASONAL INCIDENCE: VEE virus may be continuously enzootic, but exhibits seasonal fluctuations in its incidence. Outbreaks of VEE occur during the rainy season.

GEOGRAPHICAL DISTRIBUTION: Strains of VEE virus have been isolated from Honduras, but its geographic distribution remains undefined.

INCIDENCE/PREVALENCE: The last major epidemic occurred during 1969 to 1972.

VECTORS:

At least 41 species from 11 genera of mosquitoes have been reported naturally infected with VEE virus. Most of these are *Culex* species. *Cx. nigripalpus* should be regarded as a potential vector in Honduras. Shaded freshwater swamps or tropical forests with a high water table and meandering sunlit streams characterize breeding areas favored by this species.

PREVENTION/CONTROL: Although a vaccine is available, incidence levels rarely justify its widespread use. Use of bednets, avoidance of bivouacing in known vector breeding areas, and personal prophylactic measures (DEET repellent and permethrin-treated uniforms) will prevent this disease.

CUTANEOUS/MUCOCUTANEOUS LEISHMANIASIS

INFECTIOUS AGENTS: *Leishmania brasiliensis* can cause mucocutaenous and cutaneous leishmaniasis, while *L. panamensis* causes leishmaniasis only. Cutaneous leishmaniasis (CL), caused by species of the *L. mexicana* complex, probable occurs in Honduras, since cases of chiclero ulcer have been reported.

MODE OF TRANSMISSION:

RESERVOIR: The reservoirs of CL are wild animals. The relative importance of naturally infected animal species is poorly defined. However, forest rodents are important reservoir hosts of CL parasites and the two-toed sloth has been identified as the main sylvatic reservoir of *L. brasiliensis* in Panama. There is evidence that dogs, horses and donkeys may be reservoirs in an urban cycle of this disease.

CLINICAL FEATURES:

Incubation period - one week to many months.

Symptoms -

(1) Cutaneous manifestations

Usually a rather benign infection with one or only a few ulcers on the skin, especially on the face, ears or other exposed areas. The ulcers start as an erythematous papule which may then ulcerate forming lesions up to 16 cm across. The ulcer bleeds easily. Cure of affected areas can occur spontaneously in 6 months to several years, providing lasting immunity to conspecific species. Deformation and scarring occurs.

(2) Mucocutaneous manifestations

Usually follows the symptoms of a cutaneous infection. However, after the ulcer area heals, the pathogen undergoes a metastatic phase involving mucocutaneous tissues. The lesions that occur in these areas cam be dramatically disfiguring. Areas subject to invasion include nasal septum, mouth nasopharynx and the anorectal region.

SEASONAL INCIDENCE: Transmission may occur throughout the year.

GEOGRAPHICAL DISTRIBUTION: Cutaneous leishmaniasis is found in the northern and western regions of Honduras (Fig. 4). Large numbers of cases have been found in the Departments of Yoro, Colon, El Paraiso and Olancho, in the mountains on both sides of the Aguan Valley. Foci also occur in the Department of Yoro around Morazan and along the Patuca River in the Department of Olancho. Small, isolated foci also are present in the Departments of Santa Barbara, Cortes, Atlantida, and Gracias a Dios.

The distribution of mucocutaneous leishmaniasis is slightly reduced from that of cutaneous leishmaniasis (Fig. 5). The majority of cases has been reported near El Progreso and Arenal in the Department of Yoro, along the Patuca River in the Department of Olancho, and in the extreme eastern portion of the Department of El Paraiso. A single case has been reported from each of the Departments of Santa Barbara, Cortes and Gracias a Dios.

PREVALENCE/ICIDENCE: Reliable data for the incidence of leishmaniasis are lacking.

VECTORS: At least 20 species of Lutzomyia sand flies can be found in endemic areas. Many of these species may be involved in the transmission of cutaneous leishmaniasis among wild reservoirs and to man. Suspected vectors include *Lu. olmeca*, *Lu. longipalpis*, *Lu.* trapidoi, *Lu. ylephiletor*, *Lu. panamensis*, *Lu. gomezi* and *Lu. paraensis*.

BEHAVIOR - *Lutzomyia* spp. (phlebotomine sand flies) are weak fliers that are active only when there is little or no wind. They generally feed only at night. By day they rest in crevices, caves, animal burrows, tree buttresses, and other dart and protected places. They feed near where they live (usually within approximately 100-200 meters) and require a dark, humid environment with ample organic matter for larval development. Sand flies are very small (less than half the size of a mosquito) and their bites are usually are usually painless to unsensitized people, so they frequently go unnoticed.

PREVENTION/CONTROL: Anti-vector measures are the only effective means of prevention. These measures include insecticide treatment of screens and bednets with permethrin, use of DEET repellent, and wearing of permethrin-treated uniforms.

Figure 4. Cutaneous Leishmaniasis endemic areas (shaded) in Honduras.

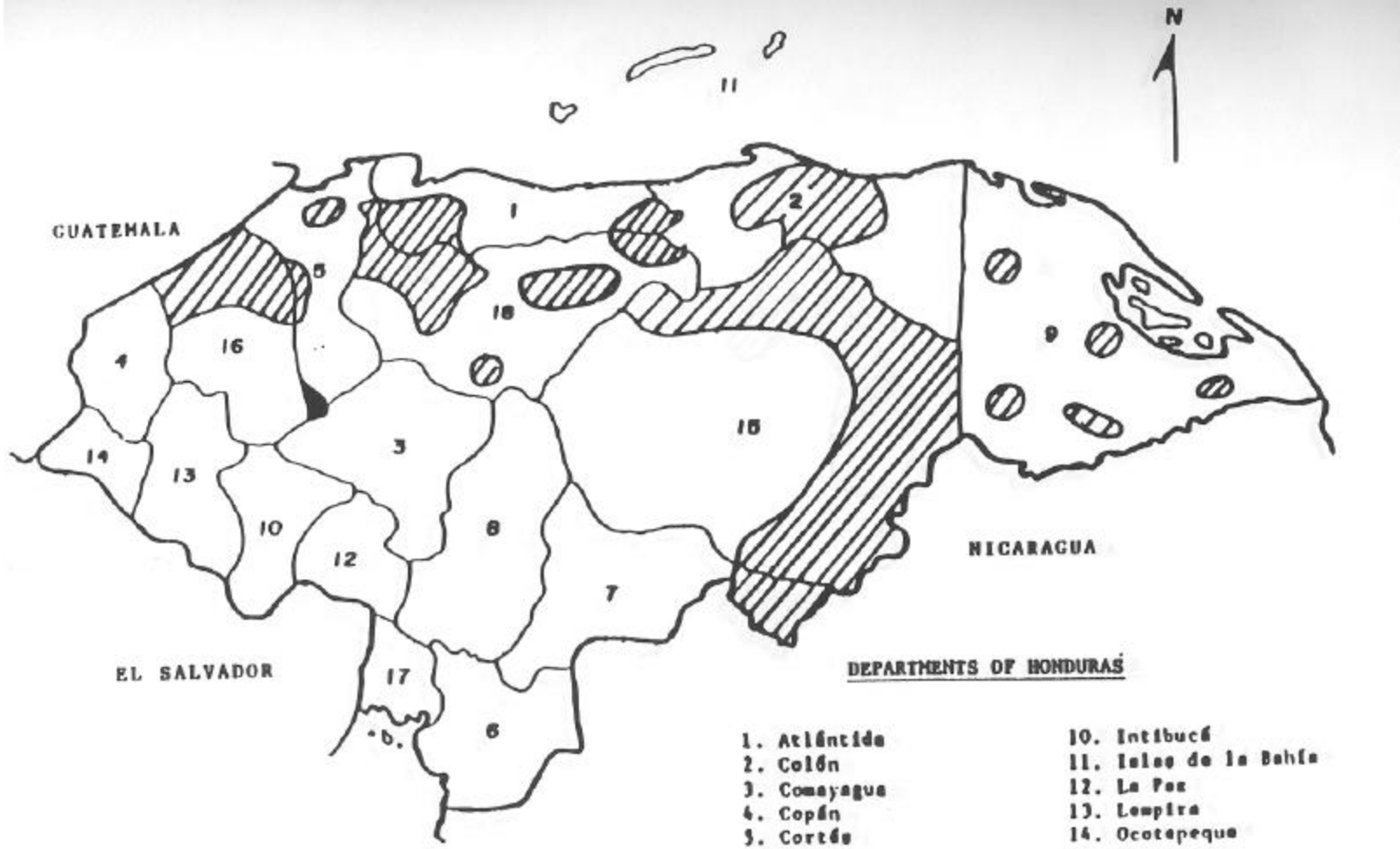
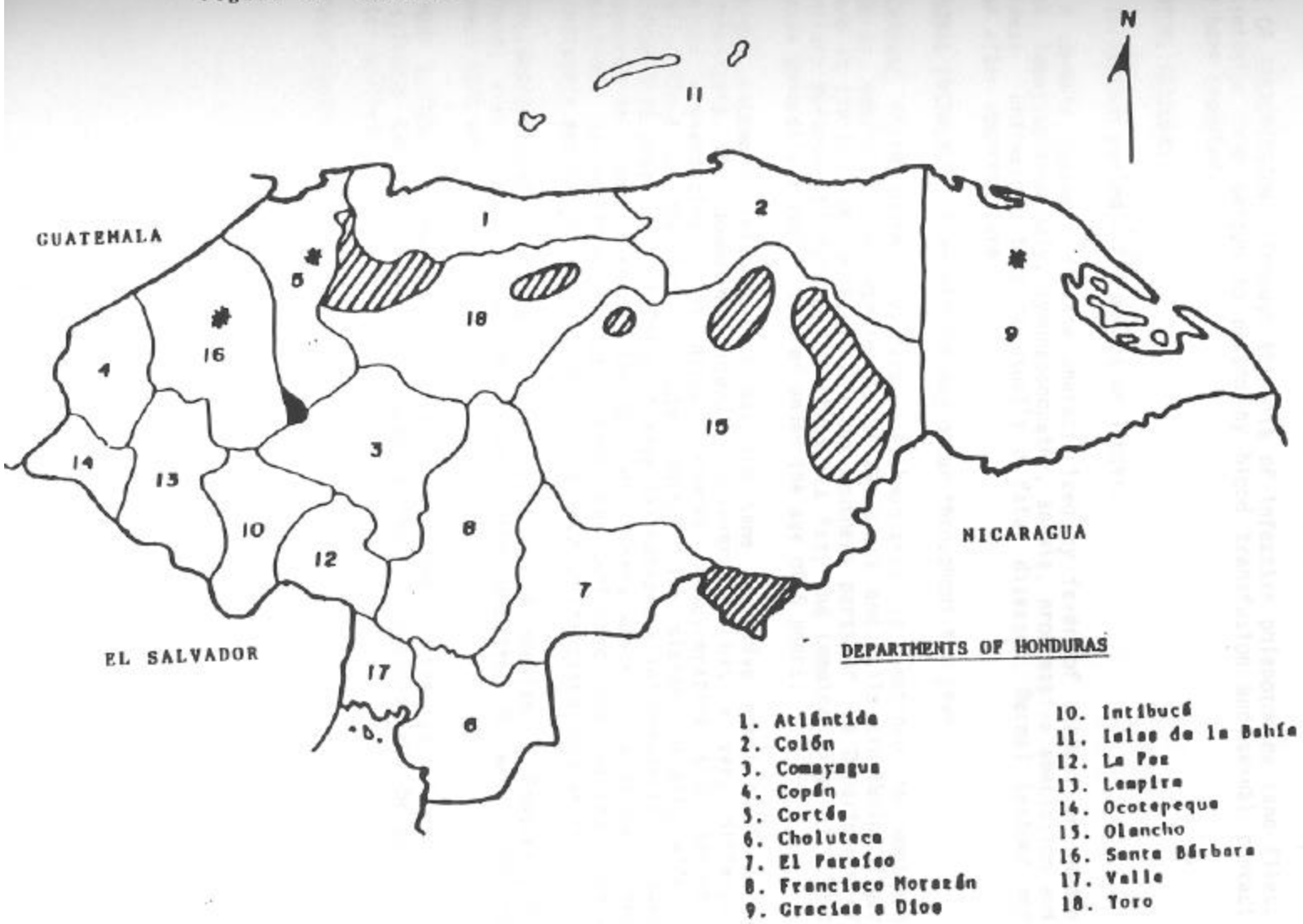


Figure 5. Mucocutaneous Leishmaniasis endemic areas (shaded) in Honduras.



VISCERAL LEISHMANIASIS

INFECTIOUS AGENT: *Leishmania donovani chagasi* is the causative agent of visceral leishmaniasis.

RESERVOIR: Wild canines, domestic dogs and rodents.

MODE OF TRANSMISSION: Through the bite of infective phlebotomine sand flies. Transmission from person to person by blood transfusion and sexual contact have been reported.

CLINICAL FEATURES:

Incubation period - 2-4 months or longer.

A chronic systemic disease characterized by fever of gradual or sudden onset, hepatosplenomegaly, lymphadenopathy, anemia, progressive emaciation and weakness. Untreated, this is usually a fatal disease. Dermal lesions may occur after apparent cure.

SEASONAL INCIDENCE: Transmission may occur throughout the year.

GEOGRAPHIC DISTRIBUTION: Visceral leishmaniasis is confined to southern Honduras, embracing the Department of Choluteca and Valle (including Tiger Island in the Gulf of Fonseca), and in the southern parts of the Departments of Francisco Morazan, El Paraiso, Intibuca, La Paz and Lempira (Fig. 6). This disease generally affects children under the age of 5 years.

Atypical cutaneous leishmaniasis has the same causative agent as visceral leishmaniasis (*L. donovani chagasi*); however, it has a very different clinical presentation. The disease causes non-ulcerative skin lesions, usually found on the face or upper torso. The disease usually affects children 5-15 years old. A focus of atypical cutaneous leishmaniasis has been discovered on Tiger Island in the Gulf of Fonseca where 27 cases have been identified. An additional 16 cases have been confirmed from the Departments of Choluteca and Valle, and the southern portion of Francisco Morazan (Fig. 7).

PREVALENCE/ICIDENCE: Although not a major health problem in Honduras, 53 patients with proven VL and 16 patients with suspected VL were diagnosed between 1975 and 1983.

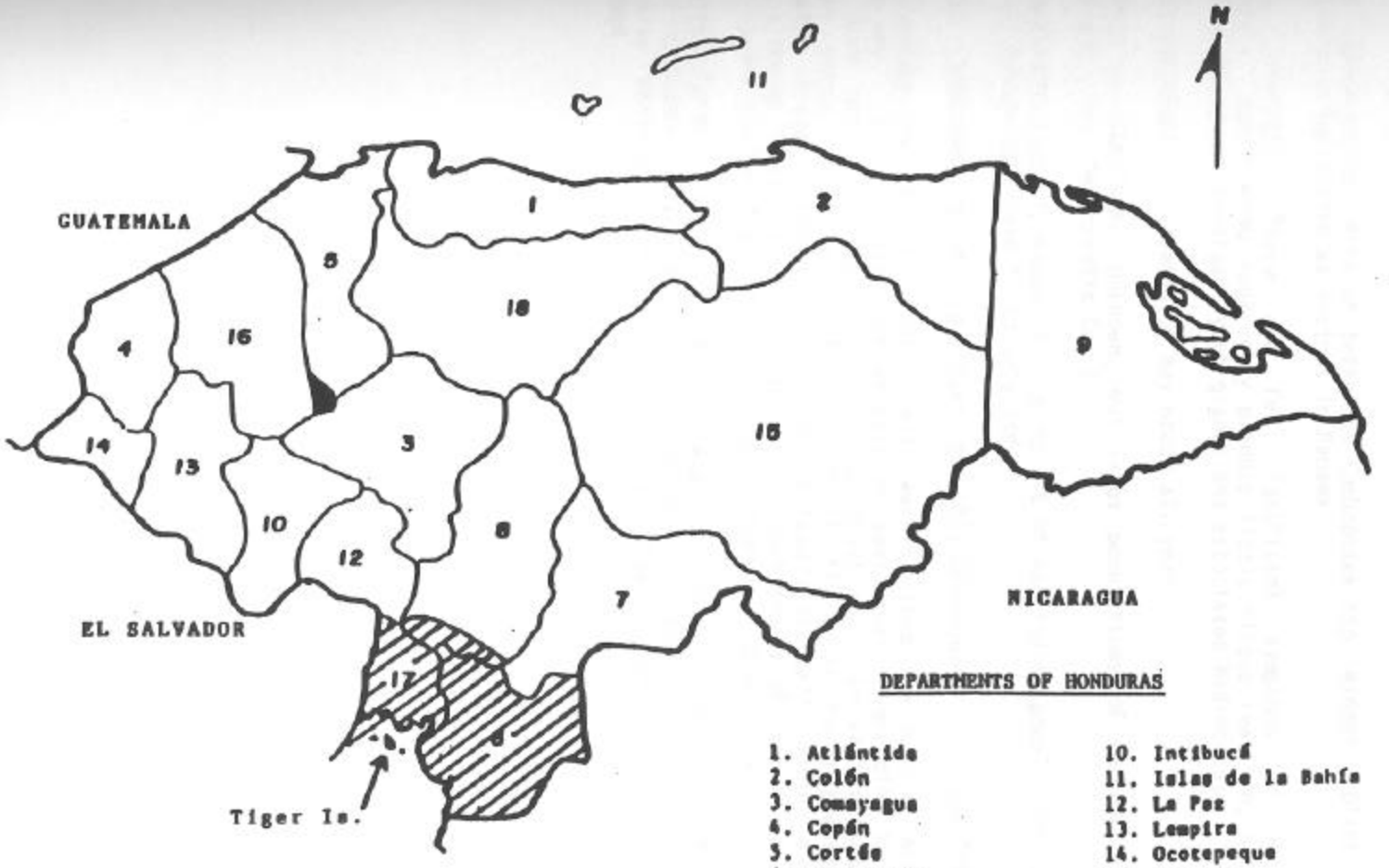
PRIMARY VECTOR: *Lutzomyia longipalpis*, peridomestic species. Transmission in sylvatic habitats, where foxes acquire their infections, may be by other vector species.

PRVENTION/CONTROL: See cutaneous leishmaniasis.

Figure 6. Visceral Leishmaniasis endemic areas (shaded) in Honduras.



Figure 7. Atypical Cutaneous Leishmaniasis endemic areas (shaded) in Honduras.



DEPARTMENTS OF HONDURAS

1. Atlántida
2. Colón
3. Comayagua
4. Copán
5. Cortés
6. Choluteca
7. El Paraíso
8. Francisco Morazán
9. Gracias a Dios
10. Intibucá
11. Islas de la Bahía
12. La Paz
13. Lempira
14. Ocotepeque
15. Olancho
16. Santa Bárbara
17. Valle
18. Yoro

FILARIASIS

INFECTIOUS AGENT: *Mansonella ozzardi*

RESERVOIR: Monkeys.

MODE OF TRANSMISSION: Bite of infective *Culicoides* spp. midges. Black flies also have been implicated as vectors in Panama.

CLINICAL FEATURES: There are few significant symptoms in infected individuals. Adult worms apparently produce little tissue reaction, although there are reports of enlarged lymph glands and associated hydroceles.

SEASONAL INCIDENCE: Transmission may occur all year.

GEOGRAPHIC DISTRIBUTION: Unknown, but large populations of *Culicoides* spp. are present along the Atlantic Coast.

INCIDENCE/PREVALENCE: Unknown, but up to 70% of Amerindian populations in the Darien of Panama have been found infected.

VECTORS: *Culicoides* spp biting midges; possibly *Simulium* spp. black flies.

Culicoides spp are extremely small, earning them the popular nickname "no-see-ums." Larval stages are aquatic or semi-aquatic, breeding in moist soil. Some species are associated with brackish water in salt marshes and mangrove swamps. The larval stages of black flies are found breeding in freshwater streams. Adults of both groups feed principally during daylight hours, although there are crepuscular peaks. Both groups of insects have long flight ranges and may fly several kilometers from their breeding sites.

PREVENTION/CONTROL: Measures effective against sand flies are also effective against *Culicoides* spp. Because of limited risk to U. S. forces, special preventive measures directed against this disease significantly are not warranted.

CHAGAS' DISEASE

INFECTIOUS AGENT: Trypanosoma cruzi, a flagellated protozoan.

RESERVOIRS: Many domestic and wild animals including t he dog, cat, pig, guinea pig, bat, house rate, wood rat, fox, opossum, raccoon and armadillo.

MODE OF TRANSMISSION: By trypanosomes in the feces voided by infected kissing bugs (Reduviidae, Triatominae) during biting. Transmission may occur by blood transfusion and is a common route of infection in many urban areas.

CLINICALFEATURES:

Incubation period: About 5-14 days after an infective bite, or 30-40 days after an infectious transfusion.

Symptoms - The acute form of the disease, which primarily affects children, is characterized by a high intermittent or unrelenting fever. Swelling of the eyelids (Romana's sign) occurs in 50% of children. Other symptoms and signs of the disease vary according to the involvement o different organs. The febrile syndrome can be accompanied by cardiac abnormalities or encephalomyelitis, as well as digestive tract involvement. The acute phase is followed by a long period of latent infection, which may last indefinitely. Cardiopathy is the most common manifestation of chronic infection, and a leading cause of death. In some endemic areas of Latin America, digestive complications known as megacolon or megaesophagus may result.

SEASONAL INCIDENCE: Transmission may occur all year.

GEOGRAPHICAL DISTRIBUTION: Chagas' disease is common in southern and central Honduras and is a serious threat to the indigenous populations of many isolated, mountain villages in western Honduras. In some mountain villages in the Department of Comayagua, approximately 15% of the vectors (*Triatoma dimidiata* and *Rhodnius prolixus*) are infected with *T. cruzi*. A study conducted in 1986-1987 identified moderate percentages (10%) of *Trypanosoma*-infected triatomines in the Departments of Santa Barbara, Copan, Lempira, Choluteca, El Paraiso and Olancho (Fig. 8.). This disease is also becoming an increasing threat to people living in and around the capital city, Tegucigalpa. Chagas' disease has not been reported from Gracias a Dios, located in the extreme eastern part of Honduras and is rare along the Atlantic coast in the Departments of Cortes, Atlantida, the Islas de la Bahia and Colon.

INCIDENCE/PREVALENCE: Limited serological surveys have found up to 2.2% of the population with T. cruzi antibodies (Fig. 9.), indicating previous exposure to the parasites at some point in life. Reliable incidence data are not available.

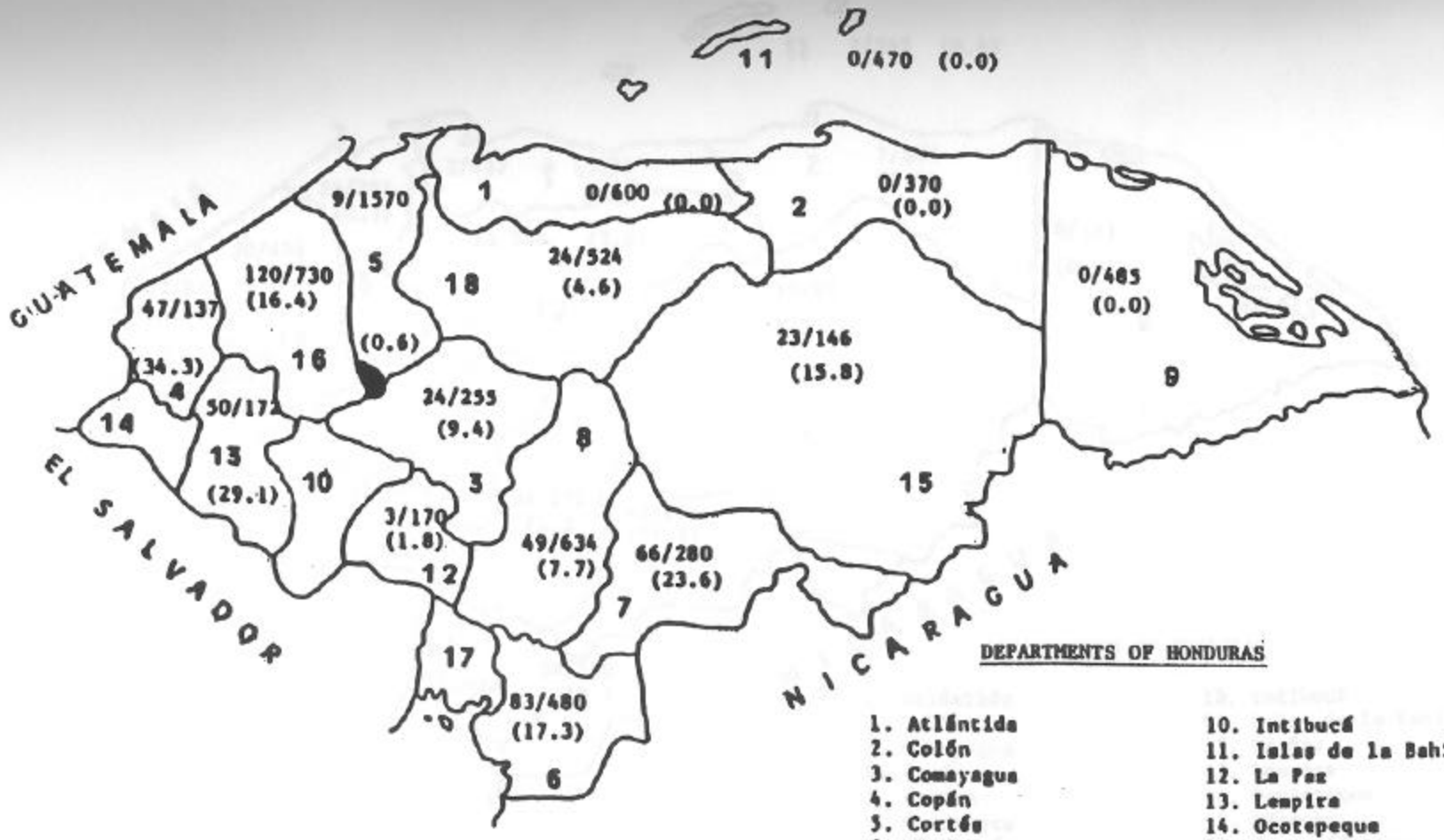
VECTORS: *Triatoma dimidiata* and *Rhodnius prolixus*, triatomine reduviid bug, are the main vectors of Chagas' disease. *Triatoma nitida* and T. *ryckmani* are also capable of transmitting this disease to man, but play a minor role due to their preference for sylvatic habitats and limited geographic distribution (Fig. 10). *Triatoma ryckmani* has been collected only in the Department of Valle. Collections of T. nitida have been confirmed from the Departments of Choluteca, El Paraiso and Francisco Morazan. The distribution and infection rates of triatomine vectors are shown in figures 8 and 10.

The preferred peridomestic habitat of *R. prolixus* is thatched roofs of wood or mud homes. This species is the most widely distributed triatomine in Honduras, and is most abundant in the drier, southern two-thirds of the country.

Triatoma dimidiata prefers cracks and crevices in the floors and walls of houses. It also readily infests piles of clothes, newspapers and wood. Although the distribution of *T. dimidiata* is more restricted than *R. prolixus*, it is widespread in south and central Honduras.

PREVENTION/CONTROL: Because of limited risk of infection to U. S. forces, special preventive measures against this disease are not warranted.

Figure 8. 1986-87 Trypanosoma cruzi-infected triatomines in Honduras.

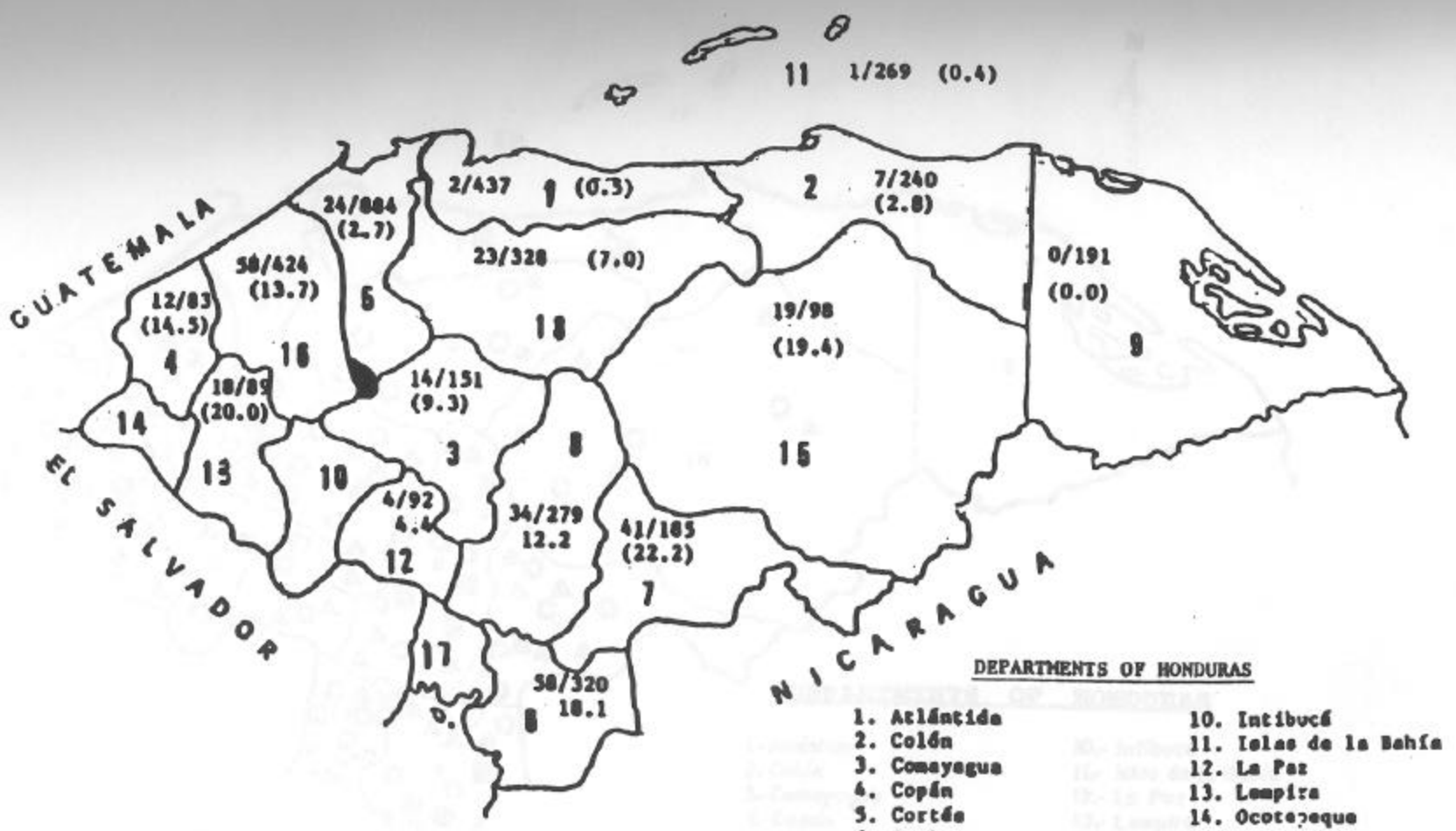


Triatomines positive/ Triatomines examined
(% positive)

DEPARTMENTS OF HONDURAS

1. Atlántida
2. Colón
3. Comayagua
4. Copán
5. Cortés
6. Choluteca
7. El Paraíso
8. Francisco Morazán
9. Gracias a Dios
10. Intibucá
11. Islas de la Bahía
12. La Paz
13. Lempira
14. Ocotepeque
15. Olancho
16. Santa Bárbara
17. Valle
18. Yoro

Figure 9. 1986-87 human serology tests for Chagas' disease in Honduras.



Persons positive/ persons examined
(% positive)

DEPARTMENTS OF HONDURAS

1. Atlántida
2. Colón
3. Comayagua
4. Copán
5. Cortés
6. Choluteca
7. El Paraíso
8. Francisco Morazán
9. Gracias a Dios
10. Intibucá
11. Islas de la Bahía
12. La Paz
13. Lempira
14. Ocotepeque
15. Olancho
16. Santa Bárbara
17. Valle
18. Yoro

Figure 10. Known distribution of triatomine vectors of Chagas disease in Honduras.



CHECKLIST OF MOSQUITOES OF HONDURAS*

Family *CULICIDAE*
- Subfamily *ANOPHELINAE*
  - Genus *ANOPHELES*
    - Subgenus *ANOPHELES*
      - *apicimacula*
      - *bradleyi*
      - *crucians*
      - *eiseni*
      - *hectoris*
      - *neomaculipalpus*
      - *pseudopunctipennis* 1, 2
      - *punctimacula*
      - *vestitipennis*
    - Subgenus *KERTESZIA*
      - *neivai*
    - Subgenus NYSSORHYNCHUS
      - *albimanus* 1,2
      - *darlingi* 2
      - *strodei*
    - Subgenus *STETHOMYIA*
      - *kompi*
- Subfamily *CULICINAE*
  - Subgenus *AEDIMORPHUS*
    - *vexans*
  - Genus *AEDEOMYIA*
    - Subgenus *AEDEOMYIA*
      - *gverrero*
      - *squamipennis*

Family *CULICIDAE*
- Genus *HAEMAGOGUS*
  - Subgenus *CONOPOSTEGUS*
    - *clarki*
  - Subgenus *HAEMAGOGUS*
    - *aeritinctus*
    - *anastasionis*
    - *chalcospilans*
    - *equinus*
    - *iridicolor*
    - *janthinomys*
    - *mesodentatus*
    - *regalis*
- Genus *PSOROPHORA*
  - Subgenus *GRABHAMIA*
    - *confinnis***
  - Subgenus *JANTHINOSOMA*
    - *albipes*
    - *ferox*
  - Subgenus *PSOROPHORA*
    - *ciliata*
    - *cilipes*
    - *cingulata*
- Genus *CULEX*
  - Subgenus *ANOEDIOPORPA*
    - *conservator*

Genus *AEDES*
- Subgenus *HOWARDINA*
  - *quadrivittatus*
- Subgenus *OCHLEROTATUS*
  - *angustivittatus*
  - *fluviatilis* 1
  - *scapularis*
  - *serratus* 1
  - *taeniorhynchus* 1, 4
- Subgenus *PROTOMACLEAYA*
  - *podographicus*
- Subgenus *STEGOMYIA*
  - *aegypti* 3
- Subgenus *MELANOCONION*
  - *conspirator*
  - *educator*
  - *erraticus* 4
  - *pilosus* 4
  - *vexillifer*

Genus *DEINOCERITES*
- *cancer*
- *pseudes*

Genus *MANSONIA*
- Subgenus *MANSONIA*
  - *dyari*
  - *titillans*

Genus *SABETHES*
- Subgenus *SABETHINUS*
  - *undosus*

Subgenus *CULEX*
- *corniger*
- *coronator* 4
- *declarator*
- *inflictus*
- *interrogator* 4
- *lactator*
- *mollis*
- *nigripalpus* 3,4
- *psadostgmatosoma*
- *quinquefasciatus* 3, 4
- *restuans* 3
- *salinarius* **
- *stenolepis*
- *yoyae*

Subgenus *MICROCULEX*
- *imitator*

Subgenus *TINOLESTES*
- *latisquama*

Genus *COQUILLETTIDIA*
- Subgenus *RHYNCHOTAENIA*
  - *fasciolata*
  - *nigricans*

Genus *LIMATUS*
- *asulleptus*
- *durhamii*

Genus *JOHNBELKINIA*
- *ulopus*

Genus *WYEOMYIA*
Subgenus *DENDROMYIA*
aporonoma
chalcocephala
pseudopecten

Genus *URANOTAENIA*

Subgenus *URANOTAENIA*
geometrica 1
lowii

Genus *TRICHOPROSOPON*
digitatum

Subgenus *WYEOMYIA*
arthrostigma
celaenocephala
melanopus
pertinans

Subfamily *TOXORHYCHITINAE*
Genus *TOXORHYNCHITES*
Subgenus *LYNCHIELLA*
hypoptes
superbus
theobaldi

*For keys to identify the mosquitoes of Honduras, use:

(1) Clark-Gil, S. and R. F. Darsie, Jr. 1983. The mosquitoes of Guatemala, their identification, distribution and bionomics, with keys to adult females and larvae in English and Spanish. Mosq. Syst. 15(3): 151-284

(2) Wilkerson, R. C. and D. Strickman, 1990. Illustrated key to the female anopheline mosquitoes of Central America and Mexico. J. Am. Mosq. Control Assoc. 6(1): 7-34.

1. Collected at the Soto Cano Air Base.
2. Potential malaria vector.
3. Potential arbovirus vector.
4. Pest Species

.

LUTZOMYIA

aclydifera
apicalis
arborealis
barrattoi
beltrani
bispinoa
carpenteri
cayennensis
chiapenensis
craftier
cruciata
cunhai
deleoni
durani
evansi
*gomezi**
*longipalpis**
*olmeca**
*ovallesi**
*panamensis**
paraensis
sanguinaria
shannoni
texana
*trapidoi**
trinidadensis
undulata
*ylephiletor**

BRUMPTOMYIA

galindoi

*Denotes suspected vector species

Ticks of Honduras

Tick paralysis may result from the bites of some species, particularly *Amblyomma* or *Dermacentor* spp., but there have been no reports. Tick-borne diseases are not confirmed, but tick-borne relapsing fever and Rocky Mountain spotted fever are suspected. The list of ticks presented herein is not considered complete; their distribution is unknown.

Argasidae

Ornithodoros kuricata

Ixodidae

Amblyomma cajennense
Am. coelebs
Am. dissimile
Am. humerale
Am. imitator
Am. naponense

Boophilus annulatus
B. microplus

Dermacentor (= *Anocentor*) *nitens*

Ixodes bequaerti
Ix. boliviensis

Scorpions

These species may produce a painful sting with local reactions, but their sting cannot be considered lethal.

Centruroides gracilis
C. koesteri
C. limbatus
C. margaritatus
C. thorelli

Diplocentrus coddingtoni
D. lourencoi
D. santiagoi

Didymocentrus krausi

Spiders

Black Widow Spider (*Latrodectus mactans*): This spider is characterized by a black abdomen with crimson markings on the ventral side which frequently form an hourglass design. Only the females bite. They are generally not aggressive unless agitated, hungry or guarding an egg sac. The bite, similar to a pin prick, is not always felt. Severe systemic reactions can result from the neurotoxic venom including muscular pain, a rigid abdomen, difficulty in breathing, nausea and profuse sweating. These spiders are frequently found in outhouses where bites on the genital areas may occur. Tarantulas (*Sericopelma communis*; *Brachypelma* spp.): The bite may be painful, but is not considered dangerous. Occasionally may cause systemic reactions.

Banana spider (*Heteropoda venatoria*): Its bite may be painful but is not considered dangerous.

Gnaphosid spider (*Herpylas* spp.): Its bite may be painful but it is harmless

Other Arthropods of Public Health Significance

Bed Bugs (*Cimex lectularius*): Commonly infests houses, hiding in cracks, crevices, seams in mattresses, loose wallpaper and similar areas during the day. They take blood meals at night. Bed bugs may transmit hepatitis B resulting in small clusters of cases, but most transmission is through parental contact with infectious human body fluids.

Itch Mites (*Sarcoptes scabiei*): Mites burrow in the skin and cause scabies, usually associated with intense itching and often secondary infection 2 to 6 weeks after infestation. People previously infested develop symptoms 1-4 days after re-exposure. Transfer of parasites is usually by direct skin-to-skin contact and occur during sexual contact. Scabies is very common.

Chiggers (*Eutrombicula batatas*): This species is common in tropical lowlands. Only the larval stages are parasitic. Itching begins a few hours after attachment and feeding. A severe dermatitis can result from infestation.

The human bot fly, torsalo (*Dermatobia hominis*): The adults parasitize a wide variety of hosts including livestock, some species of birds, monkeys and man. It is a serious pest of cattle in Central America. The female fly does not deposit eggs directly on the host, but on the body of another bloodsucking arthropod, usually a mosquito. Larvae hatch and burrow into the skin when the carrier insect feeds upon a host. Development in the body of the host requires about six weeks and can cause significant irritation. In man, the larva has been reported from various parts of the body. Myiasis is frequently diagnosed in persons who have acquired the parasite in tropical America and then returned to their homes in temperate areas before the parasite has completed it s life cycle.

The primary screwworm (*Cochliomyia hominivorax*): Adults are primary invaders of wounds, often laying eggs in minor scratches or tick bite sites. Although domestic livestock are most often affected, human cases may occur, usually in small children or invalids. In humans, larvae most often infest nasal passages but occasionally may infest the ears, vagina, or wounds, Larvae mature in about three weeks and pupate in the ground.

Horse fly (Tabanus pungens) Occasionally bites man, but is primarily a pest of cattle and horses.

PLANTS OF MEDICAL IMPORTANCE

BALSAMINA, BALSAM-PEAR WILD BALSAM APPLE (*Momordica charantia*): Though the red pulp may be eaten raw, the large seeds inside the pulp are poisonous.

CASHEW, MARANON (*Anacardium occidentale*): The nut is poisonous unless roasted until all the oil boils out. The oil will irritate the skin and cause swelling.

ALELAILA, CHINABERRY, JACINTO (*Melia azedarach*): The fruit is poisonous.

ELEPHANT EAR, DUMBCANE, OJO DE LAGARTO (*Dieffenbachia* spp.). The sap is very irritating when in contact with eyes and skin and causes serious swelling.

GIANT TARO (*Alocasia macrorhiza*): The plan contains small oxalate crystals which cause severe irritation of the mouth and throat if eaten.

LA CARICA PELTA (*Carica peltata*): Seeds of the fruit cause intestinal obstruction. The plant is a relative of the Papaya and closely resembles the latter. The local name for the condition is "papayita tapaculo".

MANCHINEEL, **MANZANILLOZ** (*Hippomane mancinella*): The milky sap is highly irritating, causing severe inflammation. Some from burning wood causes inflammation of the eye.

ORITGA, NETTLE (*Cnidoscolus* (*Jatropha*) *urens*): Occurs along the beaches on Pacific Coast. The stiff hairs cause great pain when they sting the flesh.

COWAGE, PICAPICA (*Mucuna pruriens*): Common plant in the thickets. The hairs which cover the seedpods are easily detached when dry and can penetrate the skin causing intense irritation. Particularly dangerous to the eyes.

HURA, TRONADOR,SANDBOX TREE (*Huro crepitans*): Seeds contain an oil which can cause death when eaten. The milky sap of the tree is poisonous and will cause inflammation when skin contact is made.

PIT VIPERS

Cantil (*Agkistrodon bilineatus*). Adults average 2.5 to 30 feet in length and are chocolate-brown to black in color. Found in swampy areas and along stream banks. It is aquatic and often found swimming. This is a dangerous snake capable of causing serious local lesions, but seldom death.

Fer-de-lance, terciopel (*Bothrops asper*: *atrox*). Adults of this very large pit viper average 4 to 6 feet long, but can reach a length of 8 feet. It is found from sea level to 800 meters in the tropical forests. This snake has highly toxic venom and probably accounts for more deaths from snakebite than any other species in Central America.

Hog-nosed viper (*Bothrops nasutus*). A small pit viper (maximum length slightly over 2 fee) found from sea level to about 200 meters in tropical forests.

Jumping viper (*Bothrops nummifer*). A short, thick bodied viper that averages 18-24 inches long as an adult. There is considerable intraspecific variation. It is commonly found in the hilly rain forests and plantations. Although it can strike over a distance greater than its body length, it possesses short fangs and only a moderate toxic venom.

Eyelash viper, palm viper, bocaraca (*Bothrops schlegeli*). A medium-sized viper (2 feet long) commonly found in trees and bushes of lowland areas; most bites occur on the upper part of the body. This species is extremely variable in color.

Bothrops bicolor. Adults are moderately large vipers, up to 3 feet long, found in forested areas up to 1700 meters in elevation.

Godman's pit viper (*Bothrops godmanni*). A medium-sized pit viper (2.5 feet long) distributed from 1300 to 1900 meters in tropical forests.

Bothrops nigroviridus. A medium-sized viper found at moderate elevations, generally above 1500 meters, in jungle habitats. Adults are 2 to 2.5 feet long.

Bothrops ophryomegas. A small pit viper (18-24 inches long) found from sea level to 850 meters often on hot surfaces on the southern side of mountains.

Bothrops marchi. A medium-sized pit viper (3 feet long) inhabiting the subtropical wet forest at 1000 to 1300 meters.

Tropical rattlesnake, cascabel (Crotalus durissus). Adults grow to a maximum length of 6 feet. This species inhabits dry areas, grasslands, and thorny scrub up to 1400 meters in elevation. This is one of the most dangerous snakes in the Americas, although its venom varies in toxicity throughout its range (at least 13 subspecies have been described). Its venom does not readily generate antibodies, so large amount of antivenin are frequently required to counteract the serious systemic effects of the bite.

CORAL SNAKES

These are generally small, brightly colored snakes with patterns made up of complete rings of yellow or white, black and usually red. They possess highly toxic neurovenom but normally are shy and unaggressive.

Atlantic coral snakes (*Micrurus diastema*). Coloration of this snake is highly variable, but it can usually be distinguished by the irregular black spots in the red rings. It is a medium-sized snake (up to 2 ½ feet long) which is distributed up to 750 meters in altitude.

Black-banded coral snake (*Micrurus nigrocinctus*). A medium size coral snake which may grow up to 3 feet long. It is common in lowland rain forests up to 1300 meters in elevation. This is one of the most common species of coral snakes throughout Central America.

Micrurus ruatanus. A medium-sized coral snake (up to 2 ½ feet long) which is known to occur only at elevations near sea level in tropical moist forests.

CONSTRICTORS:

Although these snakes are not poisonous they may grow very large and are able to kill large prey by constriction.

Bo constrictor A very large species which may reach 18 feet long. It is usually found at lower elevations.

SEA SNAKES. Found only on the Pacific coast.

Pelamis platurus (Pelagic sea snake). The yellow-bellied sea snake, 2 ½ to 3.5 feet long, feed on surface generally 1 to 20 kilometers from the coast; sometimes washed up on shore.

Distribution of Snakes According to the Psysiographic Regions of Honduras

Species	Pacific Lowland Region	Caribbean Lowland Regior		Mosquito Coast	Serrania Region	
		Ulua-Chamelecon Plain	Nombre de Dios Piedmont		Northern Cordillera	Southern Cordillera
					X	
Agkistrodon bilineatus	X			X	X	X
Bothrops asper		X	X		X	
Bothrops bicolor					X	
Bothrops godmani					X	
Bothrops nasutus		X	X		X	
Bothrops nigroviridus					X	X
Bothrops nummifera		X	X	X	X	
Bothrops ophryomegas	X				X	X
Bothrops schlegeli		X	X		X	
Crotalus durissus	X	X			X	X
Micrurus diastema		X	X	X	X	
Micrurus nigrocinctus	X	X	X			
Pelamis platurus	X			X	X	X
Boa constrictor	X					
		X	X			

INSECTICIDE RESISTANCE 1, 2

SPECIES	AREA	LOCALITY	INSECTICIDE	STAGE	DATE OF TEST	STATUS
Aedes aegypti	Puerto Cortes	San Pedro Sula	DDT	Adult	08/68	R
Ae. aegypti	Puerto Cortes	San Pedro Sula	DDT	Larva	08/68	R
Ae. aegypti	Puerto Cortes	Puerto Cortes	DDT	Larva	08/68	R
Ae. aegypti	Nueva Octopeque	Puerto Cortes	HCH	Larva	06/73	R
Ae. aegypti	San Pedro Sula	?	HCH	Larva	05/73	R
Ae. aegypti	San Pedro Sula	?	DDT	Larva	06/73	R
Ae. aegypti	San Pedro Sula	?	HCH	Larva	06/73	R
Ae. aegypti	Tegucigalpa	?	HCH	Larva	06/73	S
Ae. aegypti	Tegucigalpa	?	Abate	Larva	06/73	S
Ae. aegypti	Nueva Octopeque	?	Dieldrin	Larva	06/73	S
Ae. aegypti	Nueva Octopeque	?	Abate	Larva	06/73	S
Anopheles albimanus	El Paraiso	Las Lomas	Parathion	Larva		
An. albimanus	El Paraiso	Las Lomas	Malathion	Larva	7/71	S
An. albimanus	El Paraiso	Las Lomas	Propoxur	Larva	7/71	S
An. albimanus	El Paraiso	Arenales	Parathion	Larva	7/71	S
An. albimanus	El Paraiso	Arenales	Malathion	Larva	7/71	S
An. albimanus	El Paraiso	Arenales	Propoxur	Larva	7/71	S
An. albimanus	Francisco Morazan	Zamorano	Parathion	Larva	7/71	S
An. albimanus	Francisco Morazan	Zamorano	Malathion	Larva	7/71	S
An. albimanus	Francisco Morazan	Zamorano	Propoxur	Larva	7/71	S

Anopheles albimanus been reported as resistant to dieldrin, lindane, malathion, propoxur and DDT from various areas of Honduras and to clorfoxim on the Pacific Coast.

[1] Resistance test kits and protocols for resistance testing of various vector groups can be obtained by contact Mr. Brain Zeichner at the U. S. Army Environmental Health Agency (410-671-3613, DSN 584-3015/2792.

[2] These data have been extracted from data bases of the World Health Organization.

PERSONAL PROTECTIVE MEASURES

Personal protective measures are the first line of defense agaisnt arthropod-borne disease and may be the only protection for military personnel deployed in the field. Proper wearing of the uniform and appropriate use of repellents can provide high levels of protection against blood-sucking arthropods. The uniform fabric provides a significant mechanical barrier to mosquitoes, ticks and other blood-sucking insects. The uniform should be worn to cover as much skin as possible, weather and physical activity permitting.

Protection provided by a properly worn uniform can be greatly increased by use of two newly developed repellents. An aerosol formulation of permethrin (NSN 6840-01-278-1336) can be applied to the uniform but not the skin according to label directions. This will impart both repellent and insecticidal properties to the uniform material, and will remain effective through several washings. A new extended lotion formulation of diethyl-m-toluamide (DEET) (NSN 6840-284-3982) has been developed to replace the 2-oz. bottles of 70% DEET in alcohol. The formulation contains less active ingredient and does not have to be applied as often as the old formulation. It is less irritating to the skin, has less odor and is generally more acceptable to the user. Combined use of extended duration DEET lotion on exposed skin and permethrin on uniform items has been demonstrated in laboratory and field studies to provide nearly 100% protection against a variety of blood-sucking arthropods. In addition permethrin may be applied to bednets, tentage and other field items, as needed. Recent field studies in several countries have shown that bed nets treated with pyrethroids are highly effective against mosquitoes and a variety of other blood-sucking arthropods.

When operating in tick infested areas, the pants should be bloused into the boots to prevent access to the skin by ticks and other crawling arthropods, such as chiggers. Check yourself frequently when walking through tick-infested areas. Upon returning from tick-infested areas, remove all clothing and examine yourself for ticks. Infected ticks usually require several hours of feeding before pathogens are transmitted. Therefore, attached ticks should be removed as soon as possible. If ticks become attached, the preferred method of removal is by a slow, steady pull with a pair of tweezers or forceps. Do not squeeze the body, but grasp the tick where the mouthparts enter the skin and pull firmly until the tick is extracted. Be careful not to break off the mouthparts and leave them in the skin. Wipe the bite area with an antiseptic. If the hands have touched the tick during removal, wash them thoroughly with soap and water or an antiseptic since tick secretions may contain pathogens.

The U. S. Army Environmental Hygiene Agency's illustrated Technical Guide #174, entitled **Personal Protective Techniques Against Insects and Other Arthropods of Military Significance** is an invaluable reference available from:

U. S. Environmental Hygiene Agency
Entomological Science Division
Aberdeen Proving Ground, MD 21010-5422
DSN 584-3613 Commercial (410) 671-3613

More detailed recommendations for the selection, application and use of pesticides in field situations worldwide, during contingency operations or military exercises, can be found in the **Contingency Pest Management Pocket Guide**. This guide is a concise reference on: National Stock Number (NSN)-listed pesticides available through military supply channels and designated for contingency use by one or more of the Armed Services; their uses, dosages, and application methods; pesticide dispersal equipment; information on surveillance, trapping, and safety equipment; personal protective equipment against disease vectors; air-transport of pesticides that do not meet transportation requirements; pesticides dilution and dosage formulas; and U. S. military points of contact overseas who can provide information on vector-borne disease control in their respective areas of the world.

Copies of the **Contingency Pest Management Pocket Guide** (also known as Technical Information Memorandum #24 can be obtained free of charge from DPMAIC.

SELECTED REFERNCES FOR HONDURAS

ARNOTT, J. J. 1984. Medical entomologist post-deployment report from Honduras, June 1983-April 1984. 41ST CSH AHUS TARA II After Action Report: 53pp.

BELKIN, J.N. et al. 1965. Mosquito studies (Diptera, Culicidae). V. Mosquitoes originally described from Middle America. Contrib. Am. Entomol. Inst. 1(5): 1-195.

CALISHER, C.H. et al. 1971. Isolations of Nepuyo Virus strains from Honduras, 1967. Am. J. Trop. Med. Hyg. 20(2): 31-337.

CALISHER, C.H. et al. 1988. Brus Laguna Virus, A Gamboa Bunyavirus from *Aedeomyia squamipennis* collected in Honduras. Am. J. Trop. Med. Hyg. 39(4): 406-408.

CAMPBELL, J.A. and LAMAR, W. W.1989. The Venomous Reptiles of Latin America. Comstock Publishing Associates, Ithaca, N. Y. 415 pp.

COULAUD, J. P. et al. 1982. Treatment of Cutaneous Larva Migrans (Larbish) with albendazole. Report on 18 Cases. Bull. Soc. Pathol. Exot. 75(5): 534-7.

DAVIES, J.B. and LINLEY, J.R. 1965. Observations on the breeding sites of the sandfly *Leptoconops bequaerti* in the Monego Bay area Jamaica, with a note on one breeding site in Honduras. Caribb. J. Sci., (Mayaquez). 5(3/4): 17-28.

FAIRCHILD, G. B. and Hertig, M. 1959. Geographic distribution of the *Phlebotomus* sandflies of Central America (Diptera: Psychodidae). Ann. Entomol. S. Amer. 52: 121-4.

FIGUEROA, M. E. et al. 1972. Venezuelan encephalitis in humans in Honduras. In: Venezuelan Encephalitis. Proceedings of Workshop-Symposium on Venezuelan Encephalitis Virus, Washington, D. C. 14-17 September 1971.

FIGUEROA, M. E. et al. 1982. Dengue epidemic in Honduras, 1978-80. Bull Panam Health Org. 16(2): 130-7.

GALINDO, P. and BLANTON, F. S. 1954. Nine new species of neotropical Culex, eight from Panama and one from Honduras (Diptera, Culicidae). Ann. Entomol. Soc. Amer. 47: 231-47.

GUBLER, D.J. et al. 1983. Dengue in Central America. Dengue Surveillance Summary, (San Juan Lab., Puerto Rico): 14: 1-2.

HEINEMANN, S. J. and BELKIN, J. N. 1977. Collection records of the project "Mosquitoes of Middle America". 8. Central America: Belize (BH), Guatemala (GUA), and El Salvador (SAL), Honduras (HON), Nicaragua (NI, NIC). Mosq. Syst. 9(4): 403-54.

HODGE, A. R. et al. 1971. Neotropical pit vipers, sea snakes and coral snakes. In: Venomous Animals and Their Venoms. Volume II. Venomous Vertebrates edited by Bucherl et al. Academic Press, N. Y. 211-93.

INTERMILL, R. W. and MULLER W. B. 1976. New distribution records from *Lutzomyia gomezi* (Nitzulescu) and *L. chiapenensis* (Dampf) from Honduras. Mosq. News 36(4): 543.

JAMES, M. T. 1950. The Diptera collected on the Cockwell and Hubbell expedition to Honduras. Part I. Stratomyidae, Tabanidae and Acrocratidae. Pan Pacif. Entomol. 26: 86-90.

JRS, 1982. Leishmaniasis in El Paraiso. JPRS 82413 Worldwide Rep. Epidemiol. No. 304: 12

JRS, 1982. Treatment for Leishmaniasis. JPRS 82413 Worldwide Rep. Epidemiol. No. 304: 13

JRS, 1983. Colon: High Malaria Incidence JPRS 83556 Worldwide Rep. Epidemiol. No. 320: 18.

KNIGHT, K. L. and A. Stone. 1977. A catalog of the mosquitoes of the world (Diptera: Culicidae). Second Edition. Thomas Say Found., Entomol. Soc. Am. 6: 1-611.

KNIGHT, K. L. and A. Stone. 1978. Supplemental to a catalog of the mosquitoes of the world (Diptera: Culicidae). Thomas Say Found., Entomol. Soc. Am. 6(Suppl.): 1-107.

LEON, Gomez A. Jr. et al. 1960. Chagas' Disease in Honduras. Rev. Med. Hondur. 28: 78-83.

MANGUM, C.L. 1962. Fly baiting in Honduras. Pest Control. 30(4): 20.

MATTA, J. F.1967. A new species of *Culicoides* (Diptera: Ceratopogonidae) from Honduras. Florida Entomol. 50(1): 75-77.
MATTA, J. F.1967. A monograph of *Culicoides* (Diptera: Ceratopogonidae) of El Salvador and Honduras. Univ. Florida, Thesis: 232pp.
MEYER, J. R. 1966. Records and observations on some amphibians and reptiles from Honduras. Herpetologica 22(3): 172- 81.
MEYER, J. R. and WILSON, L. D. 1973. A distributional checklist of the turtles, crocodilians, and lizards of Honduras. Los Angeles County Museum Contrib. Sci. 244: 1-39.
MOLINA, A. 1975. Enumeraction de las plantas de Honduras. Ceiba 19: 1-118.
NAVIN, T. R. et al. 1985. Epidemiologic study of visceral leishmaniasis in Honduras, 1975-1983.
NGUYEN-DINH P. et al. 1981 Assessment of chloroquine sensitivity of *Plasmodium falciparum* in Choluteca, Honduras. Bull. WHO 59(4): 641-6.
NUERNBERGER, S . P. 1975. Visceral leishmaniasis in Honduras. Report on three proven cases and suspected case. Am. J. Trop. Med. Hyg . 24(6, part 1): 917-20.
PADILLA, H. C. et al. 1968. Disseminated cutaneous leishmaniasis: first case in Honduras. Medicina Cutanea 3(2): 119-23.
PAHO, 1983. Cases of rabies in man and animals. Panam. Zoonoses Cent., Epidemiol. Surveill. Enceph. Rabies 14(7-12): 3-17.
PAINTER, R. H. 1926. The biology, immature stages and control of the sandflies (biting Ceratopogonidae) of Puerto Castilla, Honduras. United Fruit Co., Med. Dept. Ann. Rep. 15: 245-62.
PEACOCK, M. G. et al. 1971. Rickettsioses of Central America. Am. J. Trop. Med. Hyg. 20(6, part 1): 941-9.
PONCE, C. and ZELDON, R. 1973. Chagas' Disease in Honduras. Bol. Ofic. Sanit. Panam. 75(3): 239-48.
PONCE, C. et al. 1975. Observations on Chagas' disease and *Trypanosoma rangeli* from three huts in Honduras. Rev. Biol. Trop. (San Jose, Costa Rica) 22(2): 289-303.
PONCE, C. et al. 1991. *Leishmania donovani chagasi*: new clinical variant of cutaneous leishmaniasis in Honduras. Lancet 327: 67-70.
REMINGTON, J. S. et al. 1970. Studies on toxoplasmosis in El Salvador. Prevalence and incidence of Toxoplasmosis as measured by the Sabin-Feldman dye test. Trans. R. Soc. Trop. Med. Hyg. 64(2): 252-67.
ROBERT, L. L. 1989. Medical entomologist post-deployment report from Honduras, April-October 1989. JTF Bravo Medical Element, Soto Cano Air Base, Honduras.
ROMERO, A. et al. 1979. Dengue in 1978. WHO PAHO Newslett. 8(2): 3-13.
SCHERER, W.F. et at. 1970. Discovery and geographic distribution of Venezuelan Encephalitis Virus in Guatemala, Honduras, and British Honduras during 1965-68, and its possible movement to Central America and Mexico. Am. J. Trop. Med. Hyg. 19(4): 703-11.
SCHERER, W.F. et at. 1972. Studies of Patois Group arboviruses in Mexico, in Guatemala, Honduras, and British Honduras Am. J. Trop. Med. Hyg. 21 (2): 194-200.
SCHERER, W.F. et at. 1972. Serologic surveys for antibodies to Western, Eastern, California, and St. Louis encephalitis and dengue 3 arboviruses in Middle America 1961-1975. Bull. Pan. Am. Health Org. 11(3): 212-223.
SHARKS, G. D. HAYS, R. C. MORGAN, B. A. et al. 1988. Medical care of U. S. military personnel deployed to Honduras. Mil. Med. 153(11): 564-67.
STOJANVICH, C.J. et al. 1966. Clave ilustrada para los mosquitos Anofelions de America Central y Panama. DHEW PHC CDC: 44PP.
STOCKWELL, S.A. 1991. Medical entomologist post-deployment report from Honduras, June-December 1990. JTF Bravo Medical Element, Soto Cano Air Base, Honduras.
STRICKMAN, D. and R. F. Darsie, Jr. 1988. *Culex restuans* (Diptera: Culicidae). Mosq. Syst. 21(1): 21-27.
STRICKMAN, D. 1989. Biosystematics of larval movement of Central American mosquitoes and its use of field identification. J. Am. Mosq. Control Assoc. 5(2): 208-212.

STRICKMAN, D. 1989. *Culex pseudostigmatosoma*, *C. yojoae*, and *Cx. aquarius*: New Central American Species in the subgenus Culex (Diptera: Culicidae). Mosq. Syst. 21(3): 143-177.

STRICKMAN, D. and J. Pratt. 1989. Redescription of *Culex* (Culex *ractator*) Dyar Knab from synonymy based specimens from Central America (Diptera: Culicidae). Proc. Entomol. Soc. Wash.91(4): 551-574.

TRAVIS, B. V. et al. 1954. List of arthropods of medical importance: Honduras 137. Dept. Ent., Cornell Univ., Ithaca, NY., Dec. : 53pp.

WARD, R.A. 1984. Second supplement to "A Mosquito Catalog of the World" (Diptera: Culicidae) Mosq. Syst. 16: 227-270.

WHO PAHO, 1981. The world malaria situation, 1979. Bull. Panam. Health Org. 15(3): 278-84.

WHO WKLY EPID REP, 1978. Dengue - Honduras. WHO Wkly. Epidemiol. Rep. 50(43): 249.

WILDER, D. M. 1984. Preventive medicine officer's post deployment report from Honduras, August 1983-December 1983. 41st CSH AHUAS TARA II After-action Report: 23pp.

WILSON, L. D. 1983. Update on the List of Amphibians and Reptiles Known from Honduras. Herp. Review 14(4): 125-126.

WILSON, L. D. and MEYER, J. R. 1985. The Snakes of Honduras, 2nd edit. Milwaukee Public Museum, Milwaukee, Wisconsin 150 pp.

WOOD, J. R. and KLINE, D. L. 1984. A survey of Ceratopogonid biting midge problems associated with Posada del Sol Resort, Guanaja, Honduras. J. Florida Anti-Mosq. Assoc. 55(1): 22-7.

WRAIR, 1963. Honduras. Hlth. Data Publ. Div. Med. WRAMC. Wash. D.C. 1L9: 1-60.

ZELEDON, R. et al. 1972. Description of a new species of *Triatoma* from Honduras, Central America. Rev. Biol. Trop. (San Jose, Costa Rica). 20(2): 275-9.

ZELEDON, R. et al. 1982. Cutaneous leishmaniasis in Honduras, Central America. Trans. R. Soc. Trop. Med. Hyg. 76(2): 276-7.