

12. THE BUTTERFLY (LEPIDOPTERA, RHOPALOCERA) FAUNA OF THE CAYMAN ISLANDS

R.R. Askew

Butterflies are a numerous and conspicuous element in the Cayman Islands insect fauna. Particular attention was paid to them because, with practice, they can be fairly easily identified on sight in the field, and quantitative estimates of their distribution, in the time available, were possible. In addition, the useful baseline study by the 1938 Oxford University Expedition (Carpenter and Lewis 1943) provides data for comparison with the present situation. Butterflies were studied on Grand Cayman and Cayman Brac, during limited periods spent on these islands, as well as on Little Cayman.

Species found on the Cayman Islands by the two expeditions are listed in table 19. Forty species are certainly known from the islands, and this total is probably very nearly complete. A relationship exists between the area of an island and the size of its fauna. A regression of the numbers of species recorded from Cuba, Hispaniola, Puerto Rico, Jamaica and the Cayman Islands on the logarithms of the areas of these islands (fig. 25) suggests that a fauna of forty species from the Cayman Islands is of the right order. Data for the Greater Antillean faunas are taken with modification from Brown and Heineman (1972) and Riley (1975). The number of species on Puerto Rico is perhaps underestimated; Riley gives only eighty certainly recorded species but Brown and Heineman attribute ninety-nine species to the island.

Disparities between the 1938 and 1975 data (table 19) are accounted for by differences in the periods of time spent by the two expeditions on each of the three Cayman Islands, and by the superior mobility of the 1975 expedition due to the provision of vehicles and, on Little Cayman, the cutting of traces by the Cadastral Survey.

Differences between the faunas of Grand Cayman, Cayman Brac
and Little Cayman

Grand Cayman is situated some 117 km. west-south-west of Little Cayman which lies only 7.5 km. east of Cayman Brac. In spite of this proximity, there are differences between the faunas of the three islands.

Grand Cayman is much the largest island and supports the largest number of species (table 19). *Battus polydamas*, *Eurema elathea*, *E. messalina*, *Aphrissa neleis*, *Danaus eresimus*, *Phyciodes phaon*, *Siproeta stelenes*, *Dryas iulia*, *Brephidium exilis* and *Panoquina sylvicola* are all recorded in the Cayman Islands only from Grand Cayman. The place of *Eurema elathea* on the Lesser Caymans may be taken by the closely allied *E. दौरa*. Cayman Brac has no unique species so far recorded in its fauna, but on Little Cayman there are four species, *Papilio aristodemus*, *Nathalis iole*, *Strymon martialis* and *Phocides pigmalion*, which are not yet known from the other two islands.

The unique quality of each island's fauna is further emphasised by the occurrence on Grand Cayman of *Papilio andraemon tailori* Rothschild and Jordan, a subspecies confined to Grand Cayman and apparently representing the entire population there. *P. a. andraemon* is found on the Lesser Caymans. *Strymon acis* also exists as two fairly distinct forms, one on Grand Cayman and the other on the Lesser Caymans. All specimens of *Junonia evarete* observed on the Lesser Caymans were of the form *zonalis* (Felder and Felder), whereas those captured on Grand Cayman were referable to form *genoveva* (Cramer). This contrasts with the findings of Carpenter and Lewis (1943) who record *genoveva* from both Grand Cayman and Little Cayman, and *zonalis* from Grand Cayman and Cayman Brac. The expression of these two forms is believed to be environmentally controlled, *zonalis* being a wet season form and *genoveva* characteristic of drier conditions; as such their distribution would be expected to vary seasonally and annually.

In addition to qualitative differences between the island faunas, some species vary in relative abundance from island to island. Striking in this respect is *Anartia jatrophae*, abundant on Grand Cayman, scarce on Cayman Brac and absent from Little Cayman. Conversely, *Anaea echemus*, *Appias drusilla* and *Euptoieta hegesia* are very common on Little Cayman but appear to be rare on Grand Cayman.

Notes on the Caymanian species

Unless mentioned to the contrary, the following notes refer to Little Cayman and localities are indicated on the map (fig. 26). Nomenclature follows Riley (1975). Most of the observations on Grand Cayman were made in and adjacent to a small, rather dense, wood behind the Mosquito Research and Control Unit on the edge of Georgetown. This locality is designated 'M'. Collecting on Cayman Brac was

Table 19. Butterfly species recorded by the 1938 and 1975 expeditions to the Cayman Islands.

	<u>Grand Cayman</u>		<u>Cayman Brac</u>		<u>Little Cayman</u>	
	<u>1938</u>	<u>1975</u>	<u>1938</u>	<u>1975</u>	<u>1938</u>	<u>1975</u>
DANAIDAE						
<i>Danaus plexippus</i>	x	x	x	-	-	-
<i>Danaus gilippus</i>	x	x	x	-	x	x
<i>Danaus eresimus</i>	x	x	-	-	-	-
APATURIDAE						
<i>Anaea echemus</i>	x	x	x	x	x	x
NYMPHALIDAE						
<i>Junonia evarete</i>	x	x	x	x	x	x
<i>Anartia jatrophae</i>	x	x	x	x	-	-
<i>Siproeta stelenes</i>	x	x	-	-	-	-
<i>Phyciodes phaon</i>	x	x	-	-	-	-
<i>Euptoieta hegesia</i>	x	x	x	x	x	x
HELICONIIDAE						
<i>Dione vanillae</i>	x	x	x	x	x	x
<i>Dryas iulia</i>	x	x	-	-	-	-
<i>Heliconius charitonius</i>	x	x	-	x	-	x
LYCAENIDAE						
<i>Strymon martialis</i>	-	-	-	-	x	x
<i>Strymon acis</i>	x	-	x	x	x	x
<i>Strymon columella</i>	x	x	-	-	-	x
<i>Hemiargus ammon</i>	x	x	-	x	-	x
<i>Hemiargus hanno</i>	x	x	-	-	-	x
<i>Brephidium exilis</i>	x	-	-	-	-	-
<i>Leptotes cassius</i>	x	x	x	x	x	x
PIERIDAE						
<i>Ascia monuste</i>	x	x	x	x	x	x
<i>Appias drusilla</i>	-	x	x	x	x	x
<i>Nathalis iole</i>	-	-	-	-	-	x
<i>Eurema elathea</i>	x	x	-	-	-	-

Table 19. (continued)

	Grand Cayman		Cayman Brac		Little Cayman	
	1938	1975	1938	1975	1938	1975
<i>Eurema दौरa</i>	-	-	-	x	-	x
<i>Eurema messalina</i>	x	-	-	-	-	-
<i>Eurema nicippe</i>	x	x	x	x	-	x
<i>Eurema lisa</i>	x	x	-	x	-	x
<i>Phoebis sennae</i>	x	x	x	x	x	x
<i>Aphrissa neleis</i>	x	-	-	-	-	-
PAPILIONIDAE						
<i>Battus polydamas</i>	x	-	-	-	-	-
<i>Papilio aristodemus</i>	-	-	-	-	x	x
<i>Papilio andraemon</i>	x	x	x	x	x	x
HESPERIIDAE						
<i>Phocides pigmalion</i>	-	-	-	-	x	x
<i>Urbanus proteus</i>	x	x	x	-	-	-
<i>Hylephila phylaeus</i>	x	-	x	-	-	-
<i>Cymaenes tripunctus</i>	x	x	-	x	-	-
<i>Calpodēs ethlius</i>	-	x	-	-	-	-
<i>Panoquina panoquinoides</i>	x	x	x	x	x	x
<i>Panoquina sylvicola</i>	x	x	-	-	-	-
Numbers of species recorded	32	28	17	18	15	23
Days on islands	109	8	11	4	13	32
Total species on each island	34		22		23	

confined to the western half of the island. The periods spent on each island are as follows: Grand Cayman July 5th - 8th, August 11th - 14th; Cayman Brac July 9th, August 7th - 8th, August 11th; Little Cayman July 9th - August 7th, August 9th - 10th.

1. *Danaus plexippus* (Linnaeus)

Twice seen on Grand Cayman (M). Probably of the subspecies *megalippe* Hübner which replaces, with overlap, the migratory *D. p. plexippus* in the West Indies except on Cuba and the Bahamas.

2. *D. gilippus* (Cramer)

Quite frequent on Grand Cayman (Georgetown dykes, M, West Bay, mid-island road, Old Man Bay). Only seen twice on Little Cayman, at Spot Bay on August 2nd, and at Bloody Bay on August 5th. Of the subspecies *berenice* Cramer.

3. *D. eresimus* (Cramer)

Two collected on Grand Cayman on July 8th (Georgetown dykes, M).

4. *Anaea echemus* (Doubleday and Hewitson)

Abundant on Little Cayman (Preston Bay, Bloody Bay, east end, north shore path, Sparrowhawk Hill, central forest), but seen once only on Grand Cayman (Cayman Kai) and on Cayman Brac. Frequently rests on branches with wings folded. Nine out of fifteen specimens examined had the apical part of one or both hind-wings missing, probably the result of attacks by lizards. Both sexes were strongly attracted by seventy percent ethanol. Of the subspecies *danieliana* Witt.

5. *Junonia evarete* (Cramer)

Common on Grand Cayman (mid-island road, Georgetown dykes, West Bay), and two seen on Cayman Brac. Common on the old plantation ground of Bloody Bay and occurring at other sites on the north and west coasts of Little Cayman. Two observed near Diggary's Point are the only south coast records. Attracted particularly to the flowers of *Stachytarpheta jamaicensis*. Distribution of the forms *zonalis* and *genoveva* is described above.

6. *Anartia jatrophae* (Johansson)

Abundant on Grand Cayman (Georgetown dykes, M, West Bay) but only two seen on Cayman Brac (near the Brown Booby colony) and absent from Little Cayman. This accords closely with the situation recorded by Carpenter and Lewis. In flight throughout the day; one attracted to an outdoor electric light in Georgetown at midnight. Specimens from the Cayman Islands are referred to subspecies *guantanamo* Munroe, described after Carpenter and Lewis attributed their Cayman specimens to *jamaicensis* Möschler.

7. *Siproeta stelenes* (Linnaeus)

One only seen, on Grand Cayman (West Bay) on August 14th. A specimen in the collection of Mr J.F. Lesieur was taken in Georgetown about 1971. Of the subspecies *insularis* Holland.

8. *Phyciodes phaon* (Edwards)

Common in open areas of Grand Cayman (Georgetown dykes, M, mid-island road, West Bay).

9. *Euptoieta hegesia* (Cramer)

Common all round the coast of Little Cayman and not infrequent in the interior scrub. One only seen on Grand Cayman (logwood pasture) and one on Cayman Brac. Specimens very variable, especially in the colour of the hind-wing underside. A fully grown larva collected on August 4th from *Evolvulus arbuscula* (probably not the food plant) produced an imago on August 11th; a pupa produced a brood of a *Pteromalus* species.

10. *Dione vanillae* (Linnaeus)

Abundant and widespread on all three islands. A male was observed attempting to copulate with a female held by a crab spider at Bloody Bay where the species was feeding in numbers at the blue flowers of *Stachytarpheta*. Carpenter and Lewis report that Grand Cayman specimens are on average larger than those from the Lesser Caymans, and this is supported by measurements of material collected in 1975. The fore-wing expanse of Little Cayman specimens ranges from 48mm. to 62mm. (mean 57mm.) for males (n = 9), and from 50mm. to 67mm. (mean 59mm.) for females (n = 6). All three males collected on Grand Cayman exceed the largest Little Cayman male in wing expanse, measuring 71mm., 67mm. and 63mm. Two females were collected on Grand Cayman; one (68 mm.) is larger than any Little Cayman female, and the other (60 mm.) is above the Little Cayman average. Cayman specimens are of the north Caribbean subspecies *insularis* Maynard.

11. *Dryas iulia* (Fabricius)

One specimen collected on Grand Cayman (Georgetown dykes). Caymanian specimens belong to subspecies *carteri* Riley.

12. *Heliconius charitonius* (Linnaeus)

Once seen on Grand Cayman (Georgetown dykes) and once on Cayman Brac. Common in the interior of Little Cayman, especially near taller trees and at the edge of mangrove swamps (Preston Bay, Mary's Bay, Bloody Bay, north shore path, Sparrowhawk Hill, east end, Charles Bight). Brown and Heineman (1972) write "It will take a longer series of specimens than is now available for study to properly place the strain that is found on the Caymans. We suspect that it is distinct from both *H. c. simulator* and *H. c. ramsdeni*". My material is certainly

distinct from the British Museum (Nat. Hist.) series of Jamaican *simulator* Röber in having the yellow markings less extensive, but it does not differ, at any rate superficially, from Cuban *ramsdeni* Comstock and Brown. Carpenter and Lewis found the species only on Grand Cayman, and they record the wing expanse ranging between 64mm. and 94mm. The smallest Little Cayman specimen collected has a wing expanse of 59mm., the largest 94mm.

13. *Strymon martialis* (Herrich-Schäffer)

Seven collected on Little Cayman, all males. Frequently seen about *Conocarpus* at Pirate's Point, and also recorded at Blossom Village on the storm beach, north shore path, Owen Island, and in the interior south of Crawl Bay.

14. *S. acis* (Drury)

Flying with *S. martialis* on *Conocarpus* by the lagoon and on the storm beach at Pirates' Point, also seen at Sandy Point, the storm beach at the east end (on *Caesalpinia*), and at Bloody Bay and Mary's Bay. Two taken on Cayman Brac. The orange spot near the base of the shorter tail on the upper-side of the hind-wing is absent or very small in all specimens, as Carpenter and Lewis reported for their material from the Lesser Caymans. On specimens from Grand Cayman, however, Carpenter and Lewis found the spot well-developed. The 1938 material is placed in the British Museum (Nat. Hist.) with subspecies *gossei* Comstock and Huntingdon from Jamaica. The Grand Cayman insects closely resemble *gossei* but Lesser Cayman specimens are more like Cuban *casasi* Comstock and Huntingdon in pattern.

15. *S. columella* (Fabricius)

The least frequently seen of the three *Strymon* and entirely coastal (Preston Bay, Diggary's Point, Bloody Bay, Mary's Bay, east end). Two captured on Grand Cayman (M). Observed feeding at flowers of *Portulaca* and, like its congeners, flying about *Conocarpus erecta*. Of the subspecies *cybira* Hewitson.

16. *Leptotes cassius* (Cramer)

Carpenter and Lewis list both *L. theonus* (Lucas) and *Hemiargus catalina* (Fabricius). These are conspecific subspecies. Examination of material in the British Museum (Nat. Hist.) indicates that *theonius* is the correct subspecific name for Caymanian insects. Common in open places on Grand Cayman (Georgetown dykes, M, West Bay, South Sound) and Little Cayman (Bloody Bay, Mary's Bay, Preston Bay, Pirates' Point, Blossom Village), and noted on Cayman Brac. Most numerous on the landward slopes of the beach ridges, at a greater distance from the sea than *Hemiargus ammon*.

17. *Hemiargus ammon* (Lucas)

Abundant on the coasts of Grand Cayman (West Bay, South Sound) and

Little Cayman (both north and south coasts); also taken on Cayman Brac (west end). Males are very variable in the degree of expression of the orange spot proximal to the outer black marginal spot on the hind-wing upperside. Of the subspecies *erembis* Nabokov.

18. *H. hanno* (Stoll)

Two females collected on Grand Cayman (West Bay) and two males on Little Cayman (Bloody Bay and, feeding at *Ambrosia hispida*, near the lighthouse). These specimens belong to the subspecies *filenus* Poey.

19. *Brephidium exilis* (Boisduval)

Carpenter and Lewis record this species only from a very limited region of Grand Cayman which they describe as English Sound off Great Sound. Neither of these names is in current use, although Great Sound must refer to North Sound, and the locality is probably to the east of Water Point. This area was visited on August 13th but found to be disturbed by development of Cayman Kai. No butterflies were found. The subspecies *thompsoni* Carpenter and Lewis was described from Grand Cayman specimens.

20. *Ascia monuste* (Linnaeus)

Common on Grand Cayman (M, mid-island road) and Cayman Brac. Abundant on Little Cayman in coastal places, but much less frequent inland although particularly numerous at the east end *Sesuvium* marsh. A large increase in numbers was noted on July 31st. The extent of the apical black dentate mark on the fore-wing upperside is very variable, often reduced, and in one male there is no dentation and the mark closely resembles that of female *Appias drusilla*. Belong on the north Caribbean subspecies *evonima* Boisduval.

21. *Appias drusilla* (Cramer)

Two specimens seen on each of Grand Cayman and Cayman Brac; abundant on Little Cayman in both coastal and inland localities. Most resemble subspecies *poeyi* Butler (all females of the dry season form *peregrina* Röber); Brown and Heineman (1972) wrongly place Caymanian insects as subspecies *castalia* Fabricius (= *jacksoni* Kay).

22. *Nathalis iole* Boisduval

A single female captured on the north shore path about one kilometre north of Blossom Village on August 2nd is the first record of the species from the Cayman Islands. This specimen resembles most closely material in the British Museum (Nat. Hist.) from Texas.

23. *Eurema elathea* (Cramer)

Found only on Grand Cayman (M, Cayman Kai, logwood pasture).

24. *E. दौरa* (Godart)

Not previously recorded from the Cayman Islands. Three males and one female taken on Cayman Brac (west end storm beach, Rebecca's Cave, near the Buccaneer Inn) and four females on Little Cayman (Bloody Bay, Blossom Village, Preston Bay, north coast near Sparrowhawk Hill). The females resemble female *E. elathea* but have less extensive black marginal marks on the hind-wing upperside and the coastal margin of the fore-wing is more strongly curved. The specimens are of the wet season form *palmira* Poey.

25. *E. messalina* (Fabricius)

Carpenter and Lewis record *E. messalina* from Grand Cayman, but it was not found in 1975.

26. *E. nicippe* (Cramer)

Seen on Grand Cayman (M, Cayman Kai) and Cayman Brac. Quite frequent on the north and west coasts of Little Cayman from Bloody Bay to Preston Bay. Only once seen on the south coast, at Diggary's Point. The species was not seen on Little Cayman until July 18th when several were observed at places previously visited.

27. *E. lisa* (Boisduval and Leconte)

Most frequent on Grand Cayman (M, mid-island road, West Bay); common locally on Cayman Brac (west end storm beach) and Little Cayman (Bloody Bay, north shore path, Diggary's Point). Like *E. nicippe*, *E. lisa* was first noted on Little Cayman on July 18th. Cayman insects are of the subspecies *euterpe* Ménétriés.

28. *Phoebis sennae* (Linnaeus)

Frequently observed on all three islands but every active and few caught. Especially numerous in Blossom Village and at Rosetta Flats.

29. *Aphrissa neleis* (Boisduval)

One specimen recorded from Grand Cayman by Carpenter and Lewis. Not seen in 1975.

30. *Battus polydamas* (Linnaeus)

Recorded from the Georgetown area of Grand Cayman by Carpenter and Lewis, but not seen in 1975. The Cayman specimens are of subspecies *cubensis* du Frane.

31. *Papilio aristodemus* Esper

Two captured in 1975 (north shore path, ironshore scrub 1 km. north of Pirates' Point), both *P. a. temenes* Godart.

32. *P. andraemon* (Hübner)

The common swallowtail of the islands. On Grand Cayman (M, Old Man Bay) specimens are clearly referable to subspecies *tailori* Rothschild and Jordan which is large and has reduced yellow markings. On the Lesser Caymans only the smaller, more yellow subspecies *andraemon* is present and widespread. Carpenter and Lewis indicate a difference between Caymanian and Cuban *P. a. andraemon* and their material was submitted to Dr Karl Jordan who noted 'a shifting of characters, perhaps the beginnings of sub-specific separation'. Lesser Cayman material from the 1938 expedition in the British Museum (Nat. Hist.) stand as *P. a. tailori* but I consider them more like Cuban *P. a. andraemon* and prefer to treat them as such. Some Cuban specimens have an orange suffusion over the hind-wing marginal lunules as in two specimens collected north of Charles Bight on Little Cayman.

33. *Phocides pigmalion* (Cramer)

Several seen feeding at flowers of *Rhizophora mangle* growing on the shore at East Rocky Point. They fly high about the mangroves and seldom come within reach of a net. Three males and a female were captured (July 25th, August 9th), of the subspecies *batabano* Lucas. Others were occasionally seen about the mangroves of the north coast. Bates (1935) records larvae feeding on *Rhizophora mangle*.

34. *Urbanus proteus* (Linnaeus)

In 1975 seen only on Grand Cayman (M, West Bay). The West Indian subspecies is *domingo* Scudder.

35. *Cybaeus tripunctus* (Herrich-Schäffer)

Grand Cayman (M) and Cayman Brac (Buccaneer Inn). Two specimens on Cayman Brac were found beneath an outside light at 11.30 p.m.

36. *Hylephila phylaeus* (Drury)

Carpenter and Lewis record *H. phylaeus* 'frequently at the top of beaches' on Grand Cayman and Cayman Brac. It was not found in 1975.

37. *Calpodus ethlius* (Stoll)

A specimen in the collection of Mr J.F. Lesieur collected about 1971 in Georgetown, Grand Cayman. Mentioned as a Caymanian species by Riley (1975) but not recorded by Carpenter and Lewis.

38. *Panoquina panoquinoides* (Skinner)

Frequent on the coasts of all three islands: Grand Cayman (Cayman Kai), Cayman Brac (west end), Little Cayman (Preston Bay, Bloody Bay, east end, Sandy Point, Mary's Bay). Carpenter and Lewis indicate that 'any future expedition should try to discover the food plant and early stages'. The early stages have since been described (see Brown

and Heineman, 1972) and the species reared on *Cynodon dactylon* in Jamaica. This grass does not grow on Little Cayman. Here the insect is always found on beach ridges in areas of *Sporobolus virginicus* which is almost certainly the food plant. Of ten captured on Little Cayman, nine are females. Riley (1975) does not include Cuba in the distribution of *P. panoquinoides* although Bates (1935) records specimens from that island.

39. *P. sylvicola* (Herrich-Schäffer)

Recorded with certainty in 1975 only on Grand Cayman (M), but a dark skipper seen at the east end of Little Cayman may have been this species or the next. Carpenter and Lewis attribute twenty-three of their specimens to form *woodruffi* Watson and two to subspecies *sylvicola*. The specimen that I took is of the former type.

40. *Nyctelius nyctelius* (Latreille)

Not certainly seen in 1975, nor recorded by Carpenter and Lewis, but said by Riley (1975) to occur in the Cayman Islands.

To this list of forty Caymanian species might be added two others whose occurrence on the islands requires confirmation. Carpenter and Lewis (1943) record an unidentified species of *Kricogonia* as seen on Cayman Brac, and these same authors write that *Phoebis agarithe* (Boisduval) has been 'authoritatively reported from Grand Cayman'.

Relationships of the Caymanian fauna

The Cayman Islands are projecting peaks of the submarine Cayman Ridge running westwards from the Sierra Maestra of south-eastern Cuba. Cayman Brac, the island nearest to Cuba and Jamaica, is separated from both by just over 200 km. Between the Cayman Ridge and Jamaica is a 6000 m. deep trench, the Bartlett Deep. The prevailing wind on the Cayman Islands is northerly, blowing from the direction of Cuba.

The butterflies of the Cayman Islands reflect this geographical relationship with Cuba. Brown and Heineman (1972) and Riley (1975) list the recorded butterfly species of Cuba, Hispaniola, Puerto Rico and Jamaica, and their data have been used to calculate values for Cole's coefficient of association between all of these islands and the Cayman Islands. These values, together with the numbers of shared species, are given in table 20. Vagrant or doubtfully recorded species are excluded. Cole's coefficient of association is an index of disequilibrium based upon the difference between the product of the numbers of species found on each of only one of two islands and the product of the numbers of species common to, and absent from, both islands. The coefficient is adjusted to give values between -100 and +100.

Table 20. Matrix showing the numbers of species shared between Cuba, Hispaniola, Puerto Rico, Jamaica and the Cayman Islands (upper right), values for Cole's coefficient of association (lower left), and the total number of butterfly species recorded for each island.

Number of species		Cuba	Hispaniola	Puerto Rico	Jamaica	Cayman Islands
156	Cuba	-	95	68	82	40
152	Hispaniola	-3	-	79	77	32
90	Puerto Rico	34	68	-	63	29
115	Jamaica	22	14	44	-	34
40	Cayman Is.	100	48	57	72	-

A dendrogram (fig. 27) constructed from mean values of Cole's coefficients of association illustrates the close relationship between the faunas of Cuba and the Cayman Islands, with a rather more distant association between the Jamaican and Caymanian faunas. The findings of Clench (1964) and Scott (1972) are essentially similar. All Cayman species are known from Cuba, but fifteen percent of Cayman species are not found on Jamaica. It must be emphasised, however, that the majority of Cayman Island species are widespread in the Greater Antilles, twenty-seven of the forty species being reported from Cuba, Hispaniola, Puerto Rico and Jamaica as well as the Cayman Islands. Associations between island faunas indicated by Cole's coefficient rely heavily upon a relatively small number of more localised species. Only three Caymanian species (*Anaea echemus*, *Phyciodes phaon* and *Aphrissa neleis*) are found on Cuba but not on other islands of the Greater Antilles, three others (*Strymon martialis*, *Nathalis iole* and *Papilio andraemon*) are recorded only from Cayman, Cuba and Jamaica, but no Caymanian species appears to be shared exclusively with Jamaica.

Lack of isolation and a limited land area of rather uniform altitude and character have probably restrained the evolution of endemic species on the Cayman Islands (see also Scott 1972). Nevertheless, as described above, there are distinctive elements in the fauna of each of the Cayman Islands, and the following four subspecies are endemic: *Anaea echemus danieliana*, *Hemiargus ammon erembis* (accorded full specific status by some authorities, e.g. Clench 1964), *Brephidium exilis thompsoni* and *Papilio andraemon tailori*. The association between the Cuban and Cayman butterfly faunas is further emphasised by the presence in the Cayman Islands of several Cuban subspecies: *Danaus gilippus berenice*, *Anartia jatrophae guantanamo*, *Heliconius charitonius simulator*, *Hemiargus hanno filenus*, *Appias drusilla poeyi*, *Siproeta stelenes insularis*, *Battus polydamas cubensis*, *Papilio aristodemus temenes* and *Phocides pigmalion batabano*. A Jamaican influence in the Cayman Island fauna is perhaps seen in the occurrence of Jamaican forms of

Strymon acis (gossei) and *Panoquina sylvicola (woodruffi)* together with Cuban forms (*casai* and *sylvicola*, respectively) of the same species. The limited available material of *Dryas iulia* is ascribed (Riley 1975) to *D. i. carteri*, a subspecies found in the Bahamas.

Daily flight activity on Little Cayman

Butterflies were flying from soon after sunrise throughout the day to sunset, and two species not found on Little Cayman, *Cybaeus tripunctus* and *Anartia jatrophae*, were seen during darkness at lights (see above). Temperatures probably never drop sufficiently low to prevent flight, but the level of butterfly activity appears to alter through the day, being greatest in the morning. To quantify this impression, butterfly sightings on a transect at Pirates' Point, Little Cayman were counted at hourly intervals from 6.00 a.m. to 6.00 p.m. local time. The transect was triangular, running along a path north from the house to the road, thence east along the road beside the lagoon, and back to the house by another path, totalling approximately 300 m. It was covered in about ten minutes, walking very slowly. All butterflies seen were recorded but multiple recordings of the same individual on one transect were avoided as far as possible. The shade temperature was noted on completion of each transect. Observations were made on three days, July 16th, 17th and 20th, all in fine weather.

The totals of butterfly sightings on each transect are shown in fig. 28, together with the shade temperatures. Most individuals were recorded at 10.00 and 11.00 a.m., before maximum temperatures had been reached, and numbers were generally lower in the afternoons. In the twelve transects from 8.00 to 11.00 a.m., 141 butterflies were sighted, whereas only 90 were recorded between 1.00 and 4.00 p.m. On July 20th, however, when afternoon temperatures were especially high, more butterflies were recorded than on either of the other two afternoons (fig. 28), showing that high temperatures do not necessarily reduce butterfly flight activity. There is no overall correlation between temperature and the numbers of butterflies sighted considering the species either collectively or separately, but at eight of the thirteen transect times the numbers of butterflies varied directly with the temperature ($P < 0.001$). On this limited data it appears that there is a pattern of high activity in the morning and lower activity in the afternoon, but this pattern can be modified by temperature so that above average flight activity occurs when the temperature is above average at any particular time. Before conclusions can be reached, however, other climatic variables must be considered. The wind on all three days was light and rather variable; relative humidity was not measured.

A total of 263 sightings were made during the transects. This was composed as follows: 84 *Dione*, 74 *Anaea*, 48 *Ascia*, 15 *Strymon*, 10 *Euptoietia*, 8 *Leptotes/Hemiargus*, 6 *Panoquina*, 5 *Papilio*, 4 *Appias*, 4 *Heliconius*, 2 *Phoebis*, 2 *Eurema* and 1 *Junonia*. The three most numerous species showed rather different patterns of flight activity (fig. 29). In all there was reduced activity at noon, but whilst *Anaea* and *Dione* were active to some extent from sunrise to sunset,

Ascia ceased flying after 3.00 p.m. *Anaea* was almost equally active in the mornings and afternoons, as might be expected of a shade-loving species, but *Dione* was most frequent in the mornings and relatively few were seen flying in the afternoons.

Butterfly distribution on Little Cayman

The widespread distribution on Little Cayman of many of its butterfly species has already been commented on, and few species have narrow habitat requirements. To investigate further the distribution of butterflies, sightings of butterflies were counted during three transects into the interior of the island. The first transect was made on July 19th from the burnt-over coastal plantation of Bloody Bay southwards over the forty-two feet high ridge of old bluff limestone to the area of dwarf mangroves about half way across the island. Butterflies were counted on both the outgoing and return journeys. The second transect was on July 27th from the coast north of Sparrowhawk Hill southwards through the belt of coastal mangroves, across the ironshore plateau and over Sparrowhawk Hill onto the dissected bluff plateau eventually descending to the central forest. Butterflies were again counted on both outgoing and return journeys. The third transect, on August 1st, crossed the island from coast to coast. It commenced on the north coast at the western end of Crawl Bay and ran through a variety of habitats, including both ironshore and bluff formations, inland and coastal mangroves, to the south coast just west of Diggary's Point. The approximate lines of all three transects are indicated on the map (fig. 26).

The transects were all made in fine weather and between 8.00 a.m. and noon, the time when butterflies are usually most active (see above). Results in a condensed form are shown in table 21. Ten habitat types are recognised on the transects (described below table 21), and the mean number of each species of butterfly seen per five minutes in each of the ten habitats on the three transects has been calculated.

Butterflies were most frequent on the disturbed, often burnt-over, land of the old coconut plantations and beside the road on the coastal strip. In contrast, no butterflies at all were seen during the transects in the other coastal habitat, the sea-grape (*Coccoloba*) woodland. Mangrove swamps were also deficient in butterflies, none being noted in coastal mangroves and very few in inland mangroves. Most of the latter were probably encouraged to penetrate the mangrove areas by the traces cut by the Cadastral Survey. Only *Phocides* appears to be characteristic of mangroves. There appeared to be little difference between the butterfly faunas of comparable habitats on ironshore and bluff formations (cf. habitats 5 and 9, 6 and 10), the tree-clad north-facing slopes of the ridges of both being richer in butterflies than the more xerothermic scrub-covered plateaux. The central forest and its edge are intermediate between the two latter habitats in butterfly numbers.

As well as being the richest habitat in terms of butterfly numbers, the old coastal plantations and storm beaches also supported

Table 21. Numbers of butterflies counted per five minutes in each habitat zone on three transects of Little Cayman (see text)

	Habitats										Total individuals
	1	2	3	4	5	6	7	8	9	10	
Total time (mins.)	38	5	40	63	15	88	15	60	24	119	
<i>Anaea</i>	0.1	0	0	0.3	2.7	0.2	1.7	3.6	1.0	0.2	74
<i>Euptoieta</i>	2.8	0	0	0.2	0.7	0.1	0	0	0.2	0	28
<i>Junonia</i>	0.5	0	0	0	0	0	0	0	0	0	4
<i>Dione</i>	4.2	0	0	0.1	1.0	0.9	1.3	0.3	3.5	0.9	97
<i>Heliconius</i>	0	0	0	0	0	0.4	0.7	0.4	0.4	0.1	18
<i>Appias</i>	1.2	0	0	0.2	2.3	1.8	3.0	2.9	3.1	1.1	135
<i>Ascia</i>	1.1	0	0	0	0.3	0.1	0	0	0	0	11
<i>Eurema nicippe</i>	0.1	0	0	0	0	0	0	0	0	0	1
<i>E. lisa</i>	0.1	0	0	0	0	0	0	0	0	0	1
<i>Phoebis</i>	0	0	0	0	0	0.1	0	0	0	0	1
<i>Papilio</i>	0	0	0	0.1	3.0	0.3	1.7	1.0	0.6	0.2	40
<i>Strymon</i> spp.	0.1	0	0	0	0.3	0	0	0	0.2	0.1	6
<i>Leptotes</i>	0.3	0	0	0	0	0	0	0	0	0	2
<i>Hemiargus</i>	0.5	0	0	0	0	0	0	0	0	0	4
<i>Phocides</i>	0	0	0	0.1	0	0	0	0	0	0	1
All species	11.1	0	0	1.0	10.3	3.7	8.3	8.2	9.2	2.7	
Total individs.	84	0	0	12	31	65	25	98	44	64	423

Habitats :	Coastal strip - storm beach, old burnt-over plantations, road and verge	- 1
	- <i>Coccoloba</i> woods	- 2
	Mangrove swamps - coastal	- 3
	- inland	- 4
	Ironshore - north slopes of ridges with tall trees	- 5
	- plateaux with scrub	- 6
	- scrub/forest boundary zone	- 7
	- forest	- 8
	Bluff - north slopes of ridges with tall trees	- 9
	- dissected plateaux with scrub	- 10

the greatest number of species (table 21). Only *Papilio*, *Heliconius* and *Phocides* were not recorded from this region (*Phoebis* was quite frequently seen here at other times), *Euptoieta*, *Dione* and *Ascia* reached their greatest densities here, and *Junonia*, the *Eurema* species, *Hemiargus*, *Leptotes* and *Panoquina* are only found here.

Anaea is most prevalent where there are trees, being numerous in the central forest and common on the northern slopes of the ridges, although it is present in most habitats. *Dione* is also widespread but, in contrast to *Anaea*, it tends to be associated inland more with areas of scrub, being scarce in the central forest but more numerous than *Anaea* on the ironshore and bluff plateaux. *Heliconius* is more restricted in its distribution and is particularly characteristic of the forest edge, although it does penetrate onto the plateaux. Elsewhere it was observed flying at the edge of mangrove swamps adjacent to ironshore scrub. *Appias* is another insect associated especially with tall trees, although it is present in some numbers also on the plateaux and coastal strip. *Appias* differs from the other large, white Pierid, *Ascia*, in being more prevalent in inland localities. Probably all transect sightings of *Papilio* refer to *P. andraemon* which has a distribution rather like that of *Heliconius*, although it may be more tolerant of xerothermic conditions. The records of *Strymon* include two species, specimens from the coastal strip being *S. columella* and *S. martialis* and those inland all *S. martialis*.

Summary and Conclusions

The butterfly fauna of the Cayman Islands is unremarkable for its specific content or number of species, but the general abundance of butterflies is a feature of the islands. No endemic full species have been described in the islands' fauna of forty species, but four subspecies are known only from the Cayman Islands.

The Cayman fauna has its strongest affinity with that of Cuba, reflecting also a geographical relationship, but also present are some Jamaican elements. The majority of Caymanian butterflies has a distribution extending throughout the Greater Antilles. Even so, and notwithstanding the proximity of the Cayman Islands, the butterfly faunas of each of the three islands have a unique quality. This finds expression both in the appearance of some recognisably distinct island forms and in differences in the distribution and relative abundance of some species.

On Little Cayman, butterflies were active from soon after sunrise until sunset, although there are specific differences in flight activity. No overall correlation was found between flight activity and temperature, flight activity generally being greatest before noon.

The richest area faunistically on Little Cayman is the disturbed coastal strip. Most species are quite widely distributed over the island but three, *Papilio aristodemus*, *Nathalis iole* and *Phocides pigmalion*, may have narrower and more restricted environmental requirements. *N. iole* was taken only in the rather mesophytic area

about one kilometre north of Blossom Village, and *P. aristodemus* was found here and also further to the west on the ironshore north of the lagoon near Pirate's Point. Both of these areas are likely to be much altered by implementation of the 1975 development plant (alternative 2), and the butterflies could disappear from the island if they are, as appears to be the case, restricted to these places. Neither species is known from the other two Cayman Islands. The future of *P. pigmalion* seems to be more assured. It also is known only from Little Cayman and is associated with *Rhizophora*, albeit locally. It is plentiful at East Rocky Point, a region free of proposed development, and was sighted at other stations on the island.

Grand Cayman is the longest settled and most densely populated of the Cayman Islands. Its fauna does not appear to have been depleted, and is probably unchanged from the situation reported in 1938 by Carpenter and Lewis (1943). Since 1965 extensive mosquito control measures, including the spraying of insecticides, have been undertaken on Grand Cayman. These may have affected butterfly numbers on some parts of the island although, in general, there seemed to be little difference in butterfly numbers on the three Cayman Islands. Only six species found in 1938 were not noted in 1975 during the relatively brief stay on Grand Cayman and, in all probability, further study will reveal their continued existence. It appears that the butterfly fauna of the Cayman Islands is tolerant of some development, and several species are especially numerous in places where the land has been disturbed. It is important, however, that any development leaves unaltered large areas of all of the natural habitats in order to safeguard those species unable to adapt to a rapidly changing environment.

Acknowledgements

I am grateful to Dr M.E.C. Giglioli, Mr. W. Brandrick, Mr. P. Fitzgerald and Mr R.G. Todd of the Mosquito Research and Control Unit, Grand Cayman, and to fellow members of the expedition, for assistance in many ways. I am indebted also to Dr L.M. Cook for supplying a computer programme to process distribution data and to Mr R.L. Vane-Wright for help in the examination of specimens in the British Museum (Natural History).

References

- Bates, D.M. 1935. The butterflies of Cuba. *Bull Mus. comp. Zool. Harv. Univ.*, 78, 63-258.
- Brown, F.M. & Heineman, B. 1972. *Jamaica and its Butterflies*. London: E.W. Classey Ltd. 478 pp.
- Carpenter, G.D.H. & Lewis, C.B. 1943. A collection of Lepidoptera (Rhopalocera) from the Cayman Islands. *Annls Carnegie Mus.* 29: 371-396.

- Clench, H.K. 1964. Remarks on the relationships of the butterflies (excluding skippers) of the Cayman Islands. *Occas. Pap. Mollusks Mus. comp. Zool.* 2, 381-382.
- Riley, N.D. 1975. *A Field Guide to the Butterflies of the West Indies*. London: Collins. 224pp.
- Scott, J.A. 1972. Biogeography of Antillean butterflies. *Biotropica*, 4, 32-45.

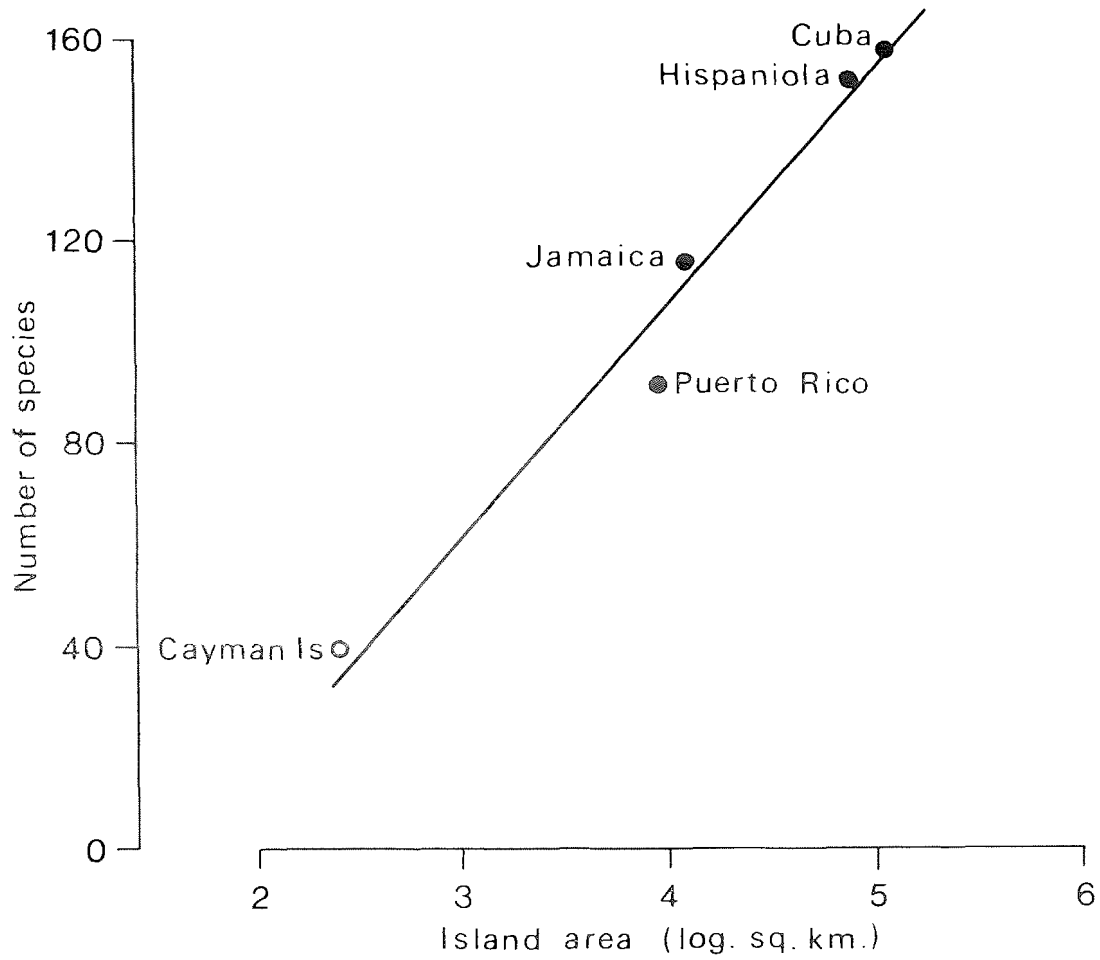


Figure 25. The relationship between the numbers of butterfly species and the areas (sq km on a logarithmic scale) of Cuba, Hispaniola, Puerto Rico, Jamaica, and the Cayman Islands ($r = 0.98$)

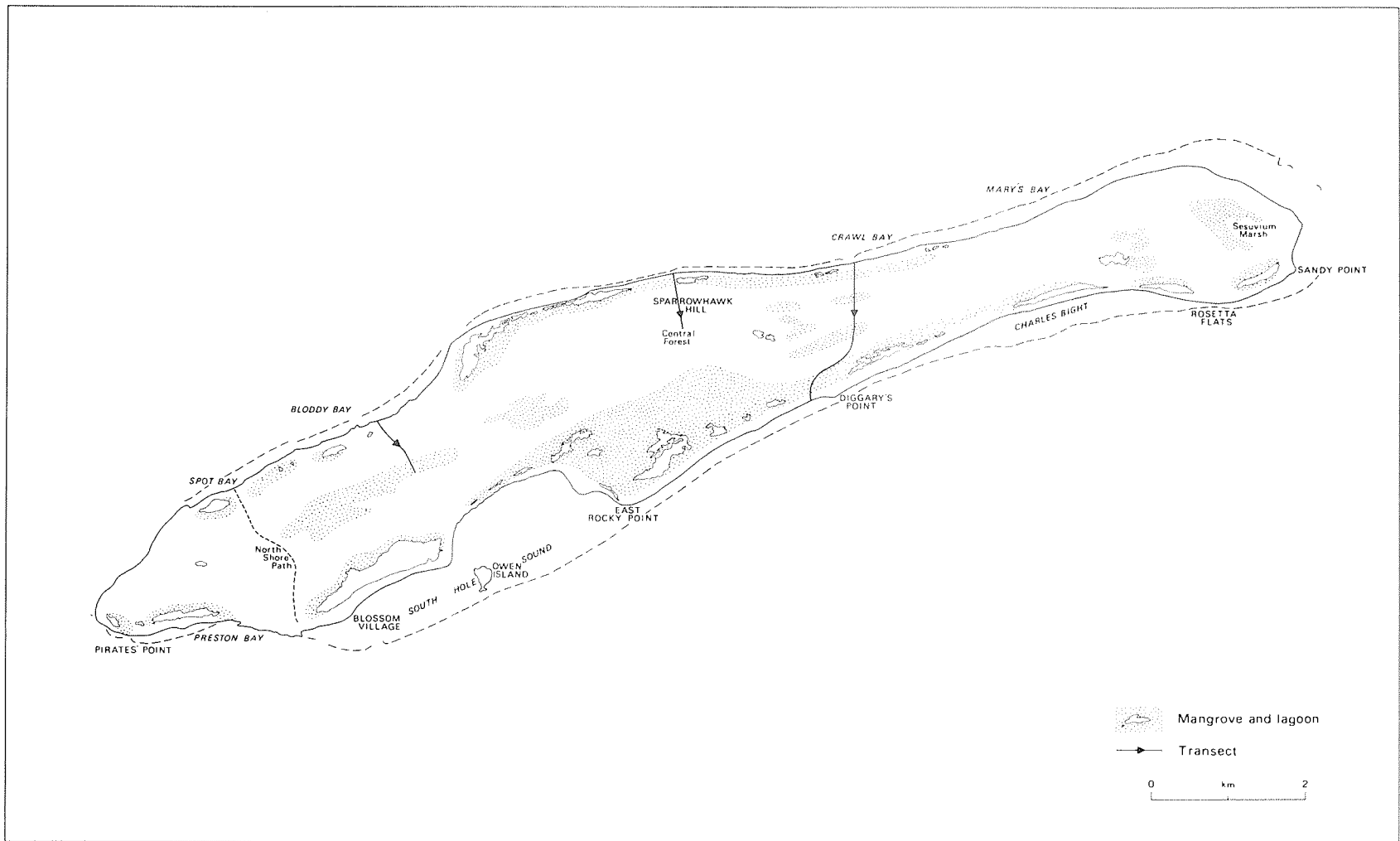


Figure 26. Map of Little Cayman showing localities mentioned in the text and the situation of the transects

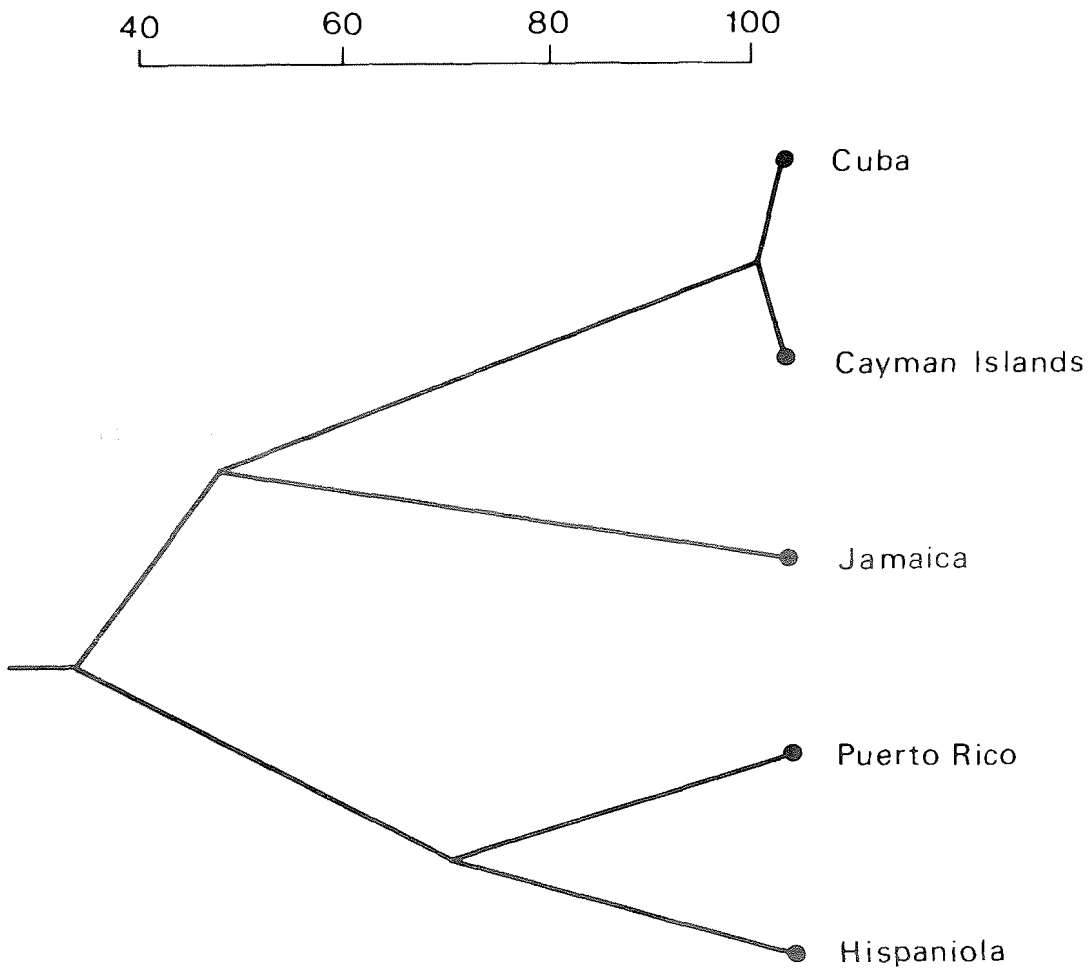


Figure 27. Associations between the butterfly faunas of the Greater Antilles based upon mean values of Cole's Coefficient of Association. The scale represents positive values of Cole's Coefficient

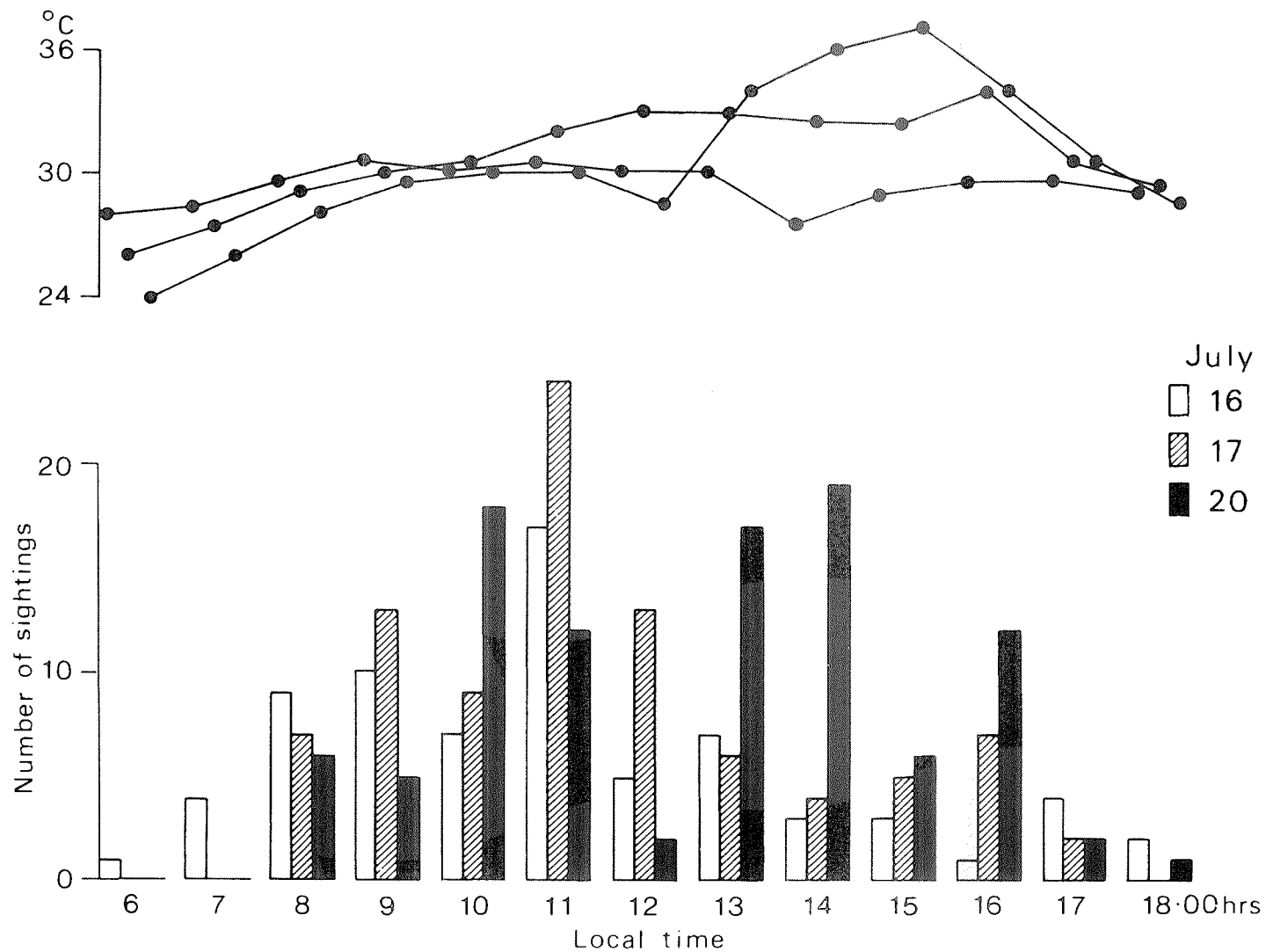


Figure 28. Numbers of butterflies sighted at hourly intervals (local time) during transects on three days at Pirate's Point, Little Cayman. Shade temperatures are shown above. For each hour the columns represent (from left to right) 16, 17 and 20 July

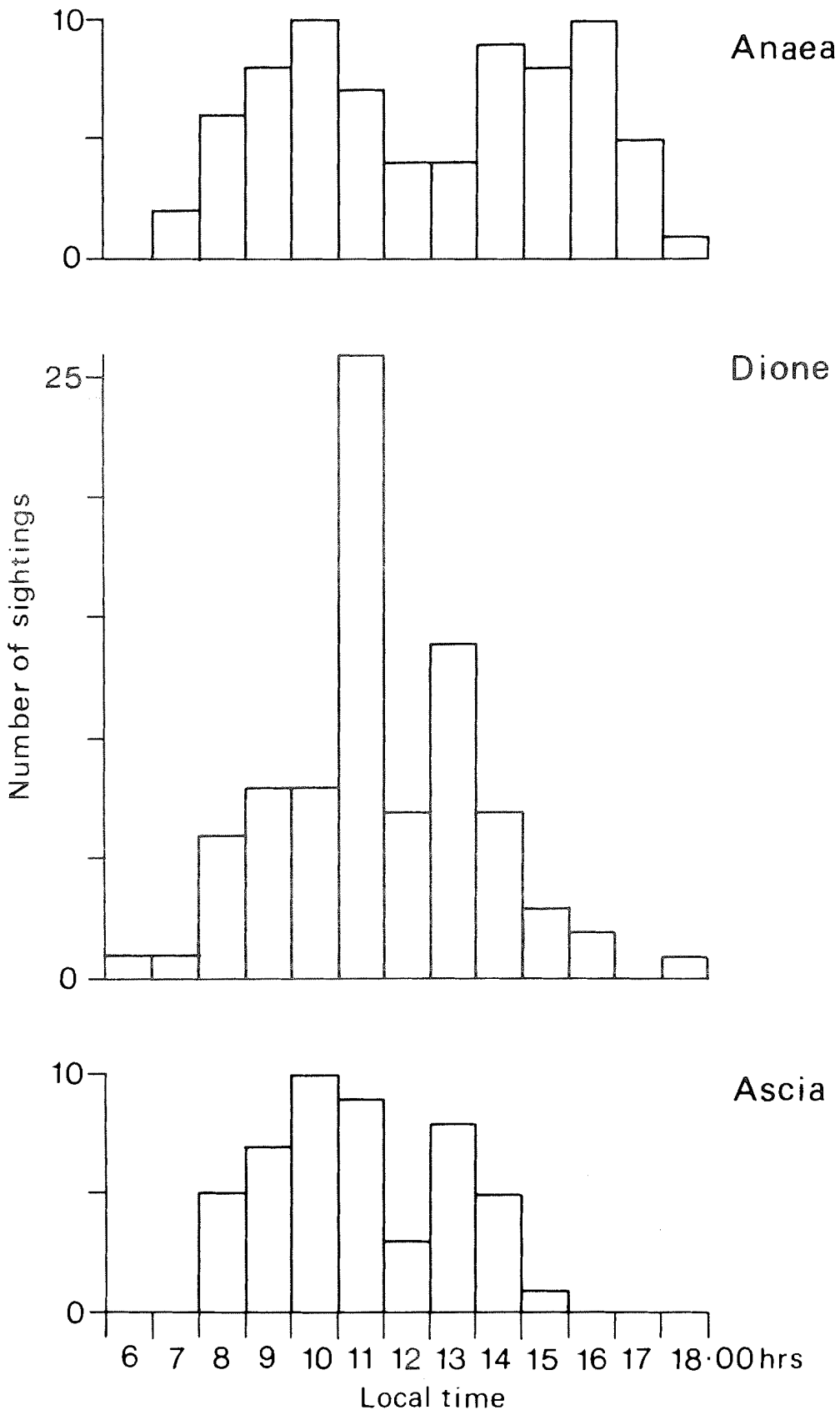


Figure 29. The hourly activity of *Anaea echemus*, *Dione vanillae* and *Ascia monuste* at Pirate's Point, Little Cayman