

## Butterflies (Lepidoptera: Rhopalocera) of the Santa Cruz group of islands, Temotu Province, Solomon Islands

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**Abstract:** Butterfly diversity on the remote islands of the Santa Cruz group (Solomon Islands, Temotu Province) is reassessed following extensive fieldwork in 1997 and 2000. The number of species recorded is raised from 28 (SAMSON 1979) to 52, including 10 genera not previously reported. A tabulated species/island list is provided, together with a brief description of the islands themselves. Some comparison is made between islands in the group and with islands of northern Vanuatu, south of the Santa Cruz group.

### Tagfalter (Lepidoptera: Rhopalocera) von der Santa-Cruz-Inselgruppe, Provinz Temotu, Solomonen

**Zusammenfassung:** Die Tagfalterdiversität von den recht abgelegenen Inseln der Santa-Cruz-Gruppe der Solomonen (Provinz Temotu) wird auf der Basis von ausgedehnten Freilanduntersuchungen in den Jahren 1997 und 2000 neu zusammengestellt. Die Artenzahl steigt von 28 (SAMSON 1979) auf 52, einschließlich 10 vorher nicht gemeldeten Gattungen. Eine Tabelle mit den Arten pro Insel wird gegeben, dazu eine kurze Vorstellung der Inseln als solche. Einige Vergleiche werden angestellt innerhalb der Gruppe und mit Inseln vom nördlichen Vanuatu, im Süden der Santa-Cruz-Gruppe.

### Introduction

Geographical isolation and local transport difficulties have combined to ensure that the remote southwest Pacific islands of the Santa Cruz group (Temotu Province, Solomon Islands) have remained virtually unexplored. SAMSON (1979, 1980, 1982) visited the islands in 1974, stopping for some three weeks on the main island of Nendo and briefly visiting Utupua, Vanikoro and Tikopia (SAMSON, pers. comm.). He provided the first (and only) published list of butterflies reported from the islands, listing 28 species (SAMSON 1979, 1980). Of these, a report of *Papilio bridgei* MATHEW, 1886 was shown to be the result of an error of labelling (TENNENT 1999), and *Tartesa ugiensis* (DRUCE, 1891) is believed to be the result of misidentification.

As part of a wider study of Solomon Islands butterflies, the author stayed on Nendo for one week in October 1997. Discovery of seven previously undescribed butterfly taxa (TENNENT 2000, 2001a, f) within walking distance (ca. 15 km) of Nendo airstrip, suggested that a longer stay, including visits to other islands in the group, was necessary before the butterflies of Santa Cruz could be placed in a biogeographic context. A further visit, of almost five months duration (longer than planned due to a coup d'état in the Solomons and local transport difficulties), took place from March to July 2000, and resulted in further publications (TENNENT 2001c–e, in press).

This paper collates the results of fieldwork outlined above in the form of a tabulated list of species and islands. It incorporates many previously unpublished data from the collections of the Natural History Museum (BMNH), London; the Oxford University Museum, Oxford; the Australian National Insect Collection, Canberra; the Australian Museum, Sydney; the Bernice P. Bishop Museum, Honolulu; and Dodo Creek Research Station, Honiara, all of which were visited by the author. Including new descriptions recently published, the number of butterfly species now known from the Santa Cruz group is raised from 28 to 52. Additionally, two new records for the Solomon Islands (*Jamides goodenovii* (BUTLER, 1876) and *J. morphoides* (BUTLER, 1884)) and approximately 100 new island or island group records were made.

### The islands

The Santa Cruz islands (see Map 1) are served by twice weekly domestic flight from the Solomon Islands capital, Honiara, on the island of Guadalcanal, to Nendo, the main island of the Santa Cruz group. Although there are plans to build additional airstrips on the Reef islands and on Vanikoro, travel to any of the other islands of the group is at present virtually impossible to plan. Ships do travel to the outer islands, but not to any reliable schedule and many months might elapse between visits. At the time of the author's visit in 2000, no ship had visited the outer islands between Christmas 1999 and mid-April 2000. A planned stay of 10–14 days on Tikopia in June 2000 extended to 8 weeks, during which time at least 4 vessels were 'scheduled' to visit Tikopia, but none did.

Previous butterfly collection (and presumably also collection of other natural history specimens) has largely been confined to less than a day on each of the outer islands; this being the usual period taken for a ship to unload its cargo and load copra. Visits by individual vessels are rarely longer because suitable anchorages are in most cases non-existent and arrival at some islands is dependent on the tides. An alternative method of reaching outer islands is on one of the infrequent ocean-going yachts which visit the Santa Cruz islands each year, although numbers of visiting yachts are said to have decreased dramatically since crocodiles killed a Swiss yachtsman off the coast of Utupua in July 1998.

The only method of independent travel to Santa Cruz islands other than Nendo for anyone wanting to stay longer than a few hours, is therefore by open boat powered by outboard motor. This is a potentially hazardous method of travel and boats are occasionally carried

considerable distances by strong ocean currents or lost altogether if, for example, the engine breaks down or runs out of fuel. The author was extremely fortunate in obtaining the services of Mr Ross HEPPWORTH, whose considerable boating skills, twin outboard motors and Global Positioning System (GPS) (the author's own GPS fell foul of the 'Millennium Bug'), reduced dangers to an acceptable minimum. The islands of the western Santa Cruz group (Tinakula, the Reef and Duff groups, Utupua and Vanikoro) were visited for at least several days each. In so doing, the first recorded direct passages by open boat from the Reef islands directly to Vanikoro (153 km) and from Utupua to the Duff islands (171 km) were made.

The eastern Santa Cruz islands of Tikopia, Anuta and Fatutaka are too remote to reach by open boat. The author's visit in 2000 coincided with a synod meeting of Temotu Diocese – an almost unique occasion when a ship travelled to the outer islands in order to collect synod delegates and was said to be guaranteed to return them to their homes 10–14 days later. The opportunity was thus taken to visit Tikopia. It is a measure of the frustration and uncertainty of travel in the Solomon Islands that the author waited on Nendo for 5 weeks beyond the first stated departure date, before a ship eventually left for Tikopia and then waited 8 weeks on Tikopia before being able to return to Nendo.

Brief descriptions of the islands follow. Population figures are derived from the results of a November 1999 census. The number of days the author stayed on each island follow is given in parentheses.

#### **Nendo: population 8246 (44 days)**

Many of the Solomon islands have a number of different names and spellings. The Times Atlas refers to Nendo as Ndeni and this has been used in the literature, including by the present author in publications resulting from the 1997 field visit referred to above (TENNETT 1999, 2000, 2001a). Although local people refer to it simply as 'Santa Cruz', the more correct name for the island is Nendo. It is the largest and most accessible of the group, due to the presence of the airstrip and a series of rough roads and tracks running south and east from the main settlement and provincial capital, Lata. The central and eastern parts of the island are rugged, heavily forested and largely unexplored. The highest point is 517 m and there are large areas of hilly ground lying between 300 m and 400 m. Previous collecting has almost exclusively been in the area of Graciosa Bay in the north west of the island.

#### **Tinakula: uninhabited (4 days)**

An active volcano which last saw a major eruption in 1973 and still belches smoke and fumes. Unique among the western islands, it has no outer reef and rises steeply from deep water, which has what is believed to be a vicious undertow (a New Zealand surveyor was drowned several years ago whilst trying to land there – his body was never recovered). There is a small landing beach which can only be used in fine weather due to the Paci-

fic swell which makes landing hazardous, and casting off even more so. The island rises to over 800 m and the cone is clothed on three sides by scrub vegetation. The remaining slope consists of scree, the result of sporadic minor eruptions, which continue today. A period of 4 days on Tinakula coincided with some heavy rainfall and only 6 butterfly species were seen, all from close to the shoreline at sea level. No butterflies were encountered on a climb to ca. 500 m in the only period of sunny weather. No butterflies have previously been reported from Tinakula.

#### **Reef islands: population 6249 (12 days)**

A series of ca. 15 ancient, low-lying uplifted coral atolls enclosed by major reef systems. At low tide it is possible to wade across the reefs between some of the southern islands. There is some population pressure and most of the available land is given over to coconut plantations and village gardens, with rough pathways through scrub linking village settlements. Historically, Reef island collecting localities mostly refer to 'Mohawk Bay', which describes the anchorage between Ngadeli and Nola islands, although there are also references to the small western outliers of Pileni and Matema west of the main Reef group.

#### **Duff islands: population 439 (4 days)**

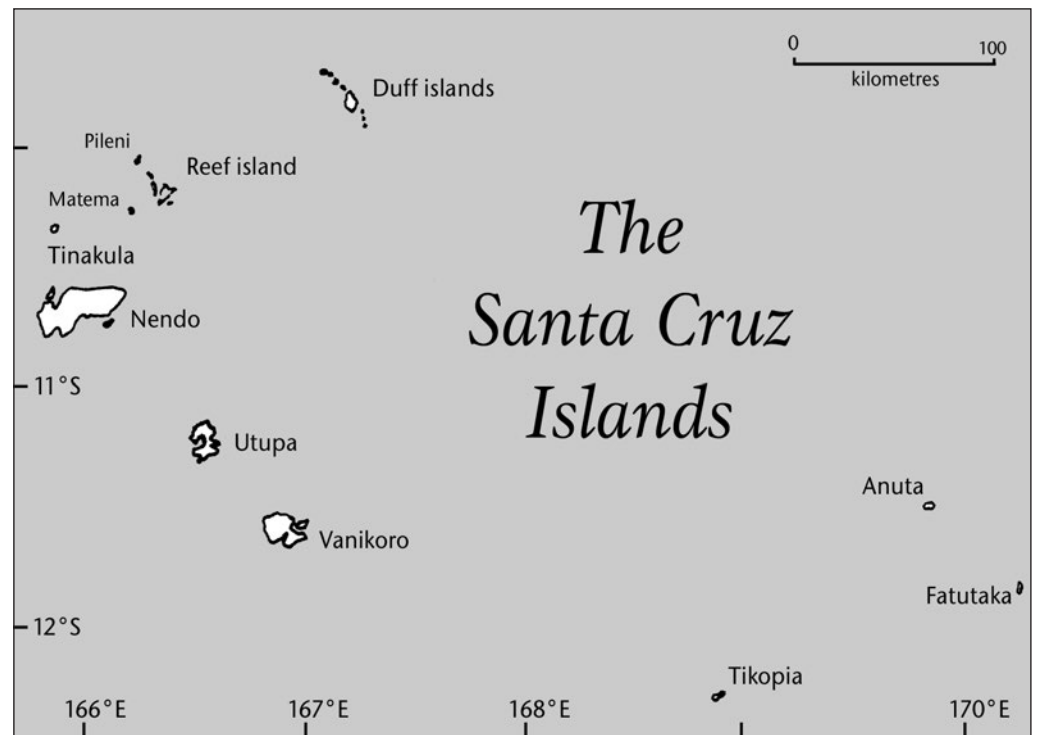
By any standards, the Duffs are among the most beautiful tropical islands on earth. Sheer volcanic cliffs rise from the ocean and most, but not all, of the ca. 9 islands have at least one small sandy beach to facilitate a boat landing. The few flat areas are largely given over to coconut trees and the steep terrain makes travel inland for the most part impossible. The highest point is ca. 240 m on the main island of Taumako. A total of 15 butterfly species were recorded; the author was unable to find any previous reports of butterflies from the Duff islands.

#### **Utupua: population 848 (4 days)**

A mountainous and heavily forested island that, unusually for a south-western Pacific island, has never been commercially logged. Saltwater crocodiles are a serious threat in coastal mangroves and estuaries, especially at high tide. They grow to considerable size and occasionally take pigs tethered close to the shore. A Swiss yachtsman was killed and eaten by crocodiles in mangroves east of the main settlement of Nemba, in July 1998. The island is covered in tropical vegetation and a few tracks lead to hillside village gardens. The highest point is Mount Rantahnimba, at 365 m.

#### **Vanikoro: population 884 (12 days)**

Vanikoro consists of two large islands: Tevai, and the main island of Vanikoro itself. There are only 8 small coastal settlements and this low population density, combined with very steep slopes covered in secondary vegetation, dictates that movement between villages is by boat. Paths and tracks are virtually non-existent and



**Map 1:** The Santa Cruz group of the Solomon Islands (Temotu province).

moving inland from any settlement necessitates cutting a path. Collecting at 400 m on a forested ridge on Tevai was unrewarding, with little butterfly diversity. As on Utupua, crocodiles are a factor to be considered near the coast but their overall numbers are lower than on Utupua due to shooting by loggers when the island was comprehensively logged some 60 years ago. Crocodile numbers are recovering slowly. There are several areas with sparse shrubs, abundant bracken-like ferns and reeds in the west of the main island, aptly known to local people as ‘desert’. The highest point is Mount Vbanie at ca. 800 m.

#### Tikopia: population 1346 (54 days)

A spectacularly scenic island with a large freshwater lake surrounded by the sheer cliffs of an extinct volcanic crater, reaching a maximum of 360 m. It is relatively rich in vegetation, including trees and shrubs planted to protect settlements and gardens from the ravages of unpredictable weather. Aside from the rocky cliffs, almost all available fertile ground, including that on steep slopes, is utilized for growing food.

#### Anuta: population not known (apparently missed from census) (1 day)

A tiny island which, like Tikopia, is culturally, linguistically and geographically a Polynesian outlier rather than being truly part of Melanesia. The highest point is 60 m. Landing is dangerous in even a moderate sea due to lack of a protective reef. Low ground is given over to growing bananas and coconuts and a network of sandy paths allows access to areas of bush which serve as protection for settlements in bad weather. A hilly section of the island is covered in neat taro and cassava gardens.

#### Fatutaka: uninhabited (not visited)

The waters around this small island, the most easterly of the Solomon Islands, are visited infrequently by fishermen sailing from Anuta, and landing is said to be impossible other than by swimming ashore and clambering up sharp rocks. The island is said to be home to large seabird populations. It is not known whether Fatutaka supports any butterfly species.

#### The butterflies

For the data, see Table 1: Diversity and distribution of Santa Cruz butterflies.

#### Discussion

Geologically, the western Santa Cruz islands are part of the New Hebrides Arc (COLEMAN 1970) and prior to the present work, lack of data made it difficult to assess whether the Santa Cruz butterfly fauna was more closely related to the Solomons Archipelago 400 km to the west, or to the islands of Vanuatu (formerly the New Hebrides), ca. 160 km (Vanikoro to Torres) to the south. Assessment was further hampered by a lack of distributional data for Vanuatu butterflies (ROBINSON 1976) and this is currently under investigation.

So far as butterfly populations are concerned, the Santa Cruz islands can be divided into a ‘western’ and an ‘eastern’ group. Although comprising fundamentally the same species, butterflies of the western group (Nendo, Tinakula, Reefs, Duffs, Utupua, Vanikoro) are dissimilar to those of the Solomons Archipelago in some respects. For example, in the Solomons Archipelago, several widespread butterflies, particularly *Euploea* FABRICIUS, 1807 (Nymphalidae: Danainae) and *Hypolimnas* HÜBNER,

Table 1: The butterflies of the Santa Cruz group of the Solomon islands (Temotu province) by islands visited (museum data incorporated)

Taxon	Nendo	Tinakula	Reefs	Duffs	Utupua	Vanikoro	Tikopia	Anuta
<b>Hesperiidae</b>								
<i>Badamia exclamationis</i> (FABRICIUS, 1775)			+	+	+	+		
<i>Hasora chromus bilunata</i> (BUTLER, 1883)	+		+	+	+	+	+	
<i>Hasora hurama kieta</i> (STRAND, 1921)	+							
<i>Borbo cinnara</i> (WALLACE & MOORE, 1866)	+					+	+	
<i>Caltonis philippina subfenestrata</i> (RÖBER, 1891)	+							
<b>Papilionidae</b>								
<i>Graphium hicetaon</i> (MATHEW, 1886)	+				+	+		
<i>Papilio aegaeus oberon</i> GROSE-SMITH, 1897	+		+	+	+	+		
<b>Pieridae</b>								
<i>Catopsilia p. pomona</i> (FABRICIUS, 1775)	+							
<i>Eurema hecabe nivaria</i> (FRUHSTORFER, 1910)	+		+	+	+			
<i>Belenois java peristhene</i> (BOISDUVAL, 1859)			+				+	
<b>Lycaenidae</b>								
<i>Hypochrysops julie</i> TENNENT, 2001	+				+	+		
<i>Bindahara phocides chromis</i> (MATHEW, 1887)	+							
<i>Nacaduba lepidus</i> TENNENT, 2000	+				+	+		
<i>Nacaduba kurava cruzens</i> TENNENT, 2000	+		+	+	+	+		
<i>Nacaduba n. novaehebridensis</i> DRUCE, 1892	+		+		+	+		
<i>Nacaduba samsoni</i> TENNENT, 2001	+							
<i>Prosotas ?nora</i> ssp.	+					+		
<i>Prosotas dubiosa livida</i> TENNENT, 2000	+		+	+		+		
<i>Nothodanis schaefferia cepheis</i> (DRUCE, 1891)	+							
<i>Catopyrops nebulosa</i> (DRUCE, 1891)	+							
<i>Ionolyce lachlani</i> TENNENT, 2001	+		+			+		
<i>Jamides cephion</i> DRUCE, 1891	+	+	+	+	+	+		
<i>Jamides goodenovii</i> (BUTLER, 1876)			+			+		
<i>Jamides morphoides</i> (BUTLER, 1884)					+			
<i>Jamides amaurage hepworthi</i> TENNENT, 2001	+					+		
<i>Jamides celeno evanescens</i> (BUTLER, 1875)	+		+		+	+		
<i>Catochrysops taitensis</i> (BOISDUVAL 1832)	+		+	+		+	+	
<i>Euchrysops cnejus cnidus</i> WATERHOUSE & LYELL, 1914		+						
<i>Lampides boeticus</i> (LINNAEUS, 1767)			+		+	+	+	
<i>Zizula hylax dampierensis</i> (ROTHSCHILD, 1915)	+		+	+	+	+		
<i>Zizina labradus lampra</i> (TITE, 1969)	+	+	+	+	+	+	+	
<i>Leptotes plinius pseudocassius</i> (MURRAY, 1873)	+							
<b>Nymphalidae: Danainae</b>								
<i>Tirumala hamata moderata</i> (BUTLER, 1875)	+							
<i>Danaus p. plexippus</i> (LINNAEUS, 1758)	+		+				+	
<i>Danaus affinis mendana</i> TENNENT, 2000	+		+					
<i>Euploea leucostictos crucis</i> CARPENTER, 1953	+		+	+	+	+		
<i>Euploea leucostictos iphianassa</i> (BUTLER, 1866)							+	
<i>Euploea leucostictos eustachiella</i> CARPENTER, 1953								+
<i>Euploea boisduvalii lapeyrousei</i> BOISDUVAL, 1832	+	+	+	+	+	+	+	+
<i>Euploea sylvester melander</i> (GROSE-SMITH, 1897)	+		+		+	+		
<i>Euploea treitschkei jessica</i> (BUTLER, 1869)	+		+	+	+	+		
<i>Euploea lewinii lilybaea</i> FRUHSTORFER, 1911						+	+	+
<b>Nymphalidae: Satyrinae</b>								
<i>Mycalis perseus lalassis</i> (HEWITSON, 1864)	+		+		+			
<i>Orsotriaena medus mutata</i> (BUTLER, 1875)			+					
<i>Melanitis leda solandra</i> (FABRICIUS, 1775)	+		+		+	+		

Nymphalidae: Nymphalinae								
<i>Parthenos sylvia thesaurinus</i> GROSE-SMITH, 1897	+		+	+	+	+		
<i>Doleschallia browni herrichii</i> (BUTLER, 1875)	+	+					+	+
<i>Hypolimnias antilope shortlandica</i> (RIBBE, 1898)	+	+	+		+	+	+	
<i>Hypolimnias pithoeka leverii</i> TENNENT, 2000	+				+	+		
<i>Hypolimnias alimena fuliginescens</i> (MATHEW, 1887)	+				+	+		
<i>Hypolimnias bolina nerina</i> (FABRICIUS, 1775)	+		+	+	+	+	+	+
<i>Junonia v. villida</i> (FABRICIUS, 1787)	+		+		+		+	+
<i>Junonia hedonia zelima</i> (FABRICIUS, 1775)	+		+			+		
<i>Vagrans egista hebridina</i> WATERHOUSE, 1920	+				+	+		
<b>Totals (overall 52 species)</b>	<b>44</b>	<b>6</b>	<b>30</b>	<b>15</b>	<b>28</b>	<b>33</b>	<b>14</b>	<b>6</b>

[1819] (Nymphalinae) species occur in notably different phenotypes on adjacent islands (e.g., Malaita, Ulawa, San Cristobal). This is thought to be due to a combination of the islands' geological history, and existing mimetic pressure. By comparison, butterflies of the 'western' Santa Cruz group, including *Euploea* and *Hypolimnias* species, generally occur in the same phenotype on each of the islands.

Within this 'western' group of islands, there is little doubt that, for example, all species found on Vanikoro also occur on both Nendo and Utupua (the reported occurrence of *Euploea lewinii* C. & R. FELDER, [1865] on Vanikoro by CARPENTER [1953: 80] requires confirmation). *Badamia exclamatoris* (FABRICIUS, 1775) and *Lampides boeticus* (LINNAEUS, 1767), both known from Vanikoro, have not yet been reported from Nendo, although both are notorious Pacific travellers and undoubtedly occur there. *Borbo cinnara* (WALLACE & MOORE, 1866), the two species of *Prosotas* DRUCE, 1891, *Ionolyce lachlani* TENNENT, 2001, and *Jamides amaraue* DRUCE, 1891, most of which were only recently discovered on the Santa Cruz group, have almost certainly been overlooked on Utupua (the author became sick on Utupua and carried out relatively little collecting). All occur on both Nendo and Vanikoro.

Some species appear to have reached Nendo, but not progressed further east, although an element of under reporting may account for some of these and it is true that several taxa (e.g., *Hasora hurama* (BUTLER, 1870), *Caltoris philippina* (HERRICH-SCHÄFFER, 1869), *Bindahara phocides* (FABRICIUS, 1793), *Nothodanis schaeffera* (ESCHSCHOLTZ, 1821), *Nacaduba samsoni* TENNENT, 2001, *Leptotes plinius* (FABRICIUS, 1793), *Tirumala hamata* (MACLEAY, 1827)) have only recently been reported from Nendo or are known from few specimens. However, there do appear to be genuine instances of species occurring on Nendo but not on Utupua and Vanikoro. For example, the unmistakable *Catopsilia pomona* (FABRICIUS, 1775) was not seen on any island east of Nendo, where it is common. Likewise, some species occur both on Nendo and Utupua but apparently not on Vanikoro: for example, *Eurema hecabe* (LINNAEUS, 1758), *Junonia villida* (FABRICIUS, 1787), and *Mycalesis perseus* (FABRICIUS, 1775), all common (sometimes abundant) on Nendo and

Utupua, were not seen on Vanikoro during almost two weeks spent at several different localities on that island.

Similarly, it is considered unlikely that a species which has reached the Duffs does not also occur on both the Reefs and Nendo. Only *Badamia exclamatoris* has been reported (for the first time in 2000) from the Reefs and the Duffs but not from Nendo, and only *Belenois java* (SPARRMANN, 1768) (another Pacific wanderer reported from the Reefs for the first time in 2000), *Lampides boeticus* and *Orsotriaena medus* (FABRICIUS, 1775) have been reported from the Reefs but not from Nendo. The Reefs record of *O. medus* refers to specimens in the Australian Museum, Sydney. It is easily confused with the common and widespread *Mycalesis perseus*.

The 'eastern' islands of Tikopia and Anuta support significantly fewer butterfly species than do the 'western' islands, as might be expected from remote, small, low-lying and cultivated islands. Most butterflies reported from the islands are widespread Pacific travellers and some danaine butterflies (e.g. *Euploea leucostictos* (GME-LIN, 1790), *E. lewinii*) have greater affinity with the islands of Vanuatu, than with the 'western' Santa Cruz islands. It is likely that the total number of butterfly species now reported from each of the islands of the Santa Cruz group approaches the actual total which occur there.

All genera found in the Santa Cruz group, including ten first reported as a result of this study (*Pelopidas* WALKER, 1870, *Caltoris* SWINHOE, 1893, *Hypochrysops* C. & R. FELDER, 1860, *Bindahara* MOORE, [1881], *Prosotas*, *Nothodanis* HIROWATARI, 1992, *Ionolyce* TOXOPEUS, 1929, *Euchrysops* BUTLER, 1900, *Leptotes* SCUDDER, 1876, *Tirumala* MOORE, [1880]), also occur in the Solomons Archipelago (in some cases these new records represent a significant eastwards extension of the genus). The Santa Cruz island butterfly fauna is clearly derived from New Guinea via the Solomons Archipelago and this fits what is generally known about faunal movement in the Pacific from west to east (GREENSLADE 1969, DIAMOND 1995). Interestingly, and perhaps slightly surprisingly, there appears to be a clear line of demarcation between the Santa Cruz and Torres groups, with demonstrably different races of the same species (e.g. *Euploea sylvester* (FABRICIUS, 1793), *E. leucostictos*) occurring north and south of the line. Even

at generic level, some genera (e.g. *Graphium* SCOPOLI, 1777, *Hypochrysops*, *Prosotas*) occur quite commonly on Vanikoro, but are unknown from the Torres, and others (e.g. *Deudorix* HEWITSON, [1863], *Yoma* DOHERTY, 1889) are common on Torres but unknown from the Santa Cruz group. If, as seems likely (TENNENT 1999), the presence of *Papilio aegeus* DONOVAN, 1805 on the Santa Cruz group is the result of accidental introduction, then the genus *Papilio* has also not extended either east from the Solomons Archipelago (there are several species of *Papilio* LINNAEUS, 1758 on San Cristobal, at the eastern end of the Solomons Archipelago), or north from Vanuatu, where *P. fuscus* GOEZE, 1779 is common (TENNENT 2001b). Data relating to the Torres group is based on the author's unpublished observations: the Vanuatu butterfly fauna is currently under investigation.

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