The Cambridge University Lepidoptera Expedition to Ecuador 2010: Final Report

Investigating the butterfly diversity of the Tercera Cordillera

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Cover photo: Cerro Machinaza viewed from near 'El Blanco' on the Ecuadorian side and showing the deforestation affecting the Cordillera del Cóndor.

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Executive summary

The 'Cambridge University Lepidoptera Expedition to Ecuador, 2010' carried out the first rapid inventories of butterflies (Lepidoptera: Papilionoidea) in the Ecuadorian “Tercera Cordillera”. This is an isolated mountain range to the east of the Andes, which in Ecuador principally consists of Volcán Sumaco, Cordillera de Kutukú and Cordillera del Cóndor. Its sedimentary geology hosts a number of plants not found in the neighbouring basaltic Andes. In fact, recent botanical surveys have found surprising similarities to the flora of the Guiana Shield, hundreds of kilometres to the north, including a number of disjunct taxa previously thought to be endemic to that zone. The absence of a high-altitude connection to the Andes also suggests that the higher regions of the “Tercera Cordillera” may exhibit island biogeography and could potentially host new butterfly taxa.

Unfortunately the vast majority of the study area has no formal protection and is under increasing pressure from habitat loss and mineral exploitation, making it a priority for scientific investigation and conservation. Butterflies are a group of particular interest as they are sensitive to habitat alteration and often dependent on specific host plants, making them potentially useful as indicators of biodiversity. The Andes also have extremely high levels of butterfly endemism and diversity with a large number of range-restricted species.

The expedition visited multiple sites in the “Tercera Cordillera” during two months in the field. The first study area was the recently created Bigal River Biological Reserve in the buffer zone of the Sumaco-Napo-Galeras National Park. The Reserve is managed by the Sumac Muyu Foundation and the team trained two members of the local community in butterfly fieldwork methods. During the second week the team was based within the National Park on the upper slopes of Volcán Sumaco. That was followed by a visit to Cordillera Napo-Galeras, a sedimentary plateau or *tepuis*, where the team was joined by a National Park Ranger. In addition to acting as a guide he was keen to learn about butterfly fieldwork and has requested permission from the Environment Ministry to set up a permanent butterfly monitoring programme in this interesting and poorly-studied region.

The team then planned to explore the Cordillera de Kutukú, however the Shuar community we approached did not approve of our fieldwork, despite us having been authorised by the Federación Interprovincial de Centros Shuar (FICSH) and accompanied by their Director of Culture & Education. A day trip was instead made to the Cordillera Shaimi, which lies to the east of the Kutukú, however no water source was found for camping. Finally, two sites were studied in the Cordillera del Cóndor, in both cases the team stayed at Ecuadorian military bases.

Identification of the specimens collected during the expedition was carried out at the McGuire Centre for Lepidoptera and Biodiversity at the University of Florida, in September 2010. The most interesting specimens include a new subspecies of *Catasticta poujadei* resembling *C. thomasorum* and a likely new species of *Stalachtis* (similar to *S. calliope*), as well as two species of *Manerebia*, two species of *Pedaliodes*, one *Panyapedaliodes* and one *Eretris* that could also represent taxa new to science. Work is ongoing to identify all of these specimens through collaboration with Dr. Keith Willmott at the McGuire Centre for Lepidoptera and Biodiversity in Florida, and other experts specialising in the relevant taxa. Any new taxa, once confirmed, will be formally described by the team in due course.

The expedition also encountered numerous rare butterflies including the first Ecuadorian records of *Amphidecta calliomma* and a new subspecies of *Hyalyris antea* known only from nearby Perú. What appear to be the first females of *Napeogenes glycera nausica* and *Perisama clisithera beaufouri* were also collected. A number of specimens were collected of an undescribed species and genus, previously known from seven male specimens in the McGuire Centre collection. Finally, there were 22 species previously recorded from three or fewer sites in Ecuador, 30 first records for different provinces, and 94 extensions to altitudinal ranges.

The data gathered by the expedition will contribute to the development of detailed species distribution maps of Ecuadorian butterflies as well as helping to establish a foundation for butterfly research and conservation in Ecuador. This in turn supports ongoing work to create guidelines for assigning IUCN threat categories to invertebrates, which would add weight to conservation efforts in the Andes.

Diversity analyses have been conducted on the butterfly data from the Cordillera del Cóndor. The two sites have predicted community richnesses of at least 214 and 125 species (Chao-1), compared to the 141 and 90 species actually observed. Both the observed and predicted data suggest that the first site, Cóndor Mirador, has significantly ($p=0.05$) higher butterfly diversity than the second, perhaps due to the high number of 'hill-topping' vagrant species at Cóndor Mirador. The two sites combined have an exponential Shannon entropy of 146 (equivalent to a site with 146 equally-common species) and a true beta-diversity of 1.48 (equivalent to 1.48 totally distinct sites.) Further analyses will be done to compare this data with that from equivalent Andean sites, including testing whether it displays biogeographic features typical of island settings, and will be published in due course.

The team has already given presentations highlighting the key findings of the expedition at the University of Cambridge and the McGuire Centre in Florida. Work is ongoing to describe the new taxa found by the expedition and a discussion of the butterfly diversity and species composition of the Cordillera del Cóndor will also be published. We hope to develop long-term butterfly monitoring programmes in the Bigal River Biological Reserve and Volcán Sumaco through collaboration with the Fundación Sumac Muyu and the village of Pacto Sumaco respectively. To support tourism in these areas, multi-lingual photographic identification guides to their common and distinctive butterfly species will be developed by the expedition team and our local partners.

All of the outputs from the expedition will be made freely available on our website in an attempt to stimulate further research in the area and support ongoing conservation efforts in the "Tercera Cordillera".

Sumario ejecutivo

La 'Expedición Lepidopterológica al Ecuador de la Universidad de Cambridge, 2010' elaboró los primeros inventarios rápidos de mariposas diurnas (Lepidoptera: Papilionoidea) en la “Tercera Cordillera” del Ecuador. Los áreas principales en Ecuador son Volcán Sumaco, la Cordillera de Kutukú y la Cordillera del Cóndor – todos están aislados al este de los Andes y tiene cumbres por encima de dos mil metros sobre el nivel del mar. A causa de su geología sedimentaria tiene una comunidad de plantas distinta de la que se encuentra en los adyacentes Andes basálticos. De hecho, recientes estudios botánicos encontraron una sorprendente similaridad con la flora del Escudo Guayanés, cientos de kilometros al norte, incluyendo algunas taxones dislocados anteriormente considerados endémicos de esa zona. Adémas, la ausencia de una conección de alta elevación con los Andes sugiere que las áreas altas de la “Tercera Cordillera” pueden tener características biogeográficas de islas y es posible que alberguen taxones nuevos de mariposa.

Desafortunadamente la gran mayoria del área del estudio tiene ninguna forma de protección gubernativa y experimenta cada vez más deforestación y presión de explotar su riqueza mineral, haciéndola una prioridad para investigación scientífica y conservación. Las mariposas son un grupo importante porque son sensibles a cambios del hábitat y frecuentemente dependen de plantas huéspedes específicas, y por lo tanto puede usarlas como indicadores de biodiversidad. Además los Andes tiene niveles sumamente altos de endemismo y diversidad de mariposas, con un gran número de especies con rangos restringidos.

La expedición visitó multiple sitios en la “Tercera Cordillera” durante dos meses en el campo. Lo primero fue la recién creada Reserva Biológica del Río Bigal en la zona de amortiguación del Parque Nacional Sumaco-Napo-Galeras. La Reserva está gestionada por la Fundación Sumac Muyu y nuestro equipo capacitó a dos miembros de la comunidad local en métodos de investigación de campo de mariposas diurnas. Durante la segunda semana el equipo estaba basado dentro del Parque Nacional, en la loma alta de Volcán Sumaco. Esa fue seguido por una visita a la Cordillera Napo-Galeras, una meseta sedimentaria o *tepuis,* donde un guardaparque nos acompañó. Además de ayudarnos como guía, nuestro trabajo de campo le interesó y desde entonces ha solicitado permisión del Ministerio del Ambiente para crear un estudio de mariposas de largo plazo en esta área interesante y escase estudiado.

El equipo entonces quería explorar la Cordillera de Kutukú, sin embargo la comunidad Shuar no aprobó de nuestra investigación, a pesar de tener autorización de la Federación Interprovincial de Centros Shuar (FICSH) y estar acompañado por su Director de Cultura y Educación. En vez del Kutukú, visitamos la Cordillera Shaimi, ubicado más al este, no obstante no había una fuente de agua para acampar. Por último, dos sitios en la Cordillera del Cóndor fueron estudiados, en ambos casos el equipo se quedó en destacamentos militares Equatorianos.

Identificación de especímenes colectado durante la expedición se hizó en el Centro McGuire para Lepidoptera y Biodiversidad de la Universidad de Florida durante Septiembre 2010. Las más interesantes incluyen una subespecie nueva de Catasticta poujadei parecido a *C. thomasorum* y una especie nueva probable de *Stalachtis* (parecido a *S. calliope*). Además había dos especies de *Manerebia*, dos de *Pedaliodes*, una *Panyapedaliodes* y una *Eretris* que pueden ser taxones nuevos para ciencia. Trabajo sigue en la identificación de todas estas especímenes por medio de colaboración con Dr. Keith Willmott del Centro McGuire de Lepidoptera y Biodiversidad en

Florida, y otros expertos quienes se especializan en los taxones relevantes. Cualquier taxón nuevo, una vez confirmado, será descrito formalmente por el equipo al final.

La expedición también encontró numerosa mariposas raras, incluyendo los primeros registros del Ecuador para *Amphidecta calliomma* y una subespecie nueva de *Hyalyris antea* anteriormente conocida solamente del Perú. Además el equipo encontró tal vez las primeras hembras de *Napeogenes glycera nausica* y *Perisama clisithera beaufouri*. Un número de especímenes fueron colectadas de una especie y género todavía indescrito, conocido solamente por siete machos en la colección del Centro McGuire antes de esta expedición. Finalmente, había 22 especies anteriormente registrado en menos que cuatro sitios en el Ecuador, 30 primeros registrados para provincias y 94 ampliaciones de rangos altitudinales.

La información generado por la expedición contribuirá al desarrollo de mapas de distribución detalladas de mariposas Ecuatorianas en adición a ayudar establecer un base para la investigación y conservación de mariposas en el Ecuador. Esto por su parte ayuda en la creación de recomendaciones para la asignación de categories de amenaza del IUCN para invertebrados, que ayudaría a los esfuerzos de conservación en los Andes.

Se hizó análisis de diversidad de los datos de la Cordillera del Cóndor. Los dos sitios tiene una riqueza de especiesde por lo menos 214 y 125 especies (Chao-1), comparado a las 141 y 90 especies observadas. Ambos los datos observados y predichos sugieren que el primer sitio, Cóndor Mirador, tiene una diversidad de mariposas significatívamente ($p=0.05$) más alto que el segundo sitio, tal vez a causa del alto número de especies transitorias sopladas por el viento en Cóndor Mirador. La combinación de los dos sitios tiene una entropía exponencial de Shannon de 146 (equivalente a un sitio con 146 especies igualmente comunes) y una diversidad beta verdadero de 1.48 (equivalente a 1.48 sitios totalmente distintos.) Análisis adicional será elaborado para comparar estos datos con los de sitios equivalentes en los Andes, incluyendo probando si tiene caracteristicos de biogeografia de islas, para inclusión en una publicación futura.

El equipo ya ha presentado los descubrimientos claves de la expedición en ambos la Universidad de Cambridge (Reino Unido) y el Centre McGuire en Florida (E.E.U.U.) Trabajo está en curso para describir los taxones nuevos descubiertos por la expedición, y una discusión de la diversidad de mariposas y la composición de especies de la Cordillera del Cóndor también será publicado. Intentamos desarrollar estudios de mariposas de largo plazo en la Reserva Biologica del Río Bigal y Volcán Sumaco, por medio de colaboración con la Fundación Sumac Muyu y la comunidad de Pacto Sumaco respectivamente. En apoyo de turismo en estas áreas, guías fotográficas de sus mariposas comúnes y característicos serán compiladas por el equipo de la expedición y nuestras organizaciones asociadas en idiomas multiples.

Toda la producción de la expedición será libremente disponible en nuestra página web para fomentar adicional investigaciones en el área y apoyar el trabajo en curso de conservación de la “Tercera Cordillera”.

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“I just wish the world was twice as big and half of it was still unexplored” – Sir David Attenborough

1. Introduction

The Cambridge University Lepidoptera Expedition to Ecuador carried out inventories of butterflies in the Ecuadorian “Tercera Cordillera” in the summer of 2010. This is an isolated range of mountains to the east of the Andes, which in Ecuador includes Volcán Sumaco, Cordillera Napo-Galeras, Cordillera de Kutukú and Cordillera del Cóndor. The principal aim of the expedition was to significantly further current knowledge of the biodiversity of this zone, which is one of the richest and most unique environments in the world.

The team visited a number of different sites in the “Tercera Cordillera” to assess butterfly diversity and trained members of local communities in butterfly surveying techniques with a view to developing long-term monitoring and tourism projects in support of future conservation efforts.

Why study butterflies?

"True" butterflies (Lepidoptera: Papilionoidea*)* have received particular attention in the literature due to their potential as indicators of biodiversity – levels of butterfly endemism and diversity are often used to estimate those of other taxa [Caro & Doherty, 1999]. This is in part due to butterflies' dependence on specific larval hostplants [Janzen, 1988], interactions with predators(in particular birds) and their role as long-distance pollinators. Additionally they are highly diverse – more than 3000 species have been registered in Ecuador, many of which have severely restricted geographical and altitudinal ranges.

Butterflies are also particularly vulnerable to habitat alteration caused by changes in land use [Wallis DeVries & Raemakers, 2001], providing a measure of deforestation due to their sensitivity to forest light levels. However, it should be noted that they are not an ideal indicator taxon – as various studies have shown, particularly at the local level [Gutierrez & Menendez, 2007] and care is required to select suitable taxa on a case-by-case basis [Fleishman & Murphy, 2009].

In fact, the above arguments apply to many insect taxa and there is a strong case for the inclusion of at least one group of insects in biodiversity assessments [Kim,1993; Kremen et al., 1993; Samways, 1993; Basset et al., 1998]. However, butterflies have the advantage of being relatively well known taxonomically and many species have distinctive patterns which aid field identification, making them suitable targets for visual counts or sampling with handnets and baited traps. A thorough knowledge of the butterfly fauna of a region can therefore make a valuable contribution to comparisons of the ecological value of different conservation alternatives.

Despite this, the current state of knowledge of their distribution is rather poor, particularly in the Andean zone which harbours the highest diversity of butterflies globally (Ecuador, Colombia and Perú have the most recorded species in the world). One of the key aims of the expedition was to gather data on the geographical and altitudinal ranges of rare and endemic species, which will contribute to work started by the Tropical Andean Butterfly Diversity Project (TABDP) in assessing the IUCN conservation status of Andean butterflies.

Why explore the "Tercera Cordillera?"

The "Tercera Cordillera" lies within the Tropical Andean hotspot, identified by Conservation International as "The richest and most diverse region on Earth" [Biodiversity Hotspots, 2007]. Within this chain of isolated mountains to the east of the Andes, the Cordillera del Cóndor stands out as having "the richest flora of any area this size in the New World"[Schulenberg & Awbrey, 1997] and yet prior to this expedition almost nothing was known of its butterfly fauna.

Southern Ecuador also lies just north of the Marañón Gap – a low altitude inter-Andean passage that forms one of the main faunal boundaries between the northern and southern Andes. The highly fragmented topography of the region, combined with the presence of both north- and south-Andean faunas results in an exceptionally high diversity of Lepidoptera species, many of which are only known from severely restricted geographical and altitudinal ranges.

A common feature to almost all of the study sites is the presence of sedimentary outcrops, ranging from the dramatic flat-topped tepuis of the Cordillera del Cóndor to the characteristic black rivers found in Cordillera Napo-Galeras which point to the underlying sedimentary geology. As a result these areas are host to plants not found in the neighbouring basaltic Eastern Cordillera of the Andes at a similar latitude. Recent studies done by the Missouri Botanical Garden, amongst others, have also found fascinating similarities between the flora of the Cordillera del Cóndor and the Guiana Shield, hundreds of kilometres to the north, including a number of disjunct taxa previously thought to be endemic to that region. The absence of a high-altitude connection to the Andes suggests that the higher regions of the "Tercera Cordillera" may exhibit characteristics of island biogeography and could potentially host new butterfly taxa. This expedition particularly targeted the only three regions to the east of the Andes in Ecuador with peaks above 2000m – Volcán Sumaco, the Cordillera Kutukú and the Cordillera del Cóndor.

Unfortunately the vast majority of the study area has no formal protection and is under increasing pressure from habitat loss due to deforestation, grazing and mineral exploitation, making it a priority for urgent scientific investigation. Another common factor is that despite being widely recognised as having exceptionally high levels of biodiversity and endemism, the 'Tercera Cordillera' has been very poorly studied, particularly with respect to its Lepidoptera fauna. In the case of the Cordillera del Cóndor this is in part due to the series of border conflicts between Ecuador and Perú, the most recent of which occurred in 1995, and has resulted in large swathes of forest becoming inaccessible due to landmines laid by both countries.

Why use rapid inventories?

The expedition team decided to carry out rapid inventories in an attempt to visit as many different sites as possible and therefore develop a more complete picture of the Lepidoptera fauna of the "Tercera Cordillera". This is seen as the first, exploratory stage of an ongoing investigation in the area and was necessary to determine priority areas for future study. Ideally the entire area should be monitored over the course of many years to account for seasonal variations and gather extensive data on the species found there, for example as done by de Vries et al. [1999] in eastern Ecuador.

However, the combined threats of deforestation and mineral exploitation make the identification of key areas for conservation an urgent priority and the benefits of conducting rapid inventories over a wide area were considered to outweigh the disadvantages of collecting only semi-quantitative abundance data.

Another important aspect of the team's work was to make contacts in the area and train National Park Rangers (such as in C. Napo-Galeras) and members of local communities (through our partnership with Fundación Sumac Muyu) with a view to developing sustainable long-term monitoring programmes. These could gather a great deal of interesting data on species abundance and diversity, including natural seasonal variations [Sparrow et al., 1994], while also supporting the management of these areas through butterfly tourism projects.

2. Materials & methods

Fieldwork methods

A “patrolling” strategy [Donegan & Huertas, 2005] was used by all members of the expedition team to maximise the area and diversity of habitats sampled at each collecting site. A more structured collecting protocol [eg. Pyrcz & Wojtusiak, 1999, 2002] with equal collecting effort focussed at each of a number of fixed sites may produce more representative abundance data, however it would also have likely reduced the species richness recorded at each site.

The original plan to carry out quantitative sampling during set time periods proved to be infeasible as the weather was highly variable and therefore no site was sampled comprehensively – numerous new taxa were recorded on the last day at each site. It was therefore decided that efforts should be focussed on collecting new species rather than on quantitative sampling for abundance data. The implications of this decision with regards to diversity analyses are discussed later.

Each member of the expedition collected during daylight hours (6:00-18:00) with a standard butterfly net and extensible handle (2-8'). The team also used 11 aerial Van Someron-Rydon traps ([Austin & Riley, 1995]; [Sourakov & Emmel, 1995]) which were hung 5~20m above the ground by throwing a weighted line over branches. Traps were baited with decomposing fish which attracts predominantly males of certain taxa (including some Nymphalidae, Riodinidae and Lycaenidae) [Hall & Willmott, 2000]. Fermented banana bait was also used in the Bigal River Biological Reserve with very limited success and was not used at any subsequent sites. Bait was also spread on the ground in places.

Voucher specimens of each species were collected by administering a sharp pinch to the thorax and placed immediately in glassine envelopes. These were stored inside zip-lock bags containing silica gel to protect them from humidity and insects. Highly distinctive species that were easily identifiable based on prior experience were not collected, but a note was made of their presence. Similarly species with multiple duplicates were also released.

The following information was recorded for each voucher specimen: description of collection site and weather conditions, GPS co-ordinates and altitude, date, method of collection (including trap height if relevant), any interesting behavioural observations, a unique specimen ID, and the collector's name. This data has been added to the Darwin Database of Andean Butterflies, a key resource for the development of IUCN Red List criteria for insect conservation.

Specimen identification

A photographic guide of species known or expected to be found in each area was prepared by Dr. Keith Willmott[1] and used by the team to carry out preliminary specimen identification in the field. The voucher specimens were exported to Florida for final identification after comparison with the collection at the McGuire Centre and consultation with Dr. Willmott. Specimens of problematic taxa were mounted on pins, spread, and photographed for consultation with specialists in those particular groups.

After confirming identification duplicate specimens were deposited in the Ecuadorian Museum of Natural Sciences (MECN) or the Museum of the Pontificia Universidad Católica del Ecuador (PUCE) in Quito, as specified by collection permits.

[1] Associate Curator of Lepidoptera, McGuire Centre for Lepidoptera and Biodiversity, University of Florida

Permits

Permits for collection and export of specimens were obtained from the relevant offices of the Ministerio del Ambiente in provinces visited by the expedition. Further details on permits and the application process for export permits are included in Appendix C: Administration & Logistics.

3. Study areas

Overview: Map

Overview: Gran Sumaco

The first area visited by the expedition, Gran Sumaco lies to the east of Quito, between the foothills of the Andes and Amazonia. It was designated a UNESCO Biosphere Reserve in 2000, covering almost one million hectares or some 8% of northern Ecuadorian Amazonia. However, much of this zone is inhabited, and only a fifth of it is officially protected within the Sumaco-Napo-Galeras National Park, established in 1994. There are also a number of privately-run or community-managed reserves, including Bigal River Biological Reserve, in the buffer zone bordering the National Park, helping to preserve a larger area of this unique habitat.

It is predicted that the Gran Sumaco region hosts in excess of 6000 species of plants, based on botanical surveying at Jatun Sacha Biological Station, however little is known of the Lepidoptera fauna of the zone, especially at higher altitudes where endemism is likely to be higher. This is partly due to the region's inaccessibility and the pristine nature of much of the forest, making fieldwork more difficult than in other areas closer to human habitation.

Prior to the completion of the Hollín-Loreto road in late 1987, Gran Sumaco was totally isolated and therefore somewhat protected from the rampant deforestation that started elsewhere in eastern Ecuador during the 1960s, driven by a boom in petroleum exploration. However since the completion of this road a 1km-wide swathe of virgin forest has been destroyed on either side, primarily by colonisers creating pasture for cattle.

The National Park also includes a continuous and undisturbed altitudinal transect from lowland rainforest at 400m, to páramo on the summit of V. Sumaco at 3732m, which is unsually well-preserved and extensive for the eastern equatorial Andes. Conservation of complete altitudinal transects is particularly important for diverse taxa that have many species restricted to narrow altitudinal ranges, including Lepidoptera.

The smaller Napo-Galeras zone of the National Park protects the Cordillera Napo-Galeras, a limestone outcrop that is separated from the Eastern Cordillera of the Andes by the Río Hollín watershed. Although nothing is known of its Lepidoptera, recent botanical exploration suggest that it should be included with the Cordillera de Kutukú and Cordillera del Cóndor as part of the 'Tercera Cordillera' of mountains lying to the east of the Andes.

Overview: Cordillera de Kutukú & Cordillera del Cóndor

The Cordillera del Cóndor is an eastern outlier to the main Andean chain, protruding into Amazonia and running nearly 150km from north to south along the Ecuador-Perú border. The Cordillera de Kutukú is a smaller range which is found further to the north, and is separated from both the Eastern Cordillera of the Andes and the Cordillera del Cóndor by major rivers.

Unlike the metamorphic and volcanic geology of the Eastern Cordillera, these sub-Andean cordilleras are sedimentary in nature and were uplifted in conjunction with the formation of the Andes. Their complicated topography, including knife-like ridges and flat-topped plateau or *tepuis,* provide a myriad of different habitats and harbour a number of range-restricted and endemic species. The Rapid Assessment Programme (RAP7) expeditions of Conservation International (CI) to the C.del Cóndor in 1993/4 found a previously unknown species of mouse opossum [Albuja & Patterson, 1996], numerous threatened birds and at least four new species of anurans, while suggesting it has “the richest flora of any area this size in the New World.” [Schulenberg & Awbrey, 1997] Their comprehensive report is an invaluable reference for any planned fieldwork in the area, and includes detailed descriptions of the terrain as well as a cultural and historical review and numerous and varied species lists.

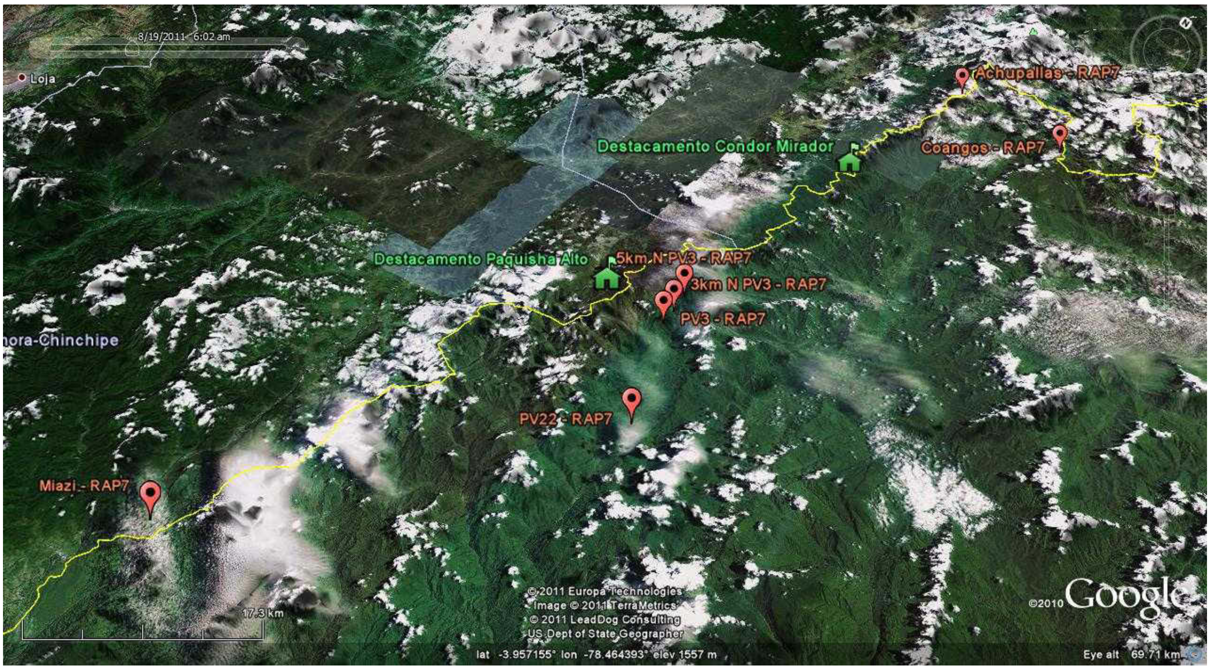
The Cordillera del Cóndor also undoubtedly contains one of the world's highest densities of species undescribed to science. Subsequent fieldwork by the Missouri Botanical Garden (MOBOT) in C.del Cóndor has found a number of species belonging to genera previously thought endemic to the sandstone *tepuis* of the Guiana Shield, thousands of kilometres to the north [Neill, 2007]. This unique *tepuis*-like flora, found on the highest plateaus, could host a number of endemic and as-yet unknown butterfly species, due to the oligophagous nature of many larvae that depend on specific hostplants.

Since the border conflict with Perú was resolved in the mid-1990's there have been a number of scientific studies in the region. However, perhaps as a result of the challenging terrain and adverse weather conditions, very few collections of Lepidoptera have been made. The work of

Lamas and colleagues (predominantly in Perú) during the RAP7 expeditions yielded a number of distinctive new species, with 21 of the 474 records potentially new to science. However, that study only recorded seven species from the flat-topped *tepuis* above 2000m (in part due to poor weather and little time [G. Lamas, *pers. comm.*]), of which three are undescribed and potentially endemic.

More recent collections in the C. del Cóndor include those of Padrón [Padrón, 2007], limited to 1850m and below, and Carvajal [A. Troya, *pers. comm.*] who apparently recently collected predominantly Ithomiinae but could not be contacted. Willmott and Hall also found a number of interesting taxa on the *tepuis* above Paquisha Alto on a single day trip in 2009 [K. Willmott, *pers. comm.*]. This expedition therefore represents the first major study of Lepidoptera on the *tepuis* of the high Cordillera del Cóndor, at elevations above ~2000m.

Figure 1 – View of Cordillera del Cóndor from Google Earth, showing all collection sites
Green – this expedition, Red - RAP7

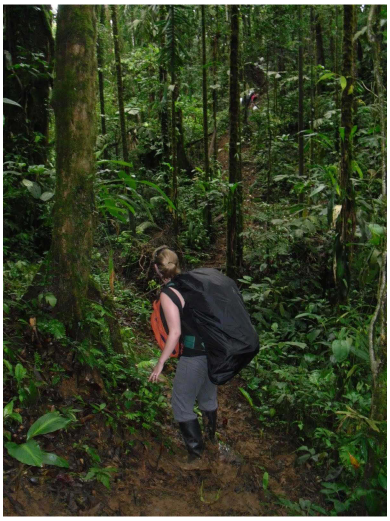


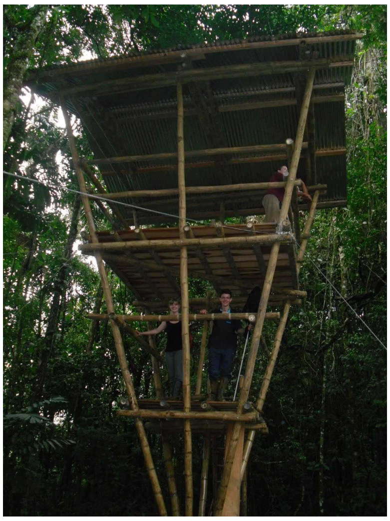
Bigal River Biological Reserve (BRBR)

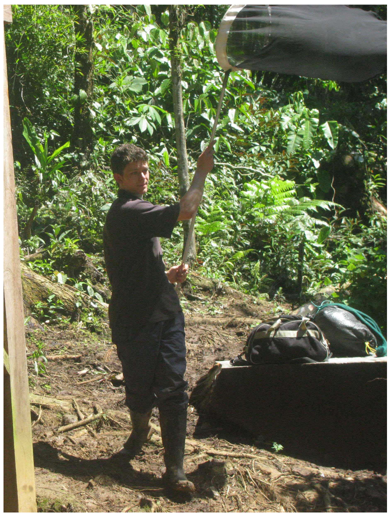
20th-25th July

Number of species recorded	**100**
New records for area	**48**
Potential new taxa	**0**
First record (Ecuador)	**2**
Three or fewer records (Ecuador)	**3**
First record (Orellana Province)	**13**
Extension to elevational range	**13**


The team at BRBR – without TG


Walking into BRBR


The 'Hooch' platform


Collecting at the campsite


The campsite at BRBR


Specimen identification

Overview: The Bigal River Biological Reserve (BRBR) was created by the Sumac Muyu Foundation (SMF) in 2009 and currently protects 1000 hectares of lowland tropical rainforest, with elevations ranging from 435 to 1100m. Located between the foothills of the Andes and the great expanse of Amazonia, it is part of the Gran Sumaco Biosphere Reserve and has one of the highest biodiversities of any comparable area in Ecuador and the world.

The BRBR also plays an important role as a buffer zone for the Sumaco-Napo-Galeras National Park, which it borders on its western side. Spectacled Bear, Amazonian Tapir, Jaguar, Ocelot, Puma, Two-toed Sloth and various species of monkey have all been recorded within the reserve, as have 370 species of birds and over 300 different species of butterflies.

The Reserve has hosted a number of scientific expeditions focussing on entomology, herpetology and Lepidoptera to name a few. The SMF also carries out a great deal of invaluable work with local communities, raising awareness about the importance of conservation and running workshops on subjects as diverse as bamboo construction and ornithology!

Our experience: Thierry Garcia and Marion Hiruois of the SMF were instrumental in organising the logistics of not just our visit to the BRBR, but also to Volcán Sumaco and Cordillera Napo-Galeras, as well as helping to secure the necessary collection and export permits for biological specimens. We can't thank them enough!

Our time at the Reserve served as useful training in Lepidoptera fieldwork techniques for the less experienced members of our team along with two SMF members from the local community, Carlos and Amable. Given their enthusiasm, Thierry's proficiency at identifying specimens, and the interesting butterfly fauna of the Reserve, we would like to encourage the SMF to set up a long-term trap-based butterfly monitoring programme within BRBR. This would add great value to the rapid inventory carried out by this expedition and other scientists. We were fortunate to have periods of sun every day and only lost the majority of one day to rain.

Interesting taxa:

First record for Ecuador - *Amphidecta calliomma, Hermeuptychia maimoune*
Second site record for Ecuador - *Pseudeuptychia languida*
Fourth site record for Ecuador – *Harjesia blanda, Splendeuptychia itonis*
First record for Orellana Province - *Adelpha alala negra, Catonophele salambria, Fountainea ryphea, Harjesia blanda, Harjesia oreba, Oressinoma typhla, Pseudeuptychia languida, Splendeuptychia clorimena, Eutresis hyperea, Greta libethris, Hyalyris coeno, Oleria estella, Parides erithalion lacydes*

Volcán Sumaco

27th July - 1st August

Overview: Volcan Sumaco stands at an elevation of 3732m at the tip of a northeasterly-curving range of foothills, separated from the Eastern Cordillera of the Andes by around 50km. The underlying geology of the region is a sedimentary plateau at 1000-1200m covered by premontane forest. Above this rises the basalt cone of Volcan Sumaco, which is shrouded in montane forest and páramo at high elevations (above ~3300m.) The páramo region is almost unique for Ecuador in never having been disturbed by grazing, burning or other human activities [Løjtnant & Molau, 1982].

Scientific fieldwork has historically focussed on the easily-accessible lower foothills, and very little is known about the flora of its upper slopes, based mostly on a visit to the summit by helicopter in 1979 [Løjtnant & Molau, 1982]. The state of knowledge of Lepidoptera is even worse – nothing is known of the fauna above 1400m [K Willmott, *pers. comm.*]. The transition zone between stunted 'elfin' forest and páramo is of particular interest as it often hosts a high proportion of endemic butterfly species.

Our experience: Tourists can climb V. Sumaco provided they are accompanied by a guide from Pacto Sumaco. The community charge $38/day/person for the service which includes all food and cooking gas. The Sumac Muyu Foundation agreed with the Director of Sumaco-Napo-Galeras National Park in advance of our visit that as a scientific expedition we would be exempt from these charges, provided we catered for ourselves and were accompanied by the Director and a National Park Ranger.

In the event, the Director was unfortunately unable to reach Huahua Sumaco due to a landslide blocking the road from Quito. The National Park Ranger then insisted that he was on holiday and refused to accompany us, even after agreeing to do so moments earlier on the phone to the Director. A compromise was eventually agreed with the community that a guide would show us the trail as far as the second shelter and we would return on our own.

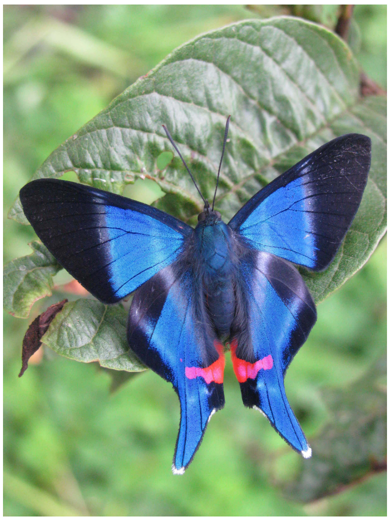
After our delayed departure from Pacto Sumaco and taking two days to reach the second cabin, half of the team needed a day off to recover from the ascent. The expedition leader (JR) then came down with gastroenteritis on the fourth day and as a result we decided to focus our fieldwork on the area around 'La Laguna' at ~2700m. Only one day trip was made as far as the third cabin, recording just a single specimen as it rained for most of the day. After recovering somewhat on the fifth day, JR's condition deteriorated overnight and the next morning we decided to return to Pacto Sumaco in case it worsened further.

The descent took ten hours and was one of the toughest experiences any of us have ever been through, with JR's equipment carried by the rest of the team. Arriving in Pacto Sumaco after dark, the community took great care of us, bringing tea and food and refusing to accept payment. A taxi was called and after a late-night visit to hospital JR recovered over the next few days.

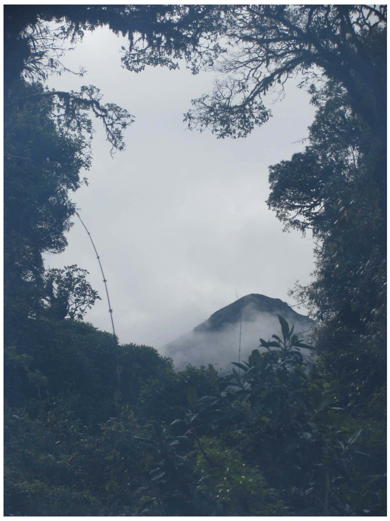
Interesting taxa:
First record for Napo Province – *Pedaliodes tucca*

Number of species recorded	**26**
New records for area	**12**
Potential new taxa	**0**
First record (Ecuador)	**0**
Three or fewer records (Ecuador)	**0**
First record (Napo Province)	**1**
Extension to elevational range	**2**


Volcán Sumaco seen from La Laguna


Rhetus dysonii


Traps drying at the cabin


Summit remains a mystery


The view towards Loreto from La Laguna


Sunset at La Laguna cabin

Cordillera Napo-Galeras

5th - 11th August

Number of species recorded	33
New records for area	N/D
Potential new taxa	0
First record (Ecuador)	0
Three or fewer records (Ecuador)	0
First record (Orellana Province)	3
Extension to elevational range	5


The high plateau of C. Napo-Galeras


Following an overgrown trail

Entering the National Park


Hanging canopy traps


Cithaerias pyropina cliftoni


The camp in C. Napo-Galeras

Overview: The Cordillera Napo-Galeras is a remote limestone massif situated to the southeast of V. Sumaco, in a separate area of the Sumaco-Napo-Galeras National Park, and is a major watershed for the Río Napo. Although nothing is known of its Lepidoptera, recent botanical investigations organised by the Fundación Izhu Magallpa Urcu [Freile & Santander, 2005] and Fundación Osa suggest it has similar levels of plant endemism as the main sub-andean cordilleras, Cordillera del Condór and Cordillera Kutukú. It certainly merits exploration due to its unusual geology and flora, which could also host endemic butterfly taxa.

Our experience: A large, gently sloping area surrounding the National Park is managed by the local community and is mostly relatively undisturbed forest with the exception of occasional plots used for agriculture. The trail to the first campsite (Luyapaccha) is gentle with a few steep ascents and can easily be covered in half a day. To reach the upper plateau there are then a number of steep, scrambling ascents, including the final one that covers approximately 100m in elevation. The trail is clear and well-used throughout due to the presence of a military base at the highest part of the range.

The lower slopes are covered in premontane forest with dense thickets of Guadua bamboo. The forest canopy on the plateau was at 10~15m and the understory was very open. 'Black rivers' and areas of stunted forest (canopy at ~5m) with distinctive reddish-coloured leaves on the ridges below (different to the 'Orange ridge forest' in Cordillera del Cóndor) suggest a sedimentary substrate, as has been previously reported [Fundación Osa].

We were accompanied by a National Park Ranger who was an enthusiastic field assistant and quickly became proficient at hanging canopy traps. His experience of the area was invaluable for locating possible camp sites and water sources on top of the plateau. Machetes were used to clear a small area to pitch our tents in and mark trails. Unfortunately family illness necessitated his return to Mushullacta on our fourth day, however we stayed on the plateau for a further two days and had no problem descending unaccompanied.

Fieldwork focused on the isolated upper plateau where endemic taxa might be found, however it was very dry (our water source almost ran out) and butterfly abundance was particularly low. Seeing fewer than ten individuals per day was commonplace and only 23 specimens were collected in three days by four people. In contrast, JR collected 20 specimens along the path to Mushullacta on the final day. The dry conditions on the plateau may explain its surprisingly low butterfly abundance.

It is interesting to note that no Euptychiina or Pronophilina species were collected on the high plateau, despite having high diversities throughout the ecuatorial Andes. The absence of a high-altitude connection to the Andes may explain the absence of Pronophilina whose diversity typically peaks at 2600~2850m [Pyrcz et al., 2009 and references therein]. The steep sides of the plateau may also act as an ecological barrier to Euptychiina which were recorded from the lower forests.

Interesting taxa:

First record for Napo Province - *Opsiphanes mutatus, Splendeuptychia sp.6, Moschoneura ela*

Cordillera de Kutukú

12^{th} - 16^{th} August

Overview: The Cordillera de Kutukú is an eastern outlier to the Andes composed of sandstones and limestones uplifted in conjunction with the formation of the Andes. As the Kutukú is isolated from C. del Cóndor it is expected to have a significantly different butterfly fauna. There are only two recorded recent collections of butterflies in the Kutukú – along the Logroño-Yaupi trail which no longer exists, and on the Macas-Yaupi trail.

Our experience: The expedition planned to investigate the Macas-Yaupi trail which crosses the Kutukú and was described in a letter sent to Keith Willmott by Martin Cooper. Our aim was to hike up to the highest point on the ridge above Macas with a guide from the village of Angel Róuby.

On arrival in Angel Róuby we were informed that we would need to request permission from the Federación Interprovincial de Centros Shuar (FICSH), with whom we should arrange all payments and guides. The President of the FICSH duly granted permission to enter the area and insisted that the FICSH Director of Culture & Education, Claudio, accompany us on the expedition. The FICSH permission was accepted by the Síndico (elected leader) of Angel Rouby, who now asked us to make a 'voluntary contribution' of around $500. After lengthy discussions with Claudio he agreed that we should only pay $50, and that a guide would be ready the following morning, provided that we bring food for him.

The following morning the community insisted that we pay for two guides - in addition to the fees paid to the Síndico and the FICSH, and in direct contrast to what was originally said that all payments should be made through the FICSH. As we discussed what to do, a group of a dozen villagers gathered and starting arguing in Shuar and gesturing heatedly with Claudio. He explained that members of the community were convinced that we were there to kill them and steal from their farms. Three different men threatened to follow us the next day and kill us if they found us on their land. We decided it would be foolhardy to do anything but leave Angel Róuby before tension escalated further. The Síndico graciously returned our 'voluntary contribution to the community' without complaint.

Recommendations: The Cordillera de Kutukú remains a fascinating and largely unexplored area, which is likely to have outstanding biodiversity and numerous endemic taxa. However, we found the Shuar to be extremely distrusting of foreigners – perhaps as a result of many areas having been exploited for their hidden oil and mineral riches. Our understanding is that they suspected us of being undercover employees of an oil company, and our use of the word 'scientist' meant we were treated with the utmost suspicion. Had we paid the $500 they requested it may well have further convinced them that we were looking for oil.

Our experience of the FICSH would suggest that although keen to help, they exercise little control over individual communities. Within Angel Róuby it was also clear that the Síndico's approval counted little more than anyone else's – the ultimate democracy. Given that we were constantly expected to pay bribes, that agreements counted for nothing from one day to the next, and that we received death threats when trying to do things 'by the book', we would strongly discourage anyone from independently attempting the Angel Róuby-Yaupi trail, unless prepared to buy over the community which still may not guarantee safe passage.

It should be stressed, however, that our experiences relate to a single Shuar *Centro* and we are not suggesting that all communities will have similar attitudes. The Missouri Botanical Garden have recently been working with Shuar communities in the eastern Kutukú [D. Neill, *pers. comm.*] and the most effective access into the area would likely be through such an organisation with existing contacts in a community.

Cordillera Shaimi (Puerto Yaupi)

17th - 18th August

Number of species recorded	28
New records for area	N/D
Potential new taxa	0
First record (Ecuador)	0
Three or fewer records (Ecuador)	2
First record (Napo Province)	1
Extension to elevational range	3


View of Perú from C. Shaimi

Overview: Puerto Yaupi is a small town where the road east to San Jose de Morona crosses the Rio Yaupi, to the northwest of Soldado Monge. It serves as an access point to Yaupi, by means of a motorised canoe which leaves at ~5am daily.

Our experience: We travelled to Puerto Yaupi on the recommendation of the FICSH Director of Culture & Education. Unfortunately when we arrived his contacts were out of town. We considered travelling to Yaupi and attempting to hire a guide to explore the Kutukú, but decided against it as there was no guarantee we would have any more success than in Angel Róuby and would lose a number of days travelling.

Instead a morning was spent collecting on a small forested hill, the site of a radio antenna owned by the FICSH in the Cordillera Shaimi. Although we were assured it was high in the mountains, it was actually at an elevation of just ~670m and there was no potable water source for camping – at this point we decided to head south to the Cordillera del Cóndor.

Interesting taxa:
Second site record for Ecuador – *Theope wallacei*
Third site record for Ecuador – *Neruda metharme*
First record for Morona Santiago Province - *Neruda metharme*

Recommendations: It may well be possible to access the Cordillera de Kutukú from the Yaupi side, and a researcher who stayed in Yaupi for a number of months was told about previous trips into the Kutukú by the community there [G. Gallice, *pers.comm.*], however a significant amount of time should be allowed for travel and negotiations.

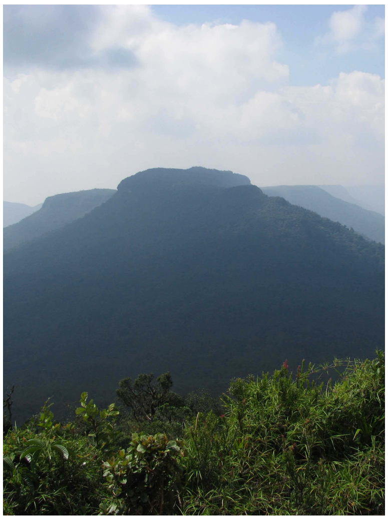
Destacamento Cóndor Mirador

20th - 28th August

Number of species recorded	**141**
New records for area	**68**
Potential new taxa	**3**
First record (Ecuador)	**0**
Three or fewer records (Ecuador)	**4**
First record (Zamora-Chinchipe Province)	**5**
Extension to elevational range	**45**

The team and military at CM

A trap overlooking the base



Plateau to the north of CM

Admiring the view

Baiting traps with rotten fish guts

Hypanartia cinderella

Overview: Destacamento Cóndor Mirador is an Ecuadorian military base, situated 2km from the Peruvian border. It has been the focus of numerous border disputes and wars between the two countries, the most recent was in 1995. The base overlooks the Río Cenepa below, and is overshadowed by a high plateau to the north and a ridge to the south. It is the site of one of the few known collections of Lepidoptera in the Ecuadorian Cóndor, by Sebastian Padrón.

Our experience: There are two main trails from the military base that we were allowed to use, however we were warned not to leave the trail on the Peruvian side as much of the area is still mined. The plateau to the north of the camp could be accessed by an hour's brisk walk and then a short scramble up the final ~20m elevation. The highest point was at 1984m on the plateau edge, however we were advised that it was unsafe to explore further due to mines.

Immediately below the plateau was a ridge where much of our collecting was done. The forest at this point was stunted ranging from 1~5m in height. There was a strong wind blowing across the ridge and numerous interesting taxa were recorded 'hill-topping' - coasting on the wind. Amongst them were *Stalachtis sp.* - a suspected new taxon from a genus typically found in the Amazonian lowlands [K. Willmott, *pers. comm.*] and *Magneuptychia modesta*, an incredible 1100m above the previous upper limit of its known range in Ecuador.

The taller trees along the ridge were excellent 'perching' sites used by male *Lycaenidae* for territorial displays and nine of the ten identified lycaenids were outside their known ranges, with 13 others still unidentified.

The ridge to the south of the base was noticeably drier than the plateau in the north, particularly above ~1800m where patches of pale sandy soil were visible between brush vegetation no more than a metre high. Butterfly abundance was also noticeably lower, except in the area surrounding the upper of the two shelters on crests of the ridge.

We found the military to be incredibly friendly and helpful throughout the expedition – they even offered to give us a lift back from D. Cóndor Mirador to Gualaquiza by helicopter! Unfortunately it was three days too soon and we had to pass up the offer to make the most of the good weather for fieldwork.

Interesting taxa:

Potentially new to science – *Stalachtis sp.*, *Manerebia sp.1, Pedaliodes sp.1*
Second site record for Ecuador – *Magneuptychia modesta*
Third site record for Ecuador – *New genus n. sp.*
Fourth site record for Ecuador – *Actinote kennethi, Ancyluris mira*
First record for Zamora-Chinchipe Province – *Fountainea titan, Memphis acaudata, Eueides vibilia, Olyras crathis, Magneuptychia modesta*

Destacamento Paquisha Alto

30th August - 9th September

Overview: Destacamento Paquisha Alto is another Ecuadorian military base, situated very close to the border with Perú. It was also heavily involved in the border conflicts, with the battles in 1981 focussing on the area. More recently the area has been under threat from mineral exploitation – the Canadian firm Kinross Aurelian discovered one of the largest gold deposits in the world, Fruta del Norte, to the north-east of Paquisha Alto, which is currently being developed for mining. It was the site of a small lepidopterological collection by Dr. Keith Willmott in 2009. The high plateau accessible from the camp is Cerro Machinaza, the Peruvian side of which was visited by the RAP7 expedition and found to be distinctive from many of the other *tepuis* in the area.

Our experience: There is a well-made trail that runs from the back of the military base at ~1850m along a ridge, eventually reaching a flat plateau at ~2300m. This provides a good altitudinal transect through relatively undisturbed forest, and served as the focus of our collecting efforts for the first four days fieldwork. In particular, there was a flat section of trail passing through distinctive stunted forest at ~2100m where a number of interesting taxa were recorded, including *Manerebia sp.2*.

On the fifth day we received permission from the military to stay in the cabin high up on the plateau, where all subsequent fieldwork was conducted. In addition to the main trail used by the military to access the *hito* (border marker) there were two other trails that are partly overgrown but still usable and occasionally marked with tape in the manner of a transect. These accessed the lowest and highest parts of the plateau and were probably cut by the MOBOT team who recently explored the same area [D. Neill, *pers. comm.*].

The vegetation found on the plateau was distinctive and similar to that described by Foster and Beltran [in Schulenberg & Awbrey, 1997, p46-50 and p61] from the Peruvian side of Machinaza as 'tepuis-like vegetation', predominantly sclerophyllous shrubland and herbaceous meadows. There was also significant variation across the plateau, from sheltered valleys where the canopy may be as high as 5m, to exposed hillocks where it was little more than a metre above the ground. A large expanse had recently been burnt and was growing back. In the lowest area of the plateau vegetation changed to 'Orange ridge forest' [Schulenberg & Awbrey, 1997] and gained height, with the canopy at ~10m above ground.

The diversity of vegetation was also reflected in the butterflies recorded – all three potentially new taxa of Pedaliodes [*sensu. lato*] werefound across the majority of the plateau, but with markedly different abundances in different areas. In contrast, *Eretris sp.* was only found in sheltered valleys with less stunted forest.

The highest point on the plateau was accessed via a long ridge covered in dense forest ~5m high which stopped abruptly at the bottom of a ~20m high cliff. However, the trail did in fact continue and with sufficient determination and scrambling experience it was possible to reach the top without ropes. This revealed another large and gently downwards sloping plateau disappearing into Perú. Having been warned that the area beyond the first *hito* was mined our explorations stopped there, however what could be seen of the Peruvian side was noticeably drier, as well as being significantly higher, than the main plateau in Ecuador.

Number of species recorded	**90**
New records for area	**60**
Potential new taxa	**6**
First record (Ecuador)	**1**
Three or fewer records (Ecuador)	**4**
First record (Zamora-Chinchipe Province)	**4**
Extension to elevational range	**23**

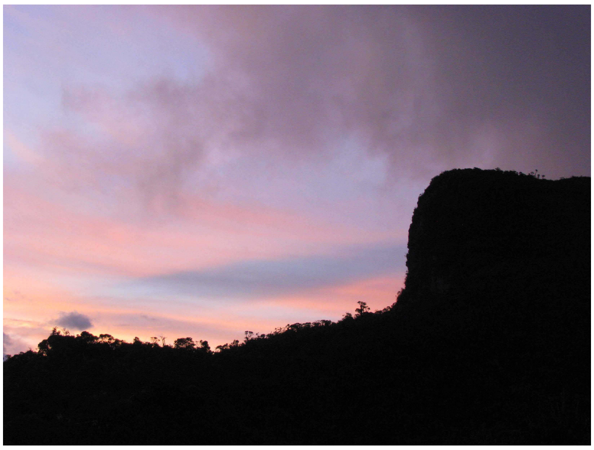
The view from Cerro Machinaza

The highest point at PA

Patricia dercyllidas hazelea

Waiting for the mist to clear

A *tepuis* in Perú, viewed from PA



Cerro Machinaza at sunset

The small area of high plateau within Ecuador was covered by a herbaceous meadow dominated by terrestrial bromeliads and orchids, as described by Foster and Beltran [in Schulenberg & Awbrey, 1997]. This site had a significantly different Lepidoptera fauna to that of the main plateau below – four of the five specimens of *Catasticta poujadei n. ssp.* were caught 'hill-topping' there and the majority of Satyrinae were individuals of an as-yet undescribed genus in the Taygetis clade, previously known only from a single specimen collected here in 2009 and a series from the Parque Nacional Podocarpus. What appears to be the first recorded female of *Perisama clisithera beaufouri* was also caught on this hilltop.

Interesting taxa:

Potentially new to science – *Catasticta poujadei n. ssp.*, *Manerebia sp.2, Panyapedaliodes sp. nr. drymaea, Pedaliodes sp.1, Pedaliodes sp.2, Eretris sp.*
First recorded female – *Perisama clisithera beaufouri, Hyalyris antea n. ssp.*
First record for Ecuador – *Hyalyris antea n. ssp.*
Second site record for Ecuador – *Splendeuptychia clementia*
Third site record for Ecuador – *Pseudomaniola asuba*
Fourth site record for Ecuador – *Euptychia cesarense viloriai, Atlides havila*
First record for Zamora-Chinchipe Province – *Eunica viola, Cissia penelope, Euptychia cesarense viloriai, Splendeuptychia clementia*

Figure 2 – View of Cerro Machinaza from Google Earth, showing all collection sites

4. Diversity analyses

Estimating community species richness

Justification & overview

Most assessments of the biodiversity and conservation value of a given habitat or area focus on the number of species recorded within its confines. This makes sense for a number of reasons – species are the fundamental building blocks of biodiversity and species lists can be rapidly and unambiguously compiled for a study site. However, because the number of species observed in a study can never exceed the total number of species found at that site, and in fact is usually lower, observed species richness is a biased estimator of community species richness [Longino et al., 2002].

Ecologists have therefore developed a variety of methods for estimating the true species richness of a community [Soberón & Llorente, 1993; Colwell & Coddington, 1994; León et al. 1998; Gotelli & Colwell, 2001] from an incomplete sample. In the case of megadiverse fauna such as butterflies, even the most comprehensive of surveys can fail to approach the asymptotic or 'true' community species richness [De Vries et al., 1999], highlighting the importance of rigorous estimators.

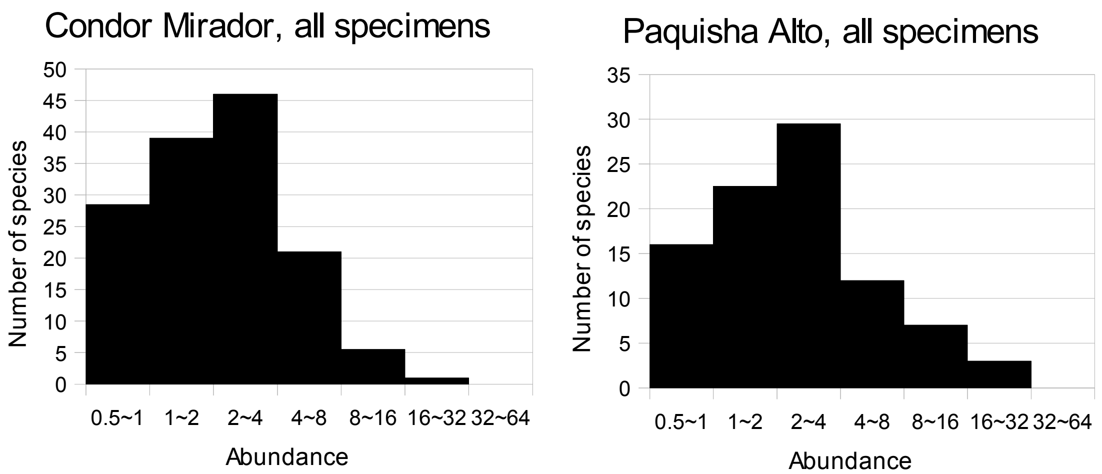
Three broad categories of estimators are widely used, as reviewed in Bunge & Fitzpatrick [1993], Colwell & Coddington [1994] and summarised by Longino et al. [2002].

1. A lognormal or logseries distribution is fitted to species abundance data, and the visible proportion of the distribution is estimated.
2. An asymptotic equation can be fitted to species accumulation or rarefaction curves.
3. Non-parametric measures based on the proportion of 'rare' species in the sample can be used to estimate community species richness.

Methods from all three categories discussed above have been used here to estimate the species richness of the two sites sampled in the Cordillera del Cóndor – Cóndor Mirador and Paquisha Alto. The numbers of individuals and species recorded at all other study sites were considered too low to give meaningful estimates of true community richness.

Method 1 – Lognormal abundance distributions

Figure 3: Lognormal abundance distributions for Cóndor Mirador and Paquisha Alto



The method of Preston [1948] has been followed with logarithmically-spaced abundance classes or 'octaves' with boundaries ½,1,2,4,8 etc. If a species' abundance falls on a boundary it is allocated equally between those two octaves, adding 0.5 to each. The resulting abundance distribution for each site is shown in Figure 3 above.

The abundance distributions shown in Figure 3 exhibit a clear mode in the 3rd octave, which contains 2-4 individuals. This was unexpected as both samples were very incomplete [Magurran, 2005] – new species were still being recorded even at the end of our time at each site. Additionally, tropical insect surveys typically display a mode in the first octave – most species are rare and few duplicates are recorded [Longino et al., 2002].

The observed modal distributions can be explained by the sampling method used during the expedition – *ad hoc* collecting by skilled taxonomists. When the expedition team visited a new area all butterfly individuals would be collected and a minimum of three voucher specimens were kept for all species[2]. However, as our knowledge of the butterfly fauna of the area improved, collectors would increasingly focus their efforts on rare or taxonomically difficult species. The result is that many common and distinctive species are only represented by three individuals in our sample, despite having a much higher abundance at the study sites. This produces a number of artificially rare species and explains the mode observed in the third octave of both abundance distributions.

As a result of only recording semi-quantitative abundance data, estimating species richness from abundance distributions alone would give severely biased results. The large number of 'tripleton' species suggests that the survey is significantly more complete than it actually is, and abundance-based estimates would yield underestimates of community species richness.

Method 2 – Rarefaction curves

Species accumulation curves show the increase in number of observed species as individuals are sequentially added to a sample. However, in the case of this study, the date (but not time) of each sample was recorded, and with four collectors working simultaneously the ordering of samples from any given day is arbitrary. Meaningful species accumulation curves cannot therefore be plotted [Gotelli & Colwell, 2001].

Individual-based rarefaction curves[3] have instead been produced which estimate the number of species that would be observed from a smaller sample, under the assumption of random mixing of individuals [Colwell & Coddington, 1994; Colwell, Mao & Chang, 2004 and references therein]. All rarefaction curves have been produced using EstimateS v8.2, which computes an analytical expression for Coleman curves [Coleman 1981; Coleman *et al.* 1982], shown to be identical to classical rarefaction curves to three or four decimal places [Colwell, 2009].

Number of individuals has been suggested as a superior measure for quantifying collecting effort than a time-based proxy (eg. person-hours) as it avoids many potential sources of error [León et al., 1998; Longino et al., 2002]. These include traps having different efficiencies in different habitats; pooling data from multiple collectors of different abilities; and variable weather within and between sites [Willott, 2001]. Additionally, Colwell & Coddington [1994] note that in the case of

2 Fewer than three specimens were taken for 17 readily identifiable and abundant species at one or other site. These have been treated as having a sampled abundance of three and are listed in Appendix A.

3 For a clear explanation of the differences between accumulation and rarefaction curves, and individual-based and sample-based methods, refer to Gotelli & Colwell [2001].

ad hoc collecting, as done here, whole habitats tend to be neglected once suitable sampled, biasing the results if a time-based measure of collecting effort is used.

The choice of number of individuals to measure collecting effort is not without its problems, however. Colwell & Coddington [1994] also note that "number of individuals…means continuing to count individuals of species already discovered...[and] is not likely [to] be useful for traditional 'museum' collecting." Neither measure will therefore produce an unbiased estimate of community species richness based on the available data.

Butterflies are highly sensitive to weather conditions, and the weather on the plateau at Paquisha Alto could change from thick fog, to sunny spells, to overcast skies, to rain, within the course of an hour. When combined with the fact that different butterfly taxa fly in different conditions[4], quantifying an equivalent collecting time for each weather condition became almost impossible. Number of individuals has therefore been used as a measure of collecting effort as it is considered more reliable than a time-based measure.

As a result of the *ad hoc* collecting procedure used, a disproportionately high number of rare species were recorded from each site [Longino et al., 2002], which could result in overestimation of community species richness. However, "samples of insufficient size ('undersampling') consistently underestimate local richness" [Colwell & Coddington, 1994]. As almost all surveys of hyperdiverse tropical insect fauna undersample local communities, these two compensating effects may reduce the error in estimates of community species richness.

A number of different equations have been suggested for projecting observed species numbers from rarefaction curves, including exponential, logarithmic and hyperbolic forms [Soberón & Llorente, 1993]. Of these, the two parameter hyperbola proposed by Clench [1979] in relation to entomology and known from enzyme kinetics as the Michaelis-Menten equation [Colwell & Coddington, 1994] is one of the most widely used [Longino et al, 2002]. It has also already been used to estimate community species richness from other samples of tropical Lepidopteran fauna [eg. Lamas et al., 1991; León et al., 1998]. Additionally it has a plausible underlying mechanism for the rate of species accumulation – "the probability of adding new species will improve (up to a ceiling) as more time is spent in the field" [Soberón & Llorente, 1993]. The Michaelis-Menten equation has therefore been used to predict community species richness in both Cóndor Mirador and Paquisha Alto.

Soberón & Llorente [1993] recommend the use of a logarithmic model for large areas with complex faunas that have been significantly undersampled, citing also "the yearly fluctuations many tropical butterfly species undergo". While we certainly do not dispute this seasonal variation, we prefer to follow the advice of Colwell & Coddington [1994] that "A point estimate of 'local richness' should be local in time as well as space."

Our sample can only be considered representative of the butterfly fauna found at the study sites during the very brief period of time that the expedition spent at each one. The 'true' species richness of each site (i.e. including seasonal variation) would be expected to be much higher, but could only realistically be estimated on the basis of a much longer sampling period spanning months or years [DeVries et al., 1999].

Chao & Shen [2010] go even further, to suggest that "when the sample size is small relative to the total species richness, ...[parametric]estimators...are generally not stable. Nevertheless, this lower bound can still be accurately estimated with the Chao1 estimator. In a highly heterogeneous

[4]A number of *Satyrinae* were even collected in dense fog.

community, it is thus generally more useful to provide an accurate lower bound than an unstable point estimate of total species richness.” Despite this warning, the Chao-1 and Michaelis-Menten estimates computed here only differed by 2 species at both sites.

EstimateS v.8.2 was used to estimate community species richness using the Michaelis-Menten equation. The MMMeans method was used to calculate the estimate for each increment in sample size, based upon the Coleman curve generated from sample data [Colwell, 2009].

Method 3 - Non-parametric estimators

Non-parametric methods have long shown promise for estimating species community richness [Bunge & Fitzpatrick, 1993] however in recent years significant progress has been made, including new algorithms that yield confidence intervals in addition to a mean or 'point' estimate [Shen et al., 2003; Chao, 2005; Chao et al., 2009].

In this investigation the Chao-1 [Chao, 1984; 1987] and ACE-1 (modified Abundance-based Coverage Estimator) [Chao & Lee, 1992; Chao et al., 1993] non-parametric asymptotic estimators have been calculated, using the program SPADE [Chao & Shen, 2010]. Chao-1 is based on the observed number of species, singletons and doubletons (those species recorded only once and twice respectively) and can therefore be confidently evaluated here as our (adjusted) abundance data is accurate at the level of 'one', 'two' or 'more' individuals. It was derived as a lower-bound estimate of community species richness, but it has since been demonstrated to be a relatively accurate point estimator for many datasets [Shen et al., 2003; Chao et al., 2006].

The evaluation of ACE-1, however, was more problematic due to our semi-quantitative abundance data, as ACE-1 relies upon the relative abundances of 'rare' species. The cut-off point for rarity was set at 20, following the advice in Chao & Shen [2010], as the default value of 10 resulted in Chao-1>ACE. Both communities were found to be highly heterogeneous (CV_Rare = 0.74 and > 0.8 for CM and PA respectively) therefore ACE-1 was used instead of ACE [as per Chao & Shen, 2010]. EstimateS was also used to evaluate
Chao-1 and ACE (there was no option to evaluate ACE-1) for each increment in sample size.

In order to demonstrate the effect of ceasing recording distinctive species when three samples had been obtained, the species abundance distributions have been adjusted to remove the mode at N=3. Details are given in Table 1 below. This estimate, termed ACE-1 sample bias corrected (ACE-1,sbc), exceeds the uncorrected ACE-1 in both cases, as would be expected. It should be stressed, however, that this is not an accurate estimate, as ACE-1,sbc is based on an arbitrarily assigned frequency for N=3 individuals. Instead it simply serves to demonstrate that ACE-1 underestimates community species richness for the sampling protocol used here.

Table 1: Adjustments to species abundance distributions and resulting ACE-1 estimates

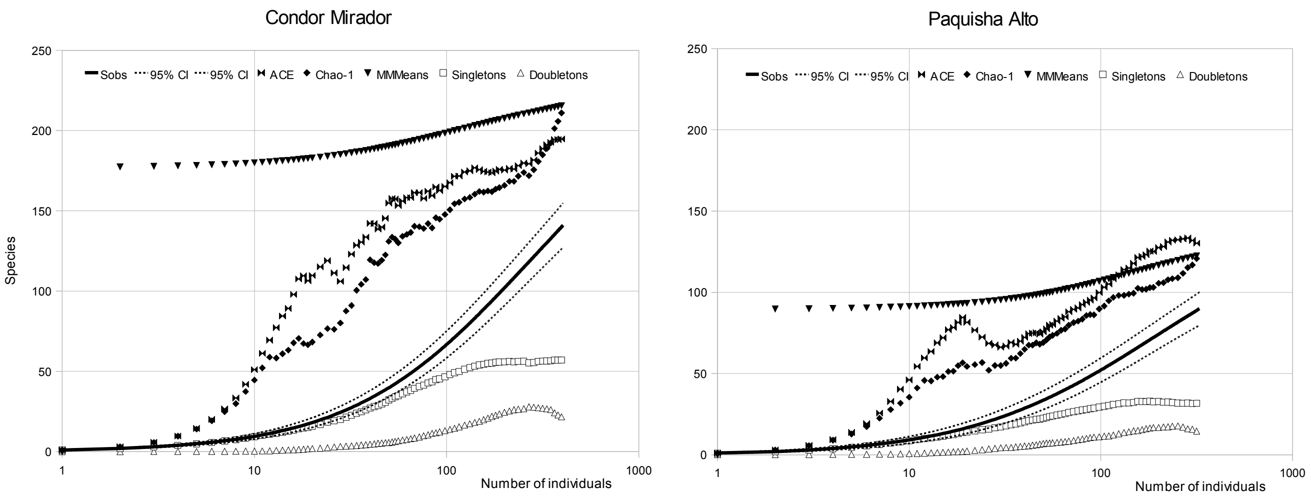
	Condor Mirador	Paquisha Alto
Observed tripletons	**33**	**21**
Adjusted tripletons	**15**	**10**
ACE-1	**225**	**148**
ACE-1,sbc	**257**	**163**

The Multinomial Model of Shen et al. [2003] has also been used, within SPADE, to estimate the number of additional species that would be found with 1) a further sample of 100 individuals and 2) doubling sample size.

Results & Discussion

The results from EstimateS of Chao-1, ACE and MMMeans calculated at each increment in sample size are shown in Figure 4 below. The abscissa of each plot is scaled logarithmically to reveal trends in the estimators that may not be evident on arithmetic plots [Longino et al., 2002].

Figure 4: Individual-based rarefaction curves for Cóndor Mirador and Paquisha Alto

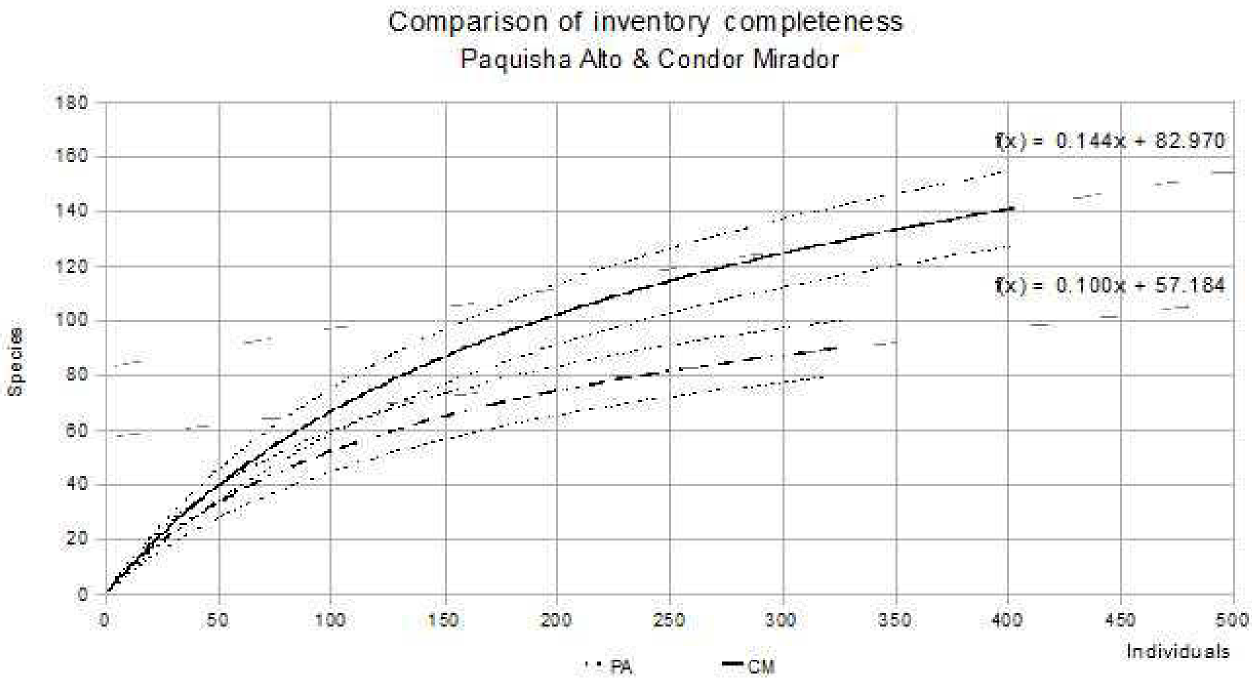


All three estimators shown in Figure 4 agree reasonably well in both cases, with ranges of 214-225 and 123-129 for Cóndor Mirador and Paquisha Alto respectively. None of the estimators had stabilised at the end of the sample. Chao-1 and MMMeans both increased monotonically as additional samples were pooled, and were continuing to increase when all samples had been included. ACE, in contrast, was more variable, with intermediate regions where it stabilised or even decreased. It was decreasing slightly at the full extent of sampling in Paquisha Alto and level for the data from Cóndor Mirador. The general increasing trend of all three estimators suggests that any predictions based on them should be treated strictly as a lower bound estimate of community species richness due to undersampling.

It can also be seen from Figure 4 that the number of singletons had stabilised, and the number of doubletons had started to fall for both data sets. These are often used as indicators of inventory completeness [Longino et al., 2002] and in fact, zero singletons is a simple heuristic to determine when sampling is complete [Chao et al., 2009]. The fact that the singleton and doubleton plots exhibit a similar trend suggests that inventory completeness is similar at the two sites.

A second comparison of inventory completeness has been made by calculating the final rate of species accumulation in each sample [c.f. Lamas et al., 1991], which of course drops to zero when the asymptote is achieved. A least-squares regression line was fitted to the final twenty samples added to each rarefaction curve, as shown in Figure 5 below.

Figure 5: Final species accummulation rates for Cóndor Mirador and Paquisha Alto



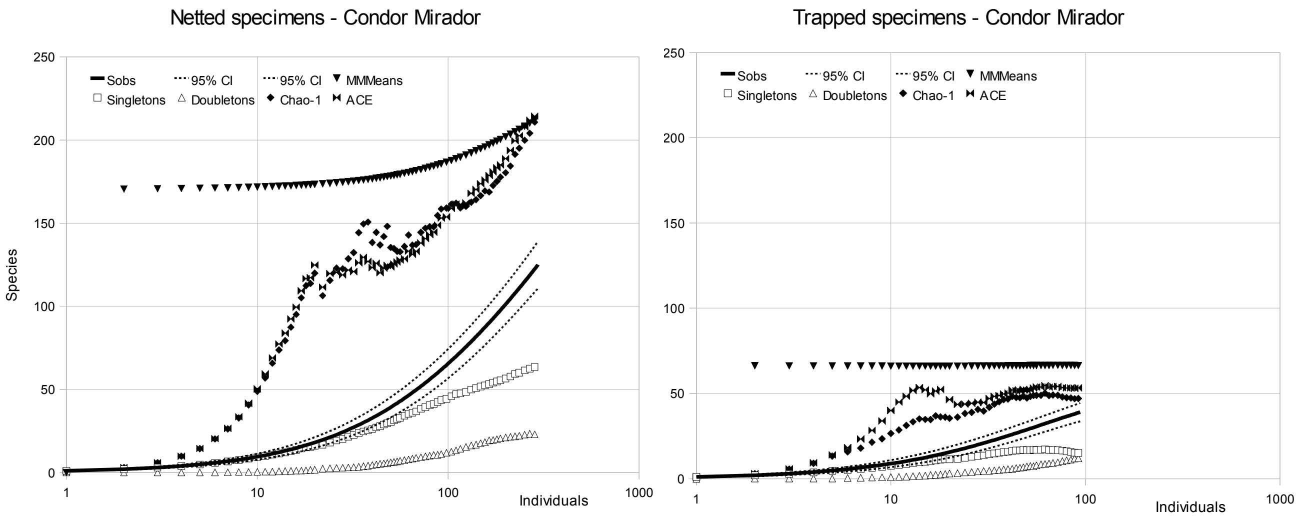
The final species accumulation rate at Cóndor Mirador was 0.14 species/individual compared to 0.10 species/individual at Paquisha Alto. This would suggest that the inventory is more complete at Paquisha Alto, despite the fact that fewer species have been recorded there.

As none of the estimators had stabilised by the end of the sample at either site, the data was partitioned into those specimens caught with a net ('netted') and those recorded from a baited trap ('trapped'). Only certain groups of butterflies visit traps, therefore the traps only sample a subset of the butterfly population at each site. Although all butterfly species can be collected by net, a number of canopy-dwelling and fast-flying taxa are only ever encountered in trapped samples. If a significant proportion of all specimens were trapped then this subset would be expected to stabilise earlier than the combined data set. The results from EstimateS v8.2 are shown below in Figure 6.

It is clear from Figure 6 that all three estimators have stabilised for the trapped specimens, giving an asymptotic species richness in the range 47-66, bounded by Chao-1 and MMMeans respectively. The observed number of trapped species was 39 at the end of sampling and the number of singletons had started to decrease, suggesting a relatively high inventory completeness.

The netted specimens, in contrast, continued to show a steep increase in all three estimators, which were in good agreement (211-214) and almost twice the observed species richness (125). Number of singletons was still increasing and doubletons were beginning to stabilise at the end of sampling, indicating that inventory completeness was significantly less complete than for the trap-visiting community.

Figure 6: Partitioned data from Condor Mirador – netted & trapped specimens



SPADE was used to calculate the Chao-1-shared and ACE-shared estimators [Chao et al., 2000; 2006]. These estimate the number of species shared by two samples, including those that were missing from one or both sample. In Cóndor Mirador, both estimated 32 species shared by the netted and trapped samples, compared to the 25 that were observed.

The mean of the three richness estimators (MMMeans, ACE, Chao-1) was calculated for each subset and summed. The mean of the Chao-1-shared and ACE-shared estimators was then subtracted to yield a new estimate of community species richness. A similar partitioned analysis was also conducted on the specimens recorded from Paquisha Alto, showing similar trends but different species richnesses.

The different estimates are summarised in Table 2 and 95% confidence intervals are given in parentheses where known. All predictions of community species richness, including finite additional sampling effort and estimated asymptotic values are also shown in Figure 7 below, along with the individual-based rarefaction curve from each site.

Table 2: Estimates of community species richness for Cóndor Mirador & Paquisha Alto

Index	Condor Mirador	Paquisha Alto
Chao-1	**214** (178-284)	**125** (105-176)
ACE-1	**225** (186-297)	**148** (116-217)
ACE-1, sbc	**257**	**163**
MMMeans	**216**	**123**
T&N Sep	**242**	**142**

Figure 7: Summary of estimated community species richness at each site

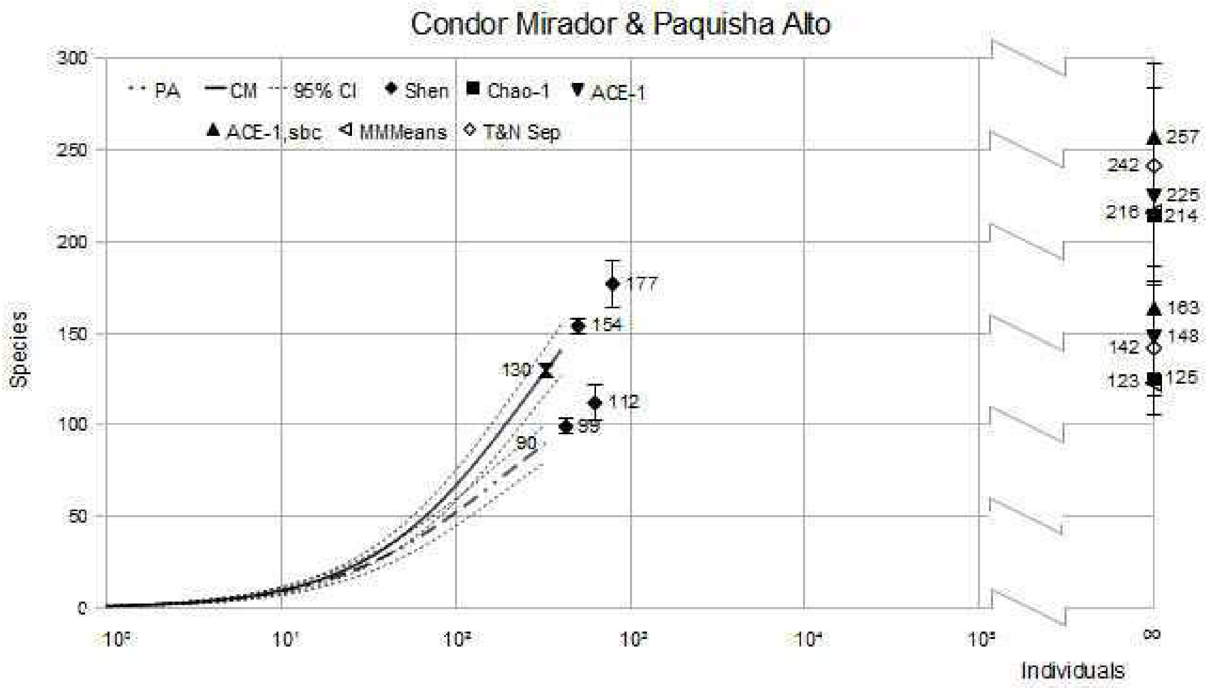


Figure 7 shows that all estimators give reasonably similar results, with means in the range 214-242 at Cóndor Mirador and 123-148 at Paquisha Alto. The ACE-1,sbc is above this range in both cases, demonstrating that by only recording three individuals of many abundant species, the ACE-1 estimator will underestimate community species richness.

Both sets of asymptote estimators are relatively low, giving ratios of observed to predicted species richness of 66% and 73% for Cóndor Mirador and Paquisha Alto respectively. However, actual inventory completeness is probably a great deal lower at both sites – these high values are the result of undersampling. Figure 4 demonstrated that none of the estimators had stabilised at the end of the sample, and therefore they should all be treated as lower bounds of true community species richness [Longino et al., 2002].

The estimates based on a doubling of sampling effort suggest that an additional 36 and 22 species would have been discovered at Cóndor Mirador and Paquisha Alto respectively. It should be stressed, however, that as these estimates are local in time as well as space, this cannot be interpreted as a prediction of how many new additions there would be to each species list if the same team were to repeat the expedition. Instead they are representative of how many additional species might have been registered if the expedition team had been twice as large, with equally skilled collectors.

These relatively low predictions are indicative of the law of diminishing returns, as well as highlighting the value of repeated sampling at different times throughout the year – far more species would be recorded from collecting for one week every three months than in a single four week visit.

Despite the incomplete nature of both inventories, some inferences can be made about the relative species richnesses of the two sites. Rarefaction allows the comparison of observed species richness for each site, using the same sample size - that of Paquisha Alto. This yields observed richnesses of 130 and 90, suggesting that the Cóndor Mirador fauna is 1.4 times richer than that of

Paquisha Alto. Comparison of the two rarefaction curves at the same point shows that the 95% confidence intervals (dashed lines) do not overlap – the effect is therefore statistically significant (p=0.05). Estimated inventory completeness based on both final species accumulation rate, and the ratio of observed to estimated species richness, both indicate that the Paquisha Alto inventory is more complete than that at Cóndor Mirador.

Comparison of the estimates of community species richness is more complicated due to the wide confidence intervals associated with extrapolation. However, it can be seen that the Chao-1 estimates (178-284 and 105-176) differ significantly (p=0.05), once again suggesting that Cóndor Mirador has higher species richness than Paquisha Alto. The ACE-1 estimates, although giving a higher mean value at Cóndor Mirador, do not differ significantly.

Diversity indices

Justification & overview

The preceding analysis was concerned only with the number of species found at each site and gave no indication of how distinct or similar the two butterfly faunas are. In order to compare the ecological values of the two sites further analysis is required.

The diversity of a region (termed γ) depends on both the average diversity of all of the sites or communities it contains (termed alpha, α) and the difference between sites (termed β) [Whittaker, 1960]. This partitioning of overall diversity can be either additive or multiplicative, with correspondingly different interpretations of β, as summarised in Table C below [Veech et al, 2002; Jost, 2007].

Table 3: Methods for partitioning beta-diversity

Additive partitioning	$\alpha + \beta = \gamma$	β = Mean number of species absent from each community
Multiplicative partitioning	$\alpha . \beta = \gamma$	β = Effective no. of distinct communities of equal richness

A great number of different indices have been proposed in the literature for the assessment of diversity, including amongst the most common: species richness, Shannon entropy, Simpson concentration and Gini-Simpson index [Allan, 1975; DeVries & Walla, 1999; Scheffler 2005; Summerville et al., 2006; Pyrcz et al., 2009]. However, Jost [2006; 2007] has shown that all of these measures are different forms of the “Hill numbers” [Hill, 1973], varying only in 'order', which determines its sensitivity to common and rare species [Keylock, 2005].

Species richness is the diversity of order zero – it is totally insensitive to the relative abundances of different species. In contrast, all diversities of order greater than one (including Simpson concentration and permutations therof) disproportionately favour common species [Tsallis, 2001]. The diversity of order one is the exponential Shannon entropy and is the only measure that favours neither common nor rare species [Jost, 2006]. Furthermore, diversity of order one is the only diversity that can be partitioned into independent α and β components for dissimilar sized communities or samples [Wilson & Shmida, 1984; Jost, 2007].

Significant confusion arises from the comparison of raw diversity indices, many of which are in fact entropies rather than diversities. A Gini-Simpson similarity coefficient (α/γ) of 0.999, for example, could arise from two totally distinct or identical communities, depending on their size

[Jost, 2006]. All diversity indices should therefore be converted to a 'true diversity', or 'numbers equivalent', in which case they behave as a diversity intuitively should – if half the species are lost from a community, its diversity approximately halves. Formulae are given for converting most standard diversity indices into true diversities by Jost [2007].

Results & Discussion

In the analysis presented here, the true diversities of order zero (species richness), one (exponential Shannon entropy) and two (inverse Simpson concentration) have been estimated for each study site using the program SPADE [Chao & Shen, 2010]. The ratios of these three diversities gives an indication of community dominance, varying from 1 for complete equitability to 0 for high dominance [Jost, 2006]. Fisher alpha-diversity has also been included for comparison with other studies [eg. Pyrcz et al., 2009] despite not being a true diversity. These results are summarised in Table 4 below.

The estimated true diversities of order one (exponential Shannon entropy) for Cóndor Mirador and Paquisha Alto are 129 and 71 species. That is to say they have diversity equivalent to communities composed of 129 and 71 equally common species respectively. The lack of overlap between the two estimates (confidence intervals shown in parentheses below) again suggests that the butterfly fauna of Cóndor Mirador is significantly more diverse than Paquisha Alto.

The ratios of the true diversities are moderately low at each site, suggesting that both communities are relatively heterogeneous. The values at Paquisha Alto are lower than those at Cóndor Mirador, suggesting that the former community has a higher level of dominance. This could be explained by the higher proportion of “hill-topping” species recorded at Cóndor Mirador, however it should be noted that these ratios depend on the abundance data for each site, which is only semi-quantitative. Firm conclusions cannot therefore be drawn regarding the relative heterogeneities of the two sites.

In order to compare the β-diversity between Cóndor Mirador and Paquisha Alto, SPADE has been used to estimate the true γ-diversity of order one (i.e. exponential Shannon entropy of the pooled data set). Average α-diversity of the two communities has been calculated as the average of Shannon entropy weighted by community size. This has then been converted to a true diversity by taking its exponential. Finally, β-diversity has been calculated using multiplicative partitioning [Jost, 2007] as shown in Table 5 below.

The Horn index of overlap has also been evaluated for the two sites – this is a true overlap measure, as demonstrated by Wolda [1981], and equals the proportion of species shared between two commmunities that are both composed of equally common species. It is based on diversity of order one, and is therefore the only measure of similarity or overlap that is mathematically valid for unequally weighted communities. The widely used Sørensen and Morisita-Horn indices are derived from the same underlying equation, but of order zero and two respectively, and only valid for equally weighted communities.

Table 4: Alpha-diversity for Cóndor Mirador and Paquisha Alto

Index	Order, q	Condor Mirador	Paquisha Alto
Species Observed	0	**141**	**90**
Indivs. Observed	0	**403**	**327**
Chao-1	0	**214** (178-284)	**125** (105-176)
ACE-1	0	**225** (186-297)	**148** (116-217)
Exponential Shannon entropy	1	**129** (109-149)	**71** (59-83)
Inverse Simpson concentration	2	**89** (89-90)	**45** (45-46)
Ratio: D(q=1) / D(q=0)	/	**0.59**	**0.52**
Ratio: D(q=2) / D(q=0)	/	**0.41**	**0.33**
Fisher Alpha	/	**77** (64-90)	**41** (33-49)

Table 5 - Beta-diversity for Cóndor Mirador and Paquisha Alto

	Order, q	CM + PA	CM	PA
Species observed	0	**191**	**141**	**90**
Proportion of individuals	/	1	**0.55**	**0.45**
True γ- or α-diversity [Expntl. Shannon entropy]	1	**146** (129-164)	**129** (109-149)	**71** (59-83)
Mean true α-diversity [Expntl. Shannon entropy]	1	**99**		
True β-diversity [Expntl. Shannon entropy]	1	**1.48**		
Horn index of overlap	1	**0.43**		

The true beta-diversity of 1.48 for Cóndor Mirador and Paquisha Alto indicates that the combination of the two sites has the same diversity as 1.48 'average' sites. Alternatively, based on the Horn index, the overlap of the butterfly faunas of Cóndor Mirador and Paquisha Alto is equivalent to that of two communities of equally common species sharing 43% of those species.

These measures highlight the incredible diversity of the butterfly fauna of the Cordillera del Cóndor, as only 43% of diversity is shared between two sites a mere 40km apart. This would suggest that the complicated topography of the area acts as an ecological barrier to many butterfly species and that adjacent *tepuis* and ridges may host significantly different communities. Considering that the Cordillera del Cóndor stretches for 150km and a total of just nine sites have been sampled, mostly at lower elevations, the true diversity of this region will only become apparent in future years.

5. Expedition findings & Conservation implications

Bigal River Biological Reserve

In just two years since the creation of Bigal River Biological Reserve (BRBR) more than 300 species of butterfly have been registered in its forests. This expedition recorded at least 100 different species, almost half of which were new records for the Reserve. All previous studies have only used photography as a method for recording species and it is therefore perhaps unsurprising that certain difficult groups (principally Ithomiinae, Satyrinae and Riodinidae) were underrepresented on the species list - 40 of the 48 new records presented here come from those taxa. The fact that 250 species have been identified from photographs is an impressive feat and testament to the hard work of Thierry Garcia, Kim Garwood and many others.

The BRBR certainly merits further exploration – most of the interesting records reported here were Satyrinae found around stands of Guadua bamboo, including a number of first and second records for Ecuador. Since our visit an additional 50 species (included in the list presented here) have been reported from the Reserve as new trails have enabled access to different areas.

In order to support butterfly tourism at BRBR, which could become a vital source of income for the local community, the expedition team will prepare a triilingual (Spanish, English and French) photographic guide to the Reserve's most common and distinctive species. The compilation of a comprehensive species list (see Appendix B: Bigal River Biological Reserve) was the first stage in this process and work is ongoing on the development of the guide.

A long-term, trap-based butterfly monitoring project would also gather invaluable ecological data and could be an important contribution to the literature as studies of this type are unfortunately relatively rare [eg. DeVries et al. 1997; 1999]. A significant number of additions to the Reserve's species list would also surely be found – particularly amongst strong-flighted canopy dwellers (eg. Apaturinae, Charaxinae) and reclusive Satyrinae, both of which are notoriously difficult to photograph.

Despite the excellent work of the Sumac Muyu Foundation (SMF) involving local communities in the conservation of BRBR, the Reserve is still under threat – particularly from hunting in the dry season [T. Garcia, *pers. comm.*]. Logging, clearance for agriculture and environmental pollution from solid and chemical wastes are other challenges affecting the area [Sumac Muyu Foundation, 2011]. We urge you to support the SMF and help to save this unique forest before it is lost forever.

Volcán Sumaco

So little is known of the Lepidopteran fauna of Volcán Sumaco that it was one of our highest priorities on the expedition. Unfortunately the combination of events detailed above prevented a thorough survey being completed, however we believe this to be the first collection of butterflies from its upper slopes. This is reflected by the fact that almost half of the 26 species recorded here were new to the area, and there are surely many more waiting to be found. Significant further work is required, particularly from ~2800m to the summit, whose fauna remains totally unknown. Members of the expedition team are hoping to return within the next couple of years and will focus their efforts on the unexplored forest-páramo transition zone.

The community of Pacto Sumaco control visitor access to the mountain as part of their local tourism project. The leader of this project asked us to collaborate with them and study the butterfly fauna of the forests surrounding the village on our return from Volcán Sumaco. Unfortunately the expedition leader's illness meant that we had to return directly to Loreto for hospital treatment.

After identifying all specimens collected during the expedition, we gave the community a copy of the species list we had compiled for Volcán Sumaco. Since then Kim Garwood has kindly shared with us her records from both Wild Sumao Lodge and San Isidro on the slopes of Volcán Sumaco, which are included in the complete list presented here (Appendix B: Volcán Sumaco).

We appreciate that a simple species list of scientific names is of little use to the Pacto Sumaco tourism project, however it was immediately available and served to reinforce our commitment to collaborating with them. Over the course of the next year, the expedition team plans to prepare a bilingual (English and Spanish) photographic guide to the most common and distinctive species found both in the vicinity of Pacto Sumaco, and at each cabin on the trail up Volcán Sumaco. Local names for species will also be included where known.

It is hoped that this will prove to be a valuable resource for the community, supporting their tourism projects. A similar collaboration with Wild Sumaco Lodge may even help encourage some of their more intrepid guests to climb the volcano, bringing significant additional income to the local community and reinforcing the value of forest conservation. EH has been living in Pacto Sumaco since the end of the expedition and will be pivotal in facilitating this collaboration.

Cordillera Napo-Galeras

The rapid inventory presented here is, as far as we are aware, the first study of butterflies in the Cordillera Napo-Galeras. This is despite the fact that it is mostly covered in relatively undisturbed primary forest, and its unusual sedimentary geology is host to a distinctive flora, similar to that of the Cordillera del Cóndor in the south.

The 33 species recorded here represent only a small fraction of the true butterfly diversity of this plateau - the lower elevations in particular remain almost entirely unknown. A number of interesting species were recorded, both on the plateau and around bamboo thickets in the forest below, suggesting that both areas merit further investigation. It would also be interesting to determine whether the low abundance observed here was the result of local weather patterns during the expedition or a true indication of a depauperate fana in the upper Cordillera Napo-Galeras.

The conservation status of the area is somewhat uncertain – much of the area is within the Napo-Galeras National Park and therefore receives the highest designated level of governmental protection. Additionally there is a large area of community-owned forest, used partly for subsistence activities, acting as a buffer zone to the west of the National Park and perhaps also in other areas.

However, on our way to Mushullacta the Park Director stopped to interrogate a group of men loading illegally logged timber onto a truck. There is certainly no way that the Park Rangers could effectively patrol the area with their current resources and prevent hunting or logging within the National Park – for that they must rely on educating the local communities and actively involving them in its management.

Since our return from the expedition we have also found out about Fundación Osa, who are working to protect Wairachina Sacha – 9000 acres of intact Tropical Wet Forest on the eastern border of the National Park. Despite being “the most species-rich forest ecosystem on the globe” undisturbed Tropical Wet Forest is not represented in any of Ecuador's existing National Parks [Fundación Osa]. The area is also rich in endemic species – a botanical study in March 2010 found six species undescribed to science and 80% of its plant species are not currently represented within Napo-Galeras National Park.

Wairachina Sacha is connected to the National Park by a narrow conservation corridor that enables large mammals to move freely between that forest and the lower parts of Cordillera Napo-Galeras. However, this forest is now under severe threat due to an illegal road built in 2008 that triggered a land-grab by local communities and an influx of settlers and loggers, threatening to isolate Wairachina Sacha. This in turn would threaten the survival of Jaguar, Puma and other large mammals in the region.

Fundación Osa has petitioned the government for the inclusion of Wairachina Sacha in the Napo-Galeras National Park, and even received a signed letter of approval from the then Director of INEFAN (who manage the National Parks) in 1994. They are currently working with the Director of Sumaco-Napo-Galeras National Park and local government in a bid to save the area.

Cordillera del Cóndor & Cordillera de Kutukú

A strong case was made for the conservation of the Cordillera del Cóndor based on the findings of RAP7 as it "probably has the greatest richness of vascular plants in South America." The importance of the area has become even clearer in recent years with further botanical discoveries [Neill, 2007] as well as new species of frogs [eg. Terán-Valdez & Guayasamín, 2010] and a reported 14 globally threatened or almost threatened bird species [Freile & Santander, 2005].

The key finding of this expedition is that the high *tepuis* of the Cordillera del Cóndor have a high diversity of butterflies (Lepidoptera: Papilionoidea), something that had not previously been reported. Of the 193 species recorded during this phase of the expedition eight are potentially new to science and a further fourteen taxa were previously known from three or fewer sites in Ecuador. 107 were new records for the Cordillera del Cóndor.

Rarefaction analysis has shown Cóndor Mirador to have significantly higher species richness than Paquisha Alto, with an estimated 178-284 and 105-176 species respectively[5]. This difference in alpha-diversity is also reflected in first and second order 'true' diversities.

The different diversities of the two sites could be explained by the high proportion of species caught hill-topping and perching on the ridge to the north of Cóndor Mirador. This was an excellent site for Lepidoptera that certainly merits further investigation as a wide variety of 'transient' species from the surrounding lower elevation forests were sampled along with its resident fauna.

The two sites had a true beta-diversity of 1.5 – that is to say that their combined diversity is 1.5 times greater than the average of the two sites. Alternatively, 43% of species would be shared between the two sites if all species found at a site were equally common[6]. This beta-diversity is also reflected by the possible new taxa – of the five registered from Paquisha Alto, only one is shared with Cóndor Mirador, a mere 40km away.

This demonstrates the huge diversity and endemism of the Cordillera del Cóndor – only a tiny fragment of which has currently been explored, with even less of it surveyed for butterflies. Currently 539 species have been recorded from the Cordillera del Cóndor – 107 of which (i.e. 20%)

[5] Lower bound Chao-1 estimates quoted here. For more details refer to Section 4 – Diversity analyses

[6] This is the Horn index of overlap, explained in more detail in Section 4 – Diversity Analyses

were new records from this expedition. Only 332 species have so far been recorded from Ecuador, which surely represents only a small fraction of its true diversity.

The high-altitude plateaus of the Cordillera del Cóndor are a globally-unique, well preserved and highly diverse group of habitats that should be studied as a matter of urgency. Multidisciplinary expeditions involving varied groups of scientists (eg. botanists, lepidopterists, herpetologists, mammologists etc.) could make significant progress by co-ordinating logistics, pooling resources and sharing knowledge of the area.

The prolonged border conflict between Ecuador and Perú has posed a number of problems to conservation, with aggressive settlement policies encouraged by both governments during the 1960s and then again following the confllict of 1981. During the latest dispute in 1995, three hundred tons of bombs were dropped on the area and the 20,000 soldiers stationed in just 72 square kilometers produced tonnes of toxic wastes that were dumped directly into the environment [Schulenberg & Awbrey, 1997].

However, since the Acta Presidencial de Brasilia was signed in 1998 significant progress has been made, with the establishment of the Parque Binacional del Cóndor, a 'peace park' on the Ecuador-Perú border [Alcalde et al., 2005]. Various indigenous and regional federations have also led the way and 4232ha are now included in the Bosque y Vegetacion Protectora Cuenca Alta del Rio Nangaritza (BVP-AN). The San Miguel de las Orquideas Association of Independent Workers and the Association of Shuar Tayunts are currently petitioning the Environment Ministry to upgrade its protection category in order to ensure the conservation of this unique area in the future [Guayasamín & Bonnacorso, 2011].

The ecological importance of the whole 'Tercera Cordillera' is becoming increasingly clear and Conservation International are working to establish the Abiseo-Cóndor-Kutukú Conservation Corridor (CCACK). The CCACK covers approximately 13 million hectares, stretching from Sangay National Park in Ecuador south to the Cordillera Azul National Park in Perú. Key achievements to date include the creation of the Parque Nacional Ichigkat Muja – Cordillera del Cóndor in 2007, covering almost 90,000ha on the Peruvian side of the range, and the Concesión de Conservación Alto Huayabamba which protects 143,000ha and was created in 2009 [Conservation International, 2009].

However, significant work remains to conserve corridors of forest between existing protected areas, prevent mining (at both commercial and individual scales) and to work with local communities in developing sustainable management plans that ensure the long-term survival of this unique region and the preservation of its incredible biodiversity.

6. Dissemination of results

Final Report: Distribution list

10th Duke of Rutland Trust

Adrian Ashby-Smith Memorial Trust

Balfour-Browne Trust Fund

British Library Legal Deposit Office

Cambridge Expeditions Committee

Cambridge Expeditions Fund

Cambridge University Explorers' & Travellers' Club Library (in C.U. Library Map Room)

Dspace @ Cambridge (University digital repository service)

Ecuadorian Natural History Museum (MECN, Quito)

Gilchrist Educational Trust

Mary Euphrasia Mosley, Sir Bartle Frere & Worts Travel Funds

McGuire Centre for Lepidoptera and Biodiversity, University of Florida

Osa Foundation

Panton Trust

Proyecto Ashaninka 2004

Queens' College Expeditions Fund

Royal Geographical Society (with Institution of British Geographers)

Simpson Education and Conservation Trust

Sumac Muyu Foundation

Complete

Publications

All publications will be made available online at: www.culepex.org.uk

Radford, J.T. (2011) "Cambridge University Lepidoptery Expedition to Ecuador 2010: 'Exploring the Tercera Cordillera'", Queens' College Record.

Radford, J.T. (2010) "Cambridge University Lepidoptery Expedition to Ecuador 2010: Summary Report".

Presentations

Radford, J.T. (2010) "The first Lepidoptera inventories of Ecuador's Tercera Cordillera", September 14th 2010, McGuire Centre for Lepidoptera and Biodiversity, University of Florida, Gainesville, FL.

Radford, J.T. (2011) “The first butterfly inventories of Ecuador's Tercera Cordillera:
A Cambridge Expedition”, February 10th 2011, Cambridge University Explorers' & Travelers' Club, Trinity College, University of Cambridge, Cambridge, UK.

Other

All records from this expedition have been added to the Darwin Database of Andean butterflies at the McGuire Centre in Florida: http://www.andeanbutterflies.org/database.html

Upcoming & Ongoing

Articles

Work is ongoing to identify and describe those taxa that could be new to science. Formal descriptions of any new taxa will be published in due course and listed on our website. Estimated: December 2012

A paper describing the butterflies of Ecuador's 'Tercera Cordillera', including the key findings from this Final Report is also in preparation. Estimated: December 2012

Other

Photographic ID guides for the common and distinctive butterflies of Bigal River Biological Reserve will be prepared in collaboration with Fundación Sumac Muyu. Estimated: June 2013

7. Acknowledgements

Throughout the planning and execution of this expedition countless people have offered their assistance and support to the team and we would like to sincerely thank all of them. The list below is by no means exhaustive and we apologise for any omissions.

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Bigal River Biological Reserve - http://reservadelriobigal.googlepages.com

Biodiversity Hotspots - www.biodiversityhotspots.org

Butterflies of Ecuador - www.butterfliesofecuador.com/

Fundación Osa - www.4biodiversity.net/

NaTHNaC - http://nathnac.org/travel/

Tropical Andean Butterfly Diversity Project (TABDP) - www.andeanbutterflies.org/

TABDP - Darwin Andean Butterfly Database - www.ucl.ac.uk/taxome/tabd/php/

Appendix A: Abundant species in Cordillera del Cóndor

Fewer than three specimens were taken of 17 readily identifiable and abundant species at one or both of Cóndor Mirador and Paquisha Alto. They have been treated as having an observed abundance of three in the diversity analyses. The species were: *Abananote abana, Abananote erinome, Altinote dicaeus, Altinote neleus, Altinote stratonice, Heliconius telesiphe, Dione glycera, Anartia jatrophae, Hypanartia cinderella, Siproeta epaphus, Epiphile imperator, Eunica viola, Corades chelonis, Corades enyo, Corades medeba, Oressinoma typhla, Oxeoschistus leucospilos.*

Appendix B: Annotated species checklists

Bigal River Biological Reserve

Species that are 'greyed out' were not recorded on this expedition, but are reported by Kim Garwood and Thierry Garcia who kindly shared their data to produce this synthesised list.

NYMPHALIDAE

Danaeinae					
1	Lycorea	halia	pales	[C. & R. Felder, 1862]	-
2	Lycorea	pasinuntia			
Heliconiinae					
3	Agraulis	vanillae			
4	Dione	juno			
5	Dryas	iulia			
6	Heliconius	clysonymus			
7	Heliconius	erato	lativitta	[Butler, 1877]	-
8	Heliconius	hecale	quitalena	[Hewitson, 1853]	ID on wing found on floor
9	Heliconius	melpomene	malleti	[Lamas, 1988]	-
10	Heliconius	numata	bicoloratus		
11	Heliconius `	sp tiger			
12	Heliconius	wallacei	flavescens		
13	Laparus	doris			
14	Philaethria	dido			
15	Altinote	sp.			
Nymphalinae					
16	Colobura	dirce	dirce	[Linnaeus, 1758]	MAX(922)
17	Historis	acheronta			
18	Historis	odius			
19	Tigridia	acesta	fulvescens	[(Butler, 1873]	-
20	Anartia	amathea			
21	Anartia	jatrophae			
22	Hypanartia	lethe		[Fabricius, 1793)]	-
23	Metamorpha	elissa		[Hübner, 1819]	-
24	Siproeta	stelenes			
25	Anthanassa	drusilla	alceta		
26	Castilia	angusta			
27	Castilia	ofella			
28	Castilia	perilla			
29	Eresia	clara	clara	[H.W. Bates, 1864]	-
30	Eresia	datis	moesta	[Salvin & Godman, 1868]	
31	Eresia	nauplius			
32	Eresia	pelonia			
33	Eresia	polina			
34	Tegosa	anieta			
35	Tegosa	claudina			
36	Telenassa	teletusa			
Limenitidinae					
37	Adelpha	alala	negra	[C. & R. Felder, 1862]	NR(ORELLANA)

38	Adelpha	boreas			
39	Adelpha	capucinus	capucinus		
40	Adelpha	cytherea			
41	Adelpha	irmina	tumida		
42	Adelpha	lycorias	lara		
43	Adelpha	mesentina			
44	Adelpha	plesaure			
45	Adelpha	sichaeus			
46	Adelpha	ximena	ximena		
Biblidinae					
47	Callicore	eunomia			
48	Callicore	lyca	aegina		
49	Callicore	pygas	cyllene	[Doubleday, 1847]	MAX(955)
50	Callicore	tolima	denina		
51	Catonephele	numilia			
52	Catonephele	(orites?)			
53	Catonephele	salacia			
Biblidinae					
54	Catonephele	salambria		[C. & R. Felder, 1861]	NR(ORELLANA)
55	Diaethria	clymena	peruviana	[Guenée, 1872]	-
56	Diaethria	euclides			
57	Diaethria	neglecta			
58	Dynamine	artemisia	glauce		
59	Dynamine	gisella			
60	Epiphile	lampethusa			
61	Eunica	norica			
62	Eunica	sp.			
63	Panacea	procilla	divalis		
64	Panacea	regina			
65	Paulogramma	pyracmon			
66	Pyrrhogyra	amphiro			
67	Pyrrhogyra	edocla		[Doubleday, 1848]	-
68	Pyrrhogyra	otolais		[Bates, 1864]	-
69	Temenis	laothoe			
70	Temenis	pulchra	pallidior	[Oberthür, 1901]	-
71	Marpesia	berania			
72	Marpesia	chiron		[Fabricius, 1775]	-
73	Marpesia	crethon		[Fabricius, 1776]	-
74	Marpesia	furcula			
75	Marpesia	livius			
76	Marpesia	zerynthia	dentigera		
Charaxinae					
77	Archaeoprepona	demophon			
78	Consul	fabius	diffusus	[Butler, 1875]	-
79	Fountainea	eurypyle	eurypyle	[C. & R. Felder, 1862]	-
80	Fountainea	ryphea	ryphea	[Cramer, 1776]	NR(ORELLANA)
81	Hypna	clytemnestra			
82	Memphis	lemnos			
83	Memphis	offa			
84	Memphis	sp.			
85	Polygrapha	cyanea			
Apaturinae					
86	Doxocopa	elis			
87	Doxocopa	lavinia			
88	Doxocopa	zunilda	floris		

Morphinae					
89	Antirrhea	hela		[C. & R. Felder, 1862]	-
90	Antirrhea	philoctetes	avernus	[Hopffer, 1874]	-
91	Antirrhea	taygetina	ssp		-
92	Morpho	cisseis			
93	Morpho	deidamia			
94	Morpho	telemachus			
95	Bia	actorion	rebeli	[Bryk, 1953]	-
96	Caligo	idomeneus			
97	Caligo	illioneus			
98	Catoblepia	berecynthia			
99	Catoblepia	soranus			
100	Eryphanis	gerhardi			
101	Opoptera	aorsa			
102	Opsiphanes	cassina			
103	Opsiphanes	quiteria			
104	Selenophanes	cassiope			
Satyrinae					
105	Cithaerias	pireta	aurorina	[Weymer, 1910]	-
106	Haetera	piera	negra	[C. & R. Felder, 1862]	-
107	Pierella	lena	brasiliensis	[C. & R. Felder, 1862]	MAX(976)
108a	Pierella	hortona	hortona		-
108b	Pierella	hortona	hortensia	[C. & R. Felder, 1862]	-
Satyrinae					
109	Pierella	lamia	chalybea	[Godman, 1905]	-
110	Pierella	lucia		[Weymer, 1885]	-
111	Amphidecta	calliomma		[C. & R. Felder, 1862]	NR(ECUADOR)
112	Amphidecta	pignerator			
113	Caeruleuptychia	lobelia		[Butler, 1870]	MAX(909)
114	Caeruleuptychia	scopulata			
115	Chloreuptychia	arnaca		[Fabricius, 1776]	-
116	Chloreuptychia	chlorimene			
117	Cissia	penelope		[Fabricius, 1775]	-
118	Cissia	sp.			
119	Euptychia	enyo		[Butler, 1867]	-
120	Euptychia	jesia			
121	Euptychia	meta		[Weymer, 1911]	-
122	Euptychia	mollina			
123	Euptychia	sp. 1			-
124	Euptychia	sp. (4)			
125	Forsterinaria	neonympha			
126	Hermeuptychia	hermes			
127	Hermeuptychia	maimoune		[Butler, 1870]	NR(ECUADOR)
128	Magneuptychia	fugitiva		[Lamas, 1996]	-
129	Magneuptychia	iris			
130	Magneuptychia	libye			
131	Magneuptychia	ocypete			
132	Magneuptychia	sp. 7			-
133	Megeuptychia	antonoe			
134	Pareuptychia	metaleuca			
135	Pareuptychia	ocirrhoe			
136	Pareuptychia	sp. nr. ocirrhoe			1 stripe?
137	Pseudeuptychia	languida		[Butler, 1871]	1PR, MIN(892), NR(ORELLANA)
138	Splendeuptychia	ashna			

139	Splendeuptychia	clorimena		[Stoll, 1791]	MAX(965), NR(ORELLANA)
140	Splendeuptychia	itonis		[Hewitson, 1862]	3PR
141	Splendeuptychia	sp. 1			
142	Yphthimoides	maepius			
143	Yphthimoides	renata			
144	Harjesia	blanda		[Möschler, 1877]	3PR, MIN(732), NR(ORELLANA)
145	Harjesia	griseola			
146	Harjesia	obscura		[Butler, 1867]	-
147	Harjesia	oreba		[Butler, 1870]	MIN(892), NR(ORELLANA)
148	Harjesia	sp.	pale		
149	Posttaygetis	penelea	penelea	[Cramer, 1777]	-
150	Taygetis	mermeria	mermeria	[Cramer, 1776]	-
151	Taygetis	thamyra		[Cramer, 1780]	-
152	Taygetis	virgilia			
153	Taygetomorpha	celia			
154	Lymanopoda	acraeida			
155	Oxeoschistus	pronax	protogenia		
156	Oressinoma	typhla	typhla	[Doubleday, 1849]	NR(ORELLANA)
Ithomiinae					
157	Ceratinia	neso	espriella		
158	Ceratinia	tutia	poecila	[H.W. Bates, 1862]	-
159	Dircenna	loreta	loreta	[Haensch, 1903]	-
160	Dircenna	dero			
161	Dircenna	sp. nr. dero			blacker
162	Dircenna	loreta	acreana		
163	Pteronymia	primula			
164	Brevioleria	arzalia	ssp	[Willmott, MS]	-
165	Godyris	zavaleta	matronalis		
166	Greta	libethris	libethris	[C. & R. Felder, 1865]	NR(ORELLANA)
167	Hypoleria	lavinia	chrysodonia	[H.W. Bates, 1862]	-
168	Hypoleria	sp.			
Ithomiinae					
169	Pseudoscada	florula	aureola	[H.W. Bates, 1862]	
170	Pseudoscada	timna	timna	[Hewitson, 1855]	
171	Ithomia	agnosia			
172	Ithomia	lichyi	neivai		
173a	Ithomia	salapia	derasa		
173b	Ithomia	salapia	salapia	[Hewitson, 1853]	-
174	Forbestra	olivencia	juntana	[Haensch, 1903]	-
175	Mechanitis	lysimnia	elisa		
176	Mechanitis	mazaeus	mazaeus	[Hewitson, 1860]	-
177a	Mechanitis	messenoides	deceptus	[Butler, 1873]	-
177b	Mechanites	messenoides	messenoides		
178	Methona	confusa			
179	Scada	reckia	ethica	[Hewitson, 1861]	-
180	Scada	zibia	quotidiana		
181	Thyridia	psidii	ino	[C. & R. Felder, 1862]	-
182	Eutresis	hypereia	banosana	[Fox, 1956]	MIN(927), NR(ORELLANA)
183	Melinaea	marsaeus	mothone	[Hewitson, 1860]	-
184	Melinaea	menophilus	zaneka		
185	Melinaea	sp. 1			
186	Melinaea	sp. 2			"10/25"
187	Hyalyris	coeno	norellana	[Haensch, 1903]	NR(ORELLANA)
188	Hyalyris	praxilla	praxilla		

189	Hypothyris	euclea	intermedia		
190	Hypothyris	semifulva	satura		
191	Napeogenes	cf. inachia			
192	Hyposcada	illinissa	ida	[Haensch, 1903]	-
193	Oleria	agarista	agarista	[C. & R. Felder, 1862]	MAX(851)
194	Oleria	assimilis	assimilis	[Haensch, 1903]	-
195	Oleria	estella	estella		NR(ORELLANA)
196	Oleria	ilerdina	lerida	[Kirby, 1878]	-
197	Oleria	onega	ssp	[Willmott & Lamas, MS]	-
198	Oleria	sp.			yellow
199a	Aeria	eurimedia	negricola	[C. & R. Felder, 1865]	-
199b	Aeria	eurimedia	sisenna		

RIODINIDAE

Euselasiinae

200	Euselasia	clithra			
201	Euselasia	eumenes		[Hewitson, 1853]	Awaiting confirmation by specialist
202	Euselasia	eupatra?		[Seitz, 1916]	Awaiting confirmation by specialist
203	Euselasia	melaphaea		[Hübner, 1823]	Awaiting confirmation by specialist
204	Euselasia	sp.			banded
205	Euselasia	sp.			grey

Riodininae

206	Eunogyra	satyrus		[Westwood, 1851]	-
207	Leucochimona	icare			
208	Mesosemia	amarantus		[Stichel, 1910]	-
209	Mesosemia	decolorata			
210	Mesosemia	epidius			
211	Mesosemia	jucunda		[Stichel, 1923]	-
212	Mesosemia	loruhama		[Hewitson, 1869]	-
213	Mesosemia	ozora		[Hewitson, 1869]	-
214	Mesosemia	sp. 1			dark blue wht line
215	Mesosemia	sp. 2			blue 2 eyes
216	Mesosemia	sp. 3			brown pair
217	Mesosemia	sp. 4			pale blue dorsal
218	Mesosemia	sp. 5			white ring
219	Napaea	eucharila		[Bates, 1867]	-
220	Semomesia	croesus			
221	Teratophthalma	maenades			
222	Eurybia	dardus			

Riodininae

223	Eurybia	latifasciata		[Hewitson, 1869]	-
224	Eurybia	juturna			
225	Eurybia	nicaeus			
226	Amarynthis	meneria		[Cramer, 1776]	-
227	Ancyluris	aulestes	jocularis	[Stichel, 1909]	-
228	Ancyluris	etias			
229	Chamaelimnas	briola			
230	Charis	anius			
231	Crocozona	coecias	coecias	[Hewitson, 1866]	-
232	Detritivora	matic			
233	Detritivora	(caria?)			
234	Exoplisia	cadmeis			
235	Metacharis	regalis		[Butler, 1867]	-

236	Monethe	albertus			
237	Parcella	amarynthina			
238	Rhetus	periander			
239	Rhetus	sp.			
240	Riodina	lysippus			
241	Siseme	neurodes			grey w/white strp
242	Esthemopsis	sp.			
243	Pirascca	(iasis?)		[Godman, 1903]	Awaiting confirmation by specialist
244	Anteros	formosus		[Cramer, 1777]	
245	Sarota	chrysus			
246	Sarota	myrtea		[Godman & Salvin, 1886]	Awaiting confirmation by specialist
247	Echydna	punctata			
248	Emesis	castigata			
249	Emesis	mandana			
250	Emesis	ocypore			
251	Calospila	emylius			
252	Lemonias	zygia			
253	Livendula	huebneri			
254	Nymphidium	azanoides			
255	Nymphidium	balbinus			
256	Nymphidium	cachrus			
257	Nymphidium	ninias			
258	Nymphidium	plinthobaphis	plinthobaphis		
259	Nymphidium	sp. 1			no orng
260	Nymphidium	sp. 2			
261	Nymphidium	sp. 3			red dots fw
262	Setabis	buckleyi		[Grose-Smith, 1898]	-
263	Setabis	sp. 1			pink band vfw
264	Setabis	sp. 2			red base, white spots V
265	Theope	nycteis			
266	Thisbe	irenea			
267	Unknown stalachtini				blue w/white bands

Additional specimens identified to genus level in: **Euselasia, Eurybia, Sarota, Mesosemia, Napaea, Nymphidium, Livendula, Metacharis, Calospila**

LYCAENIDAE

Polymmatinae

268	Hemiargus	hanno			
269	Zizula	cyna			

Theclinae

270	Brangas	insolitus			
271	Arcas	imperialis			
272	Atlides	inachus			
273	Theritas	hemon			
274	Arawacus	separata			
275	Laothus	gibberosa		[Hewitson, 1867]	-
276	Strephonota	sp.			

PIERIDAE

Coliadinae

277	Eurema	albula			
278	Eurema	salome			
279	Phoebis	philea	philea	[Linnaeus, 1763]	-

280	Phoebis	sennae			
281	Pyrisitia	nise			
282	Pyrisitia	venusta			
283	Rhadbodryas	trite			

Pierinae

284	Ascia	monuste			
285	Catasticta	prioneris	estancia		
286	Catasticta	sp.			dark d
287	Melete	lycimnia	aelia	[C. & R. Felder, 1861]	-
288	Melete	c.f. lycimnia			yellow
289	Perrhybris	lorena			
290	Perrhybris	pamela			

Dismorphiinae

291	Dismorphia	crisia			
292	Dismorphia	niepelti			NR(ORELLANA)
293	Enantia	melite			
294	Lieinix	nemesis			
295	Pseudopieris	nehemia			

PAPILIONIDAE

Papilioninae

296	Eurytides	serville			
297	Protographium	agesilaus			
298	Parides	erithalion	lacydes	[Hewitson, 1869]	MIN(892), NR(ORELLANA)
299	Parides	lysander	brissonius	[Hübner, 1819]	-
300	Parides	sesostris	sesostris		
301	Battus	lycidas			
302	Battus	polydamas			
303	Heraclides	anchisiades			
304	Heraclides	androgeus			
305	Heraclides	astyalus			
306	Heraclides	isidorus	flavescens		

Total recorded species = 306
Species recorded by expedition = 100
Additions to list from expedition = 48

Volcán Sumaco

'Greyed out' species reported by Kim Garwood from Wild Sumaco Lodge.

NYMPHALIDAE

Danainae

1	Lycorea	halia	pales		

Heliconiinae

2	Dione	juno			
3	Heliconius	antiochus			
4	Heliconius	clysonymus			
5	Heliconius	melpomene	malleti		
6	Heliconius	melpomene			
7	Heliconius	telesiphe	sotericus	[Salvin, 1871]	-
8	Laparus	doris			
9	Philaethria	dido			
10	Altinote	dicaeus	albofasciata		
11	Altinote	stratonice			

Nymphalinae

12	Historis	odius			
13	Hypanartia	dione		[Latreille, 1813]	-
14	Hypanartia	lethe			
15	Anartia	amathea			
16	Metamorpha	elissa			
17	Siproeta	epaphus			
18	Castilia	castilla	occidentalis		
19	Eresia	datis	moesta		
20	Eresia	letitia			
21	Eresia	polina			
22	Tegosa	anieta			
23	Telenassa	jana			

Limenitidinae

24	Adelpha	alala	negra		
25	Adelpha	epione			
26	Adelpha	erotia			
27	Adelpha	iphicleola	thessalita		
28	Adelpha	irmina			
29	Adelpha	justina	valentina		
30	Adelpha	lycorias	(lara?)		
31	Adelpha	plesaure			
32	Adelpha	saundersii			
33	Adelpha	thessalia			
34	Adelpha	zina	irma		

Biblidinae

35	Callicore	eunomia			
36	Catonephele	chromis			
37	Catonephele	cf chromis			
38	Catonephele	salambria			
39	Diaethria	clymena			
40	Diaethria	euclides			
41	Diaethria	neglecta			

42	Dynamine	tithia			
43	Epiphile	boliviana			
44	Epiphile	iblis			
45	Eunica	clytia			
46	Eunica	norica			
47	Eunica	sydonia			
48	Hamadryas	chloe			
49	Hamadryas	feronia			
50	Hamadryas	fornax			
51	Nessaea	obrinus			
52	Pyrrhogyra	edocla			
53	Temenis	laothoe			
54	Marpesia	chiron			
55	Marpesia	corinna			
Biblidinae					
56	Marpesia	crethon			
57	Marpesia	livius			
58	Marpesia	zerynthia	dentigera		
Charaxinae					
59	Archaeoprepona	demophoon			
60	Fountainea	centaurus		[C. & R. Felder, 1867]	-
61	Fountainea	nessus			
62	Memphis	acidalia			
63	Memphis	anassa			
64	Memphis	lineata			
Apaturinae					
65	Doxocopa	cyane			
66	Doxocopa	elis			
67	Doxocopa	cherubina			
Morphinae					
68	Morpho	menelaus	dividius		
69	Caligo	prometheus			
Satyrinae					
70	Cithaerias	pireta			
71	Cithaerias	pyropina			
72	Pseudohaetera	hypaesia			
73	Chloreuptychia	arnaca			
74	Cissia	sp.			
75	Euptychoides	albofasciata			
76	Euptychoides	griphe			
77	Euptychoides	sp.			
78	Hermeuptychia	calixta			
79	Hermeuptychia	harmonia			
80	Hermeuptychia	hermes			
81	Hermeuptychia	sp. n.			
82	Magneuptychia	alcinoe			
83	Magneuptychia	sp.			
84	Megeuptychia	antonoe			
85	Pareuptychia	metaleuca			
86	Pareuptychia	ocirrhoe			
87	Pareuptychia	sp. nr. ocirrhoe			1 stripe?
88	Splendeuptychia	sp.			

89	Harjesia	sp.			
90	Forsterinaria	boliviana			
91	Forsterinaria	stella			
92	Forsterinaria	sp. 2			-
93	Pseudodebis	valentina			
94	Taygetis	chrysogone			
95	Taygetis	larua			
96	Taygetis	leuctra			
97	Taygetis	sp. nr. mermeria			
98	Taygetis	thamyra		[Cramer, 1780]	
99	Taygetomorpha	celia			
100	Corades	cistene			
101	Corades	enyo	almo	[Thieme, 1907]	NR(NAPO)
102	Corades	medeba			
103	Daedalma	dinias	emma		
104	Eretris	apuleja	ochrea	[Thieme, 1905]	-
105	Eretris	ocellifera		[C. & R. Felder, 1867]	-
106	Eretris	porphyria	ssp		-
107	Lasiophila	prosymna	dirempta	[Thieme, 1907]	-
108	Lymanopoda	acraeida			
109	Lymanopoda	altis		[Weymer, 1890]	-
110	Oressinoma	typhla			
Satyrinae					
111	Oxeoschistus	pronax	protogenia		
112	Panyapedaliodes	jephtha		[Thieme, 1905]	
113	Pedaliodes	dracula		[Pyrcz & Viloria, 1999]	-
114	Pedaliodes	montagna		[Adams & Bernard, 1981]	MAX(2046)
115	Pedaliodes	pomponia			
116	Pedaliodes	porcia		[Hewitson, 1860]	MIN(2505)
117	Pedaliodes	praemontagna		[Pyrcz & Viloria, 2007]	-
118	Pedaliodes	simpla		[Thieme, 1905]	-
119	Pedaliodes	tucca		[Thieme, 1905]	NR(NAPO)
120	Pronophila	epidipnis	orchewitsoni	[Adams & Bernard, 1979]	
121	Pronophilia	sp.			orange spots FWD
122	Pronophilia	unifasciata	deverra		
Ithomiinae					
123	Athesis	acrisione	acrisione		
124	Melinaea	marsaeus	clara		
125	Melinaea	marsaeus	mothone		
126	Melinaea	marsaeus			black/orange
127	Melinaea	menophilus	zaneka		
128	Olyras	crathis	montagui		
129	Ithomia	agnosia			
130	Ithomia	salapia	derasa		
131	Ithomia	terra			
132	Oleria	estella	estella		
133	Oleria	makrena			
134	Ceratinia	tutia	poecila		
135	Dircenna	andina	lorica		
136	Episcada	pichita			
137a	Pteronymia	alissa	amandes		
137b	Pteronymia	alissa	andreas		
138	Pteronymia	hara			
139	Pteronymia	ozia	browni		

140	Pteronymia	teresita	thabena		
141	Godyris	duillia			
142	Greta	alphesiboea			
143	Greta	andromica			
144	Greta	libethris			
145	Greta	ortygia	ortygia	[Weymer, 1890]	-
146	Pseudoscada	timna	timna		

RIODINIDAE

Riodininae

147	Leucochimona	lepida			
148	Mesosemia	mevania			
149	Eurybia	juturna			
150	Eurybia	latifasciata			
151	Amarynthis	meneria			
152	Amarynthis	stenogramma			
153	Ancyluris	sp.			
154	Baeotis	bacaenis			
155	Crocozona	coecias			
156	Lasaia	agesilas			
157	Lasaia	kennethi			
158	Melanis	sp.			red edge HW
159	Nahida	coenoides	trochois		
160	Necyria	bellona	saundersi		
161	Rhetus	dysoni	psecas		
162	Rhetus	periander			
163	Siseme	alectryo			
164	Siseme	neurodes			
165	Esthemopsis	sp.			

Riodininae

166	Pirascca	iasis			
167	Emesis	sp. nr. cypria			orange band

LYCAENIDAE

Polyommatinae

168	Zizula	cyna

Theclinae

169	Theritas	sp.
170	Micandra	aegides
171	Timaeta	timaeus
172	Arawacus	leucogyna
173	Laothus	viridicans

PIERIDAE

Coliadinae

174	Eurema	sp
175	Eurema	xantochlora
176	Phoebis	neocypris
177	Phoebis	philea
178	Pyrisitia	nise
179	Pyrisitia	venusta
180	Rhadbodryas	trite

Dismorphiinae

181	Dismorphia	arcadia			
182	Dismorphia	crisia			
183	Dismorphia	sp. nr. crisia			wht
184	Dismorphia	lewyi			
185	Dismorphia	lysis			
186	Dismorphia	sp.1			wht
187	Dismorphia	sp. 2			wht/blk 3spts
188	Dismorphia	sp. 3			wht dorsal ring
189	Pseudopieris	nehemia			

190	Catasticta	prioneris	estancia		
191	Catasticta	sp. nr. prioneris			wider blck
192	Catasticta	sisamnus	telasco		
193	Catasticta	sp. 1			blck Pereute mimic
194	Catasticta	sp. 2			dark + whte stripe hw
195	Catasticta	teutamis	epimene		
196	Leodonta	sp			
197	Leptophobia	aripa			
198	Leptophobia	cinerea			
199	Leptophobia	eleone	luca	[Fruhstorfer, 1907]	
200	Leptophobia	eleusis			
201	Leptophobia	penthica	penthica	[Kollar, 1850]	
202	Leptophobia	philoma			
203	Leptophobia	subargentea			
204	Leptophobia	tovaria			
205	Melete	leucanthe			
206	Melete	lycimnia			
207	Pereute	callinira			
208	Pereute	charops			
209	Pereute	leucodrosime			

Total recorded species = 209
Species recorded by expedition = 26
Additions to list from expedition = 12

Cordillera Napo-Galeras

NYMPHALIDAE

Heliconiinae

1	Heliconius	clysonymus	clysonymus	[Latreille, 1817]	-
2	Heliconius	congener	congener	[Weymer, 1890]	-
3	Heliconius	melpomene	malleti	[Lamas, 1988]	MAX(1556)
4	Altinote	alcione	alcione	[Hewitson, 1852]	-
5	Altinote	stratonice	aereta	[Jordan, 1913]	-

Limenitidinae

6	Adelpha	justina	valentina	[Fruhstorfer, 1915]	-
7	Adelpha	olynthia		[C. & R. Felder, 1867]	-

Biblidinae

8	Callicore	hystaspes	hystaspes	[Fabricius, 1782]	-
9	Eunica	norica	norica	[Hewitson, 1852]	MAX(1668)

Charaxinae

10	Fountainea	nessus		[P.A. Latreille, 1813]	-
11	Fountainea	titan	titan	[C. & R. Felder, 1867]	-
12	Memphis	lineata		[O. Salvin, 1869]	-
13	Memphis	phoebe	phoebe	[H. Druce, 1877]	-
14	Prepona	praeneste	praeneste	[Hewitson, 1859]	-

Morphinae

15	Opsiphanes	mutatus	mutatus	[Stichel, 1902]	NR(NAPO)

Satyrinae

16	Cithaerias	pyropina	cliftoni	[Constantino, 1995]	MAX(1572)
17	Pseudohaetera	hypaesia		[Hewitson, 1854]	-
18	Chloreuptychia	arnaca		[Fabricius, 1776]	-
19	Hermeuptychia	hermes		[Fabricius, 1775]	-
20	Splendeuptychia	sp. 6			NR(NAPO)

Ithomiinae

21	Dircenna	loreta	loreta	[Haensch, 1903]	-
22	Godyris	duillia		[Hewitson, 1854]	-
23	Greta	libethris	libethris	[C. & R. Felder, 1865]	-
24	Pseudoscada	timna	timna	[Hewitson, 1855]	-
25	Melinaea	isocomma	simulator	[Fox, 1960]	-
26	Melinaea	marsaeus	mothone	[Hewitson, 1860]	-
27	Oleria	cyrene	solida	[Weymer, 1883]	-
28	Oleria	onega	ssp	[Willmott & Lamas, MS]	-

PIERIDAE

Dismorphiinae

29	Moschoneura	ela	ela	[Hewitson, 1877]	MAX(1556), NR(NAPO)
30	Leptophobia	aripa	aripa	[Boisduval, 1836]	-

RIODINIDAE

Riodininae

31	Hermathena	candidata		[Hewitson, 1874]	-
32	Baeotis	felix	felicissima	[Thieme, 1907]	-
33	Symmachia	aurigera		[Weeks, 1902]	MAX(1650)

Cordillera Shaimi (Puerto Yaupi)

NYMPHALIDAE

Heliconiinae					
1	Dryas	iulia	alcionea	[Cramer, 1779]	-
2	Eueides	vibilia	vicinalis	[Stichel, 1903]	-
3	Heliconius	erato	lativitta	[Butler, 1877]	-
4	Heliconius	melpomene	malleti	[Lamas, 1988]	-
5	Heliconius	numata	laura	[Neustetter, 1932]	-
6	Heliconius	sara	thamar	[Fabricius, 1793]	-
7	Neruda	metharme	metharme	[Erichson, 1848]	2PR, MAX(674), NR(M STGO)
Limenitidinae					
8	Adelpha	cocala	cocala	[Cramer, 1780]	-
9	Adelpha	plesaure	phliassa	[Godart, 1824]	-
Biblidinae					
10	Eunica	norica	norica	[Hewitson, 1852]	-
11	Eunica	viola		[H.W. Bates, 1864]	-
12	Pyrrhogyra	crameri	hagnodorus	[Fruhstorfer, 1908]	
Charaxinae					
13	Memphis	acidalia		[Hübner, 1819]	-
14	Memphis	polycarmes		[Fabricius, 1775]	-
Satyrinae					
15	Euptychia	enyo		[Butler, 1867]	-
16	Hermeuptychia	hermes		[Fabricius, 1775]	-

PIERIDAE

Colidinae					
17	Eurema	albula	espinosae	[Fernández, 1928]	-
18	Pyrisitia	venusta	aequatorialis	[C. & R. Felder, 1861]	-

RIODINIDAE

Riodininae					
19	Emesis	ocypore		[Geyer, 1837]	-
20	Juditha	odites	odites	[Cramer, 1775]	-
21	Synargis	abaris		[Cramer, 1776]	-
22	Nymphidium	omois		[Hewitson, 1865]	-
23	Theope	azurea		[Bates, 1868]	-
24	Theope	wallacei		[Hall, 1999]	1PR, MAX(674)

Additional specimens identified to genus level in: **Ancyluris**, **Perophthalma** and **Calospila**

LYCAENIDAE

Theclinae					
25	Theritas	mavors		[Hübner, 1818]	-
26	Lamprospilus	coelicolor		[Butler & H. Druce, 1872]	-
27	Strymon	gabatha		(Hewitson, 1870)	-
28	Ministrymon	zilda		(Hewitson, 1873)	P.Yaupi Rd

Cordillera del Cóndor

NYMPHALIDAE

Heliconiinae

1	Actinote	sp.			-	PA	-	-
2	Actinote	abana	abana	[Hewitson, 1868]	CM	-	RAP	-
3	Actinote	euryleuca		Jordan, 1910	-	-	RAP	-
4	Actinote	alcione	theophila	[Dognin, 1887]	-	-	RAP	-
5	Actinote	dicaeus	albofasciata	[Hewitson, 1869]	CM	PA	RAP, SP	-
6	Actinote	neleus		[Latreille, 1813]	CM	PA	RAP	-
7	Actinote	stratonice	scotosis	[Jordan, 1910]	CM	PA	RAP	Should be *A. negra scotosis*?
8	Actinote	kennethi		[Freitas, Willmott & Hall, 2009]	CM	-	-	3PR, MAX(1984)
9	Philaethria	sp.			-	-	RAP	Sight record only
10	Podotricha	telesiphe	telesiphe	[Hewitson, 1867]	-	-	RAP	-
11	Dryas	iulia	alcionea	[Cramer, 1779]	-	-	RAP	-
12	Dione	glycera		[C.&R. Felder, 1861]	-	PA	-	-
13	Dione	juno	juno	[Cramer, 1779]	-	-	RAP	-
14	Eueides	lampeto	fuliginosus	[Stichel, 1903]	CM	-	-	MAX1984
15	Eueides	vibilia	vicinalis	[Stichel, 1903]	CM	-	-	MAX(1972), NR(Z-C)
16	Heliconius	charithonia		[Linnaeus, 1767]	-	-	SP	-
17	Heliconius	congener	congener	[Weymer, 1890]	-	-	RAP, SP	
18	Heliconius	erato	etylus	Salvin, 1871	-	-	RAP, SP	
19	Heliconius	melpomene	ecuadorensis	[Emsley, 1964]	-	-	RAP	-
20a	Heliconius	numata	bicoloratus	[Butler, 1873]	-	-	RAP, SP	
20b	Heliconius	numata	lenaeus	[Weymer, 1891]	-	-	RAP	-
21	Heliconius	sara	thamar	[Hübner, 1806]	-	-	RAP, SP	
22	Heliconius	telesiphe	telesiphe	[Doubleday, 1847]	CM	PA	SP	
23	Heliconius	timareta	timareta	Hewitson, 1867	-	-	RAP, SP	
24	Heliconius	xanthocles	zamora	[Holzinger & Brown, 1982]	-	-	RAP	-
25	Neruda	aoede	bartletti	(Druce, 1876)	-	-	RAP	-

Limenitidinae

26	Adelpha	alala	negra	[C. & R. Felder, 1862]	CM	-	RAP, SP	-
27	Adelpha	boeotia	boeotia	(C. & R. Felder, 1867)	-	-	RAP, SP	-
28	Adelpha	boreas	boreas	[Butler, 1866]	-	-	RAP	-
29	Adelpha	cocala	cocala	(Cramer, 1780)	-	-	RAP, SP	-
30	Adelpha	corcyra	dognini	[Willmott, 2001]	CM	-	-	-
31	Adelpha	cytherea	cytherea	(Linnaeus, 1758)	-	-	RAP, SP	-
32	Adelpha	epione	agilla	[Fruhstorfer, 1907]	-	-	RAP	-
33	Adelpha	iphiclus	iphiclus	[Linnaeus, 1758]	-	-	RAP	-
34	Adelpha	zina	irma	[Fruhstorfer, 1907]	-	-	RAP	-
35	Adelpha	irmina	tumida	[Butler, 1873]	CM	-	RAP, SP	-
36	Adelpha	erotia	erotia	[Hewitson, 1847]	-	-	RAP	-
37	Adelpha	lycorias	lara	[Hewitson, 1850]	-	PA	RAP, SP	MAX(2319)
38	Adelpha	mesentina		[Cramer, 1777]	-	-	SP	-
39	Adelpha	olynthia	olynthia	[Fruhstorfer, 1907]	-	-	RAP	-
40	Adelpha	capucinus	capucinus	(Walch, 1775)	-	-	RAP	-
41	Adelpha	saundersii	saundersii	[Hewitson, 1867]	CM	-	SP	-
42	Adelpha	seriphia	aquillia	[Fruhstorfer, 1915]	CM	-	RAP, SP	MAX(1972)
43	Adelpha	sichaeus		[Butler, 1866]	-	-	SP	-
44	Adelpha	sp.			CM	-	-	-
45	Adelpha	thessalia	thessalia	[C. & R. Felder, 1867]	-	-	RAP	-
46	Adelpha	justina	valentina	[Fruhstorfer, 1915]	-	-	RAP	-

Apaturinae

47	Doxocopa	agathina	agathina	[Cramer, 1777]	-	-	RAP, SP	-
48	Doxocopa	cyane	cyane	[Latreille, 1813]	CM	-	RAP, SP	-
49	Doxocopa	elis		[C. & R. Felder, 1861]	-	-	RAP, SP	-
50	Doxocopa	laurentia	cherubina	[C. & R. Felder, 1867]	CM	-	RAP, SP	MAX(1956)
51	Doxocopa	linda	linda	[C. & R. Felder, 1862]	-	-	RAP	-

Biblidinae

52	Catonephele	acontius	acontius	[Linnaeus, 1771]	-	-	RAP	-
53	Catonephele	chromis	chromis	[Doubleday, 1848]	CM	PA	SP	-
54	Catonephele	numilia	numilia	[Cramer, 1775]	-	-	RAP, SP	-
55	Eunica	alcmena	flora	[C. & R. Felder, 1862]	-	-	RAP	-
56	Eunica	alpais	alpais	[Godart, 1824]	-	-	RAP	-
57	Eunica	bechina	bechina	[Hewitson, 1852]	-	-	RAP	-

58	Eunica	caralis	ariba	[Fruhstorfer, 1908]	-	-	RAP	-
59	Eunica	carias	cabira	[C. & R. Felder, 1861]	CM	-	-	MAX(1899)
60	Eunica	clytia		[Hewitson, 1852]	-	-	RAP	-
61	Eunica	eurota	eurota	[Cramer, 1775]	-	-	RAP	-
62	Eunica	malvina	malvina	[Bates, 1864]	-	-	RAP	-
63	Eunica	mygdonia	mygdonia	[Godart, 1824]	-	-	RAP	-
64	Eunica	norica	occia	[Fruhstorfer, 1909]	-	-	RAP	-
65	Eunica	orphise		[Cramer, 1775]	-	-	RAP	-
66	Eunica	phasis		[C. & R. Felder, 1862]	-	-	RAP	-
67	Eunica	viola		[H.W. Bates, 1864]	-	PA	-	MAX(2444), NR(Z-C)
68	Nica	flavilla		[Godart, 1824]	-	-	SP	-
69	Pyrrhogyra	crameri		[Aurivillius, 1882]	-	-	SP	-
70	Pyrrhogyra	edocla	lysanias	[C. & R. Felder, 1862]	CM	-	RAP, SP	-
71	Pyrrhogyra	otolais	olivenca	[Fruhstorfer, 1908]	-	-	RAP, SP	-
72	Temenis	laothoe	laothoe	[Cramer, 1777]	-	-	RAP, SP	-
73	Epiphile	boliviana	boliviana	Fassl, 1912	-	-	SP	-
74	Epiphile	chrysites		[Latreille, 1809]	CM	PA	-	MIN(1779)
75	Epiphile	imperator		[Attal, 2005]	-	PA	-	-
76	Epiphile	orea	negrina	C. & R. Felder, 1862	-	-	SP	-
77	Nessaea	hewitsonii	hewitsonii	[C. & R. Felder, 1859]	-	-	RAP	-
78	Ectima	iona		[Doubleday, 1848]	-	-	RAP	-
79	Batesia	hypochlora		[Felder, 1862]	-	-	SP	-
80	Panacea	prola	amazonica	[Fruhstorfer, 1915]	-	-	RAP	-
81	Panacea	regina		[Bates, 1864]	-	-	RAP	-
82	Hamadryas	amphinome	amphinome	[Linnaeus, 1767]	-	-	SP	-
83	Asterope	markii	davisii	[Butler, 1877]	-	-	RAP	-
84	Peria	lamis		[Cramer, 1779]	-	-	RAP	-
85	Callicore	cynosura	cynosura	[Doubleday, 1847]	-	-	RAP	-
86	Callicore	eunomia	eunomia	[Hewitson, 1853]	-	-	RAP	-
87	Callicore	excelsior	elatior	(Oberthür, 1916)	-	-	RAP	-
88	Callicore	lyca	salamis	[C. & R. Felder, 1862]	-	-	RAP, SP	-
89	Callicore	pastazza	splendida	[Staudinger, 1886]	-	-	SP	-
90	Callicore	texa	sigillata	[Kotzsc, 1939]	-	-	RAP	-
91	Callicore	tolima	tolima	[Hewitson, 1852]	-	-	RAP	-
92	Catacore	kolyma	kolyma	[Hewitson, 1852]	-	-	RAP	-
93	Diaethria	clymena	peruviana	[Guenée, 1872]	CM	-	-	MAX(1973)
94	Diaethria	euclides	lidwina	[C. & R. Felder, 1862]	CM	-	-	MAX(1974)
95	Diaethria	anna	neglecta	[Salvin, 1869]	-	-	RAP, SP	-
96	Paulogramma	pyracmon	peristera	[Hewitson, 1853]	-	-	RAP	-
97	Perisama	clisithera	beaufouri	[Attal & C. du C., 1996]	-	PA	RAP	MAX(2444), 1ST FEMALE
98	Perisama	lebasii	phenix	[Attal & C. du C., 1996]	CM	-	-	-
99	Perisama	ouma		[Dognin, 1891]	CM	-	SP	-
100	Perisama	paralicia	paralicia	Fruhstorfer, 1916	CM	-	SP	-
101	Perisama	philinus	nyctimene	[Hewitson, 1868]	-	PA	-	-
102	Perisama	tringa	tringa	[Guenée, 1872]	CM	PA	SP	-
103	Perisama	vaninka	doris	[C. & R. Felder, 1861]	-	-	RAP	
Cyrestinae								
104	Marpesia	berania	berania	[Hewitson, 1852]	-	-	RAP	-
105	Marpesia	chiron	marius	[Cramer, 1779]	-	-	RAP	-
106	Marpesia	corinna		(Latreille, [1813])	CM	-	-	-
107	Marpesia	crethon		[Fabricius, 1776]	-	-	RAP	-
108	Marpesia	furcula	oechalia	[Westwood, 1850]	-	-	RAP	-
109	Marpesia	livius	livius	(Kirby, 1871)	CM	-	-	MAX(1972)
110	Marpesia	petreus	petreus	[Cramer, 1776]	-	-	RAP	-
111	Marpesia	zerynthia	dentigera	[Fruhstorfer, 1907]	-	-	RAP, SP	-
Nymphalinae								
112	Baeotus	beotus		[Doubleday, 1849]	-	-	RAP	-
113	Baeotus	deucalion		[C. & R. Felder, 1862]	-	-	RAP	-
114	Baeotus	japetus		[Staudinger, 1885]	-	-	RAP	-
115	Historis	acheronta	acheronta	[Fabricius, 1775]	-	-	RAP	-
116	Historis	odius	dious	[Lamas, 1995]	-	-	RAP	-
117	Colobura	dirce	dirce	[Linnaeus, 1758]	-	-	RAP, SP	-
118	Tigridia	acesta	fulvescens	[Butler, 1873]	-	-	RAP, SP	SP ID only given to species level
119	Hypanartia	cinderella		[Lamas, Willmott & Hall, 2001]	CM	PA	RAP, SP	MAX(2376) "*H. sp. n.*" in RAP
120	Hypanartia	dione	dione	[Latreille, 1813]	CM	-	RAP	-
121	Hypanartia	lethe		[Fabricius, 1793]	CM	-	RAP, SP	-
122	Anartia	jatrophae	jatrophae	[Linnaeus, 1763]	CM	-	-	MAX(1730)

123	Metamorpha	elissa	elissa	[Hübner, 1819]	-	-	RAP	-
124	Siproeta	epaphus	epaphus	[Latreille, 1813]	CM	-	-	-
125	Siproeta	stelenes	stelenes	(Linnaeus, 1758)	-	-	RAP, SP	-
126	Tegosa	anieta	anieta	[Hewitson, 1864]	CM	-	-	MAX(1781)
127	Tegosa	claudina		[Eschscholtz, 1821]	-	-	RAP	-
128	Tegosa	etia		[Hewitson, 1868]	CM	-	-	MAX(1974)
129	Anthanassa	drusilla	alceta	[Hewitson, 1869]	-	-	RAP	-
130	Eresia	clara	clara	[Bates, 1864]	-	-	RAP	-
131	Eresia	datis	moesta	[Salvin & Godman, 1868]	CM	-	SP	-
132	Eresia	letitia		[Hewitson, 1869]	-	-	SP	-
133	Eresia	perna	mylitta	[Hewitson, 1869]	-	-	RAP	-
134	Eresia	polina		[Hewitson, 1852]	CM	-	-	MAX(1674)
135	Castilia	angusta		[Hewitson, 1868]	-	-	RAP	-
136	Castilia	castilla	occidentalis	[Fassl, 1912]	-	-	RAP	-
137	Castilia	ofella		[Hewitson, 1864]	-	-	SP	-
138	Castilia	perilla	perilla	[Hewitson, 1852]	-	-	RAP, SP	-
139	Telenassa	berenice	berenice	[C. & R. Felder, 1862]	-	-	RAP	-
140	Telenassa	jana		[C. & R. Felder, 1867]	-	-	RAP	-

Charaxinae

141	Consul	fabius	semifulvus	(Butler, 1875)	-	-	RAP	-
142	Fountainea	nessus		[Latreille, 1813]	-	-	RAP, SP	-
143	Fountainea	ryphea	ryphea	[Cramer, 1775]	-	-	RAP	-
144	Fountainea	sosippus		[Hopffer, 1874]	CM	-	RAP, SP	-
145	Fountainea	titan	titan	[C. & R. Felder, 1867]	CM	-	SP	NR(ZAMORA-CHINCHIPE)
146	Hypna	clytemnestra	negra	[C. & R. Felder, 1862]	-	-	RAP	-
147	Memphis	acaudata		[Röber, 1916]	CM	-	SP	MAX(1972), NR(Z-C)
148	Memphis	anassa	anassa	[C. & R. Felder, 1862]	CM	-	RAP, SP	"*M. memphis anassa*" in RAP
149	Memphis	basilia	drucei	[Staudinger, 1887]	-	-	RAP, SP	"*M. brunnea*" in SP
150	Memphis	beatrix	ates	[H. Druce, 1877]	CM	-	-	-
151	Memphis	beatrix	pseudiphis	[Staudinger, 1887]	-	-	SP	-
152	Memphis	cluvia		[Hopffer, 1874]	CM	-	-	MIN(1847)
153	Memphis	acidalia		(Hübner, [1819])	-	-	RAP	-
154	Memphis	mora	montana	[Röber, 1916]	-	-	SP	-
155	Memphis	moruus	morpheus	[Staudinger, 1886]	-	-	RAP	-
156	Memphis	offa		[H. Druce, 1877]	-	-	SP	-
157	Memphis	philumena	philumena	[Doubleday, 1849]	-	-	SP	-
158	Memphis	phoebe	phoebe	[H. Druce, 1877]	CM	-	SP	-
159	Memphis	polycarmes		[Fabricius, 1775]	-	-	RAP	-
160	Memphis	xenocles	xenocles	[Westwood, 1850]	-	-	RAP	-
161	Polygrapha	cyanea		[Salvin & Godman, 1868]	-	-	RAP, SP	-
162	Zaretis	isidora		[Cramer, 1780]	-	-	SP	-
163	Zaretis	itys	itys	[Cramer, 1777]	-	-	RAP	-
164	Zaretis	syene		[Hewitson, 1856]	CM	PA	SP	MAX(2076)
165	Agrias	claudina	lugens	[Staudinger, 1886]	-	-	RAP	-
166	Archaeoprepona	demophon	muson	[Fruhstorfer, 1905]	-	-	RAP, SP	SP ID only given to species level
167	Archaeoprepona	demophoon	andicola	[Fruhstorfer, 1904]	-	-	RAP	-
168	Archaeoprepona	meander	megabates	[Fruhstorfer, 1916]	-	-	RAP	-
169	Noreppa	chromus	chromus	[Guérin, 1844]	-	PA	RAP, SP	SP ID only given to species level
170	Prepona	laertes	demodice	[Godart, 1824]	-	-	RAP, SP	SP ID only given to species level
171	Prepona	praeneste	praeneste	[Hewitson, 1859]	CM	-	-	MAX(1973)

Satyrinae

172	Bia	actorion	rebeli	[Bryk, 1953]	-	-	RAP	-
173	Eryphanis	automedon		[Cramer, 1776]	-	-	SP	-
174	Narope	anartes		[Hewitson, 1874]	-	-	SP	-
175	Opsiphanes	invirae	cassina	[C. & R. Felder, 1862]	-	-	RAP	-
176	Opsiphanes	sallei		[Doubleday, 1849]	-	-	SP	-
177	Catoblepia	berecynthia		[Cramer, 1777]	-	-	SP	-
178	Catoblepia	xanthicles	orientalis	[Bristow, 1981]	-	-	RAP	-
179	Caligo	eurilochus		[Cramer, 1776]	-	-	SP	-
180	Caligo	idomeneus	idomenides	[Fruhstorfer, 1903]	-	-	RAP	-
181	Caligo	illioneus		[Cramer, 1776]	-	-	SP	-
182	Caligo	oberthurii		[Deyrolle, 1872]	CM	-	SP	-
183	Caligo	oileus	phorbas	[Röber, 1904]	-	-	RAP	-
184	Caligo	prometheus	atlas	[Röber, 1904]	-	-	RAP, SP	-
185	Antirrhea	philoctetes	ssp. n.		-	-	RAP	-

186	Antirrhea	taygetina	ssp. n.		-	-	RAP	-
187	Morpho	aurora	ssp.		-	-	RAP	ID suspect - Sight record only
188	Morpho	deidamia	neoptolemus	[Wood, 1863]	-	-	RAP	-
189	Morpho	didius		[Höpffer, 1874]	-	-	SP	-
190	Morpho	sulkowskyi		[Kollar, 1850]	CM	PA	-	-
191	Morpho	telemachus	iphiclus	[C. & R. Felder, 1862]	-	-	RAP	-
192	Oressinoma	typhla	typhla	[Doubleday, 1849]	CM	PA	SP	-
193	Caeruleuptychia	aegrota	ssp.	[Butler, 1866]	-	-	SP	-
194	Caeruleuptychia	coelica		[Hewitson, 1869]	-	-	RAP	-
195	Caeruleuptychia	lobelia		[Butler, 1870]	-	-	RAP	-
196	Chloreuptychia	agatha		[Butler, 1867]	-	-	RAP	-
197	Chloreuptychia	arnaca		[Fabricius, 1776]	-	-	RAP	-
198	Chloreuptychia	herseis		[Godart, 1824]	-	-	RAP	-
199	Cissia	myncea		[Cramer, 1780]	-	-	RAP	-
200	Cissia	penelope		[Fabricius, 1775]	-	PA	-	MAX(1899), NR(Z-C)
201	Euptychia	cesarense	viloriai	[Andrade, Pulido, Peña, Lamas, 2011]	-	PA	RAP	3PR, MAX(2100), NR(Z-C) "*E. sp. n.*" in RAP
202	Euptychia	jesia		[Butler, 1869]	-	-	RAP	-
203	Euptychia	meta		[Weymer, 1911]	-	-	RAP	-
204	Euptychia	sp. n.			-	-	RAP	-
205	Euptychoides	albofasciata		[Hewitson, 1869]	-	-	RAP	-
206	Euptychoides	eugenia		[C. & R. Felder, 1862]	CM	PA	-	MAX(2100)
-	Euptychoides	sp.			-	-	SP	-
207	Forsterinaria	boliviana		[Godman, 1905]	-	-	SP	-
208	Forsterinaria	pallida	pallida	[Peña & Lamas, 2005]	CM	PA	-	-
209	Forsterinaria	sp. 1			-	PA	-	-
210	Forsterinaria	sp. 2			-	PA	-	-
211	Harjesia	oreba		[Butler, 1870]	-	-	RAP	-
212	Hermeuptychia	cucullina		[Weymer, 1911]	-	PA	RAP	"H. calixta" in RAP
213	Hermeuptychia	gisella		[Hayward, 1957]	-	-	RAP	-
214	Hermeuptychia	hermes		[Fabricius, 1775]	-	-	SP	-
215	Hermeuptychia	sp. nr. hermes			CM	-	-	Small specimens
216	Hermeuptychia	n. sp.			CM	-	-	-
217	Magneuptychia	alcinoe		[C. & R. Felder, 1867]	-	-	RAP, SP	-
218	Magneuptychia	francisca		[Butler, 1870]	-	-	RAP	-
219	Magneuptychia	libye		[Linnaeus, 1767]	-	-	RAP	-
220	Magneuptychia	modesta		[Butler, 1867]	CM	-	-	1PR, MAX(1914), NR(Z-C)
221	Magneuptychia	sp. n. nr. probata		[Weymer, 1911]	-	-	RAP	-
-	Magneuptychia	sp.			-	-	SP	-
222	Megeuptychia	antonoe		[Cramer, 1775]	-	-	SP	-
223	Megeuptychia	monopunctata		[Willmott & Hall, 1995]	-	-	RAP	-
224	New genus	n. sp.			CM	PA	-	2PR
225	Parataygetis	albinotata		[Butler, 1867]	CM	-	RAP, SP	-
226	Pareuptychia	interjecta	hesionides	[Forster, 1964]	-	-	RAP	-
227	Pareuptychia	ocirrhoe		[Fabricius, 1776]	-	-	RAP, SP	-
228	Pseudeuptychia	languida		[Butler, 1871]	-	-	RAP	-
229	Pseudodebis	valentina		[Cramer, 1780]	-	-	SP	-
230	Splendeuptychia	clementia		[Butler, 1877]	-	PA	RAP	2PR, MAX(2010), NR(Z-C)
231	Taygetis	chrysogone		[Doubleday, 1849]	CM	-	RAP, SP	-
232	Taygetis	cleopatra		[C. & R. Felder, 1862]	-	-	RAP	-
233	Taygetis	larua		[C. & R. Felder, 1867]	-	-	SP	-
234	Taygetis	thamyra		[Cramer, 1779]	-	-	RAP, SP	-
235	Ypthimoides	renata		[Stoll, 1780]	-	-	RAP	-
236	Ypthimoides	sp. n.			-	-	RAP	-
237	Zischkaia	sp. n.			-	-	RAP	-
238	Corades	enyo	almo	[Thieme, 1907]	CM	PA	RAP, SP	-
239	Corades	medeba		[Hewitson, 1850]	CM	-	SP	-
240	Corades	pannonia	condorita	[Lamas, 1996]	CM	-	RAP	"*C. pannonia ssp. n.*" in RAP
241	Corades	chelonis	lactefusa	[Thieme, 1907]	-	PA	-	-
242	Corderopedaliodes	corderoi		[Dognin, 1893]	CM	-	-	MIN(1087)
243	Daedalma	fraudata		[Pyrcz, 2004]	-	PA	-	-
244a	Eretris	calisto	calisto	[C. & R. Felder, 1867]	CM	-	SP	MAX(1972)
244b	Eretris	calisto	ssp. n.		-	-	RAP	-
245	Eretris	sp. n. nr. ocellifera		[C. & R. Felder, 1867]	-	PA	RAP	-
246	Eretris	porphyria	ssp		-	PA	-	-
247	Eretris	sp.			-	PA	-	-

248	Lasiophila	orbifera	intercepta	[Thieme, 1907]	-	PA	-	-
249	Lymanopoda	albocincta	albocincta	[Hewitson, 1861]	-	PA	-	-
250	Lymanopoda	obsoleta		[Westwood, 1851]	-	PA	-	-
251	Lymanopoda	panacea	panacea	[Hewitson, 1869]	CM	PA	RAP, SP	-
252	Manerebia	benigni	ssp.	[Pyrcz, 2004]	-	PA	-	MAX(2299)
253	Manerebia	satura	pauperata	[Pycrz & Hall, 2006]	CM	PA	-	-
254	Manerebia	sp. 1			CM	-	-	-
255	Manerebia	sp. 2			-	PA	-	-
256	Manerebia	sp. n.			-	-	RAP	-
257	Manerebia	trimaculata		[Hewitson, 1870]	CM	PA	-	-
258	Mygona	prochyta	poeania	[Hewitson, 1870]	CM	-	RAP, SP	-
259	Oxeoschistus	leucospilos	leucospilos	[Staudinger, 1876]	CM	PA	SP	-
260	Oxeoschistus	pronax	protogenia	[Hewitson, 1862]	-	-	RAP, SP	-
261	Panyapedaliodes	muscosa		[Thieme, 1905]	CM	PA	-	-
262	Panyapedaliodes	phila	philaenis	[Thieme, 1905]	-	PA	-	-
263	Panyapedaliodes	sp nr drymaea			-	PA	-	-
264	Pedaliodes	balnearia		[Pyrcz & Viloria, 1999]	CM	PA	-	MIN(1779)
265	Pedaliodes	dracula		[Pyrcz & Viloria, 1999]	-	PA	-	MIN(2010)
266	Pedaliodes	montagna		[Adams & Bernard, 1981]	-	PA	-	-
267	Pedaliodes	pelinna		[Hewitson, 1870]	-	PA	-	-
268	Pedaliodes	petri		[Pyrcz & Viloria, 1999]	CM	PA	-	-
269	Pedaliodes	phrasicla		[Hewitson, 1874]	-	PA	-	-
270	Pedaliodes	phrasiclea		[Grose-Smith, 1900]	-	-	RAP	-
271	Pedaliodes	pisonia		[Hewitson, 1862]	CM	-	SP	MAX(2271)
272	Pedaliodes	poesia	poesia	(Hewitson, 1862)	-	PA	-	-
273	Pedaliodes	sp. n. 1			-	-	RAP	-
274	Pedaliodes	sp. n. 2			-	-	RAP	-
-	Pedaliodes	sp. 1			CM	PA	-	-
-	Pedaliodes	sp. 2			-	PA	-	-
275	Pedaliodes	sp. nr. phthiotis		[Hewitson, 1874]	-	-	RAP	-
276	Pedaliodes	tucca		[Thieme, 1905]	CM	-	SP	-
277	Physcopedaliodes	porina	corderoi	[Dognin, 1893]	-	-	SP	-
278	Physcopedaliodes	praxithea		[Hewitson, 1870]	CM	PA	-	-
279	Pronophila	epidipnis	orchewitsoni	[Adams & Bernard, 1979]	CM	PA	SP	MAX(2421)
280	Pronophila	thelebe	unifasciata	[Lathy, 1906]	-	-	RAP	-
281	Pronophila	timanthes	intercidona	[Thieme, 1907]	-	-	RAP	-
282	Pronophila	unifasciata	unifasciata	[Lathy, 1906]	CM	-	SP	-
283	Pseudomaniola	asuba		[Thieme, 1907]	-	PA	-	2PR, MAX(2425)
284	Pseudomaniola	clethra		[Thieme, 1907]	-	PA	-	-
285	Steroma	bega		[Westwood, 1850]	CM	PA	-	-
286	Steroma	modesta		[Weymer, 1912]	-	-	RAP, SP	-
287	Thiemeia	phoronea	phoronea	[Doubleday, 1849]	CM	-	-	MIN(1947)
288	Cithaerias	pireta	aurorina	[Weymer, 1910]	-	-	RAP, SP	-
289	Haetera	piera	negra	[C. & R. Felder, 1862]	-	-	RAP	-
290	Pierella	hortona	ssp. n.		-	-	RAP	-
291	Pierella	hyceta	latona	[C. & R. Felder, 1867]	-	-	RAP, SP	SP ID only given to species level
292	Pierella	lena	brasiliensis	[C. & R. Felder, 1862]	-	-	RAP	-
293	Pierella	lucia		[Weymer, 1885]	-	-	RAP	-
294	Pseudohaetera	hypaesia		[Hewitson, 1854]	-	-	RAP, SP	-

Danainae

295	Melinaea	marsaeus	mothone	[Hewitson, 1870]	-	-	RAP	-
296	Melinaea	menophilus	zaneka	[Butler, 1870]	CM	-	RAP, SP	-
297	Olyras	crathis	montagui	[Butler, 1870]	CM	-	-	NR(ZAMORA-CHINCHIPE)
298	Mechanitis	messenoides	deceptus	[Butler, 1873]	-	-	RAP	-
299	Mechanitis	polymnia	ssp.		-	-	RAP, SP	SP ID only given to species level
300	Scada	reckia	ethica	[Hewitson, 1861]	-	-	RAP	-
301	Tithorea	harmonia	hermias	Godman & Salvin, 1898	-	-	SP	-
302	Patricia	dercyllidas	hazelea	[Fox, 1956]	-	PA	-	-
303	Patricia	oligyrtis	oligyrtis	[Hewitson, 1877]	-	PA	-	-
304	Ithomia	agnosia	agnosia	[Hewitson, 1855]	CM	-	SP	MAX(1972)
305	Ithomia	salapia	derasa	[Hewitson, 1855]	CM	-	RAP	-
306	Pagyris	ulla	zorrilla	[Lamas, 1986]	CM	-	-	-
307	Hyalyris	antea	ssp. n.		-	PA	-	1ST FEMALE, NR(ECUADOR)
308	Hyalyris	frater	ssp. n.		-	-	RAP	-
309	Hyalyris	ocna	ssp. n.		-	-	RAP	-
310	Hyalyris	praxilla	praxilla	[Hewitson, 1870]	CM	-	RAP	MAX(1974)
311	Hypothyris	euclea	ssp.		-	-	RAP	-

312	Hypothyris	moebiusi	moebiusi	[Haensch, 1903]	-	-	RAP	-
313	Hypothyris	semifulva	semifulva	[Salvin, 1869]	-	-	RAP	-
314	Napeogenes	rhezia	ssp. n.		-	-	RAP	-
315a	Napeogenes	apulia	sangay	[Vitale & Willmott, 2008]	CM	-	-	MAX(1947)
315b	Napeogenes	sulphureophila		[Bryk, 1937]	-	-	RAP	-
316	Napeogenes	glycera	nausica	[Weymer, 1899]	CM	-	RAP	-
317	Napeogenes	harbona	chiguinda	[Willmott & Vitale, 2008]	CM	-	-	-
318	Napeogenes	lycora	attali	[Vitale & Willmott, 2008]	CM	-	-	-
319	Napeogenes	pharo	lamia	[Hewitson, 1869]	-	-	RAP	-
320a	Hyposcada	illinissa	ssp. n.		-	-	RAP	-
320b	Hyposcada	illinissa	tundayme	[Padron, 2008]	-	-	SP	-
321	Oleria	bioculata		[Haensch, 1905]	-	-	SP	-
322	Oleria	estella	estella	[Hewitson, 1868]	-	-	RAP	-
323	Oleria	makrena	makrenita	[Haensch, 1903]	CM	-	-	-
324a	Oleria	onega	ssp.	[C. & R. Felder, 1862]	-	-	RAP	-
324b	Oleria	onega	janarilla	[Hewitson, 1863]	-	-	SP	-
325	Ceratinia	neso	espriella	[Hewitson, 1868]	-	-	RAP	-
326	Pteronymia	hara	hara	[Hewitson, 1877]	CM	PA	-	MAX(2444)
327	Pteronymia	veia	ssp.		-	-	RAP	-
328	Pteronymia	zerlina	machay	[T. & L. Racheli, 2003]	-	PA	-	-
329	Dircenna	adina	lorica	Weymer, 1875	-	-	SP	-
330	Greta	alphesiboea		[Hewitson, 1869]	-	-	RAP, SP	-
331	Greta	andromica	andania	[Hopffer, 1874]	CM	PA	RAP, SP	-
332	Greta	libethris	libethris	[C. & R. Felder, 1865]	CM	-	SP	MAX(1974)
333	Greta	lydia	lydia	[Weymer, 1899]	-	PA	RAP	MAX(2425)
334	Greta	ortygia	ortygia	[Weymer, 1890]	-	PA	-	-
335	Greta	theudelinda	zalmunna	[Hewitson, 1869]	-	-	RAP	-
336	Pseudoscada	timna	timna	(Hewitson, [1855])	-	-	RAP	-
337	Pseudoscada	florula	aureola	[Bates, 1862]	-	-	RAP	-
338	Godyris	duillia		[Hewitson, 1854]	CM	-	RAP	MAX(1972)
339	Godyris	panthyale	panthyale	[C. & R. Felder, 1862]	CM	PA	RAP, SP	-
340	Godyris	zavaleta	matronalis	[Weymer, 1883]	-	-	RAP	-
341	Hypoleria	alema	ina	[Hewitson, 1859]	-	-	RAP	-

RIODINIDAE

Euselasiinae

342	Euselasia	pellonia		[Stichel, 1919]	-	-	RAP	-
343	Euselasia	euoras		[Hewitson, 1855]	-	-	RAP	-
344	Euselasia	eutychus		[Hewitson, 1856]	-	-	RAP	-
345	Euselasia	perisama		[Hall & Lamas, 2001]	-	-	RAP	-
346	Euselasia	clithra	jugata	[Stichel, 1919]	-	-	RAP	-
347	Euselasia	zena		[Hewitson, 1860]	-	-	RAP	-
348	Euselasia	aff. eulione #1		[Hewitson, 1856]	-	-	RAP	-
349	Euselasia	aff. eulione #2		[Hewitson, 1856]	-	-	RAP	-
350	Euselasia	euromus		[Hewitson, 1856]	-	-	RAP	-
351	Methone	cecilia		[Cramer, 1777]	-	-	SP	-

Riodininae

352	Mesophthalma	idotea		[Westwood, 1851]	-	-	RAP	-
353	Leucochimona	anophthalma		[C. & R. Felder, 1865]	CM	PA	-	MAX(2010)
354	Leucochimona	matisca		[Hewitson, 1860]	-	-	RAP	-
355	Leucochimona	matatha	subalbata	[Seitz, 1913]	-	-	RAP	-
356	Semomesia	croesus	trilineata	[Butler, 1874]	-	-	RAP	-
357	Mesosemia	metura	metura	[Hewitson, 1873]	-	-	RAP	-
358	Mesosemia	mesoba		[Hewitson, 1873]	-	-	RAP	-
359	Mesosemia	dulcis		[Stichel, 1910]	-	-	RAP	-
360	Mesosemia	visenda		[Stichel, 1915]	-	-	RAP	-
361	Mesosemia	sifia	isshia	[Butler, 1869]	-	-	RAP	-
362	Mesosemia	latizonata	ssp. n.		-	-	RAP	-
363	Mesosemia	amarantus		[Stichel, 1910]	-	-	RAP	-
364	Mesosemia	judicialis		[Butler, 1874]	-	-	RAP	-
365	Mesosemia	ama	ama	[Hewitson, 1869]	-	-	RAP	-
366	Mesosemia	mevania	mimallonis	[Stichel, 1909]	-	-	RAP	-
367	Mesosemia	loruhama	loruhama	[Hewitson, 1869]	-	-	RAP	-
368	Mesosemia	gigantea		[Stichel, 1915]	-	-	RAP	-
369	Mesosemia	tenebricosa		[Hewitson, 1877]	-	-	SP	-

370	Teratophthalma	bacche	ssp. n.		-	-	RAP	-
371	Teratophthalma	maenades		[Hewitson, 1858]	-	-	SP	-
372	Eunogyra	satyrus		[Westwood, 1851]	-	-	RAP	-
373	Hyphilaria	anthias	orsedice	[Godman, 1903]	-	-	RAP	-
374	Hermathena	candidata		[Hewitson, 1874]	CM	-	SP	MAX(1972)
375	Napaea	melampia	ssp.		-	-	RAP	-
376	Napaea	nepos		[Fabricius, 1793]	-	-	RAP	-
377	Napaea	tanos		[Stichel, 1910]	-	-	RAP	-
378	Cremna	actoris	meleagris	[Hopffer, 1874]	-	-	RAP	-
379	Alesa	telephae		[Boisduval, 1836]	-	-	RAP	-
380	Eurybia	caerulescens	caerulescens	[Druce, 1904]	-	-	RAP	-
381	Eurybia	dardus	franciscana	[C. & R. Felder, 1862]	-	-	RAP	-
382	Eurybia	juturna	juturna	[C. & R. Felder, 1865]	-	-	RAP	-
383	Eurybia	rubeolata	rubeolata	[Stichel, 1910]	-	-	RAP	-
-	Eurybia	sp.			-	-	SP	-
384	Lyropteryx	apollonia	apollonia	[Westwood, 1851]	-	-	RAP	-
385	Ancyluris	aulestes	eryxo	[Saunders, 1859]	-	-	RAP	-
386	Ancyluris	formossima		[Hewitson, 1870]	-	-	SP	-
387	Ancyluris	cacica	formosa	[Hewitson, 1870]	-	-	SP	"*A. formosa*" in SP
388	Ancyluris	mira		[Hewitson, 1874]	CM	-	-	3PR, MAX(1810)
389	Brachyglenis	esthema		[C. & R. Felder, 1862]	-	-	SP	-
390	Chalodeta	chaonitis		[Hewitson, 1866]	-	-	SP	-
391	Necyria	bellona	saundersii	[Hewitson, 1854]	CM	-	SP	-
392	Rhetus	dysonii		[Saunders, 1849]	-	-	SP	-
393	Rhetus	periander	laonome	[Morisse, 1838]	-	-	RAP, SP	-
394	Ithomeis	corena		[C. & R. Felder, 1862]	-	-	RAP, SP	-
395	Notheme	erota	diadema	[Stichel, 1910]	-	-	RAP	-
396	Monethe	albertus	albertus	[C. & R. Felder, 1862]	-	-	RAP	-
397	Melanis	passiena		[Hewitson, 1870]	CM	PA	-	-
398	Metacharis	lucius		[Fabricius, 1793]	-	-	RAP	-
399	Parcella	amarynthia		[C. & R. Felder, 1865]	-	-	RAP	-
400	Charis	anius		[Cramer, 1776]	-	-	RAP	-
401	Charis	argyrea		[Bates, 1868]	-	-	RAP	-
402	Charis	major		[Lathy, 1932]	-	-	RAP	-
403	Crocozona	coecias	arcuata	[Godman, 1903]	-	-	RAP, SP	SP ID only given to species level
404	Lasaia	agesilas	agesilas	[Latreille, 1809]	-	-	RAP	-
405	Lasaia	moeros	moeros	[Staudinger, 1888]	-	-	RAP, SP	-
406	Limnas	sp.			-	-	SP	-
407	Amarynthis	meneria		[Cramer, 1776]	-	-	RAP, SP	-
408	Siseme	alectryo	spectanda	[Stichel, 1909]	CM	-	RAP, SP	-
409	Siseme	aristoteles	ochrotaenia	[Seitz, 1917]	CM	-	-	-
410	Siseme	neurodes	caudalis	[Bates, 1868]	-	-	RAP	-
411	Lucillella	camissa		[Hewitson, 1870]	-	-	RAP	-
412	Symmachia	calderoni		[Hall & Lamas, 2001]	CM	-	-	-
413	Symmachia	miron	miron	[Grose-Smith, 1898]	-	-	RAP	-
414	Pirascca	iasis		[Godman, 1903]	-	-	RAP	-
415	Sarota	sp. n. nr. acantus			-	-	RAP	-
416	Emesis	castigata		[Stichel, 1910]	-	-	SP	-
417	Emesis	cypria		[Felder, 1861]	-	-	SP	-
418	Emesis	fatimella	fatimella	[Westwood, 1851]	-	-	RAP	-
419	Emesis	mandana	mandana	[Cramer, 1780]	-	-	RAP	-
420	Emesis	ocypore	ocypore	[Geyer, 1837]	-	-	RAP	-
421	Emesis	temesa	emesina	[Staudinger, 1887]	-	-	RAP	-
422	Argyrogrammana	caelestina		[Hall & Willmott, 1995]	-	-	RAP	-
423	Argyrogrammana	pacsa		[Hall & Willmott, 1998]	-	PA	-	MAX(2010)
424	Argyrogrammana	pastaza		[Hall & Willmott, 1996]	CM	-	-	MAX(1751)
425	Argyrogrammana	sp. nr. saphirina		[Staudinger, 1887]	-	-	RAP	-
426	Thisbe	incubus		[Hall, Lamas & Willmott, 2001]	-	-	RAP	-
427	Lemonias	zygia	egaensis	[Butler, 1867]	-	-	RAP	-
428	Calospila	emylius	crispinella	[Stichel, 1911]	-	-	RAP	-
429	Adelotypa	amasis		[Hewitson, 1870]	-	-	RAP	-
430	Adelotypa	desenmaculata		[Hewitson, 1870]	-	-	SP	-
431	Theope	eudocia	eudocia	[Westwood, 1851]	-	-	RAP	-
432	Theope	pedias	pedias	[Herrich-Schäffer, 1853]	-	-	RAP	-
433	Nymphidium	ascolia	ascolia	[Hewitson, 1853]	-	-	RAP	-

434	Nymphidium	azanoides	amazonensis	[Callaghan, 1986]	-	-	RAP	-
435	Nymphidium	leucosia	ssp. n.		-	-	RAP	-
436	Nymphidium	lisimon	lisimon	[Stoll, 1790]	CM	-	RAP	-
437	Stalachtis	sp.			CM	-	-	-

PIERIDAE

Coliadinae

438	Phoebis	argante	chincha	Lamas, 1976	-	-	RAP	-
439	Phoebis	neocypris	rurina	[C. & R. Felder, 1861]	-	-	RAP	-
440	Rhabdodryas	trite	trite	[Linnaeus, 1758]	-	-	RAP	-
441	Aphrissa	statira	statira	[Cramer, 1777]	-	-	RAP	-
442	Pyrisitia	leuce	flavilla	[Bates, 1861]	-	-	RAP	-
443	Pyrisitia	nise	ssp.		-	-	RAP	-
444	Eurema	agave	agave	[Cramer, 1776]	CM	-	-	MAX(1674)
445	Eurema	albula	espinosae	[Fernández, 1928]	-	-	RAP	-
446	Eurema	reticulata		[Butler, 1871]	CM	-	RAP	-
447	Eurema	xystra		[d'Almeida, 1936]	-	-	RAP	-
448	Eurema	venusta		[Boisduval, 1836]	-	-	SP	-
449	Eurema	xantochlora	ectriva	[Butler, 1873]	-	-	RAP	-

Dismorphiinae

450	Dismorphia	arcadia	lucilla	[Butler, 1899]	CM	-		-
451	Dismorphia	crisia	sylvia	Lamas, 2004	-	-	RAP	-
452	Dismorphia	lysis	lysis	[C. & R. Felder, 1861]	-	-	RAP, SP	-
453	Dismorphia	teresa		[Hewitson, 1869]	-	PA	-	MAX(2444)
454	Dismorphia	theucharila	yolanda	Lamas, 2004	-	-	RAP	-
455	Dismorphia	zaela	abilene	[Hewitson, 1872]	-	-	RAP	-
456	Lieinix	nemesis	nemesis	[Latreille, 1813]	CM	-	RAP, SP	-
457	Enantia	citrinella	citrinella	(C. & R. Felder, 1861)	-	-	RAP	-
458	Enantia	lina	galanthis	[Bates, 1861]	-	-	RAP	-
459a	Moschoneura	pinthous	ela	[Hewitson, 1877]	-	-	RAP	-
459b	Moschoneura	pinthous	ithomia	[Hewitson, 1867]	-	-	RAP	-
460	Pseudopieris	nehemia	jessica	Lamas, 2004	-	-	RAP	-
461	Pseudopieris	viridula	viridula	[C. & R. Felder, 1861]	-	-	RAP	-

Pierinae

462	Hesperocharis	emeris	nera	[Hewitson, 1852]	-	-	RAP	-
463	Hesperocharis	marchalii		[Guérin, 1844]	-	-	RAP	-
464	Hesperocharis	nereina		[Hopffer, 1874]	-	PA	RAP	MAX(2100)
465	Archonias	brassolis	negrina	[C. & R. Felder, 1862]	-	-	RAP, SP	SP ID only given to species level
466	Charonias	theano	eurytele	[Hewitson, 1853]	-	-	RAP	-
467	Catasticta	anaitis	anaitis	[Hewitson, 1869]	-	-	RAP	-
468	Catasticta	nimbata	philobata	[Eitschberger & Racheli, 1998]	CM	-	SP	MAX(1973)
469	Catasticta	poujadei	ssp. n.		-	PA	-	-
470	Catasticta	reducta	reducta	[Butler, 1896]	CM	-	-	-
471	Catasticta	scurra		[Röber, 1924]	-	PA	-	-
472	Catasticta	sisamnus	telasco	[Lucas, 1852]	-	-	RAP	-
473	Catasticta	teutamis	epimene	[Hewitson, 1870]	-	-	RAP	-
474	Catasticta	tomyris	tomyris	[C. & R. Felder, 1865]	CM	PA	-	MAX(2444)
475	Leodonta	tellane		[Hewitson, 1860]	-	-	SP	-
476	Leodonta	n. sp.			CM	-	-	-
477	Pereute	leucodrosime	bellatrix	[Fruhstorfer, 1907]	-	-	RAP	-
478	Melete	leucanthe		[C. & R. Felder, 1861]	-	-	RAP	-
479	Melete	lycimnia	aelia	[C. & R. Felder, 1861]	-	-	RAP	-
480	Glutophrissa	drusilla	drusilla	[Cramer, 1777]	-	-	RAP, SP	-
481	Leptophobia	aripa	aripa	[Boisduval, 1836]	CM	-	SP, RAP	SP ID only given to species level
482	Leptophobia	cinerea	cinerea	[Hewitson, 1867]	-	-	RAP	-
483	Leptophobia	eleusis		[Lucas, 1852]	CM	PA	SP, RAP	SP ID only given to species level
484	Leptophobia	penthica	penthica	[Kollar, 1850]	-	PA	-	-
485	Leptophobia	subargentea	pastaza	[Joicey & Talbot, 1928]	CM	-	RAP	-
486	Perrhybris	lorena		[Hewitson, 1852]	-	-	RAP, SP	-
487	Perrhybris	lypera		[Kollar, 1850]	-	-	SP	-

PAPILIONIDAE

Papilioninae

488	Protographium	agesilaus	autosilaus	[Bates, 1861]	-	-	RAP	-

489	Protographium	leucaspis	leucaspis	[Godart, 1819]	-	-	RAP	-
490	Eurytides	serville	serville	[Godart, 1824]	-	-	RAP	-
491	Mimoides	euryleon	anatmus	[Rothschild & Jordan, 1906]	-	-	RAP	-
492	Mimoides	xeniades	xeniades	[Hewitson, 1867]	-	-	RAP, SP	-
493	Battus	belus	varus	[Kollar, 1850]	-	-	RAP	-
494	Battus	chalceus	ingenuus	[Dyar, 1907]	-	-	RAP	-
495	Battus	crassus	crassus	[Cramer, 1777]	-	-	RAP	-
496	Battus	polydamas		[Linnaeus, 1758]	-	-	SP	-
497	Parides	aeneas	bolivar	[Hewitson, 1850]	-	-	RAP	-
498	Parides	erithalion	lacydes	[Hewitson, 1869]	-	-	RAP	-
499	Heraclides	anchisiades	anchisiades	[Esper, 1788]	-	-	RAP	-
500	Heraclides	androgeus	androgeus	[Cramer, 1775]	-	-	RAP	-
501	Heraclides	isidorus	flavescens	[Oberthür, 1879]	-	-	RAP	-
502	Heraclides	thoas	cinyras	[Ménétriès, 1857]	-	-	RAP	-
503	Heraclides	torquatus	torquatus	[Cramer, 1777]	-	-	RAP	-

LYCAENIDAE

Theclinae

504	Thestius	meridionalis		[Draudt, 1920]	-	-	RAP	-
505	Laothus	gibberosa		[Hewitson, 1867]	-	-	RAP	-
506	Arawacus	dolylas		[Cramer, 1777]	CM	-	-	MAX(1674)
507	Arawacus	separata		[Lathy, 1926]	-	-	RAP, SP	-
508	Ocaria	aholiba		[Hewitson, 1867]	CM	-	RAP	MAX(1972)
509	Ocaria	ocrisia		[Hewitson, 1868]	-	-	RAP, SP	-
510	Cyanophris	sp.			-	-	SP	-
511	Micandra	aegides		[Felder, 1865]	-	-	SP	-
512	Panthiades	bitias		[Cramer, 1777]	-	-	RAP	-
513	Calycopis	devia		[Möschler, 1883]	-	-	RAP	-
514	Calycopis	vitruvia		[Hewitson, 1877]	-	-	RAP	-
515	Calycopis	cerata		[Hewitson, 1877]	-	-	RAP	-
516	Calycopis	vidulus		[Druce, 1907]	-	-	RAP	-
517	Calycopis	orcilla		[Hewitson, 1874]	-	-	RAP	-
518	Calycopis	sp.			-	-	RAP	-
519	Tmolus	echion		[Linnaeus, 1767]	-	-	RAP	-
520	Tmolus	sp. n. nr. cydrara			-	-	RAP	-
521	Siderus	sp. n. nr. metanira			-	-	RAP	-
522	Arcas	splendor		[Johnson, 1991]	-	-	RAP	-
523	Janthecla	sista		[Hewitson, 1867]	-	-	RAP	-
524	Brangas	felderi		[Goodson, 1945]	CM	-	RAP	-
525	Busbiina	bosora		[Hewitson, 1870]	-	-	RAP	-
526	Celmia	celmus		[Cramer, 1775]	-	-	RAP	-
527	Celmia	color		[Druce, 1907]	-	-	RAP	-
528	Laothus	viridicans		[C. & R. Felder, 1865]	CM	-	-	MAX(1974)
529	Atlides	browni		[Constantino, Salazar & Johnson, 1993]	CM	-	-	-
530	Atlides	havila		[Hewitson, 1865]	CM	PA	-	-
531	Theritas	paupera		[C. & R. Felder, 1865]	CM	-	-	MAX(1984)
532	Thaeides	theia		[Hewitson, 1870]	CM	-	-	MAX(1972)
533	Penaincisalia	amatista		[Dognin, 1895]	-	PA	-	MAX(2444)
534	Penaincisalia	juliae		[Hall & Willmott, 2004]	-	PA	-	-
535	Penaincisalia	lustra		[Johnson, 1992]	CM	PA	-	-
536	Rhamma	hybla		[H. H. Druce, 1907]	CM	PA	-	-
537	Rhamma	"#151"			CM	PA	-	ID pending
538	Erora	"#159"			CM	-	-	ID pending
539	Erora	"#160"			CM	-	-	ID pending
-	Unknown genus	"#139"			CM	-	-	ID pending
-	Unknown genus	"#140"			CM	-	-	ID pending
-	Unknown genus	"#141"			CM	-	-	ID pending
-	Unknown genus	"#142"			CM	-	-	ID pending
-	Unknown genus	"#143"			CM	-	-	ID pending
-	Unknown genus	"#144"			CM	-	-	ID pending
-	Unknown genus	"#146"			CM	PA	-	ID pending
-	Unknown genus	"#147"			CM	-	-	ID pending
-	Unknown genus	"#153"			CM	-	-	ID pending
-	Unknown genus	"#158"			CM	-	-	ID pending
-	Unknown genus	"#165"			-	PA	-	ID pending
-	Unknown genus	"#166"			-	PA	-	ID pending

Appendix C: Administration & Logistics

Expedition members

Jamie Radford, 23, British & New Zealander, MEng, University of Cambridge (Queens')

Spent eight weeks in remote and inaccessible cloudforest sites in the Eastern Cordillera of the Ecuadorian Andes, accompanied by local guides and a university student in 2007 & 2008. The focus of the expeditions were to carry out rapid inventories of Lepidoptera as part of the Tropical Andean Butterfly Diversity Project, as well as providing basic training in fieldwork techniques for the accompanying team. Also attended the "Second International Theoretical-Practical Course – Advanced Fieldwork Techniques for the Study of Tropical Butterflies (Lepidoptera:Papilionoidea) San Francisco, Parque Nacional Podocarpus, Zamora-Chinchipe, Ecuador"

Emily Hartley, 23, British, BA(Natural Sciences), University of Cambridge (Emmanuel)

Has been involved in field research a number of times, including a project carried out in the Cambridge Botanical Gardens as part of her degree. However, the most relevant fieldwork experience was a 10 week conservation project in the Ecuadorian Amazon, helping compile a species list of all mammals, birds, amphibians and butterflies in a reserve.

Katie Buckland, 23, British, BA(Natural Sciences), University of Cambridge (Girton)

Experience of ecology fieldwork includes an investigation into the human impact of crabbing on crabs at Wells-Next-The-Sea and the impact of a previous conservation intervention. Also conducted entomology field research into whether the invasive foreign coccinellid species (*Harmonia axyridis*) poses a threat to native British species through competition for resources such as ant-tended aphid colonies.

Lic. Pablo Sebastián Padrón, Ecuadorian, MSc(Entomology), University of Florida

Completed a Masters degree at the McGuire Centre for Lepidoptera, University of Florida in July 2010. It addressed the systematics, evolution and biogeography of high elevation Andean satyrines, particularly the genera Altopedaliodes and Neopedaliodes. Also attended the First & Second International Theoretical-Practical Courses – Intermediate & Advanced Fieldwork Techniques for the Study of Tropical Butterflies (Lepidoptera:Papilionoidea), organised by the Tropical Andean Butterfly Diversity Project in 2006 & 2007 respectively. At the latter he presented a paper on his research into the variation of pronophiline butterflies (Nymphalidae: Satyrinae*)* along an altitudinal gradient in the Cordillera del Condor, Ecuador.

Due to the timing of his Masters course, Sebastián was unfortunately only able to join the expedition in the Cordillera del Cóndor. Serious blisters on his foot then forced him to return home when we left Cóndor Mirador. Despite his brief time with us he was a valuable addition to the team and also helped secure the necessary military permission for visiting Paquisha Alto. He also kindly shared his data from a previous visit to Cóndor Mirador in 2007.

The team originally also included Oscar Mahecha (Colombian) and Armando Narvaiz (Ecuadorian). Oscar was unable to join us as his Masters project on Colombian Pronophilina (Nymphalidae: Satyrinae*)* had extended into the summer and therefore clashed with the expedition. Armando had returned to the University of Loja to continue studying despite previously agreeing to join the team.

Local collaborators

Thierry Garcia, Sumac Muyu Foundation – BRBR & Volcán Sumaco

In addition to his invaluable logistical support in organising our visits to BRBR, Volcán Sumaco and Cordillera Napo-Galeras, Thierry was a keen field assistant collecting a number of interesting taxa while he was with us. He also has an in-depth knowledge of the butterfly fauna of BRBR and facilitated the identification of a number of specimens in the field.

Carlos & Amable, Sumac Muyu Foundation – BRBR

Having joined us in Loreto for our visit to BRBR they took part in the fieldwork training given by the expedition leader and excelled at hanging canopy traps - quickly surpassing his ability to reach the highest branches! Their boundless enthusiasm also helped them collect a number of interesting specimens, particularly on the walk out of the Reserve.

Hernán, Pacto Sumaco community guide – Volcán Sumaco

Hernán joined us as a guide for our visit to Volcán Sumaco and was interested in our work and its conservation and tourism implications. He suggested that we should produce three separate photographic butterfly ID guides specific to the fauna around each cabin, rather than a single one. These would then be left in the three cabins for the benefit of tourists climbing the volcano.

Leónidas, National Park Ranger, Mushullacta – Cordillera Napo-Galeras

As well as being an excellent guide, Leónidas had a clear passion for natural history and accompanied JR while setting traps and collecting specimens. He was very keen to make his own traps and set up a permanent butterfly monitoring programme, and indeed applied for permission to do so from the Director of the National Park, insisting that we leave a number of strings in place for canopy traps. However, despite exchanging email addresses we have been unable to contact him since returning from the expedition.

Claudio, FICSH – Cordillera de Kutukú & Cordillera Shaimi (Puerto Yaupi)

The FICSH Director of Culture & Education, Claudio, went out of his way to help us reach the Cordillera de Kutukú. Without his assistance we would have been even less likely to be accepted by the community of Angel Rouby, and it was with his guidance that we spent a morning collecting in the Cordillera Shaimi on land owned by the FICSH.

Gregorio, Anthropologist – Cordillera de Kutukú & Cordillera Shaimi (Puerto Yaupi)

Gregorio's experience of living with remote indigenous communities helped us to assess the situation in Angel Rouby. He is also a keen amateur entomologist and clearly enjoyed helping with fieldwork in the Cordillera Shaimi.

Research materials & information sources

The Instituto Geográfico y Militar (IGM) in Quito was a valuable source of maps, with their 1:50,000 series particularly useful. The Cambridge University Library Map Room had a small number of these maps, although none that were of use to this expedition. Keith Willmott and Patricio Salazar kindly bought maps from the IGM during visits to Quito, which greatly facilitated expedition planning.

The 'Butterflies of Ecuador' website gave useful advice on priority areas for study, and the Missouri Botanical Garden website [Neill, 2007] and that of Lou Jost [Jost, N/D] gave reports of botanical expeditions to the Cordillera del Cóndor. The RGS (with IBG) Geographical Fieldwork Grant interview panel also gave useful feedback and suggested improvements to our fieldwork methodology. A number of journal articles were also used as references, particularly for the diversity analyses, as listed in Section 8: References.

Discussions with Keith Willmott, Thierry Garcia and David Neill helped finalise the expedition itinerary and previous Cambridge University expedition reports provided advice on potential sources of funding.

Itinerary

Day	Week Day	Date	Itinerary	Weather
1	Saturday	17/07/10	Arrive Quito	-
2	Sunday	18/07/10	Quito	-
3	Monday	19/07/10	Quito → Loreto	-
4	Tuesday	20/07/10	Into Bigal River Biological Reserve	Y
5	Wednesay	21/07/10	BRBR	Y
6	Thursday	22/07/10	BRBR	Y
7	Friday	23/07/10	BRBR	Y
8	Saturday	24/07/10	BRBR	N
9	Sunday	25/07/10	Out of BRBR	Y
10	Monday	26/07/10	Coca → Guagua Sumaco	-
11	Tuesday	27/07/10	Into VS (4h)	N
12	Wednesay	28/07/10	Into VS (6-7.5h)	Y
13	Thursday	29/07/10	VS	Y
14	Friday	30/07/10	VS	Y
15	Saturday	31/07/10	VS	Y
16	Sunday	01/08/10	Out of VS (10.5 h)	N
17	Monday	02/08/10	Loreto	-
18	Tuesday	03/08/10	Loreto/Coca	-
19	Wednesay	04/08/10	Loreto → Guagua Sumaco	-
20	Thursday	05/08/10	Into Napo-Galeras (4.5h)	N
21	Friday	06/08/10	Into Napo-Galeras (6h)	N
22	Saturday	07/08/10	GA	Y
23	Sunday	08/08/10	GA	Y
24	Monday	09/08/10	GA	Y
25	Tuesday	10/08/10	GA	Y
26	Wednesay	11/08/10	Out of GA (8h)	Y

Day	Week Day	Date	Itinerary	Weather
27	Thursday	12/08/10	Tena → Macas	-
28	Friday	13/08/10	Macas	-
29	Saturday	14/08/10	Macas (Angel Rouby & Sucúa)	-
30	Sunday	15/08/10	Macas	-
31	Monday	16/08/10	Macas → Sucúa → AR → Macas	-
32	Tuesday	17/08/10	Macas → AR → Puerto Yaupi	-
33	Wednesay	18/08/10	Cordillera Shaimi (Puerto Yaupi) → Macas	Y
34	Thursday	19/08/10	Macas → Gualaquiza	-
35	Friday	20/08/10	Into Condor Mirador (1.5h)	N
36	Saturday	21/08/10	CM	Y
37	Sunday	22/08/10	CM	Y
38	Monday	23/08/10	CM	Y
39	Tuesday	24/08/10	CM	Y
40	Wednesay	25/08/10	CM	Y
41	Thursday	26/08/10	CM	N
42	Friday	27/08/10	CM	Y
43	Saturday	28/08/10	Out of CM (1.5h)	Y
44	Sunday	29/08/10	Gualaquiza → Yantzaza + Zamora	-
45	Monday	30/08/10	Into Paquisha Alto (bus)	-
46	Tuesday	31/08/10	Destacamento PA	Y
47	Wednesay	01/09/10	Destacamento PA	Y
48	Thursday	02/09/10	Destacamento PA	N
49	Friday	03/09/10	Destacamento PA	N
50	Saturday	04/09/10	Into PA plateau (3h)	Y
51	Sunday	05/09/10	PA plateau	N
52	Monday	06/09/10	PA plateau	N
53	Tuesday	07/09/10	PA plateau	Y
54	Wednesay	08/09/10	Out of PA alto (1h)	Y
55	Thursday	09/09/10	Out of PA base (bus) → Loja	-
56	Friday	10/09/10	Loja → Quito	-
57	Saturday	11/09/10	Quito	-
58	Sunday	12/09/10	End ☹	-

Finances

A community account was opened with HSBC for managing expedition funds. This did not provide a cash card that could be used overseas, therefore funds were transferred into the expedition leader's account to cover in-country expenses. Money was withdrawn from cashpoints by debit card in major towns. There were no cashpoints that accepted international debit cards in either Loreto or Gualaquiza. Travellers cheques can only be cashed in Quito and major tourist towns such as Baños, with high rates of commision – they are therefore not recommended.

Income

Total = £7990

Over £1000

Cambridge Expeditions Fund

£500-£1000

10th Duke of Rutland Trust

Balfour Browne Trust

Gilchrist Educational Trust

Gumby Awards: RGS (with IBG) - Geographical Fieldwork Grant

2x Mary Euphrasia Mosley, Sir Bartle Frere & Worts Travel Funds

Panton Trust

Personal contributions

Proyecto Ashaninka 2004 donation

Queens' College Expedition Fund

Smaller amounts

2x RGS-WMT Student Bursary for 'Far from Help' course

Adrian-Ashby Smith Memorial Trust

Potential sources of funding

Additional sources of funding that could be relevant to similar projects:

Albert Reckitt CT, Archie Sherman CT, Basil Samuel CT, Bill Wallace Grant, British Ecological Society – SEPG & UEPS, Cambridge Rotary Club, Cecil Pilkington CT, Donald Robertson Travel Fund, Equafor, Explorer's Club Youth Activity Fund, Henrietta Hutton Memorial Fund, Isaac Newton Trust Fund, Laing's CT, Loke Wan Tho Memorial Foundation, National Geographic Society – Young Explorers, Round Table Trust – Individual Award, Royal Entomological Society, Shell Personal Development Award, Shipton-Tilman Grant, Sigma Xi Grants in aid of research, Spirit of Adventure Award, Topinambour Trust, Transglobe Expedition, WF Southall Trust, Wilderness Award, Winston Churchill Memorial Trust.

Expenditure

Unit cost	Quantity	Total	Description	Category	Remaining budget
£196	x2	£391	RGS-WMT Far From Help	Medical	£7,599
£149	x1	£149	Medical supplies	Medical	£7,450
£100	x3	£300	Vaccinations	Medical	£7,150
£20	x1	£20	BES student membership	Application Fee	£7,130
£10	x1	£10	RGS – GFG Application fee	Application Fee	£7,120
£33	x1	£33	GFG interview (JR, EH)	UK Travel	£7,086
£48	x1	£48	WMT travel (JR, EH)	UK Travel	£7,038
£12	x1	£12	iPod external battery	Kit	£7,026
£82	x1	£82	Glassine envelopes	Kit	£6,944
£23	x1	£23	Customs fee – envelopes	Kit	£6,921
£128	x1	£128	GPS – Garmin eTrex Summit HC	Kit	£6,793
$182	x1	£114	Lepidoptera nets	Kit	£6,679
£150	x3	£450	Camping equipment – tents etc	Kit	£6,229
$50	x1	£31	Camping gas	Kit	£6,198
£23	x1	£23	Customs fee – Bioquip	Kit	£6,175
£900	x3	£2,700	LHR-UIO Airfare	International travel	£3,475
$97	x3	£182	LOJA-UIO Airfare	Local travel	£3,294
$50	x3	£94	Bus fares	Local travel	£3,200
$52	x18	£585	Field subsistence ($13 x 4pax)	Subsistence	£2,615
$78	x24	£1,170	Town subsistence ($26 x 3pax)	Subsistence	£1,445
$1,000	x1	£625	Rio Bigal, Sumaco & Galeras	Subsistence & Fees	£820
$75	x1	£47	FICSH fees	Fees	£773
$5	x3	£9	PN Sumaco entrance fee	Fees	£764
$5	x3	£9	PN Galeras entrance fee	Fees	£754
£164	x3	£492	Insurance	Insurance	£263
$100	x1	£63	MIA-GNV (Florida) Coach	Travel	£200
£200	x1	£200	Report printing & postage	Report	£0
		£7,990	**TOTAL**		

Medical

Vaccinations & Malaria prophylaxis

All team members had to ensure they were up to date with vaccinations against:

· Diphtheria
· Hepatitis A
· Hepatitis B
· Meningococcal meningitis
· Polio
· Rabies
· Tetanus
· Tuberculosis (BCG)
· Typhoid
· Yellow fever

Malaria prophylaxis was taken as BRBR and some of the towns visited were in malarious zones, even though the majority of study sites was not. Either Doxycycline or Chloroquine/Proguanil was taken by expedition members, following the advice of UK health professionals and the NaTHNaC website. Standard bite avoidance measures were also taken.

Medical training

Wilderness Medical Training: 'Far From Help' – 2 day course

Organised by the RGS-IBG Expedition Advisory Centre and delivered by Wilderness Medical Training, the course is aimed at small expeditions operating in remote environments where professional medical care is not readily available. It gives a thorough grounding in providing comprehensive care to injured and ill patients, enabling a wide variety of problems to be resolved in the field without evacuation.

Syllabus:

Legal considerations
Expedition medical planning
Diagnosis – taking a history, physical examinations
Head, neck, chest and abdominal injuries
Fractures, dislocations and use of splints
Shock – first and second aid
Soft tissue injuries and burns
Common medical conditions, including management of diarrhoea
Cold injuries and altitude sickness
Tropical problems – heat illness, malaria, bites and stings
Medical kits and supplies

Prescription-only-medications whose use had been covered during the course were available through the WMT and Nomad Travel & Outdoor.

Medical kit list

Wound treatment

Alcohol wipes	x16	Plasters – Medium	x20
Antiseptic wipes	x30	Small	x25
Bandage	x1	Splint	x1
Compressed dressing	x2	Steri-strips	x4
Iodine spray	x1	Triangular bandage	x1
Microporous tape	x14m	Wound dressings	x4
Plasters – Oval	x5	Wound pad (5x5cm)	x4
Large	x10		

Medication

Chlorphenamine - 4mg	x28	E45 calming skin cream	x1
Ciprofloxacin - 250mg	x40	Hydrocortisone cream 1% - 15g	x2
Co-Amoxiclav - 250/125mg	x63	Ibuprofen	x83
Co-Codamol - 30/500	x5	Imodium	x10

Doxycycline - 100mg	x26	Loperamide - 2mg	x20
Paracetamol - 500mg	x88	Oral rehydration salts - sachets	x10
Prednisolone - 500mg	x28	Tyrozets throat lozenges	x12

Other

Digital thermometer	x1	Epipen (Epinephrine - 0.3mg)	x1
Emergency blanket	x1	Latex gloves (non-sterile)	x10

Medical report

Details of all medical incidents, as well as any 'near misses' are listed below.

23rd July – One team member slips while climbing onto camp platform and seriously grazes chest and thigh. Iodine spray repeatedly applied to prevent infection.

24th July – Two team members swarmed by bees but not stung. One is stung on the face by a hairy caterpillar. Antihistamine cream applied to caterpillar sting.

27th July - One team member slips and bangs knee on the first step out of Pacto Sumaco. Remainder of walk is done slowly and carefully to prevent further twisting and injury.

27th July – One team member stung on arm by nettle. No action taken until 28th when affected area is red, sore and oozing. Iodine spray applied and gradually clears up.

30th July - One team member falls ill with diarrhoea. Drinks lots of water with ORS and rests.

1st August - Decision taken to descend Sumaco. Ill team member takes doxycycline and imodium before setting out. Vomits shortly afterwards. Taken to hospital in Loreto, given intravenous painkiller. Recovers significantly overnight.

2nd August - Ill team member diagnosed with bacterial gastroenteritis and parasites. Prescribed ciprofloxacin and anti-parasite medication, recovers fully after a few days' rest.

7th August - One team member suffers cold sweats during the night. Rests in camp, takes no medicine and recovers.

24th August - A new member of the team arrives with a large blister on the heel from walking to camp. Wears different shoes and limits walking until we leave.

31st August - One team member stung on back of the neck, experiences associated dizziness. Takes Ibruprofen and rests until recovered.

3rd September – One team member stung on the hand, which swells up dramatically. Treated with antihistamine cream and extent of swelling marked for monitoring. Swelling reduces overnight and disappears after the second day with continued application of cream.

5th September – One team member aggravates a knee injury from before the expedition. Wears a knee support for walking, takes regular rests and warms up and down before and after walks until the end of the expedition.

Blisters – All team members had blisters from wearing rubber boots in wet conditions, particularly during the first two weeks of the expedition. Blister plasters were used on affected areas and anti-fungal talcum powder used to dry boots overnight.

Bites and stings – E45 bite cream applied to minimise scratching and resulting infection.

Scratches and cuts – Treated with iodine spray and monitored to ensure they don't turn septic.

Specialist equipment

6x Spade Tip Butterfly Forceps – bought in Japan, also available from Bioquip (#4747)
50x 4 x 4” Glassine envelopes – from Clearbags
300x 2½ x 4¼” Glassine envelopes – from Clearbags
2000x 2 x 2” Glassine envelopes – from Clearbags
Numerous sachets of silica gel and zip-lock bags for drying and storing specimens

3x Lepidoptera net bag, close weave black chiffon (18”) - #7218FAB from Bioquip
3x Collapsible net ring (18”) - #7118RC from Bioquip
8x Collapsible net handle 24” extension – #7312AB from Bioquip
The Bioquip order unfortunately did not include the connection between the net ring and handle. This is only available as part of a complete net (#7118GR or CP), which comes with an unwanted coarse-weave net bag. Connecting pieces were therefore made by an ironmonger in Quito and secured by lashing with rubber.

JR already owned a folding frame net and bag (21”), supplied by Worldwide Butterflies, with handle extensions from Alana Ecology.

11x Van Someron-Rydon traps were made by JR from old net curtains and a reel of fencing wire. Any light-coloured, fine-weave netting is suitable although synthetic materials are less likely to rot in hot and humid conditions.

Fish guts were procured in local markets at each town visited during the expedition for use as bait. These were diced, mixed with a small amount of remaining bait, diluted with an equal volume of water and then left in the sun for two days to rot.

2x 100m roll of string – used for hanging aerial traps
6x Fishing weights – used for hanging aerial traps

1x Garmin Etrex Summit HC GPS

2x Machete – bought and sharpened in Quito

Recommendations

The custom-made connection for the Bioquip nets was slightly flexible and prevented them from folding as designed. Take care if ordering nets from Bioquip as it is not obvious which are supplementary parts and which are complete sets.

Despite using dozens of sachets of silica gel, some of the specimens were not entirely dry at the end of the expedition. Bulk-ordering silica gel from a chemical supplier would be advised for future lepidopterological expeditions.

The handheld GPS unit selected for this expedition has an inbuilt barometric altimeter. This provided accurate elevational data where accurate maps were available for calibration. A separate barometer would, however, be recommended for measuring atmospheric pressure to independently calibrate the device.

Hiking boots were taken on the expedition, however they were typcially left in storage in towns as rubber boots were worn throughout due to the wet terrain.

Study areas

Bigal River Biological Reserve

Getting there: 1 hour camioneta ride from Loreto, followed by a 1½ hr hike with mules until the end of the road. A further ½ hour trek through muddy jungle terrain carrying luggage and equipment.

IGM 1:50,000 Map: Unknown

Toilet facilities: The camp has a dry composting toilet. There was also a nearby stream and waterfall with plenty of privacy for washing.

Cooking facilities: Basic tarpaulin kitchen with cooking fire and wooden storage/work surfaces. However, the SMF catered for us during our stay.

Accommodation: Large, roofed, wooden platform raised above the ground to pitch tents on. Underneath was a living/dining area with hammocks and wooden tables and chairs. No electricity.

Since the expedition team visited BRBR the FSM team have built a second campsite with the assistance of the local community "8 de Diciembre". It consists of a sleeping platform, kitchen, dining area and toilets as well as trails opening up new areas of the Reserve for research. Plans are afoot to add a rainwater harvesting system and showers.

Organisational details: Contact Thierry Garcia of the SMF to arrange a visit. Further details available at their website: http://reservadelriobigal.googlepages.com

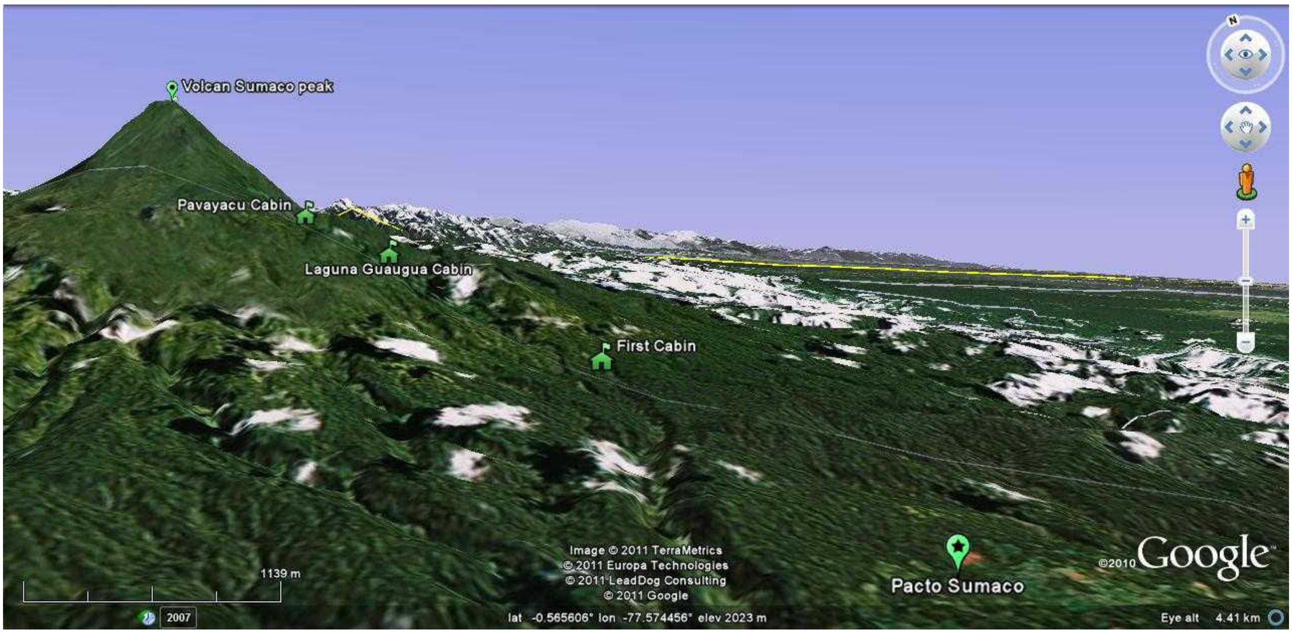
Volcán Sumaco

Getting there: HuaHua Sumaco Information Centre is ~1 hour by bus from Loreto (towards Tena) and is a ten minute walk from the main road. The village of Pacto Sumaco is a further 8km down the track. Although there is no formal transport service it is common to hitch a ride on a passing truck or motorbike, it would also make a pleasant walk.

From Pacto Sumaco: 10-11½ hr hike up steep and muddy paths, split over two days. 4 hrs to first 'refuge', 6-7½ hrs to second. The descent typically takes 4~6 hours. Mule access was not possible at the time of the expedition as stretches of the trail were heavily overgrown.

IGM 1:50,000 Map: O-III-C-4 "Volcan Sumaco"

Figure A – Google Earth view of Volcán Sumaco



Toilet facilities: Flushing toilet. A large rainwater tank outside for cooking and washing.

Cooking facilities: First two cabins have a gas cooker and a few pieces of cooking equipment. The third cabin has no gas, but there may be semi-dry firewood stored under the platform.
Accommodation: Bunks are available at Huahua Sumaco Information Centre for $7 per person – useful to get off to an early start. We also stored some of our equipment there. Once past Pacto Sumaco there are three comfortable wooden cabins with wooden bunks. No electricity.

Organisational details: Visitor access is managed by the community of Pacto Sumaco and given our experience we would recommend dealing with them directly. Any agreement made in advance with the National Park authorities may not be accepted on the ground, particularly if the community have not been involved in the planning, which appears to have been the case here.

There is a National Park entrance fee of $5 per person, payable to the Park Ranger in Pacto Sumaco. There is limited mobile phone coverage in some places, including the second cabin, Laguna HuaHua Sumaco.

Cordillera Napo-Galeras

Getting there: There is a National Park building in the village of Mushullacta, which is the nearest access point to the Cordillera. We were fortunate to get a lift from HuaHua Sumaco Information Centre to Mushullacta with the Director of the National Park, otherwise there are buses that run once or twice daily from Tena. Returning to Tena, be prepared to get up early – the bus doesn't always reach Mushullacta and we had to walk for 2hrs to catch the 6am bus!
From Mushullacta: 10h hike over 2 days, 4 hours to first camp site, 6 hours to second.

IGM 1:50,000 Map: Unknown

1st Campsite (Luyapaccha)
Toilet facilities: Non existent. Small stream nearby for cooking and washing.

Cooking facilities: Tarpaulin covered kitchen area with wood fire and wooden table and benches. Camping stove is advisable in case wood is damp.
Accommodation: Small clearing with tarpaulin suspended for pitching tents under.

2nd Campsite ("Chez CULEPEX")
Toilet facilities: Non existent. Small stream nearby for cooking and washing.
Cooking facilities: Non existent. Camping gas and cooking equipment taken. Small clearing with own tarpaulin erected to create a cooking area.
Accommodation: Non existent. Small clearing to pitch tents

Organisational details: There is a National Park entrance fee of $5 per person, payable to the Park Ranger in Mushullacta.
There is limited mobile coverage in some places along the trail and from part of the plateau.

Cordillera de Kutukú

IGM 1:50,000 Maps: ÑV-B-2, ÑV-B-4, ÑV-D-2, ÑV-D-4, ÑV-F-2, ÑV-F-4, OV-A-1, OV-A-3, OV-C-1, OV-C-3, OV-E-1 & OV-E-3

Organisational details: Permission from the FICSH cost $25/person and must be solicited in person in Sucúa, with passports, by all individuals intending to enter the area. The more remote Shuar communities are reportedly entirely self-governing and do not request FICSH documentation [Gregorio, *pers. comm.*].

Cordillera Shaimi (Puerto Yaupi)

Getting there: Puerto Yaupi is on the Macas-San Jose de Morona bus route – the journey took 10 hours due to road works, military checkpoints and a puncture.
A hired camioneta drove us ~½hr from Puerto Yaupi to the collecting site. There was only one return bus, at ~5pm, destination Macas.

IGM 1:50,000 Maps: OV-E-3 "Yaupi"

Toilet facilities: Non existent. River (Rio Yaupi) nearby for washing. No water source was found at the collecting site.

Cooking facilities: Non existent. Breakfast was kindly provided by relatives of the FICSH Director of Education, who accompanied us.

Accommodation: Concrete floor of a community meeting centre and ferry port.

Destacamento Cóndor Mirador

Getting there: There are no buses but a 'ranchera' from Gualaquiza does pass through Tundayme Bajo, from where a dirt-track leads up to the military base. There is no formal transport service along this road but a camioneta may be hired locally or direct from Gualaquiza. We would recommend the latter, which cost ~$20 as the limited number of cars in the village allows them to demand an extortionate fee for transport. Consider arranging a time and date for the return journey, or get a taxi-driver's mobile number.

Alternatively it is probably a full day's walk up to the base, and perhaps half a day's walk back down. There was a landslide (approx. 6 months old) blocking the road ~1½h walk below the base at the time of the expedition. The military access the bases in the area by helicopter and it may be possible to get a lift, or to have supplies delivered, when they have a change of duty every month.

IGM 1:50,000 Maps: ÑVI-D-3 "Cóndor Mirador"

Figure B – Google Earth view of Cóndor Mirador

Toilet facilities: Flushing toilets, sink and outdoor shower.

Cooking facilities: Our own camping gas and cooking equipment was used.

Accommodation: A basic cabin in which to pitch tents was kindly provided by the military. However, this was the decision of the commanding Sargeant, who may not always be so generous. A diesel generator provided electric light in the evenings. We did not try to charge batteries, which may or may not be possible.

Organisational details: Permission to enter Destacamento Cóndor Mirador should be solicited at the barracks just outside Gualaquiza. The expedition leader went alone, was asked to show passports and provide proof that we were a scientific expedition and permission was granted within an hour.

Destacamento Paquisha Alto

IGM 1:50,000 Maps: ÑVI-F-3 “Jímenez Banda”

Lower camp

Getting there: The military base is at the end of the road to La Zarza and El Blanco – leave the main road and cross the river at Los Encuentros. The ranchera/bus which runs along this road may go beyond the final stop and reach the military base if you ask nicely!

Toilet facilities: Flushing toilet, sink and outdoor ‘heated’ shower.

Cooking facilities: The Sargeant kindly let us use their well equipped indoor kitchen complete with gas cooker, table, benches, sink, pots, pans, cutlery, plates etc. It also doubles as an indoor football pitch and 24-hr disco!

Accommodation: A room was generously provided where we could lay our camping mats on the wooden floor. However, this may not always be possible.

Upper camp

Getting there: 3hr hike up from Paquisha Alto military base.

Toilet facilities: Non existent. Small stream nearby for washing and cooking.

Cooking facilities: Small amount of firewood and a fireplace, however portable stove is advisable.

Accommodation: A very basic, old wooden cabin in which to lay camping mats. Warm sleeping bags are a must – it gets very cold at night. There was also a lean-to with tables, benches and a fireplace.

Organisational details: Permission to enter Destacamento Paquisha Alto should be solicited at the barracks just outside Zamora. Passports and proof that we were a scientific expedition was again required and permission was granted within an hour. Photocopies of our passports were kept at the barracks – we were asked to return to collect them and prove that we had come back town, rather than disappearing into Perú!

Transport

In-country travel between towns was typically done by local bus – there is a regular and cheap service (fares are ~$1.20 per hour travelled) that covers most of the country. The two main exceptions were the journey from Quito-Loreto which was done by private car belonging to Thierry Garcia of the Sumac Muyu Foundation, and our return from Loja to Quito at the end of the expedition which was done by plane with Icarus Airways. Taxis were used for transport within towns to save time, or in areas where it was unsafe to walk. All specialist equipment was carried as hold baggage on a flight from the UK by the expedition leader, or bought in-country.

Food & Water

Lightweight food suitable for trekking was bought locally in towns – rice, lentils and porridge formed the core of our diet. In the case of the Bigal River Biological Reserve and Destacamento Paquisha Alto, which could be accessed by mule and bus respectively, heavier luxuries such as vegetables, eggs and meat supplemented the basic provisions. As we were only at each site for approximately a week at a time there was no danger of malnutrition as fresh vegetables could be eaten on the 'rest' days in towns. Water was collected from nearby streams and treated with iodine solution or boiled before drinking.

Permissions & permits

Details of the expedition's collection permits are listed below.

Napo	No. 002-IC-FAU/FLO-DPN/MA
Orellana	No. 0014-2010-IC-FAU-DPO-MA
Morona Santiago	No. 004-2010-FAU-PNS-ZB-DPMS/MAE
Zamora-Chinchipe	No. 005-IC-FAU/FLO-DPZCH/MA

In order to obtain export permits a letter of request was prepared by Santiago Villamarin, Curator of Invertebrates at the Ecuadorian Museum of Natural Sciences (MECN) and signed by the Museum's Executive Director. Details of the (estimated) number of specimens for export in each family, as well as addresses and flight details were required.

An original copy of this letter was delivered by hand to Environment Ministry office in each provincial capital. One office specifically instructed us that the letter had to be delivered by hand and could not be emailed as a PDF. Others said that they would accept an electronic version but did not start to prepare the export permit until we came to collect it in person! Most permits took ~2 weeks to be issued, although Morona Santiago was a notable exception with the permit issued within a few hours of delivery of the letter.

Securing export permits was a significant administrative burden and the expedition leader spent most of the time between sites securing them. In August 2011 we were informed that the procedure has changed again – it is now possible for export permits to be issued by the MECN (and perhaps other partner institutions) in Quito, but a separate 'Transport permit' is still required to move specimens between different provinces, and has to be requested at the provincial offices of the Environment Ministry. Future expeditions should give careful consideration to the process of obtaining permits and have contingency plans in place – it was relatively common to be told that the relevant official was away for a week and we would have to return at a later date.

Ministerio del Ambiente

AUTORIZACION DE INVESTIGACION CIENTÍFICA
Nº 005-IC-FAU/FLO-DPZCH/MA
Zamora, 31 de mayo del 2010

FLORA () FAUNA (X)

El Ministerio del Ambiente, en uso de las atribuciones que le confiere La Codificación a La Ley Forestal y de Conservación de Areas Naturales y Vida Silvestre, autoriza a los investigadores principales: Keinth Willmott, documento de identidad, Pasaporte No. 093003941, Jason Hall, documento de identidad, Pasaporte No. 0540063034, de Nacionalidad inglesa, a los investigadores colaboradores: Marianne Elias documento de identidad, Pasaporte No. 04AE93444, de Nacionalidad Francesa; David Ahrenhoiz, documento de identidad, Pasaporte No. 435835260, Robert Busby, documento de identidad, Pasaporte No. 224850704, Geoffrey Gallice documento de identidad, Pasaporte No. 016962893, de nacionalidad Norteamericana (EE.UU), James Radford, documento de identidad, Pasaporte No. 307881165, de nacionalidad inglesa y al investigador representante de la contraparte Nacional Ecuatoriana; Pablo Padrón Cedula de identidad No. 0103930541, de Nacionalidad Ecuatoriana, Elena Ortiz Cedula de identidad No. 52869027, de Nacionalidad Colombiana, Ian Segebarth documento de identidad, Pasaporte No. 407082840, de nacionalidad Norteamericana (EE.UU), Alexandre Toporov, documento de identidad, Pasaporte No. 09AL4297, de nacionalidad Francesa, Serafín Aldaz, Cedula de identidad No. 1800848077, Ismael Aldaz, Cedula de identidad No. 1801213057 y Santiago Villamarín; Cedula de identidad No. 1707330237, de Nacionalidad Ecuatoriana, para que lleven a cabo la investigación Científica **"Diversidad Biológica de Lepidópteros en el Ecuador".** Como complemento en el Parque Nacional Podocarpus, Parque Binacional El Cóndor y Provincia de Zamora Chinchipe.

De acuerdo a las siguientes especificaciones:

1.-Solicitud de: Santiago Villamarín Curador de la División de Entomología Museo Ecuatoriano de Ciencias Naturales
2.-Valoración técnica del proyecto: (Agr. Luis Tambo e Ing. Gober A. Polo Paladines).
3.-Auspicio Institución Científica extranjera: Universidad de Florida.
4.- Auspicio de Institución Científica Nacional: Museo Ecuatoriano de Ciencias Naturales
5.- Contraparte del Ministerio del Ambiente: Ing. Ernesto Israel Lima, Director Provincial del Ministerio del Ambiente de Zamora Chinchipe
6.- Complementos autorizados de la Investigación Científica: COLECCIÓN DE ESPECIMENES ZOOLOGICOS LEPIDOPTEROS, Parque Nacional Podocarpus y Parque Binacional El Cóndor, Provincia de Zamora Chinchipe.
7.- Duración: del 30 de marzo del 2010 hasta 30 de marzo del 2011.
8.- Obligaciones del Investigador: Entregar 2 copias en formato impreso y digital (formato PDF) de los resultados finales de la investigación en Castellano a la Dirección Provincial de Zamora Chinchipe del Ministerio del Ambiente.
9.- Entregar copia de las fotografías (impreso y digital) que formen parte de la investigación.

Ministerio del Ambiente

10.- Entregar al Ministerio del Ambiente Dirección Provincial de Zamora Chinchipe el registro de las especies objeto de su investigación, en formato digital incluyendo la localización exacta de los especímenes observados o colectados con las coordenadas UTM
11.- Depositar duplicados de las colecciones producto de esta investigación: Museo Ecuatoriano de Ciencias Naturales,
12.- El Responsable del cumplimiento de las obligaciones dispuestas en el párrafo anterior se responsabiliza al Sr. Lic. Santiago Villamarin contraparte Nacional del MECN.
13.- Cumplir con los plazos de entrega de informes finales o parciales el 30(Cada Seis meses) y final. De Marzo del 2011.
14.- Respetar y hacer cumplir los aspectos técnicos, legales y administrativos a los que el investigador Esté obligado ejecutar.

Ing. Israel Lima Esparza

DIRECTOR DE LA DIRECCCION PROVINCIAL DE ZAMORA CH

Ministerio del Ambiente
DIRECCION PROVINCIAL DE ZAMORA CHINCHIPE

Quito, 22 de julio de 2010

MSc. Ernesto Lima
Director Provincial de Ambiente Zamora Chinchipe
MINISTERIO DEL AMBIENTE

Presente,

Por medio de la presente le solicito a usted, muy comedidamente, se conceda un **PERMISO DE EXPORTACIÓN** para el permiso de investigación No. **005-IC-FAU/FLO-DPZCH/MA** del proyecto **"Diversidad Biológica de Lepidópteros del Ecuador"**, el cual se lleva a cabo por Los investigadores: **Dr. Keith Willmott, Dr. Jason Hall, Ms. Julia Robinson Willmott, Dr. Marianne Elias, Dr. David Ahrenholz, Dr. Robert Busby, Dr. Geoff Gallice, Lcda. Elena Ortiz, Lcdo. Sebastián Padrón, Sr. James Radford, Sr. Ian Segebarth, Sr. Alexandre Toporov, Sr. Ismael Aldas, Sr. Raul Aldaz** y **Lcdo. Santiago Villamarín**. El proyecto contempla la investigación científica de lepidópteros del Ecuador, en el cual el Museo de Ciencias Naturales actúa como **CONTRAPARTE** del proyecto. El investigador que exportará los especímenes es el **Sr. James Radford**, en un vuelo de American Airlines 0932, programado para el 12 de septiembre de 2010, desde el Aeropuerto Mariscal Sucre de la ciudad de Quito.

La tabla de especímenes a exportar se envía en un documento digital adjunto con formato del Ministerio del Ambiente en Excel.

Por la favorable atención que se digne dar a la presente le reitero mis sentimientos de estima y consideración.

Atentamente,

Marco Altamirano B. PhD.
Director Ejecutivo

Lcdo. Santiago Villamarín-Cortez
Curador Sección Invertebrados

MUSEO ECUATORIANO DE CIENCIAS NATURALES
Rumipamba Nº 341 y Av. De los Shyris, Parque La Carolina • Quito-Ecuador • Casilla Postal; 07-07-8976
Teléfonos (593-2) 2449 825 / 2449 824 • E-mail: info@mecn.gov.ec • www.mecn.gov.ec

Example export permit

AUTORIZACIÓN DE EXPORTACIÓN CIENTIFICA

Ministerio del Ambiente

UNIDAD DE PATRIMONIO NATURAL, BIODIVERSIDAD

EXPORTACION X
IMPORTACION
RE-EXPORTACION

FINES CULTURALES
INVESTIGACION X
COMERCIO
COLECCIÓN

FAUNA SILVESTRE X
FLORA SILVESTRE
ELEMENTOS

005-10 EXP-CI-FAU-DPO/MA

VALIDO: 1 MES
FECHA: 12 de Septiembre del 2010
CADUCA: 11 de Octubre del 2010

PAÍS DE ORIGEN: ECUADOR **PAÍS DE TRÁNSITO:** **PAÍS DE DESTINO:** Reino Unido **PAÍS DE RETORNO: ECUADOR**

LUGAR DE COLECCIÓN: FRANCISCO DE ORELLANA PARQUE YASUNI (Estación Científica Yasuni)

EXPORTADOR:
NOMBRES: James Timothy Radford NACIONALIDAD: Gran Bretaña DOCUMENTO DE IDENTIDAD: Pasaporte Nro. 307881165 INSTITUCIÓN: University of Cambridge, Zoology Department AUTORIZACIÓN DE INVESTIGACIÓN: Nro.0014-IC-FA-DPO-MA

IMPORTADOR:
NOMBRES: Santiago Villamarín NACIONALIDAD: Ecuatoriano DOCUMENTO DE IDENTIDAD: Cédula de Identidad Nº. 1707330237 INSTITUCIÓN: Museo Ecuatoriano de Ciencias Naturales
DIRECCIÓN DE INSTITUCIÓN EXPORTADORA: Downing Street, Cambrige, CB2 3EJ
DIRECCIÓN DE INSTITUCIÓN IMPORTADORA: Rumipamba 341 y Shyris, Qutio, Ecuador

LIBRE PAGO DE DERECHOS SI X SIGLAS DEL FUNCIONARIO RESPONSABLE: AJ
EXONERACIÓN : X

PUERTO DE EMBARQUE: Aeropuerto Mariscal Sucre

Transporte: Aéreo Nombre de compañia: American Airlines Fecha: 12-09-2010 Nº de Vuelo: AA0932
Página: 1/1

Código	Nombre Técnico	Nombre común	Descripción de los Especímenes	Nº Especímenes	Nº Envases	Total Exportado/Cupo
001 - 050 0014-DPO-MA	*Lycaenidae*	Mariposa	En sobres de papel, en 1 caja mediana	50	50 fundas de glassine	50
051 - 205 0014-DPO-MA	*Riodinidae*	Mariposa	En sobres de papel, en 1 caja mediana	155	60 fundas de glassine	155
206 - 256 0014-DPO-MA	*Pieridae*	Mariposa	En sobres de papel, en 1 caja mediana	50	200 fundas de glassine	50
257 - 307 0014-DPO-MA	*Papilionidae*	Mariposa	En sobres de papel, en 1 caja mediana	50	50 fundas de glassine	50
308 - 1855 0014-DPO-MA	*Nymphalidae*	Mariposa	En sobres de papel, en 1 caja mediana	1550	500 fundas de glassine	1550
				1855	1840 fundas de glassine	**1855**

ESPECIFICACIONES: Estos especímenes no podrán ser utilizados como recurso genético, ni para actividades de bioprospección. Las muestras colectadas con su respectiva identificación deberán ser depositadas en el Museo Ecuatoriano de Ciencias Naturales, cuya certificación de entrega la hará llegar el Investigador o la Institución auspiciante a la Dirección Provincial del Ministerio del Ambiente en Orellana.

Se autoriza la exportación en base a la Autorización de Investigación Nro.0014-IC-FA-DPO-MA

Atentamente,

JAVIER VARGAS
DIRECTOR PROVINVIAL DE ORELLANA

MINISTERIO DEL AMBIENTE DIR. PROV. DE ORELLANA

SELLO DEL MINISTERIO DEL AMBIENTE

Toda adulteración al texto de este documento así como borrones o manchas anulan la presente autorización

Insurance

Comprehensive travel insurance was taken out through STA Travel before the expedition, which included cover for search and rescue and emergency medical evacuation costs. An additional premium was paid to cover trekking and hiking from 3000-3500m above sea level. Fortunately no claims needed to be made.

Risk management

Risk assessment retrospective

The comprehensive risk assessment written for the expedition covered all of the risks to the wellbeing of team members and served as a useful tool for briefing all team members at the start of the expedition. On the advice of the RGS (with IBG) Geographical Fieldwork Grants interview panel, a summary risk assessment was also produced to highlight the key risks to our personal safety, and the control measures taken to minimise those risks.

All of the events described in the Medical Report were covered by the risk assessment, which helped us to make operational decisions quickly on how to deal with them. One serious risk that was not included in the original risk assessment was the presence of anti-personnel landmines in the study sites in the Cordillera Napo-Galeras and Cordillera del Cóndor (Cóndor Mirador and Paquisha Alto). The team sought advice from local guides and the military as to which areas could be safely accessed, and there were clear signs demarcating danger zones. If there was any doubt as to the presence of mines in an area, it was avoided. It should be noted that the Sargeant at Destacamento Paquisha Alto informed us that we could explore the entire plateau as it was free from landmines, despite signs to the contrary in some areas. The expedition team did not feel comfortable exploring these areas, despite his assurances, and during our debrief at the headquarters outside Zamora the Colonel's Adjutant confirmed that some areas of the high plateau are indeed mined.

One area that was overlooked by the risk assessment was events that could impact our scientific research programme. These included inclement weather preventing fieldwork, as was the case at a number of sites and particularly at Paquisha Alto, and time lost due to mis-information and logistical problems, as occurred in Volcán Sumaco, Cordillera de Kutukú and Cordillera Shaimi (Puerto Yaupi). Failure to receive the required specimen export permits – which was a very real possibility given that multiple visits were made to different provincial offices of the Environment Ministry was another risk which would have significantly delayed the final identification of specimens.

Summary risk assessment

Hazard	Description	Severity	Likelihood	Severity x Likelihood
Trips & falls	Particularly when carrying heavy rucksacks along paths through thick vegetation or near steep cliffs and ridges. More likely after heavy rain or in the dark. Injuries could include sprained ankles, broken wrists and spinal injuries if falling from height.	3	2	6
Infected wounds & sores	In tropical conditions wounds or sores go septic very quickly. These injuries could originate from scratches and cuts, insect bites, splinters and thorns, blisters etc.	2	3	6
Wildlife & Tropical diseases	Mosquitos are of particular concern as they transmit malaria, dengue & yellow fevers. Other risks include ticks and leaches. Snakes, although rarely encountered in cloudforests, pose a serious risk.	3	2	6

Hazard	Control Measures	New severity	New likelihood	New severity x likelihood
Trips & falls	Wear suitable footwear at all times. Only carry day-packs where possible. Clear paths carefully with machete. Never walk alone outside camp. Always return to camp before nightfall or when heavy rain starts. Always walk in a calm and careful manner – always think of personal safety before chasing a butterfly! Each fieldwork team will be accompanied by a trained medic who can offer first aid and decide whether to evacuate in the event of a serious injury.	2	1	2
Infected wounds & sores	Avoid touching plants – some have poisonous spines. Look after one's feet – keep clean and dry. Report any wounds or sores, no matter how small, to a team medic for treatment and monitoring. Keep wounds covered to reduce likelihood of infection. Expedition has two trained medics and a fully-equipped first aid kit to treat injuries and prevent infection.	1	2	2
Wildlife & Tropical diseases	Bite avoidance is key to limiting impact of mosquito-borne diseases – wear loose-fitting, long clothing and apply mosquito repellent regularly. All team members advised to take malaria prophylaxis – although we will be based at around 2000+m we will also spend nights in towns in malarial zones. Dengue is most common in urban/peri-urban areas – bite avoidance is critical. All team members will be vaccinated against yellow fever. Likelihood of encountering snakes reduced by sticking to clear paths at all times and avoiding touching vegetation.	3	1	3

Comprehensive risk assessment

Category	Hazard	Risk	Control Measure
Health	Food poisoning	Serious illness.	Food to be properly cooked through, and washed in clean water. In the case of an expedition member feeling unwell, it will be immediately reported to the group leader. Medication to alleviate the symptoms of food poisoning
	Waterborne infections	Serious illness.	All water to be sterilised before being consumed, water purification tablets to be carried as well as medication to alleviate symptoms of waterborne infections.
	Secondary infection due to injury	Extremely severe illness / death.	Wounds to be cleaned and dressed by medically qualified expedition member and all injuries to be logged with expedition leader.
	Illness due to previous medical conditions	Severe illness/reaction, death.	All previous medical conditions to be disclosed before the expedition begins. An excess of relevant medication is to be carried at all times.
	Illness of any kind during the expedition (e.g.. Tropical diseases)	Risk from mild discomforting symptoms, through to severe illness or even death.	Participants required to be vaccinated against recommended diseases before arrival in country. Basic hygiene and all necessary precautions to be taken.
	Exhaustion	Confusion, inability to continue.	Walking at the speed of the slowest member of the team, be tolerant of said speed, and encourage fitness training before the expedition begins.
	Dehydration	Confusion / fatigue / death.	Each team member to carry a supply of water adequate for the proposed amount of time to be spent away from camp. Purification tablets and rehydration salts also to be carried for use in an emergency.
	Allergic reaction (including reactions to plant and insect stings)	Irritation / severe discomfort / anaphylactic shock / death.	Carry antihistamine cream for relief of irritation. In the case of respiratory failure, rescue breathing should be administered by a trained team member.
Fieldwork	Getting lost	Death.	Never walk out into the jungle alone, always go in a group. Always carry a GPS and compass. Leave markers, such as small pieces of brightly coloured plastic tied to trees, to aid finding your way back on the return journey. Always return to camp well before dusk.
	Falling down cliffs/mountains	Serious injury / death.	Walk carefully, paying attention to surroundings. Do not walk along the edge of cliffs. In the case of a fall, the other team members should not attempt to rescue the fallen team member until the area has been assessed and it has been decided that it is safe to do so.
	Wildlife (including insects)	Bites, stings (poisonous or otherwise) / serious injury / death.	Basic training will be provided on how to walk though the jungle (i.e.. Do not steady yourself with your hands as you walk, step onto and then off fallen logs, not directly over them.) Food in camp must be stored in sealed containers so as not to attract wildlife, and waste disposed of at a sensible distance from the camp. Insect repellent should be used at all times. In the case of someone being bitten, medical attention should be provided by the trained expedition members, and the injured person evacuated from the field if deemed necessary.
	Falling/tripping	Serious injury.	Walk carefully, paying attention to surroundings. In the case of a fall, the other team members should not attempt to rescue the fallen team member until the area has been assessed and it has been decided that it is safe to do so.
	Cutting oneself with a machete	Serious injury, potentially leading to secondary infections.	Machete training will be provided.
	Effects of the sun	Sunburn / sunstroke / heat stroke / heat exhaustion / death.	Use a high factor sunscreen and sunglasses when in direct sunlight. When resting, rest in the shade, and make sure there are regular breaks to avoid over exhaustion.

Category	Hazard	Risk	Control Measure
Fieldwork	Running out of water	Dehydration / death.	Each team member to carry a supply of water adequate for the proposed amount of time to be spent away from camp. Purification tablets and rehydration salts also to be carried for use in an emergency.
	Running out of food	Death.	A record of how much food there is left will always be kept. In the event of supplies running dangerously low, the team will be evacuated from the field, and any further work at that site aborted until supplies can be purchased.
Travel	Aeroplane accident	Death.	Follow safety procedures outlined by airline staff.
	Aeroplane delay	Late arrival or departure, resulting in missing connecting flights.	Insurance that covers such delays. When initially organising the flights, ensure that there is a feasible time margin between connections.
	Road travel	Crashes / hijacking / serious injury / death.	Use respectable bus companies and carry sufficient supplies in case of breaking down. Record the bus company and number when boarding in case it is later needed to recover lost possessions.
	River travel	Crashes / drowning / being stranded / serious injury / death.	Expedition leader should be happy that vessel is river worthy. Life jackets should be worn.
Politics & Crime	Political climate	Military coup / coup d'état / protests or strikes / war.	Check with British Embassy before departure in order to be aware of any potential issues.
	Theft/Mugging	Loss of passports, money credit cards etc. Risk of injury.	When in towns or on public transport, all valuables and money should be stowed out of sight. Staying in a group will also help reduce the risks. In the event of a theft or mugging give the thief what they want, do not try any
	Rape/Attack	Serious injury / psychological trauma / pregnancy / death.	Avoid risky situations, do not drink alcohol to excess, and stay in a group. In the event of a rape or attack, the local police should be directly notified and all necessary support and care offered to the victim.
	Drug use	Legal action / serious illness / death.	Do not carry any drug apart from those for medical use. If you are offered anything at any time, notify the expedition leader, and refuse the offer. In the event that a team member is found to be taking illegal substances, they will face immediate dismissal from the expedition.
	Attitudes to foreigners	Belief that all foreigners are rich / harassment /	Be mindful of local customs and traditions so as not to cause offence. Act in a sensible, responsible manner. In high risk areas, remember to always stay in a group.
Environment	Volcanic Eruption	Evacuation / serious injury / death.	Listen to local and national warnings about possible eruptions. Evacuate the area as quickly as possible.
	Major earthquake	Evacuation / serious injury / death.	Evacuate the area as quickly as possible. Listen to both local and national advice on follow up measures.
	Extreme weather	Evacuation / being stranded in the field / serious injury / death.	Swift evacuation, if necessary. Listen to forecasts and both local and national advice.
	Heavy rainfall	Increased likelihood of falling branches, trees or other debris in the canopy. Injury / death.	Do not walk in the forest during heavy rainfall. If already in the field, return to camp.
Accommodation	Fire	Setting fire to the tent / smoke inhalation / serious injury / loss of	Never leave cooking unattended. Take care to cook in a clear, uncluttered environment
	Strong Winds	Loss of equipment or specimens.	Make sure tents are anchored to something so that they cannot blow away.
	Heavy rainfall	Mudslides / loss of tent / destruction of equipment / serious injury.	Don't set up camp in a place that looks likely to be inundated with mud in the event of heavy rainfall. In the event of a mudslide and subsequent loss of equipment, evacuation may be necessary.

Crisis management plan

The Risk Assessment that we have completed is an identification of the hazards associated with this expedition that have the potential to cause harm to the team members. The advantages of having an effective crisis management plan have been well documented. The three main aims of the plan, according to the RGS handbook, are as follows:

1. To prevent the crisis from happening in the first place by having appropriate preventative measures put in place.
2. To aid recognition of a 'crisis in the making', thus hopefully making it preventable.
3. To have a plan that can be effectively implemented in the case of a crisis actually occurring.

Preventative Measures

By having identified possible hazards and by having previously thought out, and put into place, measures that will aid crisis prevention, we can significantly reduce the risk of a crisis happening. For this reason, it is fair to assume that it is much more likely that a crisis, should it occur, will have come from a previously unidentified hazard. As such, the Risk Assessment and Crisis Management Plan will be reviewed on a regular basis throughout the expedition and amended to include any newly identified hazards. All team members will be required to read both the Risk Assessment and Crisis Management Plan, and will be given appropriate training, such as how to use a machete, how to walk through the jungle in a safe manner, how to sterilise water and prepare food hygienically, the correct usage of equipment and how to minimise theft in high risk areas. The risks posed by external factors, such as weather conditions, are much harder to control, but by careful observation of relevant information from a number of sources, both local and national, we will minimise the threat posed by these hazards.

Recognising a Crisis

Familiarity of the Risk Assessment and Crisis Management Plan are central in the recognition of a crisis. Because of this, all team members will be required to familiarise themselves with both of these documents, and as such will be in a position to recognise the potential hazards involved in all activities, and therefore take necessary steps in order to prevent the crisis from developing further, or reduce the risk caused by the hazard. As previously stated, the Risk Assessment and Crisis Management Plan will be continually under review, and the team will be notified of any additions or revisions on a regular basis.

Handling a Crisis Effectively – Crisis Management Implementation

In order to deal with a crisis effectively, the group involved must have the skills necessary to deal with the hazards associated with the expedition. For this reason, it will be necessary for at least one person with First Aid training or Wilderness Medical training to be present in each group. Fully stocked first aid kits must also be carried at all times, and replenished during each visit to a town. The first aid kits will be used to treat any minor injuries encountered in the field, under guidance of the First Aid and Wilderness Medical courses. Mobile phones will be carried by the groups, although it is likely that we will be out of signal coverage for significant periods of time, and as such we will assume that for the purposes of preparing for a worst case scenario, that the phones will not be useful.

If a crisis should develop, then the following four steps will be followed in order to resolve the situation:

1. Treatment of Injuries in the Field.

If an injury occurs in the field then the team member that has been trained in First Aid and Wilderness Medicine will be the one responsible for administering medical treatment. All broken skin injuries will be cleaned carefully and antiseptic cream or iodine solution applied before the wound is dressed with sterilised dressings. If the injury in question is serious then the casualty will be evacuated from the field to the nearest medical centre.

2. Evacuation of Casualty to Medical Care.

If the casualty is mobile then they can be escorted back to the camp and from there to the nearest village, which will be the first step in the evacuation procedure. From the village, the casualty can then be transported to the nearest hospital. Since this will be situated some hours away, it will be necessary for a team member trained in either first aid or wilderness medicine to accompany the casualty in order to administer any ongoing treatment that is required, and to liaise with medical staff at the hospital. If the casualty is not mobile then it may be necessary to stretcher them back to the camp and from there on to the nearest village. If this is necessary, then the local guide with us will be sent on as a runner in order to alert the village of the predicament and to bring help. If more immediate hospital treatment is required then air rescue is an option. This would require a runner to go to the nearest point of mobile signal coverage, or more likely the nearest village, to arrange the airlift and provide details of the location of the casualty. Once the casualty has been transported to hospital, then their family will be notified and, if necessary, transfer back to the UK for further treatment will be arranged. All injuries, however minor, will be recorded, with a brief description of the treatment administered, in an accident book.

3. Communication.

Whilst in the field, it is likely that mobile phone signal coverage will be non-existent for the majority of the time. Contact will be maintained with international contacts by e-mail at every available opportunity, which will be upon arrival in towns during transfer from site to site. If it is necessary to contact families directly, then this will be possible, either by mobile phone in the case of signal coverage, or by using public telephone kiosks which are found in most small towns. In the event of a family crisis back home, the family will attempt to communicate with the expedition members in the field by mobile phone, failing which an e-mail will be sent so that the expedition members are aware of the situation as soon as they return to civilization and can ring the family concerned.

Travel insurance that will be taken out which will include cover for emergency airlift, repatriation and medical care. The insurance company will also be contactable from towns in the case of emergency. The local country contact will also be helpful for notifying the relevant local authorities in the event of a crisis and helping to arrange the details of an evacuation, if required.

4. Revision of Expedition Due to Crisis.

There will be a total of three UK nationals working on the expedition, accompanied by local collaborators and guides. In the event of the worst case scenario with one of the expedition members having to be evacuated, it would be possible to continue the expedition with only two members. If one of the expedition medical officers is evacuated all subsequent fieldwork would be done in a single group so that there is always a trained medical officer present. In the case of a hazard that threatens the safety of fieldwork in general, then it will be necessary to reassess the situation in order to minimise the risks, or potentially abandon the expedition.

If a crisis does occur, the team will review the situation immediately, and a written report will be filed for inclusion in the Expedition Report. If it is the expedition leader that has to be evacuated then the second group leader will take charge of the expedition. If necessary, the Risk Assessment will be reviewed in order to categorise the risk involved in continuing the expedition. If the risk is too high, then data and specimen collection in that particular area will have to be abandoned completely.

If the expedition as a whole has to be evacuated, for example due to political instability, then advice will be sought from the British Embassy in Quito, and contact with that organisation will be maintained so that continued advice may be received and followed. The expedition will register with the British Embassy on arrival in the country, using the online LOCATE service, so that embassy staff are aware of our itinerary and able to contact us in the event of a situation developing that requires the evacuation of British nationals from Ecuador.

Medical Umbrella

Two of the three British expedition members will be trained medical officers and will have completed a Wilderness Medical Training course prior to departure. Prior to embarkation, and again in the field, all expedition members will have a briefing outlining the dangers of the field and reminding them of the procedures put in place both to minimise and to deal with these dangers. The distance to the nearest hospital will vary with the site at which we are working, but it will not be less than a couple of hours away from the nearest village, by bus. For this reason, care in the field is particularly important and it will not be possible to receive immediate professional medical attention. Also for this reason, it is recommended that all expedition members receive a rabies vaccination, in addition to all the other standard vaccinations, in order to reduce the risks associated with a long journey to the nearest hospital in the case of being bitten by a wild animal. If necessary, it will also be possible to arrange transport of casualties to either Quito, or even back to the UK. Travel insurance will be bought to cover this. Each team member will carry a small personal medical kit and people with previous medical conditions will carry a surplus of medicine with them for the expedition.

Equipment Failure

The piece of scientific equipment most likely to fail during the course of the expedition is the entomological nets. These are prone to breaking at the joint between the pole and net ring, as well as the fabric of the net bag ripping. The expedition leader has experience of mending entomological nets and the team will carry supplies of rubber, glue, tape and twine for temporary field repairs should they become necessary. Sewing kits will also be carried for stitching any tears in the fabric. We will pass through major towns roughly once every fortnight, where skilled metalworkers can usually be found to make impromptu repairs to nets. In the case of a GPS device failure the group without a working unit would record careful site descriptions for any specimens collected and then return the following day to correlate these with GPS coordinates and altitude. This is unlikely as the units will be new, having been bought specifically for the expedition.

Communication Protocol

Without mobile phone coverage:

Casualty
|
Group Medical Officer
|
Group Leader
| |
Local guide (runner to nearest village) Expedition leader
|
Host country contact
| |
Local emergency services/ military evacuation team Home officer

With mobile phone coverage:

Casualty
|
Group Medical Officer
|
Group Leader
| |
Host country contact Expedition leader
| |
Local emergency services/ military evacuation team Home officer