

An Assessment of the Avifauna Associated with the Remnant Forest Patches on the Polillo Islands and a Review of the Threats posed

Susan Walker, 16 Marlborough Ave, Torquay, Devon.TQ1 1TT suwalker@hotmail.com

ABSTRACT

Formal survey work between the months of July and December, 2001 was conducted in remnant forest patches on the Polillo Islands. Further observations were made between March and May 2002. Avian inventories were produced and the analysis focused particularly on the island-endemic, globally threatened and forest-indicator species. All seven island subspecies (six observed directly) and seven internationally recognised threatened birds were reported. The critically endangered Philippine Cockatoo, *Cacatua haematuropygia* was sighted on Patnanungan Island and the near-threatened endemic Blue-naped Parrot, *Tanygnathus lucionensis hybridus* was observed in Patnanungan and Panukulan, with the latter site supporting a breeding pair (May 2002). Species with distributions more widespread than previously thought include the Philippine Forest Kingfisher, *Ceyx melanurus* and the Polillo-endemic Philippine Trogon, *Harpactes ardens minor*. In addition to the primary old growth forest of Sibulan watershed reserve, these species were also found in more disturbed patches of logged primary forest. The pressures imposed by deforestation are exacerbated by direct persecution. The Luzon Bleeding Heart, *Gallicolumba luzonica* and the Colassisi, *Loriculus philippensis* are among the more commonly caught birds. A small hunting network is still prevalent.

BACKGROUND

The history of avian surveys on Polillo dates back to McGregor and Manuel in 1910 and 1956, respectively and more recently the surveys by Gonzalez in 1996 and Hilario and Walker in 1999 (McGregor, 1910; Manuel, 1957; Gonzalez, 1997; Walker and Hilario, 2000). The latter focussed specifically on the 200 hectare protected Sibulan Watershed Reserve whereas that of Gonzalez (1996) extended outside this reserve and to the islands of Patnanungan and Jomalig. The field sites for this current survey were dictated by the distribution of forest patches within the Polillo Islands - the main exception to this being the surveys on Jomalig Island, wherein a breeding population of the Philippine Duck, *Anas luzonica*, resides.

Aims:

- To produce an inventory of avifaunal communities in selected forest patches.
- To determine the distribution of threatened, endemic and forest indicator/specialist species and where feasible provide microhabitat information.
- To identify current threats to the islands' avifauna

Subsidiary aims:

- To produce a library of bird calls
- To facilitate the re-assessment of taxonomic boundaries, through morphological, acoustic and photographic data.
- To produce a list of local names (appendix 5)
- To document the arrival of migrants

Conservation and Taxonomical Status of Birds on the Polillo Islands

The Polillo Islands are classified as an Important Bird Area ¹(*PH021*) and fall within the Luzon Endemic Bird Area². The islands host one critically endangered, one endangered, two vulnerable and six near-threatened species (Collar *et al* 1999, Table 1). The seven endemic island

¹ Important Bird Areas represent a network of sites critical for the long-term viability of a range of species where a site-based approach is appropriate. Four categories are used to select Important Bird Areas: 1. Globally Threatened Species; 2. Restricted Range Species; 3. Biome-restricted Species; 4. Congregations. The respective criteria corresponding to these categories are 1: 'The site regularly holds significant numbers of globally threatened species or other species of global conservation importance.' 2. 'The site is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area or Secondary Area'. 3. 'The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.' 4. 'Those species that are vulnerable as a consequence of their congregatory behaviour at regularly used sites, either as breeding colonies or during the non-breeding season, including foraging, roosting or migratory stop-over sites' (Birdlife International).

²Endemic Bird Areas (EBAs) have two or more species of restricted range (breeding range < 50,000km²), whose breeding ranges overlap within the boundaries of this area (ICBP 1992). A Secondary Area supports one or more restricted-range species, but does not qualify as an EBA because, usually, only one species is entirely confined.

shown in table 2. The Blue-backed parrot is not a species⁵ recognised as internationally threatened though the subspecies endemic to the Polillo Islands is notably rare; in contrast to many other species that have undergone a recent dramatic decline on the Polillos, the scarcity of this species was also reported at the turn of the 20th century (McGregor, 1910). Six Restricted Range Species⁴ are found in the Polillos: Luzon Bleeding Heart, *Gallicolumba luzonica*; Cream-bellied Fruit-dove, *Ptilinopus merrilli*, Red-crested Malkoha, *Phaenicophaeus superciliosus*; Rufous Coucal, *Centropus unirufus*; Luzon Hornbill, *Penelopides manillae*; Short-crested Monarch, *Hypothymis helenae* (Mallari *et al.*, 2001).

Table 1: Red Data Book Listed Birds of the Polillo Islands - their Status, Distribution and Threats (based on Collar *et al.* 1999)

Species	Status	Distribution	Threats (past/present)
<i>Cacatua haematuropygia</i> , Philippine Cockatoo	Critically Endangered	Philippine endemic now confined to a few islands	Deforestation (inc. mangrove destruction), hunting for the pet-trade, persecution – as a pest feeding on rice and maize
<i>Ceyx melanurus</i> Philippine Forest Kingfisher	Vulnerable	Philippine endemic. Three subspecies inc. <i>C. m. melanurus</i> found only on Alabat, Luzon, Polillo + Catanduanes	A strict lowland forest specialist. Thus particularly sensitive to deforestation.
<i>Egretta eulophotes</i> Chinese Egret	Endangered	Formerly wide-ranging in East Asia. A winter visitor to the Philippines.	Persecution inc., hunting for plumes. Decline of breeding colonies due to infrastructural developments.
<i>Anas luzonica</i> Philippine Duck	Vulnerable	Philippine endemic	Hunting and trapping (primarily) + habitat loss (conversion of natural wetlands),
<i>Ptilinopus merrilli</i> Cream Bellied Fruit Dove	Near threatened	Luzon endemic: Sierra Madre, Polillo and Catanduanes	Habitat destruction (present mainly in primary and selectively logged forest up to 1100m), hunting. Ecological partitioning with other doves unknown
<i>Gallicolumba luzonica</i> Luzon Bleeding Heart	Near threatened	Near endemic to Luzon	Habitat destruction (lowland forest (<1400m), snaring (pet trade)
<i>Tanygnathus lucionensis</i> Blue-naped Parrot	Near threatened	Philippines, Talaud Islands, Indonesia, Malaysian islands off NE Borneo. Subspecies endemic to Polillo.	Hunting (pet trade) and habitat loss
<i>Centropus unirufus</i> Rufous Coucal	Near threatened	Luzon endemic, satellite populations on Polillo + Catanduanes	Destruction of lowland forest
<i>Hypothymis helenae</i> Short-crested Blue Monarch	Near threatened	Philippine endemic	Loss of habitat (forest below 1000m)
<i>Charadrius peronii</i> Malaysian Plover	Near threatened	Breeding resident along coasts in Peninsular Malaysia, Greater Sundas, Sulawesi and the Philippines	Human disturbance of breeding beaches

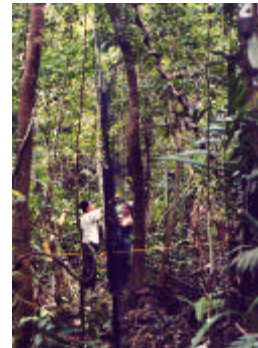


Table 2: Island Endemics and their Diagnostic Features

Subspecies	Criteria for Endemicity and notes from recent surveys
<i>Copsychus luzionensis parvimaculatus</i> , White-browed Shama	Shorter white tips on tail retrices (McGregor, 1910)
<i>Harpactes ardens minor</i> , Philippine Trogon	Darker red feathers and smaller wing (W) of 133cm rather than 145cm (Manuel, 1957).
<i>Penelopides manillae subnigra</i> , Tarictic Hornbill	Larger upperparts and green rather than brown glossed tail. (McGregor, 1910).
<i>Tanygnathus lucionensis hybridus</i> , Blue-naped Parrot	Larger, paler race with less blue on head (McGregor 1910)
<i>Tanygnathus sumatranus freeri</i> , Blue-backed Parrot	Lighter green crown, lighter blue back, a yellow collar on hind neck + larger dimensions (McGregor, 1910)
<i>Accipiter trivirgatus castroi</i> , Crested Goshawk	Dark blue back, darker more heavily barred under-parts + longer wing + tarsus (Manuel and Gilliard, 1952).
<i>Chrysocolaptes lucidus grandis</i> , Greater Flameback	Smaller white spots on crown, under-parts browner + larger (Hachisuka, 1930).

METHOD

Surveys were conducted between July and December 2001 at nine sites on the islands of Polillo, Patnanugan, Jomalig and Minasawa Island. With the exception of the latter two islands¹ the surveys were conducted within forest patches, wherein complementary faunal and tree surveys were conducted². Mist netting was used to detect more cryptic under-storey species. At each site three days of netting using 12m bird nets were conducted between dawn and dusk. Nets were sited at riparian/terrestrial and interior/edge habitats within each patch. Upon capture birds were measured, marked and photographed. Transects and observations from vantage points were conducted between the hours of 05:30-09:00 and 15:00-17:30 over the three days. Bird calls were recorded using a parabolic reflector and Marantz recorder. Copies of all recordings are stored at the British Library of Wildlife Sounds (BLOWS) and UPLB (appendix 4). The prevalence of hunting was assessed from primary sources and through discussions with residents.



RESULTS

A total of seventy-eight species were recorded from the thirteen forest patches (Appendix 1), with an additional fifteen records from the island of Jomalig; the latter records were not restricted to the forest. With the exception of *Tanygnathus sumatranus freeri*, the Blue-backed Parrot, all endemic subspecies were recorded from Polillo Island; only secondary evidence was obtained for this subspecies near Macnit. The critically endangered Philippine Cockatoo was observed on Patnanungan Island although a flock had apparently been sighted on Jomalig in March 2002. One vulnerable, four near threatened species and five restricted-range² species were recorded from Polillo Island. The distribution of island-endemic subspecies and threatened species is shown in table 3 and discussed below. Notable Records including those which are new for the islands, affirm historical records or pertain to migrant records are outlined in Box 1.

The calls of 40 bird species were recorded (appendix 4) and local names collated (appendix 5).

Netting Data (Appendices 2 and 3)

The greatest number (14) of species caught was at Sibulan Watershed Reserve with notable forest specialists including *H.ardens minor*, *C.melanurus* and *G. luzonica*. No species classified as nectivores/insectivores were netted at this site. The site had a relatively high diversity index of 2.417

¹ Jomalig Island, mainly comprised of grassland and marshes is renowned for its population of Philippine Duck, *Anas luzonica*. Minasawa is an uninhabited island covered in beach forest. An overnight visit was scheduled here.

² Site selection was based on the recommendations of the Polillo Ecology Stewardship Warden and additional explorations with the aim of, representing the main patches of forest on the islands - those most pristine and larger in extent, were given priority. Sites are described in greater detail in the mapping section of the main report.

combined with high equitability of species (0.916). The Czekanowski Similarity Index linked this site most closely to site JH; this site is within the closest proximity to Sibulan though far more disturbed. Sibulan was least similar to Jomalig (0.086) as expected from this largely deforested island with only small remnant patches of beach forest. The Fairy Bluebird, *Irena cyanogaster*, a species absent from the 1996 inventory of Gonzalez and recorded only from the north of Polillo island in 1999 was netted at both Sibulan and JH. The netting records from Patnanungan island were the second most similar to Sibulan however with the exception of *C.luzoniensis*, none of the captures included forest-specialist species. In addition to the capture of a pair of *C.lucidus* at Aluyon, a single bird was caught at Macnit. A more detailed description of netting sites is provided within the individual species accounts is discussed below.

Species Accounts for Island-endemic Sub-species and Globally-Threatened Species

Table 3: The Distribution of Threatened and Polillo-endemic (E) Species, based on 2001 surveys (CR=Critically Endangered, V=vulnerable, NT=Near-threatened, R=report from local resident)

SPECIES/SITE	SI	JH	ML	ALB	AN	AW	MC	KA	BS	AB	SA	JO	IN	PS
<i>Anas luzonica</i> Philippine Duck (V)			X		X		X		X			X		X
<i>Accipiter trivirgatus castroi</i> Crested Goshawk (E)							X							
<i>Gallinula luzonica</i> Luzon Bleeding Heart (NT)	X	N	X		X	X		X			X			
<i>Ptilinopus merrilli</i> Cream Bellied Fruit Dove (NT)	X													
<i>Cacatua haematuropygia</i> Philippine Cockatoo													X	X
<i>Tanygnathus lucionensis hybridus</i> Blue Naped Parrot (E, NT)										X				X
<i>Tanygnathus sumatranus freeri</i> Blue Backed Parrot (E)								R						
<i>Tanygnathus sp</i>							X				R			
<i>Centropus unirufus</i> Rufous Coucal (NT)	X	X	X	X	X	N	X			X				
<i>Harpectes ardens minor</i> Philippine Trogon (E)	N	X	X		X		X	X		X				
<i>Ceyx melanurus</i> Philippine Dwarf Kingfisher (V)	N	N	N		N			X	N					
<i>Penelopides manillae subnigra</i> Tarictic Hornbill (E)	X	X	X	X	X	N	X	X	X	X	X		X	
<i>Chrysocolaptes lucidus grandis</i> Greater Flameback (E)				N		X	X	N		X				
<i>Copsychus luzoniensis parvimaclulatus</i> White Browed Shama (E)	X	N	X	N	X	N	X	N	X	N	X	N	X	X

(X=presence documented; N=capture in mist nets; R=report from secondary evidence)

Sites: SI=Sibulan Watershed, JH=Jerry and Hilario, ML=Mt Malulod, ALB=nr. Aluyon (not community reserve), AN=Anibawan, AW=Aluyon watershed, MC=Macnit, KA=Kalubakis, BA=Balete Sapa, AB=Abaca, SA=Salapakan, JO=Jomalig IN=Inusukan, Patnanungan, PS=Patnanungan South. Complete surveys (inc. netting) were not conducted at ALW and SA)

Details on Birds from table 3:

***Ceyx melanurus*, the Philippine Forest Kingfisher (V)** was reported in five of the fifteen study sites. Sightings and netting records (table 4) confirmed that this species does not have an obligate association with watercourses (Collar et al., 1999), though does use the riparian habitat. In Sibulan an individual was observed taking shelter under a thin canopy of *Cyathea* (tree fern) adjacent to a stream.

Table 4: A description of positive netting sites for *Ceyx melanurus*.

Location	Netting Site
Kalubakis	Disturbed forest. Net bisecting and running perpendicular to small stream. Sandy substrate in valley bottom. <i>Dipterocarpus</i> sp. felled nearby.
Anibawan	(1) Ascending ridge ca. 20m from moderately flowing stream ca. 1m wide. Disturbed forest. (2) ca 10m higher up ridge
Jerry and Hilario	Traversing stream ca. 1m wide, fairly open canopy. (close to forest edge)
Malulod	Within 20m of fast-flowing stream ca. 1m wide. Net running up slope, perpendicular to flow of stream
Sibulan	(1) Primary forest within 10-20m of a stream. (2) as (1) but <i>Cyathea</i> (tree fern) abundant.

***Harpactes ardens minor*, The Philippine Trogon, (E)**

This species was recorded from seven of the study sites on Polillo Island including more disturbed/edge habitat. It was represented within all the main geographical areas surveyed in Polillo, thus revising previous documentation wherein it was reported as restricted to the old growth forest of Sibulan Watershed reserve (Gonzalez *et al.*, 1998). Its apparent absence from Jomalig and Patnanungan corresponds with the inventories of 1996 (Gonzalez 1997); the former is expected by the lack of forest on this Island. While thought to forage in dense areas of secondary forest this bird is typically associated with deep forests (Rabor 1977). Despite this, the 2001 survey reported Trogons on the edge of both primary and disturbed forest. A female Trogon was sighted approximately 10m away from a path bordering Sibulan Watershed. The individual was perched approximately 8 metres high on the edge of a small strip of trees with a notably open canopy. Following disturbance from passing people, the bird retreated into the main part of the reserve. A male Trogon in Sibulan watershed was caught on a ridge, approximately 10-20 metres from a 1-metre wide stream and over 100m from the forest edge. 95% of trees in the vicinity of this netting site had architecture typical of primary forests - branching concentrated above half the height of the tree (Bibby *et al.* 1998).

***Chrysoclaetes lucidus grandis*, the Greater Flameback (E)**

The Greater Flameback, a bird of primary and secondary forest (Dickenson *et al.* 1991), was recorded at four of the study sites on Polillo Island and caught at Aluyon and Macnit; the latter netting sites were set within a patch of forest bordered by a cleared hillside. At Macnit the birds frequented dead trees remaining on a deforested slope – holes evident. The species is thus more widespread on Polillo Island than previously thought – the 1998 stewardship report believed it to be restricted to the old growth forests of Polillo watershed reserve. (Gonzalez *et al.* 1998). No records were obtained from Patnanungan despite previous records here (Gonzalez 1996).

***Hypothymis helenae*, the Short-crested Blue-Monarch (NT)**

No records. The 1999 record of this uncommon resident of the forest understorey, was based upon a single encounter in Sibulan Watershed Reserve (Walker & Hilario, 1999).

The Luzon Bleeding heart, *Gallicolumba luzonica* (NT)

The Bleeding heart, is known from both primary and secondary forest (Kennedy *et al.*, 2000) yet was only recorded at six of the study sites. However, information from residents including hunters suggests that it is present at all the study sites on Polillo Island. It is a highly cryptic terrestrial insectivore and as such neither direct observations nor mist netting will adequately determine the presence/absence of this species - an inter-site comparison is not appropriate³. In reality, the distribution of this species is more likely to mirror that of the Shama's – a terrestrial insectivore relatively tolerant to disturbance. In accordance with the inventories of Gonzalez (1996), it was absent from both Patnanungan and Jomalig. Breeding Notes (03 May 2002)

A nest with an incubating bird was discovered within 50m of Sibulan Watershed Reserve, towards the bottom of a forested slope, approximately five metres away from a small sandy stream. The nest, composed of flat-bedded leaves and twigs was constructed around the midrib of a rattan frond, approximately four metres from the forest floor. Dickenson *et al.*, (1991) and Kennedy *et al.*, (2000) identify May as the month during which it breeds.



***Ptilinopus merrilli*, the Cream-bellied Fruit-Dove (NT)**

This shy species associated with virgin dipterocarp forest or late second growth (Kennedy *et al.* 2000), was observed only on the edge of Sibulan Watershed Reserve (10/09/01), feeding in a fruiting Balete tree. The species was recorded in both Patnanungan and Polillo Island in 1996.

³ Attempts to make netting and observer results suitable for comparative analyses were unavoidably haltered by:

- Seasonal variations and weather eg.(1) Macnit –severe winds resulting from the passing of a typhoon; (2) The arrival of migrants
- Presence/absence of fruiting trees eg. Vantage point near Aluyon; the fruiting balete tree near Sibulan Watershed reserve
- Accessibility and logistics – routes were often dictated by streams thus biasing the riparian habitat and it's associated avifauna. At sites where it was preferable to use a vantage point rather than ground transects, inevitable biases arose concerning the probability of detecting under-storey species. At Macnit the riparian habitat failed to be represented due to its relative inaccessibility.
- Species-specific behaviour eg. Cryptic ground dwelling birds easily overlooked.

Combined, these factors undermine direct inter-site comparisons that place undue weight to absences.

***Penelopides manillae subnigra*, the Polillo Tarictic Hornbill (E)**

The Tarictic hornbill was present at all study sites, aside from Jomalig. Typically seen in small aggregations though ten were seen together both near Aluyon and on the edge of Sibulan Watershed wherein there was a high density of fruiting trees and a fruiting balete, respectively. Nesting excavations were discovered in Sibulan Watershed and what appeared to be sealed entrances (thus indicative of an occupied nest) was seen near Abaca. One male was caught in the mist nets at Anibawan and two pet juveniles seen near Mount Malulod.

***Tanygnathus sumatranus freeri*, the Blue-backed Parrot ('Kagit') (E)**

This forest resident is considered rare in the Philippines, though more common in the Sulus (Dickinson et al 1991). The species does not qualify for globally threatened status (Collar et al 2000). Unlike many other species on Polillo its current status of scarcity on the islands may be little different to that at the turn of the twentieth century. Indeed, in McGregor's expedition (1910), the species, then known as *T. everetti* was recorded only after the October typhoons, whereas *Tanygnathus lucionensis* was considered abundant. Recently a local resident reported six individuals in a small rice paddy bordering the forest at the Macnit study site. The timing of the sighting (early November) corresponded to the ripening of grain. The species was recorded as *T. sumatranus* due to the white bill, a diagnostic feature of female *T. sumatranus*. Parrots were reported to frequent the area fairly regularly though it was not confirmed as to whether *Tanygnathus hybridus* was included in these sightings. A silhouetted *Tanygnathus* sp. was viewed during our visit to this site.

Blue-naped parrot, *Tanygnathus lucionensis hybridus* ('Kagit') (E, NT)

A nest of this rarely seen endemic Polillo subspecies was in the municipality of Panukulan (9 May 02). The nesting cavity was in an emergent 'Tugaway'/'Lameyo' tree approximately 50-60m high. A flock of five were seen and heard calling on approaching the site and two were seen copulating near the tree with the cavities. The tree had four cavities including one active 'kagit' nest, at least 30 metres high and one active Coletto nest (*Sarcops calvus*). Kagits were seen entering and leaving the nest on numerous occasions and at one stage two birds left the cavity sequentially. A flock of five 'kagits' were also seen at Abaca (30 Nov 01 6:30am), initially preening in a tree emerging from a ridge of logged primary forest and then calling in flight. At Patnanungan South an individual was observed - flying through the understorey of logged primary forest, that bordered an area of rice paddies. Polillo residents also reported parrots from 'Malu' in Polillo municipality.



***Cacatua haematuropygia*, the Philippine Cockatoo ('Kalangay') (CE)**

Internationally recognised as Critically Endangered, the Philippine Cockatoo is thought to have undergone a decline of at least 80% over the last 10 years or three generations (Collar et al 1999). Further, there are believed to be fewer than 250 mature individuals remaining and its continuing rate of decline is estimated to be at least 25% per generation. The population structure of *C. haematuropygia*, is so severely fragmented that no subpopulation is believed to contain more than 50 mature birds.

On Polillo it is locally known as the 'Kalangay' and was once so abundant that it was considered a rice pest. Indeed, in 1909 McGregor described a roosting flock of several hundred birds. However, within a hunter's lifetime, the population has plummeted dramatically and today sightings are essentially confined to Patnanungan Island. Persecution was certainly ripe in the past especially during the period of logging concessions in the 1950s-70s, wherein loggers supplemented their income by catching birds. They were either caught as nestlings or by using sticky 'Antipolo' sap. Some residents also believe that a severe typhoon in the 1970s was also responsible for the decline of the cockatoo. When the cockatoo was abundant prices per bird reached about 5 pesos (June 2002, 50 pesos = 1 US \$). More recent figures are in the region of 1000-3000 pesos, with a staggering 12,000 pesos being asked for in Arangke, Manila (A. Pulumbarit pers. comm., 2001). This latter figure approaches the 1995 average annual household income of some barangays (AHI/B) within the Polillo Islands (eg. in the municipality of Panukulan the lowest AHI/B in 1995 was 14,219 pesos) (Panukulan municipality report, 1995).

Even today hunting has not been entirely eliminated. This threat is most serious considering the tiny population remaining, the lack of large trees for breeding, the inherent low rate of reproduction and perhaps most crucially their open vulnerability to hunters. If the threat of hunting could be eliminated, there is, arguably the potential for translocation. However, foremost is the need to establish protection

measures for both the identified forest sites and nearby areas of mangroves. There is also the need to reassess the taxonomic status of the ‘Kalangay’, formerly recognised as a Polillo subspecies, *Kakatoe haematuropygia mcgregori* (Hachisuka, 1930) until synonymized by Dickinson *et al.* in 1991.

Psittacidae site reports may be obtained on request from Susan Walker - suwalker@hotmail.com

***Copsychus luzoniensis parvimaclatus*, the Polillo White-browed Shama (E)** was, with the exception of Jomalig Island, present at all study sites. This ground-dwelling, insectivorous forest resident inhabits both pristine and more disturbed areas of forest. It was commonly encountered towards forest edge. Akin to previous surveys (eg. Gonzalez, 1996) it was found to be absent from the predominantly deforested island of Jomalig.

A morphological review of *Copsychus luzoniensis parvimaclatus*, the White-browed Shama (historically known as *Kittacincla luzoniensis*, McGregor, 1910)

The sub-species of Shama on Polillo characteristically have shorter white terminal tips on the tail retrices (McGregor, 1910, table 3). The justification for this status has been confirmed in the 2001 surveys (table 3) (1-sample t-test, testing for any difference in means between *Copsychus luzoniensis parvimaclatus* and *Kittacincla luzoniensis* (highly significant, p=0.00). Further, these latest measurements for the tips on retrice one are significantly less than those recorded by McGregor, 1910 (1-sample t-test for difference in means, p=0.00). In the current sample of 28 birds, all individuals had well-developed tips on retrices 1 and 2, 50% had tips on retrice 3 and one individual had a tip on retrice 4. An additional individual had a rufous tip of 0.7mm on retrice 3. On average there was a tip of approximately 4.0mm on retrice one and 4-5mm on retrice 2.



Table 3: Length of white tips on tail retrices (R) (mm) in *Kittacincla parvimaclata* (the Polillo sub-species) and *Kittacincla luzoniensis*, according to McGregor, 1910, together with measurements of *Copsychus luzoniensis parvimaclatus* from 2001.

Measurements: IS=mean measurement for the extent of the white tip on the inner side of vane (mm 2dp); OS=extent of white tip on outer side of vane; se=standard error, n=sample size; R1=outermost retrice; R4=innermost retrice)

	R1	R2	R3	R4
<i>Kittacincla parvimaclata</i>	7-8	Approx 7	Trace/absent	Absent
<i>Kittacincla luzoniensis</i>	13	13	Well developed	Usually well developed
<i>Copsychus luzoniensis parvimaclatus</i> (2001)	IS=3.93, se=0.20; OS=4.39, se=0.24, n=28	IS=4.72, se=0.24; OS=4.53, se=0.28; n=28	IS=2.37, se=0.24; OS=4.53; se=0.28; n=14	IS=OS=0.5; n=1

Recommendation: A test of significance, using a larger population size, should be conducted against an equivalent population on mainland Luzon and sex-based differences should be assessed.

Non-forest Species – *Anas luzonica*, the Philippine Duck, (VU)

Anas luzonica, locally known as the ‘Papan’, was recorded close to Sibulan watershed reserve, Balete Sappa, in an area of mangroves near Mabini, Macnit, Anibawan, Patnanugan and Jomalig. Apart from Jomalig, sightings typically consisted of a pair. Jomalig is renowned for its breeding population of *Anas luzonica*, with numbers estimated at 3000 (Gonzalez, J.C.T., 1997). Surveys found a maximum of 50 individuals at one time though due to long grass this is likely an underestimate.

Recent television coverage of the ‘Papan’ has generated enthusiasm for its protection however it continues to be perceived as a pest of the rice paddies and nestlings are taken from the wild. In Jomalig, attention was drawn to the need for effective anti-depredatory devices.

Breeding: *A. luzonica* is reported to breed throughout the year (Collar *et al* 1999). Captured nestlings around four weeks old were recorded on Jomalig Island between the 18th and 21st of September.

Taxonomic Review of Subspecies

Morphological information regarding subspecies is outlined in table 4.

Table 4: Island Endemics and their Diagnostic Features with additional notes from recent measurements

Subspecies	Criteria for Endemicity and notes from recent surveys
<i>Copsychus luzionensis parvimaculatus</i> , White-browed Shama	Shorter white tips on tail retrices (McGregor, 1910) – confirmed in 2001 (see above)
<i>Harpactes ardens minor</i> , Philippine Trogon	Darker red feathers and smaller wing (W) of 133cm rather than 145cm (Manuel, 1957). 2001- W (male) =133cm
<i>Penelopides manillae subnigra</i> , Tarctic Hornbill	Larger upperparts and green rather than brown glossed tail. (McGregor, 1910). 2001: W (male)=260mm, thus corresponding to that reported by McGregor (1910) and being larger than that of <i>manillae</i> , to which it is considered most similar ¹ (McGregor, 1910). The adult male had a cream band on retrices 1-3, a buff-rufus band on retrices 4 and 5 and a darker chestnut-rufus band on retrice 5. Two juvenile males had wing-lengths of 255mm and 264mm with whitish rather than the darker rufus retrice bands of the adult. An additional, small white-pale rufus sub-terminal band was present on retrice four.
<i>Chrysocolaptes lucidus grandis</i> , Greater Flameback	Smaller white spots on crown, under-parts browner + larger. W of 154-156, compared to 142-145 for the Luzon race, <i>C.lucidus haematribon</i> (Hachisuka, 1930). 2001 - two males with W of 151mm and female with W of 142mm.

¹ A sub-terminal rufous-white band on black tail retrices unites the Polillo subspecies and *manillae*.

Box 1: Notable Records during Survey Period, including New Records, Affirmation of Historical Records, and Migrant Records

Affirmation of Historical Records

Muscicapa griseistrica, the Grey-Streaked Flycatcher, a migrant species last recorded in 1910 (McGregor) was observed in both Patnanungan and Jomalig (2001).

Actitis hypoleucos, the Common Sandpiper last recorded in 1910 (McGregor) was recorded from Jomalig Island.

Hirundo rustica, the Barn Swallow a migrant last listed in the surveys of McGregor, 1910, was recorded on Jomalig.

Alcedo atthis, the Common Kingfisher, a migrant species that was recorded from Jomalig Island. Only previously reported in 1910 (McGregor).

Halcyon capensis, the Stork-billed kingfisher – previously recorded in 1956 (Manuel).

This species was reported by team members near an inland river between Sibulan watershed reserve and the Barangay of Pinaglubayan. The Ecology Warden has sighted it previously in this area. It is notable that this species is more commonly considered a coastal species, often associated with mangroves (Collar et al., 2000), though may sometimes be found along large inland rivers (Dickenson *et al.*, 1991).

Gallirallus cinerea, the Watercock –previously recorded in 1956 by Manuel. Seen and heard on Jomalig Island in April 2002.

Affirmation of more recent Records

Himantopus himantopus, the Black-winged Stilt, seen on Jomalig and previously recorded by Gonzalez (2000).

Ardea purpea, the Purple Heron, recorded from Jomalig and Patnanungan – previously recorded from 1999 (Walker and Hilario) and 2000 (Gonzalez) surveys.

New Records

Ixobrychus cinnamomeus, the Cinnamon Bittern was recorded in a rice paddy near Sibulan Watershed Reserve. A nest with two nestlings was discovered on the 8 August; the nest largely concealed by undergrowth was composed of a small number of overlapping twigs.

Cuculus saturatus, Oriental Cuckoo, Jomalig Island

Sula leucogaster, the Brown Boobie. This species had been caught in fishing nets off the north west coast of Polillo in November and was being held captive in Polillo town.

Streptopelia tranquebarica, the Red turtle Dove, recorded from Polillo, Jomalig and Patnanungan.

Migrant Records

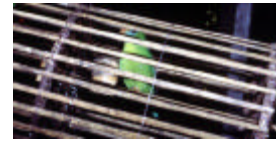
The timing of the surveys saw the arrival of migrants that reaffirmed historical records (see above). A notably early arrival was *Muscicapa griseistrica*, the Grey-Streaked Flycatcher on the 20 September; it is typically recorded in the Philippines between the 30 September and the 7 June (Kennedy *et al.*, 2000). The Brown Shrike, *Lanius cristatus* is recorded in the Philippines every month but more usually from mid-September to late May; the first record from Polillo was on the 23 August. Flocks of hawks, thought to be Chinese Goshawks were reported over Patnanungan between the 23 and 25 September; this species typically recorded in the Philippines between August and 29 May would constitute a new record for the Polillo Islands.

A Notable Record - *Irena cyanogaster*

The frugivorous Philippine Fairy Bluebird, reputed to be a relatively common bird of the forest and forest edge (Dickinson *et al.* 1991) was observed in the Sibulan Watershed reserve and the nearby forest patch of 'Jerry and Hilario'. This distribution contrasts with that of 1999 wherein it was observed only in the north of the island, on a forest fringe near Panukulan. This species was absent from the 1996 surveys though was recorded in the inventories of 1910 and 1956.

Persecuted Birds and The Pet Trade

Today the rewards of the hunter feature mainly: *Gallicolumba luzonica*, the Luzon Bleeding Heart (near-threatened), *Chalcophaps indica* the Green-winged Emerald Dove, *Ducula aenea*, the Green-Imperial Pigeon and *Loriculus philippensis*, the Philippine Hanging-Parrot (Colasisi); the latter is a particularly popular pet on the island. Sales of these birds on the island typically fetch 50 pesos (June 2002, 50 pesos = 1 US \$) each. A hunter was reported with Colasisi from either within or close to Sibulan Watershed Reserve during the study period.



A small hunting network appears to exist with a middleman taking birds to Manila. On Polillo island the shipping of birds seems to be more prevalent in the more remote northern stretches eg. Anibawan; the municipality of Polillo in the South has passed a bylaw against hunting, thus rebuking such an activity.

Captured birds seen on the island, aside from those mentioned above include:

- *Penelopides manillae subnigra*, the Tarictic Hornbill – 2 males, reported to be 3.5 months old that had been extracted from a nest in a ‘Mamaho’ tree.
- *Cacatua haematuropygia*, the Philippine Cockatoo - an individual at Patnanungan North. See species account (appendix 5) for details about persecution.
- *Haliaeetus leucogaster*, the White-bellied Sea-Eagle –2 juveniles seen on Patnanungan Island; apparently imported from mainland Luzon (2001). 2002-juvenile tethered at Inusukan (locally caught) and two caught from Sibulan watershed.
- *Accipiter trivirgatus*, the Crested Goshawk-seen in Jomalig though apparently originally from Burdeos.
- *Anas luzonica*, the Philippine Duck – ducklings on Jomalig Island
- *Dendrocygna arcuata*, the Whistling Duck – ducklings on Jomalig Island
- *Gallus gallus*, the Junglefowl, on Polillo Island
- *Nycticorax caledonicus*, the Rufous Night Heron – tethered juvenile

Eggs of *Megapodius cumingii*, the Tabon Scrubfowl were reported to be collected on Jomalig Island. Apparently it is forbidden to sell though not forbidden to collect the eggs. According to the our guide on Jomalig, nesting typically occurs between April and June; a single egg is laid daily until a final clutch size of ten is reached. The nesting area observed was in a strip of fine sand bordered on the seaward side by pandans and by a mixture of scrub and coconuts on the landward side; four females were reported to have occupied this site.

DISCUSSION

The assemblage of birds on the Polillo Islands is remarkable considering the current status of the lowland forest and the past level of persecution. The forest is highly fragmented and is estimated to represent less than 16% of the total land area (2001-2002 research). Nevertheless highly specialist forest species are represented in both pristine and more disturbed patches of forest to the extent that it is difficult to identify species suitable as being indicators of undisturbed forest.

A classification of forest-dependent species

We can crudely classify forest dependent species into three categories:

A) Forest Indicator Species which are relatively sedentary, intolerant to forest disturbance and thus particularly associated with primary forest: *Harpactes ardens minor*, The Philippine Trogon, *Hypothymis helenae* the Short-crested Blue Monarch,, *Ceyx melanurus* and the Philippine Forest Kingfisher

B) Forest Species with high dispersal ability: The presence/absence of frugivorous, wide-ranging, upper-canopy birds may be dictated primarily by seasonal fruiting patterns rather than forest structure per se. Indeed species such as the Tarictic Hornbill, *Penelopides manillae subnigra*, and members of the family Columbidae may frequent isolated fruiting trees despite being dependent upon intact forest. The high numbers of arboreal insectivores/ frugivores, notably the Philippine and Wattle bulbuls at both Aluyon and Anibawan maybe related to the abundance of fruit-laden trees at these sites.

C) Forest-dependent species tolerant to some degree of disturbance. At Macnit *Chrysocolaptes lucidus grandis*, the Greater Flameback was seen excavating the dead trees standing on a felled hillside.

Notably the distribution of species here classified as category A were found to be more widespread than previously thought - in addition to the primary old growth forest of Sibulan watershed reserve,

these species were also found in more disturbed forest; six of the eight patches of logged primary forest on Polillo Island supported the Philippine Trogon with the Philippine Forest Kingfisher being present at four of these sites. We therefore conclude that the category Forest Indicator Species is largely redundant. This reflects in part the broad terminology used to classify forest and in part the failure to identify accurately the nature of forest-bird associations. Further, forest structure is merely part of a more complex equation that attempts to predict the presence/absence of a species. Other aspects of this equation include: forest size and the extent to which a single forest patch is isolated from any other such patch (the degree of isolation).

Evaluation of methods and the significance of species' presence/absence

Surveys are hugely constrained by: 1) only providing a snapshot into complex inter-patch dynamics 2) their inability to draw firm conclusions from absences; an absence of evidence is not evidence for absence. Highly cryptic species, such as the Philippine Forest Kingfisher, *Ceyx melanurus*, recorded mainly by mist netting, fall into this category.

While species absences can be misleading, they can, if accurate be exceptionally revealing about the state of the forest. Indeed the absence of nectivores/insectivores at relatively undisturbed sites may be dictated, at least in part by the absence of nectar-providing plants that colonise disturbed land. The disturbed nature of the netting sites at Balete Sapa is reflected in the relatively high abundance of nectar-devouring sunbirds (nectivores); in contrast the nets at Sibulan caught no such species.

Jomalig – an island apart

At an inter-island level the unique avifaunal assemblages are a product of differential colonisation and faunal relaxation (loss of species through time), especially that exacerbated by anthropogenic pressures. A notably discrete assemblage of birds with a similarity index to Sibulan of only 0.086 (appendix 2) is that associated with Jomalig Island, where no forest patch exceeds 5 hectares and the few trees present are typically light demanding pioneer species associated with secondary growth. Jomalig has a notable lack of large frugivores; the Balicassiao, *Dicurus balicassius*, Taricitic Hornbill, *Penelopides manillae subnigra*, Red-crested Malkoha, *Phaenicophaeus superciliosus*, and Rufous Coucal, *Centropus unirufus* were all absent. The latter two species were also absent from Patnanungan island. A notable addition to Jomalig's inventory was the Koel, *Eudynamis scolopacea mindanensis*². *Passer montanus*, the Eurasian House Sparrow was particularly prevalent though there was a surprising lack of Sunbirds and Flowerpeckers, with only *Nectarinia jugularis*, the Olive-backed sunbird being recorded. The same trend was reported in 1996 with the exception of a single record of *Nectarinia sperata*, the Purple-throated Sunbird. A large roosting site for *Oriolus chinensis*, the Black-naped Oriole was observed in a small patch of forest.

CONCLUSION

The degraded state of the forest on the Polillos is undisputed yet the islands continue to have global significance for their avifaunal assemblage. As such there is an urgent need both to protect and expand what forest is remaining, acknowledging the indispensable nature of even the more heavily disturbed forest patches. Of crucial importance is maintaining connectivity between patches. In hand with protecting an adequate habitat matrix is the need to address further the current albeit reduced levels of hunting. A real achievement for the Polillos would be to see species such as the Philippine Cockatoo ('Kalangay') return towards their former numbers. While translocation programmes could facilitate this they would be futile in the presence of persecution. As such, the 'Kalangay', as it is locally called, symbolises most powerfully the need to strengthen increasingly the enthusiasm and support from local people.

ACKNOWLEDGEMENTS

Particular thanks extend to Alfie Pulumbarit, counter-part researcher based at the University of the Philippines Los Baños, William Bulalacao, guide on the Polillo Islands and Vicente Yngente, Polillo Ecology Steward, whose assistance was immeasurable. Acknowledgements also go to Des Allen for his expertise, Richard Ranft at the British Library of Wildlife Sounds, the residents of the Polillos, associates at the University of the Philippines Los Baños and the entire Polillo research team.

² In 2002 the Koel was heard in Jomalig, Patnanungan, Panukulan and Sibulan Watershed

REFERENCES:

- Bibby, C. Jones, M. and Marsden, Stuart, 1998. *Expedition Field Techniques Bird Surveys* RGS
- Collar, N.J., Crosby, M.J. and Stattersfield, A.J. (1994) *birds to watch 2: the world list of threatened birds*. Cambridge, U.K.: Birdlife International (Birdlife Conservation Series 4).
- Collar, N.J., Mallari, A.D. and Tabaranza, B.R. Jr. 1999. *Threatened birds of the Philippines - The Haribon Foundation/Birdlife International Red Data Book*. Bookmark, Philippines. B
- Dickinson, E.C., R.S.Kennedy, K.C.Parkes. 1991. *The birds of the Philippines, B.O.U. Checklist* No. 12. British Ornithologists' Union.
- Gonzalez, J.C.T. 1997. The ecology and distribution of birds in the Polillo Islands, Philippines. M.Sc. Thesis, UPLB. Unpublished. 134 pp.
- Gonzalez, J.C.T., 1998, *Status report – Polillo Ecology Stewardship Project Apr-Sept 1998*
- Gonzalez, J.C.T., 2001 *Polillo Ecology Stewardship Project: Annual Report 2000*
- Hachisuka, M.1930. Contributions to the Birds of the Philippines, no. 2, part VI. *Orn. Soc. Japan, suppl.* 14:141-222
- ICBP 1992 *Putting Biodiversity on the Map: Priority areas for global conservation*. Cambridge, U.K.: International Council for Bird Preservation
- Kennedy, R.S., P.C. Gonzales, H.C. Miranda Jr., T. Fisher 2000. *Field guide on the Birds of the Philippines*. Oxford University Press.
- Mallari, N.A.D., B.R. Tabaranza, Jr and M.J. Crosby 2001. *Key conservation sites in the Philippines: A Haribon Foundation & BirdLife International directory of Important Bird Areas*. With contributions from M Lepiten-Tabao & G Gee. The Department of Environment & Natural Resources & Bookmark, Inc.
- Manuel, C.G. and E.T. Gilliard, 1952. Undiscovered and newly recorded Philippine Birds. *Am. Mus. Novit.*, 1545:1-9
- Manuel, C.G. 1957. Resident birds of Polillo Island. *Philippine Journal of Science* 86, pp. 1-11.
- McGregor, R.C. 1910. Birds collected in the island of Polillo, Philippine Islands. *Philippine Journal of Science* 5: 103-114.
- Rabor, D.S.1977. *Philippine Birds and Mammals*. Quezon City, UP Science Education Center 284pp
- Walker, S. and Hilario, M. 2000. in "Oxford University/University of the Philippines at Los Banos Polillo Project 1999" Viper Press

Appendix 1: Site-based Inventories with Netting Data - with the exception of Jomalig, records forest-based. (based on the historical list of species recorded on Polillo in Gonzalez, 1997, with additions and amendments following the nomenclature of Kennedy et al., 2000)

SPECIES	SITE													
	SI	JH	ML	ALB	AN	ALW	MC	KA	BS	AB	SA	JO	IN	PS
<i>Pterodroma phaeopygia</i> Dark-Rumped Petrel														
<i>Calonectris leucomelas</i> Streaked Shearwater														
<i>Ardea purpurea</i> Purple Heron												X	X	
<i>Ardea cinerea</i> Grey Heron												X		
<i>Egretta garzetta</i> Little Egret								X	X			X	X	X
<i>Egretta sacra</i> Eastern Reef Egret														
<i>Egretta intermedia</i> Intermediate egret														
<i>Egretta alba</i> Great Egret												X	X	
<i>Bubulcus ibis</i> Cattle Egret				X	X		X					X	X	
<i>Butorides striatus</i> Striated Heron														
<i>Gorsachius melanolophus</i> Malayan Night Heron														
<i>Nycticorax caledonicus</i> Rufous Night-Heron							X					X		
<i>Dendrocygna arcuata</i> Wandering Whistling-Duck												X		
<i>Anas luzonica</i> Philippine Duck			X		X		X		X			X		X
<i>Anas clypeata</i> Northern Shoveler														
<i>Pernis ptilorhynchus</i> Oriental Honeybuzzard														
<i>Haliaeetus indus</i> Brahminy Kite														
<i>Haliaeetus leucogaster</i> White-Bellied Sea-Eagle		X				X	X						X	
<i>Spilornis cheela holospilus</i> Philippine Serpent-Eagle			X				X						X	X
<i>Accipiter gularis</i> Japanese Sparrowhawk														
<i>Accipiter virgatus</i> Besra			N											
<i>Accipiter trivirgatus castroi</i> Polillo Crested Goshawk							X							
<i>Accipiter</i> sp				X										X
<i>Butastur indicus</i> Grey-faced Buzzard				X	X	X	X	X		X	X		X	
<i>Megapodius cumingii</i> Tabon Scrubfowl												X	X	
<i>Gallus gallus</i> Red Junglefowl			X							X				
<i>Coturnix chinensis</i> Blue-breasted Quail												X?		
<i>Gallirallus philippensis</i> Buff banded Rail														
<i>Gallirallus torquatus</i> Barred Rail														
<i>Porzana cinerea</i> White-browed Crake														
<i>Amauornis olivaceus</i> Plain Bush-hen							X							
<i>Amauornis pheoniceus</i> White-breasted Waterhen			X		X				X				X	X
<i>Gallicrex cinerea</i> Watercock														
<i>Pluvialis squatarola</i> Grey Plover														
<i>Pluvialis fulva</i> Asian Golden-Plover														
<i>Charadrius dubius</i> Little Ringed Plover														
<i>Charadrius alexandrinus</i> Kentish Plover														
<i>Charadrius mongolus</i> Lesser Sand-Plover														
<i>Charadrius leschenaulti</i> Greater Sand-Plover														
<i>Charadrius peronii</i> Malaysian Plover														
<i>Numenius phaeopus</i> Whimbrel														
<i>Tringa totanus</i> Common Redshank														
<i>Tringa stagnatilis</i> Marsh Sandpiper														
<i>Tringa nebularia</i> Common Greenshank												X		
<i>Tringa ochropus</i> Green Sandpiper														
<i>Tringa glareola</i> Wood Sandpiper														
<i>Actitis hypoleucos</i> Common Sandpiper												X		
<i>Heteroscelus brevipes</i> Grey Tailed Tattler												X		
<i>Arenaria interpres</i> Ruddy Turnstone														
<i>Gallinago megalala</i> Swinhoe's Snipe														
<i>Gallinago</i> sp.												X		

SPECIES	SITE													
	SI	JH	ML	ALB	AN	ALW	MC	KA	BS	AB	SA	JO	IN	PS
<i>Calidris ruficollis</i> Rufous-necked Stint														
<i>Calidris alba</i> Sanderling														
<i>Esacus magnirostris</i> Beach Thick-knee														
<i>Glareola maldivarum</i> Oriental Pratincole														
<i>Himantopus himanopus</i> Black-winged Stilt												X		
<i>Sterna bergii</i> Greater Crested Tern														
<i>Sterna albifrons sinensis</i> Little Tern														
<i>Childonias leucopterus</i> White-winged Tern												X		
<i>Treron pompadora</i> Pompadour Green-Pigeon	O	X					X							
<i>Phapitreton amethystina</i> Amethyst Brown-Dove	X		X		X		N		N	X				
<i>Phapitreton leucotis</i> White-eared Brown-Dove														
<i>Ptilinopus merrilli</i> Cream-bellied Fruit-Dove	O													
<i>Ptilinopus leclancheri</i> Black-chinned Fruit-Dove														
<i>Ducula aenea</i> Green Imperial-Pigeon	X		X	X	X	X	X	X	X	X	X		X	X
<i>Ducula bicolor</i> Pied Imperial-Pigeon														
<i>Macropygia phasianella</i> Reddish Cuckoo-Dove	AC				X								X	
<i>Streptopelia bitorquata</i> Island Collared-Dove														
<i>Streptopelia chinensis</i> Spotted Dove												X		X
<i>Streptopelia tranquebarica</i> Red Turtle-Dove	X											X	X	
<i>Chalcophaps indica</i> Common Emerald-Dove	X	N	N	X	N	N		X	N	N	X	N	X	X
<i>Gallinula luzonica</i> Luzon Bleeding-heart	X	N	X			X	X		X			X		
<i>Cacatua haematuropygia</i> Philippine Cockatoo													X	X
<i>Tanygnathus lucionensis hybridus</i> Polillo Blue-naped Parrot										X				X
<i>Tanygnathus sumatranus freeri</i> Polillo Blue-backed Parrot							R							
<i>Tanygnathus sp.</i>							X				TR			
<i>Loriculus philippensis</i> Colasisi				X				X						
<i>Cuculus sparverioides</i> Large Hawk-Cuckoo														
<i>Cuculus saturatus</i> Oriental Cuckoo													X	
<i>Eudynamis scolopacea</i> Common Koel													X	
<i>Phaenicophaeus superciliosus</i> Red crested malkoha	X	N	X	X	X	N	X	X	N	X	X			
<i>Centropus viridis</i> Philippine Coucal	X	X	X	X	X	X	X	X		X	X	X	X	X
<i>Centropus unirufus</i> Rufous Coucal	X	X	X	X	X	N	X			X				
<i>Tyto capensis</i> Grass Owl														
<i>Ninox philippensis</i> Philippine Hawk-Owl					X									
<i>Otus megalotis</i> Philippine Scops-Owl		X(B)												
Owl sp.				X					X	X				
<i>Batrachostomus septimus</i> Philippine Frogmouth														
<i>Collocalia vanikorensis</i> Island Swiftlet														
<i>Collocalia esculenta</i> Glossy Swiftlet	N							X						
<i>Collocalia troglodytes</i> Pygmy Swiftlet			X		X									
<i>Collocalia sp.</i>				X	X		X							
<i>Hirundapus celebensis</i> Purple Needle tail						X								
<i>Cypsiurus balasiensis</i> Asian Palm-Swift														
<i>Harpectes ardens minor</i> Polillo Philippine Trogon	N	X	X		X		X	X		X				
<i>Alcedo atthis</i> Common Kingfisher												X		
<i>Alcedo cyanopecta</i> Indigo-banded Kingfisher	N							X	N		X			
<i>Ceyx melanurus</i> Philippine Dwarf Kingfisher	N	N	N		N			X	N					
<i>Halcyon capensis</i> Stork-billed kingfisher														
<i>Halcyon smyrnensis</i> White-throated kingfisher	X				X		X	X						
<i>Halcyon chloris</i> White-collared kingfisher												X	X	X
<i>Eurystomus orientalis</i> Dollarbird				X	X		X			X	X		X	
<i>Penelopides manillae subnigra</i> Polillo Tarictic Hornbill	X	X	X	X	X	N	X	X	X	X	X		X	
<i>Mulleripicus funebris</i> Sooty Woodpecker	X													
<i>Chrysocolaptes lucidus grandis</i> Polillo Greater Flameback				N		X	X	N		X				

SPECIES	SITE													
	SI	JH	ML	ALB	AN	ALW	MC	KA	BS	AB	SA	JO	IN	PS
Woodpecker sp.		X												
<i>Hirundo rustica</i> Barn Swallow														
<i>Hirundo tahitica</i> Pacific Swallow												X		
<i>Coracina striata</i> Bar-bellied Cuckoo-shrike		X					X							
<i>Lalage nigra</i> Pied Triller														
<i>Pericrocotus divaricatus</i> Ashy Minivet														
<i>Pycnonotus urostictus</i> Yellow-wattled Bulbul	X	N	X	N	X	N	X	X	N	X	N	X	N	X
<i>Hypsipetes philippinus</i> Philippine Bulbul	X	N	X	N	X	N	X	X	X	N	X	N	X	N
<i>Dicrurus balicassius</i> Balicassiao	X	N	X	N	X	N	X	X	N	X	N	X	N	X
<i>Oriolus chinensis</i> Black-naped Oriole	X		X	X	X	N	X	X	X	X	X	X	N	X
<i>Irena cyanogaster</i> Philippine Fairy-Bluebird	X	N	X	N										
<i>Corvus macrorhynchos</i> Large-billed Crow	N	X	X	X	X		X	X	X	X	X	X	N	X
<i>Copsychus luzoniensis parvimaclulatus</i> Polillo White Browed Shama	X	N	X	N	X	N	X	X	N	X	N	X	N	X
<i>Phylloscopus borealis</i> Arctic Warbler													X	
<i>Phylloscopus cebuensis</i> Lemon-throated Leaf-Warbler			N	N	N			N				N	N	
<i>Cisticola exilis</i> Bright-capped Cisticola												X		
<i>Cisticola juncidis</i> Zitting Cisticola													X	X
<i>Muscicapa griseisticta</i> Grey-streaked Flycatcher												X	X	
<i>Cyornis rufigaster</i> Mangrove Blue Flycatcher		N		N			N	N	N				N	
<i>Rhipidura javanica</i> Pied Fantail														
<i>Hypothymis azurea</i> Black-naped Monarch	X	N	X	X	N	X	N	X	N	X	N		X	N
<i>Hypothymis helenae</i> Short-crested Monarch														
<i>Terpsiphone cinnamomea</i> Rufous Paradise-Flycatcher	X	N	X	N	X	N	N	X	N	X	N		X	N
<i>Pachycephala sp.</i>		X (B)												
<i>Motacilla cinerea</i> Grey Wagtail					X									
<i>Motacilla flava/cinerea</i>				X	X							X	X	
<i>Anthus novaeseelandiae</i> Richard's Pipit												X	N	
<i>Anthus gustavi</i> Pechora Pipit							X							
<i>Artamus leucorhynchus</i> White-breasted Swallow				X			X	X				X		
<i>Lanius cristatus</i> Brown Shrike			X	X	X	X				X		X	N	X
<i>Aplonis panayensis</i> Asian Glossy Starling												X		
<i>Sarcops calvus</i> Coledo	X	X	X	X	X		X	X		X	X	X	X	X
<i>Nectarinia sperata</i> Purple-throated Flowerpecker		X	N	X	X		X		X	N	X		X	X
<i>Nectarinia jugularis</i> Olive-backed Sunbird	X			X								X		
<i>Nectarinia sp.</i>	X													
<i>Aethopyga shelleyi</i> Lovely Sunbird			N					N	N					
<i>Dicaeum trigonostigma</i> Orange-bellied Flowerpecker	X	X	N	N	N	X			X	N				
<i>Dicaeum hypoleucum</i> Buzzing Flowerpecker														
<i>Dicaeum pygmaeum</i> Pygmy Flowerpecker							X							
<i>Dicaeum sp.</i>								X						
<i>Passer montanus</i> Eurasian Tree Sparrow												X		
<i>Lonchura leucogastra</i> White-bellied Munia		N	N				X						N	
<i>Lonchura malacca</i> Chestnut Munia		N										X	N	

X=Recorded during formal study period
O=Notable additions outside formal study period
AC=Acoustic record awaiting confirmation
X(B)= Identified by naturalist 'Boying Fernandez'
N=capture in bird net, R=report from secondary evidence
TR=*Tanygnathus* sp. reported by residents but not seen frequently.
Dates of main survey periods: SI=Sibulan Watershed (Aug 4-9); JH=Jerry and Hilario (Sept 3-7); ML=Mt Malulod (Oct 10-12);
ALB=Aluyon Base-camp (Oct 15-18); AN=Anibawan (Oct 25-29); ALW=Aluyon Watershed (Oct 29-30);
MC=Macnit (Nov 05-13); KA=Kalubakis (Nov 15-19); BS=Balete Sapa (Nov 26-28); AB=Abaca (Nov 30-Dec 4);
SA=Salapakan (Dec 4-5); JO=Jomalig (Sept 18-21); PS=Patnanungan South (Sept 24-29); IN=Inusukan (Oct 3-5)

Appendix 2: Site-based Netting Data (following the nomenclature of Kennedy et al., 2000)

SPECIES	SI	JH	JO	PA	ML	AL	AN	MC	KA	BS	AB
<i>Accipter virgatus</i> , Besra					1						
<i>Phapitreron amethystina</i> Amethyst Brown-Dove								1		1	
<i>Chalcophaps indica</i> Common Emerald-Dove	1	2			1	2	3		1	4	1
<i>Gallicolumba luzonica</i> Luzon Bleeding-heart	1										
<i>Phaenicophaeus superciliosus</i> Red-crested malkoha	1					1		1		1	
<i>Centropus unirufus</i> Rufous Coucal							3				
<i>Collocalia esculenta</i> Glossy Swiftlet	1										
<i>Harpectes ardens minor</i> Polillo Philippine Trogon	1										
<i>Alcedo cyanopecta</i> Indigo-banded Kingfisher	3								1		
<i>Ceyx melanurus</i> Philippine Dwarf Kingfisher	3+2R	1			2		2		1		
<i>Chrysocolaptes lucidis grandis</i> Greater Flameback						2		1			
<i>Penelopides manillae subnigra</i> Tarictic Hornbill							1				
<i>Pycnonotus urostictus</i> Yellow-wattled Bulbul	1	1			2	8	8	3	1	2	1
<i>Hypsipetes philippinus</i> Philippine Bulbul	5	4	6	5	5	12	48	9	3	14	14
<i>Dicrurus baliassius</i> Balicassiao	4	1		4	1		2	1	4		1
<i>Oriolus chinensis</i> , Black-naped Oriole			2								
<i>Corvus macrorhynchos</i> , Large-billed Crow			1								
<i>Irena cyanogaster</i> Philippine Fairy-Bluebird	2	2									
<i>Copsychus luzoniensis parvimaclatus</i> Polillo White Browed Shama	6	4		5	1	5	3	4	2	5	3
<i>Cyornis rufigastra</i> Mangrove Blue Flycatcher		2		3		1		1	2	1	
<i>Hypothymis azurea</i> Black-naped Monarch	5			3	1	1	1	2		3	1
<i>Terpsiphone cinnamomea</i> Rufous Paradise-Flycatcher	5	2		5	1	1	3	3	3		3
<i>Anthus novaeseelandiae</i> Richards pipit			1								
<i>Lanius cristatus</i> , Brown Shrike			5								
<i>Nectarinia sperata</i> Purple-throated sunbird		1								2	
<i>Aethopyga shelleyi</i> Lovely Sunbird					1				1	2	
<i>Dicaeum trigonostigma</i> Orange-bellied flowerpecker		2		2	1		9				1
<i>Lonchura leucogastra</i> , White-bellied Munia		2		2							
<i>Lonchura malacca</i> Chestnut Munia		2	1				1				
<i>Phylloscopus cebuensis</i> Lemon-throated Leaf-Warbler				2	1	1	3	5	2		
<i>Phyllocopus borealis</i> Arctic Warbler			1								

SI=Sibulan Watershed (Aug 6-10), JH=Jerry and Hilario (Sept 3-7), JO=Jomalig (Sept 19-21), PA=Patnanungan (Sept 27-29), MC=Macnit (Nov 6-13), AL=nr. Aluyon(not community reserve) (Oct 16-18), AN=Anibawan (Oct 26-29), ML=Malulod (Oct 10-12), KA=Kalubakis (Nov 16-19) BS=Balete Sappa(Nov 26-28), AB=Abaca(Nov 30-Dec 03)

R=recapture

Appendix 3: Analysis of Netting Data

Site	SI	JH	JO	PA	ML	AL	AN	MC	KA	BS	AB
Total no. Captures	39	26	17	29	19	35	87	31	21	35	25
Species Richness	14	13	7	8	13	11	12	10	11	10	8
Species Diversity	2.417	2.468	1.646	2.021	3.007	1.919	1.664	1.977	2.269	1.898	1.477
Species Equitability	0.916	0.962	0.846	0.972	0.93	0.857	0.66	0.859	0.946	0.824	0.71
Similarity (relative to Sibulan)	X	0.746	0.086	0.314	0.217	0.197	0.164	0.236	0.258	0.211	0.242

Shannon-Weiner Diversity Index = $-\sum p_i \cdot \ln(p_i)$

Shannon-Weiner Equitability Index = $-\sum p_i \cdot \ln(p_i) / \ln(s)$

where p_i is the proportion of species i expressed as the total number of individuals of all species and s = number of species

Similarity Index (Czekanowski) = $[2 \cdot \min(X_i, Y_i)] / [X_i + Y_i]$

where X_i and Y_i are the abundances of species i in habitat X and Y respectively and $\min(X_i, Y_i)$ is the sum of the lowest abundance where species i , occurs in both habitat X and Y.

(indices, as used in Bibby *et al.*, 1998)

Appendix 4: Species for which Acoustic Records were obtained

(Records deposited at University of the Philippines Los Banos and the British Library of Wildlife Sounds)

<i>Alcedo cyanopecta</i>	<i>Hypsipetes philippinus</i>
<i>Anas luzonica</i>	<i>Halcyon smyrnensis</i>
<i>Amauornis olivacea</i>	<i>Ixobrychus cinnamomeus</i>
<i>Amauornis phoenicurus</i>	<i>Lonchura leucogastra</i>
<i>Aplonis panayensis</i>	<i>Loriculus philippensis</i>
<i>Ardea purpurea</i>	<i>Macropygia phasianella</i>
<i>Copsychus luzoniensis parvifasciatus</i>	<i>Mulleripicus funebris</i>
<i>Chrysocolaptes lucidus grandis</i>	<i>Nectarinia sperata</i>
<i>Corvus macrorhynchus</i>	<i>Oriolus chinensis</i>
<i>Coracina striata</i>	<i>Penelopides manillae subnigra</i>
<i>Centropus unirufus</i>	<i>Phaenicophaeus superciliosus</i>
<i>Centropus viridis</i>	<i>Phapitreron amethystina</i>
<i>Ducula aenea</i>	<i>Pycnonotus urostictus</i>
<i>Dicrurus balicassius</i>	<i>Rostratula benghalensis</i>
<i>Dicaeum trigonstigma</i>	<i>Sarcops calvus</i>
<i>Eudynamis scolopacea</i>	<i>Streptopelia chinensis</i>
<i>Gallirallus torquatus</i>	<i>Streptopelia tranquebarica</i>
<i>Harpactes ardens minor</i>	<i>Terpsiphone cinnamomea</i>
<i>Hypothymis azurea</i>	<i>Tanygnathus lucionensis hybridus</i>
<i>Halcyon chloris</i>	<i>Treron pompadora</i>

Appendix 3: Analysis of Netting Data

Site	SI	JH	JO	PA	ML	AL	AN	MC	KA	BS	AB
Total no. Captures	39	26	17	29	19	35	87	31	21	35	25
Species Richness	14	13	7	8	13	11	12	10	11	10	8
Species Diversity	2.417	2.468	1.646	2.021	3.007	1.919	1.664	1.977	2.269	1.898	1.477
Species Equitability	0.916	0.962	0.846	0.972	0.93	0.857	0.66	0.859	0.946	0.824	0.71
Similarity (relative to Sibulan)	X	0.746	0.086	0.314	0.217	0.197	0.164	0.236	0.258	0.211	0.242

Shannon-Weiner Diversity Index = $-\sum p_i \cdot \ln(p_i)$

Shannon-Weiner Equitability Index = $-\sum p_i \cdot \ln(p_i) / \ln(s)$

where p_i is the proportion of species i expressed as the total number of individuals of all species and s = number of species

Similarity Index (Czekanowski) = $[2 \cdot \min(X_i, Y_i)] / [X_i + Y_i]$

where X_i and Y_i are the abundances of species i in habitat X and Y respectively and $\min(X_i, Y_i)$ is the sum of the lowest abundance where species i , occurs in both habitat X and Y.

(indices, as used in Bibby *et al.*, 1998)

Appendix 4: Species for which Acoustic Records were obtained (Records deposited at University of the Philippines Los Banos and the British Library of Wildlife Sounds)

<i>Alcedo cyanopecta</i>	<i>Hypsipetes philippinus</i>
<i>Anas luzonica</i>	<i>Halcyon smyrnensis</i>
<i>Amauornis olivacea</i>	<i>Ixobrychus cinnamomeus</i>
<i>Amauornis phoenicurus</i>	<i>Lonchura leucogastra</i>
<i>Aplonis panayensis</i>	<i>Loriculus philippensis</i>
<i>Ardea purpurea</i>	<i>Macropygia phasianella</i>
<i>Copsychus luzoniensis parvimaculatus</i>	<i>Mulleripicus funebris</i>
<i>Chrysocolaptes lucidus grandis</i>	<i>Nectarinia sperata</i>
<i>Corvus macrorhynchus</i>	<i>Oriolus chinensis</i>
<i>Coracina striata</i>	<i>Penelopides manillae subnigra</i>
<i>Centropus unirufus</i>	<i>Phaenicophaeus superciliosus</i>
<i>Centropus viridis</i>	<i>Phapitreron amethystina</i>
<i>Ducula aenea</i>	<i>Pycnonotus urostictus</i>
<i>Dicrurus balicassius</i>	<i>Rostratula benghalensis</i>
<i>Dicaeum trigonstigma</i>	<i>Sarcops calvus</i>
<i>Eudynamis scolopacea</i>	<i>Streptopelia chinensis</i>
<i>Euryostmus orientalis</i>	<i>Streptopelia tranquebarica</i>
<i>Gallirallus torquatus</i>	<i>Terpsiphone cinnamomea</i>
<i>Harpactes ardens minor</i>	<i>Tanygnathus lucionensis hybridus</i>
<i>Hypothymis azurea</i>	<i>Treron pompadora</i>
<i>Halcyon chloris</i>	

Appendix 5: Local names of Birds on Polillo

	Local Name	Common Name	Scientific Name
1	TUHAK	Eastern Reef-Egret	<i>Egretta sacra</i>
2	LAWIN	Philippine Serpent-Eagle	<i>Spilornis holospilus</i>
3	SALIBAD	Besra/Crested Goshawk	<i>Accipiter virgatus/trivirgatus</i>
4	TIK-WEET	Grey-faced Buzzard	<i>Butastur indicus</i>
5	LABUYO	Red Junglefowl	<i>Gallus gallus</i>
6	TSUBAK	White-breasted Swamphen	<i>Amouornis phoenicurus</i>
7	TIKLING	Barred Rail	<i>Gallirallus torquatus</i>
8	PUNAY	Pompadour Green-pigeon	<i>Treron pompadora</i>
9	CROOO CROO	White-eared Brown-Dove	<i>Phapiteron leucotis</i>
10	BALOD	Green Imperial-pigeon	<i>Ducula aenea</i>
11	BATO-BATO	Red Turtle-Dove	<i>Streptopelia tranquebarica</i>
12	UMUMBAN	Green-winged Emerald Dove	<i>Chalcophaps indica</i>
13	LAGARAN	Luzon Bleeding-heart	<i>Gallicolumba luzonica</i>
14	KALANGAY	Philippine Cockatoo	<i>Cacatua haematuropygia</i>
15	KAGIT	Blue-naped/Blue-backed parrot	<i>Tanygnathus lucionensis/sumatranus</i>
16	COLASISI	Philippine Hanging-Parrot	<i>Loriculus philippensis</i>
17	MANOK-MANOK	Red-crested Malkoha	<i>Phaenicophaeus superciliosus</i>
18	CHAGOC	Philippine Coucal	<i>Centropus viridis viridis</i>
19	SABUKOT	Rufous Coucal	<i>Centropus unirus</i>
20	BUCOW/KUWAGO	(Philippine Hawk) Owl	<i>(Ninox philippensis)</i>
21	KINGFISHER NG GUBAT	Philippine Dwarf-Kingfisher	<i>Ceyx melanurus</i>
22	SALAKSAK	Indigo-banded Kingfisher	<i>Alcedo cyanopectus</i>
23	SAGKARIT	White-throated Kingfisher	<i>Halcyon smyrnensis</i>
24	TAGKAIRIT	White-collared Kingfisher	<i>Halcyon chloris</i>
25	KARAGKASAG	Dollar Bird	<i>Eurystomus orientalis</i>
26	TARIKTIK	Tarctic Hornbill	<i>Penelopides manillae</i>
27	MANOKTOK	Greater Flameback/Sooty Woodpecker	<i>Chrysocolaptes lucidus or Mulleripicus funebris</i>
28	TIYONG	Wattled Bulbul	<i>Pycnonotus urostictus</i>
29	TORORIYAK	Philippine Bulbul	<i>Hypsipetes philippinus</i>
30	UWAK-UWAKAN	Balicassiao	<i>Dicrurus balicassius</i>
31	KILYAWAN	Black-naped Oriole	<i>Oriolus chinensis</i>
32	WOK	Large-billed Crow	<i>Corvus macrorhynchos</i>
33	MANIPOL	White-browed Shama	<i>Copsychus luzoniensis parvimaculatus</i>
34	ASUL NA TSIKI-TSIKI	Mangrove Blue Flycatcher	<i>Cyornis rufogastra</i>
35	ORANGE NA TSIKI-TSIKI	Rufus Paradise-Flycatcher	<i>Terpsiphone cinnamomea</i>
36	PASISIT	Black-naped Monarch	<i>Hypothymis azurea</i>
37	PAKISKIS	Brown Shrike	<i>Lanius cristatus</i>
38	KOLING	Coletto	<i>Sarcops calvus</i>
39	PULANG BUKWIT	Purple-throated Sunbird	<i>Nectarinia sperata</i>
40	BERDE NA BUKWIT	Olive-backed Sunbird	<i>Nectarinia jugularis</i>
41	DILAW NA BUKWIT	Orange-bellied Flowerpecker	<i>Dicaeum trigonostigma</i>
42	BUKWIT	Sunbird/Flowerpecker	<i>Dicaeum/Nectarinia</i>