

## **Biodiversity and conservation priority setting in the Babuyan Islands, Philippines**

### **Genevieve Broad**

Hartpury College, Hartpury House, Gloucestershire, GL19 3BE, United Kingdom.  
gen.broad@hartpury.ac.uk or gen\_broad@yahoo.co.uk

### **Carl Oliveros**

Isla Biodiversity Conservation, Inc., 9 Bougainvillea St., Manuela Subdivision,  
Las Piñas City 1741, Philippines. carl\_oliveros@yahoo.com

*A wildlife survey was conducted in the Babuyan Islands during 2004. The aims were to assess the fauna present, in particular the bird species; to identify threats to wildlife; and to determine priority habitats for conservation. The methodology included bird searches, mist netting, opportunistic recording of mammals, reptiles and amphibians and interviews with local residents. A scale to determine conservation priorities for specific habitats was developed using a matrix comprised of numbers of threatened species present and the level of local threat. Species lists for each island were compiled from this project and annotated with records from previous studies. The study recorded 126 bird species, 18 mammals, 31 reptiles and 7 amphibian species. A previously undescribed bird species was discovered, the Calayan Rail *Gallirallus calayanensis* and 18 globally threatened or near-threatened species were recorded, together with 21 endemic species. Current threats include illegal logging and fishing, slash and burn farming and heavy hunting pressures. Based on the habitat priority scale, two areas of lowland forest and the coastal waters off the Babuyan Islands were assigned Very High conservation priority status. The study concluded that the Babuyan Island group is a center of endemism, containing globally threatened species and habitats. It is recommended that further ecological research work be undertaken, protected areas be established, community conservation measures be implemented and a resource management plan be developed.*

**Keywords: important bird area, threatened species, endemic species, Calayan Rail, *Gallirallus calayanensis*, habitat priority scale, Babuyan Islands**

### THE BABUYAN ISLANDS ARE A SMALL GROUP OF LITTLE-KNOWN ISLANDS

that lie at the northern tip of the Philippines. This group of islands, together with the Batanes Islands comprise the Philippines' most northerly Important Bird Area (IBA code PH001) (Mallari *et al.* 2001) and is included as one of its Secondary Areas (SA 094) for endemic birds (Stattersfield *et al.* 1998). The Babuyan island group lies on an extensive bird migration route that stretches from Siberia, Japan, Korea and China through Taiwan to the Philippine archipelago. Consequently, it is perhaps surprising that little scientific exploration has been undertaken in the islands. What little is known of the island group's avifauna comes mainly from records collected in the early 1900s. Historical records show a total of 124 bird species from the island group, 56 of which were resident (Kennedy *et al.* 2000). One threatened species (the Yellow Bunting *Emberiza sulphurata*) and four near-threatened/restricted range species have been recorded while 13 subspecies of birds endemic to the Babuyan Islands were identified. Fifteen mammal species have been recorded, of which 11 were marine mammals (Heaney *et al.* 1998, Acebes and Lesaca 2003). Very little was known about the reptilian and amphibian fauna of the Babuyan Islands. Eight reptile species were identified by Ota and Ross (1994), Brown and Acala (1978, 1980), WCSP (1997) and Leviton (1964, 1970), but specimens from collections in the island group in 1989 and 1990 are housed at the Smithsonian Institution, U.S.A., and the results of this collection remain to be published (C. Ross, pers. comm.).

During 2004, a small team of Filipino and British researchers conducted a survey of avian diversity on the Babuyan Islands. The study was conducted between 29 March and 6 June by a team of eight wildlife researchers and was accompanied by a British consultant ornithologist. The aim of the project was to provide an initial assessment of the fauna present, in particular the bird species; to identify significant threats to wildlife; and to determine priorities for conservation measures. The methodology and results of this study are reported in full in Oliveros *et al.* 2004. This paper provides an overview of the results of the study, together with an initial analysis of habitat conservation priorities in the Babuyan island group.

## Methodology

### Study Area

The Babuyan island group lies at the northern tip of the Philippines, between 18° and 19° north of the equator (Figure 1). The island group consists of five major islands: Camiguin Norte, Babuyan Claro, Calayan, Dalupiri and Fuga; and several islets, including Pamoctan, Guinapao Rocks and Didicas. A profile of these islands is shown in Table 1. The largest of these is Calayan (196 km<sup>2</sup>), while the highest peak in the island group is found at Mt. Pangasun (1,108 masl) on Babuyan Claro. Calayan is the municipal capital of the islands, with the exception of Fuga, which falls under the municipality of Aparri on the mainland.

---

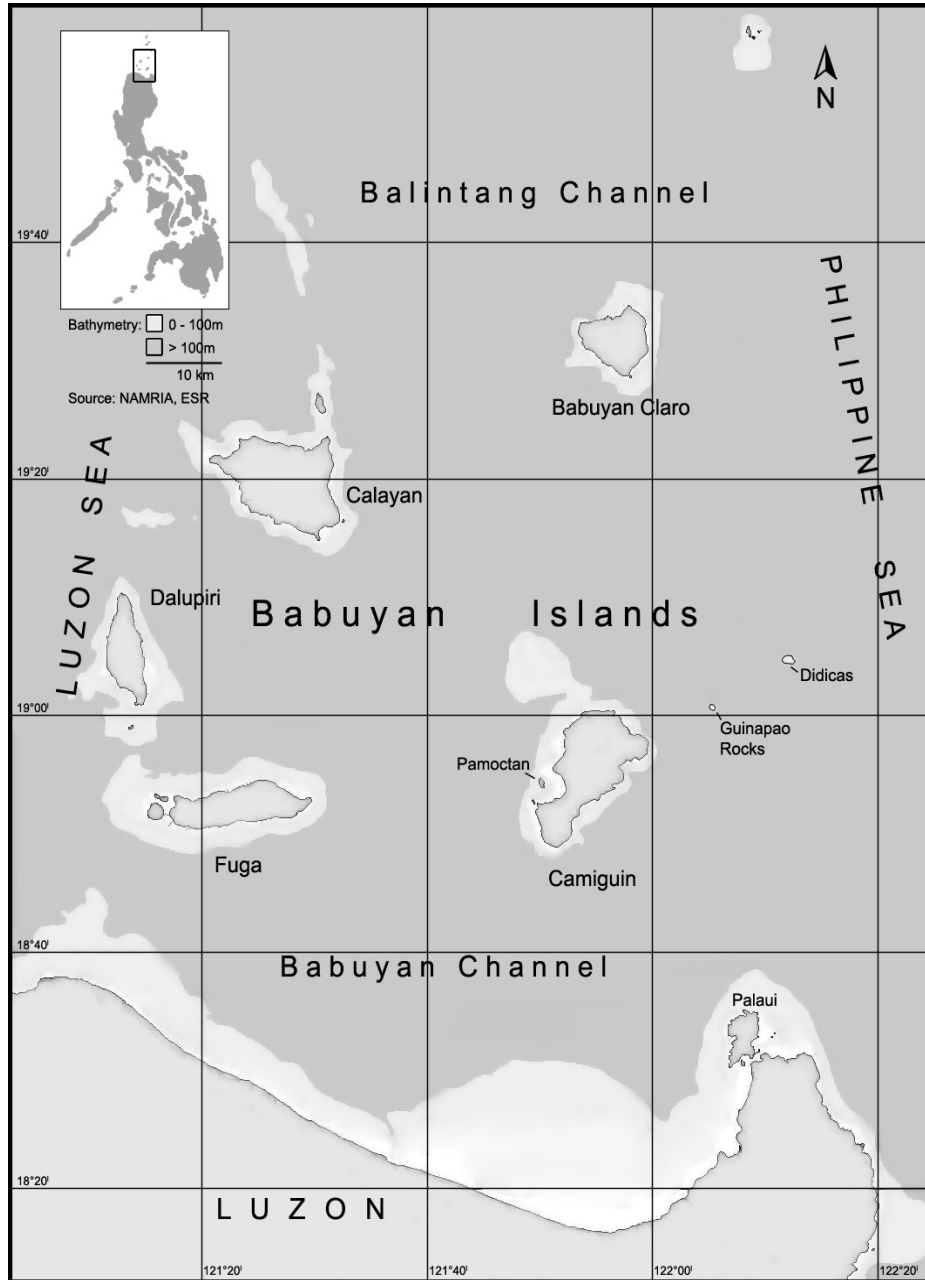


Figure 1. Location of the Babuyan Islands.

The islands of the Babuyan Island group are volcanic in origin. Calayan was formed in the late Miocene, Camiguin in the Pliocene and Babuyan Claro in the late Pliocene (Defant *et al.* 1989). Didicas Island is a very young island formed by a volcanic eruption in 1952; Pamoctan is a young andesitic lava dome (SI 2004). Mt. Camiguin on Camiguin Island, Didicas Island and Mt. Pangasun and Smith on Babuyan Claro are active volcanoes (PHIVOLCS 2004). Mt. Camiguin last erupted in 1857; Didicas in 1969 and the last eruptions on Babuyan Claro were in 1913 and 1917 (PHIVOLCS 2004). The Babuyan Channel, a narrow stretch of water, approximately 70 km wide and more than 100 m in depth, separates the nearest islands of Camiguin and Fuga from mainland Luzon (Figure 1). The location of a 120 m bathymetric line in this area suggests they were distinct islands at the end of the last ice age (Heaney 1986) and this factor, together with Voris (2000) maps of Pleistocene sea levels, shows that the island group has been separated from the Luzon mainland during the last 250,000 years.

**Table 1. Profile of selected islands and islets of the Babuyan group.**

Name	Coordinates (Luzon datum)	Area (km <sup>2</sup> )	Highest elevation (m)	Population (2000)
Calayan	N 19° 20' E 121° 27'	196	499	8,451
Camiguin	N 18° 55' E 121° 55'	166	828	3,936
Babuyan Claro	N 19° 32' E 121° 57'	100	1108	1,367
Fuga	N 18° 52' E 121° 22'	70	208	1,733
Dalupiri	N 19° 05' E 121° 13'	50	297	555
Pamoctan	N 18° 54' E 121° 50'	0.7	202	1
Didicas	N 19° 04' E 122° 12'	0.7	244	Uninhabited
Guinapao Rocks	N 18° 58' E 122° 06'	<0.3	96	Uninhabited

Sources: National Mapping and Resource Information Authority and National Statistics Office, Philippines.

Surveys were conducted on Camiguin, Pamoctan, Guinapao Rocks, Didicas, Babuyan Claro, Calayan and Dalupiri. A range of habitats were visited on each island to maximize opportunities for recording species and to increase the scope of the survey (Table 2). Each site was 4 sq km or less in size, enabling all observations to be made during walks of up to four hours from the central camp site. In addition, a coastline survey was conducted by boat around the island of Calayan.

### Field techniques

The research team employed a range of techniques in different habitat types in order to record the greatest variety of bird species in each site, thus ensuring maximum

**Table 2. Description of habitat types surveyed in the Babuyan Islands. The search effort for bird species in hours for each island and the number of days at each field site is shown.**

Island (Search effort)	Field site name and number of days at site	Habitat types surveyed
Camiguin (52.8 man hours)	Balatubat – 6 days Limandok – 9 days Magas-asok Lake - 2 days Kauringan - 5 days	Agricultural land, inhabited site, sandy beach, grassland
Pamoctan (15.3 man hours)	6 days	Lowland forest, freshwater lake
Babuyan Claro (57.3 man hours)	Corog - 11 days Ayumit - 9 days Rakwaranom - 5 days	Agricultural land, inhabited site, sandy beach, grassland
Calayan (52.9 man hours)	Centro - 10 days Longog - 10 days	Rice fields, scrubland, sandy beach, rocky shore, coastal cliffs, lowland forest, agricultural land
Dalupiri (23 man hours)	Visita – 6 days Caucauyan - 7 days	Inhabited site, scrubland, rocky shore, sandy shore, tidal flats, estuary, dry river systems, riverine gully forest, agricultural land

coverage of the area. Searches were conducted from dawn until 10:00 a.m. and from 16:00 until dusk. Recordings of bird calls were made and photographs of species taken for subsequent identification when possible. Records were made of species names, numbers of individuals, and whether seen or heard; and other notes were taken to assist further with identification and to support sighting records. However, records made outside the active search effort and those made by the team's ornithological consultant of previously unrecorded species were added to the island species lists.

Some trapping of small mammals, reptiles and amphibians was undertaken, although capture effort was limited by lack of available personnel and equipment. Mist netting was used to capture skulking bird species and volant mammals using 35 mm monofilament

nets. The greatest amount of time spent mist netting was undertaken on Babuyan Claro (591 m-net days and 588 m-net nights) and Calayan (508 m-net days and 405 m-net nights). Less than 100 m-net days and nights were spent on Pamoctan and Dalupiri.

Trapping of small non-volant mammals, amphibians and reptiles was undertaken using snap traps, pitfall traps and by hand. Roosting bats in caves were caught with nets and identified in the hand. Searches were made in a variety of habitats, including on the forest floor, in caves and in streams and ponds. Capture and sighting effort for mammals, reptiles and amphibians was on an opportunistic basis only.

Standard biometric measurements and photographs of captured individuals were taken in order to verify species identification. All animals were released as soon as possible, unless a voucher specimen was needed for further identification, in which case the animals were euthanized immediately. Bats were marked for future identification in case of re-capture.

Other evidence such as old skeletal parts were collected. Animal droppings and tracks were noted. Opportunistic sightings of seabirds and marine mammals were recorded from shores and from boats during island crossings, and photographs taken when possible.

We conducted interviews with local residents, including hunters and local government officials, to gather information on the presence of species, local names, species utilization, ecology, local conservation initiatives and threats to wildlife and their habitats. Interviews were conducted in Tagalog and the local language, Ilocano.

## Analyses

Bird species were identified using Kennedy et al. (2000), Taylor (1998), DuPont (1971) and Robson (2002). Recordings of bird calls were compared with Scharringa (2001). Taxonomy and scientific names follow Dickinson (2003) with Corrigenda (2004) and English names follow Kennedy et al. (2000) with a few exceptions. The English names of the following species were taken from Dickinson (2003) to highlight their recent taxonomic splits: Philippine (Reddish) Cuckoo-Dove *Macropygia tenuirostris*, Striated (Red-rumped) Swallow *Cecropis striolata*, and White's (Scaly Ground) Thrush *Zoothera aurea*. Mammal species were identified using Ingle and Heaney (1992), Heaney and Ruedi (1994), Jefferson et al. (1993), and Balete et al. (1995). Reptile and amphibian specimens were identified using Brown and Alcala (1978, 1980), Leviton (1964, 1968, 1970), McGuire and Alcala (2000), Ota and Ross (1994), Ota and Crombie (1989), Taylor (1922), Alcala and Brown (1998), Gonzalez et al. (1995). Where possible, identifications were verified with ornithologists, zoologists and herpetologists and specimens were compared with material from the Philippine National Museum.

---

A species list of birds, mammals, reptiles and amphibians recorded from the current survey was prepared for each island and was annotated with records from previous studies in the area. Species endemic or near-endemic to the Philippines (endemic status based on Kennedy *et al.* 2000, Ingle and Heaney 1992, Gonzalez *et al.* 1995) and those globally threatened (based on IUCN 2004) were identified and the conservation status recorded for each species.

### Habitat Priority Setting

Information from the biological surveys and from interviews was analyzed to identify the threatened habitats within the Babuyan Islands and to set priorities for future conservation. An evaluation of the importance of each habitat type of each island was made based on the number of globally threatened species present and the estimated level of local threat to these species and their habitats. For each habitat type the following scales of global importance were assigned: Low – habitats with no threatened species, High – habitats with one or two threatened species and Very High – habitats with three or more threatened species. Local threats to the species and survey habitats were assessed and levels of Low, Moderate or High were assigned. A matrix was drawn up to determine a scale of conservation priority levels based on these two variables (Table 3). Conservation priority levels were then assigned to habitats, assuming the level of local threat to be the most significant factor (Sutherland 2000).

**Table 3. Evaluation of conservation priority for habitats.**

Scale of local threats	Scale of habitat global importance		
	Low	High	Very High
Low	Low	Low	Low
Moderate	High	High	Very High
High	High	Very High	Very High

### Results

Species lists for all currently known bird, mammal, reptile and amphibian records from the Babuyan Islands, including this survey and previous survey results, are shown in Appendices I to IV. The data from this survey was collected by the authors and team members Desmond Allen, Carmela Española, Marisol Pedregosa, Mark Anthony Reyes, Harvey John Garcia, Juan Carlos Gonzalez and Amado Bajarias, Jr.

### Birds

A total of 126 bird species was recorded in the study, including three that were new to the Philippines – Jacobin's Cuckoo *Clamator jacobinus*, Orange-flanked Bush-robin

*Luscinia cyanura*, and the Calayan Rail *Gallirallus calayanensis* (Allen et al. 2004), a previously undescribed species discovered on Calayan Island. New distributional records made during this study are discussed in Allen et al. (in preparation). The total number of species identified in each island is shown in Table 4 together with the number of resident and migratory species. Of the 126 species recorded, 65 were resident (52%), 59 were migrant (47%) and two were vagrant species. In order to distinguish Philippine resident species from passage or wintering migrants, the residency status of each species has been assigned in accordance with Kennedy et al. (2000). Species classified as 'resident/migrant' in Kennedy et al. (2000) were assigned either a 'resident' or 'migrant' status based on available information. The greatest number of bird species was recorded on Calayan (76) and Camiguin (71) islands, 60 were recorded on Babuyan Claro and 59 on Dalupiri. The fewest number of species were recorded on Pamoctan (35).

**Table 4. Summary of the residency status of birds.**

Species	Camiguin	Pamoctan	Babuyan Claro	Calayan	Dalupiri	Babuyan group
Resident species	43	26	24	44	34	65
Migrant species	28	9	36	31	24	59
Vagrant species	0	0	0	1	1	2
<b>Total</b>	<b>71</b>	<b>35</b>	<b>60</b>	<b>76</b>	<b>59</b>	<b>126</b>

The threatened Philippine Duck *Anas luzonica* (Vulnerable) was recorded on Dalupiri, and the endemic Calayan Rail *Gallirallus calayanensis* has subsequently been included in the Birdlife International Globally Threatened Bird discussion forums and will be classified as Vulnerable in the 2005 IUCN Red List (evaluated by Birdlife International – the official Red List authority for birds for IUCN) (Birdlife International 2005). Four near-threatened birds were recorded: the Malaysian Plover *Charadrius peronii*, Whistling Green Pigeon *Treron formosae*, Ryukyu Scops-Owl *Otus elegans* and Short-Crested Monarch *Hypothymis helenae*.

Ten bird species endemic to the Philippines were recorded: the Philippine Duck *Anas luzonica*, Bukidnon Woodcock *Scolopax bukidnonensis*, Philippine Coucal *Centropus viridis*, Pygmy Swiftlet *Collocalia troglodytes*, Elegant Tit *Parus elegans*, Short-Crested Monarch *Hypothymis helenae*, Yellow-bellied Whistler *Pachycephala philippinensis*, Red-keeled Flowerpecker *Dicaeum australe*, Pygmy Flowerpecker *Dicaeum pygmaeum* and Yellowish White-eye *Zosterops nigrorum*. Two near-endemic species were recorded, which otherwise have only extremely restricted ranges within Taiwan: the Philippine Cuckoo-Dove *Macropygia tenuirostris* and Lowland White-eye *Zosterops meyeri*. The Black-chinned Fruit Dove *Ptilinopus leclancheri* is also described as a near-endemic, but has recently been found to be widespread in Taiwan (D. Allen pers. comm.). Seven of these endemic and near-endemic species were recorded on Calayan and Camiguin, five on Pamoctan, four on Babuyan Claro and two on Dalupiri.



The study recorded species from 42 families, of which the most common were Scolopacidae – Curlews, Godwits, Sandpipers, Snipes (18 species); Ardeidae – Bitterns, Egrets, Herons (12); Rallidae – Coots, Crakes, Rails, Waterhens (9); Columbidae – Doves, Pigeons (9) and Charadriidae – Lapwings, Plovers (7). Most members of the families Scolopacidae, Ardeidae and Charadriidae recorded during the study are migratory species.

### Mammals

A total of 18 mammal species were recorded during the study, of which eight (44%) were volant mammals, five (28%) were small non-volant mammals, two (11%) were large mammals and three (17%) were marine mammals. Eleven of these (61%) were new records for the Babuyan Islands. Three threatened species were recorded: the Ryukyu Flying Fox *Pteropus dasymallus* (Endangered), the Philippine Warty Pig *Sus philippensis* (Vulnerable) and the Humpback Whale *Megaptera novaeangliae* (Vulnerable). Two species endemic to the Philippines were found: the Yellow-faced Horseshoe Bat *Rhinolophus virgo* and the Common Philippine Forest Rat *Rattus everetti*. The following families were represented in the survey: Soricidae (shrews), Pteropodidae (flying foxes and Old World fruit bats), Rhinolophidae (horseshoe bats and Old World leaf-nosed bats), Vespertilionidae (evening bats and vesper bats), Muridae (mice, rats and voles), Viverridae (civets, genets and linsangs), Suidae (pigs), Balaenopteridae (baleen whales), Delphinidae (dolphins, killer whales, pilot whales).

### Reptiles and Amphibians

A total of 31 reptile species and seven amphibian species were recorded. Twenty-eight reptile species (90%) were new records for the Babuyan Island group and all of the amphibian species were new records, based on published records from the area. Two threatened species were recorded: the Green Turtle *Chelonia mydas* (Endangered) and an unidentified crocodile species. A subsequent study has confirmed that the species is the Philippine Crocodile *Crocodylus mindorensis* (Critically Endangered, Oliveros *et al.* (in press)). The Hawksbill Turtle *Eretmochelys imbricata* (Critically Endangered) was reported as being present from local interviews. Six reptile species endemic to the Philippines were recorded: Philippine Bent-toed Gecko *Cyrtodactylus philippinicus*, Philippine Blunt-headed Tree Snake *Boiga philippina*, Banded Burrowing Snake *Oxyrhabdium leporinum*, Northern Water Snake *Rhabdophis spilogaster*, Philippine Pit Viper *Trimeresurus flavomaculatus*, and McGregor's Pit Viper *Trimeresurus mcgregori*. Three amphibian species endemic to the Philippines were recorded: Giant Philippine Frog *Limnonectes macrocephalus*, Woodworth's Frog *Limnonectes woodworthi*, and Slender-digit Chorus Frog *Kaloula picta*. Indications of the existence of a frugivorous monitor lizard on Camiguin were encountered, but a subsequent study found no further evidence of such a lizard on the island (Reyes *et al.* 2005).

### Conservation and habitat conservation priorities

The study identified 18 globally threatened or near-threatened species, as defined in the IUCN Red List, except for the following three species: the Camiguin Island Wolf Snake *Lycodon bibonius*, Jareck's Wolf Snake *Lycodon chrysoprateros* and McGregor's Pit Viper *Trimeresurus mcgregori*. These species are not cited in the Red List, but have been assigned a precautionary near-threatened status for the purposes of this study because of their restricted ranges. These conservation priority species and their habitats (based on records and information from interviews), together with known or observed local threats, are shown in Table 5.

**Table 5. Conservation priority species, their habitats and local threats to these species.**

Important species	Habitats	Local Threats
1. Philippine Duck <i>Anas luzonica</i> (VU)	Ricefields in Dalupiri	Possibly hunted
2. Calayan Rail <i>Gallirallus calayanensis</i> (VU)	Primary and secondary lowland forest on coralline limestone in Calayan	Hunting, habitat loss, Introduced species
3. Malaysian Plover <i>Charadrius peronii</i> (NT)	Isolated sandy beaches in Calayan, Dalupiri	Human encroachment on habitat (including dogs)
4. Whistling Green-Pigeon <i>Treron formosae</i> (NT)	Lowland forest in Camiguin, Babuyan Claro, Pamoctan, Calayan, Dalupiri	Babuyan Claro, Camiguin and Calayan: heavy hunting pressure -preferred species of hunters; habitat loss. Pamoctan: hunting pressure low.
5. Ryukyu Scops-Owl <i>Otus elegans</i> (NT)	Lowland forest in Camiguin, Pamoctan, Calayan, and Babuyan Claro	Loss of nesting trees due to forest clearing
6. Short-crested Monarch <i>Hypothymis helenae</i> (NT)	Lowland, sub-montane forest in Camiguin	Habitat loss. Not hunted
7. Yellow Bunting <i>Emberiza sulphurata</i> (VU)	Scrub and cultivated areas of Calayan	Habitat loss. Not hunted
8. Ryukyu Flying Fox <i>Pteropus dasymallus</i> (EN)	Primary lowland forest in Babuyan Claro, Dalupiri	Heavy hunting pressure
9. Philippine Warty Pig <i>Sus philippensis</i> (VU)	Lowland and sub-montane forest in Camiguin, Babuyan Claro, Calayan	Hunted in Camiguin, Babuyan Claro and Calayan, hybridization with feral/domestic pigs

Table 5. Cont.

Important species	Habitats	Local Threats
10. Common Bent-winged Bat <i>Miniopterus schreibersi</i> (NT)	Lowland forest in Dalupiri	Possible habitat loss due to disturbance of roosting sites
11. Yellow-faced Horseshoe Bat <i>Rhinolophus virgo</i> (NT)	Primary lowland forest in Calayan, Babuyan Claro	Possible habitat loss due to disturbance of roosting sites
12. Humpback Whale <i>Megaptera novaeangliae</i> (VU)	Waters off the Babuyan Islands	Use of dynamite during illegal fishing practices
13. Green Turtle <i>Chelonia mydas</i> (EN)	Waters off the Babuyan Islands*	Poaching for food and trade
14. Hawksbill Turtle <i>Eretmochelys imbricata</i> (EN)	Waters off the Babuyan Islands*	Poaching for trade
15. Philippine Crocodile <i>Crocodylus mindorensis</i> (CR)	Freshwater creeks in Dalupiri	Previously hunted by traders from Luzon but apparently not hunted currently by local residents. Very small population
16. Camiguin Island Wolf Snake <i>Lycodon bibonius</i> (NT*)	Lowland forest in Camiguin (Ota and Ross 1994)	Habitat loss, human-wildlife conflict - usually killed upon sight
17. Jareck's Wolf Snake <i>Lycodon chrysoprateros</i> (NT*)	Lowland forest in Dalupiri (Ota and Ross 1994)	Habitat loss, human-wildlife conflict - usually killed upon sight
18. McGregor's Pit Viper <i>Trimeresurus mcgregori</i> (NT*)	Lowland forest in Camiguin, Babuyan Claro and Calayan	Habitat loss, human-wildlife conflict - usually killed upon sight

CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near-threatened (IUCN, 2004), NT\* = Precautionary near-threatened

\*There is no information indicating that the listed turtle species use the Babuyan Island beaches for nest sites.

The level of conservation priority for each habitat on each island, identified by comparing the scale of habitat global importance with the scale of local threat (see Table 3) is shown in Table 6.

**Table 6. Habitats and their level of conservation priority.**

Habitat	Scale of habitat global importance(number of threatened species)	Scale of local threats	Conservation Priority
<b>Camiguin</b>			
Lowland forest	High (1 T, 5 NT)	Moderate	High
Sub-montane forest	High (1 T, 1 NT)	Moderate	High
<b>Pamoctan</b>			
Lowland forest	Low (2 NT)	Low	Low
<b>Babuyan Claro</b>			
Lowland forest	High (2 T, 4 NT)	High	Very high
<b>Calayan</b>			
Lowland forest	High (2 T, 4 NT)	Moderate	Very high
Sandy beach	Low (1 NT)	Low	Low
Scrub, cultivated areas	High (1 T)	Low	Low
<b>Dalupiri</b>			
Ricefields	High (1 T)	Low	Low
Riverine gully forest	High (1 T)	Moderate	High
Sandy beach	Low (1 NT)	Low	Low
Lowland forest	High (1 T, 3 NT),	Low	Low
<b>Waters off Babuyan Islands</b>	Very High (3 T)	Moderate	Very high

T=Threatened, NT=Near-threatened

These analyses indicate that two terrestrial habitats and the waters off the Babuyan islands should be considered to be of very high priority for conservation since each of these hold three or more threatened species. The two terrestrial habitats are the lowland forests in Babuyan Claro, which contain the Ryukyu Flying Fox and the Philippine Warty Pig, and Calayan, where the endemic Calayan Rail and the Philippine Warty Pig are of interest to conservation. In particular, the site of Ayumit in Babuyan Claro is important, while the Longog area of Calayan requires immediate protection to safeguard the habitat of the island-endemic Calayan Rail. The waters off the Babuyan Islands are rich in marine animals (Acebes and Lesaca 2003) and, in particular, the Humpback Whale, and the Green and Hawksbill Turtles are regularly recorded off the islands.

Lowland forests are extremely important habitats because they hold the greatest concentration and diversity of wildlife (Sutherland 2000). Protecting the forests of Camiguin, Babuyan Claro and Calayan could have great potential to protect other less-studied forms of life, including plants and invertebrates.

Current threats to the wildlife of the Babuyan Islands were identified as illegal logging, slash and burn farming (kaingin), heavy hunting pressures, and illegal blast fishing. Hybridisation with feral pigs is a serious threat for the Philippine Warty Pig.

The local government is rapidly improving road networks in Calayan. This will facilitate movement around the island, but care must be taken to protect the environment during this development. Aside from the possibility of cutting across important natural habitats, the building of new roads facilitates the spread of settlements with their associated dogs, cats and rats, which may threaten species such as the Calayan Rail. A potential tourism industry based on the presence of humpback whales for part of the year or the Calayan Rail may also lead to widespread changes that, without control mechanisms, could introduce new threats in the future.

However, there is a strong willingness to conserve resources amongst some members of the Babuyan Island community, particularly at local government level. Ordinances have been passed controlling slash and burn agriculture, illegal fishing practices and the killing of sea turtles. The results of local interviews, however, indicated that government officials are unable to enforce the ordinances due to a lack of resources and a general lack of awareness of the benefits of conservation amongst the general public. The officials requested the implementation of education programs to explain the need for, and methods of achieving, the conservation of natural resources.

At the national level, a bill was filed in June 2003 in the Lower House of the Philippine Congress seeking protected status of the Islands for the municipality of Calayan and its surrounding waters under the National Integrated Protected Areas System (NIPAS) Act. Base-line surveys have already been undertaken by the Department of Environment and Natural Resources (DENR) on the Islands of Calayan and Camiguin as part of the Protected Area Survey Assessment, one of several steps in the process of declaration of a protected area under the NIPAS Act.

## **Discussion**

The results indicated that the Babuyan Island group, in spite of its small size, is a site of outstanding biological importance, with unique fauna and habitats containing globally important species of birds, mammals, reptiles and amphibians.

---

Six globally threatened and six near-threatened species of terrestrial animals were found by this study in these islands, together with a total of ten bird species, two mammal species, six reptile species and three amphibian species endemic to the Philippines.

A pattern of endemism in each island of the Babuyan group is demonstrated. In Calayan, the previously undescribed Calayan Rail was discovered, the first bird species known to be endemic to the island, while Dalupiri and Camiguin are known to harbor one wolf snake species each, *Lycodon chrysoprateros* and *Lycodon bibonius*, respectively (Ota and Ross 1994). Some lizards and geckos encountered during this study are potentially island-endemic forms. Indeed, Lazell (1992) predicts a full species of flying lizard will be found in each of Camiguin, Calayan, Babuyan Claro and Fuga Islands. It is likely that mammal species endemic to the islands in the Babuyan group will be found since, as Heaney (1986) states, endemic species can be found in oceanic islands as small as 47 km<sup>2</sup>.

It is common for conservation work to be focused on areas that are already suffering severe damage from habitat loss and human activities. Although the Babuyan Islands face current threats, they remain relatively undamaged at present and the major dangers to the Islands' ecosystems lie in future developments. While the Philippines as a whole has lost 93% of its forest since 1900 (Ong *et al.* 2002), more than half the land area of remote islands such as Calayan, Camiguin and Babuyan Claro are still covered by forest. Given this situation, the actions taken by the Philippine legislature and the Department of the Environment and Natural Resources to declare the islands a Protected Area under the NIPAS system are encouraging and a clear sign of their awareness of the importance to conserve this area. However, the involvement of local stakeholders is crucial and protection at the local government level may be more effective and have more impact than protection from the distant central government. One option that has proved successful in other situations in the Philippines is the declaration of sanctuaries through local ordinances (Van der Ploeg and van Weerd 2004), thus passing protection to the local government unit and creating a situation of local ownership. Stakeholders should be able to choose from such alternative options for environmental protection in order to decide which best suits their particular circumstances.

The results of the study indicate that there are local concerns about environmental protection and, in spite of heavy hunting pressure, an awareness of the need to live sustainably in the present to preserve natural resources for the future. The interest in protecting the environment and wildlife generated by the project can be used to great effect in future conservation programs. Successful conservation work relies on the cooperation of the community's stakeholders (Sutherland 2000), it is therefore essential that future work identify all the relevant stakeholders. These include the municipal government officials, national government departments, local people's organisations,

---

individuals working in conservation initiatives and private landowners. The international community and non-government organisations can provide training and direct experience of similar projects in other countries and regions of the Philippines. The ordinances currently in place prohibiting illegal logging, slash and burn farming, excessive hunting and illegal hunting practices are not effective; external assistance can help to support local government and community-led initiatives.

There must be a planning framework for the future. The necessary information is now available for the local government to develop an effective resource management plan, together with the stakeholders and with the aid of external organisations. Such a plan could utilise charismatic 'flagship' species, such as the Calayan Rail and the Yellow Bunting, to help protect whole habitats, thus benefiting other associated species. This would be of particular interest in the lowland forest habitats which probably hold a large number of unrecorded species, as well as the threatened species already identified.

This study is only a snapshot of the wildlife diversity to be found in this remote and unique group of islands; further research is clearly needed. The evaluation of this study was based on scientific information currently available on the species and their habitats and may be revised in the light of further studies. More undescribed species may yet be found in these islands, a view shared by Lazell (1992) and affirmed by this short preliminary survey. Specifically, the project recommends further studies on the status and habitat requirements of the Calayan Rail and assessment of the conservation status of species such as the Camiguin Island Wolf Snake *Lycodon bibonius*, Jareck's Wolf Snake *Lycodon chrysoprateros* and McGregor's Pit Viper *Trimeresurus mcgregori*. More extensive surveys of the mammals, reptiles and amphibians and initial surveys of the flora and invertebrates are needed. In the future, priorities must be re-evaluated as more knowledge is gained about the life histories and habitats of the species present in the Babuyan Islands, or new threats arise. The study also recommends the establishment of protected areas in the priority sites identified in order to maintain populations of endemic species and their habitats; and the implementation of education campaigns to raise awareness of the value of conserving the natural resources of the Islands through sustainable use.

The need for communication between scientists, government and members of the public has never been greater as habitats are being lost daily on a global scale. Encouragingly, there are individuals within the Babuyan Island communities with the potential to form a core group for environmental initiatives. This factor, together with local conservation initiatives, local interest in protecting the environment and the current 'good health status' of the islands' natural resources, indicates that successful conservation programs could be implemented. However, any conservation activities will require human and financial resources as well as an understanding of their possible ecological,

---

social and economic implications. The challenge now is to combine studying the conservation requirements of important species, while helping the local community to protect their natural resources for the future. The Babuyan Island project created an opportunity to recognize and encourage local conservation initiatives, thus building future conservation and education projects on a solid foundation, supported by the local community.

### ACKNOWLEDGEMENTS

The authors would like to extend grateful thanks to the team: Marisol Pedregosa, Carmela Española, Mark Anthony Reyes, Harvey John Garcia, Juan Carlos Gonzalez, Amado Bajarias, Jr.; and Desmond Allen, who accompanied us as a consultant in oriental birds. Warm thanks to the people of the Babuyan Islands, in particular Mayor Joseph Llopis of Calayan, our guides, those who extended hospitality and the local and national government officials who provided support. Lourdes Castillo and Lourdes Cardenas of UPLB provided the collection permit. The following people generously shared their knowledge: Jo Marie Acebes, Desmond Allen, Phillip Atkinson, Danilo Balete, Daniel Bennett, Rafe Brown, Dennis Bulan, Mary Ann Cajano, Edison Cosico, Edward Dickinson, Arvin Diesmos, John Dutton, Orlando Eusebio, Anna Feistner, Larry Heaney, Jon Hornbuckle, Nina Ingle, Arne Jensen, Robert S. Kennedy, Ariel Laron, Ireneo Lit, Rob Lucking, Jimmy McGuire, William Oliver, Hidetoshi Ota, Lisa Marie Paguntalan, Mylanar Saulog, Lucia Liu Severinghaus, William Sutherland; Nigel Collar, Richard Thomas and Stuart Butchart of Birdlife International, Maria Josefa Veluz, Francis Veluz and Roger Sison of the National Museum of the Philippines; Kiyooki Ozaki and Takashi Hiraoka of the Yamashina Institute for Ornithology; Robert Prws-Jones and Mark Adams of the Department of Zoology Bird Group, the Natural History Museum, Tring, UK. Our thanks to Abegail Machina and Elson Aca who assisted with Figure 1. We thank Chris Brown, Merlijn van Weerd and two anonymous reviewers whose valuable comments improved this paper. The project was funded by the Rufford Small Grant Committee and the Oriental Bird Club; equipment donation from Ideawild, U.S.A.

### References

- Acebes, J.V. and L.A.R. Lesaca. 2003. Research and conservation of Humpback Whales (*Megaptera Novaeangliae*) and other cetacean species in the Babuyan Islands, Cagayan Province, Northern Luzon, Philippines. In: Van der Ploeg, J., A.B. Masipiquena and E.C. Bernardo (editors), *The Sierra Madre Mountain Range: Global Relevance, Local Realities*. Cagayan Valley. Program on Environment and Development, Golden Press, Tuguegarao City. 34-42 pp.
-



- 
- Alcala, A.C. and W.C. Brown. 1998. Philippine amphibians: an illustrated field guide. Bookmark, Makati City. 116 pp.
- Allen, D., C. Oliveros, G. Broad, C. Española, and J.C. Gonzalez. 2004 A new species of Gallirallus from Calayan island, Philippines. Forktail 20:1-7.
- Allen, D., C. Española, G. Broad, C. Oliveros, and J.C. Gonzalez. New bird records for the Babuyan Islands, Philippines, including two first records for the Philippines (In preparation).
- Balete, D.S., L.R. Heaney, and R.I. Crombie. 1995. First records of *Hipposideros lekaguli* Thonglongya and Hill 1974 from the Philippines. Asia Life Sciences 4(1):89-94.
- BirdLife International (2005) Species factsheet: *Gallirallus calayanensis*. Downloaded 09 September 2005. < <http://www.birdlife.org> >
- Brown, W. C. and A.C. Alcala. 1978. Philippine lizards of the Family Gekkonidae. Silliman University Natural Science Monograph Series (1), Dumaguete City, Philippines. 146 pp.
- Brown, W. C. and A.C. Alcala. 1980. Philippine lizards of the Family Scincidae. Silliman University Press, Dumaguete, Philippines. 264 pp.
- Defant, M.J., D. Jacques, R.C. Maury, J. De Boer, J-L. Joron. 1989. Geochemistry and tectonic setting of the Luzon arc, Philippines. Geological Society of America Bulletin 101(5):663-672.
- Dickinson, E.C. (Ed.) 2003. The Howard and Moore Complete Checklist of the Birds of the World. 3<sup>rd</sup> Edition. Princeton University Press, Princeton, New Jersey.
- Dickinson, E.C. (Ed.) 2004. Howard and Moore Edition 3:Corrigenda 2.1
- du Pont, J.E. 1971. Philippine birds. Monograph Series No. 2. Delaware Museum of Natural History, Greenville, Delaware, USA. 480 pp.
- Gonzalez, J.C.T., L.E. Afuang, and A.T.L. Dans. 1995. A manual in Wildlife 101 – introduction to Philippine wildlife. Wildlife Biology Laboratory, Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Baños, Philippines. 130 pp.
-

- 
- Heaney, L.R. 1986. Biogeography of mammals in S.E. Asia: estimates of rates of colonization, extinction and speciation. In: Heaney, L.R. and Patterson, B.D., *Biological Journal of the Linnean Society*, 28:127-165.
- Heaney, L. R., D. S. Balete, L. Dolar, A.C. Alcala, A. Dans, P.C. Gonzales, N. Ingle, M. Lepiten, W. Oliver, E.A. Rickart., B.R. Tabaranza, Jr., and R.C.B. Uzzurum. 1998. A synopsis of the mammalian fauna of the Philippine Islands. *Fieldiana Zoology new series* 88:1-61.
- Heaney, L.R. and M. Ruedi. 1994. A preliminary analysis of biogeography and phylogeny of *Crocidura* from the Philippines. *Special Publication* 18:357-377. Carnegie Museum of Natural History.
- Ingle, N.R. and L. R. Heaney. 1992. A key to the bats of the Philippine Islands. *Fieldiana: Zoology, new series* 58:1-44.
- IUCN 2004 IUCN Red List of Threatened Species. Downloaded 05 September 2004. <<http://www.iucnredlist.org>>
- Jefferson, T.A., S. Leatherwood and M.A. Webber. 1993. *FAO species identification guide, marine mammals of the world*. FAO, Rome. 320 pp.
- Kennedy, R. S., P.C. Gonzales, E.C. Dickinson, H.C. Miranda, and T.H. Fisher. 2000. *A guide to the birds of the Philippines*. Oxford University Press, Oxford.
- Lazell, J. 1992. New flying lizards and predictive biogeography of two Asian archipelagos. *Bull. Mus. Comp. Zool.* 152(9):475-505.
- Leviton, A. E. 1964. Contributions to a review of Philippine snakes, V. The snakes of the genus *Trimeresurus*. *Philip.J. Sci.* 93:251-276.
- Leviton, A.E. 1968. Contributions to a review of Philippine snakes, V. The snakes of the genus *Ahaetulla*. *Philip.J. Sci.* 96:73-90.
- Leviton, A. E. 1970. Contributions to a review of Philippine snakes, XII. The Philippine snakes: of the genus *Dendrelaphis* (Serpentes: Colubridae). *Philip. J. Sci.* 97:371-396.
- 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*. Bookmark, Makati City. 485 pp.
-

McGuire, J.A. and A.C. Alcala. 2000. A taxonomic revision of the flying lizards (Iguani: Agamidae:Draco) of the Philippine Islands, with a description of a new species. *Herpetological Monographs* 14:81-138.

Oliveros, C., G. Broad, M. Pedregosa, C. Española, M.A. Reyes, H.J. Garcia, J.C. Gonzalez, A. Bajarias, Jr. 2004 An avifaunal survey of the Babuyan Islands, Northern Philippines with notes on mammals, reptiles and amphibians, 29 March-6 June 2004. Unpublished report. Babuyan Islands Expedition 2004.

Oliveros, C., R. Manalo, E. Coñate Jr, B. Tarun, S. Telan, and M. van Weerd. Philippine Crocodile recorded on Dalupiri Island. IUCN Crocodile Specialist Group Newsletter (in press).

Ong, P.S., L.E. Afuang, and R.G. Rosell-Ambal. (editors). 2002. Philippine Biodiversity Conservation Priorities: A second iteration of the national biodiversity strategy and action plan. Department of Environment and Natural Resources-Protected Areas and Wildlife Bureau, Conservation International Philippines, Biodiversity Conservation Program-University of the Philippines Center for Integrative and Development Studies, and Foundation for the Philippine Environment, Quezon City, Philippines. 113 pp.

Ota, H. and R.I. Crombie. 1989. A new lizard of the genus *Lepidodactylus* (Reptilia: Gekkonidae) from Batan Island, Philippines, *Proc. Biol. Soc. Washington* 102:559-567.

Ota, H. and C.A. Ross 1994. Four new species of *Lycodon* (Serpentes:Coluridae) from the Northern Philippines. *Copeia* 1:159-174

Philippine Institute of Volcanology and Seismology 2004. Quezon City, Philippines. Downloaded 27 September 2004.

< <http://www.phivolcs.dost.gov.ph/Volcano/Volcanolist/didicas.htm> >

< <http://www.phivolcs.dost.gov.ph/Volcano/Volcanolist/smith.htm> >

< <http://www.phivolcs.dost.gov.ph/Volcano/Volcanolist/babuyanclaro.htm> >

< <http://www.phivolcs.dost.gov.ph/Volcano/Volcanolist/camiguindebabuyanes.htm> >

Reyes, M.A.P., V. Bennett, and C. Oliveros. 2005. The Monitor Lizards of Camiguin Island, Northern Philippines. Unpublished Report.

Robson, C. 2002. A field guide to the birds of South-East Asia. New Holland Publishers, UK. 504 pp.

- Scharringa, J. 2001. Birds of tropical Asia 2.0 (CD-ROM). Bird Songs International B.V., Westernieland, The Netherlands.
- Smithsonian Institution. 2004. Global Volcanism Program, Department of Mineral Sciences, National Museum of Natural History, SI, Washington DC.  
Downloaded 06 September 2004. <<http://www.volcano.si.edu/world/volcano>>
- Stattersfield, A.J., M.J. Crosby, A.J. Long, and D.C. Wege. 1998. Endemic bird areas of the world: priorities for biodiversity conservation. *Birdl. Cons. Ser.* 7, Cambridge, UK.
- Sutherland, W.J. 2000. *The Conservation Handbook: Research, Management and Policy*. Blackwell Publishing, Oxford.
- Taylor, E.H. 1922. The snakes of the Philippine Islands. *Monog. Bureau Sci. Manila*, No. 16, 312 pp.
- Taylor, B. 1998. *Rails: a guide to the rails, crakes, gallinules and coots of the world*. Pica Press, Mountfield, Sussex, UK.
- Van der Ploeg, J. and M. van Weerd. 2004. Devolution of Natural Resource Management and Crocodile Conservation: The Case of San Mariano, Isabela. *Philippine Studies* 52(3):345-82.
- Voris, H.K. 2000. Maps of Pleistocene sea levels in Southeast Asia: shorelines, river systems and time durations. *Journal of Biogeography*. 27:1153-1167.
- Wildlife Conservation Society of the Philippines, Inc. 1997. *Philippine Red Data Book: Red List of Threatened Animals*. Bookmark, Makati City.
-

APPENDIX I  
BIRDS

Species	Camiguin	Pamoctan	BabuyanClaro	Calayan	Dalupiri
Little Grebe <i>Tachybaptus ruficollis</i>	-	-	-	K	-
Tahiti Petrel <i>Pseudobulweria rostrata</i>	-	-	X	-	-
Bulwer's Petrel <i>Bulweria bulwerii</i>	X	-	-	-	-
Wedge-tailed Shearwater <i>Puffinus pacificus</i>	X	-	X	-	X
Great Cormorant <i>Phalacrocorax carbo</i>	-	-	-	K	-
Brown Booby <i>Sula leucogaster</i>	-	X	-	K	-
Grey Heron <i>Ardea cinerea</i>	X	-	X	X	-
Great Egret <i>Ardea alba</i>	X	X	-	X	-
Eastern Reef-Egret <i>Egretta sacra</i>	X	X	X	XK	XK
Intermediate Egret <i>Egretta intermedia</i>	X	X	X	XK	-
Little Egret <i>Egretta garzetta</i>	X	X	X	X	-
Chinese Pond-Heron <i>Ardeola bacchus</i>	-	-	X	-	-
Little Heron <i>Butorides striata</i>	-	-	-	K	-
Cattle Egret <i>Bubulcus ibis</i>	X	-	X	XK	X
Black-crowned Night-Heron <i>Nycticorax nycticorax</i>	X	-	X	XK	-
Rufous Night-Heron <i>Nycticorax caledonicus</i>	XK	-	X	-	X
Schrenck's Bittern <i>Ixobrychus eurhythmus</i>	X	-	-	-	X
Yellow Bittern <i>Ixobrychus sinensis</i>	-	-	-	K	X
Cinnamon Bittern <i>Ixobrychus cinnamomeus</i>	X	-	-	-	X
Woolly-necked Stork <i>Ciconia episcopus</i>	-	-	-	K	-
Wandering Whistling-Duck <i>Dendrocygna arcuata</i>	K	-	-	-	-
Green-winged Teal <i>Anas crecca</i>	-	-	-	K	-
Spot-billed Duck <i>Anas poecilorhyncha</i>	-	-	-	K	-
Philippine Duck <i>Anas luzonica</i>	-	-	-	-	X
Eurasian Wigeon <i>Anas penelope</i>	-	-	-	K	-
Garganey <i>Anas querquedula</i>	-	-	-	K	-
Northern Shoveler <i>Anas clypeata</i>	-	-	-	K	-

Species	Camiguin	Pamoctan	BabuyanClaro	Calayan	Dalupiri
Tufted Duck <i>Aythya fuligula</i>	-	-	-	K	-
Osprey <i>Pandion haliaetus</i>	X	-	-	X	X
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	XK	X	X	XK	X
Chinese Goshawk <i>Accipiter soloensis</i>	-	-	X	XK	-
Grey-faced Buzzard <i>Butastur indicus</i>	K	-	X	XK	-
Peregrine Falcon <i>Falco peregrinus</i>	K	-	-	K	-
Tabon Scrubfowl <i>Megapodius cumingi</i>	K	X	X	XK	X
Blue-breasted Quail <i>Coturnix chinensis</i>	-	-	-	-	X
Calayan Rail <i>Gallirallus calayanensis</i>	-	-	-	X	-
Barred Rail <i>Callirallus torquatus</i>	XK	X	XK	XK	XK
Slaty-legged Crane <i>Rallina eurizonoides</i>	X	X	X	-	-
Baillon's Crane <i>Porzana pusilla</i>	-	-	-	-	X
White-browed Crane <i>Porzana cinerea</i>	X	-	-	-	-
Plain Bush-hen <i>Amauromis olivacea</i>	X	-	-	XK	X
White-breasted Waterhen <i>Amauromis phoenicurus</i>	X	X	X	X	X
Watercock <i>Gallicrex cinerea</i>	X	-	-	X	X
Common Moorhen <i>Gallinula chloropus</i>	X	X	-	XK	X
Pheasant-tailed Jacana <i>Hydrophasianus chirurgus</i>	-	-	-	K	-
Greater Painted-Snipe <i>Rostratula benghalensis</i>	-	-	-	X	X
Grey-headed Lapwing <i>Vanellus cinereus</i>	X	-	-	-	-
Asian Golden-Plover <i>Pluvialis fulva</i>	-	-	X	K	X
Little Ringed-Plover <i>Charadrius dubius</i>	X	-	-	K	-
Kentish Plover <i>Charadrius alexandrinus</i>	-	-	X	XK	-
Malaysian Plover <i>Charadrius peronii</i>	-	-	-	XK	X
Lesser Sand Plover <i>Charadrius mongolus</i>	-	-	X	XK	-
Greater Sand Plover <i>Charadrius leschenaultia</i>	-	-	X	X	X
Whimbrel <i>Numenius phaeopus</i>	-	-	-	X	-
Black-tailed Godwit <i>Limosa limosa</i>	-	-	X	-	-
Common Redshank <i>Tringa totanus</i>	X	-	-	-	-
Common Greenshank <i>Tringa nebularia</i>	-	-	-	X	-

## APPENDIX I. Cont.

Species	Camiguin	Pamoctan	BabuyanClaro	Calayan	Dalupiri
Wood Sandpiper <i>Tringa glareola</i>	X	-	X	K	-
Marsh Sandpiper <i>Tringa stagnatilis</i>	-	-	X	-	-
Common Sandpiper <i>Actitis hypoleucos</i>	X	-	X	XK	X
Terek Sandpiper <i>Xenus cinereus</i>	-	-	X	-	-
Grey-tailed Tattler <i>Heteroscelus brevipes</i>	-	-	-	XK	X
Ruddy Turnstone <i>Arenaria interpres</i>	-	-	X	X	X
Pintail Snipe <i>Callinago stenura</i>	-	-	X	K	-
Bukidnon Woodcock <i>Scolopax bukidnonensis</i>	-	-	X	-	-
Sanderling <i>Calidris alba</i>	-	-	-	-	X
Rufous-necked Stint <i>Calidris ruficollis</i>	-	-	X	K	-
Long-toed Stint <i>Calidris subminuta</i>	-	-	X	-	-
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	X	-	X	-	-
Curlew Sandpiper <i>Calidris ferruginea</i>	-	-	X	-	-
Red-necked Phalarope <i>Phalaropus lobatus</i>	X	-	-	-	-
Oriental Pratincole <i>Glaresola maldivarum</i>	X	-	X	XK	X
Beach Thick-knee <i>Esacus magnirostris</i>	K	-	-	K	-
Black-winged Stilt <i>Himantopus himantopus</i>	-	-	-	-	X
Black-tailed Gull <i>Larus crassirostris</i>	-	-	-	X	-
Common Tern <i>Sterna hirundo</i>	-	-	X	K	-
Little Tern <i>Sterna albifrons</i>	-	-	X	-	-
Bridled Tern <i>Sterna anaethetus</i>	-	X	-	-	-
Whiskered Tern <i>Chlidonias hybridus</i>	-	-	-	-	X
Whistling Green-Pigeon <i>Treron formosae</i>	XK	X	-	XK	-
Black-chinned Fruit-Dove <i>Ptilinopus leclancheri</i>	XK	X	-	XK	-
Green Imperial-pigeon <i>Ducula aenea</i>	XK	-	X	XK	-
Metallic Pigeon <i>Columba vitiensis</i>	XK	X	-	K	-
Philippine Cuckoo-Dove <i>Macropygia tenuirostris</i>	-	-	X	K	-
Island Collared-Dove <i>Streptopelia bitorquata</i>	K	-	-	XK	X
Red Turtle-Dove <i>Streptopelia tranquebarica</i>	-	-	-	K	-
Spotted Dove <i>Streptopelia chinensis</i>	X	-	X	X	X

## APPENDIX I. Cont.

Species	Camiguin	Pamoctan	BabuyanClaro	Calayan	Dalupiri
Zebra Dove <i>Geopelia striata</i>	X	-	-	-	-
Common Emerald Dove <i>Chalcophaps indica</i>	XK	X	X	XK	X
Jacobin Cuckoo <i>Clamator jacobinus</i>	-	-	-	-	X
Oriental Cuckoo <i>Cuculus saturatus</i>	-	-	-	K	-
Common Koel <i>Eudynamis scolopacea</i>	XK	-	X	XK	X
Lesser Coucal <i>Centropus bengalensis</i>	X	-	-	-	X
Philippine Coucal <i>Centropus viridis</i>	XK	X	X	XK	XK
Ryukyu Scops-Owl <i>Otus elegans</i>	X	X	-	XK	-
Brown Hawk-Owl <i>Ninox scutulata</i>	X	-	-	XK	-
Grey Nightjar <i>Caprimulgus indicus</i>	-	-	-	K	-
Island Swiftlet <i>Collocalia vanikorensis</i>	-	-	-	-	X
Glossy Swiftlet <i>Collocalia esculenta</i>	X	X	XK	XK	X
Pygmy Swiftlet <i>Collocalia troglodytes</i>	-	-	-	X	-
Fork-tailed Swift <i>Apus pacificus</i>	-	X	-	X	X
House Swift <i>Apus nipalensis</i>	XK	-	-	X	X
Dollarbird <i>Eurystomus orientalis</i>	K	-	-	XK	-
Common Kingfisher <i>Alcedo atthis</i>	X	X	X	XK	-
Ruddy Kingfisher <i>Halycon coromanda</i>	XK	-	X	XK	-
White-collared Kingfisher <i>Todirhamphus chloris</i>	XK	X	X	X	-
Red-bellied Pitta <i>Pitta erythrogaster</i>	XK	-	-	-	-
Sand Martin <i>Riparia riparia</i>	-	-	-	XK	X
Barn Swallow <i>Hirundo rustica</i>	X	X	X	XK	X
Pacific Swallow <i>Hirundo tahitica</i>	XK	X	XK	X	X
Striated Swallow <i>Cecropis striolata</i>	XK	X	X	XK	X
Asian House-martin <i>Delichon dasypus</i>	-	-	-	K	-
Oriental Skylark <i>Alauda gulgula</i>	-	-	-	-	X
Pied Triller <i>Lalage nigra</i>	X	X	-	-	-
Ashy Minivet <i>Pericrocotus divaricatus</i>	-	-	-	K	-
Chestnut-eared Bulbul <i>Microscelis amaurotis</i>	XK	X	XK	XK	XK
Black-naped Oriole <i>Oriolus chinensis</i>	XK	X	-	XK	K



## APPENDIX I. Cont.

Species	Camiguin	Pamoctan	BabuyanClaro	Calayan	Dalupiri
Large-billed Crow <i>Corvus macrorhynchos</i>	-	-	XK	XK	XK
Elegant Tit <i>Parus elegans</i>	XK	-	-	XK	-
Orange-flanked Bush Robin <i>Luscinia cyanura</i>	-	-	-	X	-
Siberian Rubythroat <i>Luscinia calliope</i>	-	-	-	K	-
Northern Wheatear <i>Oenanthe oenanthe</i>	-	-	-	K	-
Blue Rock-Thrush <i>Monticola solitarius</i>	X	X	X	K	-
Brown-headed Thrush <i>Turdus chrysolaus</i>	XK	X	-	K	-
Pale Thrush <i>Turdus pallidus</i>	-	-	-	K	-
Eyebrowed Thrush <i>Turdus obscurus</i>	-	-	-	K	-
Arctic Warbler <i>Phylloscopus borealis</i>	-	-	-	K	-
Oriental Reed-warbler <i>Acrocephalus orientalis</i>	-	-	-	K	-
Gray's Grasshopper-warbler <i>Locustella fasciolata</i>	-	-	-	K	-
Lanceolated Warbler <i>Locustella lanceolata</i>	-	-	-	XK	X
Middendorf's Grasshopper-warbler <i>Locustella ochotensis</i>	-	-	-	K	X
Zitting Cisticola <i>Cisticola juncidis</i>	XK	-	-	XK	X
Oriental Bush-warbler <i>Cettia diphone</i>	-	-	-	K	-
Grey-streaked Flycatcher <i>Muscicapa griseisticta</i>	-	-	X	XK	X
Narcissus Flycatcher <i>Ficedula narcissina</i>	-	-	-	K	-
Snowy-browed Flycatcher <i>Ficedula hyperythra</i>	-	-	-	XK	-
Mangrove Blue Flycatcher <i>Cyornis rufigastra</i>	X	X	-	-	-
Short-crested Monarch <i>Hypothymis helenae</i>	XK	-	-	-	-
Yellow-bellied Whistler <i>Pachycephala philippinensis</i>	XK	X	-	XK	-
Grey Wagtail <i>Motacilla cinerea</i>	-	-	X	XK	X
Yellow Wagtail <i>Motacilla flava</i>	XK	-	X	XK	X
White Wagtail <i>Motacilla alba</i>	-	-	-	K	-
Forest Wagtail <i>Dendronanthus indicus</i>	-	-	-	K	-
Richard's Pipit <i>Anthus richardi</i>	X	-	X	XK	X
Red-throated Pipit <i>Anthus cervinus</i>	X	-	-	XK	-

## APPENDIX I. Cont.

Species	Camiguin	Pamoctan	BabuyanClaro	Calayan	Dalupiri
Olive Tree-pipit <i>Anthus hodgsoni</i>	-	-	-	K	-
Pechora Pipit <i>Anthus gustavi</i>	-	-	-	K	-
Brown Shrike <i>Lanius cristatus</i>	X	X	X	XK	X
Asian Glossy Starling <i>Aplonis panayensis</i>	XK	X	X	X	X
Silky Starling <i>Sturnus sericeus</i>	-	-	-	K	-
White-shouldered Starling <i>Sturnus sinensis</i>	-	-	-	K	-
Chestnut-cheeked Starling <i>Sturnus philippensis</i>	-	-	-	K	-
Crested Myna <i>Acridotheres cristatellus</i>	X	X	X	X	X
Purple-throated Sunbird <i>Leptocoma sperata</i>	XK	-	XK	XK	-
Red-keeled Flowerpecker <i>Dicaeum australe</i>	XK	-	-	-	-
Pygmy Flowerpecker <i>Dicaeum pygmaeum</i>	-	-	-	XK	-
Lowland White-Eye <i>Zosterops meyeri</i>	-	-	-	XK	-
Yellowish White-Eye <i>Zosterops nigrorum</i>	XK	X	-	-	-
Eurasian Tree Sparrow <i>Passer montanus</i>	X	-	X	X	X
White-bellied Munia <i>Lonchura leucogastra</i>	XK	-	-	XK	-
Chestnut Munia <i>Lonchura malacca</i>	-	-	-	XK	X
Brambling <i>Fringilla montifringilla</i>	-	-	-	K	-
Eurasian Siskin <i>Carduelis spinus</i>	-	-	-	K	-
Yellow Bunting <i>Emberiza sulphurata</i>	-	-	-	K	-

Legend: X – this study; K – Kennedy et al. (2000). Species in bold are listed as globally threatened and those underscored near-threatened (IUCN 2004, Birdlife International 2005)

APPENDIX II  
MAMMALS

Species	Camiguin	Pamoctan	Babuyan Claro	Calayan	Dalupiri
Indochinese Shrew <i>Crocidura attenuata</i>	-	-	-	X	-
Asian House Shrew <i>Suncus murinus</i>	-	-	-	-	X
Common Short-nosed Fruit Bat <i>Cynopterus brachyotis</i>	X	-	X	X	H
Dagger-toothed Flower Bat <i>Macroglossus minimus</i>	-	-	-	X	-
Ryukyu Flying Fox <i>Pteropus dasymallus</i>	-	-	X	-	H
Large Flying Fox <i>Pteropus vampyrus</i>	-	-	-	X	-
Common Roussette <i>Rousettus amplexicaudatus</i>	X	X	-	X	XH
Diadem Roundleaf Bat <i>Hipposideros diadema</i>	-	-	-	X	-
Yellow-faced Horseshoe Bat <i>Rhinolophus virgo</i>	-	-	X	X	-
Common Bent-winged Bat <i>Miniopterus schreibersi</i>	-	-	-	-	XH
Common Philippine Forest Rat <i>Rattus everetti</i>	-	-	X	-	-
Polynesian Rat <i>Rattus exulans</i>	X	-	-	-	-
Oriental House Rat <i>Rattus tanezumi</i>	X	-	-	-	-
Philippine Warty Pig <i>Sus philippensis</i>	X	-	X	-	-
Humpback Whale <i>Megaptera novaeangliae</i>		Sighted off Camiguin (X), waters off Babuyan Islands (A)			
Short-finned Pilot Whale <i>Globicephala macrorhynchus</i>		Skeleton found on Dalupiri (X), waters off Babuyan Islands (A)			
Fraser's Dolphin <i>Lagenodelphis hosei</i>		Waters off Babuyan Islands (A)			
Melon-headed Whale <i>Peponocephala electra</i>		Waters off Babuyan Islands (A)			
False Killer Whale <i>Pseudorca crassidens</i>		Waters off Babuyan Islands (A)			
Pantropical Spotted Dolphin <i>Stenella attenuata</i>		Waters off Babuyan Islands (A)			
Spinner Dolphin <i>Stenella longirostris</i>		Waters off Babuyan Islands (A)			
Rough-toothed Dolphin <i>Steno bredanensis</i>		Sighted off Camiguin (X), waters off Babuyan Islands (A)			
Bottlenose Dolphin <i>Tursiops</i> sp.		Waters off Babuyan Islands (A)			
Dwarf Sperm Whale <i>Kogia simus</i>		Waters off Babuyan Islands (A)			
Sperm Whale <i>Physeter macrocephalus</i>		Waters off Babuyan Islands (A)			

Legend: X – this study; H – Heaney et al. (1998); A – Acebes and Lesaca (2003); Species in bold are listed as globally threatened and those underscored near-threatened (IUCN 2004)

**APPENDIX III  
REPTILES**

Species	Camiguin	Pamoctan	Babuyan Claro	Calayan	Dalupiri
Green Turtle <i>Chelonia mydas</i>	W	-	-	W	X
Hawksbill Turtle <i>Eretmochelys imbricata</i>	W	-	-	W	-
Philippine Crocodile <i>Crocodylus mindorensis</i>	-	-	-	-	X
Philippine Bent-toed Gecko					
<i>Cyrtodactylus philippinicus</i>	X	-	X	-	-
Tender-skinned House Gecko <i>Gehyra mutilate</i>	-	-	-	X	-
Unidentified gecko Gekko sp. 1	X	X	-	-	-
Unidentified gecko Gekko sp. 2	-	-	X	-	-
Unidentified gecko Gekko sp. 3	-	-	-	X	X
Common House Gecko <i>Hemidactylus frenatus</i>	X	X	X	-	X
Unidentified smooth-scaled gecko					
<i>Lepidodactylus</i> sp.	-	-	X	-	X
McGregor's Flap-legged Gecko					
<i>Luperosaurus mcgregori</i>	-	-	-	B	-
Unidentified flying lizard <i>Draco</i> sp.	X	-	X	-	-
Gray Swamp Skink <i>Emoia atrocostata</i>	-	-	X	-	X
Spotted Green Tree Skink					
<i>Lamprolepis smaragdina</i>	-	-	X	-	-
Northern Two-striped Mabouya					
<i>Mabuya multicarinata borealis</i>	X	X	-	-	-
Unidentified mabouya <i>Mabuya</i> sp. 1	-	-	X	-	X
Unidentified mabouya <i>Mabuya</i> sp. 2	-	-	-	X	-
Unidentified sphenomorphus					
<i>Sphenomorphus</i> sp.	-	-	X	X	X
Water Monitor Lizard <i>Varanus salvator</i>	X	X	X	X	-
Reticulated Python <i>Python reticulatus</i>	-	-	-	-	X
Philippine Vine Snake					
<i>Ahaetulla prasina preocularis</i>	X	-	-	-	-
Mangrove Blunt-headed Tree Snake					
<i>Boiga dendrophila divergens</i>	-	-	-	X	-

## APPENDIX III. Cont.

Species	Camiguin	Pamoctan	Babuyan Claro	Calayan	Dalupiri
Philippine Blunt-headed Tree Snake	-	-	X	-	X
<i>Boiga philippina</i>					
Northern Triangle-spotted Snake	X	-	-	-	-
<i>Cyclocorus lineatus</i>					
Lined Slender Tree Snake	L(a)	-	-	-	-
<i>Dendrelaphis caudolineatus luzonensis</i>					
<i>Dendrelaphis caudolineatus</i>	-	-	-	-	X
<i>caudolineatus</i>					
<i>Dendrelaphis caudolineatus terrificus</i>	-	-	X	-	-
Camiguin Island Wolf Snake	O	-	-	-	-
<i>Lycodon bibonius</i>					
Jareck's Wolf Snake	-	-	-	-	O
<i>Lycodon chrysoprateros</i>					
Unidentified wolf snake <i>Lycodon</i> sp.	X	-	-	X	-
Banded Burrowing Snake	-	-	-	X	-
<i>Oxyrhabdium leporinum leporinum</i>					
Northern Water Snake	X	-	-	-	-
<i>Rhabdophis spilogaster</i>					
Yellow-lipped Sea Snake	-	-	X	X	-
<i>Laticauda colubrine</i>					
Black-lipped Sea Snake	-	-	-	X	-
<i>Laticauda laticaudata</i>					
Half-banded Sea Snake	-	-	X	-	-
<i>Laticauda semifasciata</i>					
Philippine Pit Viper	XL(b)	-	X	-	-
<i>Trimeresurus flavomaculatus flavomaculatus</i>					
McGregor's Pit Viper	X	-	-	X	-
<i>Trimeresurus mcgregori</i>					

Legend: X – this study; W – WCSP (1997); B – Brown & Alcalá (1980); L(a) – Leviton (1970); L(b) – Leviton (1964); O – Ota and Ross (1994). Species in bold are listed as globally threatened (IUCN 2004), and those underscored are precautionarily considered as near-threatened

APPENDIX IV  
AMPHIBIANS

Species	Camiguin	Pamoctan	Babuyan Claro	Calayan	Dalupiri
Giant Marine Toad <i>Bufo marinus</i>	X	-	X	X	X
Giant Philippine Frog <i>Limnonectes macrocephalus</i>	X	X	-	-	-
Woodworth's Frog <i>Limnonectes woodworthi</i>	X	-	-	-	-
Unidentified forest frog <i>Platymantis</i> sp. 1	X	-	-	-	-
Unidentified forest frog <i>Platymantis</i> sp. 2	X	-	-	-	-
Common Tree Frog <i>Polypedates leucomystax</i>	X	-	-	-	-
Slender-digit Chorus Frog <i>Kaloula picta</i>	-	-	-	X	X

Legend: X – this study