Dragonflies of Babuyan and Batanes group of islands, Philippines (Insecta: Odonata)

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Introduction

The sea north of Luzon Island (Fig. 1) is dotted by several small islands of which Calayan (Babuyan group) is the largest (196 km^2). The islands belong to two groups, the Batanes and Babuyan islands separated by Balintang Channel and both belonging to the Cordillera Administrative Region. The Batanes group, the northernmost Philippine territory in the archipelago, comprises several small islands scattered between the Pacific Ocean in the east, the China Sea in the west, the Taiwan Strait in the north and the Balintang Channel in the south. Human settlement is limited to the three islands of Batan, the capital island, Sabtang and Itbayat. Itbayat Island is the largest in the group and the northernmost inhabited island in the Philippine archipelago.

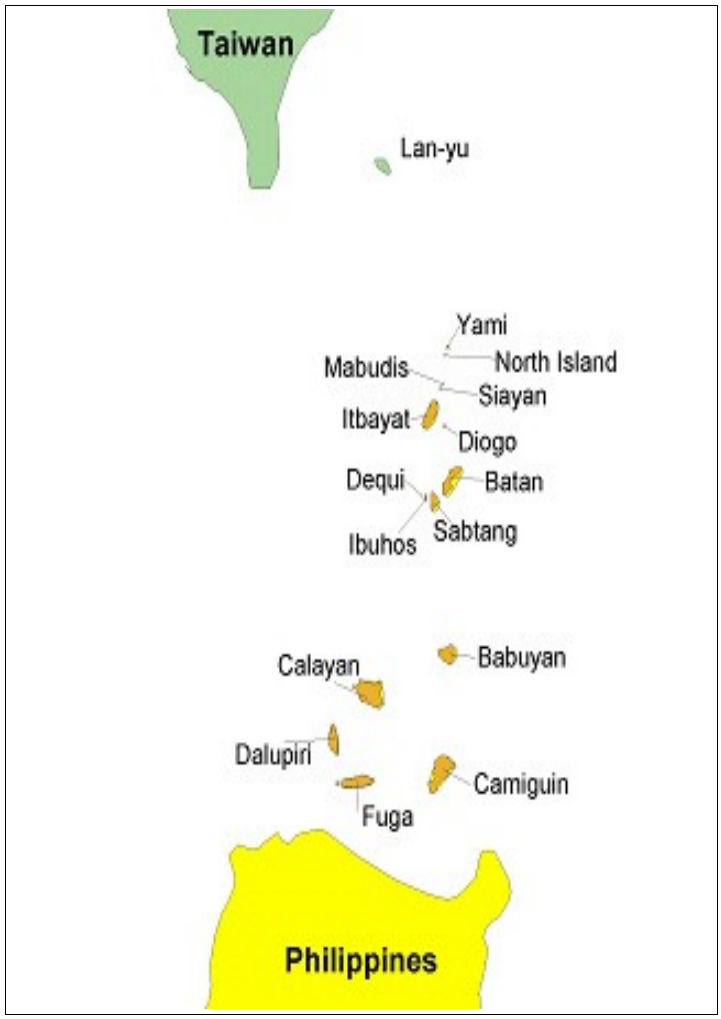
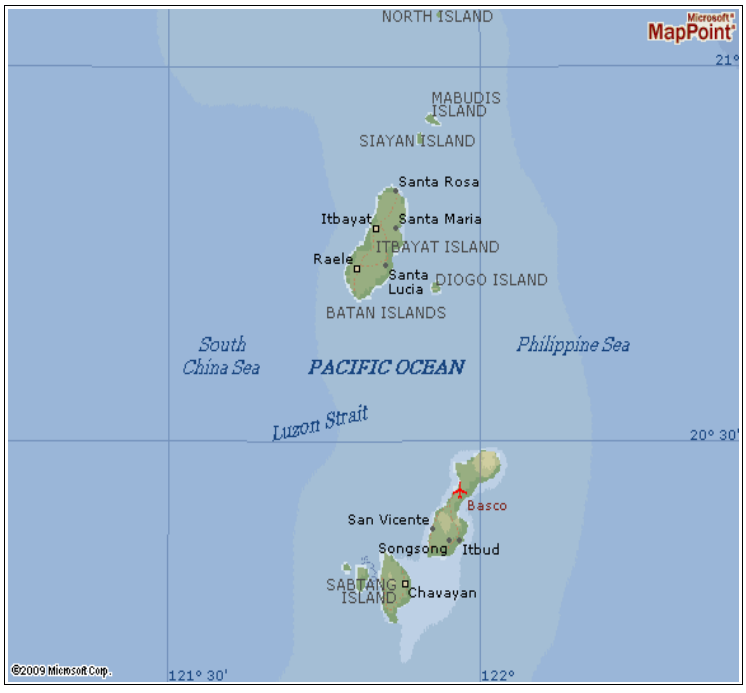


Figure 1: Map of Batanes and Babuyan island group, Philippines (www.ecai.org)

The Babuyan group is situated between the Batanes group and the northern tip of Luzon Island. The 70 km wide Babuyan channel separates the group from mainland Luzon. Calayan (196 km^2), Camiguin Norte (166 km^2), Babuyan Claro (100 km^2), Fuga (70 km^2) and Dalupiri (50 km^2) are the major islands with human settlements. They are volcanic and oceanic in origin.

Figure 2: Babuyan Islands, The Philippines



The uplifted landmass in Batanes is of more recent origin than the Babuyan group which is presumed to have been an isolated land mass for the past 250,000 years and was probably never connected to mainland Luzon (Broad & Oliveros 2005). The long isolation of these islands resulted in a unique fauna and flora with endemic species (Allen et al. 2004; Broad & Oliveros 2005).

Figure 3: Batanes Islands, The Philippines

Several biological surveys have previously been conducted in these island groups, all were mainly focused on vertebrates. The most recent one resulted in the discovery of a new bird species, *Gallirallus calayanensis* (Allen et al. 2004). Invertebrate surveys were limited to butterflies and a few beetle groups mainly collected for the insect trade. Unfortunately no published reports from these travels are available.

To date no odonatological information is available from these island groups (Hämäläinen & Müller 1997). Gapud (2006) listed one species, *Risiocnemis atropurpurea*, from Palaui Island just north of the Cagayan Province (northern Luzon) which represents thus far the northernmost record of a Philippine odonate. In this publication the species noted during an odonatological survey in 2008 on Babuyan and Batanes group are presented.

Methods

Odonata were recorded and voucher specimens collected between April 23 and May 14 2008 although bad weather condition and transportation delays precluded fieldwork on several days. I also trained two local residents in Calayan Island to conduct more surveys on Calayan and if possible on other Babuyan islands. I surveyed as many suitable habitats as possible. In the islands of Sabtang and Itbayat >90% of the known freshwater system was explored while for Batan and Calayan approximately 60 and 40 percent respectively.

Logistics

From Manila I took a twelve hour bus ride to Aparri, Cagayan. A more expensive alternative is to take a plane from Manila to Tuguegarao and a bus from there to Aparri. Ferries do not regularly serve Calayan Island and I was stranded in Aparri for two days. Unfortunately, bad weather in Aparri made odonatological work impossible. The travel to Calayan took eight hours by a large motorised boat crossing the Babuyan Channel. In Calayan, I stayed for about a week in a house rented by the ISLA, a non-government organization that deals with environmental research and conservation primarily on Calayan Rail. I hired two local guides (Fig. 4) and a motorcycle for faster transport. We

camped in the forested area in Lungog and so managed to explore a significant part of the watershed area.

Figure 4: Forest creek with field Guides Arjay and Albert in Calayan Island

Other islands of the Babuyan group were not visited because of a lack of regular, or even irregular, ferry connection. Travel to these islands requires renting an expensive motorboat.

The travel to Batanes from Manila was more convenient. After arriving in Basco, Batan Island I went to Sabtang Island where I hired one local worker who served as guide for the entire Batanes trip (Fig. 5). I stayed in the island for three days and explored all freshwater sources in the island except for one that was recently burned to give way for planting. I also stayed for three days on Itbayat Island but had to leave the island sooner than anticipated because an arriving tropical storm posed a danger of leaving me stranded.

Figure 5: The author and Peter Abonador, field guide in Batanes

On Batan island I stayed for about six days, I had to leave earlier again because of a developing low pressure area in the Pacific. The Batanes group of island was frequented by tropical depressions. Despite the long stay in the island I was able to explore only for three good days due to very uncooperative weather condition.

Use of Money from the IDF

The money granted by the IDF was used for the wages of local workers and mainly for the transportation. Local workers served mainly as field guides and also help in locating and collecting Odonata, especially in Calayan Island. Majority of transportation expenses came from IDF grant.

Localities surveyed

Babuyan group

1. Calayan: Baranggay (Brgy.). Centro I, lowland rice field. The site was about 50-100m from the coast line. The rice was ready for harvesting in some areas. The rice field was located within the community and surrounded by houses except the eastern side.
2. Calayan: Brgy. Centro I, lowland creek. This creek irrigates the nearby rice field. It is surrounded by secondary growth trees. The creek was muddy with some rocky areas ranging in depth from a half to two metres and two metres wide. The spring was in the nearby hill but was not explored as it was heavily disturbed by farmers and cattle.
3. Calayan: Brgy. Centro II, river. This shallow four to six metre wide river runs along several patches of rice paddies and agricultural land. It is dammed at two points for irrigation. The substrate was muddy in some portions though predominantly sandy to rocky with slow to moderate flow. The river was prominently surrounded by secondary growth trees except along the open rice field area. The river drains the municipal watershed and is heavily forested upstream. Recent slash and burn farming was however evident during the tip.
4. Calayan: Brgy. Centro II, lowland creek. This shallow creek was more open being surrounded by tall bushes and occasional trees. The substrate was predominantly graveled with clearer water than location (2).
5. Calayan: Brgy. Macsidel, lowland stream, heavily covered by primary vegetation though slash and burn activity was also noted in the upstream portion. The canopy cover reached 80% in some areas.

6. Calayan: Brgy. Macsidel, upland creek. This creek had good forest cover and was surrounded by old trees. Canopy cover in some areas reaches 80%. The water was clear and the water flow was slow to moderate. The substrate was sandy to rocky. In some areas, old slash and burn activity were evident.
7. Calayan: Longog area. This karst area is part of the municipal watershed. Rice paddies, creek, river, stream, spring and seepages were present. Except for rice paddies, the surrounding was prominently forested. Old trees reach the height of 30 metres in some areas with dense canopy cover. The site is a known habitat of the island endemic rail (*Gallirallus calayanensis*) and effort to save the area is ongoing. To my knowledge this is the only example of pristine lowland forest on a small island in the Philippines.

Batanes group

8. Sabtang: Mt. Giraya, the highest peak on the island. Seepages were noted in the boulder side with one creek. When visited only standing pools were seen because of the long dry season. The creek was primarily open and serves as wading and drinking pool for the grazing cattle and carabao. The area was barren with scattered trees.
9. Sabtang: Sumnanga, large coastal creek. The area supposedly drains the mountain side but when visited the creek was largely dry and the water started just a few hundred meters from the coast. The creek is open with few scattered trees and large bush especially the upstream part. The substrate was predominantly muddy near the coast and rocky upstream.
10. Sabtang: Sinakan, temporary creek. The creek drains the northern slope of Mt. Giraya during period of heavy rains. During the visit, the creek was dry with remaining muddy pools trapped in large boulders. It was relatively forested with good canopy cover surrounding the creek with rocky substrate.
11. Sabtang: Savidug, permanent pond. Tilapia fish was previously introduced into this pond. Presently it is used as drinking and wading pool for carabao.

12. Batan: Uyugan, river. The riverbed was dry except for some stagnant pool near the coastal end. It was partly covered with secondary growth trees.
13. Batan: Mahatao, Balugan creek. This creek runs along a steep slope and heavily covered by secondary growth trees and bushes. The water was clear with rocky substrate.
14. Batan: Mahatao, municipal watershed, creek. The area drains Mt. Matarem. The creek was dry with scattered stagnant pool surrounded by secondary trees. The water source is presently enclosed by cement and the water was channelled to the town.
15. Batan: Mahatao, Sungan creek. The creek was about two to three metres wide with good canopy cover. The water was shallow for most part with rocky substrate.
16. Batan: Basco San Joaquin, Mt. Iraya. The area had good canopy cover except for some open areas used for cattle grazing. Several streambeds were explored with no signs of water. According to locals, the water was dammed at the source and channeled to the town same with that in Mahatao watershed.
17. Itbayat: Katoxnos, Mt Karoboban, two creeks. The first creek (Fig. 4) was relatively long with a fair canopy cover except in some partly open areas. The water varied in depth from 5 to 200 cm with rocky to muddy substrate. The second creek was heavily forested but its water was confined to scattered pool during the visit.
18. Itbayat: pond. This large pond was open with muddy substrate. No aquatic plants were present and even the banks lacked any vegetation.

Results

Odonata recorded from Calayan Island (Babuyan group) and Batanes islands

In total 33 species belonging to 21 genera and 7 families were found. In addition to this three unidentified species were seen. All these species are new to the islands and one species is new to the Philippines. Furthermore, four of the recorded species (*Amphicnemis* in Calayan, *Drepanosticta* 1 & 2 in Calayan and Batan, *Teinobasis* in Calayan and Batan) are probably new to science. For a further four species the ma-

terial shows differences with the specimens from the mainland. Some of these might also represent species new to science. Nearly 55 percent of the recorded species are Anisoptera.

On the island of Calayan I found 29 species, most of which are forest specialists. Among these species are three probably new species, *Amphicnemis*, *Drepanosticta* and *Teinobasis*. Some of the species, *Diplacina, Neurobasis* and *Teinobasis* requires further comparison with known species. Only one species (*Rhyothemis regia*) noted on the island was not captured. On Sabtang I found 12 species including a new record for the Philippines (*Tramea virginia*). On Batan 9 species were found including two possibly new species of Zygoptera. Only one species noted in the island was not collected. The island of Itbayat has nine species including possible one new species. Two species were noted only by sighting and could not be confirmed for proper identification.

Table 1. Number of recorded species per island and the number of endemics. The possible number of species new to science are in brackets.

	Number of species	Number of endemics
Calayan, *Babuyan*	29	13 [3]
Sabtang, *Batanes*	12	0
Batan, *Batanes*	9	3 [2]
Itbayat, *Batanes*	9	2

Annotated species list (Localities where species were recorded are given in brackets)

Agriocnemis f. femina (Brauer, 1868) (1, 2, 3, 7, 8)

Both, the Calayan and Sabtang populations were found in agricultural areas. It is a widespread oriental species and likely present on other island of Batanes and Babuyan.

Agriocnemis pygmea (Rambur, 1842) (1, 2, 3, 7, 8)

This species was always found together with *Agriocnemis f. femina*.

Amphicnemis spec. nov. (7)

Two females of this large damselfly were found, they were found hanging a few

meters above the ground. This new species of *Amphicnemis* has blue synthorax markings.

Argiocnemis rubescens intermedia Selys, 1877 (7)

A single female of this species was found.

Ischnura senegalensis (Rambur, 1842) (1, 9, 11)

Recorded on Calayan and Sabtang islands but extensive search in suitable habitats on Itbayat Island did not reveal this species.

Pseudagrion pilidorsum pilidorsum (Brauer, 1868) (2, 3, 4, 5, 13, 14, 15, 18)

One of the dominant damselfly species noted. Interestingly the species was not found on Sabtang Island although all possible permanent freshwater bodies were explored except one.

Pseudagrion microcephalum (Rambur, 1842) (9, 11)

On Sabtang Island a small population was found in a short permanent coastal creek but not on any other island. Compared with specimens of others parts of the Philippines the postocular spots are heavily bordered by black.

Teinobasis samaritis Ris, 1915 (3, 7)

This widespread species was found in low numbers in several creeks and streams in Calayan along with a very similar new species, *Teinobasis* sp. nov..

Teinobasis spec. (cf. *samaritis)* (3, 7, 14, 17)

This was the most abundant damselfly noted in the forested areas particularly in Itbayat. It was also found in Batan and Calayan. It closely resembles *T. samaritis* but is darker. The superior anal appendage are similar to those of *T. samaritis* except that the inner margin is shaped quadrangular rather than triangularly.

Teinobasis spec. nov. (7)

This red-orange new *Teinobasis* was found only in forested streams and springs in Calayan. It occurs with its congener in some areas in the island. It has close affinity to *Teinobasis corolla* a more distributed northern Philippine endemic.

Drepanosticta spec. nov. 1 (6, 7, 13, 14, 15)

This as yet undescribed species of *Drepanosticta* was abundant in forested areas in Calayan and Batan. Both island populations show slight but constant difference in the shape of the transverse occipital ridge. Each island has two distinct color forms, a black form with white abdominal spots and one with a plain black abdomen, probably an age related character. Suitable habitat on the island of Itbayat did not reveal this species. The present species belong to *Drepanosticta halterata* group and seems to be closely allied to *D. philippa*. Members of other groups of *Drepanosticta* were not found on the islands explored.

Drepanosticta spec. nov. 2 (15)

A single male was collected.

Rhinocypha colorata (Hagen in Selys, 1869) (2, 3, 4, 5, 6, 7, 13, 14, 15, 17)

This was the most abundant and widespread damselfly in Itbayat and Batan islands, and second only to *Euphaea* in Calayan. Despite their distance, the Calayan, Batan and Itbayat populations consisted of only one variant compared to variations seen in other neighboring islands in the Philippines. The species was found in open forested streams, creeks and rivers.

Euphaea refulgens (Hagen in Selys, 1853) (3, 7) (Fig. 6)

This was the most abundant damselfly in open creeks and rivers in the interior of Calayan Island. This island population has very reduced shadings on the wings and the metallic reflections are almost absent.

Figure 6: *Euphaea refulgens*

Neurobasis spec. (cf. luzoniensis) (3, 7)

This species resembled *N. luzoniensis* closely but differed in the ratio between forewing and hindwing length. The apical one fifth of the wing of *N. luzoniensis*

is brownish with a distinct line whereas the Calayan population has no distinct demarcation line and the metallic colour reaches the apices.

Idionyx salva Needham and Gyger, 1937 (7)

A single female of this species was collected in Lungog area, Calayan Island.

Heteronaias spec. (cf. heterodoxa) (3, 7)

Although several exuvia were noted near the agricultural areas, adults were found only in the forested habitat. These specimens are distinctly smaller and more slender than specimens of *Heteronaias heterodoxa* from the rest of the Philippines. The superior anal appendage is narrower and elongated with the inward spine more apically situated.

Agrionoptera insignis (Rambur, 1842) (3, 7, 9, 10, 11, 12, 13, 14, 15, 17)

Apparently the most widely distributed species in Calayan and Batanes island group. This species was the only anisopteran noted at shaded temporary puddles.

Diplacina braueri Selys, 1882 (4)

A single teneral specimen of this species was found in Calayan.

Diplacina lisa Needham & Gyger, 1941 (7)

A single teneral male specimen of this relatively rare species was found in Calayan.

Diplacina spec. (cf. bolivari) (3, 5)

These specimens resemble *D. bolivari* closely but differ in the colouration of the abdomen which is entirely black from S3-S10, and by the more robust hamulus. It was found in low number in similar habitat with *Neurobasis* sp.

Diplacodes trivialis (Rambur, 1842) (1, 2, 3, 9, 11)

This widespread oriental species was absent in Itbayat and even Batan. Interestingly a strong population was noted in nearby Sabtang Island.

Neurothemis r. ramburii (Brauer, 1866) (2, 3, 4, 7, 8, 9, 17, 18)

This widespread oriental species was not found in Batan Island. The Itbayat

population was strikingly different showing a significant reduction in the opacity of the hindwing leaving the entire posterior margin of the wing base hyaline.

Neurothemis t. terminata Ris, 1911 (3)

This widespread oriental species was found in Calayan Island only.

Onychothemis abnormis Brauer, 1868 (3)

A male of this rare dragonfly was found flying at the rapids in the forested area in Calayan Island guarding an ovipositing female. This record is the northernmost of this species.

Orthetrum pruinosum clelia (Selys, 1878) (3, 7, 8, 9, 15, 16)

This species along with *Agrionoptera insignis* were the most dominant anisopteran in Batanes group.

Orthetrum s. sabina (Drury, 1770) (1, 2, 3, 4, 7, 8, 9, 11, 15)

The absence of this common and widespread Asian species in Itbayat was striking. It was so unlikely that this highly opportunistic species was not found anywhere along the 5 km of streams surveyed for a few days and other suitable habitat in the island.

Orthetrum t. testaceum (Burmeister, 1839) (3)

This species was recorded in Calayan Island. Several suitable habitats in Batanes did not reveal this species.

Pantala flavescens (Fabricius, 1798) (1, 2, 3, 4, 7, 8, 9, 13, 17)

According to some farmers, the arrival of large congregation of this species in Itbayat was formerly used as an indicator for planting season to start. This was my first such cultural odonatology encounter besides larva of this species being eaten as a delicacy by other Philippine peoples.

Rhyothemis regia (Brauer, 1867) (3)

A single male was encountered in one of the irrigation dam in Calayan.

Tetrathemis irregularis Brauer, 1868 (3)

This small dragonfly was found in Calayan Island. Similar habitat in Batan and

Itbayat islands did not reveal this species.

Tramea transmarina euryale (Selys, 1878) (3, 9)

This oriental species was recorded in Calayan and Sabtang islands. In Sabtang Island, it coexists with *T. virginia* and *Pseudagrion microcephalum* in the coastal creek.

Tramea virginia (Rambur, 1842) (9)

This species was recorded for the first time in the Philippines. The nearest records are from Taiwan which is nearly a hundred kilometers away.

Discussion

The records presented here of dragonflies from the Babuyan and Batanes islands represent the first records from this part of the Philippines. The discovery of a new species for the Philippines (*Tramea virginia*) and the discovery of several species new to science show these small islands in the Philippine archipelago hold an interesting fauna despite the fact that the sampling period of this study was very limited. Each island was studied for less than a week making it unlikely that all rarer species were found. For example, Oppel (2005) showed that in rich areas a year of fieldwork is needed to have a complete list of the odonate fauna of a particular area. It is certain that the list here presented for the islands is not complete. Given that this survey resulted in several species new to science, it is likely that more species new to science can be found when more fieldwork would be done, possibly particluarly so in the pristine environments of Calayan island. For example, the present study failed to find members of the families Gomphidae and Aeshnidae but their presence at least on Calayan is very likely. Of the Babuyan group only Calayan was studied, no information is available for the others islands of this group. The volcanic mountains of the island of Camiguin and Babuyan Claro still have good forest with pristine water sources. Fieldwork on these islands might result in the discovery of new species. It is important that the fauna of these islands is better studied as this information might be used to prevent habitat destruction.

The Philippine zygopteran fauna is characterized by high diversity of *Risiocnemis* (Pla-

tycnemididae*)* and *Drepanosticta* (Platystictidae) (Gassman & Hämäläinen 2002; Hämäläinen 1991; van Tol & Müller 2003; van Tol 2005) especially in forested areas. It is interesting that *Risiocnemis* seems to be absent from the islands and that relatively few species of *Drepanosticta* were found*.* Even *Prodasineura integra* (Protoneuridae) a very widespread species in the Philippines is virtually absent from the islands surveyed. Presently it is safe to assume that these genera are poorly represented in Batanes group and in Calayan Island at least. This further stresses the isolation of these islands from Luzon.

The discovery of *Tramea virginia*, a species with a more northern distribution, shows that strong it is possible for dragonflies to colonize islands in the Batanes group from Taiwan or mainland China.

Threat

Batan: This island has a very limited water source with only few permanent streams. Almost all of the permanent springs in Mt. Iraya are dammed and channeled for local use. This practice threatens forest species that requires permanent water. The absence of *Rhinocypha colorata* in Mt. Iraya, despite good vegetation cover, is probably caused by the lack of permanent water. Though a good water supply is still present in the southern part of Batan Island, an increasing local and tourist populations threatens also these water sources.

Sabtang: The island of Sabtang has a permanent upland (Mt. Giraya) water source that is becoming drier every year especially in summer (pers. comm. by local people). Indeed, visits to this site revealed only a stagnant muddy pool. Springs are present near small towns of the coastal areas but increased freshwater demand by an increasing human population may eventually deplete this limited water source. Habitat modification also threatens Odonata species especially the clearing of the vegetation surrounding the freshwater sources.

Itbayat: The island of Itbayat has a good permanent creek (Fig. 7) but has a depauperate dragonfly fauna. Its forested stream lacks true forest specialist such as members of *Drepanosticta.*

Figure 7: Forest stream in Itbayat Island

Calayan: The Odonata fauna of Calayan Island has a relatively high number of species dependent on running water in forest. Significant amount of forest cover is still present on the island of Calayan and local ordinance has been passed to protect this forest (Broad & Oliveros 2005). The ongoing habitat degradation by slash and burn farming however was evident during the trip. This practice is aggravated since the areas being burned are close to the water sources for easy access to water for irrigation. This practice not only opens up the forest cover but also destroys the habitat of adult Odonata which particular effect the Zygoptera.

Species of Conservation Importance

The genus *Amphicnemis* and *Drepanosticta* are forest species and many of them have a restricted range and are threatened due to forest clearance (Hämäläinen 2004). The island of Calayan has one presumably new species of *Amphicnemis* and *Drepanosticta* (including Batan Island). The two species are present in the watershed area of Longog. This area is protected at least by local ordinance. The new *Teinobasis* spec. is also considered to be probably endemic to the island of Calayan. The Philippine endemics, *Diplacina, Neurobasis* and *Euphaea*, though found in other Philippine islands also need attention. These species thrive in forested areas and easily affected by habitat deterioration.

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