



Special Ecology Feature

Enhancing the Diversity of Dragonflies in Urban Areas

Text by Sek Jun-Yan, Mohd Roslee Bin Ali, Benjamin Lee, and Robin Ngiam
Photography as credited



LEFT Dragonfly pond at Labrador Nature Reserve (Photos: Sek Jun-Yan).

Introduction

There are currently 125 known species of dragonflies and damselflies in Singapore, but five are believed to be locally extinct. These fascinating insects belonging to the order *Odonata*, and are further divided into two groups, *Anisoptera*, the true dragonflies, and *Zygoptera*, or damselflies. Although there are some exceptions, true dragonflies usually rest with their wings out from their body while damselflies, at rest, hold their wings above the body.

Dragonflies are excellent fliers, with the ability to flap and beat their wings independently. The adults have particularly large eyes and exceptionally good eyesight. These insects are known to be active carnivores with strong biting mouthparts. They prey on small flies, butterflies, and mosquitoes. Their larvae, being aquatic, feed on water insects, small fishes, and tadpoles. The main predators of adult dragonflies are birds, frogs, and spiders, while their larvae often fall prey to fishes.

Drawn to habitats with abundant but sheltered vegetation, dragonflies have been known to serve as markers for good water quality. Because dragonfly larvae require clean, unpolluted water to thrive, a diverse dragonfly population in a wetland is a positive sign of a healthy ecosystem. Indeed, in some countries, scientists have been monitoring dragonfly population as a tool to manage freshwater wetlands. Aesthetically, a good population of dragonflies can also bring wonder and vibrancy to a wetland or pond in a park.

The case study below, carried out by the National Parks Board (NParks) Singapore, highlights an example of habitat creation and enhancement efforts that resulted in a wetland environment that is not only conducive as a dragonfly habitat but has managed to attract aquatic birds and at least five species of kingfishers!

Case Study: Dragonfly Pond at Labrador Nature Reserve

Labrador Nature Reserve is a 21.5-hectare park which includes parkland and a 10-hectare gazetted nature reserve protecting representative coastal hill forest and rocky shore habitats. The nearby mangrove-lined Berlayer Creek coupled with the sea grass patches in the adjacent shallow waters further complement the biodiversity of the nature reserve, which was re-gazetted in 2002. Being a small nature reserve, the habitats found within it are limited both in size and diversity. To increase biodiversity within the nature reserve, it was decided that a new habitat type in the form of a freshwater wetland was needed. A freshwater pond was then born out of a water-logged field beside Labrador Villa Road. By creating the pond, we also solved the problem of seepage overflow onto the pedestrian footpath which makes it slippery at times.

Prior to the creation of a freshwater pond, a quick survey of the dragonfly species was undertaken in September 2009 to obtain baseline data for future comparisons. Only four species were recorded then. Among them are *Diplacodes trivialis* and *Pantala flavescens*, two species known to occur in ephemeral wetland habitats. *Neurothemis fluctuans* and *Orthetrum sabina* were the other two species.

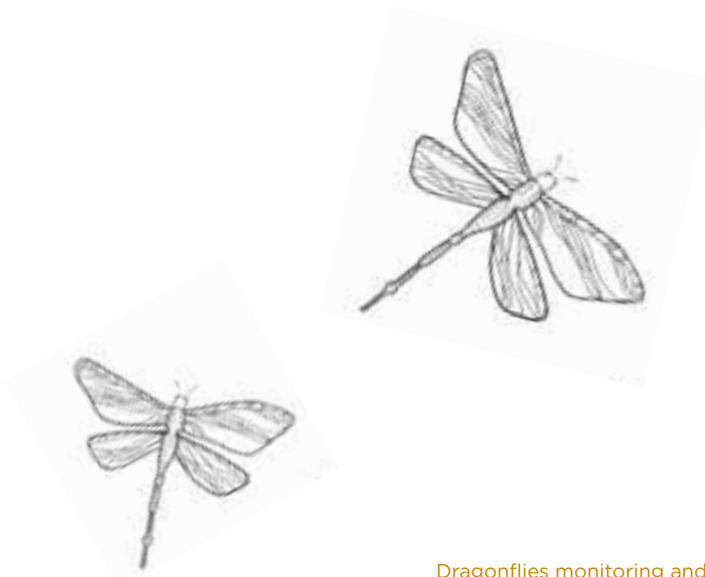
Habitat enhancement

In November 2009, five trial holes with dimensions 0.6 metres by 0.6 metres and 0.5 metres deep were dug. The holes were left to collect rainwater for a week. No linings were used for the test. After three weeks, it was observed that the water level in the trial holes did not drop. This indicated a high water table for this stretch of open field beside the main road.



TOP *Ictinogomphus decoratus* (Common Flangetail) (Photo: Robin Ngiam).
BOTTOM *Aethriamanta gracilis* (Pond Adjutant) (Photo: Robin Ngiam).

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Construction of the pond began in early February 2010 during a prolonged dry period. A pond with dimensions 15 metres by 30 metres, 0.5 metres deep at the edge and 0.6 metres deep at the centre, was constructed using an excavator. The excavated soil was placed at the edge of the pond to create a two- to four-metre dry edge for planting. No lining was used in the created pond. Instead the clay bed was shaped to the required gradient and hardened. By the end of March 2010, the pond was full.

In April 2010, four native plant species were planted. At the pond edge, emergent plants such as the *Cerapteris thalicroides*, *Eriocaulon longifolium*, and *Monochoria vaginalis* were planted. Floating leaf plants, *Nymphoides indica*, were planted in the water. Cuttings of *Nymphoides indica* from the original planting were made in May and June and planted in the pond bed to hasten the spread of the species. Dry branches were placed in the pond for the perching of dragonflies. Fallen leaves that dropped in the pond were left to sink to create a suitable hiding place from dragonfly larvae.

In May 2010, other water plants such as *Thalia geniculata f. Ruminoides*, *Thalia geniculata*, *Typha angustifolia*, and *Cyperus papyrus* "dwarf" were introduced.

In June 2010, to enhance the look of the pond, large boulders were placed around the pond for park users to sit and enjoy the pond life.

The bogged areas surrounding the pond were left untouched and grass cutting was not carried out for these areas. Occasionally, the removal of dead leaves, including the thinning of fast growing *Typha* plants, are required to ensure that the pond is not fully covered by them. Fogging of areas surrounding the pond was prohibited.

Dragonflies monitoring and results

Dragonfly monitoring started in May 2010 as pond construction entered its final phases. In total, 44 weekly monitoring surveys were conducted from May 2010 to April 2011. A typical monitoring survey took place at mid day (10:00 a.m. onwards) for approximately one hour on fine, windless days. During sampling, all dragonflies within the vicinity of the pond (five metres from the pond edge) were recorded. The count was carried out in opposite directions around the pond on alternate survey dates.

In all, 34 species have now been recorded. On average, a total of 12 to 14 species can be seen during each survey. Rare species recorded include *Aethriamanta brevipennis* and *Indothemis limbata*, which is listed as critically endangered in the Singapore Red Data Book. Several uncommon species are also encountered including *Pseudagrion australasiae*, *Agrionoptera insignis*, *Anax guttatus*, *Diplacodes nebulosa*, *Rhyothemis triangularis*, and *Trithemis pallidinervis*. Not only has the number of species increased, the dragonfly community is also thriving. On any given day, it is not unusual to spot more than 50 dragonflies flying about.

Conclusion

Apart from the case study, NParks has taken various steps to document dragonfly diversity in its parks and gardens, and also to explore methods of enhancing their diversity whenever the opportunity arises. There have also been several outreach programmes to highlight these lively insects. Public and school talks as well as training workshops are some examples. These workshops also aim to reach out to park planners and developers so that creating dragonfly habitats will become a mainstay in their work processes. One major realisation of NParks' dragonfly work is the recent publication of the book *Dragonflies Of Our Parks and Gardens* (Robin Ngiam, 2011). 