

OBSERVATIONS OF PISCIVOROUS AVIFAUNA ALONG SIGLAP CANAL, SINGAPORE

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ABSTRACT. — A summary of personal observations on eight species of piscivorous birds along the urban waterway, Siglap Canal, flanking the Siglap Park Connector is accompanied with respective photographic records. Where possible, the identities of the fish prey are provided. The importance of water cleanliness and quality for both the ichthyofauna and avifauna is highlighted.

KEY WORDS. — birdlife, avifauna, piscivory, kingfisher, egret, heron, water quality

INTRODUCTION

The Siglap Park Connector is flanked by the major canal, Siglap Canal, that connects to the sea at the East Coast area and its water level fluctuates constantly with the tides. Numerous drains originating from adjacent residential areas and minor commercial establishments discharge their contents into this canal. During heavy rains, excess runoff is channelled into this canal, carrying with it substantial amounts of silt and organic and inorganic substances. During the drier periods, the waters can be surprisingly clean, clear and green, especially at high tide (Fig. 1). At low tide, the shallow waters are particularly conducive for piscivorous (fish-eating) birds as they forage for fish prey (Fig. 2).

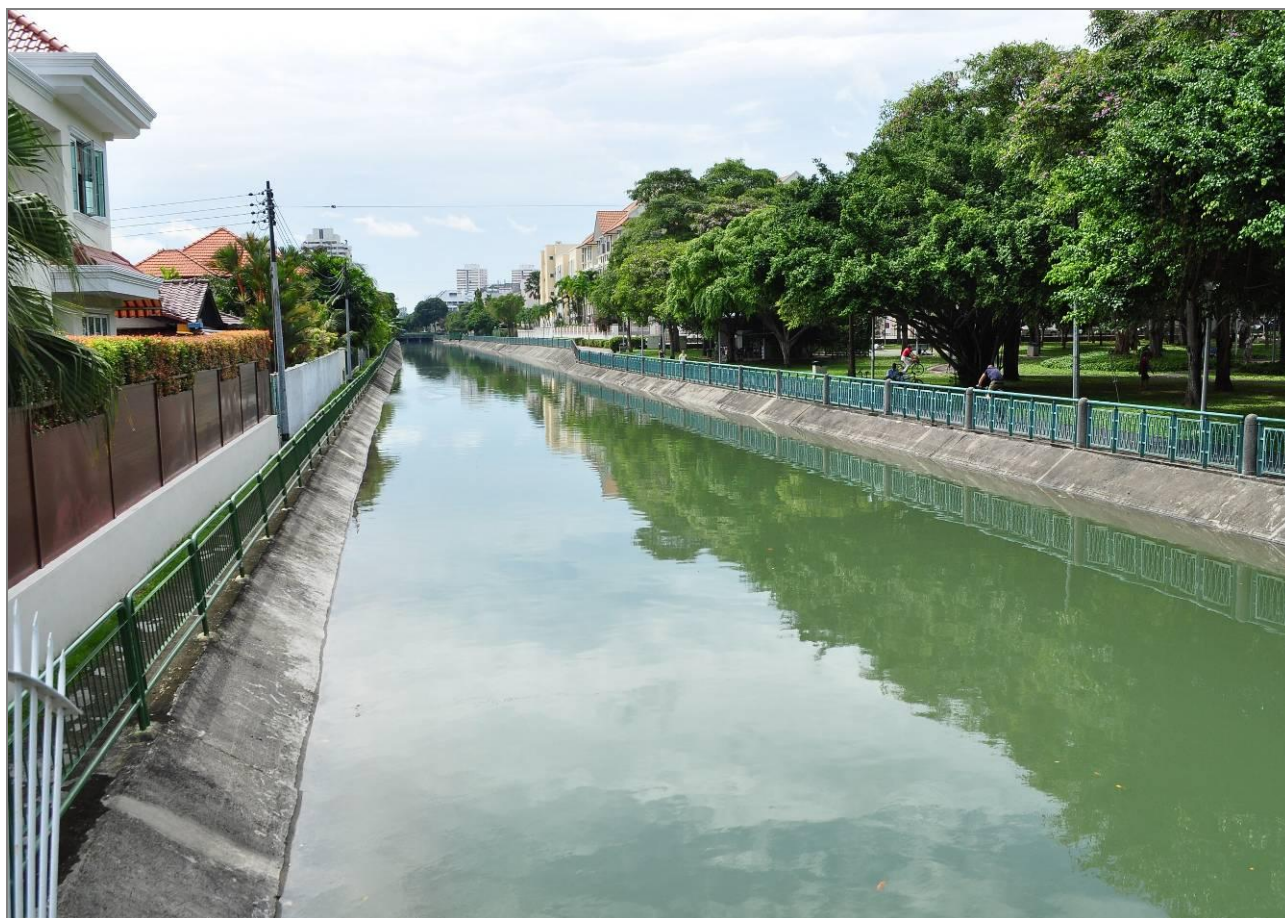


Fig. 1. The Siglap Canal along the Siglap Park Connector (on the right) at high tide (view to the south).



Fig. 2. At low tide, the waters become sufficiently shallow for certain piscivorous birds, such as egrets and herons, to hunt for fish prey. A solitary little egret, *Egretta garzetta* (arrowed) is wading in the water.

Although a comprehensive inventory of the fish diversity in this canal has yet to be conducted, preliminary observations have shown that at least 10 different species frequent this stretch, with most of them well adapted to typical estuarine habitats and tolerant of fluctuating salinity conditions. For example, mullets (family Mugilidae) are regularly seen along this stretch, swimming up the canal with the incoming high tide (Fig. 3). At low tide, the Mozambique tilapia, *Oreochromis mossambicus*, are clearly visible as the males (recognised by the red fin margins) excavate shallow craters in the sediment and compete for territory and females (Fig. 4). Since 2008, occasional and anecdotal observations of the birds and their fishing behaviour have been documented. However, more concerted efforts to acquire photographs and video clips of the birds and their feeding and breeding activities were only carried out particularly in the last two years. Each species is presented together with pertinent details of observations, and where possible, their fish prey was identified accordingly.

DIVERSITY OF PISCIVOROUS BIRDS OBSERVED

Family Alcedinidae

Common kingfisher (*Alcedo atthis* Linnaeus)

This diminutive kingfisher is a winter visitor or passage migrant in Singapore. It has been occasionally seen fishing along the canal at both low and high tides. They would usually perch on railings on the side of the canal while looking out for schools of small fish that come close to the water surface (Fig. 5a). They can hover momentarily over the water to acquire a target, before diving down to capture the fish.

Family Halcyonidae

White-throated kingfisher (*Halcyon smyrnensis* Linnaeus)

This resident kingfisher has a preference for higher perches, such as overhead cables (Fig. 5b) or the branches of tall trees. Apart from hunting fish, this species also regularly consumes terrestrial prey (vertebrates and invertebrates), such as small lizards, frogs, worms, and insects. As it is not a specialist fish eater, observations of this kingfisher diving into the waters for prey have been few and far between.



Fig. 3. A small school of mullets (family Mugilidae) swimming near the water surface at high tide. Photographed on the afternoon of 8 Apr.2011.



Fig. 4. Two male (M) Mozambique tilapia, *Oreochromis mossambicus* sparring over territory and a female (F) at low tide. Photographed on the evening of 25 Jan.2012.

Collared kingfisher (*Todiramphus chloris* Boddaert)

Compared to the previous two kingfishers, this species appears to be more commonly seen and heard along this canal. Small fish from the canal, such as mollies or young rabbitfish (siganids) may be captured for food (Fig. 6a). In Apr.2011, a breeding pair was observed to be utilising a weephole on the vertical bank of the canal as their nesting cavity (Fig. 6b). Freshly caught fish would be regularly delivered to this cavity to be fed to the chick(s) inside. During this period, the parents were particularly cautious of anyone or anything approaching them or their nest hole. A stray cat that was walking past one morning was even dive-bombed by one of the protective parents.



Fig. 5. (a) A common kingfisher, *Alcedo atthis* perched on the railing beside the canal, in between diving bouts into the waters below. Photographed on the evening of 17 Feb.2012. (b) A white-throated kingfisher, *Halcyon smyrnensis* perched on overhead cable and drying out its wings after successful dives to capture fish in the canal. Photographed on the evening of 25 Mar.2012.

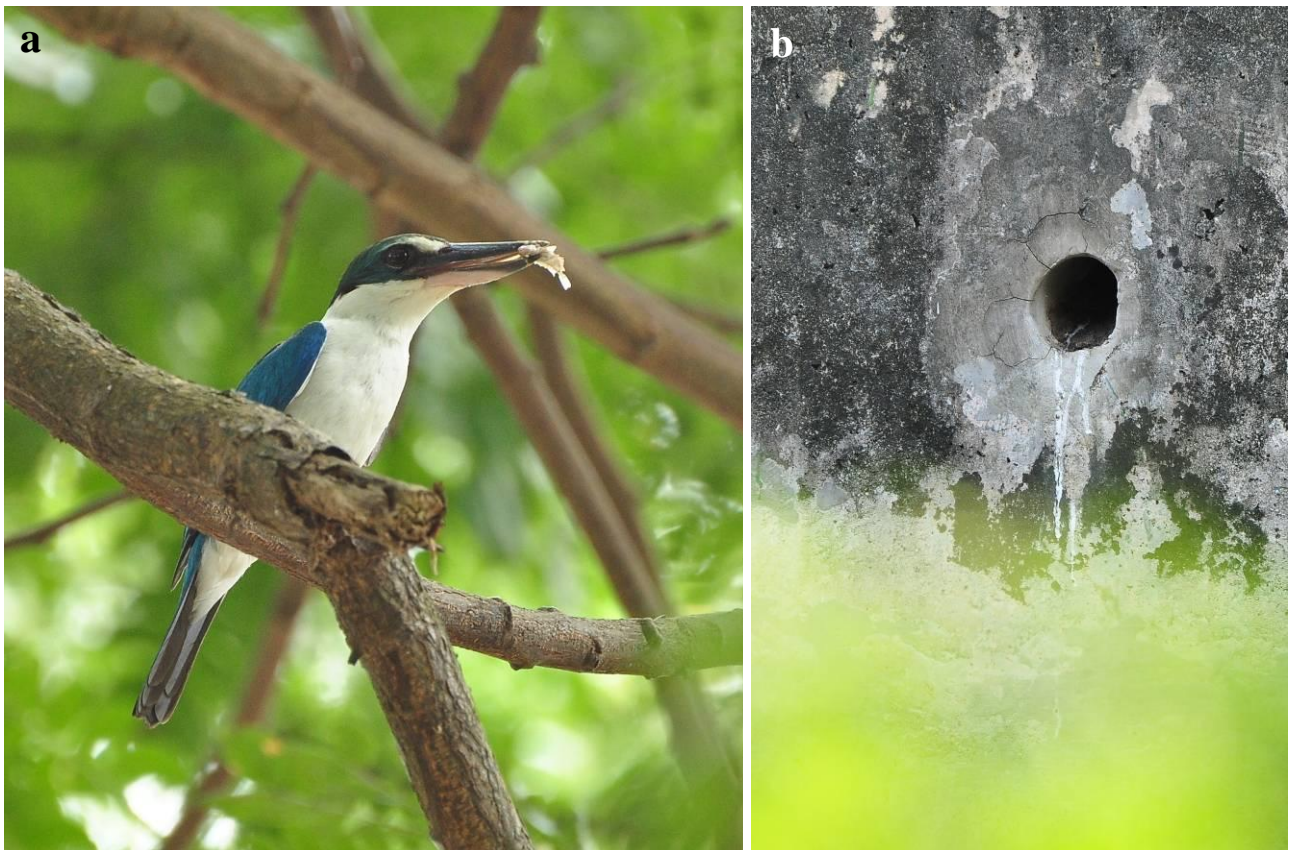


Fig. 6. (a) A collared kingfisher, *Todiramphus chloris* with a small fish (possibly young siganid) in its beak. (b) The weephole (diameter ca. 7 cm) along the concrete bank of the canal which was used as a nesting cavity for a pair of collared kingfishers. Photographed on the morning of 23 Apr.2011.

Family Ardeidae

Little egret (*Egretta garzetta* Linnaeus)

Their clean, white plumage makes them one of the most conspicuous birds along the canal, either in flight or when prowling along the canal at low tide. These egrets have been observed fishing individually or in small groups, comprising four to eight birds. A brief video clip of a small flock of four egrets was recorded on the evening of 21 Feb.2012 and subsequently uploaded (<http://www.youtube.com/watch?v=tlFF6jZgAro>).

An amusing technique which is frequently employed by this egret while fishing is foot tapping, or foot stirring (del Hoyo et al., 1992). As the egret walks along the canal, it would use either foot to repeatedly tap around and under submerged leaves, in order to expose any fish or shrimp that may possibly be hiding within (Fig. 7). A video clip of this technique was recorded on the evening of 16 Feb.2011 and subsequently uploaded (<http://www.youtube.com/watch?v=YITOVBNco3Q>). Another technique that was also observed is wing flashing, whereby the birds abruptly flash out their bright white wings to startle schools of small fish and make them more mobile or visible to hunt. Prior to the breeding season, the breeding plumage begins to show. In Mar.2011, individuals were starting to exhibit typical elongate plumes from their nape, back, and breast.



Fig. 7. A foraging technique frequently used by the little egret, *Egretta garzetta* was foot tapping, whereby it used its feet to tap around and under submerged dead leaves, in order to expose any fish or shrimp that may be hiding beneath. Photographed on the morning of 12 Mar.2011.

Pacific reef egret (*Egretta sacra* Gmelin)

A dark morph individual was first sighted along the canal in Feb.2008 and stayed around till Apr.2008. Over the subsequent years, a Pacific reef egret would appear around the same time of the year and has been presumed to be the same individual. This reef egret was diurnal and hunted only when the tide was low. While waiting for the tide to recede, the reef egret would perch on the roofs of houses, railings, or overhead cables (Fig. 8). The success rate of fishing seemed to be highest at the end of a low tide, when the waters started to advance up the canal, bringing along schools of fish with it (Fig. 9).

It was at this turning point of the tides when a majority of its fish prey was documented. These include the crescent perch, *Terapon jarbua* (Fig. 10a); juvenile rabbitfish (siganid) (Fig. 10b); and the sagor catfish, *Hexanemichthys sagor* (Fig. 10c). Surprisingly, this reef egret also occasionally demonstrated the foraging technique of foot tapping (Fig. 11), although its stirring actions were not quite as vigorous or determined as that of the little egret. Whether this strategy was learnt from the little egret or an innate foraging behaviour remains to be answered. The Pacific reef egret is known to be highly territorial (del Hoyo et al., 1992), and this particular individual has been observed on a number of occasions to chase away little egrets along the canal, flying after them with aggressive squawks.



Fig. 8. A Pacific reef egret, *Egretta sacra*, perched upon overhead cables along the canal on the evening of 19 Apr.2011.



Fig. 9. Pacific reef egret poised to strike at an oncoming school of fish as they swim up the canal with the incoming tide. Photographed on the morning of 12 Apr.2011.



Fig. 10. Pacific reef egret with a variety of fish prey, including: (a) a crescent perch, *Terapon jarbua*, taken on the morning of 23 Mar.2011; (b) a juvenile siganid taken on the morning of 12 Apr.2011; and (c) a sagor catfish, *Hexanematchthys sagor*, taken on the morning of 23 Mar.2011.



Fig. 11. The Pacific reef egret would also employ the strategy of foot tapping, in order to drive out any fish concealed amongst dead leaves (compare with Fig. 7: little egret foraging). Photographed on the morning of 23 Mar.2011.

Striated heron (*Butorides striatus* Linnaeus)

This small-sized heron is probably one of the most abundant and widespread of the Ardeids within Singapore, as it is a highly adaptable species and commonly seen from coastal habitats to inland freshwater bodies. The active hunting period of this species has been reported to be crepuscular, nocturnal, and/or regulated by the rhythm of the tides (del Hoyo et al., 1992). However, personal observations along this canal have shown a great degree of flexibility in their active fishing periods. By day, they have been seen fishing even at high tide, stalking after fish prey that wander close to the water surface within striking range from the steep sloping banks of the canal. However, the striated herons are most often seen fishing during low tide by day (Fig. 12). At night, these herons appear to be adept at fishing in the dark. Both adults (Fig. 13a) and juveniles (Fig. 13b) have been observed to fish during low tides at night, with adequate success. These herons have a reputation of being highly territorial (del Hoyo et al., 1992), and numerous attempts to chase away conspecifics along the canal have been witnessed.



Fig. 12. An adult striated heron, *Butorides striatus* fishing during low tide by day. Photographed on the morning of 23 Apr.2011.



Fig. 13. Adult (a) and juvenile (b) striated herons fishing during low tide by night. Adult photographed on 22 Apr.2011, juvenile photographed on 31 Aug.2011.

Black-crowned night heron (*Nycticorax nycticorax* Linnaeus)

As its name implies, the black-crowned night heron is a truly nocturnal bird that spends most of the day time roosting among the crown of trees (Fig. 14). In the evenings, they rouse from their slumber and silently approach the canal, especially when the tide has receded or is receding. Upon entering the waters, certain birds may remain in one spot continually and watch for fishes to swim by, while others may walk about slowly to improve their chances of encountering fish. After numerous nights of observations of their feeding activity, a preliminary list of their fish prey was compiled, and these include: (i) catfish (Fig. 15a); (ii) green mollies, *Poecilia sphenops* (Fig. 15b); (iii) crescent perch, *Terapon jarbua* (Fig. 16a); (iv) mullet (Fig. 16b); (v) green chromide, *Etroplus suratensis* (Fig. 16c); (vi) gold-blotched rabbitfish, *Siganus guttatus* (Fig. 17); and (vii) Mozambique tilapia, *Oreochromis mossambicus* (Fig. 18). Both sub-adults and juveniles (Fig. 19) have been recorded from this canal, providing indications of breeding activity in this small population. For these herons, fishing at night must clearly have its advantages. One of them is the avoidance of direct competition with other fish-eating birds during the day (Watmough, 1978).



Fig. 14. By day, the black-crowned night heron, *Nycticorax nycticorax* roosts high up among the branches of mature trees. Photographed on 13 Apr.2011.

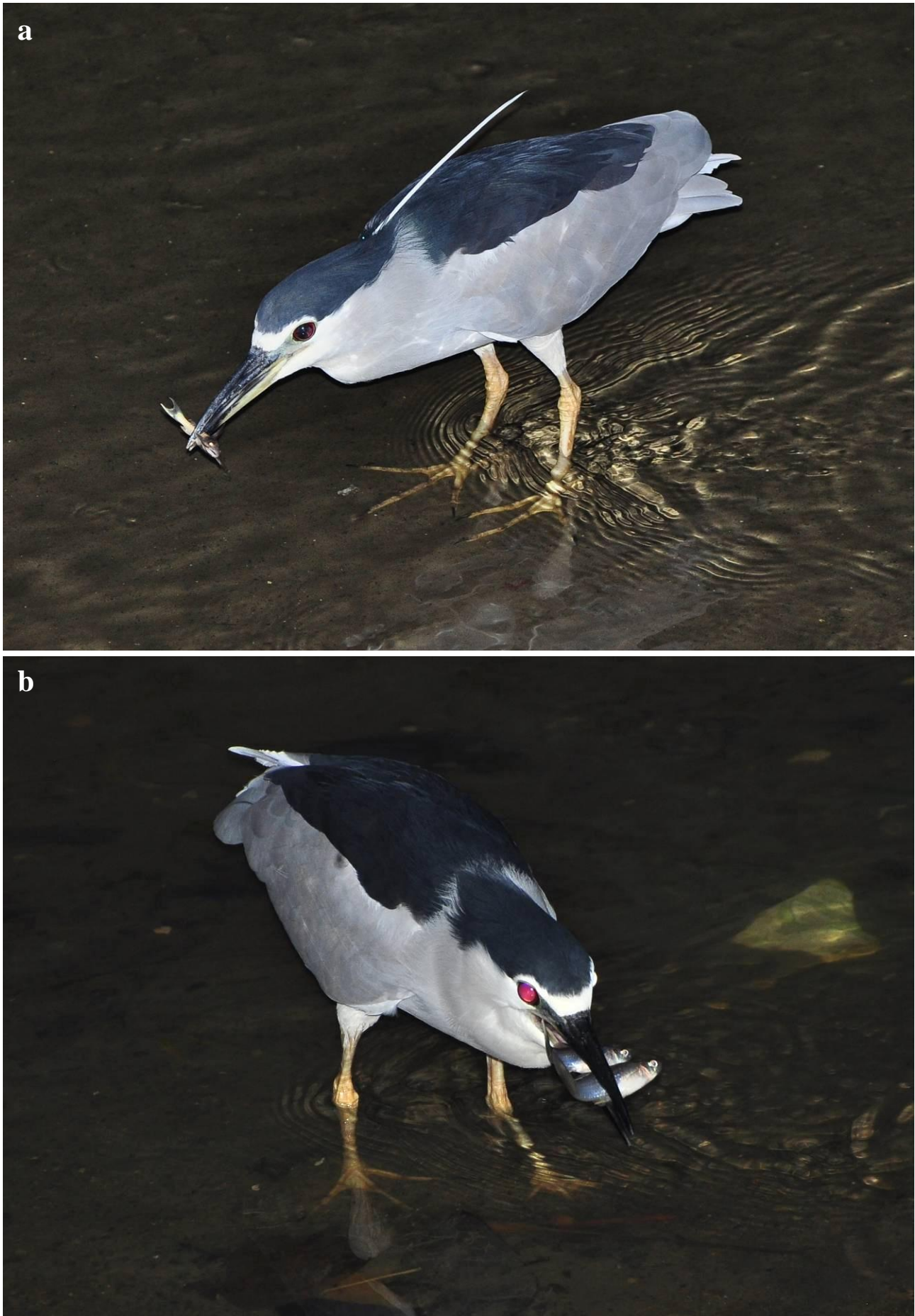


Fig. 15. Black-crowned night herons with (a) catfish prey taken on 22 Apr.2011, and (b) green mollies, *Poecilia sphenops* taken on 28 Jan.2012.

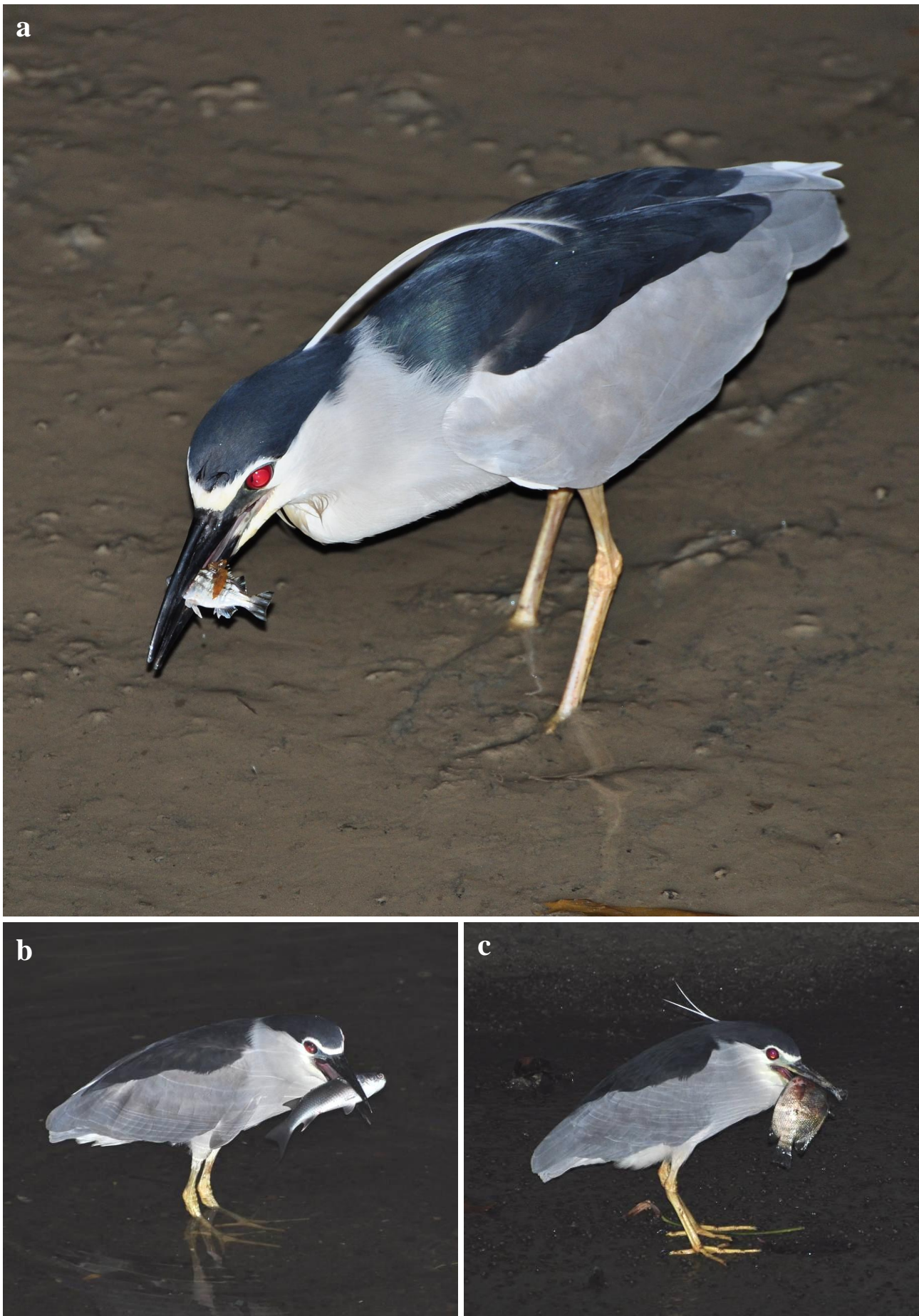


Fig. 16. Black-crowned night herons with (a) crescent perch, *Terapon jarbua* taken on 13 Jan.2012, (b) mullet taken on 24 Jan.2012, and (c) green chromide, *Etroplus suratensis* taken on 24 Jan.2012.



Fig. 17. Black-crowned night heron carefully maneuvering a freshly caught gold-blotched rabbitfish, *Siganus guttatus* with fully erect dorsal spines (main image, photographed on 25 Jan.2012), and attempting to swallow the rabbitfish prey with considerable difficulty (inset, photographed on 28 Jan.2012).



Fig. 18. A black-crowned night heron swallowing a male Mozambique tilapia, *Oreochromis mossambicus* on the night of 13 Jan.2012.



Fig. 19. A juvenile black-crowned night heron swallowing a small fish that it had just caught. Photographed on the night of 28 Jan.2012.

Grey heron (*Ardea cinerea* Linnaeus)

This tall and impressive heron was least commonly encountered along the canal. Unusually, sightings of one individual were only at night. The grey heron was initially seen on the night of 16 Jan.2012, during a low tide. Subsequently, it appeared again on the night of 28 Jan.2012 and was observed to be on the lookout for fish, together with the black-crowned night herons (Fig. 20). Owing to its significantly longer legs, the grey heron was able to wade into the deeper sections of the canal that would be unapproachable by the night herons. This, along with its longer neck and bill provided the grey heron with a substantial advantage in having a greater effective striking distance and force. This was clearly demonstrated as swift strikes were executed in quick succession, with audible splashes from the sword-like bill slicing into the water accompanied by visible ripples at the water surface (Fig. 21). From its skilful strikes, the grey heron succeeded in capturing two gold-blotched rabbitfish, *Siganus guttatus* that night (Fig. 22).



Fig. 20. A grey heron, *Ardea cinerea* fishing in the canal alongside black-crowned night heron on the night of 28 Jan.2012.



Fig. 21. The longer legs of the grey heron allowed it to wade into deeper waters that would have been inaccessible by the smaller and shorter black-crowned night heron. Photographed on the night of 28 Jan.2012.



Fig. 22. The grey heron with a gold-blotched rabbitfish, *Siganus guttatus* in its bill. Photographed on the night of 28 Jan.2012.

DISCUSSION

Amongst the variety of fish prey recorded in this compilation, the gold-blotched rabbitfish, *Siganus guttatus* would probably be one of the largest, and also the most challenging to subdue and swallow. The difficulty of handling this fish and ingesting it was repeatedly witnessed in the black-crowned night herons (Fig. 17). Upon capture, the rabbitfish immediately erect their sharp dorsal and anal spines as a means of self defence. Siganids are known to possess venom glands within their spines and are capable of inflicting painful stings (Phoon & Alfred, 1965; Lam, 1974). A sting from a single spine can result in sharp pain which may last between 10–30 min, but is otherwise harmless (Lam, 1974). However, the possibility of developing immunity towards the venom has been proposed, as subsequent contacts have seemed to be less painful (Lam, 1974).

Dead siganids are incapable of activating the venom from their spines and inflicting pain (Lam, 1974). Whether the herons possess immunity towards their venom or not remains to be ascertained. Alternatively, the birds may deliberately wait until the rabbitfish tires or dies and lowers its spines before attempting to swallow the prey. This precautionary measure appears to have been adopted by both the black-crowned night heron and the grey heron, as both species were never in a hurry to swallow the prey soon after capture. Very often, the birds would clamp the rabbitfish in their bills and carefully manipulate the fish such that the spines faced away from them (Figs. 17, 22). Usually, the birds would take the rabbitfish away from the water and move up onto the exposed banks. Many minutes would lapse before the birds initiate the attempt to swallow the fish. At one point, the grey heron was in fact seen to place the fish down

onto the substratum, and it gave a few test prods with the tip of its bill, in order to ascertain how lively it was. Compared with the grey heron, the black-crowned night heron takes a much longer time to swallow the rabbitfish, as it is a smaller bird with a smaller gape size. While the grey heron could swallow the rabbitfish in one slow gulp, the black-crowned night heron would take more than 10 minutes to do so.

The gold-blotched rabbitfish is primarily a coastal species that is capable of moving in and out of rivers following the tides (Lam, 1974). This rabbitfish is known to have distinct annual reproductive patterns throughout its geographic range. The cues for their synchronous migration and spawning is often closely associated with the lunar phase, as well as environmental parameters linked to tropical monsoons (Rahman et al., 2000; Takemura et al., 2004; Susilo et al., 2009). Whether the birds (notably egrets and herons) respond to similar lunar and environmental cues in order to increase their fishing success remains to be investigated.

Apart from the true piscivorous birds that actively pursue live fish as a principle part of their diet, other types of avifauna have been encountered along this waterway that would scavenge on dead or weak fish. Such birds include the Brahminy kite, *Haliastur indus*, occasionally sighted cruising low over the canal while seeking out food scraps (Fig. 23). House crows, *Corvus splendens* have also been seen coming down to the waters at low tide to bathe and source for dead fish or other animals.

Having observed the intimate dependency of the piscivorous avifauna on the canal and its fish diversity, the quality of the water immediately comes to mind. Potentially disruptive compounds, such as heavy metals, pesticides, detergents may inadvertently leach into such canals and eventually find their way up the food chain into key predators, including these herons and egrets. Hence, such bird species may actually serve as key bio-indicators of the health of particular channels and even their associated catchment areas.

Due to the tendency for black-crowned night herons to roost within close proximity to human habitation in certain countries, such birds have been carefully monitored and tested for excessive levels of specific pollutants, for example in Korea and New York (Kim & Koo, 2007; Padula et al., 2010). Another example of care and consideration being shown to a black-crowned night heron colony was in Illinois (USA), whereby detailed ecological models were actually considered and employed in order to optimise the management of a wetland rehabilitation programme (Bennett et al., 2011). With the understanding and appreciation that the aforementioned fish-eating birds constitute a valuable and visible component of Singapore's urban or suburban biodiversity, we should adopt measures that can maintain optimal water quality and cleanliness along such waterways that are conducive for healthy fish populations, and thereby sustain the birds that feed on them.

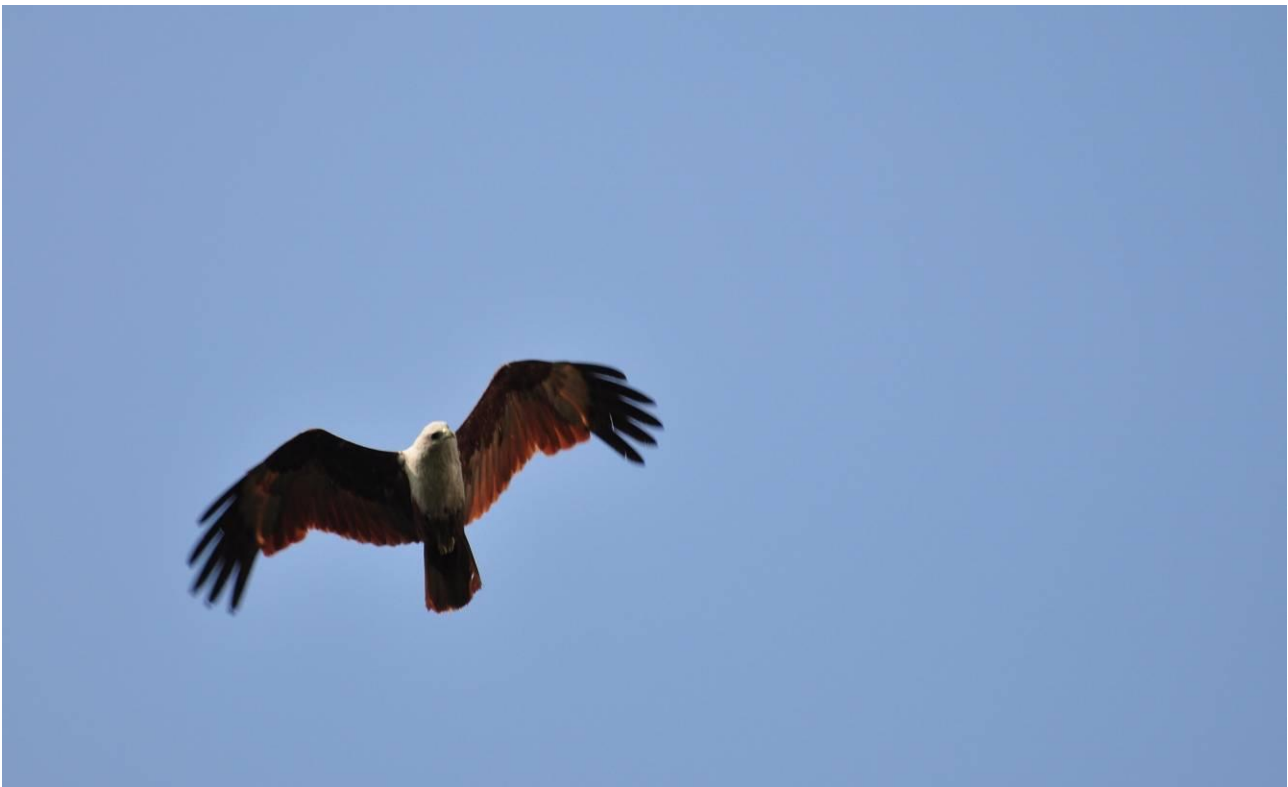


Fig. 23. A Brahminy kite, *Haliastur indus* glides overhead as it cruises along the length of the canal, on the lookout for food scraps, such as dead fish or crustaceans. Photographed on the morning of 23 Apr.2011.

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