

The birds of Madurai city

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History

Madurai (location ~10°N, 78°E), the well-known destination of pilgrims, and tourists, in Tamil Nadu, is one of the oldest continuously inhabited cities of India. It has also been a political capital of one dynasty or another for a period of some 18 centuries, which is a record of sorts. Notably, it was the seat of the Pandyas, who ruled from the early years of Christianity to the 14th century (Devakunjari 1979).

A thorough examination of the body of Tamil literature may provide us valuable information about the bird life of Madurai in historic times. In support of this statement, I provide you excerpts from M. Krishnan's translation of a work by the poet of Sathimutham village, near Thanjavur (Theodore Baskaran's e-mail of 19 January 2007; <https://in.groups.yahoo.com/neo/groups/Tamilbirds/conversations/topics/190>). The poem was written in the 3rd or 4th century AD, and it begins thus:

O stork, O stork, O red-legged stork
With coral-red beak, sharp tapered
Like the split tuber of the sprouting palmyra,
Should you and your spouse turn northward
From sojourning at the southern
Waters of Kanyakumari...

The birds addressed by the poet have been identified as White Storks (Guha 2000). The poet goes on to request these storks to inform his wife, who is in his village, that they

...Saw this wretch
In Madurai, city of our Pandya king...

...thereby providing us a putative early record of the species from Madurai—this species, it might be mentioned, is not seen over the city now.

Both, Madurai, and descriptions of nature, appear prominently in classical Tamil literature. Madurai city, for example, features in Ilango Adigal's *Silapatikaram*, one of the Tamil epics. And, in the words of Baskaran (2009), 'The poets of ancient Tamil Nadu documented their external world with great detail. In describing backdrops to their narration they wrote about birds, mammals and plants.' There are innumerable references to nature in the Sangam literature (Varadarajan 1957), a body of Tamil works from c. 2000 years ago. Indeed, nature is an important element of Sangam literature. Unfortunately, an analysis of these works is beyond the scope of this paper.

One speculates simply, however, that the avifauna of Madurai was very different in ancient times and that it has seen many changes over the long history of the city. After all, even the Meenakshi Amman temple [The Temple], so closely associated with the city from the earliest times (see below), has changed considerably, having been repaired and extended by various rulers.

The core area

The Temple is located at the centre of the oldest part of the city. It is one of the largest temple complexes in India, and it seems to have attained its present proportions and form some 300 to 400 years ago. All the main streets in the area run roughly parallel to the walls of the temple in a concentric arrangement. The streets closest to the temple walls are named the East-, West-, North-, and South- Chitrai streets. The next ring of streets is formed by the Avani Moola streets, and outside these are the Masi streets.

In 1559, Viswanatha Nayak, ruler of Madurai, built a fort around the city. The walls of the fort ran just outside the Masi streets, again parallel to the temple walls, one to each of the cardinal directions. The entire fort lay immediately to the south of the Vaigai River. (Today, water flow in the Vaigai is regulated, and is generally restricted to a few days in any year.) The walls constituted the city limits for close to three centuries, and by the 19th century, the area within had grown very crowded. In 1841, the then Collector of Madura District, John Blackburne, had the walls and the glacis and ditch outside removed to ease the congestion and to 'improve the health of the place' (Francis 1906). Soon, the historical quarter was girt with three new sets of streets comprising four streets each. The new streets were 'handsomer and broader than any others in the place', but still, they were no avenues or boulevards (Francis 1906).

The extent of this historical central part of Madurai, including the Veli streets, is around two square kilometres. This compact old quarter remains very crowded, although the city has expanded greatly since the times of Blackburne. It is heavily built up, and the buildings jostle each other. There is just one tiny park, at the junction of East and North Chitrai streets. There are practically no other open areas here. (There was one other park, also minuscule, at one end of South Avani Moola Street. It has been converted to a car park in recent years.) Around the city, there are numerous tanks, the *kanmais* of southern Tamil Nadu; but within the old town itself there are no waterbodies, unless you count the ancient pond of the golden lotus, within the temple, as one.

There continues to be a perceptible lack of trees in the old part of the city, apart from a large number of ornamental palms—*Roystonea* and *Chrysalidocarpus*—that have been planted immediately outside the temple's walls. From a rooftop, one can see the tops of only a few pipal *Ficus religiosa* trees peering over the shoulders of buildings. Walking along the streets, one finds that there *are* some trees; but these are mostly specimens of small, or badly lopped and pollarded ones—they hardly count as functional trees! In July 2013, I counted the trees (apart from the aforesaid *Roystonea* and *Chrysalidocarpus*) along the Masi and Chitrai streets, which have a combined length of some six or seven kilometres. The total was 128. I could not identify 20 of these trees. Among the rest, the neem *Azadirachta indica* was clearly the 'dominant species', numbering 49 individuals. The next most numerous trees were the pipal (15 trees), followed

by the rain tree *Albizia saman* / *Samanea saman* (ten trees), and *Pongamia glabra* (six trees). Among the remainder were a *Syzygium*, a banyan *F. benghalensis*, a couple of gulmohurs *Delonix regia*, several mast trees *Polyalthia longifolia*, and a few *Millingtonia*.

Clearly, the 'core area' of Madurai has few attractions for birds. From an avian perspective, the place is a stretch of bare rooftops and has no vegetation worth mentioning. It is practically sterile. Precisely for this reason, the city of Madurai represents an interesting observational experiment for the ornithologist. What bird life could be expected here? One could hypothesise that only a few species may be found here—some commensals and scavengers, apart from some granivorous birds that could eke a living out of the spilt grain of the markets. Perhaps there would be some frugivores too, exploiting the pipal trees seasonally when they fruit. It could be expected that some birds will stray into the city from the agricultural and wild areas around the city.

It may be instructive, therefore, to study this set of birds.

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Little has been published to date on the birds of the 'fort' of Madurai. Jerdon (1839) mentions a Common Barn Owl he caught here: 'Whilst at Madura lately, one flew into my room at an open window after a rat that was running, and I secured it alive...' Nichols (1944a, 1944b, 1945), who provided an account of the avifauna of Madura District, makes hardly any references to the birds of the city proper. I have published a few notes on the birds of the old quarter (Sathasivam 1991, 1992, 1995, 1996, 1999, 2007).

I have put together the following list from my records (maintained from the late 1980s, irregularly) and memories and impressions related to earlier years. I have 'kept an eye' on the birds at least a few days each month to the present. I have incorporated some records of Dr. Badrinarayanan (*pers. comm.*), who lived in the core area for many years.

Most of my observations were from my house, which is close to the temple. Often the birds were on a few favourite perches: a television antenna that stood on my rooftop, a gulmohur or other tree that grew in my backyard, an *Aegle marmelos* that grew just outside my wall or a tall pipal that still stands on South Kaval Kooda Street. In other instances they were just flying by. Should anyone wish to spot birds at Madurai, my advice is to do so from the open terrace of a building; from ground level, your view is just too restricted.

The list

- **Cormorants [Phalacrocoracidae].** Birds seen flying overhead, singly or in groups. My records all fall between August and January, except for one record in May 2007, when a solitary bird was noted. A group of 60 birds in December 1991.
- **Egrets [Ardeidae].** Single birds or small groups seen flying past occasionally. My records are all from April to August, except for a bird seen in January 1990.
- **Indian Pond Heron *Ardeola grayii*** Individual birds and small groups seen occasionally as they fly overhead. They are seen in all months, and as far as I can see, there is no pattern to the direction in which they head.
- **Black-crowned Night Heron *Nycticorax nycticorax*** Calls heard occasionally at night. My records are from June to January.
- **Asian Openbill *Anastomus oscitans*** Two records of single birds. Dates not recorded.
- **Glossy Ibis *Plegadis falcinellus*** A single record. A group of 11 birds flying past, May 2007. Nichols (1945) recorded the species only twice (December and January), at Sholavandan. But in recent times the bird has become quite common in wetlands around Madurai. A very large number was seen at Kunnathur, about 15 km from Madurai (Narayanan & Sathasivam 2002).
- **Black Kite *Milvus migrans*** I remember that the whinnying call of this bird was regularly heard in the 1960s and 1970s. Now its numbers seem to have dropped. A group of Black Kites, ranging in number from a dozen to 50, may be seen drifting to some roost in the evenings. Evidently breeds in January. According to Nichols (1944b), the Black Kite ranked seventh among the plains-birds in his records.
- **Egyptian Vulture *Neophron percnopterus*** One record. A single bird flying above the temple. Date not recorded, but probably in the 1980s.
- **Shikra *Accipiter badius*** Calls heard regularly. Individuals or pairs seen flying overhead or perched on my TV antenna or some adjacent building. Nichols (1944b) found it fairly common on the plains, 'in light jungle or trees near houses'.
- **Booted Eagle *Hieraaetus pennatus*** One bird in the pale plumage, seen flying in the sky on Diwali day in October 1992. Nichols (1944b) considered this bird to be rare in the district. He had three records: two in the plains and one at Kodaikanal. These records fell between 13 December and 20 March.
- **Laggar Falcon *Falco jugger*** A pair took up residence in the area in August 1992. They were seen regularly, mostly in the mornings and evenings. They could have been living off the Rock Pigeons that flock at the temple *gopurams* (towers). A month after they were first seen, the falcons disappeared as abruptly as they arrived. Nichols (1944b) found this species to be uncommon in the district.
- **Shaheen Falcon *Falco p. peregrinator*** One record. A single bird flying past, July 2006 (Sathasivam 2007).
- **Indian Peafowl *Pavo cristatus*** A few instances, possibly in the 1970s. The birds involved were almost certainly semi-domestic ones. There are populations of Peafowl in areas around Madurai, such as the base of Tiruparankundram Hill and the campuses of Madurai Kamaraj University, and the Agricultural College.
- **Eurasian Thick-knee *Burhinus oedicnemus*** Calls heard in the night twice in 1992. One bird seen flying by in the daytime in August 1994. Nichols (1945) had only one record of the species, 'one bird on a dry tank-bed at Madura on June 26'.
- **Rock Pigeon *Columba livia*** Roosts on the *gopurams* of the Meenakshi Amman Temple. In the evening, dozens of them settle on a *gopuram* in a group, only to take off immediately and return, repeating the performance a number of times, reminding one of ocean waves crashing on a rock. Found by Nichols (1945) to be an uncommon bird in the district. In 2007, as noted in my diary, there may have been a significant increase in its numbers, and it became the commonest bird of the city. Individual birds and groups seen heading swiftly across the sky at any time of the day.
- **Spotted Dove *Streptopelia chinensis*** A single record. A bird on a television antenna one morning on Town Hall Road. Date not recorded, probably after 2000.
- **Rose-ringed Parakeet *Psittacula krameri*** Single birds, and occasionally small groups, fly past a few times daily, uttering their loud calls. For a month or so, I recorded the time when I heard these calls or saw the birds flying past. But no clear pattern of timing was discernible. Parakeets are regularly seen at a rain tree

near the main entrance of the temple.

- **Asian Koel *Eudynamis scolopaceus*** Nichols (1944b) found it to be 'uncommon, wandering about much, usually ... in thick groves'. It was an uncommon bird in the early 1990s as well, but the Asian Koel has become a bird that is heard practically daily now. One male used to visit a papaya tree that grew in my house.
- **Pied Cuckoo *Clamator jacobinus*** Calls heard in the night in November in three consecutive years in the early 1990s. Calls possibly of this species heard in the night in August 1991 (Sathasivam 2002).
- **Collared Scops Owl *Otus bakkamoena*** One record. The calls heard in the temple precincts one night in June 1994.
- **Spotted Owlet *Athene brama*** A bird that has apparently declined. It used to be common once, guessing from the regularity with which its loud and raucous calls were heard in the night. Once I found a dead owlet on my terrace. At some point it seems that the species disappeared, and I did not hear it for many years. But in the last few years, the calls have been heard a few times.
- **Common Barn Owl *Tyto alba*** Found by Nichols (1944b) to be fairly common, 'judging from the frequency of sucking or grating calls at night'. This was my impression too. The temple *gopurams* were popular roosts, for the owls' hissing used to be heard from them. But I rarely hear the bird now. It does roost and probably nest in campuses of schools and colleges that have trees and large buildings. These campuses lie outside the fort area.
- **Indian House Swift *Apus affinis*** Nichols (1944b) found it to be 'locally common on the plains, especially in old temples and the Madura palace, in flocks of about 200 or more'. This bird is seen regularly in the sky, often in groups. It mills about, uttering its shrill cries, at times; quite silent at others. I have seen a group of around 200 only once, in August-September 1992. Nests in the Meenakshi Amman Temple. Dr. Badrinarayanan has seen nests at the Perumal Temple and at a cinema theatre, both close to the railway station (West Veli Street).
- **Alpine Swift *Tachymarptis melba*** Seen regularly in March 1992. A spread-out group of these birds flew over the city at 0800 hrs every day. The greatest number I saw at any time was five birds. Jerdon (1862) wrote this about this bird: 'I saw, on several occasions, large flocks of them flying eastward towards the sea from the rocky hills near Madura about sunset. On another occasion, I saw, at midday, an enormous flock of them flying eastwards from the same range, a little south of Madura; these, however, were probably taking their ordinary rounds of a few hundred miles, but the others flying seaward at sunset—where were they bound for? Where were 'my' Alpine Swifts bound for, I wonder. Nichols (1944b) found the bird to be uncommon, 'sometimes solitary, sometimes as many as 20 together'. His records fall between 27 January and 10 September.
- **Asian Palm Swift *Cypsiurus balasiensis*** Single birds or pairs seen in a few instances, including once with a group of Indian House Swifts. A group seen above the railway station (West Veli Street) once.
- **Blue-tailed Bee-eater *Merops philippinus*** Seasonal visitor. Calls regularly heard in the mornings as individuals or small groups sweep large circles in the sky or fly past. My earliest record is on 15 August. I find that I do not have records after 28 January, but I would guess the birds are around even later. Nichols' (1944b) records are from 10 August to 02 April, though he found a single bird at the northern foothills of the Sirumalais (around 50 km from Madurai) on 13 June and 04 July.
- **Indian Roller *Coracias benghalensis*** Uncommon. Single birds seen flying past. There were a few instances in which single birds were seen perched on a pipal tree or on electric wires.
- **Pied Kingfisher *Ceryle rudis*** This bird was seen regularly in the evening from the end of July to mid-September in 1991. One to three birds used to fly past overhead at around sunset then, calling. These birds may be seen at the Vaigai River and at waterbodies around the city.
- **Common Kingfisher *Alcedo atthis*** Seen a few times at the golden lotus pond in the Meenakshi Amman Temple. Status not clear.
- **White-throated Kingfisher *Halcyon smyrnensis*** Seen occasionally, flying past or perched on a vantage point such as a television antenna. Heard fairly regularly.
- **Coppersmith Barbet *Psilopogon haemacephalus*** Described by Nichols (1944b) as 'common, frequenting fairly heavy trees'. Coppersmiths were resident in the area till recently. Their calls could be heard and they were seen in a pipal tree at South Kaval Kooda Street or the *Aegle marmelos*. One of the perches on which they were seen regularly was a bamboo pole erected on a rooftop. They seem to have left the area now. My last confirmed record is dated 24 May 2007.
- **Indian Pitta *Pitta brachyura*** A few records of single birds in my backyard, close to the dates when they should have been migrating to their breeding grounds. A dead bird in October 1994, which must have been a freshly arrived specimen. Badrinarayanan (verbally, 11 August 2013) has also seen the bird in the city, at Nanmai Tharuvar Koil Street. Nichols (1944a) found the species to be rare in the district, 'on the ground near thick trees', and describes it as a winter visitor to the region, found between 10 October and 10 April.
- **Larks [Alaudidae]** A single unidentified species in the backyard, one night, just after a thunderstorm. It had disappeared the next morning.
- **Barn Swallow *Hirundo rustica*** Seasonal visitor. Individuals and small groups were seen hawking insects overhead. Sometimes these birds flew low above the ground along busy streets. Seen from 28 August till 20 April. Nichols (1944a) found it to be a common visitor, from 01 September to 19 April.
- **Red-rumped Swallow *Cecropis daurica*** Two records, from March 1992, and April 1992 respectively, but I did not see the birds well enough to confirm my identification. This is not a common bird even outside the city.
- **Western Yellow Wagtail *Motacilla flava*** Seasonal visitor. The calls of the bird were heard as the birds flew past overhead. The earliest date I have for them is 21 September; the last is 01 April (but they may be seen on later dates at water tanks around the city). On more than one occasion I have seen a few of these wagtails perching on my antenna. But I have not heard or seen them for several years. Found by Nichols (1944a) to be a 'winter visitor, September 15 to April 26. Abundant in wet fields. Flocks contain up to a thousand birds'.
- **White-browed Wagtail *M. maderaspatensis*** Single birds, or pairs seen, usually on some high perch, round the year. The calls heard regularly. Found by Nichols (1944a) to be 'fairly common at tanks and ponds. When there is no water elsewhere, they enjoy even the iron water-tanks at railway stations'.
- **Red-vented Bulbul *Pycnonotus cafer*** Pairs and single birds were seen and heard regularly around my house in the early 1990s. Sometimes I saw three or four birds together, evidence, perhaps, of breeding in the locality. On one occasion there may have been a group of six birds. The bulbuls perched regularly on

my TV antenna. Then I did not note them for a period of several years. In May 2013 I heard their calls on three occasions. Nichols (1944a) ranked this bird as the fourth most abundant among the plains-birds of Madura District. He said that it was 'found wherever there are small trees and bushes'.

- **Brown Shrike *Lanius cristatus*** One record; A single bird on my TV antenna, from October 1994. Badrinarayanan has seen this species at Nanmai Tharuvar Koil Street.

- **Yellow-billed Babbler *Turdoides affinis*** Five records, including a single bird in March 1989 and a group of three birds in the backyard in October 1996. This species is not included by Nichols (1944a) in his list of birds of Madura District. He may have mis-identified it as the Jungle Babbler, which species, he says, was found in the plains, and in the hills up to 1860 m.

- **Common Tailorbird *Orthotomus sutorius*** A couple of records. A pair seen once in the backyard. In another instance, a single bird at the 'Vilvam' tree *Aegle marmelos*.

- **Blyth's Reed Warbler *Acrocephalus dumetorum*** Two records. One from January 1990, and the other in the gulmohur tree, from November 1994.

- **Greenish Leaf Warbler *Seicercus trochiloides*** Calls heard at the temple once, in November 1994.

- **Zitting Cisticola *Cisticola juncidis*** A single, recent record (2012?). A bird that flew past high above, calling.

- **Purple Sunbird *Cinnyris asiaticus*** A male in eclipse plumage seen at the gulmohur tree once. Date not recorded.

- **House Sparrow *Passer domesticus*** Nichols (1944a) ranked it fifth in abundance among the plains birds. He found it 'about houses except when large flocks raid the grain-fields.' In my experience, it was a common bird throughout the year. At least two pairs used to nest, sometimes simultaneously, in the house. They also roosted within the house. They used to peck at mirrors and help themselves to grains of rice, scraps of food on the table, and so on. I saw 14 birds in my backyard once. But they disappeared quietly, and quickly, and my last record is from October 1994. Long after that date, I saw sparrows just once each, off South Masi Street, and near West Perumal Maistry. But I doubt that any House Sparrows are thriving in these places now.

- **Chestnut-tailed Starling *Sturnia malabarica*** Small groups seen a few times at different locations in 1992 and 1993. Nichols (1944a) records this species as a winter visitor to the plains from 06 November to 10 March. My records fall between 21 October and 03 March.

- **Brahminy Starling *S. pagodarum*** Single birds, and pairs, seen or heard, in practically all months between 1990 and 1994. The birds were fond of perching on the TV antenna. A pair was evidently nesting in a rainwater spout above a busy street in August 1992. Like the Red-vented Bulbul, this species apparently disappeared abruptly, though I found a single bird calling on East Masi Street in May 2008. For Nichols (1944a), this species was 'Fairly common in the wetter portions of the plains, sometimes near houses'. Badrinarayanan remembers that he too saw the bird in the city in the past.

- **Rosy Starling *Pastor roseus*** One record. A dozen birds seen at a pipal tree in South Kaval Kooda Street in February 1992.

- **Common Myna *Acridotheres tristis*** Resident. But not abundant. Pairs heard and seen regularly. Nichols (1944a) found it to be second only to the House Crow, in abundance, on the plains, about houses, and in remote fields.

- **Indian Golden Oriole *Oriolus kundoo*** I saw one to three of these birds regularly at a pipal tree in March and April 1992. Single birds were seen a couple of times at the same tree in

February the next year. Nichols (1944a) describes the species as a winter visitor in the district, found from October 24 to April 13.

- **Ashy Drongo *Dicrurus leucophaeus*** One record; a single bird on my TV antenna, 03 January 1990. Nichols (1944a) recorded it as uncommon in Madura District. He said it was found in mango groves, scrub jungle, and forests.

- **Drongos [Dicruridae]** Unidentified drongos were spotted at a distance (perched on a pipal tree or flying high above) in a few instances between 1991 and 1994. These birds, single on each occasion, were probably Black Drongos *D. macrocerus*, ranked third in abundance in the plains by Nichols (1944a), but my records are from September to January, and so there is a possibility of these being drongos.

- **Rufous Treepie *Dendrocitta vagabunda*** Two records. Single birds flying past.

- **House Crow *Corvus splendens*** I remember this was a very common bird in the 1970s. Crows would be seen resting in the shade of a parapet wall in the afternoon. It was easy to excite them by imitating their calls or pretending to throw something at them, and soon a number of their conspecifics would gather and circle above, cawing loudly as they checked what the agitation was about. Nichols ranked the House Crow first in abundance among the plains-birds. It does not occupy that position in the city now. But its calls are heard regularly, betraying its presence in the area.

- **Large-billed Crow *C. macrorhynchos*** The bird could be resident in the area because single birds are seen occasionally, in most months. But it is far less common than the House Crow. Pairs seen on two occasions, three birds once. Nichols (1944a) stated, 'It ranks 8th in abundance among the plains-birds, and is about one-fourth as numerous in my records as the House Crow. It avoids dense jungle, but is more a bird of the open country and the edge of the village.'

Understanding them

In the event my Madurai checklist contains more than just the few opportunistic birds—commensals, and granivores—that could have been anticipated from a description of the 'habitat'. The birds of this list constitute a mixed bag. Nevertheless, I find that the birds can be grouped thus:

1. **Overflyers.** The cormorants, egrets, Black-crowned Night Heron, Yellow Wagtail, Indian Pond Heron and Pied Kingfisher. These are birds that do not 'belong' to the city. They are really birds of the numerous wetlands around Madurai, and they are seen (or have been seen) occasionally when they use the Madurai airspace to move from one place to another.
2. **Birds of uncertain status.** This group includes birds that were once found, some were even common, but now seem to have disappeared (House Sparrow, Red-vented Bulbul, Brahminy Starling, and Coppersmith Barbet), or have become much less common (Spotted Owllet, Common Barn Owl); those that have never been common (Large-billed Crow, and Common Kingfisher); and those that were seen in only one or two seasons or instances (Rosy Starling, Chestnut-tailed Starling, Red-rumped Swallow, Indian Golden Oriole, and Indian Peafowl). It is not clear if the species that were present continuously still persist in smaller numbers. It is also not clear what led to the disappearance of these, and whether they will re-establish themselves in the city. I include the Alpine Swift, and the Laggar Falcon in this group as the nature of their occurrence is unusual. I also include

the Collared Scops Owl because there is a possibility that it leads a discreet existence in the city; perhaps roosting in a tree in the temple. These uncertainties and the unpredictable manner in which some species seem to have declined raise concerns about the group as a whole.

3. **Vagrants.** This is the largest group, with some 20 species. It is a particularly motley collection, and the occurrence of most of these species in the area is incongruous. The group includes the Blyth's Reed Warbler, Indian Roller, Rufous Treepie, Pied Cuckoo, Yellow-billed Babbler, Asian Palm Swift, Eurasian Thick-knee, Common Tailorbird, Booted Eagle, Brown Shrike, Indian Pitta, Greenish Leaf Warbler, Glossy Ibis, Asian Openbill, Shaheen Falcon, and Purple Sunbird, apart from the unidentified lark, and the drongos. The only explanation that can be offered for the records of these species is that they wandered by from outside the city. This group emphasises the point that birds disperse constantly. Are the specific birds on my list particularly good dispersers, or are they random? More than 300 species have been recorded by Nichols in Madurai District. Presumably, if one waits for a sufficiently long period, eventually all of them will be seen at Madurai city!
4. **Residents.** Here finally is the group of true Madurai birds. They actually live in the city, evidently obtaining food here. These are the ones you may expect to see or hear on a regular basis. The group includes the Black Kite, Shikra, Rock Pigeon, Rose-ringed Parakeet, Asian Koel, Indian House Swift, White-throated Kingfisher, White-browed Wagtail, Common Myna, House Crow, Blue-tailed Bee-eater, and Barn Swallow. With the exception of the last two species, the birds in this group probably also breed within the city, or in its immediate outskirts.

Sorting the birds into groups permits a glimmer of understanding—perhaps simplified—of their occurrence to be gained. Likewise, listing the birds of the last group, the resident species, in a more orderly fashion, namely with the names of the families and orders, offers insights:

Falconiformes: Accipitridae: Black Kite; Shikra.
 Columbiformes: Columbidae: Rock Pigeon.
 Psittaciformes: Psittacidae: Rose-ringed Parakeet.
 Cuculiformes: Cuculidae: Asian Koel.
 Apodiiformes: Apodidae: Indian House Swift.
 Coraciiformes: Coraciidae: Blue-tailed Bee-eater; Alcedinidae:
 White-throated Kingfisher.
 Passeriformes: Hirundinidae: Barn Swallow; Motacillidae:
 White-browed Wagtail; Sturnidae: Common Myna; Corvidae:
 House Crow.

Two aspects of this list are very striking: One, the list is quite short. A typical nature walk may produce many more species. The shortness of the list supports the hypothesis with which we began our examination: Madurai city, as we saw, offers few incentives for birds to linger in, and the dozen species that are found are ones that can thrive in a human landscape. But I wonder if the list could have been predicted *ab initio*.

Two, the distribution of species in the higher taxa is very uniform (even): there is exactly one species in each family that is represented in the city (except the family Accipitridae, which has two members) and just one to four species in each of the orders. This, we can see intuitively, is in contrast with the pattern of birds in other checklists. This is readily verified by considering Nichols' Madura District list—there are 323 species falling in 61 families in 19 orders. Since the numbers involved are so different, to compare the two areas, we could take the ratio of the number of species to number to families and the ratio of the number of species to number of orders. The values of these ratios are 1.1 and 1.7, respectively, for the city, and 5.3 and 17 for the district. Out of curiosity, I took two other lists (a list of the birds of Periyar Tiger Reserve (Robertson & Jackson 1992), and a list of the birds of India (http://en.wikipedia.org/wiki/List_of_birds_of_India; accessed on 15 August, 2013), choosing them purely on the basis of ready availability, and determined the corresponding numbers. I have presented the figures in Table 1, and there seems to be a trend of higher values of the species : families, and species : orders, ratios as you consider larger areas. However, rather than extent, *per se*, it is clearly an ecological basis that accounts for the difference in the values—Periyar is rich bird country, but it is homogeneous, compared with Madura District, which is a mosaic of habitats. India on the whole, of course, has far more habitats. You could extend the exercise to the ultimate limit by working out the ratios and numbers for all the birds of the entire world. As we know, the distribution of bird species across orders is lopsided, with a heavy list towards the order Passeriformes. But working in the reverse direction is more intriguing. What would happen to the ratios if progressively *smaller* areas were considered? Will not the manner in which the ratios diminish depend on the habitat? If you restrict yourself to a heavily built-up area in another city, what will your set of birds be? At the end of all this reflection, we only have more questions! And we have not explained why the distribution of species in the higher taxa is so even! If the distribution had been asymmetric in any way, the skew could have been explained away as a quirk of the 'habitat'.

Speaking of comparing the diversities of different places, there are measures of biodiversity that are reckoned using taxonomic information, apart from the number of species and proportions of species in a community. Quadratic entropy is one such

Table 1. Bird diversity (species and higher taxa) of four areas that differ in extent by orders of magnitude (increasing from top to bottom). The number of species per higher taxon—in terms of the range or the average—increases greatly as the area increases. This is understandable since the inclusion of more habitats brings the numbers of the taxa closer to the all-India figures. But the even distribution of species in the families and orders in Madurai city is not as easily explained.

Area	Number of species	Number of families	Number of orders	Species per family (range)	Species per order (range)	Species per family (average)	Species per order (average)	Source of data
Madurai city	12	11	7	1–2	1–4	1.1	1.7	This work
Periyar	281	57	18	1–29	1–125	4.9	15.6	Robertson & Jackson (1992)
Madurai District	323	61	19	1–29	1–145	5.3	17	Nichols (1944a, 1944b, 1945)
All India	1301	106	23	1–117	1–709	12.3	56.6	http://en.wikipedia.org/wiki/List_of_birds_of_India

measure (Desrochers & Anand 2004). Taxonomic information is involved in the calculation of quadratic entropy through the use of 'taxonomical distances'. Here is an example to illustrate the meaning of the term: The taxonomical distance between two kingfishers (same family) would be shorter than that between a kingfisher and a woodpecker (even the Orders are different).

Using a taxonomic diversity index, you could compare one set of bird species with another, and determine quantitatively which of those was more diverse. It is intuitively clear that a set of five species including a crow, a woodpecker, a pigeon, a parakeet, and a hawk, is more diverse than another set of five species, all of which are bulbuls. But real-life bird communities are more complex, and so the advantages of using a sophisticated measure of biodiversity are evident.

Given a certain species count, the quadratic entropy would be greatest when the species are taxonomically spread out (and when they are found in equal proportions—but this is not relevant here). As we have seen in the foregoing, the birds of Madurai are indeed taxonomically spread out.

Taxonomic diversity indices have been developed not just to determine which of two groups of birds is more closely related (or more unrelated—it all amounts to the same question). These indices include taxonomic information because of the premise that a more dissimilar assemblage of taxa is found in a habitat that is ecologically more varied. In other words, you can draw conclusions about habitats from these indices.

Could we apply the concept of quadratic entropy (or any taxonomic diversity index) to comparisons of cities in terms of their 'ecology'? I suppose not. They are not natural habitats. And I have not come across any publication in which values of quadratic entropy for bird assemblages have been published. But the idea is fascinating.

It is true that the higher-level taxonomic diversity of Madurai city is high, but the fact remains that the species list is very short. The reasons for this are also evident—the city does not provide the vegetation, water, food, and nesting sites that other species need. And from those reasons, birdwatchers, and naturalists, can make recommendations to improve the number and variety of birds in the middle of Madurai city:

- Grow roadside trees.
- Implement changes in the power distribution system in the city. Badrinarayanan pointed out to me that the trees in the city are lopped regularly because they come into contact with the overhead power lines when they grow. If electricity is distributed through underground cables, as is done in some other cities, branches will not have to be cut periodically.
- Grow plants on rooftops and in backyards.
- Set water out for birds.
- Provide open spaces wherever possible, including in areas that are being developed in the outskirts. Restore open spaces that have been lost.
- Provide perches on rooftops for birds.

- Provide nesting boxes and build bird-friendly constructions to permit birds to breed.

The number of overflyers and vagrants gives hope that the birds will respond to these measures.

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