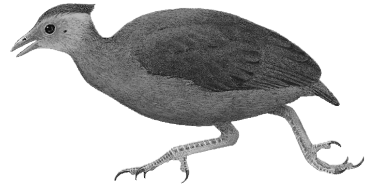


NICOBAR MEGAPODE
Megapodius nicobariensis

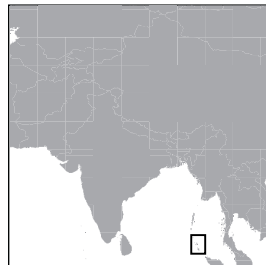
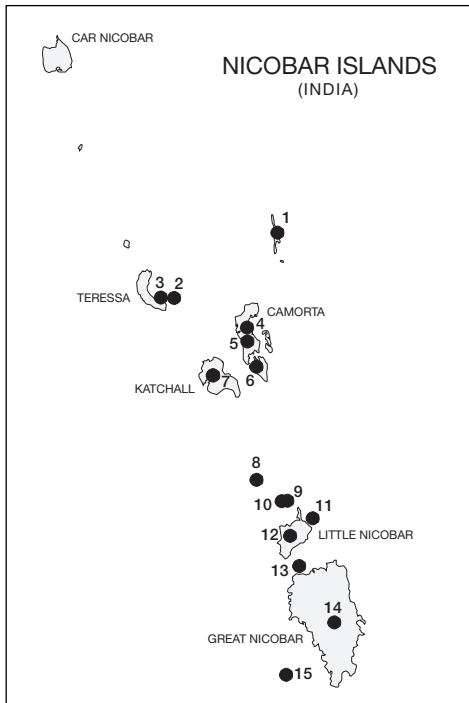


Critical —
 Endangered —
Vulnerable C1

This species qualifies as Vulnerable because it has a small, declining population as a result of the destruction of coastal forest.

DISTRIBUTION The Nicobar Megapode or Nicobar Scrubfowl is endemic to the Nicobar Islands, India, occurring (most anomalously) over 1,600 km from its nearest congener (Olson 1980). There is some question whether it might occur or have occurred in the Andaman Islands and/or adjacent islands belonging to Myanmar (see Remarks 1). Two subspecies are recognised (Abdulali 1965, 1967, Ali and Ripley 1968–1998; see Remarks 2) with *M. n. nicobariensis* north of the Sombrero channel and *M. n. abbotti* to the south. The species historically occurred on most (St John 1899, Kloss 1903) or all (Blyth 1846, Hume 1874a) of the Nicobar Islands, and continues to occupy all islands where its historical occurrence has been confirmed (Sankaran 1995a). It is absent from Car Nicobar (Butler 1899–1900) and Chaura (Baker 1921–1930, Abdulali 1967). Records are from:

■ **INDIA** ■ *Nicobar Islands Batti Malv* by local report, 1890s (Butler 1899–1900), and listed for the island sanctuary (Pande *et al.* 1991), although apparently now probably extinct (Sankaran 1997a);



The distribution of Nicobar Megapode
Megapodius nicobariensis: (1) Tillanchong; (2) Bompoka; (3) Teresa; (4) Camorta; (5) Trinkat; (6) Nancowry; (7) Katchall; (8) Meroe Island; (9) Trax; (10) Treis; (11) Menchal; (12) Little Nicobar; (13) Kondul Island; (14) Great Nicobar; (15) Megapode Island.
 ● Recent (1980–present)

- Tillanchong* March 1966 (Abdulali 1967), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Bompoka 1873 (Hume 1874a), March 1966 (Abdulali 1967), between 1992 and 1995 (Sankaran 1995a, 1997a, 1998);
Teressa March 1966 (Abdulali 1967), from 1992 to 1995 (Sankaran 1995a, 1997a, 1998);
Camorta pre-1867 (Frauenfeld 1867), January and February 1873 (four specimens in BMNH, Hume 1874a), January and December 1874 (two specimens in BMNH), February 1873, February 1905 (eggs in BMNH), March 1966 (Abdulali 1967), between 1992 and 1995 (Sankaran 1995a, 1997a, 1998);
Trinkat (Trinkut) February–March 1873, January 1874 (five specimens and eight eggs in AMNH, BMNH, Hume 1874a), March 1966 (Abdulali 1967), between 1992 and 1995 (Sankaran 1995a, 1997a, 1998);
Nancowry 1858 (specimen in NHMW), February–March 1873, 1886, 1894 (11 eggs in BMNH), undated (Sewell 1922), March 1966 (Abdulali 1967), between 1992 and 1995 (Sankaran 1995a, 1997a, 1998);
Katchall February 1873, 1874 and 1876 (specimens in BMNH, Hume 1874a), February–March 1873, February 1874 (22 eggs in BMNH), 1966 (Abdulali 1967), between 1992 and 1995 (Sankaran 1995a, 1997a, 1998);
Meroe (Mero) 1964 (Abdulali 1965), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Trax 1964 (Abdulali 1965), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Treis undated (Hume 1874a), 1964 (Abdulali 1965), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Menchal 1964 (Abdulali 1965), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Little Nicobar pre-1911 (Oberholser 1911), 1964 and 1977 (Abdulali 1965, 1978), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Kondul 1964 (Abdulali 1965), 1992–1995 (Sankaran 1995a, 1997a, 1998);
Great Nicobar 1858 (specimen in NHMW), 1873 (Hume 1874a), glimpsed near Campbell Bay, February–March 1964 (Abdulali 1965), March–April 1977 (Abdulali 1978), March 1992 (Dekker 1992), April 1992, along the east coast, from “km 35”, south of Campbell Bay to Indira Point (Pygmalion Point) and at Laful and Nevi Dera in the north (L. Vijayan *in litt.* 1999), 1992–1995 (Sankaran 1995a, 1997a, 1998), 1995–1997 (Sivakumar and Sankaran *in press*);
Megapode Island 1964 (Abdulali 1965), six collected, around 1977 (Abdulali 1978), 1992–1995 (Sankaran 1995a, 1997a, 1998).

POPULATION Apparently the species was common on all Nicobar islands early in the nineteenth century (Blyth 1846, Ball 1873). In 1988, the Great Nicobar group population was estimated to be below 400 (L. Vijayan *in litt.* 2000), but in 1992 Dekker (1992) estimated over 2,000. Sankaran (1995a,e) found healthy populations on almost all islands with confirmed historical records, and concluded that it should not be treated as threatened, although he felt that local extinction had probably taken place on the small inhabited island of Pilo Milo, around half of which is taken up by a village. Extinction was also considered imminent on Megapode Island owing to conversion of forest to coconut plantations and perhaps on Kondul because of its high human population (R. Sankaran *in litt.* 1993, Sankaran 1995a,e). However, these islands are small, while the populations on Great and Little Nicobar were “probably optimal” (R. Sankaran *in litt.* 1993). The total population was then thought to be in the order of 4,500–8,000 adults (Sankaran 1995a).

Sankaran’s (1995a) estimates were based on counts of the incubation mounds that the birds build: using a range of 2–3.5 pairs per mound, he estimated the population in coastal forests to be 2,300–4,000 breeding pairs. The nominate race *nicobariensis* is represented by 625–1,090 breeding pairs (Bompoka 52–91; Camorta 40–70; Katchall 138–242; Nancowry 120–210; Terressa 238–417; Tillanchong 20–35; Trinkat 16–28), race *abbotti* by 1,700–2,970

breeding pairs (Great Nicobar 1,030–1,802; Kondul 22–39; Little Nicobar 622–1,088; Megapode Island 4–7; Menchal 4–7; Meroe 2–4; Pilo Milo 0; Trax 6–11; Treis 8–12). Populations in the interior of islands were not estimated, but densities are believed to be much lower than in coastal forests (Sankaran 1995a).

ECOLOGY Habitat The Nicobar Megapode occurs throughout the islands in all suitable forested habitat. However, the greatest concentrations are found in coastal forests (Hume 1874, Butler 1899–1900, Sankaran 1995a), and on islands where the substrate is sandier and the undergrowth sparser (Hume 1874). W. Davison (in Hume 1874a) actually believed that “the megapode never wanders from the seashore”, which even though mistaken certainly indicates the primary importance of coastal areas to the species. At night and twilight, birds are apparently visible “running about on the shore or even at the very water’s edge” (W. Davison in Hume 1874a). Mound design, and habitat variations with respect to different types of mound have been studied in detail (see, e.g., Sivakumar and Sankaran 1996, in press, Sankaran and Sivakumar 1999).

Food The species feeds in the manner of other megapodes, scraping in soil and leaf-litter for arthropods, worms, snails and vegetable matter (Tikader 1984). W. Davison (in Hume 1874a) wrote that “the stomachs of all we examined contained tiny land shells, sometimes with the animals not yet dead, larvae of insects, dissolved matter, apparently vegetables, and minute fragments and particles of quartz and other hard rocks”. One on Tillanchong had consumed “a good deal of sand, fragments of quartz and specimens of *Scarabus plicatus* and *Helicina zelebori*” (Hume 1874a).

Breeding The Nicobar Megapode was thought to be strictly monogamous, but extra-pair copulation has been observed, and perhaps changes may be frequent: of the three pairs in which both partners were colour-marked, two pairs had separated from their original partners in the subsequent season and had taken new partners (Sankaran and Sivakumar 1999). Like most other *Megapodius*, this megapode builds large mounds containing huge quantities of leaves such that “the succulent decaying vegetation, constant moisture, and finely triturated lime, all combined in a huge heap, will account for a considerable degree of artificial heat” (Hume 1874a), and the process of direct incubation and parental care is thereby circumvented. The eggs are reportedly “abnormally tough in constitution”, hatching even when left forgotten on the surface by collectors (Baker 1922–1930), although this is also true of various bird eggs close to hatching in tropical climates (Whistler 1935). Mounds are usually made close to the shore but are also present some distance inland (Hume and Marshall 1879–1881, Baker 1922–1930). Butler (1899–1900) assumed that most nests were situated within a few metres of the edge of forest near the beach in order to “obtain a mixture of the rich leaf litter of the forest with the fine pulverised coral of the beach”.

Of the 188 active mounds for which measurements were taken by Sankaran (1995a), 52% were located within 15 m of the beach, 77% within 50 m of the beach and 97% within 100 m of the beach; while incubation mounds are present throughout suitable habitat, some degree of clustering is discernible (Sankaran and Sivakumar 1999). The 32 mounds studied in detail in 1995–1997 were in eight clusters, one of four mounds, one of three and six of two; of 14 new mounds built, eight were added to the two existing clusters, while the others formed six new clusters (Sankaran and Sivakumar 1999). The size of mounds varied during the breeding season: of the 27 mounds for which size was monitored, 19 became larger by between 0.5 to nearly 25 times the original size, two were later abandoned, three active mounds showed no size change, and three others actually decreased in size (Sankaran and Sivakumar 1999). W. Davison (in Hume 1874) noted that lizards (probably monitors) also lay eggs in megapode mounds.

The Nicobar Megapode builds mounds of sand, loam, pieces of coral and rotting vegetation within which eggs are laid; nests built further inland tend not to contain sand and

coral, but instead are composed of “dry leaves, sticks, etc., mixed with earth” and they are also much smaller than coastal mounds (Hume 1874a). An account of the mound construction procedure is as follows: “the birds first collected a heap of leaves, cocoanuts and other vegetable matter, and then scraped together sand which they threw over this heap, so as not only to fill up all interstices, but to cover everything with about a foot of pure sand” (which generally contains triturated coral and shells) (Hume 1874a). Periodically, the megapodes apparently scrape away three-quarters of the sand layer, add more leaves, and then scrape on another good depth of fresh sand; in this way, vertical sections of mounds show layers of pale sand separated by strips of old decayed matter (Hume 1874a).

Mounds vary in height from 10 cm to 2.1 m and in basal circumference from 7 m to 45 m (Sankaran 1995a). Basically three types of mound are built: type A, regular in shape and built on an open spot away from trees; type B, irregular in shape, built against the buttress or stem of a large living tree; and type C, also irregular in shape but built against, around, under or over a dead rotting tree-stump or log (Dekker 1992). Of 214 mounds located by Sankaran (1995a), type A accounted for 50%, type B 23% and type C 27%, with differences between islands and subspecies in the proportion of types. Sankaran and Sivakumar (1999) found that ground cover, density of small and big trees and canopy cover showed no differences between the three types of mound, so the vegetation profile of a site does not determine mound type; the only parameter which showed statistical differences was the girth at breast height of the four nearest trees, with type B mounds having trees of the largest girth class around the mound, type C the next, and type A the smallest.

Most mounds are used by more than one pair of megapodes (Dekker 1992, Sankaran 1995a, Sankaran and Sivakumar 1999, Sivakumar and Sankaran in press). The mean number of pairs per mound was 2.28; 10 mounds had one pair each and most of these were small in size, although colour marking would possibly result in the identification of more pairs per mound (Sankaran and Sivakumar 1999). Two or more territories overlap at the mound, where the majority of the territorial disputes take place, the position and quality of the territories varying between pairs and with the breeding cycle, so that pairs not in an egg-laying phase retreat from the mounds (Sankaran and Sivakumar 1999). There appears to be a temporally and spatially variable hierarchy amongst pairs that use a mound at any given time: the dominant pair usually spends the most time around the mound, is more involved in mound defence, and is more likely to disrupt other pairs while they are working on the mound, but they maintain their position at the mound only as long as they lay eggs, after which their hierarchical position is assumed by another pair, either one already present at the mound or a new pair (Sankaran and Sivakumar 1999). A few permanently subdominant pairs shift territories to attend a different mound, but dominant pairs as a rule do not do so, and a few pairs occupy territories with (and lay eggs in) more than one mound; both sexes defend the territory, and dominance at a mound appears to be achieved when both birds in a pair are dominant (Sankaran and Sivakumar 1999).

Hume (1874a) mentioned local reports that usually four or five eggs are laid in each mound, occasionally up to ten. Sivakumar and Sankaran (in press) also reported a maximum of 10 eggs from a mound, the smaller mounds usually having fewer eggs (two on average) and larger ones having more (>8 on average). Larger mounds tend to have more stable incubation temperatures (around 32°C) and the shortest incubation period of 72 days, although hatching success varies between years: 87% in 1996 (n=12 mounds), 37% in 1997 (n=32 mounds) (Sivakumar and Sankaran in press). However, many more eggs may be laid per mound over time: 10 is (or may simply be around) the maximum to be found at one time, since the interval between egg-laying events is quite large, and by the time the eleventh is laid the first has hatched (R. W. R. J. Dekker *in litt.* 1999). W. Davison (in Hume 1874a) asserted that the next egg in the oviduct of a bird that had just laid was the size of a large pea, and the next much smaller still. Eggs are laid in mounds regularly, so that at any one time they will

contain freshly laid eggs and ones about to hatch (Butler 1899–1900). Eggs are laid 1–1.5 m below the mound surface (W. Davison in Hume 1874a), the chicks emerging unassisted (Butler 1899–1900).

THREATS The Nicobar Megapode is one of (now) three threatened bird species in the suite of six (with the addition of Nicobar Scops-owl *Otus alius*: see relevant account under Data Deficient) that are entirely restricted to the “Nicobar Islands Endemic Bird Area”, threats and conservation measures in which are profiled by Stattersfield *et al.* (1998). The main threats have been itemised as hunting of birds for meat and egg collection, predation and habitat loss (Dekker 1992, Collar *et al.* 1994, Sankaran 1995a,e). Here a slightly different perspective and sequence are adopted.

Inadequate protection Although the area of habitat protected in the Great Nicobar group is relatively extensive and theoretically sufficient to conserve the endemic fauna, Sankaran (1997) provided three reasons why it is inadequate in its current configuration: first, the coastal forest, most important for the megapodes, is relatively unprotected and thus most likely to disappear as the islands are colonised or developed; second, the central road across Great Nicobar and the gap between national parks leaves the habitat open to fragmentation along this axis; third, the current buffer zone covers large tracts of land that are uninhabited, and as such should be fully protected.

Habitat loss This is the single largest threat to the Nicobar Megapode, especially as its favoured habitat is coastal forest and this is suffering degradation most rapidly. Abdulali (1978) remarked that “at and near Port Blair, one can see the soil being washed into the sea and the denuded areas being turned into unproductive and really barren land”. Sankaran (1995a, 1997a, 1998) suggested that deforestation has occurred in three main ways on the islands: (1) the islanders have converted coastal forests into coconut plantations and forests in the interior into banana, papaya and tuber plantations; (2) mainlanders have cleared considerable areas of forest for agricultural purposes, including a 35 × 2 km strip of forest along the south-eastern coast of Great Nicobar, primarily for paddy cultivation and coconut plantations, and over 6 km² of forest on Katchall for rubber plantations; (3) development activities by mainlanders, including the establishment and expansion of settlements with associated roads, airstrips and defence establishments, have caused considerable losses of habitat in both the Andamans and Nicobars (Whitaker 1985, Saldanha 1989, Sankaran and Vijayan 1993, Sankaran 1995a,e, 1997a, Stattersfield *et al.* 1998, L. Vijayan *in litt.* 2000). Sankaran (1995a) also mentioned forestry operations conducted in the Nicobar Islands, but there is no other reference to this threat. The most alarming threat lies in a proposal to develop Great Nicobar as a free-trade port and to create a dry dock and refuelling base for international shipping at the mouth of the Galathea river, projects that could well spell extinction for several endemic taxa (Sankaran 1995a, 1997a). Further plans to develop a hydroelectric project on Great Nicobar, to increase the acreage of rubber and cashew plantations in the Nancowry subgroup, and to expand defence facilities, roads and building construction, all predicate future losses in habitat extent on the islands (Sankaran 1997a). The Protection of Aboriginal Tribes Act (1957) exempts tribal people in the Nicobar Islands from the Indian Wildlife Protection Act (1972) and the Indian Forest Act (1980), but the impact of tribal people on the environment is markedly less than that of mainlanders, and these legislative loopholes are not thought (yet) to constitute a threat (Sankaran 1997a).

Human population increase The above threats are exacerbated by rising human population levels on the islands, a trend accelerated by colonisation programmes: immigration of mainlanders began when 337 families were settled on the south-eastern coast of Great Nicobar in 1969, and then the following year 268 families were settled on Katchall (Saldanha 1989). These governmental initiatives and the subsequent influx has led to a 26% proportion of mainlanders in the Nicobar population (Sankaran 1997a), and the year-on-year rise in these

numbers, and in the numbers of tourists, is documented in Sinha (1992). During 2,000 years of occupation by tribal people, only 10% natural habitat was converted (Singh 1978), but in the three decades of settlement by mainlanders another 4% has been added to the toll (Sankaran 1997a). This statistic indicates the destruction wrought by mainlanders and suggests that conservation action is necessary to reduce their impacts; and although the settlement programme has been abandoned, the threat of further habitat loss remains (Sankaran 1997a).

Exploitation The Nicobar Megapode's eggs are considered "equal if not superior to that of the Peafowl" and its flesh "unsurpassed", "juicy" and "delicious", suggesting that the needs or tastes of the human population of the islands might be the most serious threat to the survival of the species. For many years it has been snared or shot and its eggs collected (Hume 1874a, Murray 1889, Butler 1899–1900, Abdulali 1967, L. Vijayan *in litt.* 2000). Butler (1899–1900) was surprised that the species "seems to hold its own in spite of the regular destruction of its eggs, the breeding places being mostly known to the Nicobarese and regularly plundered". Hume (1874a) also noted that both islanders and Malay and Burmese traders "take numbers of these eggs". However, both Dekker (1992) and Sankaran (1995a) found that the rate of egg exploitation by local tribes was so low as to be a negligible threat to the species's survival. Nevertheless, as megapodes have various but variable spiritual and medicinal values attached to them, there are inter- and intra-island differences in hunting and egg collection pressures. Where traditional values have eroded, heavy to excessive local hunting pressures exist, especially with the advent of airguns (Sankaran 1995a). Snares were seen in various areas of the archipelago (Sankaran 1995a). Abdulali (1978) reported 20–25 eggs taken from a mound on Great Nicobar in one year, and several collecting trips to Megapode Island for zoos and museums. Greatest hunting pressure on *M. n. abbotti* was on the west coast of Little Nicobar; hunting of *M. n. nicobariensis* was rare or uncommon over much of the Nancowry group, with the probable exception of Katchall (in part) and Bompoka, and the species was also shot on Meroe and Treis, thus seriously threatening already depleted populations (Abdulali 1978). Abdulali (1967) interpreted the decline in collecting success as evidence of reduced populations since Hume's (1874a) time.

Mainlanders, particularly labourers on construction projects, trap megapodes: high hunting pressure existed on Great Nicobar while work on Project Yatrik (for which the island was settled) was under way, although these pressures are thought to have declined with the phasing-out of the project and the better implementation of wildlife protection laws (Dekker 1992, Sankaran 1995a). Very high hunting and egg collection pressures, albeit localised, have been recorded from Thai poachers who camp in isolated parts of Tillanchong, Great and Little Nicobar; about 5% of Great Nicobar's coast is affected in this manner (L. Vijayan *in litt.* 1999). Although insignificant natural predation by monitor lizards occurs, feral cats and dogs may pose a real and possibly increasing threat (Dekker 1992), although subsequently megapodes have been observed in the vicinity of domestic animals without undue reductions in population (Sankaran 1995a).

MEASURES TAKEN The species is listed in Schedule I of the Wildlife Protection Act, 1972; see also Remarks 3.

Protected areas Three Nicobar Islands, all uninhabited, are protected for wildlife: Batti Malv (2 km², although almost certainly lacking megapodes), Tillanchong (17 km²) and Megapode Island (0.13 km²) are wildlife sanctuaries, the last two established expressly for this species (see Pande *et al.* 1991); Great Nicobar has two national parks (Campbell Bay, 426 km², and Galathea, 110 km²) and is also a biosphere reserve (885 km²) whose core areas are the national parks (Sankaran 1997a). In addition, all the Nicobar Islands except for 90% of Great Nicobar and 10% of Katchall have been designated as tribal areas, thus legally prohibiting commercial exploitation of natural resources, along with settlement or ownership of land, by non-tribal people (Sankaran 1997a).

MEASURES PROPOSED As the major causes of habitat loss to date are development programmes and demographic changes arising from them, conservation action needs to focus primarily on this threat (Sankaran 1997a).

Protected areas There is an urgent need to improve the network of protected areas in the Nicobar Islands as, in contrast to continental systems, the protection of a single large area will not accommodate the effects of intra-archipelago speciation (Diamond 1976). On analysing the biogeography of the archipelago, Sankaran (1997a) concluded that “the development of protected areas on Great Nicobar, Camorta and Katchall, with satellite protected areas on Little Nicobar and Nancowry, will effectively conserve all endemic avifauna of the Nicobar Islands”; he advocated two biosphere reserves with multiple cores encompassing the above areas and including all other islands in both Nicobar subgroups as buffer zones. On Great Nicobar the core area should include the two existing national parks, but these should be extended so as to be contiguous and to cover the currently uninhabited and unprotected southern tip of the island, which appears to be particularly vulnerable to development (Sankaran 1997a). Considering the high density of megapodes on Little Nicobar (Sankaran 1995a), a core area should be centrally sited on this island (see also Rodgers and Panwar 1989). In the Nancowry subgroup, Camorta is the most important island, supporting 31 of 35 endemic taxa in this subgroup, and the inclusion of Katchall would add another three of these priority taxa (Sankaran 1997a). A minimum-sized protected area should thus span these two islands in the Nancowry group, especially as anthropogenic pressures are relatively low (Sankaran 1997a). Although Car Nicobar has a distinctive avifauna and merits conservation, its human population is high, a circumstance that seems to exclude it from any conservation programme because of the “practical problems in developing a protected area” (Sankaran 1997a)—but see the equivalent section under Nicobar Sparrowhawk *Accipiter butleri*.

As tribal peoples are exempt from wildlife and forestry laws, Sankaran (1997a) made the point that the development of protected areas will not impinge on their livelihoods or tribal rights, but will serve to protect their interests, as natural resources within the protected areas may legally be exploited only by tribal people.

Re-introduction The release of birds in the reserve on Batti Malv would perhaps re-establish a small population at a previous site.

Research Dekker and McGowan (1995) proposed detailed status surveys on all islands and studies on the breeding biology of the species for its better management and *in situ* conservation. These have largely been undertaken, although monitoring of populations and threats should be continued indefinitely.

REMARKS (1) There are three eggs in BMNH collected in 1907 with an enigmatic note saying “probably accidental on Andaman Islands”. A few other reports from the Andamans exist, namely those of Hume (1874a), Butler (1899–1900; see Remarks 3) and Sewell (1922), variously repeated by Kloss (1903), Abdulali (1965, 1967), and Ripley and Beehler (1989b), but they remain unsubstantiated (Sankaran 1995a). Nevertheless, Hume (1874) repeated the description of a megapode-like bird by the lighthouse keeper on “Table Island” (to Myanmar) in the north Andaman chain, and he reported a mound “which in every respect resembled” those examined in the Nicobars. Moreover, Pollok (1879) referred to “one of the Megapodidae” being shot on Great Coco (also to Myanmar and adjacent to Table Island). Stattersfield *et al.* (1998) presumed that if it had occurred in the Andamans it is now extinct there. (2) The name *trinkutensis* was applied to the Trinkut population (Sharpe 1874) but the basis for this was quickly shown to be mere plumage variation (Walden 1874). (3) It cannot be said to have been a conservation measure, but it is worth noting that Butler (1899–1900) reported that, evidently with a view to establishing new populations, “a few have been turned out in the Andamans, but nothing more was seen of them”.