

The Maleo *Macrocephalon maleo*: new information on the distribution and status of Sulawesi's endemic megapode

M. ARGELLOO

Summary

The Maleo Conservation Project Phase II surveyed the distribution and status of Maleo nesting grounds in and around Dumoga-Bone National Park in North Sulawesi, Indonesia, in 1990–1991. The number of known nesting grounds is now 83, 35 inland and 48 coastal, while 18 sites require confirmation. Most sites along this coast are now abandoned or severely threatened (many now being cut off from adjacent forest), and the population there is estimated at only 335–740 pairs. The region's inland nesting grounds, used by putatively 2,000 pairs, are also increasingly threatened, notably through egg-exploitation. An average of 5.45 birds per day visited one inland nesting ground, Tambun, over a 10-month period, indicating usage by 160 pairs altogether.

Introduction

The Maleo *Macrocephalon maleo*, a megapode endemic to Sulawesi, Indonesia, has long featured in the ICBP (now BirdLife International) checklist of threatened bird species (most recently in Collar *et al.* 1994). It suffers from habitat loss, illegal trapping and egg-collecting. Maleos are communal breeders which do not use body heat to incubate their eggs, but instead bury them in the sand on sun-exposed beaches along the coast or in volcanically heated soils at sites further inland.

The Maleo Conservation Project was established in 1985 with the aim of halting the species's decline. Phase I of the project was executed in 1985–1986 in the Dumoga-Bone National Park in North Sulawesi, focusing on semi-artificial incubation of Maleo eggs and a survey of nesting grounds in the park and its surroundings (Dekker and Wattel 1987, Dekker 1990). Phase II of the project, which I led, was conducted in 1990–1991 at the same location. Significant new and additional data on the distribution and status of Maleo nesting grounds are presented here and compared with those detailed in Dekker (1990).

Methods

Four surveys were carried out during 1990 and 1991 in the province of North Sulawesi to obtain further information on the Maleo nesting grounds described by Dekker (1990). Additional sites for further investigation throughout Sulawesi were identified through discussions with PHPA staff and local people and through a study of the literature. At each nesting ground, data were collected following the categories devised by Dekker (1990) on its condition, access and status (see Table 1).

Table 1. Criteria for the assessment of the status of Maleo nesting grounds (after Dekker 1990); see Tables 2 and 3 for their application.

1. *Condition of the nesting ground*

A nesting ground (NG) is defined as an area covered with excavations or burrows in which Maleos bury their eggs.

Intact:	NG is undisturbed.
Partly destroyed:	NG is locally unsuitable because of man-made alterations (e.g. deforestation) and/or because overgrown with secondary vegetation.
Destroyed:	NG has become totally unavailable.

2. *Access (for Maleos) to the nesting ground*

Free:	NG is immediately surrounded by primary forest for at least 50% of its periphery, which enables the Maleos to reach it undisturbed.
Limited:	NG is surrounded by primary forest for less than 50% of its periphery, so Maleos can reach it from one side only.
Disrupted:	NG is fully separated from the primary forest and the Maleos cannot reach it without passing through cultivated land, secondary vegetation or areas otherwise disturbed by human activity.

3. *Status of the nesting ground*

NG status is determined by condition, access and rate of egg-collecting.

Abandoned:	no eggs are laid at NG.
Severely threatened:	only a few pairs make use of NG and may be expected to abandon it within the near future.
Threatened:	NG is still used for egg-laying by a considerable population of Maleos, but not considered safe for the future, because of egg-collecting, adverse developments in the area, or both.
Not threatened:	NG is still intact and freely accessible, with egg-collecting absent or at a low level.

Most sites were surveyed during the dry season when egg-laying frequency at coastal nesting grounds is highest and the number of Maleos present at colonies reaches its maximum. In order to make a rough estimation of the number of Maleo pairs visiting each nesting ground, data were collected on (1) the number of burrows with and without fresh traces of digging, indicating recent use by the birds; (2) the number of eggs collected by local people during the peak of the breeding season (daily, weekly and/or monthly), which falls in the dry season at coastal sites but in the rainy season inland; and (3) the number of adult birds seen and the number reported to be present by local people.

The number of adult Maleos visiting one inland nesting ground, Tambun in the Dumoga-Bone National Park, was counted daily between 05h30 and 07h00 from December 1990 until September 1991 to estimate the population using the site and to compare the numbers with similar counts made five years earlier by Dekker (1990).

Results

Distribution and status

During Phase II 51 nesting grounds were visited, 33 along the coast and 18 inland (all marked with an asterisk* in Tables 2 and 3). Of these 51, 18 were

“abandoned”, 20 were “severely threatened”, 12 were “threatened” and one was “not threatened”. There is a marked difference between the status of inland and coastal nesting grounds. Only one of the 18 inland sites (5.5%) was abandoned, while of the 33 coastal sites 17 (51.5%) were abandoned (Tables 2 and 3). Altogether 37 of the sites were situated outside protected areas. Information on an additional 11 nesting grounds to those documented by Dekker (1990) and visited during Phase II was collated from a variety of sources, bringing the total

Table 2. The status of the 35 known inland Maleo nesting grounds in North Sulawesi, 1985–1991. Criteria correspond to those in Table 1, numbers to those in Figure 1.

Nesting ground	Condition	Access	Eggs	Status	References
31 Empung	?	—	?	A	1
32 Kiawa	?	—	?	A	1
40 Uuwan*	—	±	—	A	1,2
59 Pakuli	+	+	?	?	1
61 Sidaonta	+	+	?	?	1
62 Kaya	+	+	?	?	1
63 Kare Tambe	+	+	?	?	1
65 Taveki	+	+	?	?	1
68 Morowali NR1	?	+	?	?	1
69 Morowali NR2	?	+	?	?	1
70 Morowali NR3	?	+	?	?	1
33 Tombatu*	?	±	—	ST	1,4
34 Belang*	±	—	—	ST	3
35 Inuai*	±	—	—	ST	3
36 Lobong*	±	—	—	ST	3
37 Bakan*	±	±	—	ST	3
49 PKMT/Tulabolo*	±	±	—	ST	1,2,4
72 Morowali kecil	+	+	—	ST	1
30 Tiwo/Remesun*	+	+	—	T	1,2
38 Muara Pusian*	±	±	—	T	1,2
39 Tambun*	±	±	—	T	3
41 Tumokang*	+	+	—	T	3
43 Negeri Lama I*	+	+	—	T	3
44 Pilomanu*	+	+	—	T	3
45 Sinondu*	?	+	—	T	1,2,4
46 Leda-Leda*	?	+	—	T	1,2,4
47 Pahulongo*	±	±	—	T	1,2,4
48 Hungayono*	±	±	—	T	3
64 Kamarora	±	±	—	T	1
71 Morowali besar	+	+	—	T	1
73 Sungai Karaopa	±	?	—	T	8
42 Tapokolintang*	+	+	+	NT	1,2
60 Sakuli/Mapane	+	+	+	NT	1
80 Danau Matana	+	+	+	NT	7
81 Danau Towuti	+	+	+	NT	7

Condition: +, intact; ±, partly destroyed; —, destroyed; ?, unknown.

Access: +, free; ±, limited; —, disrupted; ?, unknown.

Eggs: safe from collectors, +, yes; —, no; ?, unknown.

Status: A, abandoned; ST, severely threatened; T, threatened; NT, not threatened.

References: 1, Dekker (1990); 2, Indonesian Dep. of Nature Conservation; 3, pers. obs.; 4, local people; 5, Kobayashi and Gurmaya (*in litt.*); 6, Priyono (*in litt.*); 7, Baltzer (1990); 8, Andrew and Holmes (1990); 9, Pramono (1991); 10, Indrawan (1992).

* information obtained during phase II Maleo Conservation Project.

PN = Proposed Nature Reserve.

Table 3. The status of the 48 known coastal Maleo nesting grounds in North Sulawesi, 1985–1991. Criteria correspond to those in Table 1, numbers to those in Figure 1.

Nesting ground	Condition	Access	Eggs	Status	Burrows	Pairs	References
01 Batu Putih*	+	+	—	A	—	0	1,2
03 Kotabunan*	—	—	—	A	—	0	3
08 Lungkap*	?	—	—	A	—	0	4
11 Dodepo*	—	—	—	A	—	0	3
12 Kumu	?	—	?	A	—	0	1
13 Laim Pangi	—	—	—	A	—	0	1
16 Babo/Ayong*	—	—	—	A	—	0	3
18 Muara Bintauna*	—	—	—	A	—	0	3
19 Bohobok*	—	—	—	A	—	0	3
20 Binjeita*	—	—	—	A	—	0	3
22 Wakat*	—	—	—	A	—	0	3
23 Iyok*	—	—	—	A	—	0	3
25 Komus I*	—	—	—	A	—	0	3
26 Komus II*	—	—	—	A	—	0	3
28 Gentuma*	—	—	—	A	—	0	3
50 Bulo Oliyo*	—	—	—	A	—	0	3
52 Tj. Panjang*	—	—	—	A	—	0	3
54 Tanggarasi*	—	—	—	A	—	0	3
55 Bunto*	—	—	—	A	—	0	3
57 Paleleh	?	?	—	?	?	?	1
58 Toli-Toli	?	—	?	?	?	?	1
66 Libun	+	±	—	?	?	?	5
74 Ambuno	?	?	?	?	?	?	6
75 Wosu	?	?	?	?	?	?	6
76 Pasangkayu	?	±	—	?	?	?	7
77 Lariang	?	?	?	?	?	?	8
78 Tj. Dapurang	?	±	—	?	?	?	7
79 Mamuju	?	?	?	?	?	?	4
82 Konoweha	?	?	?	?	?	?	1
02 Rumbia*	±	—	—	ST	3	1–10	3
04 Togid*	±	—	—	ST	20	5–20	3
05 Molobog*PN	±	—	—	ST	28	15–30	3
07 Torosik*PN	±	±	—	ST	110	30–75	3
09 Dami*	±	—	—	ST	30	5–20	3
10 Pinolosian*	±	—	—	ST	12	5–20	3
14 Labuan Uki*	±	—	—	ST	6	1–10	3
15 Buntalo*PN	±	±	—	ST	27	15–30	3
17 Sangkup*PN	±	—	—	ST	41	20–40	3
21 Saleo*	±	—	—	ST	3	1–10	3
24 Kuala*	±	—	—	ST	21	5–21	3
27 Tuntung*	±	—	—	ST	2	1–10	3
29 Molonggota*PN	±	—	—	ST	15	15–30	3
53 Malopuulo*	±	—	—	ST	24	15–30	3
06 Onggunoi	+	—	—	T	?	?	1
51 Panua*	+	±	—	T	490	125–200	3
56 Dehua*PN	±	±	—	T	246	76–125	3
67 Bakiriang	+	±	—	T	?	?	10
83 Tj. Batikolo	+	?	?	T	?	?	1
Total						335–740	

For explanation of symbols, see Table 2.

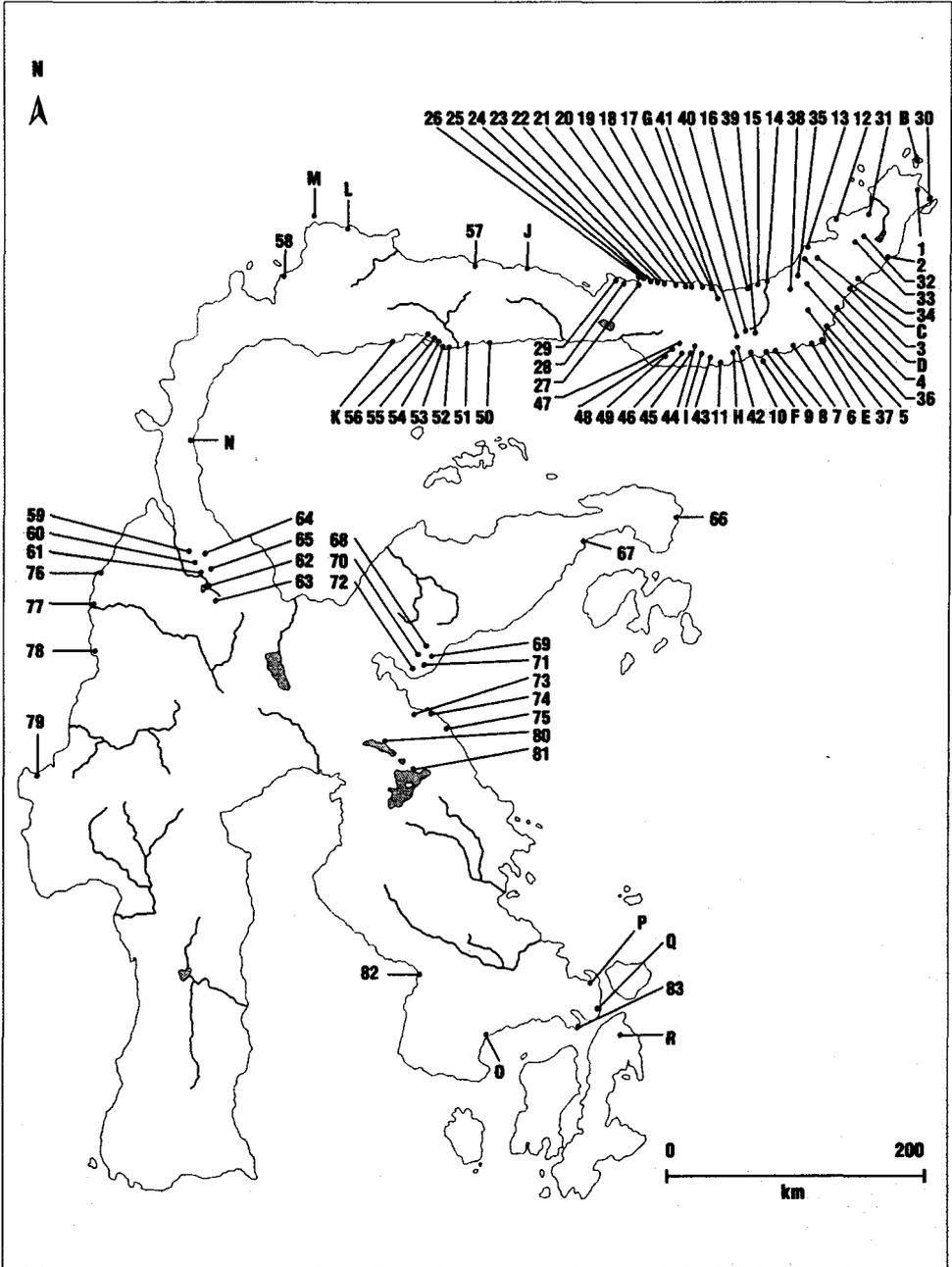


Figure 1. Sulawesi with all known and reported Maleo nesting grounds. Numbers and letters correspond to those in Tables 2–4.

number of known nesting grounds on the island to 83 (35 inland and 48 along the coast) (Figure 1 and Tables 2 and 3). A further 10 nesting grounds, described by local people and in the literature, were not visited and require confirmation (Figure 1 and Table 4).

Table 4. Potential Maleo nesting grounds requiring confirmation.

Nesting ground	CI	References
A Tagulandang (Sangihe island, not on map)	C	4
B Pulau Bangka	C	4
C Picuan	I	4
D Raanan Lama	I	4
E Tobajangan	C	1
F Pulau Pondan	C	4
G Mokima/Pangkusa	I	4
H Tapa Togop	I	4
I Negeri Lama 2	I	4
J Bolontio	C	4
K Molosipat	C	4
L Matop	C	1
M Pulau Dolongan	C	1
N Teluk Tomini	C	1
O Watumohai	C	1
P Tanjung Peropa	C	1
Q Tanjung Amulenggo	C	1
R Lebo (Pulau Buton)	I	9

For explanation of symbols, see Table 2.

Egg-collecting occurs not only at easily accessible coastal nesting grounds close to human habitation but also at remote sites. Four of nine inland nesting grounds visited during Phase II were regularly raided by rattan collectors, who build camps close to nesting grounds to ensure themselves of a daily supply Maleo eggs for food. These nesting grounds were all situated close to a river which the rattan collectors use to transport rattan. One of these sites, Pilomanu, situated deep inside the Dumoga-Bone National Park, contained 155 nesting holes. Twenty-seven of these burrows showed fresh traces of digging activities by Maleos in July 1991, 23 of which were excavated by rattan collectors in search of eggs. At the coastal nesting ground of Sangkup 10 snares were found in July 1991 and only a few Maleos now visit this site each day during the egg-laying season.

Two of the nesting grounds mentioned in Dekker (1990) as "requiring confirmation" were also visited. The Bakida nesting ground was found near Dodepo and named after this village. Mokodite/Wakat proved to be a coastal rather than an inland site and is now included in Table 3. The Lariang and Mamuju nesting grounds were visited by other people, but their status was sufficiently well documented to include them in the final list. Eighteen nesting grounds which still require confirmation are mentioned in Table 4.

The Maleo population at Tambun and Tumokang

Between December 1990 and September 1991 an average of 5.45 Maleo pairs per day visited the intensively studied inland nesting ground at Tambun. The largest numbers of birds visited the site for egg-laying between December and June (Figure 2), with an average of 9.2 pairs per day in March. The highest daily count recorded was on 25 March 1991 when 22 pairs visited the site. After

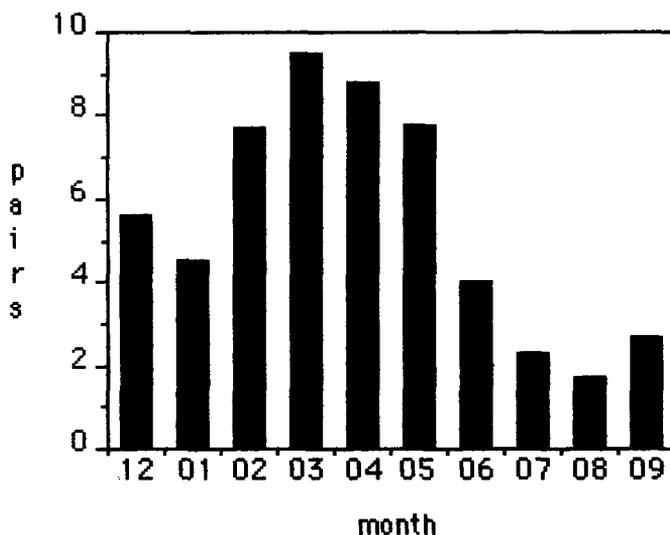


Figure 2. Monthly average number of Maleo pairs/day at Tambun nesting ground between December 1990 and September 1991.

May the numbers dropped sharply, and on several days in July and August no birds were observed at all.

Maleos visit the nesting ground with the sole purpose of laying eggs. They arrive in the evening, lay the next morning and promptly return to the forest. Different pairs, therefore, visit the nesting ground on consecutive days. If it is assumed that each female lays 10 eggs per year, and given a rate of 5.45 pairs per day over 10 months, then 160 pairs must have visited the nesting ground in that period (but this may be an underestimate: see Discussion).

On 27 March 1991 an adult female wearing a wing-tag with the inscription "ZD" was observed in the company of a male at this site. She had been released as a chick during Phase I at the Tumokang nesting ground c.25 km to the west. She had hatched on 19 March 1986 from an egg laid around 12 January 1986 and was released on 26 March 1986. The observation proves that females are not necessarily faithful to the nesting ground where they were born. It is not yet known whether males also move between nesting grounds.

Tumokang, also situated in the Dumoga-Bone National Park, was the largest inland nesting ground visited during Phase II. Although it was impossible to count the birds on a daily basis owing to logistical difficulties, it was estimated that as many as 25 pairs per day were present over several days at the peak of the egg-laying season. Correspondingly large numbers of eggs were found by project assistants from the national park, who were collecting them for semi-artificial incubation. It may be concluded that the number of pairs using this nesting ground is substantially greater than the number laying at Tambun.

The Maleo population of North Sulawesi

The number of Maleos using the 35 coastal nesting grounds so far located along 60% of the coast of North Sulawesi can be estimated from a comparison of the

Table 5. Comparison of the status of 21 nesting grounds described by Dekker (1990) and in this study

Status	Dekker (1990)	This study
Abandoned	4	4
Severely threatened	4	6
Threatened	10	10
Not threatened	3	1

total number of burrows with those at the relatively well known inland site at Tambun, where the number of used burrows on a random day during the egg-laying season never exceeded 10% of the total number of burrows available (although it is possible that other nesting grounds with approximately equal numbers of burrows may be visited by different numbers of Maleos). Once a burrow is made, it can remain recognizable for many years, depending on the soil structure, although in some cases no fresh traces were found at all. Other data used to estimate the population size were the maximum number of eggs found by the local people on one day in 1990 or 1991, and the number of birds observed at each site.

The minimum number of burrows at the 14 "severely threatened" coastal nesting grounds was two (at Tuntung), the maximum 110 (at Torosik). The number of burrows at the two "threatened" coastal nesting grounds were 246 at Dehua and 490 at Panua. At a few sites birds were seen or eggs found. Based on these data, the Maleo populations using the 14 "severely threatened" nesting grounds are estimated to vary between one and 75 pairs per year. At Dehua and Panua the number of pairs was estimated at 76 and 250 per year respectively. The number of pairs using the 35 coastal nesting grounds visited, including 19 which were abandoned, is estimated at 335–740 (Table 3).

The situation at the inland nesting grounds in North Sulawesi is less clear and needs to be studied in more detail before the population size can be gauged. The percentage of inland nesting grounds which are abandoned is lower than along the coast. This, combined with the fact that huge areas of primary forest have not been surveyed, suggests that the Maleo population using inland nesting grounds is much bigger and will probably exceed 2,000 pairs.

Discussion

The total number of known Maleo nesting grounds has increased from 48 (Dekker 1990) to 83. Unfortunately, this does not mean that the total number of Maleos has increased proportionately; in reality the situation has deteriorated. The high number (75%) of "abandoned" (18) or "severely threatened" (20) nesting grounds amongst the 51 sites visited during Phase II of the project is alarming. Of the known nesting grounds, only four inland sites are judged "not threatened" (Table 2). These figures are even more alarming if we compare the results reported by Dekker (1990) with new information which was obtained during Phase II. Of the 21 sites he documented, the number considered "severely threatened" has increased from four to six and the number of sites "not threatened" has fallen from three to one (Table 5).

Coastal

Coastal and inland nesting grounds differ in several respects, including the threats to which they are exposed. Most people live along the coast where, owing to the development of coconut plantations, fishing activities and infrastructure, almost no primary forest is left. Thus a gap now exists between the Maleo's forest habitat and its nesting grounds, rendering the newly hatched chick's journey from beach to forest difficult and perhaps impossible.

Dekker's (1990) conclusion that every flat, sandy beach above the high tide line is a potential Maleo nesting ground was confirmed in this study. These sites vary in length from 200 m to more than 2 km. In the 1950s and 1960s it was possible to find more than 10 eggs per day on almost all the coastal nesting grounds, and at the peak of the egg-laying season as many as 40 eggs could be obtained daily on some, such as Buntalo and Sangkup. Nowadays, only a few eggs are laid and a maximum of five per day can be collected at Buntalo, Molonggota and Sangkup.

Six coastal nesting grounds, all considered "severely threatened", have been proposed to the Indonesian Department of Nature Conservation (PHPA) for designation as nature reserves because they were found still to be active (visited by several pairs per day during the egg-laying season during Phase II). These sites were only partly destroyed and overgrown with vegetation due to human influence, and degraded primary or secondary forest remains in the vicinity (Table 3).

Inland

Although the majority of inland nesting grounds are located much further from human habitation than those at the coast, most of these sites were visited frequently by people, especially rattan collectors. The negative influence of egg-collecting on the remaining Maleo population has certainly increased. For example, during Phase I of the project the Tumokang nesting ground was described as "not threatened", but five years later the situation had changed dramatically and it now rates as "threatened". Indeed, given the increasing number of rattan collectors and the problems of effective protection, the site is likely to become "severely threatened" within a few years. This is particularly worrying as it is located inside a national park.

During Phases I and II Maleos were counted at Tambun. Dekker (1990) estimated the population in 1985/1986 at between 150 and 200 pairs. The results of Phase II indicate no significant increase or decrease of Maleo numbers, the average number of pairs visiting the site daily being similar in both surveys. However, the average number of pairs might have been higher in Phase II if counts had been made in October and November as well, when the egg-laying season, which runs from November to May, begins to peak (Figure 3).

Conclusion

The distribution of Maleo nesting grounds along the coast in the province of North Sulawesi is now relatively well known. Their status, however, gives little

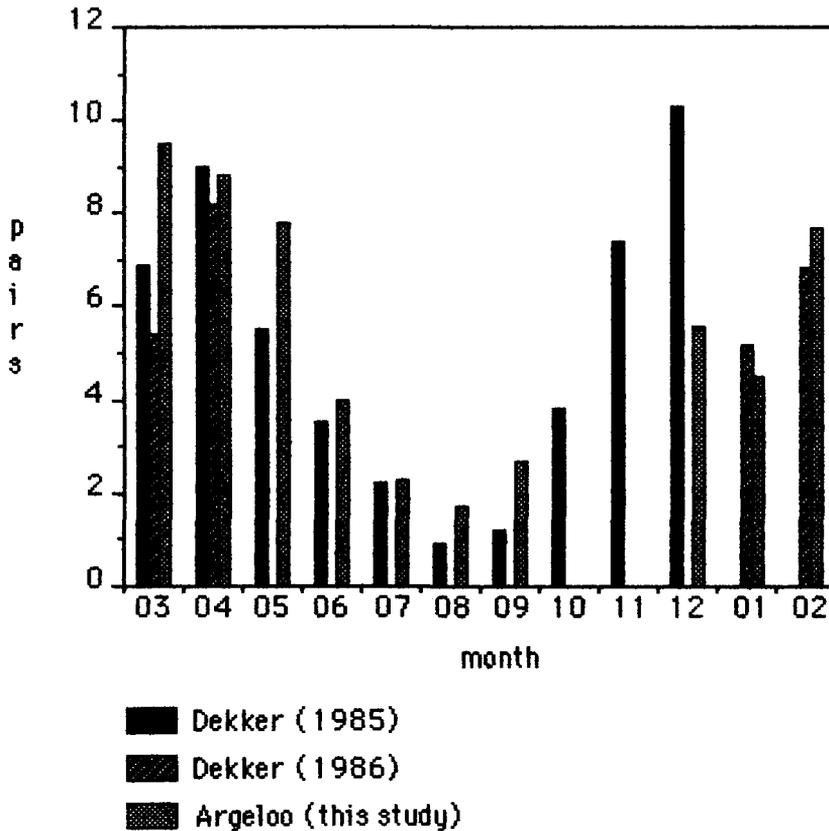


Figure 3. Average number of Maleo pairs counted at Tambun in 1985/1986 and 1990/1991.

cause for optimism. The inland nesting grounds in North Sulawesi are less well known, but at least their status allows some hope, although increased human activities in the forest, notably rattan collecting, are a new source of concern. Information on the distribution of Maleo nesting grounds in the three other provinces of Sulawesi has improved, but remains poor; further study is necessary. Comments by PHPA personnel and accounts in the literature suggest that threats such as egg-exploitation by rattan collectors are not confined to North Sulawesi.

The conservation of this peculiar bird and its tropical forest habitat depends on the support of local people. It was encouraging to see that heads of villages and subdistricts not only supported the conservation activities with words but wanted to be actively involved in the project as well. Future projects with a clear role for the local communities as conservationists are the only way to protect this species and to prevent further decline. The Maleo has a great symbolic value which could yet be the key to convincing the people of Sulawesi to protect their "goose which lays the golden eggs".

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MARC ARGELOO

Zoological Museum, University of Amsterdam, P.O. Box 94766, 1009 GT Amsterdam, The Netherlands