

C.J. Heij  
Natuurmuseum Rotterdam

# The biology of the Moluccan megapode *Eulipoa wallacei* (Aves, Galliformes, Megapodiidae) on Haruku and other Moluccan Islands; part 3: update of data until 2001

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This paper gives an update of the ongoing study on the (breeding) biology of the Moluccan megapode (*Eulipoa wallacei*) on the Tanjung Maleo nesting grounds of Haruku Island, Moluccas, Indonesia. New data on the numbers of harvested eggs and fledged chicks, the weights of eggs (in relation to the moon phase) and predation are presented. The harvest year 1997/1998 showed a sudden decrease in egg numbers, probably caused by severe drought (El Niño). Local unrest that disrupted the social life on Haruku, strongly influenced the activities of the egg collectors. In most of the 1999/2000 harvest year, no systematic egg collecting took place and in 2000/2001 eggs were collected less intensively. Hence, more chicks fledged. Social unrest also caused an increase of the predation by the wild pig (*Sus scrofa*) at the nesting grounds.

Correspondence: Dr C.J. Heij, Natuurmuseum Rotterdam, P.O. Box 23452, NL 3001-KL Rotterdam, the Netherlands; [natuurmuseum@nmr.nl](mailto:natuurmuseum@nmr.nl)

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## INTRODUCTION

My field study on the (breeding) biology of the Moluccan megapode (*Eulipoa wallacei*) carried out on the nesting grounds of Haruku and on other Moluccan islands in the period 1994-1996 resulted in two earlier publications: Heij (1995), Heij *et al.* (1997) and a privately published report in the Indonesian language (Heij & Rompas 1997, updated and reprinted in 1999). Baker & Dekker (2000) used my data to get further (statistical) evidence of the lunar synchrony in the reproduction of the Moluccan megapode. The reader of this paper, which gives an update of data collected on the Tanjung Maleo nesting grounds of Kailolo Village until 20 March

2001, is advised to consult these publications for an introduction to the subject. For methods, see Heij (1995).

The fieldwork and collecting of data on numbers of harvested eggs and fledged chicks, and investigation on some other subjects did not stop after 1996. I had acquired such a relationship with the local people (especially the *Eulipoa*-egg collectors) of Kailolo Village, that they continued the fieldwork and recorded the data on standard-forms. After 1996, I visited Kailolo and the nesting grounds on eight occasions (see below) with the following purposes (1) to obtain the harvest rights and establish some conservation

measures, (2) to get first hand data on the situation on the nesting grounds, (3) to train new local co-workers, (4) to collect the data of the previous periods, and (5) to pay my friends for their data-collecting and cooperation. Moreover, the violent clashes between Muslims and Christians in the Moluccas also occurred on Haruku and (still has) seriously disrupted the once peaceful village of Kailolo. Giving moral support in this period of (civil) war in the Moluccas was also an important purpose of my visits to Kailolo. I want to stress that after the initial riots on Ambon on 1 December 1998 (pers. obs.) and the escalation of the situation in January 1999, conducting fieldwork on Haruku was almost impossible (and, according to many, even suicidal). From August 1999 until March 2000, even the organised harvesting of eggs by the leaseholder stopped because of local unrest. In most cases, a trip from Ambon to Kailolo was only possible under military escort or in the company of a high-ranking Muslim leader. Once in Kailolo, I was safe because I was regarded as 'one of them'.

## VISITS AND OBSERVATIONS

**18 March - 30 April 1997** (four visits):

A total of nine days was spent in Kailolo. I tried to buy the harvest rights but general Marasabessy managed to buy the rights for two years, before the annual auction was held. This was against local law (adat), but the religious leaders accepted it.

**26 September - 6 October 1997** (three visits): Six days in Kailolo. A fence was erected around the nesting grounds and also a sign, indicating the official protective status of the area, was placed (Fig. 1). Local people disliked the fence.

**28 February - 11 April 1998** (four visits): A total of 17 days was spent in Kailolo. I could buy the harvest rights from general Marasabessy (who had a bad harvest-year

and handed the rights over - free of charge - to my local friend Pede Tuanaya, under the following terms: (1) egg-collecting will only be done 'cari malas' (the lazy way) which means the eggs that cannot be reached easily, will be left in the burrow; no collecting on the graveyard; (2) old, hard-set eggs which are unearthed accidentally, will be reburied at the edges of the fields at a depth of at least half an arm length; (3) eggs will only be harvested for local consumption, price 400 Rp, no selling to traders, free eggs for the poor during Muslim festivities; (4) Pede Tuanaya will collect enough eggs to provide himself and his team of collectors with a reasonable income; (5) nesting grounds will be maintained and guarded as usual; (6) the numbers of collected eggs and fledged chicks will be recorded daily. The ultimate goal of this experiment was to increase the breeding-success and the survival of the Moluccan



Figure 1 The fence that was placed around the Tanjung Maleo nesting grounds in 1997 and the sign erected by the Ministry of Forestry to indicate the area is protected. [photo: C.J. Heij, 4 October 1997]



Figure 2 The part of the forest around the Tanjung Maleo nesting grounds that was cut down in March 1999. [photo: C.J. Heij, 25 March 1999]

megapode. The egg-collector had no need to harvest 'all he could get' because he had not invested money to get the harvest rights. Other observation: the fence was badly damaged.

**28 November - 4 December 1998** (one visit): Three days in Kailolo. In the bay where boats from/to Ambon land, a concrete jetty was built and an 'office' was under construction at the edge of the forest that surrounds nesting-field 4. First signs of unrest.

**25 March 1999** (one visit): One day in Kailolo, escorted by marines. Egg collecting still continues, but atmosphere is explosive. A part of the forest that surrounds field 4 had been cut down for unknown reason (Fig. 2). Some blamed 'the Christians'.

**14 July 1999** (one visit): One day in Kailolo, escorted by marines. Violent clashes between Kailolo and neighbouring Christian villages are common. Situation unsafe. Systematic egg collecting has ceased. Near field 4, at the

site where the forest was cut in March, a house was under construction (Fig. 3). I was told that general Marasabessy (commanding officer of the Indonesian Forces on Ambon, and born in Kailolo) had ordered to build this house. I reported these illegal building activities to the local authorities in Ambon. The beach had lost sand because of a changing current due to the new landing jetty. Trees have been planted to preserve the beach. The surface of fields 1 and 3 suitable for nesting



Figure 3 Building activities on the site that was cleared (see Figure 2). [photo: C.J. Heij, 14 July 1999]

has been reduced considerably because of numerous new graves that have been dug to bury the casualties of the clashes between Christians, Muslims and the army.

**29 March 2000** (one visit): One day in Kailolo, escorted by Muslim leader Ali Salempessy. Systematic egg harvesting will commence on 1 April. The house near field 4 is still under construction. I reported this illegal activity to the Indonesian Academy of Sciences (LIPI), Jakarta.

**20 March 2001** (one visit): One day in Kailolo, escorted by marines. Egg collecting continues. 'Jakarta' had ordered the building activities to stop (and it stopped).

## RESULTS

### Lease price and egg price

The substantial increase in the lease price of the harvest rights which started in the 1998/1999 harvest year (Table 1) was caused by the dramatic devaluation of the Rupiah in 1998. Egg price did also increase but not as much as the lease price. The increase only applies to the price in Rupiah. In 97/98 the price in US\$ was 2600 and the years after the price ranged between 500 and 1665 US\$ (the

Rupiah revaluated a little). Because I obtained the harvest rights in 98/99, I fixed the price of an egg at Rp 400, 20% lower than the year before, for relief of the local population in times of economic crisis. Next year the new tenant restored the price of 500 Rp an egg, and in 2000/2001 the price was 500 Rp just in the morning at the nesting grounds (one egg per person) and 1000 Rp in the village for more eggs.

### Numbers of harvested eggs

Table 2 lists the numbers of collected eggs for the harvest years 1997/1998 until 2000/2001. For comparison, the numbers of the three preceding harvest years (Heij *et al.* 1997) have been included. Figure 4 gives a graphic representation of the egg numbers in the course of this period. Although collecting efforts were normal, in 1997/1998 a decrease of about 70% in the number of collected eggs took place. What we see is a normal drop of the numbers in June and July (see: Heij *et al.* 1997), but the increase that normally begins from August/September onwards, does not take place until January (Fig 5a), and numbers are low all over. As the decrease is sudden and dramatic, there must have been a reduction in the reproductive capacity of the population (mortality and/or less egg pro-

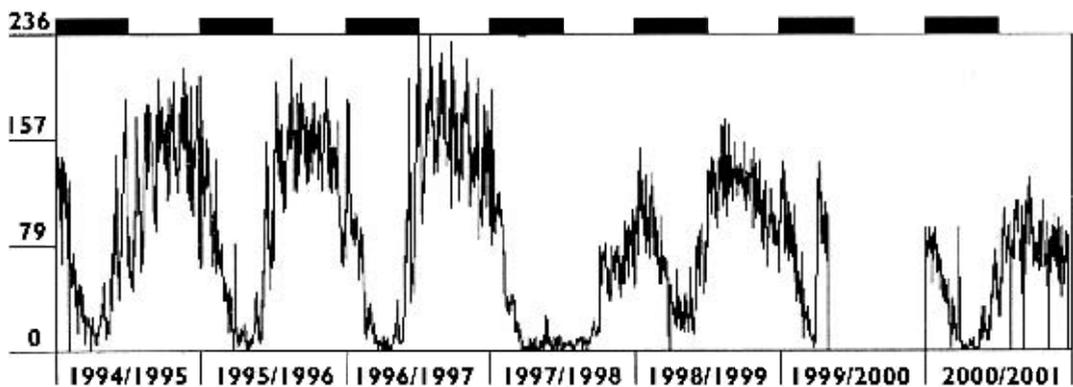


Figure 4 Numbers of collected eggs of *Eulipoa wallacei* at Tanjung Maleo in the course of the period 1 April 1994 - 20 March 2001 (see Table 2 and Appendix 1) together with indications of the rainy season (black bars). Data from 1994/1995 until 1996/1997 are after Heij *et al.* (1997).

Table 1 Lease price of harvest rights of the Tanjung Maleo nesting grounds (Kailolo, Haruku) and the price of a single *Eulipoa* egg on the local market (in Kailolo). Before 1998 1.000.000 Rp = 400 US\$; in March 1998 1.000.000 Rp = 75 US\$; in the period 1999-2000 1.000.000 Rp = 150 US\$.

harvest year	lease price		egg price
	Rp	US\$	Rp
1997/1998	6.500.000	2600	500
1998/1999	6.500.000*	500	400
1999/2000	11.000.000	1650	500
2000/2001	11.100.000	1665	500

\* rights resold to Heij, egg price fixed by Heij

duction), and/or something prevented the birds to come to Tanjung Maleo to lay. A possible cause might be the severe drought (El Niño) in the region that took place in the same period: bush fires in Seram - where most of the Moluccan megapodes that lay

eggs on Haruku have their inland habitat (Heij *et al.* 1997) - were very extensive and large parts of the Central-Moluccas were covered with smog (pers. obs.). This may have affected the availability of food and hence the egg production. Smog may also have prevented the females to fly to Haruku. The seasonal pattern in egg laying, which showed almost twice as many eggs in the dry season in earlier years (Heij *et al.* 1997) also deviated in 1997/1998. The ratio dry season : rainy season was almost equal (Table 2, Fig. 5a).

The 1998/1999 harvest year, when there was no severe drought in the region (pers. obs.), yielded egg numbers that were almost at the level of the years 1994/1995, 1995/1996 and 1996/1997. The seasonal pattern was also back to normal (Table 2, Fig. 5b). In 1999/2000 there was only systematic egg collecting from April until July (Fig 5c). Afterwards, due to the social unrest, collecting was only done irregularly and no data were record-

Table 2 Numbers of harvested *Eulipoa* eggs and fledged chicks at the Tanjung Maleo nesting grounds (Kailolo, Haruku) in the harvest years 1994/1995 - 2000/2001. Egg numbers are divided in rainy season (April - September) and dry season (October - March). A harvest year runs from 1 April till 31 March. Based on data listed in Appendix 1. Data from 1994/1995 - 1996/1997 from Heij *et al.* 1997: appendix 1 (eggs) and appendix 2 (fledglings).

harvest year	numbers of harvested eggs				fledglings	%
	total	rainy season	dry season	% dry season		
1994/1995	36263	1253	250 0	69.0	3 43	3.7
1995/1996	36618	10095	26523	72.4	2862	7.8
1996/1997	37712	9425	28287	75.0	3099	8.2
1997/1998	704	5098	6606	56.4	1098	9.4
1998/1999	32786	1443	21343	65.	3020	9.2
1999/2000	8124 <sup>2</sup>				1709 <sup>2</sup>	21.0
2000/2001	19279	5944	3335	69.2	4035 <sup>3</sup>	20.9

<sup>1</sup> no data from April-June.

<sup>2</sup> only April - July, afterwards no systematic, supervised collecting / counting due to social unrest.

<sup>3</sup> no data from February - March.

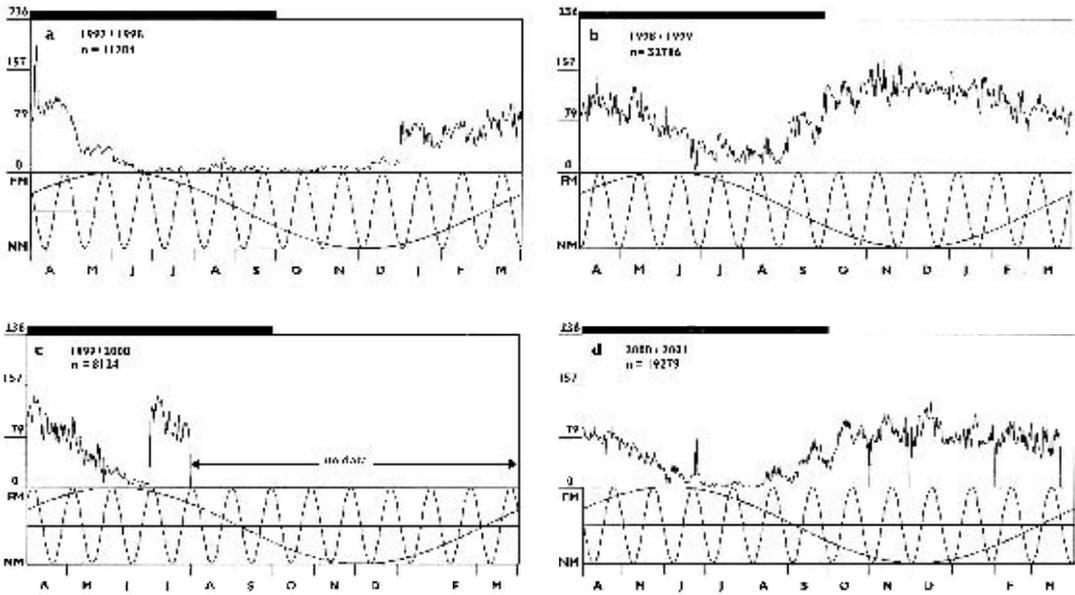


Figure 5 Numbers of collected eggs of *Eulipoa wallacei* at Tanjung Maleo in the course of four separate harvest years (1 April - 31 March): **a** 1997/1998; **b** 1998/1999; **c** 1999/2000; **d** 2000/2001; together with the course of the solar cycle (long sinusoid line), the lunar cycle (short sinusoid line; FM = full moon, NM = new moon) and indications of the rainy season (black bar).

ed. In 2000/2001 systematic egg collecting commenced again, but the low numbers (< 20.000) indicate that it was done less intensive ('the lazy way'). The ratio dry season : rainy season was, again, at the normal level of 2 : 1 (Table 2, Fig 5d). In all years, like in earlier years (Heij 1995; Baker & Dekker 2000), lunar synchrony (most eggs being laid during the days around full moon) was clearly present (Fig. 5).

### Numbers of fledged chicks

The moment of emergence of chicks from the sand can be easily established by the presence of little round craters (exit pits) on the nesting grounds (Heij *et al.* 1997). Recording their numbers continued as a daily routine by the egg collectors. Table 2 gives the numbers for the period 1997 - 2000 and a comparison can be made with the numbers of fledged chicks in the three preceding years. Like the egg numbers, the numbers of chicks are unprecedentedly low in 1997/1998, an obvious relationship and an indication that egg-

collecting efforts were normal ('take all you can get'). The number of chicks as a percentage of the total egg harvest (Table 2) was therefore in 1997/1998 almost equal to the percentage of the preceding years (between 8 and 10 %). In 1998/1999, when egg numbers were almost as high as before the drought of 1997/1998, the number of chicks were also at the normal level (9.2 % of the number of collected eggs). In 1999/2000, when - due to social unrest - eggs (and fledgling data) were only collected systematically in the first four months (April - July), an extremely high number of chicks emerged from the ground: 21 % of the numbers of collected eggs. With an average incubation period of 74 days (range 49-99 days, see Heij *et al.* [1997], table 21), some of this offspring resulted from eggs laid (and not harvested!) in the end of the 1998/1999 year, when the egg-collectors agreed to collect 'the lazy way' (see below). The next year, when systematic collecting was possible once more, but clearly less intensive, again very high numbers of chicks

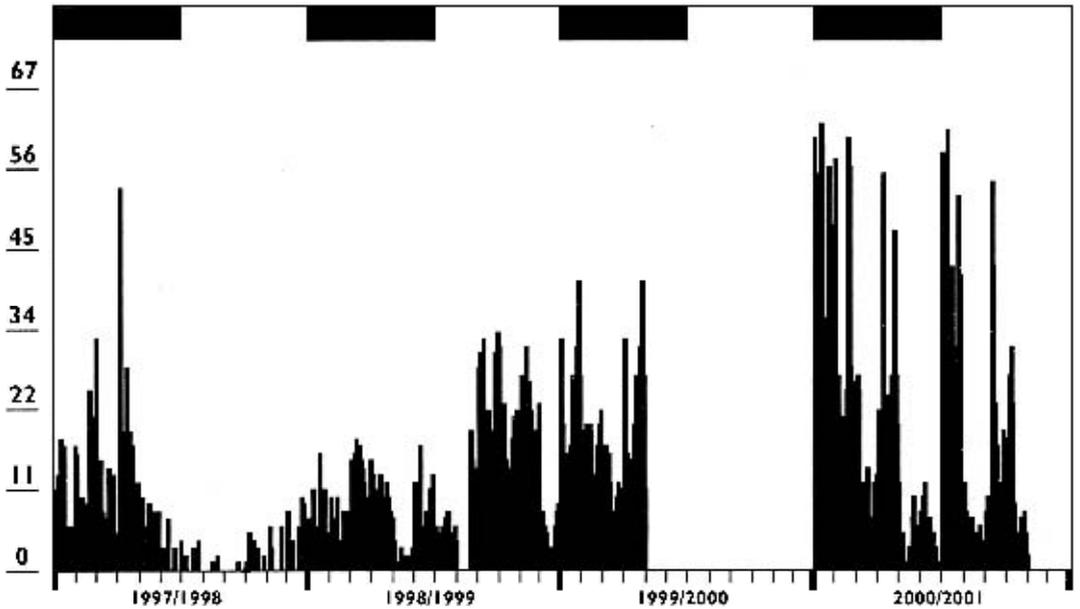


Figure 6 Numbers of fledged chicks of *Eulipoa wallacei* established by the presence of 'exit-pits' at the Tanjung Maleo nesting grounds in the course of the period 1 April 1997 - 31 January 2001 (see Table 2 and Appendix 2). Black bar = rainy season.

were recorded, especially in April and May 2000, just after the long (8 months) break in systematic egg-collecting (Table 2, Fig. 6). Clearly, the social unrest on Haruku that caused the intensive and systematic egg collecting to stop (for the time being), has benefited the breeding success of the Moluccan megapode. Less dramatic social events that ceased intensive egg collecting, such as the annual Muslim fasting or the soccer world championship, also yielded sudden peaks in the reproductive output (Heij *et al.* 1997).

### Conservation

In 1998/1999, the agreement made with the egg-collectors to harvest less intensively (the lazy way, see above) did not result in a higher breeding success of the Moluccan megapode. Fledgling numbers were the same (relative to egg numbers) as in other years. The actual numbers of collected eggs were about 10 % lower than in preceding years (Table 2), but this may even well be because the population still had to recover from the hardship of the drought in 1997/1998. Most likely, egg collecting was 'business as usual' although the

money to buy the harvest right was sponsored. The best (and probably the only) way to increase the reproductive output of the Moluccan megapode on the Tanjung Maleo nesting ground, would be to leave one of the four nesting fields untouched and to let the egg-collecting only be done on the other three fields. Field 4 (see Heij *et al.* 1997) would be most suitable because of its rather isolated location. The egg-collectors of Kailolo do not accept this possibility because it is 'against the will of Allah'.

### Egg weight

Heij *et al.* (1997) mentioned that the weight of eggs laid during the full moon period 'appeared to be the heaviest, though more data is needed to provide conclusive evidence on this matter'. To do so, each month at full moon during the 1998/1999 harvest year, 25 freshly laid eggs were weighed and their averages were compared with the weight of eggs that were collected randomly during earlier years (Table 3). Differences appear to be slight and probably insignificant: calculated over a year, eggs laid during full moon

are 1 g heavier than the eggs from the random sample (which also may include full moon eggs). In the rainy season, full moon eggs are 0.9 g lighter and in the dry season the full moon eggs are 1.5 g heavier than the eggs from the random sample. Monthly fluctuations in egg weight are sometimes rather extreme: in May and December/January there are sudden drops below 100 g, whereas in the other months the weight fluctuates between 101 and 105 g. Local collectors believe that young birds lay smaller / lighter eggs, and indeed it were always the smallest (lightest) eggs that showed traces of blood on the shell (pers. obs.), indicating a first egg being laid by a young bird. The quantity and quality of food in a certain period will also influence fluctuations in the egg weight.

Table 3 Weight of freshly laid *Eulipoa* eggs collected during full moon in the harvest year 1998/1999 at Tanjung Maleo (Kailolo, Haruku), compared with the weight of randomly collected eggs at the same location (after Heij *et al.* 1997, table 17). Ranges between brackets.

month	full moon	random (Heij <i>et al.</i> 1997)
	average weight (g)	average weight (g)
April	103.2 (90-120) n=25	
May	98.4 (95-120) n=25	
June	105.2 (95-125) n=25	
July	104.0 (90-120) n=25	
August	103.1 (95-120) n=25	
September	101.1 (100-120) n=25	
average rainy season	102.7 (90-125) n= 150	103.6 (86-120) n=130
October	102.5 (90-120) n=25	
November	103.9 (85-120) n=25	
December	99.6 (80-120) n=25	
January	99.8 (90-105) n=25	
February	101.7 (90-120) n=25	
March	105.1 (100-120) n=56*	
average dry season	102.4 (85-120) n=181	100.9 (59-124) n=303
year round average	102.7 (85-125) n=331	101.7 (59-124) n=433

\* data March 1996.

## Predation

Heij (2001) presented new data on the feral cat (*Felis catus*) as a nightly predator of the Moluccan megapode at Tanjung Maleo, and here I report on the observations of wild pigs (most likely *Sus scrofa*) on the nesting grounds. The first recent sighting of a pig at Tanjung Maleo dates from 29 March 2000 (P. Tuanaya, pers. obs.) and on 20 March 2001 I saw obvious traces of pigs at the nesting grounds: searching for eggs, several burrows were excavated. The egg collectors of Kailolo know the wild pig as a predator of eggs and chicks at the Tanjung Maleo nesting grounds (Heij *et al.* 1997). The species is however rare on the island because the Christian inhabitants of Haruku hunt for pigs everywhere, including the forest that surrounds the nesting grounds. Because of the social unrest and the violent clashes between Christians and Muslims, the Christians stopped hunting near Kailolo (a Muslim village) and the numbers of wild pig must have increased considerably. The Muslims of Kailolo do not hunt pigs for obvious reasons. When the social unrest continues, the wild pig may become a serious predator of eggs and chicks at Tanjung Maleo.

## ACKNOWLEDGEMENTS

I thank my friends on Ambon and the egg collectors of Kailolo for their cooperation. Especially in these dark times in the Moluccas, I thank the Indonesian families who helped me and always gave me a warm welcome. R.M. Biesheuvel computed the data and his software produced the graphs. J.N.J. Post commented on an earlier draft of this paper and C.W. Moeliker compiled the final version. The Moluccan and Papuan Wilcon Ecoguide Fund supplied financial help.

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## APPENDIX I Basic data on egg numbers

### harvest year 1997 /1998 (total egg-harvest 11704)

<b>A</b>	104	79	104	184	194	104	93	89	101	100	97	107	96	100	109	97	107	106	116	104	117	108	106	100	104	101	97	93	94	93				3194	
<b>M</b>	72	78	70	62	54	46	37	32	34	34	29	36	40	31	27	34	32	36	34	39	41	40	31	29	31	35	36	39	41	35	37				1252
<b>J</b>	20	14	19	21	15	13	16	17	19	7	15	12	10	11	15	6	0	0	6	2	0	5	0	0	0	1	2	1	2	0				249	
<b>J</b>	0	0	2	3	5	9	3	1	0	0	5	8	4	3	1	2	0	1	0	8	9	6	7	0	0	2	1	0	0	0	1				81
<b>A</b>	0	0	1	4	6	3	7	2	4	3	0	4	11	10	9	14	9	6	7	4	25	20	14	9	5	3	9	9	0	6	2				206
<b>S</b>	0	0	2	3	0	1	8	9	5	3	8	4	7	9	2	0	4	3	8	9	10	8	6	5	0	0	0	1	0	1				116	
<b>O</b>	4	5	4	2	3	4	5	3	4	3	4	5	7	4	3	4	5	3	4	3	6	5	3	0	2	4	2	2	1	3	0				107
<b>N</b>	8	7	8	4	7	8	8	7	7	7	8	9	9	8	7	7	9	7	0	7	7	9	8	7	7	7	5	8	5	0				205	
<b>D</b>	7	4	6	5	7	6	9	7	5	13	16	15	13	16	16	15	19	23	24	19	15	13	13	10	10	14	11	14	17	15	13				390
<b>J</b>	73	77	50	48	55	70	50	50	64	73	74	74	68	72	63	70	80	43	62	42	60	50	56	40	37	42	42	44	36	45	50				1790
<b>F</b>	50	77	60	58	56	70	52	52	66	73	76	73	65	77	67	75	77	45	65	50	59	70	60	45	40	45	57	70							1760
<b>M</b>	50	62	72	57	50	96	79	89	67	83	81	79	68	91	55	55	93	82	79	79	89	87	104	83	63	101	47	76	93	93	50				2354
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				

### harvest year 1998 / 1999 (total egg-harvest 32786)

<b>A</b>	51	87	107	94	89	100	71	134	98	109	123	103	126	151	104	98	120	111	106	97	98	85	128	103	86	103	130	90	97	72				3118	
<b>M</b>	99	94	87	91	71	88	69	115	121	131	113	130	102	97	84	122	71	96	94	106	93	93	71	74	54	89	67	65	67	49	69				2763
<b>J</b>	71	75	50	100	63	50	55	65	70	65	67	63	55	57	57	69	66	67	58	53	54	49	10	49	15	0	45	46	35	37				1618	
<b>J</b>	48	38	31	30	26	33	30	31	20	19	17	45	60	56	37	33	46	49	23	23	39	27	36	20	15	19	21	16	25	27	31				976
<b>A</b>	13	33	40	20	42	21	30	36	26	24	27	25	25	13	35	39	26	62	15	35	26	30	19	12	18	17	14	23	20	32	30				828
<b>S</b>	48	30	77	72	61	84	77	54	85	48	89	87	84	94	85	76	74	73	77	64	54	42	60	75	51	57	71	93	121	77				2140	
<b>O</b>	134	133	25	129	117	115	118	89	108	102	113	125	143	28	141	129	111	132	129	118	92	93	117	105	128	137	141	138	128	120				3731	
<b>N</b>	143	137	167	133	141	108	137	166	126	146	124	172	114	145	113	106	100	127	121	149	120	146	116	161	168	122	122	131	129	130				4017	
<b>D</b>	111	135	125	130	155	150	135	130	135	125	135	137	135	124	115	130	124	135	130	125	133	131	125	130	135	122	119	128	125	116	112				4005
<b>J</b>	153	155	127	105	115	120	133	129	121	116	132	111	121	127	132	129	136	132	142	131	119	92	93	121	151	132	146	133	116	121	99				3850
<b>F</b>	108	127	103	104	101	113	141	121	122	119	96	110	104	111	90	81	102	89	76	115	124	91	128	92	92	80	63	79							2880
<b>M</b>	90	95	101	100	95	100	120	120	90	101	105	100	90	95	80	79	85	90	100	80	85	85	79	90	100	79	75	58	73	96	84				2820
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				

**APPENDIX I (continued)**

**harvest year 1999 / 2000 (total egg-harvest 8124)**

A	105	123	127	100	125	140	132	132	134	120	107	73	80	110	118	64	85	80	100	90	73	110	78	67	85	102	73	100	85	70			3008		
M	90	87	59	108	67	101	74	60	51	78	52	62	36	58	43	42	51	35	50	40	51	25	62	73	33	29	9	46	21	34	32		1659		
J	21	22	23	28	26	24	32	20	18	15	14	22	10	12	7	9	8	7	12	12	11	11	4	2	10	3	6	7	7	8		409			
J	105	123	127	100	125	140	132	132	134	120	107	93	80	110	118	84	85	80	100	90	73	110	78	67	85	102	93	100	85	70	0		3048		
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31				

**harvest year 2000 / 2001 (total egg-harvest 19279)**

A	92	87	75	78	75	70	88	78	76	92	77	72	78	76	68	68	85	50	84	87	84	75	92	81	76	79	77	59	78	64			2321	
M	69	60	65	68	50	44	62	67	66	59	59	51	40	55	44	47	36	52	37	48	35	37	45	52	42	36	31	37	25	28	30		1477	
J	4	20	14	2	19	29	38	17	32	26	22	16	20	15	13	7	8	6	9	12	18	18	18	92	17	21	5	5	4	7		534		
J	0	0	0	3	2	4	0	3	4	3	3	3	2	2	2	2	0	5	5	4	8	6	6	7	3	9	3	3	0	0	0		92	
A	0	2	0	0	0	0	2	0	2	4	2	6	9	22	6	24	8	26	9	32	21	18	33	30	14	20	17	16	16	9		348		
S	15	7	7	9	19	25	15	32	40	41	37	43	38	35	53	40	62	52	75	67	53	67	42	64	50	38	35	44	25	42		1172		
O	36	25	43	54	50	59	65	90	78	86	95	102	105	88	106	95	74	81	66	72	76	83	80	91	95	76	73	82	60	67	0		2253	
N	75	79	70	70	69	96	68	84	108	97	111	97	111	108	102	96	77	85	82	90	74	75	67	79	85	107	62	82	0	0		2401		
D	93	77	56	83	79	111	106	80	94	103	118	122	102	108	129	106	107	79	113	87	93	101	83	68	69	63	78	67	70	80	73		2798	
J	65	72	84	72	65	80	77	73	96	60	65	96	75	62	88	98	112	94	100	62	66	74	64	67	68	68	77	65	90	95	0		2330	
F	82	52	74	58	73	84	64	82	89	93	69	101	91	102	73	68	67	82	91	87	62	88	74	52	71	78	99	77				2183		
M	56	50	92	62	60	56	39	92	68	93	75	55	70	49	52	65	66	88	76	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

## APPENDIX 2 Basic data on fledging numbers

### harvest year 1997 / 1998 (total number of fledged chicks 1098)

<b>A</b>	10	1	11	8	13	3	3	18	3	4	0	4	10	17	3	0	0	6	0	6	3	2	0	0	0	0	0	6	17	3			151		
<b>M</b>	16	3	8	6	2	0	5	1	10	2	3	0	9	6	1	0	5	0	3	8	25	8	1	6	21	11	8	21	32	25	8			254	
<b>J</b>	5	7	10	4	15	11	8	3	1	0	0	2	5	7	0	9	14	10	5	7	6	9	8	13	0	1	3	5	2	0			170		
<b>J</b>	0	27	53	2	19	13	5	0	11	12	12	0	28	12	3	19	8	15	5	3	17	8	0	0	4	10	9	0	12	4	3			314	
<b>A</b>	2	9	10	5	7	6	4	2	3	1	0	0	9	1	0	0	8	0	0	8	0	0	0	0	0	0	8	0	0	0	0			83	
<b>S</b>	0	0	0	3	0	3	0	0	0	7	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	4	0			20	
<b>O</b>	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	4	0	0	0	0	0	0	0	0			10	
<b>N</b>	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0			3	
<b>D</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0			1	
<b>J</b>	1	0	0	5	0	0	0	0	0	0	4	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0			15		
<b>F</b>	0	0	6	0	0	3	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	2					17	
<b>M</b>	4	8	1	2	2	0	0	4	0	0	0	0	0	0	0	0	6	0	0	10	0	4	0	9	0	7	0	3	0	0			60		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

### harvest year 1998 / 1999 (total number of fledged chicks 3020)

<b>A</b>	7	0	6	0	0	0	11	4	6	3	3	3	0	5	16	0	8	0	1	2	8	7	11	6	0	1	0	2	5	0			115		
<b>M</b>	10	8	6	5	4	5	4	5	6	7	4	10	1	4	3	4	4	3	4	4	8	3	6	6	6	3	8	8	7	6	2			164	
<b>J</b>	15	11	12	15	16	15	18	9	8	14	14	5	17	15	2	9	6	14	12	5	4	6	8	8	10	3	7	15	9	13			315		
<b>J</b>	9	11	8	7	5	5	10	8	11	9	10	13	5	3	3	6	9	10	6	9	12	6	10	7	4	4	8	5	3	5	7			228	
<b>A</b>	4	2	1	1	0	0	1	0	1	2	1	3	2	1	1	1	0	1	1	2	1	2	1	0	0	1	2	3	3	1	2			41	
<b>S</b>	12	12	12	12	4	9	17	4	1	4	5	5	2	5	6	8	6	4	4	8	8	11	9	8	9	9	13	5	2	6			220		
<b>O</b>	6	2	4	5	2	4	1	2	5	6	4	2	1	4	7	8	7	8	3	0	5	4	5	2	3	1	3	6	4	3	4			121	
<b>N</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	12	9	15	5	6	7	5	6	8	14			106		
<b>D</b>	28	15	17	30	28	22	17	32	31	20	20	19	18	4	22	12	8	18	10	10	17	19	14	30	19	17	27	22	33	16	23			618	
<b>J</b>	31	14	14	16	19	20	11	23	15	14	8	4	14	10	14	12	10	10	15	18	14	21	18	15	5	22	14	18	20	13	13			465	
<b>F</b>	27	24	26	23	15	22	22	31	18	20	16	26	13	20	21	22	14	7	14	16	14	19	7	7	12	12	19	23					510		
<b>M</b>	3	6	0	8	2	4	3	6	4	3	5	0	1	3	1	0	1	0	0	2	6	4	2	2	8	6	9	4	9	5	10			117	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

**APPENDIX 2 (continued)**

**harvest year 1999 / 2000 (total number of fledged chicks 1709)**

A	32	20	14	10	13	16	10	12	10	10	8	7	15	17	20	27	10	14	21	19	10	15	31	22	16	40	25	27	15	11		517	
M	13	19	10	14	11	20	12	10	15	7	20	18	11	19	8	5	11	9	12	8	13	10	17	12	20	18	19	22	13	10	8		412
J	10	13	17	9	10	7	11	16	8	12	8	5	6	2	4	8	2	6	10	8	12	9	4	7	11	9	6	10	8	12		260	
J	32	25	14	10	13	16	10	12	10	10	8	7	15	17	20	27	18	14	21	19	10	5	31	22	16	40	25	27	15	11	0	520	
A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

**harvest year 2000 / 2001 (total number of fledged chicks 4035)**

A	60	25	15	50	55	45	30	25	40	62	59	49	35	22	27	20	12	17	28	56	47	35	22	29	27	30	21	48	43	57		1051	
M	25	18	20	16	27	14	11	13	18	15	21	16	14	20	16	7	25	12	60	56	35	18	28	7	3	2	26	13	20	2	6		584
J	27	17	25	5	2	5	6	8	12	0	1	0	0	14	0	0	0	1	2	7	5	7	6	0	12	7	5	8	13	2		197	
J	15	22	10	8	12	19	16	55	12	17	10	3	2	24	20	15	22	10	27	18	25	10	34	47	36	18	27	18	20	10	0	582	
A	12	1	0	5	2	0	1	0	0	0	0	0	0	3	1	0	0	7	0	0	10	6	4	0	1	0	0	0	0	8	2	63	
S	0	2	1	10	12	0	0	0	0	6	7	3	7	0	0	0	0	5	0	1	0	3	0	0	0	0	1	1	1	0		60	
O	50	58	37	21	18	30	53	61	12	11	10	7	2	42	5	6	27	21	18	31	25	17	48	52	41	23	13	10	7	4	0	760	
N	12	9	6	8	7	0	0	0	0	2	3	7	5	0	0	0	5	0	1	0	3	2	6	4	1	0	0	0	0	0		81	
D	5	8	1	4	10	2	7	1	0	7	54	27	42	38	21	23	17	14	9	0	1	7	12	11	11	19	10	2	5	3	6	376	
J	15	18	10	5	3	27	18	31	23	16	12	9	7	5	3	1	0	0	5	2	7	4	0	0	2	0	8	5	1	2	0	239	
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

**DEINSEA - ANNUAL OF THE NATURAL HISTORY MUSEUM ROTTERDAM**  
P.O.Box 23452, NL-3001 KL Rotterdam The Netherlands