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The biology of the Moluccan megapode *Eulipoa wallacei* (Aves, Galliformes, Megapodiidae) on Haruku and other Moluccan Islands; part 4: update of data until 2005

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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, collected during the period April 2001- March 2005, on the numbers of harvested eggs and fledged chicks are presented. A new analyses of the data of 17 years of egg-harvesting is given.

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INTRODUCTION

My field study on the (breeding) biology of the Moluccan megapode *Eulipoa wallacei* (G.R. GRAY, 1861) carried out on the nesting grounds of Haruku and on other Moluccan islands in the period 1994-1996 resulted in three publications (Heij 1995; Heij *et al.* 1997; Heij & Rompas 1997, 1999). The first updates (Heij 2001a, b) presented data collected during the period 1997/1998 till 2000/2001. This paper gives an update of data collected on the Tanjung Maleo nesting grounds of Kailolo Village (3° 32' 26.6" S; 128° 24' 56.6" E) until 31 March 2005.

The violent clashes between Muslims and Christians in the Moluccas that had seriously disrupted the once peaceful village of Kailolo ended in 2003, but still the islands of Ambon and Haruku are a no-go area. I did however manage to visit the nesting grounds on four occasions between 2002 and 2004. This proved

to be important to keep in touch with the egg-collectors and local rulers who still provided the data on which this update is based.

VISITS AND OBSERVATIONS

2 April 2002 One day spend in Kailolo and the nesting grounds, escorted by marines for safety. Explosive atmosphere. Egg collecting still continued, but irregularly. The fence that surrounded the nesting grounds since 1997 was demolished completely. I was told that local military hunted wild pigs (*Sus scrofa*) that fed on *Eulipoa* eggs on the nesting grounds. Riots in Ambon prevented other visits that year.

9 November 2003 One day spend in Kailolo and the nesting grounds. No military escort was needed, no violence, situation safe. Haji Munir Tuanaya, brother of one of the earlier lease-holders, is head of the village now.



Figure 1 The house that was build next to the Tanjung Maleo nesting grounds in the period 1999-2003. [photo: C.J. Heij, 23 May 2004]

He appeared to understand the importance of the protection of the nesting grounds and had objected to the building of a house close to it. Despite this, the house (Fig. 1) owned by a high ranking military officer (general Marasabessy), was completed after four years of irregular building activities. The backyard of the house is nesting ground 4 (Fig 2, see Heij *et al.* 1997 for a map). The landing jetty close to the nesting grounds is finished now, so is a new mosk. There is also more and more activity of locals, such as a petroleum station close to the nesting grounds. The local cemetery (Fig. 3) increased in size and occupies an increasing part of nesting grounds.

26 November 2003 One day spend in Kailolo and on the nesting grounds in company of Kris Tindige, a wildlife guide and conservationist from Sorong, West-Papua. Again no military escort was needed. Nesting grounds polluted with local litter.

23 May 2004 One day spend in Kailolo and on the nesting grounds. Haruku Island was

hard to reach due to RMS-terrorism on Ambon Island, but Kailolo was peaceful and friendly. Situation stable like the years preceding the riots. Egg collecting still continues but 'the lazy way'.

RESULTS

Lease price and egg price

Despite the devaluation of the Rupiah, after the 2000/2001 harvest year the lease price decreased considerably to a mere 900 US\$ in 2003/2004 and 2004/2005 (Table 1). In the years the Regional Government was the lease holder (1999-2003) the lease price was kept artificially high. Afterwards, when the lease was free to every bidder, the price decreased. The egg price doubled but when devaluation is taken into account, it remained equal.

Numbers of harvested eggs

Table 2 lists the numbers of collected eggs for the four harvest years 2001/2002 until 2004/2005. For comparison, the numbers of all preceding harvest years with known data



Figure 2 Nesting ground 4 is now the backyard of the house depicted in Figure 1. [photo: C.J. Heij, 9 November 2003]



Figure 3 The local cemetery increased in size and slowly occupies more of the nesting grounds. [photo: C.J. Heij, 9 November 2003]

(from Heij *et al.* 1997 and Heij 2001a) have been included. Figure 4 gives a graphic representation of the egg numbers in the course of the entire 17 year study period. The three early years (1987/88 - 1990/91) show a relatively low number of harvested eggs, whereas in the period 1991/92 till 1996/97 the highest numbers were collected. In 1997/98 El Niño caused a dramatic decrease (Heij 2001a), the following year showed a remarkable recovery, and the period 1999/2000 - 2002/03 were the

scene of political turmoil and social unrest that had a clear negative impact on the egg-collecting activities. In that period the harvest-rights were government-owned, so there was no private need for intensive collecting. In 2003/04 when the social and political situation was back to normal and the harvest-rights were in private hands, we see the number of harvested eggs reach the pre-1990 figures. Although the numbers clearly reflect the local egg-collecting activities, a long term population trend seems to be present.

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\$. In 2004 1.000.000 Rp = 75 US\$.

In 2001/02, 2003/04 and 2004/05 (Fig. 5a, c, d) a normal seasonal pattern in the number of harvested eggs is visible: a decrease from April till June/July with a slow but steady increase from August onwards till peak numbers are reached in December/January, the heart of the dry season. In the 2002/03 harvest year (Fig 5b), during the period June-November the nesting grounds were unsafe due to social and political unrest (P. Tuanaya pers. comm.), as is clearly visible in the irregular egg harvest pattern and low numbers.

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
2001/2002	8.650.000**	1290	500***
2002/2003	12.000.000**	1300	1000
2003/2004	9.000.000	900	1000
2004/2005	12.000.000	900	1000

The ratio of the number of eggs collected in the dry and the rainy season remained remarkable stable (ca. 2:1) throughout the entire period (Table 2)

Numbers of fledged chicks

During daily egg-collecting activities, reproductive output was monitored by counting the so called 'exit-pits' left behind by fledged

* rights resold to Heij, egg price fixed by Heij

** leased by Regional Government

*** 500 rp when bought at the nesting ground, 1000 rp in the village and elsewhere

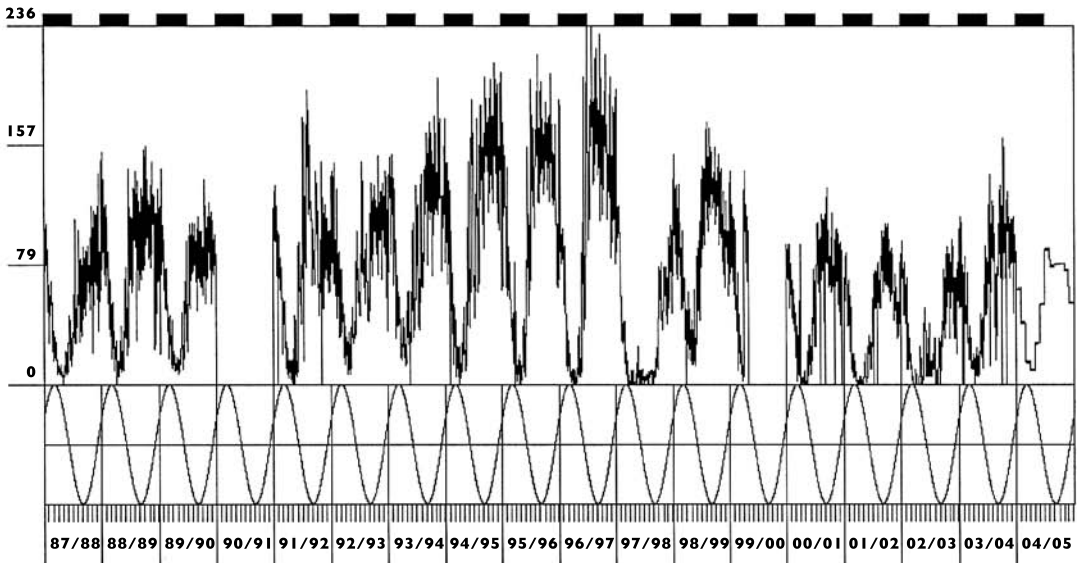


Figure 4 Numbers of collected eggs of *Eulipoa wallacei* at Tanjung Maleo in the course of the period 1 April 1987 - 31 March 2005 (see Table 2 and Appendix 1) with indications of the rainy season (black bars). Pre-2000/2001 data are after Heij *et al.* (1997) and Heij (2001a).

Table 2 Numbers of harvested *Eulipoa* eggs and fledged chicks at the Tanjung Maleo nesting grounds (Kailolo, Haruku) in the harvest years 1994/1995 - 2004/2005. Egg numbers are divided in rainy season (April - September) and dry season (October - March). A harvest year runs from 1 April till 31 March. Numbers from 2001/2002 - 2004/2005 based on data listed in Appendix 1 and 2. Data from 1994/1995 - 1996/1997 from Heij *et al.* 1997: appendix 1 (eggs) and appendix 2 (fledglings). Data from 1997/1998 - 2000/2001 after Table 2 in Heij (2001a).

harvest year	numbers of harvested eggs				fledglings	%
	total	rainy season	dry season	% dry season		
1994/1995	36263	11253	25010	69.0	3143 ¹	8.7
1995/1996	36618	10095	26523	72.4	2862	7.8
1996/1997	37712	9425	28287	75.0	3099	8.2
1997/1998	11704	5098	6606	56.4	1098	9.4
1998/1999	32786	11443	21343	65.1	3020	9.2
1999/2000	8124 ²				1709 ²	21.0
2000/2001	19279	5944	13335	69.2	4035 ³	20.9
2001/2002	15708	4026	11682	74.4	2860	18.2
2002/2003	11504	4063	7441	64.7	2866	24.9
2003/2004	22769	6860	15909	69.9	3641	16.0
2004/2005	19957	6261	13695	68.6	no data	

¹ no data from April - June

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

³ no data from February-March

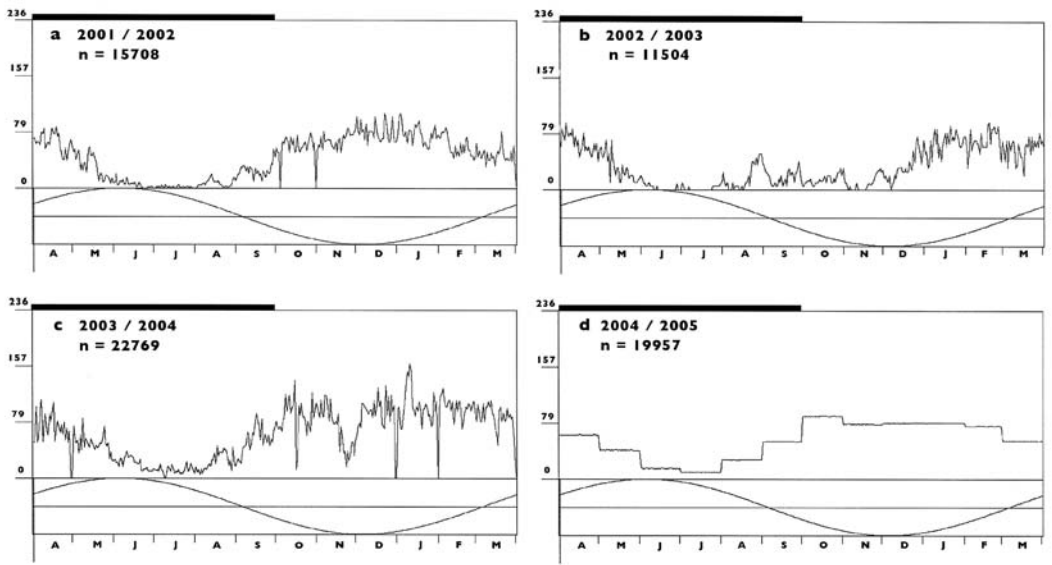


Figure 5 Numbers of collected eggs of *Eulipoa wallacei* at Tanjung Maleo in the course of four separate harvest years (1 April - 31 March): **a** 2001/2002; **b** 2002/2003; **c** 2003/2004; **d** 2004/2005 together with the course of the solar cycle (sinusoid line) and indications of the rainy season (black bar). Numbers of 2004/2005 are monthly totals.

chicks (Heij *et al.* 1997). The results are presented in Table 2 and Figure 6. Data on the number of fledged chicks in 2004/2005 are not available. The number of fledged chicks relative to the number of harvested eggs remained high compared to the pre-1999 harvest years (Table 2). In 2002/2003 the percentage of 24.9 is the highest ever recorded. In 2003/2004 egg harvest doubled, but the percentage of fledglings remained relatively high and still has values that are double as high as before 1999. This means that egg-collecting activities are still less intensive and a considerable number of eggs get a chance to hatch. Figure 7 presents the number of chicks fledged in the dry and the rainy season. Here we see no clear pattern: in four years the vast majority of the chicks (64-90%) hatch in the rainy season, in two years we see the reverse pattern, and in three years the numbers are more or less equally divided between the dry and the rainy season.

Conservation

It is apparent that local unwritten rules ('Adat') that always have protected the Moluccan

megapode and its nesting grounds in Kailolo, are slowly replaced by 'common sense' and the survival need of the local people. Violence and unrest in the Moluccas during the turn of the century have influenced this change. This 'progress' has increased other activities than egg-collecting in the area and clearly affected the pristine state of the nesting grounds. The new head of village however, showed awareness of the biological importance of 'his' nesting grounds. As stated earlier (Heij 2001a), the only workable method to protect the reproductive output of the Moluccan megapode in Kailolo is to leave one of the four nesting fields untouched. In 2006 this will be proposed to Haji Munir Tuanaya and other local rulers. Now the 'Adat' is less strictly followed, this may be accepted by the local community.

Unexpectedly, the local unrest on Haruku Island has given new life to the *Eulipoa* nesting ground near Haruku village, south of Kailolo. Local people did not dare to leave the village and collect eggs. The eggs that were relocated from Tanjung Maleo could hatch and this resulted in a considerable increase in the

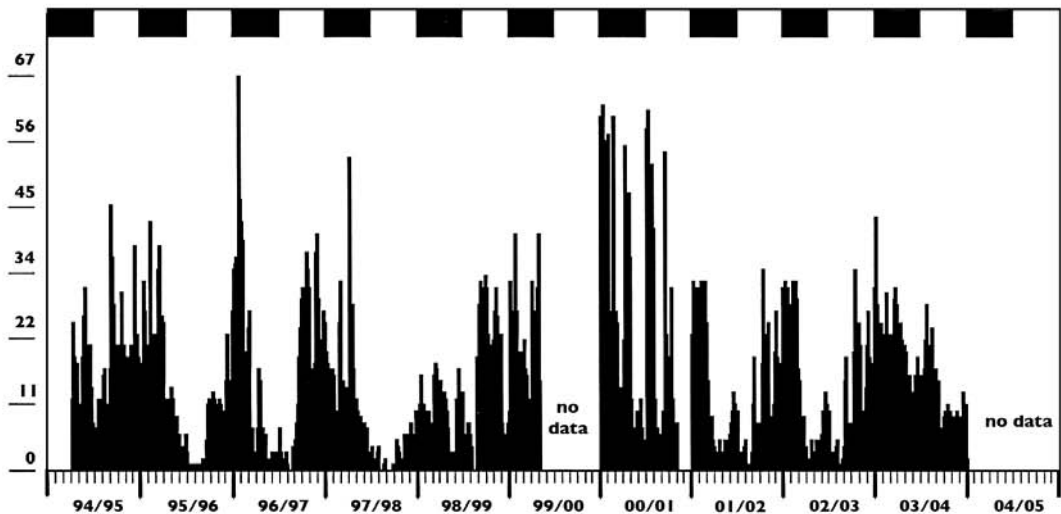


Figure 6 Numbers of fledged chicks of *Eulipoa wallacei* established by the presence of 'exit-pits' at the Tanjung Maleo nesting grounds in the course of the period 1 July 1994 - 31 March 2004 (see Table 2 and Appendix 2, those for 2004/2005 are not available). Horizontal black bars indicate the rainy season.

egg-laying population (Heij 2005). Once more it has become clear that the only conservation method is to stop egg-collecting.

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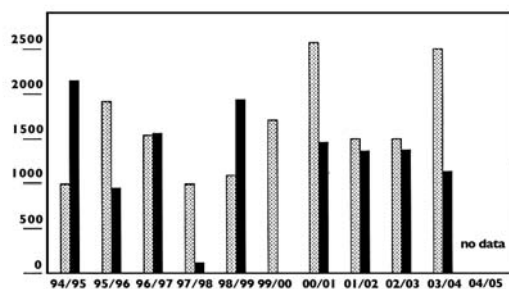


Figure 7 The number of fledged chicks of *Eulipoa wallacei* at Tanjung Maleo in the course of the period 1 July 1994 - 31 March 2004 (see Table 2 and Appendix 2) divided in eggs collected in the rainy season (grey bars) and those collected in the dry season (black bars). Data for 1999/2000 are deficient (only April-July).

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APPENDIX I Basic data on egg numbers

Harvest year 2001 / 2002 (total egg-harvest 15708)

A	70	70	62	65	64	60	78	76	84	55	61	64	60	72	84	77	75	86	72	77	54	50	40	40	56	38	50	60	68	60			1928
M	50	55	40	48	53	25	34	25	36	33	22	52	58	45	45	50	40	38	20	10	20	20	8	11	18	18	15	12	6	14	7		928
J	8	20	4	5	11	8	12	5	6	15	5	5	6	7	5	8	2	2	8	4	3	0	0	0	0	2	1	3	2	0			157
J	0	2	1	3	0	4	2	0	5	2	1	3	0	1	3	0	1	2	5	1	0	2	2	0	3	2	1	2	1	0	0		49
A	0	2	4	4	4	6	7	4	9	10	12	17	20	12	8	10	8	11	6	4	3	1	2	3	1	2	3	5	12	15	11		216
S	14	20	20	30	28	32	30	24	30	20	30	27	22	10	28	20	25	18	20	10	25	18	15	25	21	20	35	33	55	43		748	
O	56	50	50	0	63	66	62	72	70	63	50	72	61	70	50	53	74	55	50	56	58	62	65	52	60	70	78	70	54	63	0		1775
N	53	61	57	73	54	80	65	67	69	67	68	60	57	55	65	50	67	70	50	70	75	70	75	84	84	74	75	75	80	80		2030	
D	100	80	75	96	78	83	68	90	60	80	80	80	80	70	100	80	72	70	65	70	70	105	100	80	65	65	80	100	65	65	65		2437
J	77	100	105	95	75	73	80	63	80	82	80	60	80	90	85	90	95	80	75	59	65	63	56	55	62	78	70	80	89	70	75		2387
F	72	70	80	78	80	85	81	65	55	50	50	42	60	45	52	45	64	48	62	50	70	72	55	53	46	45	40	42				1657	
M	63	44	53	45	42	50	54	30	51	40	40	50	42	45	32	45	52	48	60	80	50	42	40	42	40	40	53	38	60	25	0		1396
	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 2002 / 2003 (total egg-harvest 11504)

A	60	85	75	70	94	80	75	80	75	85	60	75	60	70	45	55	60	80	55	60	55	60	52	45	50	65	55	65	40	55			1941
M	60	45	45	55	70	40	50	10	70	45	35	20	30	30	10	10	35	25	20	30	30	15	20	20	20	10	10	10	13	15	20		918
J	15	10	8	5	5	10	5	5	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0			81
J	10	5	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	5	5	5	9	10		68	
A	25	10	5	10	0	0	0	10	0	5	5	5	0	0	5	0	5	10	10	20	5	30	40	40	35	45	35	50	50	50	35		540
S	35	25	25	20	20	10	5	5	10	5	5	15	10	20	5	10	15	5	25	30	20	25	20	10	25	25	40	30	15	5		515	
O	5	10	10	13	12	15	10	5	5	10	10	10	15	12	12	15	20	10	20	20	20	10	10	16	10	20	25	25	30	20	30		455
N	10	10	5	0	5	0	0	0	0	9	3	0	0	0	0	0	0	5	8	8	7	9	13	20	22	27	26	30	25	28		270	
D	16	20	14	11	20	0	5	12	22	15	30	30	32	32	25	25	30	25	25	40	30	28	55	38	65	75	60	55	36	50	70		991
J	50	55	30	35	70	40	70	85	65	85	45	60	40	60	70	80	60	80	65	90	70	75	70	85	80	70	60	60	65	75	75		2020
F	60	30	60	85	55	65	70	70	65	65	50	80	60	60	60	60	90	95	65	85	85	90	80	80	90	55	40	70				1920	
M	55	40	70	30	70	55	65	70	60	30	35	65	55	45	45	20	60	65	60	75	50	75	55	70	60	70	60	80	65	70	60		1785
	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 fledgling numbers

Harvest year 2001 / 2002 (total number of fledged chicks 2860)

A	11	23	19	30	20	32	12	23	27	10	8	6	15	9	12	17	11	18	31	28	21	24	25	22	17	10	19	13	14	13		540	
M	15	9	13	20	25	21	32	20	24	31	11	17	12	10	18	16	21	29	21	32	26	28	29	21	25	17	14	11	12	10	15		605
J	7	2	4	1	2	1	3	7	2	1	8	1	1	2	4	1	5	6	9	5	3	2	1	3	1	4	3	2	1	3		95	
J	1	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	5	0	0	0	0	3	0	0	1	0	0	0	1	0	0	15	
A	1	3	1	0	0	0	0	5	1	2	0	0	0	0	0	0	0	0	0	1	4	2	1	2	5	1	3	1	6	4	2	45	
S	2	5	2	8	10	1	8	6	2	7	9	11	13	12	9	11	8	6	5	4	7	8	10	2	4	2	1	5	8	10		196	
O	0	0	0	1	0	0	3	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	1	4	1	3	1	2	5	1	5	30	
N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	3	1	0	3	1	2	1		15	
D	11	15	19	8	11	7	1	1	4	1	2	1	2	3	7	8	5	7	2	4	2	1	3	2	1	5	8	1	2	1	4	149	
J	7	11	14	12	18	16	20	21	25	31	34	20	19	12	13	17	18	10	19	20	11	21	23	14	17	22	25	21	10	13	16	550	
F	2	4	2	5	1	2	4	1	2	5	7	9	5	2	4	7	10	8	7	5	11	14	12	20	13	17	21	20			220		
M	27	8	6	4	9	12	17	19	14	12	18	16	12	11	9	7	10	8	7	4	3	8	10	13	17	20	31	24	17	15	12	400	
	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 2002 / 2003 (total number of fledged chicks 2866)

A	11	23	19	30	24	32	12	23	27	10	8	6	15	9	12	17	11	18	31	28	21	24	25	22	17	10	19	13	14	13		544	
M	15	9	13	20	25	21	32	20	24	31	11	17	12	10	18	16	21	24	21	32	26	28	29	21	25	17	14	11	12	10	15		600
J	7	2	4	1	2	1	3	7	2	1	8	1	1	2	4	1	5	6	9	5	3	2	1	3	1	4	3	2	1	3		95	
J	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	5	0	0	0	0	3	0	0	1	0	0	0	1	0	0	14	
A	1	3	1	0	0	0	0	5	1	2	0	0	0	0	0	0	0	0	0	1	4	2	1	2	5	1	3	1	6	4	2	45	
S	2	5	2	8	10	1	8	6	2	7	9	11	13	12	9	11	8	6	3	4	7	8	10	2	4	2	1	5	8	10		194	
O	0	0	0	1	0	0	3	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	1	4	1	3	1	2	5	1	5	30	
N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	3	1	4	3	1	2	1		19	
D	11	15	19	8	11	7	1	1	4	1	2	1	2	3	7	8	5	7	2	4	2	1	3	2	1	5	8	1	2	1	4	149	
J	7	11	14	12	18	16	20	21	25	31	34	20	19	12	13	17	18	10	19	20	11	21	23	14	17	22	25	21	10	13	16	550	
F	2	4	2	5	1	2	4	1	2	5	7	9	5	2	4	7	10	9	7	5	11	14	12	20	13	17	21	20			221		
M	27	8	6	4	9	12	17	19	14	12	18	16	12	11	9	7	10	8	7	4	3	8	10	13	17	20	31	24	17	15	12	405	
	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 fledgling numbers (continued)**Harvest year 2003 / 2004 (total number of fledged chicks 3641)**

A	36	43	35	38	28	19	23	22	26	20	21	15	18	17	18	11	11	6	3	0	0	0	9	11	25	21	23	22	11	10	542	
M	12	10	13	7	11	19	21	16	9	12	23	30	14	8	16	22	17	11	6	8	12	13	13	21	9	14	23	15	17	21	11	454
J	11	13	16	18	23	19	8	17	21	15	11	13	20	16	29	19	31	14	18	15	9	11	13	17	28	11	13	19	17	20	505	
J	18	13	9	21	12	9	17	11	13	25	16	19	22	13	9	11	14	17	8	9	13	19	18	21	7	9	11	6	20	12	7	429
A	8	16	7	11	8	6	7	11	6	9	7	7	11	16	9	3	7	9	12	9	6	6	6	10	9	7	10	11	13	0	0	257
S	12	16	8	11	7	6	9	11	8	7	13	6	19	16	8	17	13	8	7	11	8	16	8	12	10	13	9	12	8	11	320	
O	6	11	8	9	4	8	11	17	6	4	11	13	8	11	22	13	9	15	12	11	17	28	13	16	9	8	10	14	16	18	20	378
N	11	16	14	16	21	13	10	7	17	24	4	6	5	2	1	11	6	11	8	5	5	10	14	17	12	9	15	12	8	6	316	
D	9	9	4	4	11	7	0	15	2	5	2	5	7	6	3	4	6	5	1	3	5	4	3	2	5	9	7	3	0	1	2	149
J	6	10	6	0	3	5	6	3	0	0	11	3	1	0	0	0	2	2	8	2	10	4	4	0	0	0	3	7	9	0	1	106
F	0	0	2	5	8	9	4	1	0	0	8	5	0	1	5	10	2	1	0	0	7	7	1	0	0	0	7	0			83	
M	0	0	1	6	9	6	0	0	6	4	0	0	8	13	11	0	1	4	0	0	9	0	6	5	11	0	0	2	0	0	0	102
	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	