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SCHIPLUIDEN

A NEOLITHIC SETTLEMENT ON THE DUTCH NORTH SEA COAST *c.* 3500 CAL BC

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AND PETER F.B. JONGSTE

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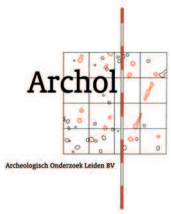

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Contents

23 Birds

Jørn Zeiler

Throughout the entire period of occupation, birds were shot on a large scale on the Schipluiden dune, in particular water fowl, more specifically ducks. The hunting of a broad range of other bird species seems to have been more incidental. Besides information on the subsistence economy, the bird remains also give us an impression of the occupants' seasonal activities. They moreover provide additional information on the landscape surrounding the dune, the ecozones exploited by the occupants and the environmental changes that took place during the period of occupation.

23.1 Research questions

The study of the bird remains focused on the following research questions:

- Which species were hunted and in what ratios? What part did fowling play in subsistence in relation to stock keeping, hunting wild mammals and fishing?
- What information do the represented (migratory) bird species provide on the seasons in which the site was occupied?
- What information do the bird species provide on the former landscape and the exploited ecozones?
- Are there any indications suggesting that birds were exploited as a source of raw materials (feathers, down) or that birds may have had a symbolic meaning?
- Did any changes take place in the aforementioned aspects throughout the period of occupation?

As in the case of the study of the mammal remains (chapter 22), the answers to these questions can contribute towards the discussion of issues such as permanent occupation versus mobility, the site's function in the settlement system and the community's place in the neolithisation process.

23.2 Methods

The bird remains were collected in the same way as the mammal bones (section 22.2), and the same criteria as used for the bones of mammals were employed in the selection and analysis of those of the birds: in view of the large numbers of remains and the limited time and means available only the (readily) identifiable fragments were studied further. This approach seems to have involved little loss of information. In this chapter, 'bird remains' and 'bird bones' are hence understood to refer exclusively to the identifiable and identified bones.

Almost two-thirds of the bird bones were collected by hand, one-third was recovered from the 4-mm sieve and just over 3% from the 1- and 2-mm sieves. So the sieving through a sieve with a mesh width of 4 mm was definitely productive.

phase		1	1–2a	2a	2b	3	1–3	totals
collected by hand		28	192	1333	1126	622	182	3483
Units		13	–	44	–	–	197	254
features								
	Totals	*41*	*192*	*1377*	*1126*	*622*	*305*	*3737*
4-mm sieve		–	230	77	795	202	422	1726
Units		–	–	–	–	–	174	174
features								
	Totals	–	*230*	*77*	*795*	*202*	*422*	*1900*
1- and 2-mm sieve		9	5	50	14	55	13	146
Units		–	–	4	–	–	41	45
features								
	Totals	*9*	*5*	*54*	*14*	*55*	*21*	*191*

Table 23.1 Bird remains, numbers of identifications presented according to recovery technique, context and phase.

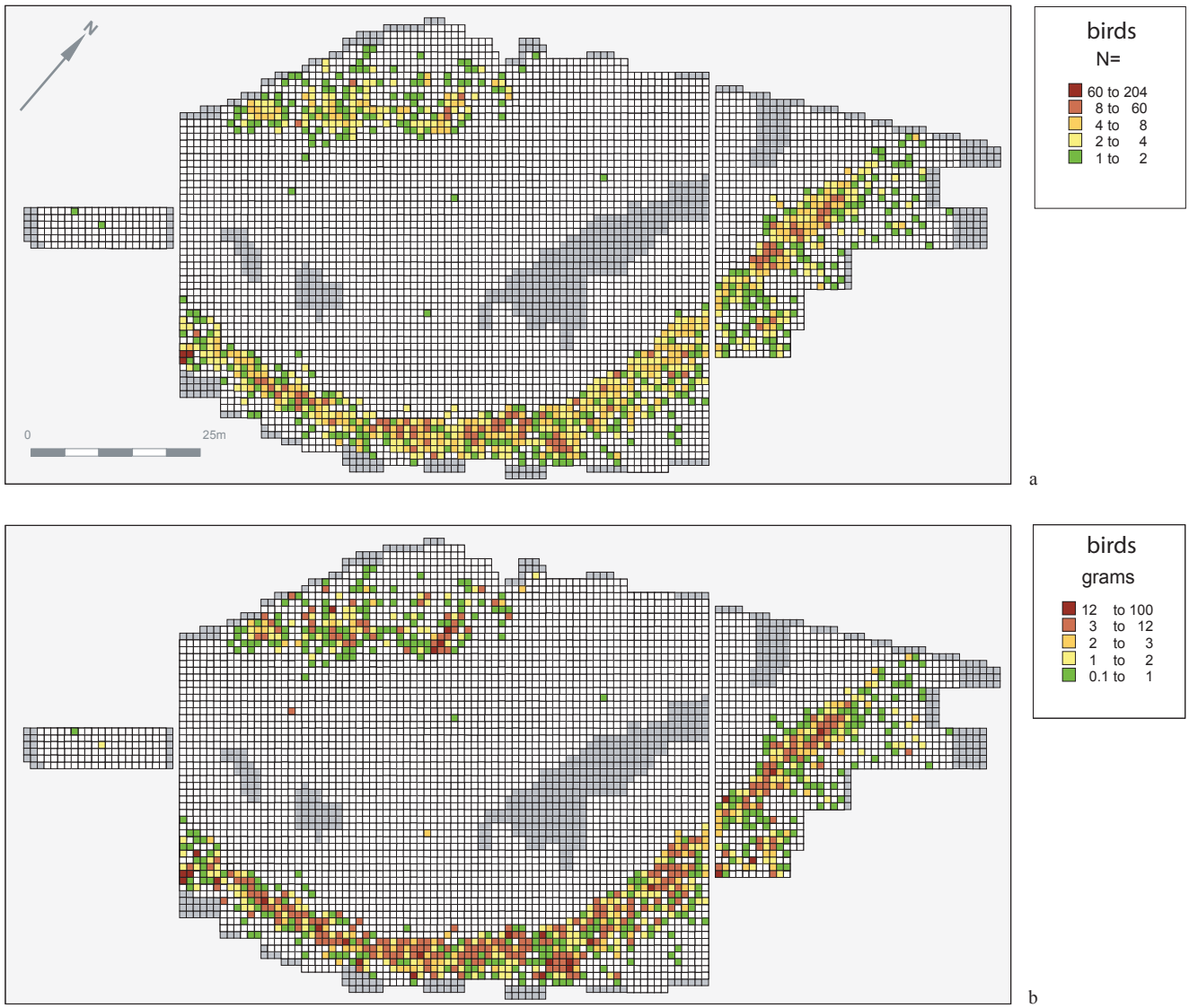

Figure 23.1 Distribution patterns of manually collected bird remains per square metre.
a numbers of identified bones
b bone weight

The bones were identified with the aid of the reference collection of the *Groninger Archeologisch Instituut* (GIA; Archaeological Institute of Groningen University). The fragments were counted and weighed in order to assess the ratios of the different species. Notable characteristics such as evidence of burning, slaughtering and gnawing were recorded to obtain an impression of the taphonomic processes. And, finally, on the basis of the traces of slaughtering on the bones and the distribution of the skeletal elements attempts were made to determine the purposes (meat, feathers, ritual) for which the different bird species were hunted.

23.3 Materials

23.3.1 Contexts

The Schipluiden assemblage of 5828 identified bird bones is by far the largest from Dutch prehistory – a good deal larger than for example those of the Late Mesolithic sites of Hardinxveld-Polderweg (N_{det} =643) and Hardinxveld-De Bruin (N_{det} = 954, Van Wijngaarden-Bakker *et al.* 2001;

			N=									
no.	Unit / feature	phase	mallard	wigeon	pintail	garganey	teal/garganey	shoveler	duck	anser sp.	total ident.	totals
285	10	3	40	19	7	–	–	5	132	–	71	132
256	10	3	15	9	–	–	–	–	54	–	24	54
294	15	2b	4	3	–	–	1	–	25	–	8	25
10.478	13-635	1-2a	2	–	–	–	7	–	14	2	9	16
10.081	11-532	1-2a	8	–	–	1	7	–	9	–	16	9
4545	18	2a	9	–	–	–	–	–	15	–	9	15
		Totals	*78*	*31*	*7*	*1*	*15*	*5*	*249*	*2*	*137*	*251*

Table 23.2 Bird remains, composition of the six largest associations.

Overstegen *et al*. 2001) and the Late Neolithic sites of Kolhorn (N_{det} =1411 and 979; Zeiler 1997) and Mienakker (N_{det} = 3594, Schnittger 1991). Sufficiently large samples (>200 identifications) are available from all the distinguished occupation phases except phase 1. Almost two-thirds (64%) of these remains could incidentally not be identified with any greater precision than as deriving from swan, goose or duck.

The majority of the identified bird bones come from the stratified deposits bordering the edges of the dune (fig. 23.1). A small proportion was recovered from features (table 23.1). This holds for both the remains that were gathered by hand and those recovered from the two sieve fractions. Two-thirds of the remains found in features came from wells, which is understandable considering their dimensions, number, depth, wet conditions and the fact that they were filled up within a short space of time. Waste was evidently primarily dumped in the wet peripheral zones of the dune, and to a much lesser extent in the wells.

We assume that the remains that were found here and there in the units represent the average outcome of long-term deposition processes, while the remains that were recovered from find concentrations within the units and in the rapidly filled wells represent brief deposition moments and single specific activities. The latter remains may tell us more about whether there was any degree of specialisation. The six largest assemblages of the hand-gathered remains, dating from different phases (table 23.2), reveal a conspicuous difference between two assemblages from wells and the other find groups. The remains from the wells comprise a relatively large number of teal bones, which are virtually absent in the other find groups. This suggests that the two groups of ducks were to some extent separately hunted. This is also suggested by the composition of the remains recovered from the 4-mm sieve fraction of a sample from one of the wells (feature 11-532): a large proportion of the remains (47%) were found to derive from teals. Find numbers 285 and 256 together comprise almost 50% of the bird bones from phase 3, so they greatly influence (distort?) our understanding of fowling in that period.

		%			
			body part		
	N=	head	body	wing	leg
collected by hand	3482	0.5	6.1	85.6	7.9
Units	255	2.4	10.6	79.6	7.5
features					
Totals	*3737*	*0.6*	*6.4*	*85.1*	*7.9*
4-mm sieve	1726	1	7.9	84.2	6.8
Units	174	0.6	14.9	63.8	20.7
features					
Totals	*1900*	*1*	*8.6*	*82.4*	*8.1*

Table 23.3 Bird remains, skeletal elements (body parts) versus recovery technique and general context.

%	burnt / charred	butchering marks	gnawing marks
collected by hand	4.6	0.1	0.2
4-mm sieve	10.4	–	–
1- and 2-mm sieve	11.5	–	–

Table 23.4 Bird bones with traces of burning, butchering or gnawing.

%	Units	features
collected by hand	4.9	1.6
4-mm sieve	10.8	5.7
1- and 2-mm sieve	6.2	28.9

Table 23.5 Bird bones with traces of burning per recovery technique and general context.

		N=							%						
	phase	1	1–2a	2a	2b	3	1–3	totals	1	1–2a	2a	2b	3	1–3	totals
swans															
whooper swan	*Cygnus cygnus*	2	–	3	–	–	–	5	5	–	+	–	–	–	0.1
Bewick's swan	*Cygnus bewickii*	–	–	3	–	–	3	6	–	–	+	–	–	–	0.2
mute swan	*Cygnus olor*	–	2	3	1	–	2	8	–	1	+	+	–	1	0.2
swan	*Cygnus sp.*	2	4	26	6	3	4	45	5	2	2	1	+	1	1.2
Subtotal		*4*	*6*	*35*	*7*	*3*	*9*	*64*	*10*	*3*	*3*	*1*	+	*2*	*1.7*
geese															
barnacle goose	*Branta leucopsis*	1	–	–	–	–	–	1	2	–	–	–	–	–	0.0
brent goose	*Branta bernicla*	–	–	2	2	–	–	4	–	–	+	+	–	–	0.1
barnacle/brent goose	*Branta sp.*	–	–	2	–	–	–	2	–	–	+	–	–	–	0.1
white-fronted goose	*Anser albifrons*	–	1	1	–	–	–	2	–	+	+	–	–	–	0.1
greylag goose	*Anser anser*	1	1	9	–	1	1	13	2	+	1	–	+	+	0.3
goose	*Anser sp.*	2	3	36	13	2	12	68	5	1	3	1	+	3	1.8
Subtotal		*4*	*5*	*50*	*15*	*3*	*13*	*90*	*10*	*2*	*4*	*1*	+	*3*	*2.4*
ducks															
pintail	*Anas acuta*	–	–	–	–	7	–	7	–	–	–	–	1	–	0.2
wigeon	*Mareca penelope*	1	4	13	8	30	1	57	2	2	1	1	5	+	1.5
goosander	*Mergus merganser*	–	–	–	1	–	–	1	–	–	–	+	–	–	0.0
teal	*Anas crecca*	–	1	5	–	–	–	6	–	+	+	–	–	–	0.2
teal / garganey	*A. crecca / querq.*	1	23	65	77	19	37	222	2	9	5	7	3	10	5.9
garganey	*Anas querquedula*	–	–	1	–	–	1	2	–	–	+	–	–	+	0.1
mallard	*Anas platyrhynchos*	18	71	364	260	146	117	976	44	29	28	23	24	31	26.1
eider	*Somateria mollissima*	–	–	2	1	1	1	5	–	–	+	+	+	+	0.1
shoveler	*Anas clypeata*	–	–	9	3	7	1	20	–	–	1	+	1	+	0.5
duck	*Anatidae*	10	119	709	728	391	188	2145	24	49	54	65	63	50	57.4
Subtotal		*30*	*218*	*1168*	*1078*	*601*	*346*	*3441*	*73*	*89*	*88*	*96*	*97*	*91*	*92.1*
birds of prey															
white-tailed eagle	*Haliaeetus albicilla*	2	4	14	5	2	–	27	5	2	1	+	+	–	0.7
marsh harrier	*Circus aeruginosus*	–	1	3	–	–	–	4	–	+	+	–	–	–	0.1
Subtotal		*2*	*5*	*17*	*5*	*2*	–	*31*	*5*	*2*	*1*	+	+	–	*0.8*
waders															
grey plover	*Pluvialis squatarola*	–	–	1	1	–	–	2	–	–	+	+	–	–	0.1
ruff	*Philomachus pugnax*	–	–	4	4	1	1	10	–	–	+	+	+	+	0.3
oystercatcher	*Haematopus ostralegus*	–	–	1	–	–	–	1	–	–	+	–	–	–	0.0
curlew	*Numenius arquata*	–	–	–	–	1	–	1	–	–	–	–	+	+	0.0
small wader	*Tringa sp*	–	–	–	–	–	1	1	–	–	–	–	–	+	0.0
Subtotal		–	–	*6*	*5*	*2*	*2*	*15*	–	–	+	+	+	*1*	*0.4*
other species															
gannet	*Sula bassana*	–	1	–	3	1	–	5	–	+	–	+	+	–	0.1
cormorant	*Phalacrocorax carbo*	–	1	23	5	4	2	35	–	+	2	+	1	1	0.9
grey heron	*Ardea cinerea*	–	–	4	–	1	1	6	–	–	+	–	+	+	0.2
crane	*Grus grus*	1	6	21	8	5	5	46	2	3	2	1	1	1	1.2
great black-backed gull	*Larus marinus*	–	2	1	–	–	–	3	–	1	+	–	–	–	0.1
carrion crow	*Corvus corone*	–	–	–	–	–	1	1	–	–	–	–	–	+	0.0
Subtotal		*1*	*10*	*49*	*16*	*11*	*9*	*96*	*2*	*4*	*4*	*1*	*2*	*2*	*2.6*
Totals		*41*	*244*	*1325*	*1126*	*622*	*379*	*3737*	*100*	*100*	*100*	*100*	*100*	*100*	*100.0*

Table 23.6 Bird remains collected by hand; identifications per phase, numbers of identifications and percentages. + = < 0.5%.

		W=							%						
	phase	1	1-2a	2a	2b	3	1-3	totals	1	1-2a	2a	2b	3	1-3	totals
swans															
whooper swan	*Cygnus cygnus*	11	–	18	–	–	–	29	9	–	1	–	–	–	0.9
Bewick's swan	*Cygnus bewickii*	–	–	18	–	–	7	26	–	–	1	–	–	2	0.8
mute swan	*Cygnus olor*	–	16	74	3	–	46	138	–	5	5	+	–	12	4.1
swan	*Cygnus sp.*	25	69	198	16	17	37	362	21	24	14	2	4	10	10.7
Subtotal		*36*	*85*	*309*	*19*	*17*	*90*	*555*	*31*	*30*	*22*	*2*	*4*	*24*	*16.5*
geese									0						
barnacle goose	*Branta leucopsis*	4	–	–	–	–	–	4	3	–	–	–	–	–	+
brent goose	*Branta bernicla*	–	–	2	4	–	–	5	–	–	+	+	–	–	+
barnacle/brent goose	*Branta sp.*	–	–	4	–	–	–	4	–	–	+	–	–	–	+
white-fronted goose	*Anser albifrons*	–	9	2	–	–	–	11	–	3	+	–	–	–	+
greylag goose	*Anser anser*	17	2	47	–	3	2	71	14	1	3	–	1	1	2.1
goose	*Anser sp.*	7	4	68	25	3	24	131	6	2	5	3	1	6	3.9
Subtotal		*27*	*15*	*122*	*29*	*6*	*26*	*225*	*23*	*5*	*9*	*4*	*2*	*7*	*6.7*
ducks									0						
pintail	*Anas acuta*	–	–	–	–	5	–	5	–	–	–	–	1	–	+
wigeon	*Mareca penelope*	1	2	9	7	14	–	33	1	1	1	1	3	–	1.0
goosander	*Mergus merganser*	–	–	–	+	–	–	+	–	–	–	+	–	–	+
teal	*Anas crecca*	–	+	2	–	–	–	2	–	+	+	–	–	–	+
teal / garganey	*A. crecca / querq.*	+	7	20	19	4	11	62	–	3	1	3	1	3	1.8
garganey	*Anas querquedula*	–	–	+	–	–	+	+	–	–	+	–	–	+	+
mallard	*Anas platyrhynchos*	28	89	335	251	141	129	972	24	31	24	32	35	35	28.8
eider	*Somateria mollissima*	–	–	2	2	2	1	7	–	–	+	+	1	+	+
shoveler	*Anas clypeata*	–	–	5	2	2	1	10	–	–	+	+	1	+	+
duck	*Anatidae*	12	54	388	373	183	89	1097	10	19	27	48	45	24	32.5
Subtotal		*40*	*152*	*761*	*654*	*350*	*231*	*2188*	*34*	*53*	*54*	*84*	*87*	*62*	*64.9*
birds of prey									0						
white-tailed eagle	*Haliaeetus albicilla*	11	22	41	22	1	–	97	10	8	3	3	+	–	2.9
marsh harrier	*Circus aeruginosus*	–	1	2	–	–	–	3	–	+	+	–	–	–	+
Subtotal		*11*	*23*	*43*	*22*	*1*	–	*100*	*10*	*8*	*3*	*3*	+	–	*3.0*
waders									0						
oystercatcher	*Haematopus ostralegus*	–	–	+	–	–	–	+	–	–	+	–	–	–	+
grey plover	*Pluvialis squatarola*	–	–	+	+	–	–	+	–	–	+	+	–	–	+
ruff	*Philomachus pugnax*	–	–	1	1	+	+	2	–	–	+	+	+	+	+
curlew	*Numenius arquata*	–	–	–	–	1	–	1	–	–	–	–	+	–	+
small wader	*Tringa sp.*	–	–	–	–	–	+	+	–	–	–	–	–	+	+
Subtotal		–	–	*1*	*1*	*1*	*1*	*4*	–	–	+	+	+	+	+
other species															
gannet	*Sula bassana*	–	1	–	12	4	–	17	–	+	–	2	1	–	+
cormorant	*Phalacrocorax carbo*	–	4	73	14	9	9	110	–	1	5	2	2	2	3.3
grey heron	*Ardea cinerea*	–	–	7	–	2	3	13	–	–	1	–	1	1	+
crane	*Grus grus*	3	7	96	24	16	13	160	3	3	7	3	4	4	4.7
great black-backed gull	*Larus marinus*	–	1	2	–	–	–	3	–	+	+	–	–	–	+
carrion crow	*Corvus corone*	–	–	–	–	–	+	+	–	–	–	–	–	+	+
Subtotal		*3*	*13*	*179*	*51*	*31*	*25*	*301*	*3*	*4*	*13*	*7*	*8*	*7*	*8.9*
Totals		*118*	*288*	*1414*	*775*	*405*	*373*	*3374*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

+ = 0.1 - 0.5 gram

Table 23.7 Bird remains collected by hand, identifications per phase; weight in grams and weight percentages.

		N=						%					
	phase	1-2a	2a	2b	3	1-3	totals	1-2a	2a	2b	3	1-3	totals
swans	*Cygnus sp.*	1	–	–	–	1	2	+	–	–	–	+	0.1
geese	*Anser sp.*	–	–	3	1	2	6	–	–	+	1	+	0.3
ducks													
pintail	*Anas acuta*	–	–	–	–	1	1	–	–	–	–	+	+
wigeon	*Mareca penelope*	3	–	5	–	1	9	1	–	1	–	+	+
teal	*Anas crecca*	1	–	–	–	–	1	+	–	–	–	–	+
teal / garganey	*A. crecca / querquedula*	35	7	105	26	147	320	12	29	13	13	25	16.8
mallard	*Anas platyrhynchos*	43	5	91	33	99	271	15	21	11	16	17	14.3
shoveler	*Anas clypeata*	–	–	1	–	–	1	–	–	+	–	–	0.1
duck	*Anatidae*	197	12	579	140	339	1267	70	50	73	69	57	66.7
Subtotal		*279*	*24*	*781*	*199*	*587*	*1870*	*99*	*100*	*98*	*99*	*99*	*98.4*
birds of prey													
white-tailed eagle	*Haliaeetus albicilla*	1	–	1	1	–	3	+	–	+	1	–	0.2
waders													
bar-tailed godwit	*Limosa lapponica*	1	–	1	1	–	3	+	–	+	1	–	0.2
dunlin	*Calidris alpina*	–	–	2	–	–	2	–	–	+	–	–	0.1
jack snipe	*Lymnocryptes minimus*	–	–	–	–	1	1	–	–	–	–	+	0.1
ruff	*Philomachus pugnax*	–	–	4	–	3	7	–	–	1	–	1	0.4
Subtotal		*1*	–	*7*	*1*	*4*	*13*	+	–	*1*	*1*	*1*	*0.7*
other species													
cormorant	*Phalacrocorax carbo*	–	–	1	–	1	2	–	–	+	–	+	0.1
crane	*Grus grus*	–	–	2	–	1	3	–	–	+	–	+	0.2
carrion crow	*Corvus corone*	1	–	–	–	–	1	+	–	–	–	–	0.1
Subtotal		*1*	–	*3*	–	*2*	*6*	+	–	+	–	+	*0.3*
Totals		*283*	*24*	*795*	*202*	*596*	*1900*	*100*	*100*	*100*	*100*	*100*	*100.0*

Table 23.8 Bird remains from 4-mm sieve residues, identifications per phase; numbers and percentages.

The remains gathered by hand from units and those recovered from features are more or less the same in terms of composition. There is for example little difference in the distribution of the skeletal elements: in the case of both the remains from units and those from features wing bones constitute more than three-quarters of the total number of identifiable remains (table 23.3). A slight difference is incidentally observable in the 4-mm sieve fraction: although the majority of the remains from both contexts derive from wings, the proportion of body and leg parts is substantially higher in the case of the remains recovered from features. The remains all came from one feature (11-532). Teals were evidently processed in a slightly different way.

23.3.2 Spatial distribution

The spatial distribution of the hand-gathered bird bones shows largely the same patterns as the distributions of the other find groups (fig. 23.1; see also chapter 4). Most remains were found in the wet swampy zone bordering the southern and southeastern flanks of the dune: 86% of the hand-gathered bird remains from units derive from those areas. A smaller cluster was found in the northwestern part. Relatively few remains were collected higher up the dune, also in comparison with the bones of mammals. This will be attributable to the fact that bird bones are more fragile, and will hence have been more susceptible to fracture due to trampling and bioturbation, certainly under the unfavourable preservation conditions higher up the dune.

23.3.3 Phasing

Most of the hand-gathered bird remains date from phases 2a and 2b and – to a slightly lesser extent – phase 3 (table 23.6). The majority of the 4-mm sieve remains date from phase 2b, whereas most of the remains from the 1-2-mm sieve fraction date from phases 2a and 3. A similar imbalance was observed in the remains representing the background fauna (chapter 24). It is directly associated with the unequal distribution of samples among the different occupation phases.

Remains from phase 1 were either absent or very scarce in all the fractions due to the find context (heavy clay) and the employed collection method.

		W=						%					
	phase	1-2a	2a	2b	3	1-3	totals	1-2a	2a	2b	3	1-3	totals
swans	*Cygnus sp.*	1	–	–	–	2	2	1	–	–	–	1	1
geese	*Anser sp.*	–	–	3	+	1	4	–	–	2	+	1	1
ducks													
pintail	*Anas acuta*	–	–	–	–	+	+	–	–	–	–	+	+
wigeon	*Mareca penelope*	1	–	1	–	+	2	2	–	+	–	+	+
teal	*Anas crecca*	+	–	–	–	–	+	+	–	–	–	–	+
teal / garganey	*A. crecca / querquedula*	5	1	14	3	19	42	11	24	9	8	18	12
mallard	*Anas platyrhynchos*	13	1	30	21	34	100	28	41	19	48	33	28
shoveler	*Anas clypeata*	–	–	+	–	–	+	–	–	+	–	–	+
duck	*Anatidae*	26	1	107	18	49	201	57	35	67	42	47	56
Subtotal		*44*	*3*	*152*	*43*	*103*	*345*	*98*	*100*	*95*	*98*	*97*	*96*
birds of prey													
white-tailed eagle	*Haliaeetus albicilla*	+	–	1	+	–	1	+	–	+	+	–	+
waders													
bar-tailed godwit	*Limosa lapponica*	+	–	+	+	–	1	+	–	+	+	–	+
dunlin	*Calidris alpina*	–	–	+	–	–	+	–	–	+	–	–	+
jack snipe	*Lymnocryptes minimus*	–	–	–	–	+	+	–	–	–	–	+	+
ruff	*Philomachus pugnax*	–	–	1	–	+	1	–	–	+	–	+	+
Subtotal		+	–	*2*	+	+	*3*	+	–	*1*	+	+	*1*
other species													
cormorant	*Phalacrocorax carbo*	–	–	3	–	+	3	–	–	2	–	+	1
crane	*Grus grus*	–	–	1	–	+	1	–	–	1	–	+	+
carrion crow	*Corvus corone*	+	–	–	–	–	+	+	–	–	–	–	+
Subtotal		+	–	*4*	–	*1*	*5*	+	–	*3*	–	*1*	*1*
Totals		*45*	*3*	*160*	*44*	*106*	*358*	*100*	*100*	*100*	*100*	*100*	*100*

+ = 0.1 - 0.5 gram

Table 23.9 Bird remains from 4-mm sieve residues; identifications per phase; weight in grams and weight percentages.

23.3.4 Taphonomy

In spite of the fairly high degree of fragmentation, the preservation of the bird remains can be classed as reasonable to good: in many cases the surface of the bone is not or only slightly worn.

Considering the assemblage as a whole, the proportion of burnt bone is small. The percentage of traces of burning is lowest in the case of the hand-gathered remains; it is substantially higher in the case of the remains from the sieve fractions (table 23.4). This is attributable to the fact that burning has a strong fragmenting effect, and smaller fragments are comparatively better represented in the finer sieve fractions.

A comparatively larger quantity of burnt remains ended up in the features (table 23.5). They do not represent residues remaining in hearths or hearth pits as none of the burnt remains were recovered from such features. It is more likely that they are fine burnt and trampled remains that made their way into former wells from the farmyards.

Traces of gnawing were observed on only six hand-gathered bones recovered from units. This by no means implies that gnawing played no part in the taphonomy of the bird bones. The fragile bird bones will have been much more readily devoured in their entirety by gnawing dogs than mammal bones, which will explain why half-eaten bones with tooth impressions were only sporadically encountered.

Evidence of butchering was likewise observed on only a few bird bones (five in total). This implies that birds – unlike mammals – were not dismembered prior to consumption, but cooked in their entirety, presumably after the removal of the head and the lower parts of the legs.

All in all, this scarcity of secondary evidence means that most of the bones were discarded in the places where they were found immediately after the processing and cooking of the birds, out of reach of scavengers and fire, and did not end up in those places via secondary processes such as colluviation. This confirms the interpretation of the find areas along the flanks of the dune – in particular that along the southeastern flank – as areas where waste was deliberately discarded.

Traces of burning, butchering and gnawing were observed on bones of a limited number of species. Traces of burning were almost exclusively found on bones of ducks in general

and on those of shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), teal or garganey (*Anas crecca*/*A. querquedula*). They were also observed on two fragments of goose bones (*Anser* sp.), one whooper swan bone (*Cygnus cygnus*) and one grey plover bone (*Pluvialis squatarola*). Of the three bones showing traces of gnawing by a dog two derive from a swan (*Cygnus* sp.) and one from a duck. One mallard bone shows evidence of gnawing characteristic of a small(er) carnivorous animal. Evidence of butchering, finally, was observed on two swan bones, one mallard bone and one cormorant bone. The evidence concerned in all cases consists of cut marks on wing bones, indicating that the meat was cut from the bones.

23.4 Identifications

23.4.1 Species spectra (tables 23.6-10)

Ducks, geese and swans (fig. 23.2)

Although the bones represent a broad range of species, ducks are by far the most numerous, amounting to >90% in numbers of identifications (fig. 23.3a). The most important duck species are mallard and teal or garganey (figs. 23.4-5). The latter two species can only be distinguished on the basis of one skeletal element (coracoid). The other species – wigeon (*Mareca penelope*), shoveler *(Anas clypeata),* pintail (*Anas acuta*), eider (*Somateria mollissima*) and goosander (*Mergus merganser*) – are represented in only small numbers. The majority of the goose remains derive from greylag goose (*Anser anser,* fig. 23.6).

Only a few remains of brent goose (*Branta bernicla,* fig. 23.7), barnacle goose (*Branta leucopsis*) and white-fronted goose (*Anser albifrons*) were identified. The identified swan remains are almost equally distributed among the three species whooper swan *(Cygnus cygnus,* fig. 23.8), Bewick's swan (*Cygnus bewickii*) and mute swan (*Cygnus olor*).

The majority of the duck, goose and swan bones are wing bones. Parts of the legs, body and head are much less numerous. The distribution of the skeletal elements was not affected by the employed collection method – the patterns observable in the hand-gathered remains and the various sieve fractions are largely the same (table 23.11).

Waders

Remains of waders are extremely scarce and were only encountered among the hand-gathered remains and in the 4-mm sieve fraction. Only remains of ruff (*Philomachus pugnax*) were regularly encountered. Other species are represented by only one or a few remains. The species in question are oystercatcher (*Haematopus ostralegus*), grey plover (*Pluvialis squatarola*), curlew (*Numenius arquata*), bar-tailed godwit (*Limosa lapponica*), dunlin (*Calidris alpina*), jack snipe (*Lymnocryptes minimus*) and *Tringa* sp., possibly redshank or spotted redshank. With the exception of leg bones of curlew and jack snipe, all the wader remains are wing bones.

Birds of prey (fig. 23.9)

Of the two represented birds of prey – marsh harrier (*Circus aeruginosus*) and white-tailed eagle (*Haliaeetus albicilla*) – the latter was encountered the most frequently. The marsh harrier bones are all wing bones. The proportion of elements from the (lower) legs of white-tailed eagle is remarkably high (approx. 67%). Most of those bones – 15 out of 20 – are phalanges (including claws). Wing bones constitute just over a quarter of the total number of remains. The other remains are part of a body (*sternum*) and part of a lower beak.

Other species (fig. 23.9)

The category of other species comprises the remains of six species, predominantly cormorant (*Phalacrocorax carbo*) and common crane (*Grus grus*), and to a lesser extent gannet (*Sula bassana*), great black-backed gull (*Larus marinus*), blue heron (*Ardea cinerea*) and carrion crow (*Corvus corone*). The cormorant bones derive from the head, body, wings and legs, with the proportion of wing bones being by far the largest (78%). Crane is represented by bones deriving from the same parts (except the head), but in the case of this species the proportion of (lower) leg bones is the highest (63%). The same distribution was observed in the case of white-tailed eagle. Wing and leg bones are equally distributed among the small numbers of gannet and blue heron bones, while the few great black-backed gull and carrion crow remains all derive from wings.

23.4.2 Differences in identification results between differently collected samples

As was to be expected, the average weight of the bird remains recovered from the 4-mm sieve fraction is lower than that of the hand-gathered remains: 0.2 g as opposed to 0.9 g. At 0.3 g, the average weight of the remains from the residue of the 1-2 mm sieve sample is a little higher, largely as a result of a number of larger remains of mallard and ducks in general, and one whooper swan bone. These samples were not dug up by hand but were taken from vertical sections.

The collection method of course influenced the identification ratios. Large species are overrepresented among the hand-gathered remains and underrepresented in the 4-mm sieve residues because the soil was in the latter case first picked over by hand. Remains of small species, but also identifiable small fragments dominate the sieve residues. Small teal and/or garganey remains and remains that could be identified with no greater precision than as deriving from ducks for example scored relatively high in the sieve residues. With due allowance for the ratio of the three fractions (1000:80:1) we may assume that the teals/garganeys

		N=							W=						
	phase	1	1-2a	2a	2b	3	1-3	total	1	1-2a	2a	2b	3	1-3	total
whooper swan	*Cygnus cygnus*	–	–	–	–	–	1	1	–	–	–	–	–	2.5	2.5
teal	*Anas crecca*	1	–	–	–	–	–	1	0.4	–	–	–	–	–	0.4
mallard	*Anas platyrhynchos*	2	1	12	–	21	9	45	2.8	0.3	3.3	–	13.2	5.2	24.8
teal / garganey	*A. crecca / querq.*	1	2	12	2	–	18	35	0.2	0.1	0.9	0.1	–	2.1	3.4
shoveler	*Anas clypeata*	–	–	–	1	–	–	1	–	–	–	0.1	–	–	0.1
duck	*Anatidae*	5	2	30	11	34	26	108	2.2	0.3	4.2	2.1	8.6	3.4	20.8
Totals		*9*	*5*	*54*	*14*	*55*	*54*	*191*	*5.6*	*0.7*	*8.4*	*2.3*	*21.8*	*13.2*	*52.0*

Table 23.10 Bird remains from 1- and 2-mm-sieve residues; identifications per phase; numbers and weights in grams.

Figure 23.2 Bird remains, water fowl (scale 1:1).

7811	Bewick's swan	*Cygnus bewckii*	carpometacarpus and scapula
6572	white-fronted goose	*Anser albifrons*	humerus
2019	mallard	*Anas platyrhynchus*	humerus
5502	shoveler	*Anas clypeata*	coracoid
8297	eider	*Somateria mollissima*	femur

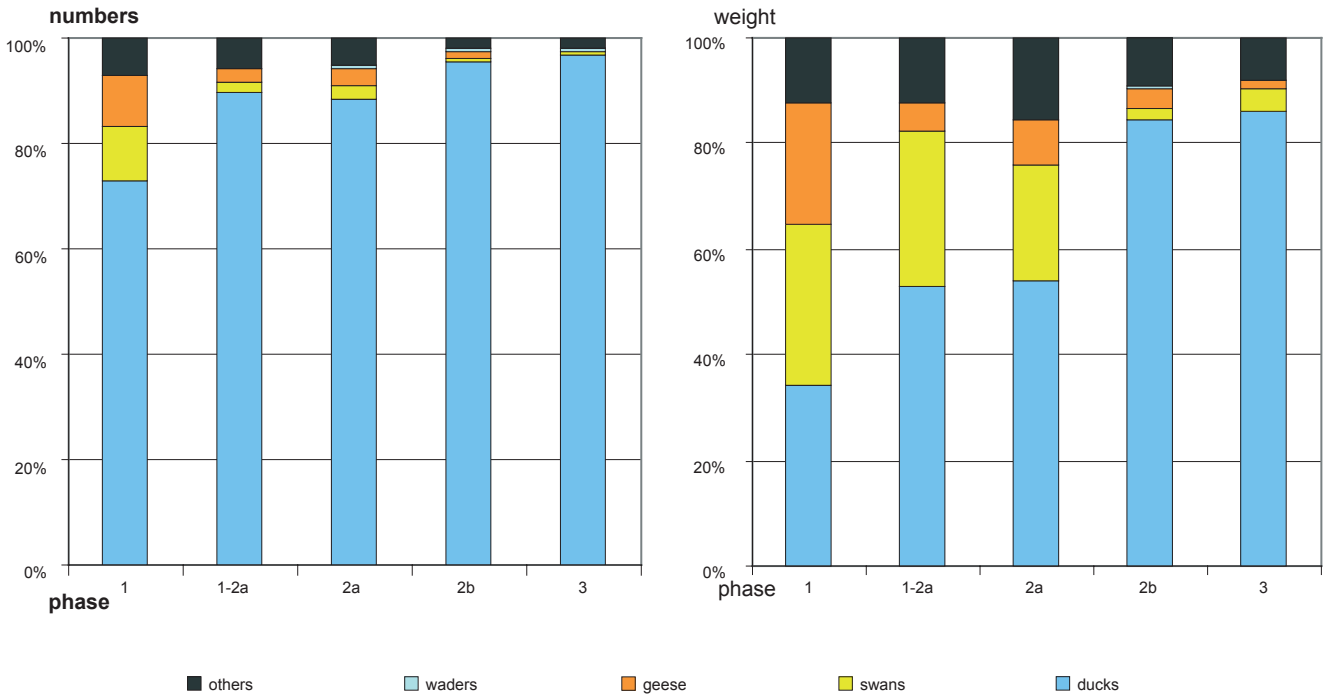

Figure 23.3 Birds, ratio of five main classes per phase. All classes, except ducks, show a decrease through time, especially swans and geese.
a numbers of identifications
b bone weight

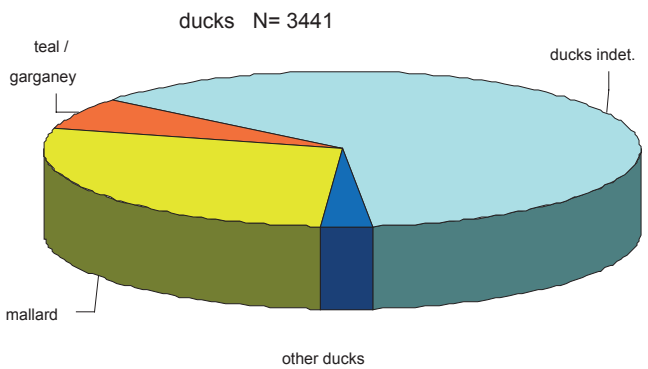

Figure 23.4 Ducks, manually collected bones; proportion of mallard and teal/garganey.

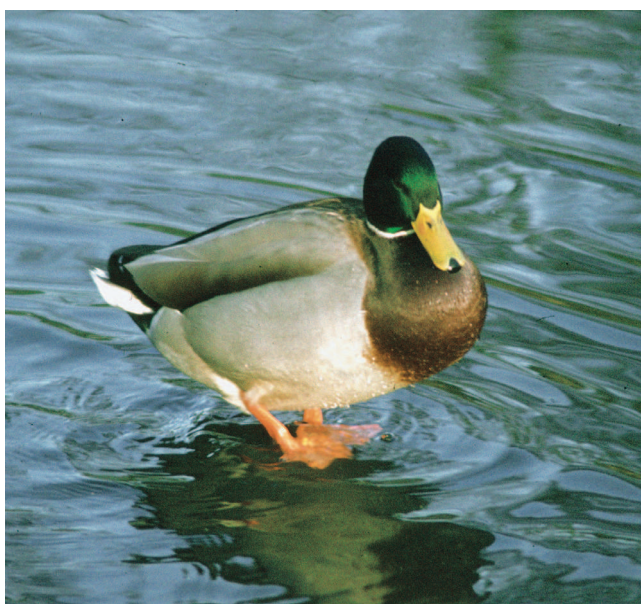

Figure 23.5 Mallard.

Figure 23.6 A family of greylag geese. Greylag geese started breeding (again) in the Netherlands in 1970 and are nowadays common wetland breeding fowl, unlike the other goose species. They were regularly shot by the Schipluiden inhabitants.

Figure 23.7 Part of a large group of brent geese on the island of Wieringen. The wetlands of the Netherlands are one of the main wintering regions for many goose species, which may form flocks of many thousands of individuals. The estuaries will have attracted the geese in prehistory, too, although there will then have been a wider range of suitable terrains. Brent geese are indicative of brackish and salt conditions.

Figure 23.8 Whooper swans, Oostvaardersplassen, March 2005. Whooper swans are arctic breeders and one of the most reliable winter indicators.

are greatly underrepresented in the hand-gathered bones. In numbers they are nevertheless no more significant than the mallard remains, because most of the *Anatidae* remains that could not be identified to species level will derive from mallard.

Species identified in the case of the wader remains recovered from the 4-mm sieve residues are, besides the relatively small ruff, one larger (bar-tailed godwit) and two new, smaller species (dunlin and jack snipe). The 1-2-mm sieve remains show no continuation of this trend. No remains of smaller birds, in particular *Passeriformes*, were identified in spite of the fact that 1.3 m^3 of find-containing soil was sieved. Such remains were also completely absent in the much larger 4-mm sieve sample. This indicates a systematic absence of such birds, which is in accordance with the general picture. Remains of small *Passeriformes* are even rarely found among the bones collected by sieving. In the rare cases in which they have been encountered, the remains each time comprised only one or a few bones, as for example at Hardinxveld-Giessendam De Bruin and Polderweg, Zeewijk and Kolhorn (Overstegen *et al*. 2001; Van Wijngaarden-Bakker *et al*. 2001; Zeiler 1988, 1997).

The question is which range represents the actual situation. This question is of particular importance in comparing the Schipluiden remains with other find assemblages. In view of the fact that around 8% of the soil was sieved, the actual archaeological ratios can be roughly reconstructed by adding 12 times the remains from the 4-mm sieve fraction to the remains gathered by hand. The totals thus obtained can be directly compared with figures from excavations in which all the soil was sieved, such as those of Hardinxveld and Swifterbant. The results are presented in table 23.11.

23.5 Subsistence

The large quantities of remains imply that fowling was practised on a large scale. The range of represented species is broad, but no more diverse than that of other large assemblages from the western Netherlands, such as the older ones of the Hardinxveld Polderweg and De Bruin sites and the younger ones of Kolhorn and Mienakker. The fowling

activities focused on ducks. Being larger birds, geese and swans were of greater economic importance than the numbers of identified remains would suggest. Their relative importance is evident from the weight ratios, that of geese and swans together relative to ducks being 1:3 (fig. 23.3b). Most species will of course have been consumed. There are two further sources of evidence supporting this: traces of butchering and the distribution of the skeletal parts. The scarce traces of butchering in all cases (swan, mallard, cormorant) show that meat was cut from the bones. The great majority of the bones of ducks, swans and geese, but also that of for example the cormorant and wader bones are wing bones (table 23.12). In a natural assemblage, leg and wing bones will be represented in more or less equal proportions. In the case of consumption waste, wing bones are always represented in greater quantities than leg bones (Ericson 1987; Livingston 1989). The legs were evidently cut off before the other parts were cooked and were discarded in a different place from the bones from which the meat had been eaten. Two species are clearly exceptions in this respect: white-tailed eagle and crane. In the case of these species the numbers of identified leg bones are twice as high as the numbers of wing bones. This implies that these birds were treated differently, and were killed not (or at least not exclusively) for their meat, but (also) for other purposes. This will be discussed further in section 23.8.

The bird remains provide no clues as to the employed fowling methods. The birds were most probably caught with a bow and arrow and nets. In one case a bird was probably caught because it was less mobile: a scapula of a duck shows a thickened part, probably representing a healed fracture, which may have caused some stiffness in the wing.

Besides practising active fowling, the Schipluiden occupants probably also gathered dead birds that were washed up on the shore after storms. Anyone walking along the floodmarks left on a beach or salt marsh after a heavy storm today will regularly come across dead birds. It is quite conceivable that the dune's occupants gathered such birds – for either their

Figure 23.9 Bird remains, various species (scale 1:1)

4573	white-tailed eagle	*Haliaeetus albicilla*	phalanx
375	white-tailed eagle	*Haliaeetus albicilla*	coracoid
3257	blue heron	*Ardea cinerea*	humerus
530	cormorant	*Phalacrocorax carbo*	humerus
10,470	great black-backed gull	*Larus marinus*	coracoid
9820	crane	*Grus grus*	coracoid

	N=			%		
	collected by hand	4-mm corr. (×12)	totals	collected by hand	4-mm corr. (×12)	totals
swans	64	24	88	1.7	0.1	0.3
geese	90	72	162	2.4	0.3	0.6
mallard	977	3,252	4,229	26.1	14.3	15.9
teal / garganey	230	3,852	4,082	6.2	16.9	15.4
other duck species	90	132	222	2.4	0.6	0.8
ducks	2,144	15,204	17,348	57.4	66.7	65.4
Subtotal	*3,441*	*22,440*	*25,881*	*92.1*	*98.4*	*97.5*
birds of prey	31	36	67	0.8	0.2	0.3
waders	15	156	171	0.4	0.7	0.6
other species	96	72	168	2.6	0.3	0.6
Totals	*3,737*	*22,800*	*26,537*	*100.0*	*100.0*	*100.0*

Table 23.11 Birds, calculation of the total numbers of bird remains >4 mm present at the site by adding the volume-corrected data of the 4-mm sieve samples to the remains collected by hand.

meat or their feathers and down, depending of course on the freshness of the cadavers. Birds that may have been gathered like this are gannet and great black-backed gull, but also small waders that are relatively difficult to catch such as dunlin and jack snipe.

Some important shifts took place over the years. In the first place, the importance of both geese and swans decreased, from 20% in terms of the number of identified bones (fig. 23.3) in the case of both species in phase 1, via 7% in phase 2a to less than 1% in phase 3. This trend is even more pronounced in the weights of the bones. Some other species also decreased in importance, in particular white-tailed eagle. The already dominant importance of ducks meanwhile increased from 73 to 97%, presumably due to changes in the landscape; this will be discussed further in section 23.7. These observations are made with due allowance for the facts that the number of identified remains from phase 1 is limited, and that the majority of these remains come from

	head	body	wings			legs			totals
			long bones	carpalia phalan.	total	long bones	tarsalia phalan.	total	
collected by hand									
ducks	17	230	2919	68	2987	206	1	207	3441
geese	1	8	63	1	64	17	–	17	90
swans	2	1	43	3	46	15	–	15	64
cormorant	1	2	28	–	28	4	–	4	35
white-tailed eagle	1	1	8	–	8	4	13	17	27
crane	–	5	13	–	13	24	4	28	46
waders	–	–	14	–	14	1	–	1	15
other	–	–	14	–	14	5	–	5	19
4-mm sieve									
ducks	19	162	1204	342	1546	138	5	143	1870
geese	–	–	3	–	3	3	–	3	6
swans	–	1	1	–	1	–	–	–	2
cormorant	–	–	1	–	1	1	–	1	2
white-tailed eagle	–	–	–	–	–	–	3	3	3
crane	–	–	–	–	–	1	1	1	2
waders	–	–	12	–	12	1	–	1	13
other	–	–	1	–	1	–	–	–	1
1- and 2-mm sieve									
ducks	2	12	143	26	169	7	–	7	190
swans	–	–	1	–	1	–	–	–	1

Table 23.12 Birds, skeletal elements of body parts versus species and recovery technique.

clay Unit 19S, which was largely excavated with the aid of a digging machine. That will have led to a bias in favour of large remains, such as swan and goose bones. It should however also have led to a higher percentage of bones of other large species (cormorant, white-tailed eagle, crane and the like), and that is not the case.

Equally remarkable is that the group of ducks shows no comparable shifts, and that various species are represented in several phases. The latter holds for gannet, cormorant, crane, ruff and grey plover, and in the case of the ducks for wigeon, eider, shoveler and teal/garganey. This must imply that the environmental changes that took place between phases 1 and 3 were certainly not dramatic.

23.6 Seasonal evidence

Seasonal evidence is based on the presence of remains of migratory bird species and the assumption that the migratory behaviour of the species concerned was largely the same in the Neolithic as it is today. Recent shifts in migratory behaviour and breeding areas of various species however show that some degree of caution is called for in drawing conclusions. The periods indicated in figure 23.13 are based on the months in which the numbers of a particular species are nowadays the highest (Bekhuis *et al.* 1987; Bijlsma *et al.* 2001).

Determining in which seasons the site was occupied is not as simple as it may seem. In the first place the 'duck' and 'goose' identifications tell us nothing, because breeding and migratory behaviour are species-specific. Secondly, all resident birds provide no helpful information. A third difficulty is that many birds may indeed be migratory species, but they often spend a large part of the year in these areas and are truly absent for only a few months. And, finally, we suspect that the migratory behaviour of some species was different in the past than it is today, but that is hard to prove. When all these factors are taken into consideration even a large database like that of Schipluiden actually proves to contain only relatively few useful data. Some 'problematic cases' deserve special attention.

The *mute swan* (fig. 23.8) is currently a (fairly scarce) breeding bird in the Netherlands. The species has however

Figure 23.10 Common cranes as winter visitors in pastureland bordered by alders near Ruurlo in the eastern part of the Netherlands. It is assumed that common cranes bred in the wooded marshland along the lower courses of the Rhine and Meuse in prehistoric times.

enjoyed this status only since around 1950; before then it was exclusively a winter bird, visiting our parts from mid-November until early April (*Commissie voor de Nederlandse Avifauna* (Dutch Avifauna Committee) 1970). For this reason we may regard the mute swan as an indicator of winter site use in the Neolithic.

The *common crane* (fig. 23.10) nowadays occurs in the Netherlands in autumn and spring during its migration. In the past few years it has (again) been breeding in the Netherlands, in the Fochtelooërveen peat area. The bird avoids populated areas. This characteristic and the species' distribution in historical times make it highly likely that in prehistoric times cranes bred all over Europe in wooded swamps, so also in the Netherlands (Voous 1960). Crane remains in a Neolithic context may hence be regarded as evidence of summer site use, with a poorly known range. Whether cranes also bred in the Schipluiden region is not certain, especially as the earliest occupation phases are concerned, considering the site's former biotopes. There may have been breeding areas further east in the peat area.

The *white-tailed eagle* (fig. 23.11) likewise avoids populated areas. It may well have bred in the Netherlands in the Neolithic, though there is no unambiguous evidence to prove it. At present, it occurs in our country in the winter months, from September until March.

The *ruff* (fig. 23.12) is known in the Netherlands primarily as a breeding bird, favouring wet pastures, but in the past decades the disappearance of that biotope has led to a dramatic decline in the number of breeding birds of this species. The ruff also passes through the Netherlands on its migrations, and is then only scarce in the middle of winter. The same holds for the *marsh harrier*. The marshy beach plain at Schipluiden would appear to have been an ideal breeding biotope for both species. The *grey plover* breeds in northwestern Russia and western Siberia, but is nevertheless to be found in the Dutch coastal areas virtually throughout the year. Two other northern breeding birds, the *bar-tailed godwit* and the *dunlin,* show the same behaviour. These species are scarce for only one or two months in the summer (June-July). The *gannet* is a typical northern sea bird that is currently to be

Figure 23.11 Two white-tailed eagles – an adult and a juvenile – on a carcass of red deer in the Oostvaardersplassen nature reserve. The white-tailed eagle – nowadays a winter visitor only – has bred in 2006 for the first time in this large reserve, which has conditions similar to those of Delfland more than 5000 years ago: a rich fauna and large flocks of water fowl in summer and winter. The white-tailed eagle will have been shot for prestige and its feathers.

Figure 23.12 Two male ruffs fighting on their display ground. The ruff must have been a common bird in Delfland. It prefers marshy grassland, which was in prehistoric times widespread, but is nowadays rare, as are consequently also the ruff. The ruff is one of the few summer indicators. The males may have been shot especially for the colourful feathers of their collars.

found along the Dutch coast outside its breeding season, especially in the months from Augustus until November.

Winter birds 'proper' are to be found primarily among the *Anatidae*, the family comprising ducks, geese and swans: all swans and all geese except the greylag goose are winter visitors in the Netherlands. White-fronted goose and whooper swan have the shortest residence period, immediately followed by Bewick's swan, mute swan, barnacle goose and goosander (fig. 23.13). They are (or were) all actually absent in our country throughout the summer, so they provide the most convincing evidence of site use in winter. As all the three swan species are regarded as winter visitors, the remains that could not be identified with any greater precision than as deriving from 'swan' were also taken as evidence of winter use.

All in all, 243 out of the total of 2308 bird remains identified to species or genus level (9.3 %) could be used in determining the seasons of the site's use because the majority of the bones derive from mallard and teal/garganey.

All winter birds except for the wigeon are represented by only one or a few bones. Some typical winter visitors known from other Neolithic delta sites such as the red-throated diver (September-April), smew (November-March) and goldeneye (October-April) are absent. The seven pintail bones were all recovered from one find concentration and derive from (at least) three individuals.

Good summer indicators are scarce, but were at Schipluiden nevertheless represented by ruff, crane, marsh harrier and garganey, the first two both by several dozen bones. No remains of birds such as purple heron or Dalmatian pelican were found, but that may be partly attributable to the biotope.

Both the winter and the summer evidence are modest, but we do indeed have evidence relating to both seasons from all phases, and in equal proportions (figs. 23.14-15). The overall seasonal spectrum comprises at least one short period of occupation, either in March-April or from the end of September until the beginning of November. All the represented birds could in principle have been killed in one of these two short

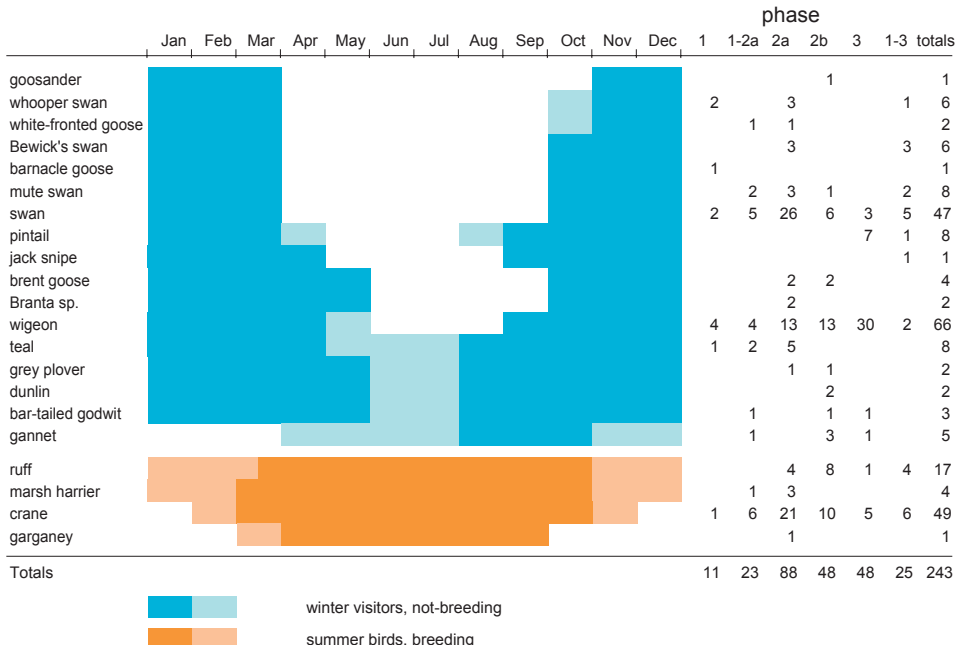

Figure 23.13 Birds as seasonal indicators. The combination of all identified species points to a presence at least in both early spring (March-April) and late autumn (October-November).
blue winter visitors
brown breeding birds
right: numbers of identifications per phase

periods. The actual period of occupation was in all probability however much longer, as all the species except gannet will have been present in the Netherlands in larger concentrations outside these periods. But the actual period cannot be determined with greater precision on the basis of the bird bone identifications alone. It would be too rash a conclusion to interpret the presence of 'summer birds' and 'winter birds' as evidence of permanent occupation. There is no concrete evidence, especially not for phase 3, for occupation in the winter, from November until the end of March.

23.7 Reconstruction of the former landscape

The bird remains reflect the landscape in the dune's wide surroundings via the eyes and preferences of the fowlers of the community that lived on the dune. We assume that their activities will have extended many kilometres from the site. In what parts of the landscape those activities took place will have depended on the territorial organisation (see chapter 27). Through their way of life and preferences for specific biotopes, the hunted bird species in turn enable us to form a more precise impression of the former landscape, in particular the water conditions. They also reveal the fowlers' range.

The many ducks, geese, swans and also the cormorant point to open water – both fresh and brackish to salty – bordered by reeds and swamp vegetation. The same conditions are indicated by the marsh harrier, crane, blue heron and white-tailed eagle. The latter two species also imply the presence of some (sturdy) marsh woodland for breeding. Most of the geese and some of the duck species, for example the wigeon, will moreover have required grassy foraging areas such as those afforded by the salt marshes and the beach plain.

All represented duck species forage in shallow water and on (partly submerged) grasslands, salt marshes and the like. Van Eerden (1998) reports as follows on wigeon, teal and garganey: "These species feed on salt marshes, sea grasses *Zostera* ssp. in tidal bays and pioneer vegetations under freshwater conditions." Diving ducks, whose distribution is largely dependent on the presence of open water with a depth of more than 50 cm, are totally absent. Two represented species are typical of deeper water – the cormorant and the goosander. The latter is however represented by only one bone fragment. This implies that there was fairly little deep water in the dune's surroundings in all the phases.

The scarcity of wader remains is in marked contrast with the landscape reconstructions based on physical-geographical and palaeobotanical evidence, which are dominated by openness, tidal influence and a salt-marsh vegetation that

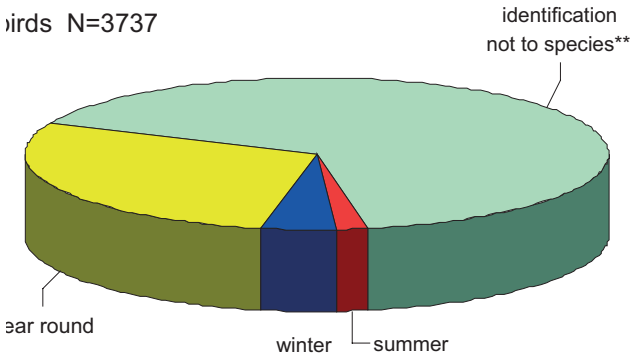

Figure 23.14 Proportions of summer and winter indicators among all bird bone identifications, material collected by hand. Not arranged per species: 'goose', 'duck', 'teal/garganey'.

later evolved into a swamp vegetation. The biotope typical of the ruff consists of wet pastures. A small range of species (grey plover, bar-tailed godwit, dunlin) indicates the presence of salt marshes in the vicinity of the dune and mud flats along the coast. Other birds indicating a marine environment are eider, brent and barnacle goose, gannet and great black-backed gull. The question is whether these birds were incidentally to be found in the dune's immediate surroundings or whether they were killed or gathered by fowlers at the coast.

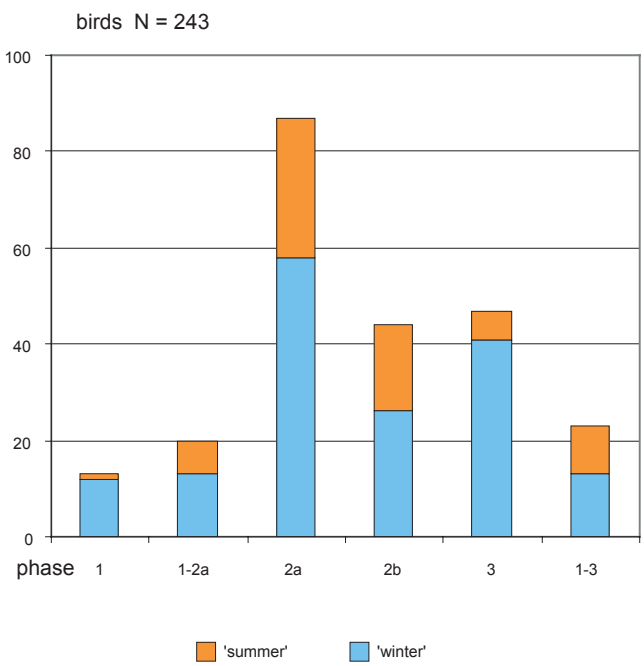

Figure 23.15 Numbers of identifications of bones of summer and winter birds per phase.

The relative importance of geese and swans as hunted animals appears to have decreased in the course of the occupation period. This shift may be attributable to the changes that took place in the landscape. The landscape however remained attractive for various duck species, and the importance of water fowl relative to that of other hunted species (chapter 22) does not seem to have declined insofar as statements can be made on this issue on the basis of the recovered faunal remains.

The various palaeoecological studies show that the initially brackish conditions in phase 1 gradually gave way to a fresh-water environment in the course of the occupation period. This process was accompanied by the growth of sedge peat. These changes may have affected the numbers of birds in the dune's surroundings in different ways. For a good understanding of the effects of these changes on the avifauna we must first consider (differences in) the biological diversity and carrying capacity of the ecozones concerned. According to Van Eerden (1998), densities of water birds are much higher in salt marshes and tidal flats than in fen peats because the latter are partly wooded or "covered with rough shrubs not suitable for water birds." Peatlands are moreover poorer in food, especially if they are covered with sedge vegetations; vegetations consisting largely of reed are somewhat richer in food (Weeda *et al.* 1995). On top of this, the highly dynamic conditions in such environments constantly degrade the vegetational succession, each time leading to the formation of a new pioneer vegetation (Van Eerden 1998, Weeda *et al.* 1995). Pioneer vegetations are very productive and hence highly attractive for many bird species. A final factor to which attention should be called in this context is the great profusion of birds that is to be found in the mud-flat areas of northwestern Europe, which is largely attributable to the short food chain (algae–soil animals–birds) (Van de Kam *et al.* 1999).

The formation of sedge peat swamps at Schipluiden will hence have led to a (substantial) decrease in the density of birds in the dune's immediate surroundings. In the earliest occupation phase the brackish environment will have attracted large quantities of birds, and the occupants will have been able to kill birds on a large scale close to their settlement. But in the later phases the biotopes that were most attractive for birds (salt marshes, mud flats and the like) came to lie further away from the dune, and people will have had to travel further on their fowling expeditions.

The change to freshwater conditions and the growth of peat may also have led to a decrease in the area of open water. Sedge swamps are generally densely vegetated, with little room for open water. This will have been particularly unfavourable for geese and swans; ducks are much better capable of living in densely vegetated swamps. But this is not entirely clear. In

principle, the foraging of greylag geese could for example have held the swamp open (see *e.g.* Van Eerden 1998), but this was evidently not the case. Perhaps the rate at which things changed was too high and/or the greylag goose population was too small to have any impact on the vegetation.

The presence among the remains from the later occupation phases (2b and 3) of bones of a number of species that are characteristic of brackish and/or saltwater environments such as barnacle goose, eider, grey plover and gannet indicates that the occupants continued to exploit the coastal area in those phases.

23.8 Other purposes for which birds may have been killed

Most of the represented bird species were evidently consumed (see section 23.5). Indications of non-consumptive use are less clear. Feathers and down will certainly have been used but, unlike the skinning of mammals, the plucking of birds leaves no traces on the bones. The main indications of other uses of certain species are provided by the distributions of the skeletal elements. Contrary to those of most species, the remains of crane and white-tailed eagle are not dominated by wing elements but by parts of the legs – in the case of the cranes predominantly fragments of the long bones and in the case of the white-tailed eagle mainly phalanges (including claws). The latter is not attributable to white-tailed eagle phalanges and claws being more easily identifiable than those of other species. Generally speaking, these elements, and also other small elements such as carpal bones, are readily recognisable and can be identified to species level fairly well. This holds for both small and larger species. Some find numbers or successive numbers relate to bones that appear to derive from the same leg, suggesting that entire (lower) legs were discarded and later disintegrated. This will partly explain the relatively large number of bones, and may largely account for the deviating ratios.

Oddly enough, no such 'deviating' distributions of the skeletal parts of these two species were observed at the nearby Hazendonk site of Ypenburg. Of the 300 or so remains that were identified as deriving from *(cf.)* crane, 47% are wing elements and 41% leg elements, and of the 25 white-tailed eagle remains 15 are wing bones and 10 are parts of legs, including one claw (De Vries 2004). So the predominance of leg elements of white-tailed eagles and cranes at Schipluiden would seem to be an incidental rather than a structural feature.

The distributions of the skeletal elements of white-tailed eagle and crane at Schipluiden indicate that these birds were not, or at least not only, killed for their meat, but (partly) for some other purpose. Albarella (1997) suggests that cranes and large birds of prey were killed predominantly for their feathers. The meat of adult birds is assumed to be tough and not very tasty, making it unlikely that they were consumed, especially if there was a sufficient supply of other, more palatable birds. Von den Driesch (1999) however writes that the meat of cranes was on the contrary highly appreciated in classical antiquity.

Reichstein (1974) is of the opinion that white-tailed eagle may have been killed for ideological reasons, but also for its meat or feathers. Ethnographic evidence leads him to choose the latter as the most likely option. In his opinion the fact that the proportion of wing elements greatly exceeds that of leg elements at nine pre- and protohistoric sites in northern and central Europe confirms the assumption that white-tailed eagles were killed primarily for their feathers. This interpretation not only contradicts that of Ericson (1987) and Livingston (1989), who regard predominating quantities of wing bones as consumption waste, but is not supported by taphonomic evidence either.

Even if cranes and white-tailed eagles were indeed partly killed for their feathers at Schipluiden, this does not explain the large proportion of leg elements. There may have been other reasons why these birds were killed. Prestige and ascribed significance may have played a role in the fowling of these two species, which – especially white-tailed eagle – were impressive birds. It could be that their legs, in particular the claws of the white-tailed eagle, were for the same reasons deliberately deposited in other places than the same elements of 'ordinary' birds.

23.9 Conclusions

Throughout the entire period of occupation, the Schipluiden occupants killed birds – in particular water birds and especially ducks – on a large scale. They also – more incidentally – fowled for a broad range of other species. In combination with the (scarce) cut marks, the prevalence of wing bones of almost all species indicates that the birds were consumed. Along with the results of the analyses of remains of mammals (chapter 22) and fish (chapter 25), this indicates a highly diverse diet.

The presence of remains of both summer and winter visitors among the remains from all phases cannot be unambiguously interpreted by itself, but in combination with the results of the other analyses it may be an argument supporting the permanent presence of people at the site and occupation all the year round.

On the basis of the bird remains, the landscape in the wide surroundings of the dune can be described as wet and largely open, with marine influences. Elements characteristic of this landscape were shallow open water (both freshwater and brackish/salt water), salt marshes, swamps and – to a limited extent or further away – a coast with estuaries. Open water with a depth of more than 50 cm must have been relatively scarce in the dune's surroundings.

English	Dutch	scientific
barnacle goose	brandgans	*Branta leucopsis*
bar-tailed godwit	rosse grutto	*Limosa lapponica*
Bewick's swan	kleine zwaan	*Cygnus bewickii*
brent goose	rotgans	*Branta bernicla*
carrion crow	zwarte kraai	*Corvus corone*
cormorant	aalscholver	*Phalacrocorax carbo*
crane	kraanvogel	*Grus grus*
curlew	wulp	*Numenius arquata*
ducks	eenden	*Anatidae*
dunlin	bonte strandloper	*Calidris alpina*
eider	eidereend	*Somateria mollissima*
gannet	jan van gent	*Sula bassana*
garganey	zomertaling	*Anas querquedula*
goosander	grote zaagbek	*Mergus merganser*
goose	ganzen	*Anser sp.*
great black-backed gull	grote mantelmeeuw	*Larus marinus*
grey heron	blauwe reiger	*Ardea cinerea*
grey plover	zilverplevier	*Pluvialis squatarola*
greylag goose	grauwe gans	*Anser anser*
jack snipe	bokje	*Lymnocryptes minimus*
mallard	wilde eend	*Anas platyrhynchos*
marsh harrier	bruine kiekendief	*Circus aeruginosus*
mute swan	knobbelzwaan	*Cygnus olor*
oystercatcher	scholekster	*Haematopus ostralegus*
pintail	pijlstaart	*Anas acuta*
ruff	kemphaan	*Philomachus pugnax*
shoveler	slobeend	*Anas clypeata*
swan	zwanen	*Cygnus sp.*
teal	wintertaling	*Anas crecca*
white-fronted goose	kolgans	*Anser albifrons*
white-tailed eagle	zeearend	*Haliaeetus albicilla*
whooper swan	wilde zwaan	*Cygnus cygnus*
wigeon	smient	*Mareca penelope*

Table 23.13 Glossary of the English, Dutch and scientific names of the birds mentioned in the text.

In the course of the occupation period the number of geese and swans killed decreased while that of ducks increased. This will be attributable to changes in the landscape. The change to freshwater conditions and the associated growth of peat, in particular sedge peat, led to a biotope with a rougher vegetation that was less rich in food, and possibly also to a decrease in the area of open water. Biotopes that were most suitable for geese and swans (salt marshes, mud flats and the like) may consequently have come to lie further away from the dune, outside the occupants' action radius. The occupants nevertheless went on fowling expeditions far away from their site in the later occupation phases, too, as can be inferred from the presence of remains of species typical of the coastal area, such as eider, grey plover and gannet.

Besides the birds' meat, the occupants will have used their feathers and down, too, though there is no direct evidence to prove this. The distributions of the skeletal parts do however seem to indicate that white-tailed eagle and crane were not, or at least not only, killed for their meat, but possibly (also) for their feathers or for prestige-related reasons.

The large numbers of bird remains found at Schipluiden are in accordance with our understanding of Neolithic sites in the open coastal environment. That understanding is based largely on evidence obtained at Late Neolithic sites in the northwest of the Netherlands (Zeiler 1997; Gehasse 2001; De Vries 2001), but also on the evidence of the Hazendonk sites of Ypenburg and Wateringen 4, which lie in the same microregion as Schipluiden (Raemaekers *et al*. 1997; De Vries 2004). Sites in freshwater swampy areas on the whole yielded far fewer bird remains (Zeiler/Clason 1993), the most important exceptions being the early Hardinxveld-Giessendam De Bruin and Polderweg sites (Overstegen *et al*. 2001; Van Wijngaarden-Bakker *et al*. 2001). These differences between coastal areas and freshwater swamps will be partly due to factors such as the character of occupation (seasonal or permanent) and subsistence strategies (more or less stock keeping/hunting), but also largely to differences in ecological diversity. Being poor in food and having a rough vegetation, peat bogs are much less attractive for (migratory) birds than dynamic landscapes with estuaries, salt marshes and mud flats. The occupants of the Schipluiden dune probably selected this particular site partly on the basis of the abundance of birds in this area.

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