Kristiina Mannermaa

BIRDS IN FINNISH PREHISTORY

Abstract

In this article I present bird bones found from Finnish sites connected to the Mesolithic, Neolithic, Early Metal Period and Bronze Age. For the first time information on the Finnish prehistoric bird fauna and fowling have been gathered together and discussed in its entity. I discuss the possibilities of interpreting bones from Finnish sites, and point out the major problems in the methods used. I have classified the sites according to their dating and location in order to see differences in the representation of bird taxa among sites. Ducks and gallinaceous birds dominate in all prehistoric periods included in this study, but there is a clear difference among sites depending on their location inland or on a coast. The osteological materials from some coastal sites indicate that fowling was a notable part of the economy.

Keywords: Finland, Åland, fowling, bird bones, Mesolithic, Neolithic, Early Metal Period, Bronze Age.

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INTRODUCTION

Archaeological interest in bird remains has risen during the past decades. After Clark's (1948) important paper, a number of studies on the use of birds in prehistoric economies have been published (Dawson 1963; Brothwell *et al*. 1981; Grigson 1985; Ericson 1987; Gotfredsen 1997; Serjeantson 1997; Potapova & Panteleyev 1999; Zhilin & Karhu 2002, *etc*.).

Bird remains in archaeological sites consist mainly of bones or fragments of bones. Sometimes even feathers or pieces of eggshells are present (Keepax 1981; Eastham & Gwynn 1997). Birds and their eggs were used as food, and bones were suitable raw material for tools and artefacts. Feathers were used for fletching arrows (Clark 1948; Gilbert *et al*. 1996:2-4; Serjeantson 1997:257; Potapova & Panteleyev 1999:129).

Bird bones can give information on the economy of the site, but they can also help in determining the season of occupation. Young individuals, migratory species and the medullary bone (temporal calcium storage during the hatching period in female birds) can help us in determining the fowling season (Olsen 1967:174-180; van Wijngarden-Bakker 1988; Morales Muñiz 1998; Serjeantson 1998).

Bones are not uncommon among the finds from Finnish archaeological sites, but large assemblages of bird bones are rare. Preservation of bones is poor in the acid soil typical of most of Finland (e.g. Fortelius 1981:11-12; Okkonen 1991; Ukkonen 1996:65-67). However, burning improves the preservation of bones although specimens are highly fragmented after burning. Finnish prehistoric bone material consists almost entirely of burnt bones. On the Åland Islands, the relatively high lime content of the soil has allowed the preservation of even unburned bones (Storå 2000:57).

Bird bones from Finnish archaeological sites have not been previously reviewed thoroughly. Some of the bird finds were earlier published by Forstén (1972:76; 1977:56), Forstén & Blomqvist (1977:51), Nuñez (1986:25), Ukkonen (1996:76; 1997:54-55) and Mannermaa (2002a). Only handful of archaeological papers mention the role of birds in the Finnish archaeology (e.g. Welinder 1977:52; Siiriäinen 1982:20; Nuñez 1986:19, 21,

22; Matiskainen 1989:53; Nuñez 1991:34-36; Nuñez & Storå 1997:152; Gustavsson 1997:121). Their general conclusion is that birds were a more or less important source of food for prehistoric people at least during certain parts of a year, although this usually cannot be proved by archaeological data. Siiriäinen (1981:17) mentions that the appearance of transverse arrowheads around 5000-5500 cal BC might be due to rise in the importance of small game and fowling. Edgren (1993:102-104) suggests that long and narrow slate arrowheads (Pyheensilta type) were used in fowling. Nuñez and Gustavsson (1995:241) underline the importance of birds as spring food for the Stone Age cultures on the Åland archipelago. Nuñez & Okkonen (1999:113-114) come to the conclusion that the rich aquatic bird fauna could be a possible basis for the rise of monumental constructions called Giants' Churches near floodplains and estuaries of North Ostrobothnia around 3500 cal BC. According to Koivisto (1998a:49) and Torvinen (2000:24) the Early Neolithic site Vepsänkangas in Ylikiiminki (North Ostrobothnia) was occupied especially during the waterfowl nesting season.

The first analyses of Finnish archaeological bones were conducted by the Dane Herluf Winge (Ailio 1909; Winge 1914), and they include also bird bones. Afterwards many Finnish osteologists have identified bird bones from Finnish archaeological sites (Appendix 1). Osteological analyses are included in the excavation reports of archaeological sites stored in the National Board of Antiquities (NBA).

Bird bones are the only direct evidence of avian fauna hunted by prehistoric people in Finland. One rock painting of a bird in Savonlinna Saunalahdenniemi (Koponen *et al*. 1993:74-75), a few clay figurines representing birds (Karjalainen 1997; Pesonen 2000:185-186), the representations of swimming birds in pottery decoration (Edgren 1967; Nieminen & Ruonavaara 1982; Pesonen 1996), and the marks of feathers used as temper in pottery (Huurre 1984:46) yield indirect information on the utilisation of birds in Finnish prehistory. Birds' humeri have been used for making pottery decoration imprints at the Early Neolithic site of Jokkavaara in Rovaniemi (Torvinen 1999b:230). A wooden spoon (from Middle Neolithic) with a carved duck on the handle from eastern Finland (Huurre 1983:292) represents exported goods from the East.

AIMS OF THE STUDY

This article deals with all available data on bird bones from Finnish archaeological sites prior to the Iron Age. The aim is to present this material as completely as possible, and to study the utilisation of birds and fowling in prehistoric Finland. The main goals of my study are to point out the most important bird species in the prehistoric economies, and to indicate major trends in fowling.

Coastal and inland sites are treated separately in order to see differences in species composition (waterbirds and land birds). The inland and coastal sites are divided according to the location of the site during the prehistoric occupation. I discuss the possibilities for using birds in determining the occupation season of the sites. Fowling methods are studied based on the archaeological finds (assumed to be) connected to fowling from Finland and other European countries. Ethnographic sources are also used in the interpretation of Finnish prehistoric fowling.

BACKGROUND FOR THE STUDY: ECOLOGICAL SETTINGS AND THE SUBSISTENCE IN FINNISH PREHISTORY

The Mesolithic hunter-gatherers utilised coastal and inland resources (Siiriäinen 1981; Matiskainen 1990:213; Hiekkanen 1990; Nuñez 1996). The Mesolithic people based their subsistence on the hunting of elks, beavers and seals as well as fishing, fowling, and gathering (Siiriäinen 1981:13; Matiskainen 1990:214; Edgren 1993:30-36; Nuñez 1996; Räihälä 1999:208-209). It seems that about 5000 cal BC the subsistence base was clearly changing towards Baltic seals and a more maritime economy (Siiriäinen 1981:17; Matiskainen 1990:214; Nuñez 1996:24; see also criticism in Hiekkanen 1990).

The majority of Neolithic inland settlements in eastern and northern Finland are situated by lakes and rivers, and on islands within lakes. The economy of the Neolithic was based on hunting and gathering with the exception of the periods of Corded Ware Culture and Kiukainen Culture during which agriculture and/or animal husbandry may have been practised (Zvelebil 1978:224; Siiriäinen 1982; Zvelebil & Rowley-

Convy 1986:82, 83; Asplund & Vuorela 1989:75; Edgren 1993:112; Ukkonen 1999; Lavento 2001:139). Settlements of the Late Neolithic Kiukainen culture were located in a coastal zone (Meinander 1954:168-186; Edgren 1993:112-115; Carpelan 2000:23).

Due to the outer archipelago environments, the Neolithic economy on the Åland Islands was based mainly on Baltic Sea fauna. From the Late Neolithic agriculture and domestic animals were part of the economy (Nuñez 1986:19-20; Liden *et al*. 1992:9; Nuñez & Storå 1997; Storå 2000:71-72).

In the Bronze Age agriculture was already part of the cultures or at least known in many parts of Finland (Edgren 1993:137-140; Taavitsainen *et al*. 1998; Vuorela 1999:344; Lavento 2001:167). Subsistence during the Early Metal Period was connected with agriculture, although, like during the earlier prehistoric phases, hunting, fishing and gathering remained the base of the economy (Lavento 2001:139-141).

MATERIAL

Archaeological bird bones from Finland

The material for this study consists of bird bones found in connection with archaeological excavations and surveys of prehistoric sites in Finland (Fig. 1). The study includes all samples analysed predating 2002. Practically all bird bones come from dwelling sites. Excavation at one burial site from the Neolithic and one from Bronze Age have yielded bird bones (Vaateranta in Taipalsaari and Storby Mellanö in Eckerö). One sample (Tapola Kotojärvi in Iitti) resulted from underwater excavations near rock paintings (Ojonen 1974), and one sample (Korpilahti in Vuoksenranta) was found in connection with a net find (the find is also known as the Antrea net find) (Pälsi 1920; Luho 1967, Carpelan 1999:160-161). Three bird bone samples come from an area which today belongs to Russia, but which was part of Finland at the time of the excavation (Häyrynmäki in Viipuri, Otsoinen in Sortavala and Korpilahti in Vuoksenranta). The material is basically a review of existing unpublished osteological analyses made by different osteologists during a relatively long period (Appendix 1). I have originally identified some of the bird bones and checked and re-analysed some of the earlier identifications.

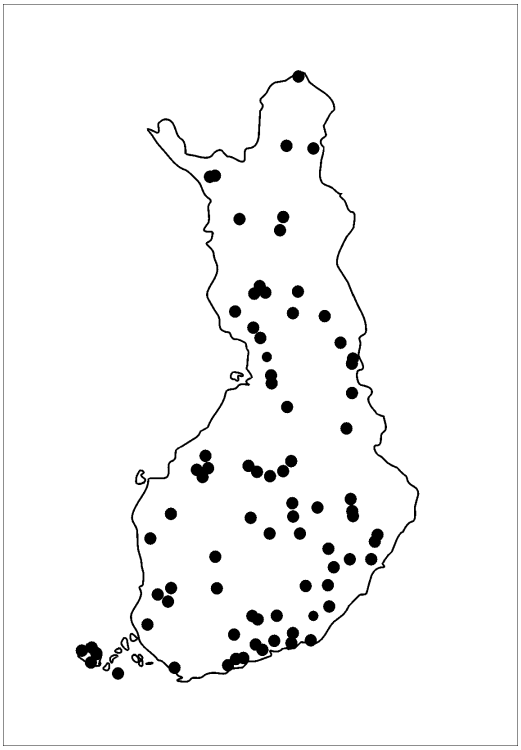

Fig. 1. Finnish sites containing bird bones from the Mesolithic, Neolithic, Bronze Age and the Early Metal Period (the sites which are today situated in Russia: Häyrynmäki in Viipuri, Korpilahti in Vuoksenranta (the Antrea net find) and Otsoinen in Sortavala are not included in the Figure).

Sites with bird bones are classified chronologically. Bone finds that can be dated to a specific prehistoric period are used in the archaeological interpretation of the data. By prehistoric periods I mean the main periods in Finnish prehistory prior to the Iron Age: the Mesolithic (ca. 8500-5000 cal BC), the Neolithic (ca. 5000-1900 cal BC), the Early Metal Period (ca. 1900-300 cal BC) and the Bronze Age (ca. 1500-500 cal BC) (Carpelan 1999b; Carpelan 2000). Bird bone samples from later than this are excluded here because the purpose of this paper is to study fowling in economies that were based (mainly) on hunting and gathering. The dating of sites and samples to a specific cultural stage is only

sometimes possible. These samples are so few that the precise investigation of cultural differences in fowling is difficult.

Fish and bird bones are usually easily distinguished from those of mammals. The osteological reports that form the basis of this study therefore contain a lot of bones assigned to the class Aves (birds). In the case of mammalian bones, on the other hand, only identified bones are documented. This means that the majority of the mammalian bones are not included and quantified in the analysis reports. Because of this, the proportions of bird and fish bones become relatively higher in a typical analysis report than in the sample.

Limitations related to the quality of samples

The restricted preservation of bones causes limitations in their identification. The principal problem in identifying burnt bones is their fragmentation and shrinkage (Fortelius 1981:11-16; Ekman & Iregren 1984:14; Ericson 1994: 252-253; Lyman 1994:391-392; Ukkonen 1996:65-67). The amount of shrinkage during burning varies depending on structural qualities of bone and the temperature (Iregren & Jonsson 1973; Okkonen 1991; Lyman 1994:386-390; Sigvallius 1994).

In this article the burnt bones are interpreted as resulting from human activity. I assume that burnt bones in settlement sites derive from food remains burned in fireplaces or from refuse pits into which the remains of prepared food were thrown. They may also be remains of animals used for other reasons than food (for example, fur animals), which were thrown into the fire. Bones from large animals may have served as fuel in the fireplaces (Welinder 1998:78, Théry-Parisot 2002). The colour of burnt bird bones varies from white to yellowish and brown.

Seven Finnish prehistoric sites include unburnt bird bones. Four of these are situated on the mainland and include only a few unburnt bones (Maarinkunnas in Vantaa (1 fragment), Jokiniemi Sandliden in Vantaa (1 fragment), Pohtiolampi in Kangasala (1 fragment) and Tapola Kotojärvi in Iitti (15 specimens). Due to the bad preservation of bones in Finnish soil, I suggest that the unburnt bones from the three former sites are not of prehistoric origin. Thus, all of these are excluded from this study. However, the finds from Tapola Kotojärvi are included in the study. These bones (from common goldeneye *Bucephala clangula*) were found in connection with underwater excavations beneath red-ochre rock paintings. Bones from elk (*Alces alces*) were also found in the same context as the bird bones, and a possible ritual character of these bones in connection with the painting has been suggested (Ojonen 1973:43). The dating of these bones is uncertain, but recent origin cannot be excluded. Eleven bones from swan (most likely whooper swan, *Cygnus cygnus*), found in Korpilahti in Vuoksenranta were deposited at the bottom of the Lake Ancylus (Pälsi 1920; Luho 1967:25-33; Carpelan 1999:160-161), which enabled their preservation.

Two large bone samples, Jettböle I in Jomala and Otterböte on the Island of Kökar, both located on the Åland Islands, consist predominantly of unburnt bones (Forstén 1977:56; Nuñez 1986:25; Lidén *et al*. 1995:6; Gustavsson 1997:44; Mannermaa 2002:86, 90). Both samples are interpreted as prehistoric and are included in the study. One sample of unburnt bird bones derives from a Bronze Age burial cairn (Storby Mellanö in Eckerö, the Åland Islands). It is included in the study, although a prehistoric origin of the bird bones is uncertain.

Problems related to the sites

The material used in this study derives from excavations conducted over a period of one hundred years which means that different methods were used in collecting it. For example, methods of documentation, collecting finds, sieving, etc., vary in archaeological investigations even today. It has been clearly demonstrated in several studies that fine mesh- or water sieving strongly affects the bone sample, especially the bones of small animals (Payne 1975:13; Aaris-Sørensen 1980:141-142; Lindqvist 1988:13-14; Lindqvist 1997; O'Connor 2001).

The bone samples in this study derive from excavations of different extent. The original

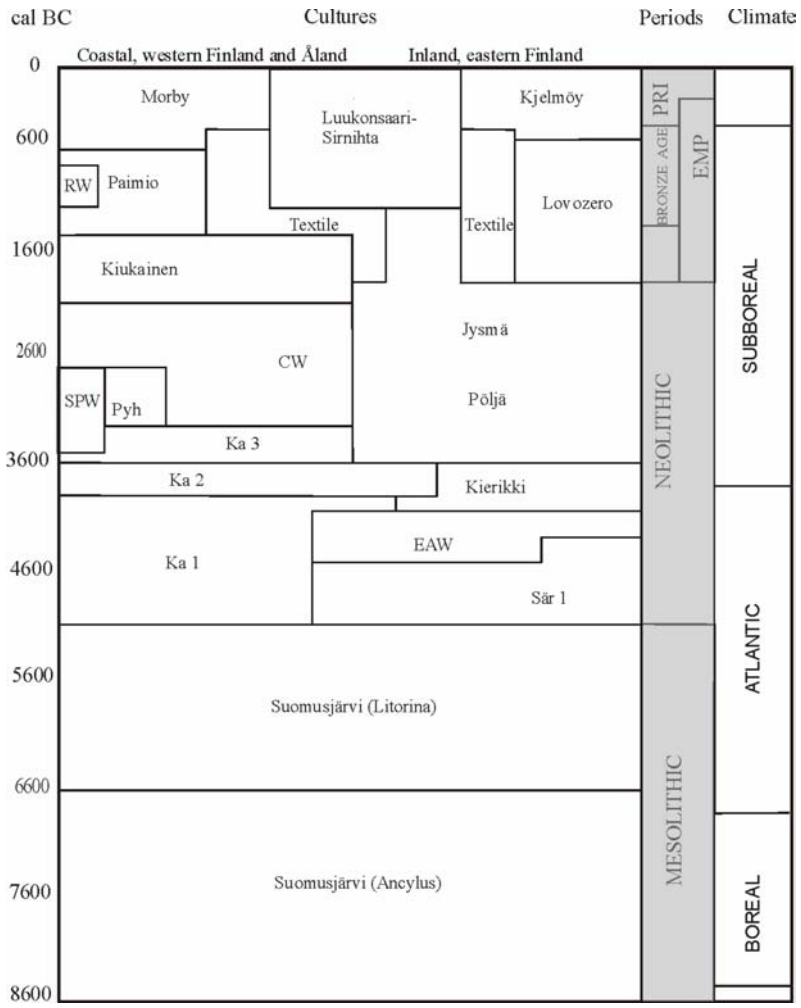

Fig. 2. General chronology for Finnish prehistory prior to the Iron Age and the climate chronozones (drawn by the author according to Carpelan 1999b and Carpelan 2000). Suomusjärvi = Suomusjärvi Culture, Sär 1 = Säräisniemi Ware 1, Ka 1 = Early Comb Ware 1, EAW = Early Asbestos Ware, Ka 2 = Typical Comb Ware, Ka 3 = Late Comb Ware, Kierikki = Kierikki Ware, Pöljä = Pöljä Ware, Jysmä = Jysmä Ware, Pyh = Pyheensilta Ware, Kiukainen = Kiukainen Ware, CW = Corded Ware, SPW = Scandinavian Pitted Ware, Paimio = Paimio Ware, Textile = Textile Ware, Kjelmöy = Kjelmöy Ware, Lovozero = Lovozero Ware, Lu-Si = Luukonsaari-Sirnihta Ware, Morby = Morby Ware, RW = Rusticated Ware, EMP = Early Metal Period, BA = Bronze Age, PRI = Pre-Roman Iron Age.

size of a dwelling site and the extent of the excavated area affect the bone material. This limits, together with the taphonomic problems connected with burned bone samples, the quantitative comparison of samples.

Another archaeological problem is connected with the mixing of cultural layers. Many sites have been in use over a long period. Sometimes different settlement phases are distinguished stratigraphically. When the soil has been disturbed, for example in modern agriculture, the stratigraphy may be disturbed, and the find material from different phases mixed. For this reason, or some of the others mentioned above, it is often impossible to connect bones or bone samples to specific cultural phases (Fig. 2).

Table 1. Radiocarbon datings from contexts connected with bird bones. The radiocarbon dates quoted here are dates BP (meaning radiocarbon years before present, i.e., before AD 1950). The radiocarbon ages are calibrated according to the "Original Groningen Method" based on cumulative probability analysis, included in the Cal25 computer program, to correspond approximately with calendar dates BC (cal BC) (van der Plicht 1993). The calibrated errors are not given. NM number: Finnish National Museum.

Site and cat nr.	Bird taxa	Lab	C14-dating	Calibrated dating	Material	Reference
Korpilahti in Vuoksenranta (former Finland) NM 6688:6	*Cygnus cygnus*	Hel-1303 Hel-269	9310+-140 BP 9230+-210 BP	8570 cal BC 8490 cal BC	Net float of bark (*Pinus*)	Carpelan 1999a
Saamen museo in Inari NM 27808:454.522	Tetraonidae sp.	Hel-3568	7330+-120 BP	6190 cal BC	Charcoal from bone concentration	Seppälä 1993
Vuopaja in Inari NM 28365:789.927	*Gavia* sp.	Hel-3583	4490+-90 BP	3180 cal BC	Charcoal	Seppälä 1994
Jettböle I in Jomala NM 4781:342	*Somateria mollissima. Melanitta* sp.. Anatidae sp.. Aves sp.	Ua-110688	3825+-70 BP	2280 cal BC	Elk bone	Storå 2000
Jettböle I in Jomala I NM 5180:707	*Phalacrocorax carbo. Cygnus cygnus. Melanitta fusca. Somateria mollissima. Mergus merganser. Mergus* sp.. *Anas platyrhynchos.* Anatidae sp.. *Cepphus grylle*	Ua-10687	4275+-65 BP	2890 cal BC	Elk bone	Storå 2000
Bläckisåsen II in Kokkola NM 22821:164	*Caprimulgus europaeus*	Su-1484	4860+-80 BP	3650 cal BC	Charcoal from fireplace	Seger 1985
Kuorikkikangas E in Posio NM 28917:559.661.668.698.713.802	*Lagopus lagopus*	Su-2679 Su-2680	3940+-70 BP 4140+-90 BP	2420 cal BC 2710 cal BC	Charcoal	Pesonen 1995
Jokkavaara in Rovaniemi NM 21012:214	*Tetrao tetrix*	Hel-1581	6300+-110 BP	5250 cal BC	Charcoal from fireplace	Torvinen 1999a
Sierijärvi Riitakanranta in Rovaniemi NM 26172	*Tetrao urogallus*. Aves sp.	Tku-037	3040+-90 BP	1280 cal BC	Charcoal from fireplace	Huurre 1983. Torvinen 1980
Autiokenttä II in Sodankylä NM 20592:26	Tetraonidae sp.	Hel-1273 Hel-1621	7030+-240 BP 7930+-110 BP	5910 cal BC 6840 cal BC	Charcoal	Kotivuori 1989 and 1990
Kuusiankangas in Yli-Ii NM 28943:661.663.704	*Podiceps auritus*	Su-2699	4620+-50 BP	3440 cal BC	Charcoal from find concentration	Katiskoski 1995

METHODS

Collecting material

Osteological reports were checked by the author, and identified bird bones were listed. Because analyses were made by different persons, differences in the reliability and accuracy of the individual analysis cannot be excluded. The extent of the reference collection and the experience of the analyst have effects on the results of the analysis.

Some of the bones were re-examined. When the species was identified, I generally deduced that the identification was likely to be correct. I also checked species found in one or two sites only (slavonian grebe *Podiceps auritus*, european night jar *Caprimulgus europaeus* and black guillemot *Cepphus grylle*). All bones identified only to family or genus level were checked and re-analysed. Pieces of bone artefacts and bones with butchering marks were always checked. In some cases, the re-identification was not possible because of difficulties of getting the material from regional museums.

Re-examination of bone samples

The re-analysis of the material was carried out in the Zoological Museum in Helsinki, and its bird skeleton collection was used as reference material. A small collection of bones was taken to the Museum of Natural History in Stockholm to secure the identification. All re-identifications were made by me except two finds of eurasian woodcock (*Scolopax rusticola*) which were identified by Per Ericson at the Museum of Natural History, Stockholm.

The re-examination resulted in a major revision. All uncertain identifications (for example Anas sp. cf. *Anas crecca*) were revised to the nearest identifiable level (*Anas* sp.). This was necessary in order to make the material uniform and to minimise the effects of possible misinterpretations.

Dating of bone samples

As mentioned above, many sites were occupied over a long period of time. The documentation does not always allow the precise determination of the cultural phase where a certain find belongs. The so-called multi-period sites (sites that contain finds

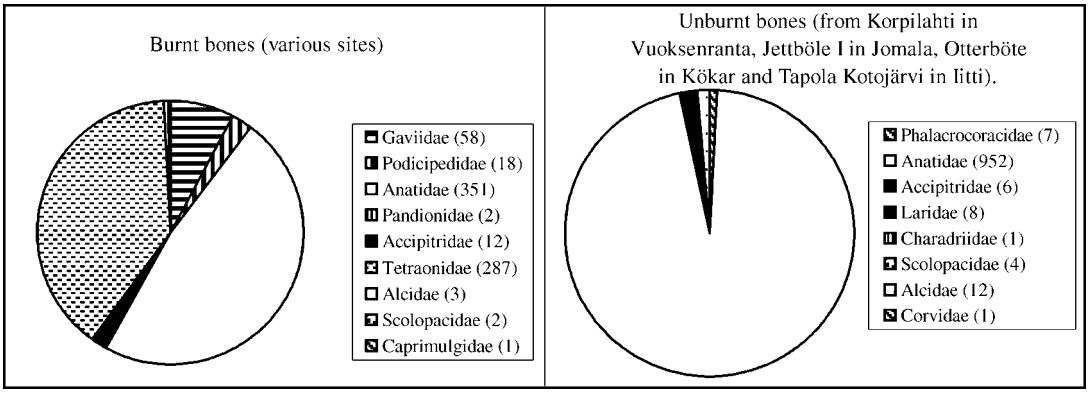

Fig. 3. The distribution of Finnish prehistoric bird bones according to bird families (number of specimens).

from two or more of these periods) are not included in the archaeological interpretation.

The dates of sites and bird bones were collected from excavation reports in the NBA. In some cases, the excavating archaeologists were consulted. All archaeological datings are given as calendar years (cal BC). Sometimes a radiocarbon date (^{14}C) is available from the same context as the bird bones (usually from charcoal in fireplaces or organic crusts on ceramics) (Table 1). The same context means here that these finds were found in one undisturbed (closed) entity. This radiocarbon date is the interpreted age of the bone (and the other finds in the context), and is used here alongside with the archaeological date. All ^{14}C -dates will be given as radiocarbon years (BP) and calibrated calendar years (cal BC).

Determination of the fowling season

Bones from young birds can be used as indicators of breeding and a late spring or summer hunting season, as can birds with medullary bones (calcium formation in the long bones of female birds during the incubation period) (Serjeantson 1998:26-27). The presence of migratory species indicates hunting during the spring, summer or autumn.

RESULTS

Re-examination

A total of 436 bird bone specimens were checked and re-analysed (98 specimens, included in the list of material that should have been checked, were not available for re-analysis). Identification of 307 specimens remained unchanged after the re-analysis. Ninety-four specimens could be identified more precisely so that either species, genus or family could be given (for example, Aves sp. turned out to be *Gavia* sp.). Thirty specimens were re-assigned to the more general level (for instance *Aythya* sp. turned out to be Anatidae sp.). Five specimens turned out to belong to totally other taxa than previously identified (for example, Anatidae sp. turned out to be Tetraonidae sp.)

Prehistoric bird bones from Finland

Finnish sites containing bird bones and the identified bird taxa are given in Appendices 2 and 3. A total of 2398 specimens of bird bones have been identified in 156 samples from 115 sites. A little less than half of these (1139) are burnt and little more than half (1259) unburnt.

About 40 % of the burnt bird bones and 67 % of unburnt bones are assigned to species or genus level. The identified taxa belong to 13 different families (Fig. 3). About 35 % of burnt and 21 % of unburnt bones could only be identified as to class level (Aves).

Altogether 28 species are represented in the material (Table 2). Four species, common eider (*Somateria mollissima*), velvet scoter (*Melanitta fusca*), willow grouse (*Lagopus lagopus*) and capercaillie (*Tetrao urogallus*) stand out clearly in the list. The first two of these species are numerous because of Jettböle I in Jomala, where these species

Table 2. Bird bones from Finnish prehistoric sites (the Stone Age, the Bronze Age and the Early Metal Period) (NISP= Number of identified specimens).

Taxa	Total NISP	Burned NISP	Unburned NISP
Black-throated diver (*Gavia arctica*)	5	5	-
Red-throated diver (*Gavia stellata*)	14	14	-
Undetermined diver (*Gavia* sp.)	39	39	-
Slavonian grebe (*Podiceps auritus*)	5	5	-
Red-necked grebe/Great crested grebe (*Podiceps grisegena/Podiceps cristatus*)	13	13	-
Great cormorant (*Phalacrocorax carbo*)	7	-	7
Whooper swan/indet swan (*Cygnus cygnus/Cygnus* sp.)	35	15	20
Undetermined goose (*Anser* sp.)	4	2	2
Undetermined goose (*Anser* sp./*Branta* sp.)	1	-	1
Mallard (*Anas platyrhynchos*)	22	18	4
Mallard/European wigeon (*Anas platyrhynchos/Anas penelope*)	8	8	-
Teal (*Anas crecca*)	19	19	-
Teal/Garganey (*Anas crecca/Anas querquedula*)	12	12	-
Tufted duck/Greater scaup (*Aythya fuligula/Aythya marila*)	6	6	-
Anas sp./*Aythya* sp.	1	1	-
Anas sp.	16	16	-
Common eider (*Somateria mollissima*)	657	19	638
Velvet scoter (*Melanitta fusca*)	105	5	100
Common eider/Velvet scoter (*Somateria mollissima/Melanitta fusca*)	10	-	10
Common scoter (*Melanitta nigra*)	2	-	2
Melanitta sp.	18	3	15
Long-tailed duck (*Clangula hyemalis*)	8	8	-
Golden eye (*Bucephala clangula*)	3	-	3
Golden eye/ Long-tailed duck (*Bucephala clangula/Clangula hyemalis*)	1	1	-
Smew (*Mergus albellus*)	5	5	3
Goosander (*Mergus merganser*)	11	4	7
Red-breasted merganser (*Mergus serrator*)	2	-	2
Mergus sp.	17	1	16
Mergus sp./*Melanitta* sp.	9	1	8
Common eider/Goosander (*Somateria mollissima/Mergus merganser)*	1	-	1
Undetermined duck. (Anatidae sp.)	327	207	120
White-tailed sea eagle (*Haliaeetus albicilla*)	3	-	3
Osprey *Pandion haliaetus*	2	2	-
White-tailed sea eagle/Golden eagle (*Haliaeetus albicilla/Aquila chrysaetos*)	7	7	-
Accipitridae sp./Pandionidae sp.	7	7	-
Willow grouse (*Lagopus lagopus*)	104	104	-
Capercaillie (*Tetrao urogallus*)	79	79	-
Black grouse (*Tetrao tetrix*)	47	47	-
Willow grouse/Black grouse (*Lagopus lagopus/Tetrao tetrix*)	18	18	-
Hazel grouse (*Bonasa bonasia*)	7	7	-
Capecaillie or black grouse *Tetrao* sp.	3	3	-
Undetermined grouse (Tetraonidae sp.)	29	29	-
Ruddy turnstone (*Arenaria interpres*)	1	-	1
Western curlew (*Numenius arquata*)	2	-	2
Eurasian woodcock (*Scolopax rusticola*)	3	2	1
Ruff (*Philomachus pugnax*)	1	-	1
Herring gull/Black-backed gull (*Larus argentatus/Larus marinus*)	1	-	1
Lesser black-backed gull/Herring gull (*Larus fuscus/Larus argentatus*)	4	-	4
Undetermined gull (*Larus* sp.)	6	-	6
Laridae sp.	1	-	1
Black guillemot (*Cepphus grylle*)	14	2	12
Razorbill (*Alca torda*)	1	1	-
Undetermined owl (Strigiformes sp.)	4	4	-
European nightjar (*Caprimulgus europaeus*)	1	1	-
Carrion crow (*Corvus corone*)	1	-	-
Undetermined birds (Aves sp.)	667	399	268
Total	2398	1139	1259

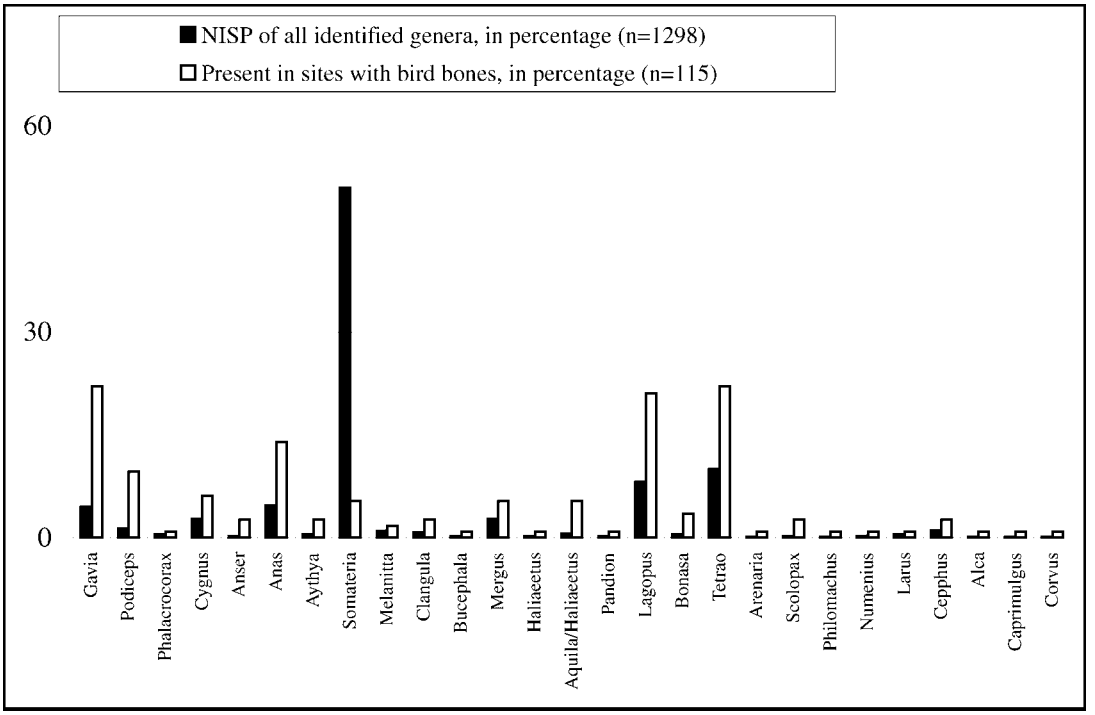

Fig. 4. The commonness of identified bird genera from Finnish Stone Age, Bronze Age and Early Metal period. NISP = number of identified specimens.

dominate in the bird sample, and Otterböte in Kökar where the common eider dominates. Mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*) as well as divers (genus *Gavia*) and swans (genus *Cygnus*) are relatively well represented. It is difficult to assign fragmented bones from swans to species, but the majority of the Finnish prehistoric swan bones probably derive from the whooper swan. Swans are not common in Finnish prehistoric sites. Only 7 of 105 sites include bones from swans, and the total number of identified bones is 35. Bones from the swan, found in the same context with remains of a net in Korpilahti in Vuoksenranta (Pälsi 1920:14; Luho 1967; Carpelan 1999a:160-161), are the oldest bird bones from Finland (about 8500 cal BC).

The frequencies of different taxa are estimated by their relative representation at all sites where bird bones have been found. In Figure 4 the frequencies of different genera in sites are compared to the total number of fragments (NISP). The most common genera are *Tetrao*, *Lagopus*, and *Gavia*, which all are present in more than 20 % of all sites. Ducks (family Anatidae) are present in 46 %, gallinaceous species (family Tetraonidae) in 22 %, divers (*Gavia* sp.) in 17 %, and grebes (*Podiceps* sp.) in 7 % of all samples.

The average proportion of bird bones at Finnish sites (on the mainland and Åland) where bird bones are present is about 6.2 % of all identified bone fragments. Samples from all excavation seasons at each site are added together in these counts. But as mentioned above, mammal fragments are underestimated because of methodological reasons. Nine sites are excluded from the count because the total number of identified bones is unknown. The Bronze Age burial site Storby Mellanö in Eckerö, a Stone Age burial site Taipalsaari Vaateranta, the red-ochre painting site Tapola Kotojärvi in Iitti, and the net find from Korpilahti in Vuoksenranta are also excluded because they do not represent refuse faunas.

Two relatively large bird bone samples, from Vepsänkangas in Ylikiiminki (the relative number of bird bone fragments is 21.7 %) and Otterböte in Kökar (the number of bird bone fragments is 15.6 %) include a clearly higher proportion of bird bones than the average. The relative number of bird bones is also high at

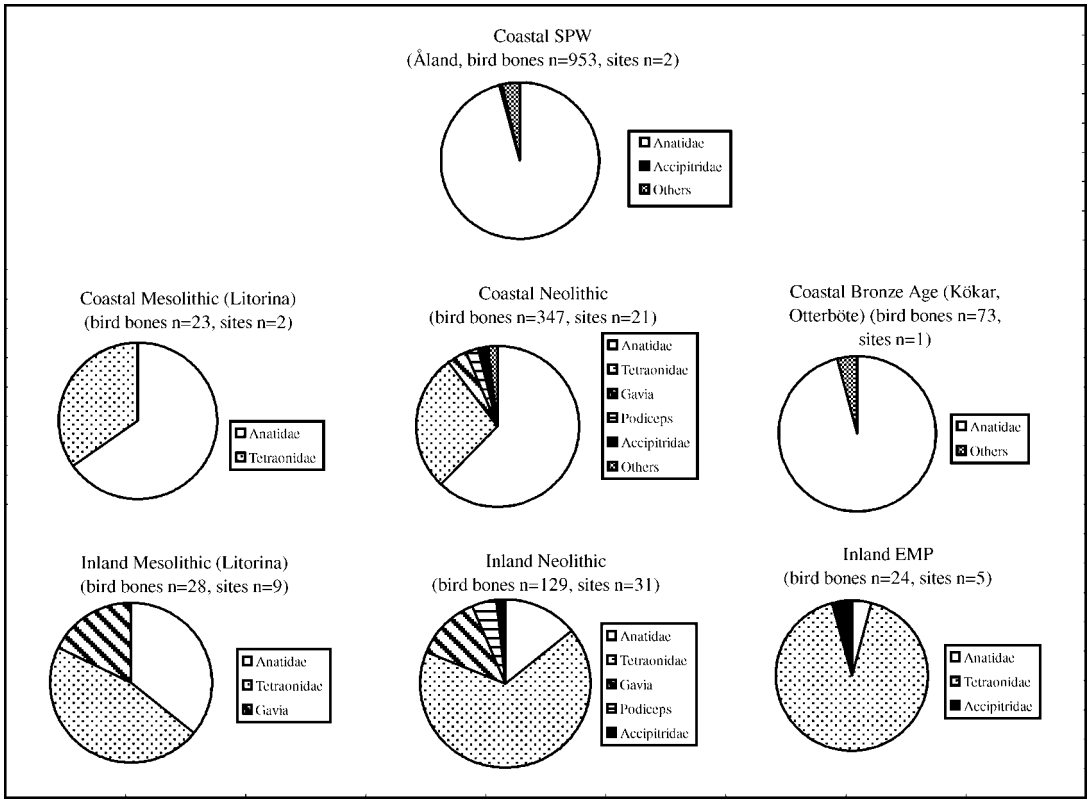

Fig. 5. The distribution of bird bones from Finnish prehistoric settlement sites according to prehistoric periods (numbers of specimens). All Scandinavian Pitted Ware (SPW) sites are located in the Åland Islands, and the only Bronze Age sample comes from Otterböte in Kökar, the Åland Islands. Only bone fragments which could be identified as belonging to the families or genera Gavia *or* Podiceps *are included in the Figure.*

Bosmalm in Espoo (20 %), Bläckisåsen II in Kokkola (30.8 %), Voudinniemi in Saarijärvi (36 %) and Ala-Jalve in Utsjoki (28.6 %), but the number of identified fragments from these sites is small.

Cultural aspects

The material was grouped in six periods according to the dating and the locations of the sites (Fig. 5). From the figure, it is clearly seen that gallinaceous birds and ducks dominate in all periods. At inland sites, the gallinaceous birds are more common than ducks in all periods. At coastal sites, ducks are more common than gallinaceus birds in all periods. Divers are more common at inland Neolithic sites than at coastal Neolithic ones. They are not represented in coastal Mesolithic and inland Early Metal Period sites.

Only a few bird species have been identified from Mesolithic sites (Table 3). This could indicate limited utilisation of birds. Mesolithic people hunted mainly bird species typical of inland environments. Neolithic materials have yielded the largest number of identified taxa, and seem to represent a varying and intensive utilisation of birds. The number of identified fragments and bird taxa are relatively high. Bird species from both inland and coastal environments are present.

Coastal and inland aspects

A total of 53 coastal and 62 inland sites yielded bird bones in Finland (Appendix 2). About 82 % of all bones (and about 64 % of burnt bones) derive from sites situated by the Litorina Sea or Lake Ancylus (a sample from

Table 3. Bird taxa from Finnish prehistoric periods (in NISP, numbers of identified specimens).

Taxa	Mesolithic	Neolithic	Bronze Age	Early Metal Period
Black-throated diver (*Gavia arctica*)	-	5	-	-
Red-throated diver (*Gavia stellata*)	-	7	-	-
Undet. diver (*Gavia* sp.)	5	18	-	-
Slavonian grebe (*Podiceps auritus*)	-	5	-	-
Red-necked grebe/Great crested grebe (*Podiceps grisegena*/*Podiceps cristatus*)	-	10	-	-
Great cormorant (*Phalacrocorax carbo*)	-	7	-	-
Whooper swan/indet. swan (*Cygnus cygnus*/*Cygnus* sp.)	11	7	-	-
Undetermined goose (*Anser* sp.)	-	2	-	-
Undetermined goose (*Anser* sp./*Branta* sp.)	-	1	-	-
Mallard (*Anas platyrhynchos*)	-	23	-	-
Mallard/European wigeon (*Anas platyrhynchos*/*Anas penelope*)	-	7	-	-
Teal (*Anas crecca*)	1	17	-	-
Teal/Garganey (*Anas crecca*/*Anas querquedula*)	1	6	-	-
Anas sp.	-	15	-	-
Anas sp./*Aythya sp.*	1	-	-	-
Tufted duck/Greater scaup (*Aythya fuligula*/*Aythya marila*)	-	5	-	-
Golden eye/Long-tailed duck (*Bucephala clangula*/*Clangula hyemalis*)	-	1	-	-
Common eider (*Somateria mollissima*)	-	587	70	-
Velvet scoter (*Melanitta fusca*)	-	104	-	-
Common scoter (*Melanitta nigra*)	-	2	-	-
Long-tailed duck (*Clangula hyemalis*)	2	6	-	-
Smew (*Mergus albellus*)	-	5	-	-
Goosander (*Mergus merganser*)	-	8	-	-
Red-breasted merganser (*Mergus serrator*)	-	2	-	-
White-tailed sea eagle (*Haliaeetus albicilla*)	-	2	-	-
White-tailed sea eagle/Golden eagle (*Haliaeetus albicilla*/*Aquila chrysaetos*)	-	5	-	1
Osprey (*Pandion haliaetus*)	-	2	-	-
Willow grouse (*Lagopus lagopus*)	8	81	-	2
Capercaillie (*Tetrao urogallus*)	6	30	-	19
Black grouse (*Tetrao tetrix*)	2	37	-	-
Hazel grouse (*Bonasa bonasia*)	-	7	-	-
Ruddy turnstone (*Arenaria interpres*)	-	1	-	-
Western curlew (*Numenius arquata*)	-	2	-	-
Eurasian woodcock (*Scolopax rusticola*)	-	2	-	-
Ruff (*Philomachus pugnax*)	-	1	-	-
Herring gull/Black-backed gull (*Larus argentatus*/*Larus marinus*)	-	-	1	
Lesser black-backed gull/Herring gull (*Larus fuscus*/*Larus argentatus*)	-	4	-	-
Undetermined gull (*Larus* sp.)	-	1	-	
Black guillemot (*Cepphus grylle*)	-	14	1	-
Razorbill (*Alca torda*)	-	1	-	-
European nightjar (*Caprimulgus europaeus*)	-	1	-	-
Carrion crow (*Corvus corone*)	-	1	-	-

Korpilahti in Vuoksenranta) at the time of occupation. The rest of the fragments (18 % of all bones and 36 % of burnt bones) derive from the sites situated inland, by or near lakes or rivers.

Altogether 19 of all species are present only at coastal sites (Fig. 6). It is notable that divers, which breeds on inland lakes, have been found at many coastal sites. The gallinaceus species, excluding hazel grouse (*Bonasa bonasia*), derive mainly from inland sites, and many of the duck species derive entirely from coastal sites. Common goldeneye (*Bucephala clangula*) is present at one inland site only (however, the prehistoric character of these remains doubtful).

Seasonal indicators

The Finnish material contains a total of 35 bone specimens from young birds (the epiphyses are

Table 4. Bird bone artefacts, cutmarks and pathological changes in bird bones from Finnish prehistoric sites (the Stone Age, the Bronze Age and the Early Metal Period).

Modification	Site	Museum number	Bone	Taxa	Burned/ unburned
Artefact?	Vihi 1 in Rääkkylä	NM 30460:11697	ulna	Anatidae sp.	b
Artefact	Korpilahti in Vuoksenranta (former Finland)	NM 6688:28	humerus	*Cygnus cygnus*	ub
Artefact	Hiitteenharju in Harjavalta	NM 20493:603	radius	Anatidae sp.	b
Artefact	Jettböle I in Jomala	NM 5180:783	tibiotarsus	*Somateria mollissima*	ub
Artefact	Jettböle I in Jomala	NM 5907:488	humerus	*Phalacrocorax carbo*	ub
Cutmarks	Veskankangas in Kuivaniemi	NM 26699:117	undetermined	Aves sp.	b
Cutmarks	Vihi 1 in Rääkkylä	NM 30460:11624	ulna	Anatidae sp.	b
Cutmarks	Jettböle I in Jomala	NM 5180:707	humerus	*Cygnus* sp. cf. *Cygnus cygnus*	ub
Cutmarks	Jettböle I in Jomala	NM 5907:16	humerus	*Somateria mollissima*	ub
Pathological changes	Jettböle I in Jomala	NM 5180:718	carpometacarpus	*Somateria mollissima*	ub
Pathological changes	Vepsänkangas in Ylikiiminki	NM 31036:625	humerus	*Gavia* sp.	b
Pathological changes	Vepsänkangas in Ylikiiminki	NM 31036:628	coracoideum	*Gavia* sp.	b
Pathological changes	Jettböle I in Jomala	NM 5180:747	scapula	*Somateria mollissima*/ *Melanitta fusca*	ub
Pathological changes	Jettböle I in Jomala	NM 5180:718	coracoideum	*Somateria mollissima*	ub
Pathological changes	Jettböle I in Jomala	NM 5180:718	vertebra	Anatidae sp.	ub

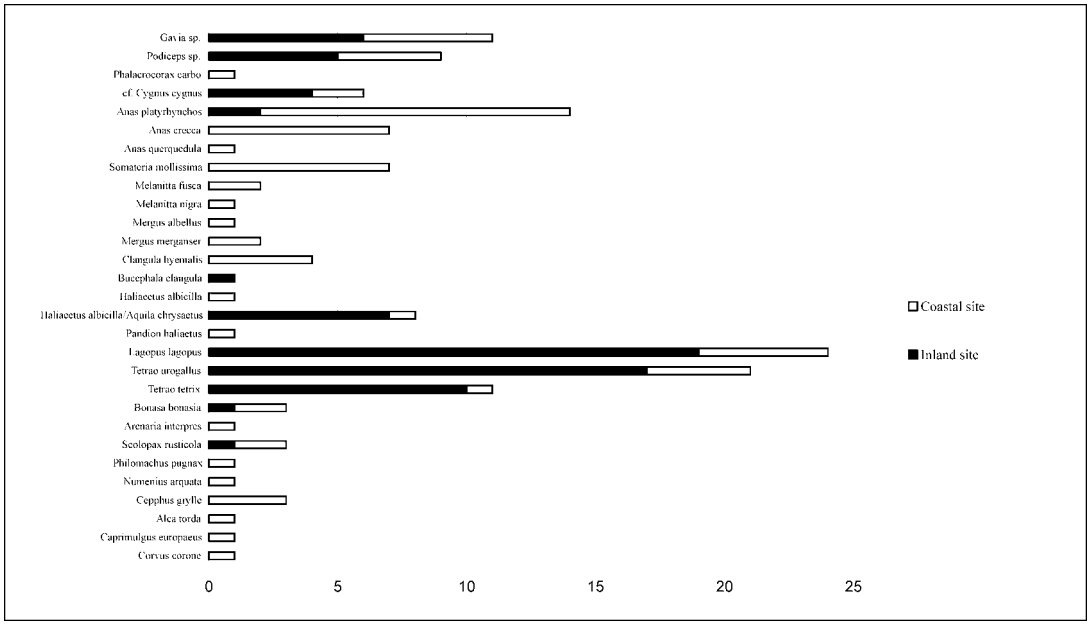

Fig. 6. Prehistoric coastal and inland sites containing bird species and the genera Gavia *and* Podiceps *(Mesolithic, Neolithic, Early Metal Period and Bronze Age) (the Mesolithic Antrea net find is excluded from Figure because it does not represent a settlement site).*

loose or only partially fused and the bone surface is rough). They come from two places, Jettböle I in Jomala on the Åland Islands (common eider, black guillemot, and an undetermined gull Laridae sp.), and Maarinkunnas in Vantaa in southern Finland (common eider). The medullary bone has been observed in 52 unburnt samples from two sites on the Åland Islands, Jettböle I (common eider, velvet scoter and western curlew *Numenius arquata*) and Otterböte in Kökar

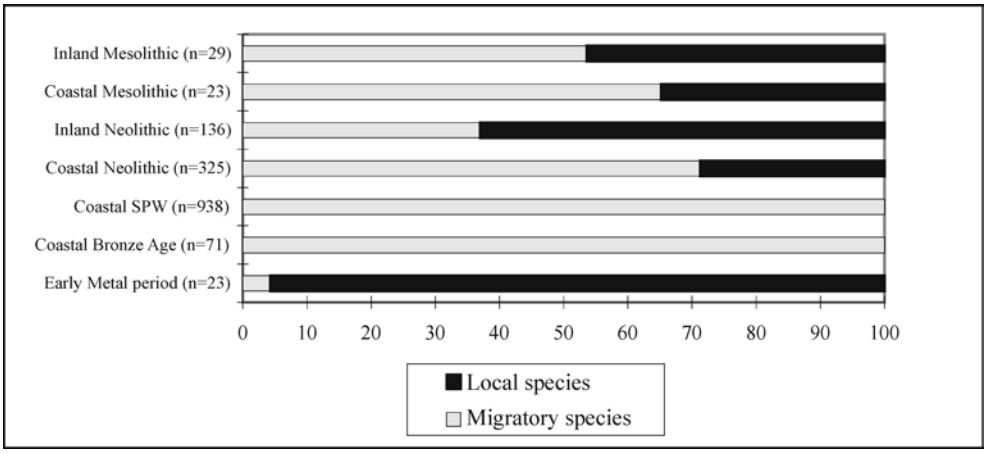

Fig. 7. The distribution of bird bones from Finnish prehistoric sites in to migratory and local species (percentages). The material used in this Figure is the same as in Fig. 6.

(common eider). These sites were occupied at least during the spring or summer.

Migratory species are more numerous than local species at coastal sites, and local species are more common at inland sites than at coastal sites (Fig. 7). The exception is inland Mesolithic where migratory species are slightly more numerous than local species. Here, again, the sample size affects the interpretation of the results.

Butchering marks, artefacts and pathological changes

Five artefacts or pieces of artefacts made of bird bone were recognised in the material (Table 4). Artefacts from Jettböle I in Jomala are awls (Fig. 8). One humerus of a swan from Vuoksenranta has been worked on its distal end (Fig. 9). Other fragments are so small that it is impossible to say from what kind of artefacts they derive.

Four bird bone specimens from three sites have cutmarks or possible cutmarks and six bird bones from two sites show pathological changes. Cutmarks on the distal part of humerus from the whooper swan at Jettböle I in Jomala may have been caused when the ulnar wing was separated from the humeral wing. The humerus from the common eider at Jettböle I in Jomala has one deep cutmark with several light scrapes around it on the supraproximal part. This bone might be an unfinished awl. The origin of marks on the other bones is not possible to estimate. The pathological changes on bones from Jettböle I and Vepsänkangas are probably caused by advanced age of bird individual.

Bird bones in graves

Bones from birds are present only at one Neolithic burial, Vaateranta in Taipalsaari. One bone of *Anas* –genus duck and three bones of undetermined birds were found under a red ochre layer, together with a few remains of human bones, and most probably represents grave goods (K. Katiskoski, pers. comm. 2000). In the Bronze Age grave mound at Storby Mellanö in Eckerö, a number of unburnt fragments from undetermined bird species are present (Iregren, unpublished manuscript; Martinsson-Wallin & Wallin 1986:116). The connection of these bird bones with the burials is uncertain.

DISCUSSION

Birds in Finnish prehistory

Ducks and gallinaceus birds were the most commonly utilised bird families in Finland during Mesolithic and Neolithic. The obvious exception is the Åland archipelago where gallinaceus species are absent from the prehistoric material. The scarce bone material from the Bronze Age and Early Metal Period does not allow any precise interpretations. Ducks and gallinaceous birds form the

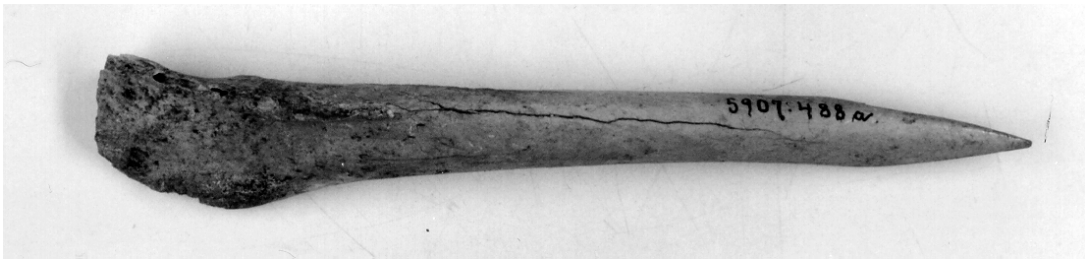

*Fig. 8. Awl made from humerus of the great cormorant (*Phalacrocorax carbo*). Jomala Jettböle I, the Åland Islands. The length of the awl is 10.3 cm. Photo: Kristiina Mannermaa.*

main groups also in the prehistoric avian materials from northern Sweden (Ekman & Iregren 1984:27-28). Waterbirds (mainly ducks, grebes, divers and waders) grey heron (*Ardea cinerea*) and capercaillie seem to have a dominate place in the Mesolithic and Early Neolithic avian material from Central Russia (Zhilin & Karhu 2002; Mannermaa 2002b; Zhilin & Matiskainen 2003:695-698; Chaix 2003:647). Waterbirds dominate in bird bone samples from Mesolithic and Neolithic Estonia (Lõugas *et al*. 1996:403; Mannermaa 2002c), Neolithic Latvia (Loze 1993:132) and Neolithic Lithuania (Bilskiene & Daugnora 2000; Daugnora *et al*. 2002). It is interesting to note that ducks and gallinaceous birds form the two most important groups in contemporary hunting in Finland — the development of hunting methods has not brought about any great change.

The majority of bird bones identified in Finnish prehistoric samples derive from ducks. However, the most common bird genera in Finnish prehistory (excluding the Åland Islands) are the two gallinaceous genera *Tetrao* and *Lagopus* and the diver genus *Gavia*. They are present at more than 20 % of the sites containing identified bird genera. Willow grouse is the most numerous bird species in burnt bone material in Finland. The small number of identified species or genera from the duck family is mostly caused by difficulties in identification. Nevertheless, the swans and swimming ducks (*Anas* sp.) are relatively often present in Finnish prehistoric material (excluding material from the Åland Islands). The relatively high proportion of swan bones is due to the Antrea net find including eleven specimens from Korpilahti in Vuoksenranta. The most common identified species in the genus *Anas* are mallard, the biggest species, and green-winged teal, the smallest species. Common eider was the most important species on the Neolithic Åland Islands. The total number of identified common eider bones exceeds 650, which makes it the most numerous bird species in Finnish prehistoric bone material prior to the Iron Age. Only seven of these have been identified (at five sites) in Finnish mainland.

Ducks (Anatidae)

Small and middle sized ducks were the most important game birds for Finnish prehistoric

Fig. 9. Worked humerus from undeterminated swan (most likely the whooper swan Cygnus cygnus*) from Korpilahti in Vuoksenranta (the Antrea net find). The length of the artefact is 18.8 cm. Photo: Ritva Bäckman, National Board of Antiquities.*

hunters. This is indicated clearly in the bone material, although species are rarely identified.

Mallard is the most commonly identified duck species in prehistoric samples from the Finnish mainland. All mallard bones derive from the Neolithic. The frequency of mallards is at least partly explained by the fact that it is the biggest of the *Anas* -species, and thus frequently identified. However, it has to be remembered that the identification of mallard and other middle-sized duck species in burnt material is in many cases doubtful. Mallard is the most commonly identified duck species also in other northern European prehistoric refuse faunas (e.g., Lepiksaar 1982; Hufthammer 1997:54; Ljungar 1996; Daugnora *et al*. 2002:236; Zhilin & Karhu 2002:112; Ericson & Tyrberg, in press).

Goosander (*Mergus merganser*), red-breasted merganser (*Mergus serrator*), common goldeneye (*Bucephala clangula*) and long-tailed duck (*Clangula hyemalis*) are rare in Finnish bone samples. The scarcity of these species is most likely caused by bad preservation and identification problems. The rarity of long-tailed ducks seems perhaps most surprising. Its skeleton is characteristic, and complete bones as well as fragments from epiphyses should be easily separated from other middle-sized ducks.

The low representation of geese (*Anser* sp., *Branta* sp.) in Finnish refuse faunas is also surprising. During historic times, geese have been important species in the hunting practised in northern Sweden and Finland (e.g., Ekman 1910:189; Itkonen 1948a:272; Storå 1968). Geese are found among the refuse fauna of the historic Saami summer village site of Juikenttä in Sodankylä (Carpelan 1992:37). Archaeological finds of geese in other northern European Stone Age sites are common (e.g., Ljungar 1996; Zhilin & Karhu 2002:112; Ericson & Tyrberg, in press). The reasons for the scarcity of geese in Finnish refuse fauna remains open.

All prehistoric sites where common eider is present in Finland, were situated on the inner or outer archipelago, near the breeding sites of eiders. The high number of common eiders on sites from the Åland Islands can be interpreted as an indication of a culture specialised in marine fauna. The scarcity of common eider bones at coastal sites on the Finnish mainland might be explained by the fact that these coastal dwelling peoples did not commonly practise hunting in the outer parts of the archipelago. However, the finds of remains of pelagic harp seal (*Phoca groenlandica*) at several Stone Age sites on the Finnish coast (Ukkonen 2002) does not support this interpretation. According to Storå (2002:46), the main season for harp seal hunting was late spring through early autumn, the same period when common eider is present within Finnish waters.

Swans have probably been of special importance for prehistoric cultures. Swans are represented in one Finnish red-ochre rock painting, and they are frequently represented in the rock carvings in Lake Ladoga and Lake Onega region in Russia (Storå 1968:152-153; Koponen *et al*. 1993:74-75; Pesonen 1996:110). Many bird representations in the decoration on Neolithic pottery resemble swans (Pesonen 1996:11). Considering the frequency of swan motifs in art, the scarcity of swan bones in the Finnish material is surprising. Bones from swans are rather easy to distinguish from other bird species, so the scarcity cannot be explained by identification problems.

According to archaeological finds, as well as ethnographic sources, whooper swan had some ritual meaning for ancient cultures (Itkonen 1948a; Harva 1933:309, 311-313; Storå 1968:37-41; Møhl 1979:68). This is supported by a grave in the Mesolithic burial site Vedbæk Bøgebakken in Zealand, Denmark where a new-born baby was buried with a swan's wing (Albrethsen & Brinch Petersen 1976:8-9). It is possible that some religious attitude towards swans, and the possible prohibitions against hunting them, might be one reason for the small amount of swan remains in the refuse faunas from Finnish prehistoric sites.

During historic times, the meat of swans was eaten, and the skin was used in clothing (Olaus Magnus 1555:112; Storå 1968:46). Wing feathers have been used in fletching arrows, and feathers and down in clothing and decoration. Whistles were made of pens from swans' wing (Itkonen 1948b:31; Leisiö 1983:89). Needlecases have been made of pens of wings from swan and geese (Itkonen 1948a:323). Whole wings may have been used in cleaning the floor (Itkonen 1948b:32).

Meat from various ducks was used as food, and eggs were collected from nests and nesting holes. Bones were used in manufacturing tools and other artefacts. Feathers and down were collected and used for many purposes (Itkonen 1948b:51; Storå 1982).

Gallinaceus birds (Tetraonidae)

Gallinaceous birds were important game for prehistoric cultures in Finland. This can be seen even in the limited material. There are no geographical differences seen in the presence of gallinaceous birds at Finnish sites although they are more common at inland sites than coastal sites. The situation appears similar to that of northern Sweden where the inland Stone Age sites contain both gallinaceous species and waterbirds, but coastal sites contain only waterbirds (Ekman & Iregren 1984:31, 38), and Estonia, where bones from gallinaceous birds are rare at coastal Stone Age sites (Lõugas *et al*. 1996:403). However, capercaillie is relatively commonly found on Danish coastal Mesolithic and Neolithic sites (Løppenthin 1955; Ljungar 1996).

There are severe problems in identifying Tetraonidae -species in burnt bone material. This concerns mainly the distinguishing of (female) capercaillie from (male) black grouse, or (female) black grouse from (male) willow grouse. Misinterpretations cannot be totally avoided when identifying gallinaceous species in Finnish burnt material. From *Lagopus* -species, only willow grouse has been identified in Finland. The absence of rock ptarmigan (*Lagopus mutus*) derives from the difficulty in separating the bones from these species. Presumably rock ptarmigans were hunted during prehistory in northern Finland as they were in northern Sweden (Ericson & Tyrberg, in press), although it cannot be proved archaeologically.

The most important use of gallinaceous birds in prehistoric times was most likely the use of meat as food. Most probably bones, sinews, skin and feathers were also utilised although we lack the archeological evidence. Ethnographic literature mentions the use of pens from capercaillie, black grouse and hazel grouse as whistles (Leisiö 1983:89).

Divers (Gaviidae)

Divers are present at inland and coastal sites from the Mesolithic and Neolithic. Finds from coastal sites may indicate hunting during bird migration. Another explanation could be that divers were killed on inland lakes and brought to a settlement site near the coast. Divers are commonly found among refuse faunas from coastal and inland sites from other parts of northern Europe (Bochenski 1993:350-351; Ljungar 1996:35-37; Lõugas *et al.* 1996:403; Zhilin & Karhu 2002:112; Ericson & Tyrberg, in press). A clay figurine probably representing a swimming diver (*Gavia* sp.) has been found in connection with Typical Comb Ware at Lintutorni in Outokumpu (Karjalainen 1997). This small figurine gives the impression that divers were of some special importance for the occupants of Lintutorni site.

During historic times the meat from divers, as well as their eggs, were eaten and skins were used, for example, in the preparation of small bags (Itkonen 1948a:273, 507; Itkonen 1948b:36, Kielatis 2000). Black-throated divers' beaks were even suitable for use as arrowheads (Itkonen 1948b:371-372).

Grebes (Podicipediidae)

Grebes are relatively commonly found in Finnish prehistoric refuse faunas. It is not possible to distinguish bones from the great crested grebe (*Podiceps cristatus*) and the red-necked grebe (*Podiceps grisegena*) in burned and fragmented material. The only identified grebe species from a Finnish site, a Slavonian grebe, was found at Kuuselankangas in Yli-Ii (North Ostrobothnia). Grebes are often present in other northern European archaeological bone samples (Tyrberg & Ericson 1991:29; Ljungar 1996; Lõugas *et al*. 1996:403; Zhilin & Karhu 2002:112; Ericson & Tyrberg, in press). Evidence of the decorative use of grebe bones exists from the Mesolithic Vedbæk Gøngehusvej burial site where a beak from an undetermined grebe formed part of the hair-do of a buried woman (Brinch Petersen *et al*. 1993:66-67).

Birds of prey (Accipitridae, Pandionidae, Strigiformes)

Eagle bones have been found on relatively many Finnish sites from the Neolithic and the Early Metal Period. The only specimens that can be identified as to species come from Jettböle I in Jomala, and belong to white-tailed sea eagle (*Haliaeetus albicilla*). Other birds of prey present at Finnish sites are osprey (*Pandion haliaetus*) and unidentified owl species (Strigiformes) from Stenkulla in Vantaa (southern Finland).

Wing feathers from birds of prey were used for fletching arrows and for decorative purposes in the Early Iron Age in the Ural area (Potapova & Panteleyev 1999:135). Ethnographic examples of arrows fletched with feathers from white-tailed sea eagles exist in Finland (Clark 1948:129-130). The commonness of white-tailed sea eagles in northern European sites may indicate that they were eaten (Olsen 1967:84; Piehler 1976:tab.58; Møhl 1971:67; Lepiksaar 1982; Tyrberg & Ericson 1991:29; Jonsson 1995:157; Lõugas *et al*. 1996:404; Moora & Lõugas 1995:276; Ljungar 1996:52; Potapova & Panteleyev 1999; Bilskiene & Daugnora 2000:571, 573, 576). In the Neolithic burial mounds on the Island of Orkney, bones from several white-tailed sea eagles were placed among the human burials (Jones 1998:308) which indicates some immaterial significance for the birds.

Other bird taxa

Other bird taxa are not numerous at Finnish prehistoric sites. The great cormorant (*Phalacrocorax carbo*) has been identified at one site only (Jettböle I on Åland). Cormorants are common in refuse faunas from prehistoric northern European sites (Ericson & Hernandez Carrasquilla 1997; Lõugas *et al*. 1996:403; Ljungar 1996; Ericson & Tyrberg, in press). Meat and eggs were most probably eaten. Bones were used in tool preparation, as is indicated by the awl made of a humerus of the great cormorant from Jettböle I.

Gulls (Laridae) have been identified only at Jettböle I in Jomala and Otterböte in Kökar. Waders are represented by four species. The woodcock is present at two Finnish sites, and the ruff (*Philomachus pugnax*), the western curlew (*Numenius arquata*) and the ruddy turnstone (*Arenaria interpres*) at one site only (Jettböle I). The three previously mentioned species have been identified in several other prehistoric sites in northern Europe (Olsen 1967:84; Bogucki 1979:38; Bochenski 1993:419; Jonsson 1995:157; Ljungar 1996:55-56; Ericson & Tyrberg, in press). The ruddy turnstone from Jettböle I is the earliest find of this species in the Baltic Sea area (Mannermaa 2002a:95-96).

A handful of auk (Alciidae) bones have been identified from prehistoric samples in Finland. Black guillemot is present at two coastal sites, and razorbill has been identified at one site only. The small number of auks can have three explanations: Auks were not numerous along the Finnish coast during that period, the bones have not been preserved or people did not hunt auks. It seems unlikely that auks would not have been hunted and eaten by prehistoric people if they lived nearby. The importance of auks for coastal prehistoric cultures is indicated by archaeological finds from other countries (Olsen 1967; Piehler 1976:tab. 96; Brothwell *et al*. 1981:200; Ljungar 1996:66; Gotfredsen 1997) and ethnographic sources (e.g., Storå 1966).

A bone from a european nightjar at Bläckisåsen II in Kokkola (Ostrobothnia) is interesting. The burned bone, a fragment of the carpometacarpus (a wing bone), was found in the Neolithic dwelling depression. The uses of this small bird by prehistoric people can only be guessed. According to historic sources, this species had a special symbolic meaning for people (Tillhagen 1978:178-183; Ericson & Tyrberg, in press).

Fowling during Finnish prehistory

As already mentioned, all Finnish sites yielding *relatively* many bird bones were located by or near the coast. This indicates that fowling was a more important part of prehistoric economies on coastal sites than on inland sites. The general dominance of duck bones at coastal sites and gallinaceus species inland seems to be typical for all prehistoric periods prior to the Iron Age.

With few exceptions, the average proportion of bird bones is low in all prehistoric periods (6.2 %). If one takes into account the documentation method, which does not include the unidentified mammalian bones, the proportion is considerably

lower. The small amount of bird bones seems to be a general phenomenon in northern European sites. In previous studies, it has been explained by taphonomic loss (e.g. Aaris-Sørensen 1980:146; Moora & Lõugas 1995:478; Ukkonen 1996:74; Kotivuori 2002:149), or the marginal importance of fowling in the economy (e.g. Zvelebil 1978:166; Indrelid 1978:166; During 1987:140).

In general, it might be misleading to interpret the role of birds in prehistoric economies as marginal. Migrating birds were presumably an important addition to the diet in spring, summer, and autumn. The role of fowling in the subsistence basis of the people depends on the location and the occupation season(s) of the habitation or camp, and the other bases of subsistence. Subsistence in hunter-fisher-gatherer groups was never really stabile year after year. Annual and periodical fluctuations in weather, and changes in animal population sizes have had an impact on peoples' choices of fowling patterns.

Hunting patterns and game choices may have been more tightly connected to cultural and social identity than we can see based on the archaeological finds. Material uses of birds and other animals are easier to interpret compared to symbolic, sacred, or ritual (material and immaterial) uses.

Bird bones are relatively common at five Finnish coastal Neolithic sites and one coastal Bronze Age site. At Vepsänkangas in Ylikiiminki and Jettböle I in Jomala, the number of bird bones and the number of taxa are relatively high. At Otterböte in Kökar, the number of bird bones is high, but the number of identified taxa is low. At Stenkulla, Jokiniemi and Jokiniemi Sandliden sites in Vantaa, the number of bird bones is low but the number of identified taxa is relatively high. People have hunted predominantly ducks at these sites. Gallinaceous birds, divers and grebes have also been hunted (except at Jettböle I in Jomala and Otterböte in Kökar), but in clearly smaller proportions.

A famous example of a northern European site specialised in fowling is the Mesolithic Aggersund swan hunting camp in Jutland, Denmark (Møhl 1979). There are no such sites known from Finland, but at Jettböle I in Jomala and Otterböte on Kökar, fowling seems to be practiced systematically judging by the large amount of bird bones and the location of the sites. Vepsänkangas in Ylikiiminki is another candidate for a Finnish site specialised in waterbird hunting. The site was situated in the inner archipelago (Koivisto 1998a). It seems likely that the location of this site was chosen especially because of the rich avian fauna in the area. Sieves of 5 mm were used at Vepsänkangas (Koivisto 1998b), which may have contributed to the large proportion of bird bones. However, this explanation is not entirely satisfactory because sieves were used at several other sites (for example, Rusavierto in Saarijärvi, Saamen Museo in Inari) where the number of bird bones is low. The people from Kuuselankangas in Yli-Ii (North Ostrobothnia) practiced a specialised hunting for willow grouse, as interpreted from the high number of identified specimens.

The Finnish archaeological bone material suggests that bird resourses were utilised most intensively during the Neolithic. The amount of identified fragments and identified taxa are highest from Neolithic samples. This seems true even if one takes into account that the material from the Neolithic is larger than from other periods. A more intensive use of birds in the Neolithic is seen, for example, at the coastal site of Kotedalen in western Norway where bird bones are clearly more numerous and varied in the Neolithic rather than the Mesolithic layers (Hufthammer 1992:21-44; Bergsvik 2001:10-13). However, at the coastal sites Ajvide and Stora Förvar on Gotland, bird bones are relatively more numerous in Mesolithic rather than Neolithic layers (Lindqvist & Possnert 1997:71, 74).

Birds have had roles in the prehistoric burial rituals in Europe. Remains of birds or artefacts made of bird bones at the famous Mesolithic and Neolithic burial sites Ajvide on Gotland, Tamula in Estonia, Vedbæk Bøgebakken in Denmark and Zvejnieki in Latvia are evidence of the material or immaterial place of birds in death rituals in these prehistoric cultures (Janzon 1974; Albrethsen & Brinch Petersen 1976; Jaanits *et al*. 1992; Brinch Petersen *et al*. 1993; Zagorska 1993:112; Burenhult 2002; Eriksson *et al*. 2003:7-8). Four bones of undetermined bird species from the Neolithic site of Vaateranta in Taipalsaari are the only sure wild birds found in

Finnish Stone Age graves. Bird bones in the Bronze Age burial mound in Eckerö do not necessarily belong to the burial. It is likely that birds had a more significant role in the burial customs of prehistoric peoples in Finland than the scarce finds indicate. Finnish Stone Age graves typically include stone and amber grave goods and red-ochre, but nearly all organic materials have vanished (Halinen 1999).

Fowling methods

Siiriäinen (1981:17) mentions a possible link between the rise in the importance of fowling and the appearance of transverse quartz arrowheads in the find material about 5000 cal BC. A large number of transverse arrowheads and bird bones at a site may indeed indicate fowling with arrows. At Ølby Lyng in Zealand, Denmark (Ertebølle culture), the transverse flint arrowheads comprise the majority of all flint material (Brinch Petersen 1971:9-10). The bird bone material from the same site is large and rich (Møhl 1971:63-69). However, at another site, Grisby on Bornholm (also Ertebølle culture), the transverse flint arrowheads are numerous but birds seems not to have played an important role in the economy (Vang Petersen 2001). The use of transverse arrowheads by no means can be restricted to birds and other small game. The famous auroch from Plejlerup in Zealand, Denmark, was injured by about twelve arrows, some of them provided with transverse flint heads (Aaris-Sørensen & Brinch Petersen 1986).

The Finnish bone material is too limited to decide if fowling really increased in the Late Mesolithic and Early Neolithic, although more intense fowling during the Neolithic seems probable, as mentioned above. In order to get more information on the prehistoric fowling methods, it would be productive to study the artefact composition, bird bones and the topography of individual prehistoric sites.

Long and narrow slate arrowheads (the so called Pyheensilta type arrowheads), typical of the Late Neolithic in Finland, might have been used for hunting birds as well as other small game (Edgren 1993:102-104). Most likely wood, bone and antler provided raw material for a variety of arrows and darts used in fowling. For instance, blunted arrowheads made of wood and bone from diverse European archaeological sites (Becker 1945:66-68; Clark 1948:119; Oshibkina 1988:409; Zhilin & Karhu 2002:115; Zhilin & Matiskainen 2003) have been used for hunting birds and fur animals. Hunting swans and other waterbirds with arrows is represented in Neolithic rock carvings at the mouth of the Vyg river near the White Sea (Autio 1981:77, 80). Ethnographic data from northern Europe also exists. For example, golden eagles and capercaillies were hunted with arrows in sixteenth century Scandinavia (Olaus Magnus 1555:103, 121). Double-pointed arrowheads were used in hunting large waterbirds in Siberia (Vilkuna 1950:354-359).

Archaeological finds of calls or whistles probably used in fowling exist from Middle Neolithic Gotland (Janzon 1974:75; Burenhult 1997:20). Ethnographic evidence on bird whistles (Storå 1968:100; Leisiö 1983:91-96; Sirelius 1989:71, 80) supports their use in prehistory.

Ethnographic data from Nordic countries indicate the use of nets in waterbird hunting (Olaus Magnus 1555:153; Dahlström 1938; Itkonen 1948b:55-56; Storå 1968:162-274; Sirelius 1989:80-81). Nets may also have been used in fowling during prehistory. They might have been air-nets, but most likely also water-nets (the same used in fishing) were used for hunting diving birds (e.g., Itkonen 1948:55-56). The catching of birds in water-nets must have been more or less occasional unless birds were driven into the net.

Moulting waterbirds were caught by hand, or clubbed with wooden sticks, or they were driven into nets or other kinds of traps (Storå 1968:37-42; Sirelius 1989:68).

According to ethnographic sources, gallinaceous birds were caught with snares and different traps made of wooden stakes, vegetable fibres, sinews and hide (Sirelius 1934:61-76; Clark 1948:123; Itkonen 1948b:40-56; Sirelius 1989:97-112, 118, 126-127). Often the same traps were used for gallinaceous birds and small mammals (Ekman 1910:167). Dogs were used in hunting capercaillies during late autumn (Ekman 1910:166). During winter, willow grouse were captured in from their winter holes in the snow (Itkonen 1948b:44)

Hunting season and occupation season

If we assume that the migration routes have remained more or less the same after the last glaciation, we can use modern knowledge of the migration patterns of birds in determining the fowling season. However, the presence of one or two bones from migratory species, which is the case in many sites in Finland, gives no real basis for determining the season of occupation. It is possible that birds were caught during the autumn, but the meat consumed during winter.

Jettböle I in Jomala, Otterböte in Kökar (the Åland Islands), Vepsänkangas in Ylikiiminki (North Ostrobothnia) and Stenkulla in Vantaa (southern Finland) were occupied at least during the spring, summer or autumn according to the relatively large amount of bones from migratory species. Migratory birds were probably hunted from early spring to late autumn — the whole period of their presence in the area. The main fowling season of migratory birds probably took place in spring when the flocks of migratory birds arrive. Moulting season in mid-summer was another important time for waterbird hunting (Clark 1948:117; Storå 1968:154). Autumn was also a good fowling season because birds are in good physical condition after summer and young birds are perhaps more easily available than adults (Serjeantson 1998:25).

The importance of migratory birds as a seasonal resource in coastal areas and islands is supported by earlier studies from other areas (Olsen 1967:176-177; Møhl 1971:63-69; Indrelid 1978:156; Møhl 1979; Knape & Ericson 1983:173; Serjeantson 1988; Moora & Lõugas 1996:478; Lõugas *et al.* 1996:403). Waterbirds, in particular geese were so important for Skolt Saami people, that the moving from winter villages to summer villages was done just before their arrival to Lapland (Itkonen 1948b:32).

Young birds were caught during the summer. Bones from juvenile birds have been found at two Finnish prehistoric sites (Jettböle I in Jomala and Maarinkunnas in Vantaa). These sites were occupied at least during the summer. It is probable that young birds were hunted at many other sites too, but the fragile bones have vanished. The presence of medullary bones in some unburnt bones from Jettböle I in Jomala and Otterböte in Kökar indicates that these sites were inhabited at least during spring or early summer.

Recurrent places of open water in sea ice have been good resting and feeding places for early migrating waterfowl. Such places may have offered opportunities for successful hunting during the late winter and early spring (Nuñez & Gustavsson 1995; Nuñez 1996:29-32). The rich mammal and avian fauna utilising areas of open water has been suggested as a principal reason for occupying the archipelago of Åland in the Early Neolithic (Nuñez 1996:27-29, 31-32).

Resident birds (Tetraonidae) could supply the food demand year round although the best hunting season for them would have been during the autumn, winter and the mating period in the early spring. Probably capercaillie and grouses were very important as part of the winter and early spring diet of prehistoric people. Capercaillie is well represented, for example, in refuse fauna from the historic Saami summer village of Juikenttä in Sodankylä (Carpelan 1992:37), which indicates that capercaillies were also caught during the summer.

Prehistoric seasonal and specialised bird hunting camps are difficult to detect. Short-term fowling camps do not necessarily leave traces in the ground. Traces of wooden shelters or hut constructions, as well as traps and other hunting equipment, have vanished. In historic times, people constructed blinds from stones and waited for waterbirds behind them (Ekman 1910:188; Sirelius 1989:80). Such constructions should be located on ancient coastlines, most likely on the inner archipelago near the areas preferred by waterbirds. During the late winter, people used to hunt displaying black gouse in the sea ice from behind a wooden blind (Sirelius 1989:74).

Artefacts made of bird bones

Awls made of bird bones from Jettböle I are clear indicators of versatile use of birds. Jomala Jettböle I represents a western cultural phase (Scandinavian Pitted Ware) that never spread to the Finnish mainland (Edenmo *et al.* 1997; Miettinen 1999). If awls were connected to the western culture, it would explain their absence on the Finnish mainland. However, similar awls have been found on many sites from different cultures in northern Europe (Jaanits 1965:40; Janzon 1974:258; Jensen 1993:75-79; van Wijngaarden-Bakker 1997:341). The finds indicate a widely spread phenomenon which most probably covered Finnish mainland as

well. Awls have been used as leather punches for sewing hides, but presumably had other uses like decorating pottery and wooden, bone and antler artefacts. Awls may even have been used as arrowheads (Jensen 1993:96).

Function of the object from Korpilahti in Vuoksenranta remains open. It may be used as chisel or scraper. It has previously been suggested, that it might be a flute (Lund 1981:259; Leisiö 1983:547-548). For me this explanation seems unlikely due to very deep opening of the worked end.

Missing species

Many birds breeding abundantly in contemporary Finland are missing from the Finnish prehistoric bone material. There may exist simple explanations for this — these taxa were not present in Finland, people did not choose to hunt these birds, or, the bones from these species have not preserved. It is likely that prehistoric people hunted many other bird species which are not represented in the Finnish bone material. However, the absence of large species like the common crane (*Grus grus*) seems surprising. One Finnish find of the common crane was found from the Iron Age site of Varikkoniemi in Hämeenlinna (From 1990), but the dating is obscure due to mixed stratigraphy. Common cranes are present in many archaeological avifaunas from northern Europe (Ekman 1974:225; Piehler 1976:tab. 75; Ekman & Iregren 1984:56; During 1987:141; Bochenski 1993; Ljungar 1996:54-55; Stewart 2001:142; Ericson & Tyrberg, in press). The preservation of crane bones should be better than that of many smaller species. Bones of common cranes are relatively easy to identify and should not be missed because of identification problems.

Common cranes were hunted by people at the Juikenttä Saami summer village in Sodankylä (Carpelan 1992:37). From ethnographic sources, we know that common cranes were considered unclean by the Skolt Saami people and were not eaten (Itkonen 1945b:36, 370). However, in Finnmark (Norway) common cranes were eaten (Paulaharju 1961:118-119).

It is possible that some special attitude towards common cranes had effects on their use in prehistory. Symbolic or ritual significance is connected to the common crane in one grave at the Late Neolithic burial site of Tamula in Estonia. Parts of the wings from a common crane have been put in both hands of the deceased, a young child (Jaanits *et al.* 1982:82, 99).

CONCLUSIONS

Ducks and gallinaceus birds were the most commonly utilised bird families in Finland during Mesolithic and Neolithic. General dominance of duck bones at coastal sites and gallinaceous species inland seems to be typical for all prehistoric periods studied. Arrows, nets and various kind of traps were assumably used by the hunters of birds. Blinds, decoys, whistles and dogs may have helped people in catching birds.

Presence of migratory species or medullary bone may in some cases be helpful for archaeologist determining the season of occupation. To go further on with the research of fowling in Finnish prehistory, a more thorough investigation and consideration of the find material in the economy of selected sites should be conducted. Local topography as well as prevailing ecological and climatic circumstances should be taken into account.

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Appendix 1.

The list of samples included in this paper. Museum numbers refer to catalogue numbers in the National Museum (National Board of Antiquities) (NM), Ålands museum (ÅM), University of Turku (TYA).

Osteological analyses were made by AF = Ann Forstén, AO = Arvo Ohtonen, EI = Elisabeth Iregren, HM = Helen Martinsson, HW = Herluf Winge, JJ = Jukka Jernvall, KM = Kristiina Mannermaa, MF = Mikael Fortelius, NP = Nina Peltonen, NS = Niklas Söderholm, PE = Per Ericson, PU = Pirkko Ukkonen, SF = Stella From, SN = Sirpa Nummela, TF = Tarja Formisto. The first initials refer to the original analysis, and the second to the possible corrections made by Kristiina Mannermaa.

Township and site	Museum number	Excavation	Osteologist
Anjalankoski, Ankkapurha	NM 31785	Schulz E-L. 1999	KM
Askola, Pappila Siltapellonhaka I	NM 12600	Luho 1950	JJ
Eckerö, Storby Mellanö	ÅM 216	Dreijer 1951	EI
Enontekiö, Museotontti	NM 23877	Kankaanpää 1987	SF
Enontekiö, Suonttajoki	NM 28752	Halinen 1993	PU
Espoo, Bosmalm	NM 22396	Kankkunen 1984	TF
Espoo, Bosmalm	NM 23045	Taskinen, Kankkunen 1985	TF, KM
Espoo, Bosmalm	NM 23809	Kankkunen 1987	TF, KM
Evijärvi, Jokela Koskimäki	NM 11904	Luho 1948	MF,KM
Evijärvi, Lahdenkylä Isokangas	NM 20603	Hiekkanen 1979	MF, KM
Geta, Östergeta 16.9	ÅM 561	Vinberg 1984	HM
Harjavalta, Hiitteenharju	NM 20493	Taavitsainen 1979	MF, KM, PE
Harjavalta, Lyytikänharju	NM 13842	Meinander 1955	MF, KM
Helsinki, Malminkartano Kårböle	NM 29896	Lesell 1996	PU
Hyrynsalmi, Koppeloniemi	NM 20634	Perkko 1979	MF
Iisalmi, Runni Jysmä	NM 13944	Edgren 1956	PU
Iitti, Tapola Kotojärvi	NM 18428	Ojonen 1971	MF, KM
Ilomantsi, Kuuksenvaara Suiponniemi	NM 23382	Kankkunen 1986	PU
Ilomantsi, Piilovaara Syväys	NM 18200	Saarvola 1970	MF
Inari, Vuopaja	NM 28365	Seppälä 1994	PU
Inari, Vuopaja N	NM 27810	Seppälä 1993	PU
Inari, Nellimjoen suu S	NM 24376	Sohlström 1988	PU
Inari, Saamen museo	NM 27808	Seppälä 1993	PU
Jomala, Jettböle I	NM4630,4781,5180,5907	Cederhvarf 1905,1906,1908,1911	KM, HW
Kangasala, Sarsa Pohtiolampi	NM 32000	Schulz E-L. 1999	KM
Kangasala, Sarsa Pohtiolampi	NM 32554	Schulz E-L. 2000	KM
Karttula, Kuivaniemi Riihikallio	NM 29891	Aroalho 1995	PU
Kemijärvi, Neitilä 4	NM 16145	Sarvas 1963	PU
Kemiö, Branten	TYA 589	Asplund 1989	PU
Kesälahti, Purujärvi Sirnihta	NM 18910	Carpelan 1972	PU
Kiikoinen, Uusi Jaara	NM 9409	Äyräpää 1931	MF, KM
Kitee, Sarvisuo	NM 29714	Pesonen 1996	PU
Kittilä, Vanhainkoti	NM 28555	Pesonen 1994	PU
Kokemäki, Kraviojankangas	NM 20584	Heikkurinen 1979	MF
Kokkola, Bläckisåsen II	NM 22821	Seger 1985	TF

Kristiinankaupunki, Rävåsen	NM 28659	Vanhatalo 1994	PU, KM
Kristiinankaupunki, Rävåsen	NM 29610	Laulumaa 1996	PU
Kristiinankaupunki, Rävåsen	NM 30588	Laulumaa 1997	PU
Kristiinankaupunki, Rävåsen	NM 30970	Laulumaa 1998	PU
Kuhmo, Vasikkaniemi SW	NM 29136	Karjalainen 1995	PU
Kuhmo, Katerma Järvelä	NM 27024	Schulz H-P. 1991	PU
Kuivaniemi, Veskankangas	NM 24928	Wallenius 1989	PU, KM
Kuivaniemi, Veskankangas	NM 25800	Wallenius 1990	PU, KM
Kuivaniemi, Veskankangas	NM 26699	Wallenius 1991	PU, KM
Kuivaniemi, Veskankangas	NM 27365	Wallenius 1992	SN
Kuopio, Pappila Luukonsaari	NM 15517	Stray finds	PU
Kurikka, Myllykylä Topee B	NM 17486	Luho 1967	MF, KM
Kökar, Otterböte	ÅM 200	Meinander 1950	AF, KM
Lahti, Renkomäki Ristola	NM 18501	Schauman 1971	MF, KM
Laitila, Kotjala Nästinristi	NM 20606	Väkeväinen 1979	MF, KM
Laukaa, Hartikka	NM 25807	Miettinen & Vanhatalo 1990	PU
Laukaa, Hartikka	NM 26604	Miettinen & Vanhatalo 1991	PU
Liljendal, Kvarnbacken	NM 9273,18900, 19152	Äyräpää, Pohjakallio	MF
Luumäki, Hietaranta	NM 30909	Seppänen 1998	KM
Luumäki, Hietaranta	NM 31517	Seppänen 1999	KM
Nastola, Kilpisaari	NM 32180	Poutiainen 2000	KM
Outokumpu, Laavussuo	NM 29556	Karjalainen 1996	PU
Outokumpu, Sätös	NM 18225	Meinander 1970	PU
Outokumpu, Sätös	NM 27704	Karjalainen 1992	PU
Outokumpu, Sätös	NM 28153	Karjalainen 1993	KM
Outokumpu, Sätös	NM 30892	Karjalainen 1998	PU
Pieksämäki, Vemmellahti 1	NM 22367	Jussila 1984	PU
Pieksämäki, Vemmellahti 1	NM 22436	Bergström 1984	PU
Pieksämäki, Kirkonkylä Kahvikivi	NM 25275	Lehtinen 1989	PU
Pieksämäki, Naarajärvi	NM 21519	Matiskainen 1982	MF, KM
Pieksämäki, Naarajärvi	NM 22019	Jussila 1983	MF
Pielavesi, Kivimäki	NM 24465	Halinen 1988	SF
Purmo, Hundbacka Myllykangas	NM 20723	Miettinen 1980	MF
Pihtipudas, Rönni	NM 4146	Ailio 1902	HW
Pihtipudas, Vuohtojärvi	NM 4148	Ailio 1902	HW
Porvoo, Böle	NM 17387	Edgren 1968	MF, KM
Porvoo, Böle	NM 19799	Ruonavaara 1975	MF, KM
Posio, Kuorikkikangas E	NM 28917	Pesonen 1995	PU
Puumala, Kärmelahti	NM 31376	Katiskoski 1998	KM
Pyhtää, Siltakylä Brunamossen I	NM 20613	Bergström 1979	MF, KM
Rantasalmi, Ritokangas	NM 30771	Karjalainen 1997	PU
Ranua, Kultisalmi	NM 25927	Katiskoski 1990	PU
Ranua, Kultisalmi	NM 26851	Katiskoski 1991	PU, KM
Riihimäki, Sinivuokkoniemi	NM 30884	Matiskainen & Jussila 1999	PU
Riihimäki, Sinivuokkoniemi	NM 31510	Matiskainen & Jussila 1998	PU
Ristiina, Liikala Linnaniemen kärki	NM 27391	Sepänmaa 1992	PU
Rovaniemi, Rautiosaari Turpeenniemi	NM 14709	Sarkamo 1958	MF
Rovaniemi, Kolpene	NM 13985	Paloniemi 1956	PU
Rovaniemi, Kolpene	NM 13768	Kopisto 1955	PU
Rovaniemi, Saarenkylä Piirittävaara	NM 26057	Lavento 1990	PU
Rovaniemi, Jokkavaara	NM 21012	Torvinen 1982	PU, KM
Rovaniemi, Jokkavaara	NM 21307	Karjalainen 1991	PU
Rovaniemi, Jokkavaara	NM 21834	Karjalainen 1991	PU
Rovaniemi, Jokkavaara	NM 26610	Karjalainen 1991	PU

Rovaniemi, Sierijärvi Kotijänkä	NM 26780	Kotivuori 1991	PU
Rovaniemi, Sierijärvi Riitakanranta	NM 26172	Kotivuori 1990	PU
Ruovesi, Lapinniemi	NM 29573	Vanhatalo 1996	PU
Rääkkylä, Vihi 1	NM 30460	Pesonen 1997	PU
Rääkkylä, Jaamankangas	NM 26436	Stray finds	PU
Rääkkylä, Kivilamminsuo S	NM 28774	Pesonen & Karjalainen 1995	PU
Rääkkylä, Pörrinmökki	NM 28013	Pesonen 1993	PU
Rääkkylä, Pörrinmökki	NM 29713	Pesonen 1996	PU
Saarijärvi, Haikanniemi N	NM 31409	Vanhatalo 1998	PU
Saarijärvi, Rusavierto	NM 29406	Schulz 1995	PU
Saarijärvi, Rusavierto	NM 31616	Leskinen 1999	KM, NP
Saarijärvi, Summassaari Eteläranta	NM 28690	Schulz 1994	PU
Saarijärvi, Tarvaala Summassaari	NM 11865, 12234, 14537	Luho 1948, 1949, 1958	AF
Saarijärvi, Voudinniemi 5	NM 28216	Schulz 1993	PU
Saarijärvi, Voudinniemi 7	NM 28216	Schulz 1993	PU
Savonlinna, Tynkkylänjoki	NM 27178	Sepänmaa 1992	PU
Simo, Tainiaro	NM 26698	Wallenius 1991	PU, KM
Sodankylä, Autiokenttä II	NM 20592	Torvinen 1979	MF
Sodankylä, Kotamaa	NM 27957	Sarkkinen 1993	PU
Sodankylä, Matti-Vainaan Palo	NM 27678	Halinen 1992	PU
Sortavala, Otsoinen (former Finland)	NM 7898	Äyräpää 1921	MF, KM
Sulkava, Kapakkamäki	NM 20787	Huurre 1977	MF, KM
Sund, Kolsvidja	NM 13383	Meinander/Lindqvist 1988	PE
Suomussalmi, Tormua Särkkä	NM 18322	Huurre 1970	MF, KM
Suomussalmi, Kalmosärkkä	NM 14504	Huurre 1958	MF
Suomussalmi, Kalmosärkkä	NM 14830	Huurre 1959	MF, KM
Suomussalmi, Kellolaisten Tuli I-II	NM 14831	Huurre 1959	MF
Suonenjoki, Saunaniemi	NM 14448	Kopisto 1958	MF, KM
Säräisniemi, Nimisjärvi	NM 4080	Mustonen, Heikel, Ailio 1900	HW
Taipalsaari, Vaateranta	NM 30887	Katiskoski 1998	PU
Taivalkoski, Tervaniemi	NM 28899	Raike 1995	PU
Tervola, Törmävaara (30)	NM 21599	Nieminen 1982	PU
Tervola, Törmävaara (30)	NM 22071	Nieminen 1983	PU
Tervola, Törmävaara (30)	NM 22481	Nieminen 1984	SF, KM
Tervola, Törmävaara (30)	NM 23399	Schulz 1986	PU
Tervola, Törmävaara (30)	NM 23816	Ruonavaara 1987	PU
Tervola, Törmävaara (42)	NM 19009	Lönnberg 1972	PU
Tervola, Törmävaara (48)	NM 22911	Ruonavaara 1985	PU
Tohmajärvi, Lietunniemi	NM 30463	Stray finds	PU
Utsjoki, Ala-Jalve	NM 22488	Rankama 1984	TF
Utsjoki, Ala-Jalve	NM 23808	Rankama 1987	TF
Utsjoki, Utsjoensuu	NM 24814	Rankama 1989	TF
Vantaa, Etelä-Vantaa 2	NM 18470	Purhonen 1971	AF, KM
Vantaa, Etelä-Vantaa 3	NM 18978	Purhonen 1971	MF, KM
Vantaa, Gröndal 2	NM 31945	Saunaluoma 1999	PU
Vantaa, Maarinkunnas	NM 19992	Väkeväinen 1976	MF, KM
Vantaa, Maarinkunnas	NM 30464	Leskinen 1997	NS
Vantaa, Stenkulla	NM 29954	Katiskoski 1996	PU
Vantaa, Jokiniemi	NM 28065	Katiskoski 1993	PU, KM
Vantaa, Jokiniemi	NM 28382	Katiskoski 1994	PU
Vantaa, Jokiniemi Sandliden	NM 28203	Fast 1993	PU, KM
Vantaa, Jönsas (North-East)	NM 19914	Ojonen 1976	MF
Vantaa, Jönsas (North)	NM 19275	Purhonen 1973	MF, KM
Vantaa, Jönsas (North)	NM 19383	Pajari 1974	MF, KM

Veteli, Kiikkunicmi	NM 32135	Katiskoski 2000	KM
Viipuri, Häyrynmäki (former Finland)	NM 5428	Soikkeli 1910	MF, KM
Viipuri, Häyrynmäki (former Finland)	NM 5620	Soikkeli 1910	MF, KM
Virolahti, Kattelus I	NM 31786	Lesell 1999	KM
Vuoksenranta, Korpilahti (former Finland)	NM 6688	Pälsi 1914	HW
Yli-Ii, Kuuselankangas	NM 28943	Katiskoski 1995	PU
Yli-Ii, Kuuselankangas	NM 39665	Koivunen & Makkonen 1994	AO
Yli-Ii, Kuuselankangas	NM 29907	Halinen 1996	PU
Ylikiiminki, Latokangas	NM 23715	Mäki-Vuoti 1987	PU
Ylikiiminki, Niemikylä Latokangas	NM 25731	Mäki-Vuoti 1990	PU
Ylikiiminki, Säävälä Latokangas	NM 24377	Sarkkinen 1988	PU
Ylikiiminki, Vepsänkangas	NM 30561	Koivisto 1997	PU, KM
Ylikiiminki, Vepsänkangas	NM 31036	Koivisto 1998	KM

Appendix 2.

The list of samples included in this study, the number of identified bird bones, the number of identified bones (all together, including bird bones), the quality of bones (burned/unburned), the dating, and the location of a site. Museum numbers refer to catalogue numbers in the National Museum (National Board of Antiquities) (NM), Ålands museum (ÅM), University of Turku (TYA).

Names of culture stages: Suomusjärvi = Suomusjärvi culture (aceramic), Sär 1 = Säräisniemi 1 Ware, Ka 1 = Early Comb Ware, EAW = Early Asbestos Ware, Ka 2 = Typical Comb Ware, Kierikki = Kierikki Ware, Pöljä = Pöljä Ware, Jysmä = Jysmä Ware, SPW = Scandinavian Pitted Ware, Ka 3 = Late Comb Ware, Pyh = Pyheensilta Ware, CW = Corded Ware, Kiukainen = Kiukainen Ware, Lu-Si = Luukonsaari-Sirnihta Ware, RW = Rusticated Ware, Morby = Morby Ware, Lovozero = Lovozero Ware, Neo = Neolithic, Meso = Mesolithic, BA = Bronze Age, EMP = Early Metal Period, IA = Iron Age, HA = Historic Age.

Township and site	Museum number	Burned/ unburned	Bird bones	All bones	Periods	Culture stage	Ecotype
Anjalankoski, Ankkapurha	NM 31785	b	6	223	Neo	Ka 1	Coastal (river)
Askola, Siltapellonhaka I	NM 12600	b	2	47	-	Suomusjärvi, Ka 1	Coastal
Eckerö, Storby Mellanö	ÅM 216	ub	18	104	BA	Bronze Age	Coastal
Enontekiö, Museotontti	NM 23877	b	2	216	-	Suomusjärvi, Neo, IA	Inland
Enontekiö, Suonttajoki W1	NM 28752	b	1	673	Meso	Suomusjärvi	Inland
Espoo, Bosmalm	NM 22396	b	1	13	Neo	Ka 2, Ka 3	Coastal (island)
Espoo, Bosmalm	NM 23045	b	8	60	Neo	Ka 2, Ka 3	Coastal (island)
Espoo, Bosmalm	NM 23809	b	14	41	Neo	Ka 2, Ka 3	Coastal (island)
Evijärvi, Jokela Koskimäki	NM 11904	b	2	24	Neo	Neo	Coastal
Evijärvi, Lahdenkylä Isokangas	NM 20603	b	5	108	Neo	Ka 3, Pyh, Pöljä	Coastal
Geta, Östergeta 16.9	ÅM 561	b	5	148	Neo	SWP, Kiukainen	Coastal
Harjavalta, Hiitteenharju	NM 20493	b	4	451	Neo	Pyh	Coastal
Harjavalta, Lyytikänharju	NM 13842	b	1	91	Neo	Pyh, Kiukainen	Coastal
Helsinki, Malminkartano Kårböle	NM 29896	b	1	352	Neo	Ka 3	Coastal
Hyrynsalmi, Koppeloniemi	NM 20634	b	33	602	Neo	Sär 1	Inland (lake)
Iisalmi, Runni Jysmä	NM 13944	b	1	10	Neo	Pöljä, Jysmä	Inland (lake)
Iitti, Tapola Kotojärvi	NM 18428	ub	15	?	?	?	Inland (lake)
Ilomantsi, Kuuksenvaara Suiponniemi	NM 23382	b	6	273	EMP	Sär 2	Inland (lake)
Ilomantsi, Piilovaara Syväys	NM 18200	b	3	98	-	Ka 1, Ka 2, Ka 3, Pöljä, Textile, Anttila, Lu-Si	Inland (lake)
Inari, Vuopaja	NM 28365	b	2	417	Neo	Neo	Inland (river, lake)
Inari, Vuopaja N	NM 27810	b	2	423	-	Suomusjärvi, Neo, Textile	Inland (river, lake)
Inari, Nellimjoen suu S	NM 24376	b	2	86	Neo	Sär 1	Inland (lake)
Inari, Saamen museo	NM 27808	b	3	776	Meso	Suomusjärvi	Inland (river, lake)
Jomala, Jettböle I	NM 4781, 4630, 5907, 5180	ub, (b)	1240	?	Neo	SPW	Coastal (island)

Kangasala, Pohtiolampi	NM 32000	b, (ub)	3	426	-	Suomusjärvi, Ka 1, Ka 2, Pyh, Textile	Inland
Kangasala, Pohtiolampi	NM 32554	b	33	1510	-	Suomusjärvi, Ka 1, Ka 2, Pyh, Textile	Inland
Karttula, Kuivaniemi Riihikallio	NM 29891	b	11	879	Meso	Suomusjärvi	Inland (lake)
Kemijärvi, Neitilä 4	NM 16145	b	1	74	-	Suomusjärvi, Sär I, Lovozero	Inland (lake)
Kemiö, Branten	TYA 589	b	1	79	Neo	Kiukainen	Coastal
Kesälahti, Purujärvi Sirnihta	NM 18910	b	1	31	-	Ka 2, NAW, Lu-Si	Inland (Island)
Kiikoinen, Uusi Jaara	NM 9409	b	2	36	Neo	Ka 1, Ka 2	Coastal
Kitee, Sarvisuo	NM 29714	b	4	350	Neo	EAW	Inland (lake)
Kittilä, Vanhainkoti	NM 28555	b	1	37	Neo	Neo	Inland
Kokemäki, Kraviojankangas	NM 20584	b	1	1135	Neo	Ka 2, CW	Coastal
Kokkola, Bläckisåsen II	NM 22821	b	4	13	Neo	Ka 2	Coastal
Kristiinankaupunki, Rävåsen	NM 28659	b	3	456	Neo	Ka 3, Pyh, Kiukainen	Coastal
Kristiinankaupunki, Rävåsen	NM 28863	b	6	706	Neo	Ka 3, Pyh, Kiukainen	Coastal
Kristiinankaupunki, Rävåsen	NM 29610	b	5	264	Neo	Ka 3, Pyh, Kiukainen	Coastal
Kristiinankaupunki, Rävåsen	NM 30588	b	6	286	Neo	Ka 3, Pyh, Kiukainen	Coastal
Kristiinankaupunki, Rävåsen	NM 30970	b	1	112	Neo	Ka 3, Pyh, Kiukainen	Coastal
Kuhmo, Vasikkaniemi SW	NM 29136	b	8	9924	-	Suomusjärvi, Textile, Sär 2	Inland (lake)
Kuhmo, Katerma Järvelä	NM 27024	b	1	427	-	Suomusjärvi, Ka 2	Inland (lake)
Kuivaniemi, Veskankangas	NM 24928	b	29	1935	Meso	Suomusjärvi	Coastal
Kuivaniemi, Veskankangas	NM 25800	b	17	147	Meso	Suomusjärvi	Coastal
Kuivaniemi, Veskankangas	NM 26699	b	1	17	Meso	Suomusjärvi	Coastal
Kuivaniemi, Veskankangas	NM 27365	b	3	892	Meso	Suomusjärvi	Coastal
Kuopio, Pappila Luukonsaari	NM 15517	b	1	3	-	Stray find	Inland (island)
Kurikka, Myllykylä Topee B	NM 17486	b	3	27	-	Suomusjärvi, Ka 1, CW	Inland (island)
Kökar, Otterböte	ÅM 200	ub	73	469	BA	RW	Coastal (island)
Lahti, Renkomäki Ristola	NM 18501	b	4	139	-	Suomusjärvi, CW	Coastal
Laitila, Kotjala Nästinristi	NM 20606	b	1	25	Neo	Ka 2, Ka 3	Coastal
Laukaa, Hartikka	NM 25807	b	3	195	Neo	Ka 2	Inland (lake)
Laukaa, Hartikka	NM 26604	b	1	100	Neo	Ka 2	Inland (lake)
Liljendal, Kvarnbacken	NM9273/18900 /19152	b	1 ?		Neo	Ka 1, Ka 2	Coastal
Luumäki, Hietaranta	NM 30909	b	4	116	Neo	Ka 1, Ka 2	Inland (lake)
Luumäki, Hietaranta	NM 31517	b	12	218	Neo	Ka 1, Ka 2	Inland (lake)
Nastola, Kilpisaari I	NM 32180	b	4	637	-	Suomusjärvi, Textile	Inland
Outokumpu, Laavussuo	NM 29556	b	1	75	Neo	Pöljä	Inland (lake)
Outokumpu, Sätös	NM 18225	b	3	290	Neo	EAW, Ka 2, Pöljä	Inland (lake)
Outokumpu, Sätös	NM 27704	b	1	263	Neo	EAW, Ka 1, Ka 2, Pöljä	Inland (lake)
Outokumpu, Sätös	NM 28153	b	13	494	Neo	EAW	Inland (lake)
Outokumpu, Sätös	NM 30892	b	3	181	Neo	EAW. KA 1, Pöljä	Inland (lake)
Pieksämäki, Vemmellahti 1	NM 22367	b	7	398	Neo	Ka 1, Ka 2, IA	Inland (lake)
Pieksämäki, Vemmellahti 1	NM 22436	b	2	150	Neo	Ka 1, Ka 2, IA	Inland (lake)

Pieksämäki, Kirkonkylä Kahvikivi	NM 25275	b	8	128	Neo	Ka 2, Pöljä	Inland (lake)
Pieksämäki, Naarajärvi	NM 21519	b	1	14	Neo	Ka 2	Inland (lake)
Pieksämäki, Naarajärvi	NM 22019	b	3	128	-	Ka 2	Inland (lake)
Pielavesi, Kivimäki	NM 24465	b	3	21	Neo	Ka 1	Inland (lake)
Pihtipudas, Rönni	NM 4146	b	1 ?		-	Suomusjärvi, Sär 1, Ka 2	Inland (lake)
Pihtipudas, Vuohtojärvi	NM 4148	b	1 ?		-	Stone Age	Inland (lake)
Porvoo, Böle	NM 17387	b	1	24	Neo	Ka 1, Ka 2, Ka 3, Textile	Coastal
Porvoo, Böle	NM 19799	b	5	71	Neo	Ka 1, Ka 2, Ka 3, Textile	Coastal
Posio, Kuorikkikangas E	NM 28917	b	6	873	Neo	Sär 1, NAW, Sär 2	Inland (lake)
Purmo, Hundbacka Myllykangas	NM 20723	b	1	14	Neo	Ka 3	Coastal
Puumala, Kärmelahti	NM 31376	b	3	576	Neo	Ka 2, Ka 3, NAW	Inland (lake)
Pyhtää, Siltakylä Brunamossen I	NM 20613	b	3	18	Neo	Ka 3, Pyh	Coastal
Rantasalmi, Ritokangas	NM 30771	b	1	29	Neo	NAW	Inland (lake, island)
Ranua, Kultisalmi	NM 25927	b	2	86	Neo	Ka 2	Inland (lake)
Ranua, Kultisalmi	NM 26851	b	11	494	-	Sär 1, Ka 2, Sär 2, IA?	Inland (lake)
Riihimäki, Sinivuokkoniemi	NM 30884	b	3	298	-	Ka 1, Ka 3, Pyh, Kiukainen, EMP	Inland (lake)
Riihimäki, Sinivuokkoniemi	NM 31510	b	2	226	-	Ka 1, Ka 3, Pyh, Kiukainen, EMP	Inland (lake)
Ristiina, Liikala Linnaniemen kärki	NM 27391	b	1	4	-	Stray finds	Inland
Rovaniemi, Rautiosaari Turpeenniemi	NM 14709	b	1	8	Neo	Ka 1	Inland (river, lake)
Rovaniemi, Kolpene	NM 13985	b	24	234	Neo	Ka 2	Inland (river, lake)
Rovaniemi, Kolpene	NM 13768	b	1	42	Neo	Ka 2	Inland (river, lake)
Rovaniemi, Saarenkylä Piirittävaara	NM 26057	b	5	99	Neo	Ka 2, Pöljä	Inland (river)
Rovaniemi, Jokkavaara	NM 21012	b	4	237	Neo	Sär 1	Inland (river)
Rovaniemi, Jokkavaara	NM 21307	b	1	1022	Neo	Sär 1	Inland (river)
Rovaniemi, Jokkavaara	NM 21834	b	2	576	Neo	Sär 1	Inland (river)
Rovaniemi, Jokkavaara	NM 26610	b	2	309	Neo	Sär 1	Inland (river)
Rovaniemi, Sierijärvi	NM 26780	b	26	1453	-	Neo, HA	Inland (lake)
Rovaniemi, Sierijärvi	NM 26172	b	19	2119	EMP	EMP	Inland (lake)
Ruovesi, Lapinniemi	NM 29573	b	1	47	-	Stone Age, EMP, IA	Inland (lake)
Rääkkylä, Vihi 1	NM 30460	b	9	384	Neo	Ka 2	Inland (lake)
Rääkkylä, Jaamankangas Lappalaissuo	NM 26436	b	1	8	Neo	EAW, Ka 2, EMP	Inland (lake)
Rääkkylä, Kivilamminsuo S	NM 28774	b	2	1830	Neo	EAW	Inland (lake)
Rääkkylä, Pörrinmökki	NM 28013	b	1	443	Neo	Ka 2	Inland (lake)
Rääkkylä, Pörrinmökki	NM 29713	b	2	224	Neo	Ka 2	Inland (lake9
Saarijärvi, Haikanniemi N	NM 31409	b	4	38	-	Suomusjärvi, Ka 1	Inland (lake)
Saarijärvi, Rusavierto	NM 29406	b	1	683	-	Suomusjärvi, Neo	Inland (lake)
Saarijärvi, Rusavierto	NM 31616	b	18	2685	-	Suomusjärvi, Ka 1, Pöljä	Inland (lake)
Saarijärvi, Summassaari Eteläranta	NM 28690	b	2	2089	-	Suomusjärvi, NAW	Inland (lake)

Saarijärvi, Tarvaala Summassaari	NM 11865/12234/ 14537	b	5	?	-	Suomusjärvi, Neo, IA?	Inland (lake)
Saarijärvi, Voudinniemi 5	NM 28216	b	2	257	-	Suomusjärvi, Ka 2, Textile	Inland (lake)
Saarijärvi, Voudinniemi 7	NM 28216	b	9	25	-	Suomusjärvi, Ka 2	Inland (lake)
Savonlinna, Tynkkylänjoki	NM 27178	b	2	45	-	NAW, EMP, IA	Inland
Simo, Tainiaro	NM 26698	b	4	346	Neo	Ka 1	Coastal
Sodankylä, Autiokenttä II	NM 20592	b	2	46	Neo	Suomusjärvi	Inland (river)
Sodankylä, Kotamaa	NM 27957	b	1	56	EMP	EMP	Inland (river)
Sodankylä, Matti-Vainaan Palo	NM 27678	b	3 ?		Meso	Suomusjärvi	Inland (river)
Sortavala, Otsoinen (former Finland)	NM 7898	b	4	66	Neo	Ka 2, Ka 3	Coastal
Sulkava, Kapakkamäki	NM 20787	b	7	240	Neo	Ka 2, NAW	Inland (lake)
Sund, Kolsvidja	NM 13383	b	4	3507	Neo	SPW, Säter, Ka 3	Coastal (island)
Suomussalmi, Tormua Särkkä	NM 18322	b	3	145	-	Suomusjärvi, Neo, EMP	Inland (lake)
Suomussalmi, Kalmosärkkä	NM 14504	b	3	74	-	Sär 1, EAW, Ka 2, Ka 3, NAW, Textile, Sär 2	Inland (lake)
Suomussalmi, Kalmosärkkä	NM 14830	b	3	184	-	Sär 1, EAW, Ka 2, Ka 3, NAW, Textile, Sär 2	Inland (lake)
Suomussalmi, Kellolaisten Tuli I-II	NM 14831	b	3	172	-	Sär 1, Ka 2, Ka 3, NAW, Pyh, Anttila, Lovozero, Lu-Si	Inland (lake)
Suonenjoki, Saunaniemi	NM 14448	b	7	76	Neo	Ka 1, Ka 2	Inland (lake)
Säräisniemi, Nimisjärvi Niemelänmäki	NM 4080	b	1 ?		-	Suomusjärvi, Sär 1	Inland (lake+river)
Taipalsaari, Vaateranta	NM 30887	b	4	212	Neo	Ka 2	Inland (lake)
Taivalkoski, Tervaniemi	NM 28899	b	7	194	Meso	Suomusjärvi	Inland (lake)
Tervola, Törmävaara (30)	NM 21599	b	3	151	Neo	Ka 2	Coastal (river)
Tervola, Törmävaara (30)	NM 22071	b	1	81	Neo	Ka 2	Coastal (river)
Tervola, Törmävaara (30)	NM 22481	b	6	211	Neo	Ka 2	Coastal (river)
Tervola, Törmävaara (30)	NM 23399	b	4	52	Neo	Ka 2	Coastal (river)
Tervola, Törmävaara (30)	NM 23816	b	1	94	Neo	Ka 2	Coastal (river)
Tervola, Törmävaara (42)	NM 19009	b	5	41	Neo	Ka 2	Coastal (river)
Tervola, Törmävaara (48)	NM 22911	b	1	264	Neo	Ka 2	Coastal (river)
Tohmajärvi, Lietunniemi	NM 30463	b	1	1	Neo	Ka 2, Pöljä	Inland (lake)
Utsjoki, Ala-Jalve	NM 22488	b	1	4	-	Suomusjärvi, Lovozero, IA	Inland (river)
Utsjoki, Ala-Jalve	NM 23808	b	1	3	-	Suomusjärvi, Lovozero, IA	Inland (river)
Utsjoki, Utsjoensuu	NM 24814	b	1 ?		-	Suomusjärvi, Lovozero	Inland (river)
Vantaa, Etelä-Vantaa 2	NM 18470	b	4 ?		-	Suomusjärvi, Ka 1, CW, Morby	Coastal
Vantaa, Etelä-Vantaa 3	NM 18978	b	7	81	-	Ka 1, Morby	Coastal
Vantaa, Gröndahl 2	NM 31945	b	1	720	Meso	Suomusjärvi	Coastal
Vantaa, Maarinkunnas	NM 19992	b	50	742	Neo	Ka 2, Ka 3, CW	Coastal
Vantaa, Maarinkunnas	NM 30464	b	15	8956	Neo	Ka 2, Ka 3, CW	Coastal
Vantaa, Stenkulla	NM 29954	b,(ub)	80	1691	Neo	Ka 2, Ka 3	Coastal
Vantaa, Jokiniemi	NM 28065	b	17	197	Neo	Ka 2, Ka 3	Coastal
Vantaa, Jokiniemi	NM 28382	b	4	266	Neo	Ka 2, Ka 3	Coastal

Vantaa, Jokiniemi Sandliden	NM 28203	b, (ub)	34	523	Neo	Ka 2, Ka 3	Coastal
Vantaa, Jönsas (North-East)	NM 19914	b	2	69	-	Suomusjärvi, Kiukainen, CW, Morby	Coastal (island)
Vantaa, Jönsas (North)	NM 19275	b	14	344		Meso, Kiukainen, CW, Morby	Coastal (island)
Vantaa, Jönsas (North)	NM 19383	b	5	83	-	Suomusjärvi, Kiukainen, CW, Morby	Coastal (island)
Veteli, Kiikkuniemi	NM 32135	b	9	99	Neo	Ka 1	Coastal
Viipuri, Häyrynmäki (former Finland)	NM 5428	b	5	700	-	Ka 1, Ka 2, Ka 3, EMP	Coastal (island)
Viipuri, Häyrynmäki (former Finland)	NM 5620	b	7	186	-	Ka 1, Ka 2, Ka 3, EMP	Coastal (island)
Virolahti, Kattelus I	NM 31786	b	8	443	-	Kiukainen, Textile, Paimio, Morby	Coastal
Vuoksenranta, Korpilahti (former Finland)	NM 6688	ub	11	33	Meso	Suomusjärvi	Ancylus-lake
Yli-Ii, Kuuselankangas	NM 28943	b	5	211	Neo	Ka 2, Kierikki	Coastal (river)
Yli-Ii, Kuuselankangas	NM 39665	b	1	285	Neo	Ka 2, Kierikki	Coastal (river)
Yli-Ii, Kuuselankangas	NM 29907	b	48	431	Neo	Kierikki	Coastal (river)
Ylikiiminki, Latokangas	NM 23715	b	11	898	Neo	Sär 1, EAW, Ka 1, Ka 2	Coastal
Ylikiiminki, Latokangas	NM 25731	b	3	137	Neo	Sär 1, EAW, Ka 1, Ka 2	Coastal
Ylikiiminki, Latokangas	NM 24377	b	4	1933	Neo	Sär 1, Ka 1, EAW	Coastal
Ylikiiminki, Vepsänkangas	NM 30561	b	35	115	Neo	Sär 1	Coastal
Ylikiiminki, Vepsänkangas	NM 31036	b	80	414	Neo	Sär 1	Coastal

Appendix 3.

Identified bird taxa from Finnish archaeological sites. Museum numbers refer to catalogue numbers in the National Museum (National Board of Antiquities) (NM), Ålands museum (ÅM), University of Turku (TYA).

Township	Site	Cat. Nr.	Gavia arctica	G. stellata	Gavia sp.	Podiceps auritus	P. cristatus/P. grisegena	Phalacrocorax carbo	Cygnus cygnus/Cygnus sp.	Anser sp.	Anser sp./Branta sp.	Anas platyrhynchos	A. platyrhynchos/A. penelope	A. crecca	A. crecca/A. querquedula	Anas sp.	Aythya fuligula/A. marila	Anas sp./Aythya sp.	Somateria mollissima	Melanitta fusca	S. mollissima/M. fusca	Melanitta nigra	Melanitta sp.	Clangula hyemalis	Bucephala clangula	C. hyemalis/B. clangula	Mergus albellus	M. serrator	M. merganser	Mergus sp.	Mergus sp./Melanitta sp.	Anatidae sp.	Haliaeetus albicilla	Pandion haliaetus	H. albicilla/Aquila chrysaetos	Accipitridae sp./Pandionidae sp	Lagopus lagopus	Tetrao urogallus	T. tetrix	L. lagopus/T. tetrix	Bonasa bonasia	Tetrao sp.	Tetraonidae sp.	Arenaria interpres	Numenius arquata	Scolopax rusticola	Philomachus pugnax	Larus fuscus/L. argentatus	L. argentatus/L. marinus	Larus sp.	Laridae sp.	Cepphus grylle	Alca torda	Strigiformes sp.	Caprimulgus europaeus	Corvus corone	Undetermined Aves
Anjalankoski	Ankkapurha	NM 31785													1	1																3																									1
Askola	Pappila Siltapellonhaka I	NM 12600																														1																									1
Eckerö	Storby Mellanö	ÅM 216																																																							18
Enontekiö	Museotontti	NM 23877																																			2																				
Enontekiö	Suonttajoki W1	NM 28752																																																							1
Espoo	Bosmalm	NM 22396																														1																									
Espoo	Bosmalm	NM 23045																	1							1																															6
Espoo	Bosmalm	NM 23809																														2																									12
Evijärvi	Jokela Koskimäki	NM 11904																														1																									1
Evijärvi	Lahdenkylä Isokangas	NM 20603																														2																									3
Geta	Östergeta 16.9	ÅM 561																																																							5
Harjavalta	Hiitteenharju	NM 20493																														2														1											1
Harjavalta	Lyytikänharju	NM 13842																														1																									
Helsinki	Malminkartano Kårböle	NM 29896										1																																													
Hyrynsalmi	Koppeloniemi	NM 20634			1		2																														6	2	5	3			5														9
Iisalmi	Runni Jysmä	NM 13944																														1																									
Iitti	Tapola Kotojärvi	NM 18428																							3							8														1											3
Ilomantsi	Kuuksenvaara Suiponniemi	NM 23382																																				6																			
Ilomantsi	Piilovaara Syväys	NM 18200																																																							3
Inari	Vuopaja	NM 28365			2																																																				
Inari	Vuopaja N	NM 27810																														1																									1
Inari	Nellimjoen suu S	NM 24376																																																							2
Inari	Saamen museo	NM 27808																																									3														
Jomala	Jettböle I	NM 4781 etc.						7	18	2	1	4							578	104	10	2	17					2	8	16	8	136	3			2								1			1	4		2	1	12	1			1	292
Kangasala	Pohtiolampi	NM 32000																																																							2
Kangasala	Pohtiolampi	NM 32554			8		1																									3			1	2	2	1		1		1	1														12
Karttula	Kuivaniemi Riihikallio	NM 29891			3																											7																									1
Kemijärvi	Neitilä 4	NM 16145			1																																																				
Kemiö	Branten	TYA 589																																																							1
Kesälahti	Purujärvi Sirnihta	NM 18910					1																																																		
Kiikoinen	Uusi Jaara	NM 9409																														1																									1
Kitee	Sarvisuo	NM 29714	1									3																																													
Kittilä	Vanhainkoti	NM 28555																																																							1
Kokemäki	Kraviojankangas	NM 20584																																																							1
Kokkola	Bläckisåsen II	NM 22821																																				2																	1		1
Kristiinankaupunki	Rävåsen	NM 28659												1																		2																									
Kristiinankaupunki	Rävåsen	NM 28863																																				1				2										1					2
Kristiinankaupunki	Rävåsen	NM 29610												1																								2																			2
Kristiinankaupunki	Rävåsen	NM 30588			1									1																		2					1				1																
Kristiinankaupunki	Rävåsen	NM 30970																																				1																			
Kuhmo	Vasikkaniemi SW	NM 29136			3													1														3																									1
Kuhmo	Katerma Järvelä	NM 27024																																																							1
Kuivaniemi	Veskankangas	NM 24928							1					1	1																	5					5		1																		15
Kuivaniemi	Veskankangas	NM 25800														1								2								2																									12
Kuivaniemi	Veskankangas	NM 26699																																																							1
Kuivaniemi	Veskankangas	NM 27365																														1					1	1																			
Kuopio	Pappila Luukonsaari	NM 15517																																		1																					
Kurikka	Myllykylä Topee B	NM 17486					1								1																	1																									
Kökar	Otterböte	ÅM 200																	70																	1?													1			1					
Lahti	Renkomäki Ristola	NM 18501																														1					1																				2
Laitila	Kotjala Nästinristi	NM 20606																														1																									
Laukaa	Hartikka	NM 25807			2																											1																									
Laukaa	Hartikka	NM 26604																																																							1
Liljendal	Kvarnbacken	NM 9273																														1																									
Luumäki	Hietaranta	NM 30909																																					2																		2
Luumäki	Hietaranta	NM 31517		3																																							1														8
Nastola	Kilpisaari	NM 32180			1				1																							1						1																			
Outokumpu	Laavussuo	NM 29556																																									1														
Outokumpu	Sätös	NM 18225			1																																						1														1
Outokumpu	Sätös	NM 27704																																																							1
Outokumpu	Sätös	NM 28153																																	1		1	3	4				1														3
Outokumpu	Sätös	NM 30892																																				2																			1
Pieksämäki	Vemmellahti 1	NM 22367			1																																4						1														1
Pieksämäki	Vemmellahti 1	NM 22436																														2																									
Pieksämäki	Kirkonkylä Kahvikivi	NM 25275			4																																3																				1
Pieksämäki	Naarajärvi	NM 21519																																																							1
Pieksämäki	Naarajärvi	NM 22019																																			1																				2
Pielavesi	Kivimäki	NM 24465																																			1																				2
Pihtipudas	Rönni	NM 4146																														1																									
Pihtipudas	Vuohtojärvi	NM 4148					1																																																		
Porvoo	Böle	NM 17387																														1																									
Porvoo	Böle	NM 19799																	1													2																									2
Posio	Kuorikkikangas E	NM 28917																																			6																				
Purmo	Hundbacka Myllykangas	NM 20723																																				1																			
Puumala	Kärmelahti	NM 31376	1	2																																																					
Pyhtää	Siltakylä Brunamossen I	NM 20613								1																						2																									
Rantasalmi	Ritokangas	NM 30771																																				1																			
Ranua	Kultisalmi	NM 25927																																																							2
Ranua	Kultisalmi	NM 26851							2																												9																				

Township	Site	Cat. Nr.	Gavia arctica	G. stellata	Gavia sp.	Podiceps auritus	P. cristatus/P. grisegena	Phalacrocorax carbo	Cygnus cygnus/Cygnus sp.	Anser sp.	Anser sp./Branta sp.	Anas platyrhynchos	Anas platyrhynchos/A. penelope	A. crecca	A. crecca/A. querquedula	Anas sp.	Aythya fuligula/A. marila	Anas sp./Aythya sp.	Somateria mollissima	Melanitta fusca	S. mollissima/M. fusca	Melanitta nigra	Melanitta sp.	Clangula hyemalis	Bucephala clangula	C. hyemalis/B. clangula	Mergus albellus	M. serrator	M. merganser	Mergus sp.	Mergus sp./Melanitta sp.	Anatidae sp.	Haliaeetus albicilla	Pandion haliaetus	H. albicilla/Aquila chrysaetos	Accipitridae sp./Pandionidae sp.	Lagopus lagopus	Tetrao urogallus	T. tetrix	L. lagopus/T. tetrix	Bonasa bonasia	Tetrao sp.	Tetraonidae sp.	Arenaria interpres	Numenius arquata	Scolopax rusticola	Philomachus pugnax	Larus fuscus/L. argentatus	L. argentatus/L. marinus	Larus sp.	Laridae sp.	Cepphus grylle	Alca torda	Strigiformes sp.	Caprimulgus europaeus	Corvus corone	Undetermined Aves
Riihimäki	Sinivuokkoniemi	NM 30884																																																		1
Riihimäki	Sinivuokkoniemi	NM 31510															1															1																			
Rovaniemi	Laikala Linnamiehen karki	NM 27391																																																	1
Rovaniemi	Rautiosaari Turpeenniemi	NM 14709																																																	1
Rovaniemi	Kolpene	NM 13985														1																1						6		13				1								2
Rovaniemi	Kolpene	NM 13768																																						1												
Rovaniemi	Saarenkylä Piiritävaara	NM 26057																														1																			4
Rovaniemi	Jokkavaara	NM 21012																																						2						1						1
Rovaniemi	Jokkavaara	NM 21307																														1																			
Rovaniemi	Jokkavaara	NM 21934																																						1												1
Rovaniemi	Jokkavaara	NM 26510																														1																			1
Rovaniemi	Sierijärvi	NM 26780																														4						1		5		5		2								9
Rovaniemi	Sierijärvi	NM 26172																																				2		14												3
Ruovesi	Lapinniemi	NM 29573																																																		1
Räikkylä	Vihi 1	NM 30460							2																							5												1								1
Räikkylä	Jaamankangas Leppalaissuo	NM 26436																																																		1
Räikkylä	Kvlämmänsuo 5	NM 26774						2																																												
Räikkylä	Pörrinmökki	NM 28013																														1																			
Räikkylä	Pörrinmökki	NM 29713	1																																																1
Saarijärvi	Haikanniemi N	NM 31409																																						3						1						
Saarijärvi	Rusavierto	NM 29406																																		1																
Saarijärvi	Rusavierto	NM 31516																																				2		2						2						12
Saarijärvi	Summassaari Etelärantа	NM 28690																														2																			
Saarijärvi	Tarvaala Summassaari	NM 11865 etc.		4																																					1											
Saarijärvi	Voudinniemi 5	NM 28216																																						2											
Saarijärvi	Voudinniemi 7	NM 28216																																						9											
Savonlinna	Tynikkylänjoki	NM 27178																																				2													
Simo	Tainiaro	NM 26698													2																																					2
Sodankylä	Autiokenttä II	NM 20592																																												2						
Sodankylä	Kolamaa	NM 27957																																											1						
Sodankylä	Mettä-Vainaan Palo	NM 27676																																																	3
Sortavala (former Finland)	Otsoinen	NM 7898						1																								1						1														1
Sulkava	Kapakkamäki	NM 20787			1																											2						1		2												1
Sund	Kolsvidja	NM 13383																														2																		1		1
Suomussalmi	Tormua Särkkä	NM 18322		1	1																																														1
Suomussalmi	Kalmosärkkä	NM 14504																																																	3
Suomussalmi	Kalmosärkkä	NM 14830																																											1			1			1
Suomussalmi	Kellolaisten Tuli I-II	NM 14831																																																	3
Suonenjoki	Saunaniemi	NM 14448																																				2						5						
Säräisniemi	Nimisiitsvi Niemelänmäki	NM 4080							1																																										
Taipalsaari	Veateranta	NM 30887														1																																				3
Taivalkoski	Tervaniemi	NM 28899																																				2		5												
Tervola	Törmävaara (30)	NM 21599																														3																			
Tervola	Törmävaara (30)	NM 22071																														1																			
Tervola	Törmävaara (30)	NM 22481																														4																			2
Tervola	Törmävaara (30)	NM 23399																														3																			1
Tervola	Törmävaara (30)	NM 23816																														1																			
Tervola	Törmävaara (42)	NM 19009																														5																			
Tervola	Törmävaara (48)	NM 22911																																																	1
Tohmajärvi	Lietunniemi	NM 30463																																		1															
Utsjoki	Ala-Jalve	NM 22488																														1																			1
Utsjoki	Ala-Jalve	NM 23808																																																	1
Utsjoki	Utsjoensuu	NM 24814																														1																			
Vantaa	Etelä-Vantaa 2	NM 18470																							3				1																							
Vantaa	Etelä-Vantaa 3	NM 18978																														2																			5
Vantaa	Gröndal 2	NM 31945																														1																			
Vantaa	Maarinkunnas	NM 19992																		3												2																			45
Vantaa	Maarinkunnas	NM 30464																														4								1						1					9
Vantaa	Stenkulla	NM 29954			1							1		1	1									2								34	2	2	1	10	8		2	2					4				9
Vantaa	Jokiniemi	NM 28065													1	10		1										1				1																			3
Vantaa	Jokiniemi	NM 28382														1																1																			2
Vantaa	Jokiniemi Sandliden	NM 28203			1		1							1	2	1	1		1											1		17																			8
Vantaa	Jönsas (North-East)	NM 19914																														1																			2
Vantaa	Jönsas (North)	NM 19275					1			1																			1			4																			7
Vantaa	Jönsas (North)	NM 19383					1																									1																			2
Veteli	Kilkkuniemi	NM 32135			1																																														3
Vipuri (former Finland)	Häyrynmäki	NM 5428		1	1																											1																			2
Vipuri (former Finland)	Häyrynmäki	NM 5620													1																1	1																			4
Virolahti	Kattelus I	NM 31786		1										1	2																	1																			3
Vuoksenranta (former Finland)	Korpilahti	NM 6688							11																																											
Yli-I	Kuuselankangas	NM 28943																																																	
Yli-I	Kuuselankangas	NM 30665	1																																															
Yli-I	Kuuselankangas	NM 29907																																				38			3		3								4
Ylikiiminki	Latokangas	NM 23715																														3		3																5
Ylikiiminki	Niemikylä Latokangas	NM 25731																																				3													
Ylikiiminki	Säävälä Latokangas	NM 24377																														1								1						2				
Ylikiiminki	Vepsänkangas	NM 30561			1								3		7			4														5																			8
Ylikiiminki	Vepsänkangas	NM 31036	1	2	4		1						10	7	5				1	1				4			5					7																			39