DANISH REVIEW OF GAME BIOLOGY Vol. 9 no. 1

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by
ANDERS HOLM JOENSEN

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Continued cover page 3

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CONTENTS

Chapter III

Chapter IV

Chapter V

Chapter VI

Abstract

The study during 1965–1973 comprised surveys of 1) the size and distribution of the non-breeding populations of waterfowl (except geese), based on monthly ground counts in selected inland and coastal habitats and aerial surveys over coastal and offshore waters. – 2) the size and distribution of the annual kill by sportsmen of each duck species, based on the official bag-record supplemented with questionnaire surveys and analysis of game dealer statistics. – 3) the annual age- and sex-composition in ducks, diving ducks in particular, based on a material of bagged birds, and in the case of three seaduck species also oil-killed individuals. The report summarizes the main aspects of occurrence of each species and the importance of the different areas, and evaluates the relations between the populations, their age- and sex-composition and their utilization by shooting. Some preliminary remarks are given on factors determining the distribution pattern, particularly the weather and the existence of areas where shooting and traffic are restricted. The importance of Denmark as a staging and wintering area for waterfowl in NW. Europe is discussed.

Introduction

Denmark and its surrounding waters play a very important role for waterfowl of the western Palaearctic region. The country has very large areas of excellent waterfowl habitats, and is situated on a major migration route. Some of the fifteen breeding species occur in sizeable numbers, but the populations of non-breeding waterfowl found almost throughout the year are far larger. They include several hundred thousand seaducks which undergo a wing moult in summer, and in addition hundreds of thousands of ducks and coot and tens of thousands of swans and geese visiting Denmark during autumn, winter and spring. Some are only present during their passage between northern breeding grounds and winter quarters further south and southwest in Europe, while many spend the winter in Denmark. The country has a long tradition of waterfowl shooting, and as regards the increasing interest in bird-watching, waterfowl represent a natural resource of great recreation value. At the same time however, the development of modern society has led to increased pressure on waterfowl populations, both indirectly through the destruction of wetlands, and more directly through increased disturbance, shooting, and pollution.

In recent years, both the public and the authorities of most countries have come to understand the importance of maintaining large and varied waterfowl populations. It has also been realized that only by collection of quantitative and qualitative information on bird populations can the fundamental requirements of waterfowl be considered in plans for the utilization of natural resources. On this premise the International Waterfowl Research Bureau (IWRB) was founded about twenty-five years ago, and during the last ten to fifteen years in particular this body has prompted authorities and research workers to

initiate and co-operate in research projects, of which the present study forms part.

Waterfowl research in Denmark is mainly conducted by the Zoological Museum in Copenhagen (ZM), Dansk Ornithologisk Forening (DOF), and, in particular, at the Game Biology Station (GBS). All three institutes have begun new projects in recent years, (especially since 1960), and with reference to the abovementioned problems, the mapping of important bird-breeding areas including wetlands (DOF), the surveys of non-breeding waterfowl (GBS), and the intensified ringing of waterfowl (ZM, GBS), have been emphasized.

In 1963 the Game Biology Station initiated counts of visiting geese, and much of the information obtained has been dealt with in reports by Mrs. METTE FOG, who has been in charge of this project. In 1966 a general survey of the size and distribution of the non-breeding populations of all *Anatidae* was started, and in subsequent years this programme was gradually expanded to cover other aspects of waterfowl populations in Denmark. The present report summarizes the results obtained during 1965–1973 for ducks, swans and coot (see Appendix 3 p. 206). Published information on geese has been used in Chapter V, while other waterbirds are not included in this report.

OBJECTIVES OF THE STUDY

The main objectives of the study during 1965–1973 were:

1) estimation of the size of the waterfowl populations occurring during autumn, winter and spring, and study of their seasonal and annual variations.

2) study of the geographical distribution of waterfowl and classification of the different wetlands, according to their importance for waterfowl.

Data on waterfowl populations were obtained by monthly ground counts during Sept.–April in selected inland and coastal areas, and by all-year aerial surveys over coastal and offshore waters.

3) estimation of the size, geographical distribution and monthly and annual variations of the bag of each species of duck, and evaluation of the impact of shooting on the duck populations.

Information on the kill was obtained from the official bag-record, supplemented by special surveys: a) a questionnaire survey to sportsmen about the bag of diving ducks other than *S. mollissima* in five seasons (1966/67–1970/71), and b) analysis of game-dealer data concerning the bag of dabbling ducks other than *A. platyrhynchos* in three seasons (1969/70, 1970/71, 1971/72).

4) study of the levels and annual variations of the juvenile production in ducks, and evaluation of the importance of this factor to the size of the winter population and the kill.

This study primarily covered diving ducks, for which data was obtained by examination of bagged birds in five seasons (1968/69–1972/73). Additional information on seaducks was obtained by examination of birds killed in oil disasters, and in addition a small sample of bagged dabbling ducks (except *A. platyrhynchos)* was obtained in three seasons (1970/71–1972/73).

5) establishment of methods by which annual variations and long-term trends in population sizes and kill, and variation in production, could be studied in future.

Information on mortality etc., as illustrated by ringing data, has not been used in the present study.

The three first chapters of this report describe the methods and materials of the three main parts of the study, the waterfowl population survey (Chapter I), the waterfowl kill survey (Chapter II), and the production survey (Chapter III). Chapter IV summarizes the main results for each species of duck and swan and the coot, and Chapter V comprises a survey of the most important areas in Denmark and its surrounding waters. Finally Chapter VI contains a discussion of the results and conclusions.

In addition to the main projects outlined above, the following specialized studies treated in earlier reports were conducted during 1966–1973: a) the size and distribution of the population of *S.mollissima* breeding in Denmark (JOENSEN 1973 b). – b) the distribution and numbers of seaducks moulting in Danish waters (JEPSEN & JOENSEN 1973, JOENSEN 1973 a), – and c) the problem of oil pollution in Danish waters, with special reference to the impact of major disasters on the winter populations of seaducks (JOENSEN 1972 a, 1972 b, 1973 c). Preliminary reports on the waterfowl counts were published annually (JOENSEN 1967–1973, and 1968), and in another report some of the main aspects of the present study have been summarized (JOENSEN in press).

Some comments on the use of aircraft for waterfowl surveys may be given here. The Game Biology Station started this method in 1966 by hiring aircraft. From 1968 the Royal Danish Airforce and the Station initiated a joint programme, with the purpose of reducing the number of collisions between aircraft and birds. Statistical information from bird-strike reports showed that the more or less permanent concentrations of waterbirds presented a major hazard to aviation, and among several projects, the mapping of bird concentrations was given high priority. For this reason the Royal Danish Airforce assigned a large amount of flying time to the study, which together with surveys from aircraft hired by the Game Biology Station served two functions, viz. to create a basis for improved flight safety, and to collect data for the waterfowl population survey. Also ornithologists doing military service were participating in the project. The bird-strike aspects of the surveys have been treated in maps showing bird concentration areas which are particularly hazardous to aircraft on low-level missions, published by military and civil aviation authorities (Air Information Publication, AIP Denmark 1970 and 1973. – Flight Information Publication, 1973. – Official Danish Low Level Charts, 1971 and 1973) (ANON).

ACKNOWLEDGEMENTS

The present report is the result of the contribution of several thousand people, who provided information and co-operated in various ways to establish a sound basis for the future conservation and management of waterfowl in Denmark. So many have contributed that it is not possible to thank them all individually. The author is most indepted to them all, and it has been of great satisfaction to work on a project which created so much interest and voluntary effort.

In particular the author would like to thank Mr. EBBE BØGEBJERG HANSEN, who has been attached to the waterfowl survey at the Game Biology Station since 1969. Great admiration is due him for his initiative and never-failing efforts to obtain information in the field, whether from the ground, at sea or in the air, –

and for his excellent organization of the tedious compilation of endless amounts of count data.

Counts on the ground were conducted by several hundred people, many of whom worked voluntarily on the project year after year. They are all to be thanked, and particularly the organizations of Dansk Ornithologisk Forening and Natur & Ungdom for their help in recruiting counters among their members. Thanks are also due to the game advisers and wardens, who covered most of the game reserves, and to Mr. PELLE ANDERSEN-HARILD, who organized counts on Sealand in the first years of the study.

The author is greatly indebted to the Royal Danish Airforce and the Army Air Corps for supplying aircraft and manpower for the joint effort to solve the problem of bird-strikes and to collect data for the waterfowl population survey. Thanks to Lt.Col. E. P. SCHNEIDER, chairman of the Bird-Strike Committee Europe, this has been a most inspiring and successful co-operative project. Thanks are also due to the many pilots, both military and civil, whose interest in the project and professional experience have been essential for the very specialized type of flying, often under marginal conditions. The author is most indebted to Messrs. I. CLAUSAGER, P. UHD JEPSEN, L. KORTEGAARD, H. NOER and F. SPAGNER, who together with E. BØGEBJERG HANSEN and himself, acted as observers in aerial surveys. Thanks are also due to the drafted ornithologists who during their time in service worked on the compilation of count data.

The analysis of the species composition of the bag of diving ducks is based on information from several thousand sportsmen, many of whom also supplied important additional data. The study of age- and sex-composition among bagged birds is based on material obtained at the following game firms: MØLLER & MELGAARD (Copenhagen), ANDERSEN & SCHRØDER (Copenhagen), BARTELS EFTF. (Århus), and CENTRUMFISK (Svendborg). The author thanks them all, especially Mr. J. PRYDS (†) and director H. VORBECK of MØLLER & MELGAARD, who also supplied data from the files, used for monthly kill indices and the study of species composition among bagged dabbling ducks.

The author wishes to extend cordial thanks to the director of the Game Biology Station, Professor H. M. THAMDRUP, and to the executive committee of Kalø Jagtgård for encouragement and support of the project. Thanks are also due to colleagues at the Game Biology Station, in particular Mr. BIRGER JENSEN, for many inspiring discussions during the study and criticism of the manuscript of this report. Mr. H. NOER helped in the statistical treatment of data on species composition of the bag, and Mr. L. FERDINAND supplied unpublished data on the breeding populations of some waterfowl species, and both are to be thanked.

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Chapter I

The waterfowl population survey

The present report describes the results of waterfowl counts during the period September 1965–April 1973. The data were obtained 1) by ground counts once a month from September to April in selected inland and coastal areas, and 2) by aerial surveys over coastal and offshore waters. In nine country-wide surveys, data from aerial surveys and ground counts were combined to estimate the size and distribution of the total waterfowl population in the whole of Denmark and large parts of its surrounding waters. Aerial surveys have only been conducted on a rather limited scale in Europe, and therefore particularly the method and accuracy of this type of survey is treated in some detail in the present report.

GEOGRAPHICAL DIVISION

It became evident after some survey activity that for treatment of the growing amounts of data, it would be necessary to adopt a geographical division of waterfowl habitats in Denmark, based both on biotope criteria and on methodological aspects, particularly those connected with aerial surveys. In the system introduced in 1969, and to which also previous information has been transferred, the country and surrounding waters were divided into 18 districts, 54 sub-districts and approximately 1,600 units. Districts and sub-districts are shown in Fig. 1. The division into districts is primarily based on biotope criteria, for example most inland habitats being separated from coastal areas. The smaller sub-districts are also separated on biotope criteria, but their size is limited to an area which can be covered with aircraft in one flight. The division into units is based on both biotope and survey criteria. One unit mostly comprises one small lake, or, in the case of larger lakes or coastal habitats, only those areas which can be surveyed by ground counts from a few points along the shore. Such units are often very small, whereas in offshore waters surveyed only from aircraft they are considerably larger. The code used for the geographical classification comprises a capital letter for the district, followed by a small letter for the sub-district and a two-figure number for the unit. For example, the Kalø estate with its ponds is one unit, coded »Fa 10«.

CLIMATIC CONDITIONS IN WINTER

Some meteorological data on the eight count seasons are presented in Table 1, and the ice-conditions in Danish waters as recorded in country-wide waterfowl surveys in winter are illustrated in Fig. 3 p. 21. Such information is essential for understanding aspects concerning both the waterfowl populations and their utilization by shooting, and is touched upon in several connections in the following

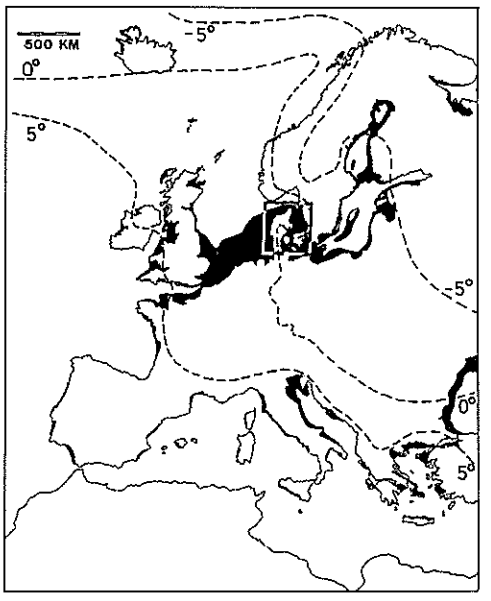


Fig. 1a. Map of Europe showing the position of the study area, January isotherms (5°, 0°, and –5° C.), and the distribution of salt water areas with less than 40 m. depth (black), see Fig. 72 p. 133.

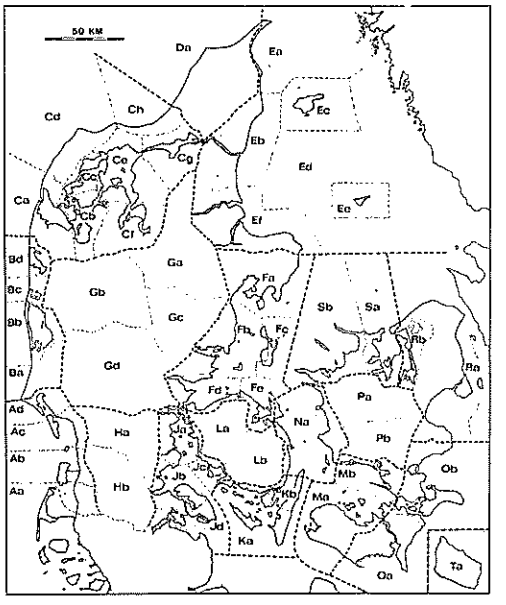


Fig. 1b. The division of Denmark and its surrounding waters into districts and sub-districts used in the waterfowl counts.

	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	Normal
No. days with frost Sept.–April	112	72	83	109	105	69	76	65	96
No. days with max. 0° C.	44	8	18	30	57	19	17	1	24
Amount of cold (see note)	163	32	94	116	208	84	133	59	102
No. days with windforce ⩾6, Beaufort scale, Oct.–Feb.	14	17	21	11	21	20	28	20	20

Table 1. Meteorological data illustrating the severity of the winters 1965/66 – 1972/73, and the frequency of strong winds in the corresponding diving duck shooting seasons. From »Statistical Yearbook« and Statens Istjeneste. – Note: Amount of cold = The product of the mean temp. (° C.) of the frosty period and the number of days of the period.

chapters. It is seen that the eight winters illustrate the extremely variable conditions occurring during winter in Denmark. For example, five seasons were close to the normal (mean) conditions, but the period also includes two very mild winters (1966/67 and 1972/73) with very little ice in Danish waters, and a very severe winter (1969/70) during which large stretches of open sea were covered by ice (see p. 158).

Monthly ground counts 1965/66 - 1972/73

In the winter of 1965/66 ground counts were conducted in various areas, including several wetland reserves. In 1966/67 the Game Biology Station initiated a programme of monthly ground counts, and in 1967/68 the number of count localities was increased considerably and has remained high in succeeding years. In the annual reports of the Station »Dansk Vildtforskning«, preliminary reports on count activities with maps showing count localities have been given (JOENSEN 1967–1973). Here only a brief summary of activities in eight seasons (1965/66–1972/73) is mentioned.

Some important areas in western and northern Jutland have been covered by staff of the Station, and in most wetland reserves counts were conducted by game advisers or wardens. However most localities were covered by amateur ornithologists, sportsmen, foresters and others who voluntarily joined the programme. Since 1967/68 150–250 persons have participated annually, and the total number in all seasons exceeds five hundred people.

The count season included eight months (September–April), the intention being to cover each locality once a month. The count date (the international date) was the Sunday nearest to the 15th of the month. In practice however, adverse weather conditions and other factors often caused alteration of the count dates. Approximately 75% of the counts were conducted within a five day period around the actual count date.

In Table 2 information on the activities in each count season and each geographical district is given. In the last six seasons about five hundred localities have been covered annually. About 60% were covered more than four times, and 25% in all eight months during the count season. The total number of reports is 16,500, each of which represents one locality in one month, and in addition repeat surveys during September–April resulted in about 500 reports, and counts during May–August in about 1,000 reports.

In planning the monthly counts, localities known to be important waterfowl haunts were selected in particular, and the most important areas were covered in almost every season. In addition, many types of habitat apparently of little importance were included.

The material available after eight seasons represents both a very large number of localities and a great variety of biotopes. Practically all lakes of more than 0.5 km^2 in area were covered in at least three count seasons, and large amounts of data were also gathered from many smaller lakes, ponds, moors and streams. All types of coastal biotopes have been surveyed, and particularly important marshlands, fiords, bays, coves and shallow tidal waters were covered for several seasons in succession.

The total number of geographical units represented in the material exceeds 900, of which 60% were covered more than ten times during the whole period 1965–1973. Table 2 (right column) shows that in most districts, ground count data were available from a large proportion of the geographical units. However, particularly in districts D, H and L, the values were low. Nearly all the important localities in these districts were in fact covered, but data from secondary waterfowl habitats were scarce compared to other parts of the country. For districts D and H this was primarily caused by an absence of local contributors.

District	1965/66		1966/67		1967/68		1968/69		1969/70		1970/71		1971/72		1972/73		% of all units represented
	1–4	5–8	1–4	5–8	1–4	5–8	1–4	5–8	1–4	5–8	1–4	5–8	1–4	5–8	1–4	5–8	
A	–	–	17	4	30	12	23	12	24	5	6	5	4	7	21	10	73
B	–	–	12	4	9	10	17	4	11	1	8	10	18	4	8	12	66
C	10	4	22	8	8	29	19	44	16	33	17	51	39	38	44	36	67
D	1	–	–	–	–	–	2	2	–	3	1	6	–	5	3	5	22
E	6	2	13	5	4	9	16	12	24	12	14	15	11	11	12	8	41
F	12	4	12	12	24	22	24	32	19	23	11	20	12	18	13	15	58
G	16	1	9	13	33	35	13	45	27	53	13	52	14	52	17	47	59
H	–	1	3	2	–	7	–	7	3	4	3	4	–	5	2	4	12
J	8	2	21	3	6	33	23	49	12	35	17	42	4	25	12	32	75
K	14	3	9	6	5	12	1	14	4	16	3	8	4	4	3	8	60
L	8	1	1	5	1	7	2	9	4	4	3	5	3	6	1	5	30
M	–	5	7	10	3	16	13	11	6	15	3	13	7	12	9	12	66
N	3	–	1	–	12	5	8	4	8	6	7	8	11	5	3	7	48
O	9	4	5	6	5	16	8	16	15	15	12	24	13	22	11	20	73
P	–	1	7	4	11	6	1	6	4	7	6	5	3	15	7	15	53
R	51	3	23	15	30	36	15	31	36	40	21	50	21	40	29	41	90
S	1	1	12	3	22	4	5	1	6	4	4	4	4	2	3	5	70
T	–	2	–	2	25	3	15	5	13	8	13	16	2	16	6	10	51
Subtotal	139	34	174	102	228	262	205	304	232	284	162	338	170	287	204	292	
Total	173		276		490		509		516		500		457		496		59
Covered 8 months	26		40		119		152		118		170		157		169		
No. reports	484		1012		2216		2592		2424		2746		2483		2494		

Table 2. The number of localities covered in each season from 1965/66 to 1972/73 by ground counts. For each district (see Fig. 1) the number of localities covered 1–4 and 5–8 months in the season respectively is given. Total number of localities covered in all eight months is given below (used for monthly count indices). Right column: The percentage of geographical units for which ground count data has been obtained.

Aerial surveys

The coastline (about 7,300 km) and the presence of huge areas of shallow water far from the coast (see Fig. 72 p. 133) imply that a large proportion of the waterfowl occur in areas which cannot be covered from the ground, and such populations can only be satisfactorily mapped and assessed using aircraft (JOENSEN 1968).

Before 1966 aircraft had only been used in Denmark in connection with studies of particular species. When the waterfowl population survey started that year, the Game Biology Station began methodological studies on the use of aircraft in general waterfowl surveys. In the following years survey activities gradually increased, and aircraft became a routine instrument in surveys without which we would today still have very little idea of the size and distribution of waterfowl populations in Danish waters.

Although the primary purpose of the aerial surveys was to estimate the num-

bers of ducks, swans and coot, many other species were also recorded. Data on geese (particularly *B. bernicla)* have been used in the goose survey at the Game Biology Station (FOG 1967, 1971). In addition the material comprises very valuable information on *Phalacrocorax carbo* (see JOENSEN 1968 p. 64–65), some species of waders, gulls, and seals *(Phoca vitulina)*. Although *Gavia* spp., *Podiceps* spp. and *Alcidae* are difficult to observe from aircraft, some data are also available on these species. In the present report only data on ducks, swans and coot have been used.

In the following chapters the method and accuracy of aerial survey will be discussed, and later (p. 17) an account of the survey activities in the period 1966–1973 is given.

METHOD

The method of conducting aerial surveys of waterfowl has been described in a previous report (JOENSEN 1968), and only a brief summary is given here.

Two types of single-engined high-winged aircraft were used: 1) CESSNA 172 (hired by the Game Biology Station), which seats up to four persons and has an endurance of approximately five hours. This aircraft was mostly used in regions where its long endurance and the possibility of having two (and even three) observers besides the pilot were advantageous. 2) The KZ VII supplied by the Royal Danish Airforce and the Army Air Corps, which seats two persons and has an endurance of two hours. This type has mostly been used in areas where its lower speed and excellent performance are advantageous, but the presence of only one observer besides the pilot prolongs the time of coverage compared to that of the Cessna.

Only professional pilots with long experience in low flying were engaged in the surveys. The aircraft were equipped with radio, and each crew member had a waterproof immersion suit, crash helmet, life jacket with emergency transmitter and a one-man dinghy. Since most surveys were conducted over offshore waters, often in unfavourable winter weather conditions, the safety measures taken were considered very important. In later years both pilots and observers have participated in life-saving drills at sea arranged by the Airforce. During nearly one thousand hours of flying only one major incident was experienced, when in Nov. 1969 an aircraft landed in the sea due to engine failure. It was severely damaged but the three crew members were uninjured.

Only a small number of observers, all carefully trained, have participated in aerial surveys. As a result, more than three-quarters of all survey time has been performed by observers with more than 75 hours of survey experience. The importance of this point will be fully understood when considering the duties of the first observer, seated beside the pilot in the aircraft. They include flight-planning before and during the flight, navigation and instruction of the pilot, spotting of the majority of birds, determination of species and estimation of flock size, dictation into a tape-recorder of observations made by himself and other crew members, constant recording of the flying route (drawn on a map) and the location (geographical unit) of all flocks, recording of ice-cover and weather data, and after the flight, the preparation of a report. The first observer's acquaintance with the areas to be covered and

his experience in estimating flock size are of particular importance.

The altitude of the flight path depends on weather conditions, type of habitat and the species involved, but is generally 150–300 feet above sea-level. During conditions of flat calm sea, altitudes of 400–600 feet are often advantageous.

ACCURACY OF AERIAL SURVEYS

The experience gained in the first two years concerning accuracy of aerial surveys was described in a previous report (JOENSEN 1968). Since then further studies have been made, which in most respects confirm the earlier results, although the impression from later surveys, often conducted under less favourable conditions, is that accuracy in practice is often less than originally assumed.

In the following, the most important points concerning accuracy of counts by experienced observers are discussed.

1) Species identification in general presents no major problems, because in aerial surveys the birds are closer than in most ground counts, and also viewed from a more favourable angle, in which details such as wing patterns are more easily seen. The different species generally occur in separate groups although dabbling ducks in particular are occasionally found in mixed flocks. In such cases the proportion of each species can be difficult to estimate. The three species of swans also often occur together, and accurate distinction requires very close observation. In most cases »undetermined swans« have been classified as *C. olor* (the most numerous species), and the numbers of *C. cygnus* and in particular *C. columbianus* are undoubtedly often under-estimated. This was particularly the case in Jan. 1969 (see p. 123), when the species of most swans observed in the south-eastern part of Denmark was undetermined.

2) Species generally occurring in small numbers and/or widely scattered will often be overlooked, particularly when they constitute a small proportion of the birds in the area (e.g. *A. clypeata* and *M. albellus*, and in some areas also *Cl. hyemalis* and *M. serrator).*

3) The recording efficiency varies with the conspiciousness and behaviour of the species. For instance *Cl. hyemalis, B. clangula* and occasionally *M. nigra* under certain conditions of light are well-camouflaged and often readily dive or take off and fly away when approached by the aircraft, and are thus often overlooked. In contrast *T. tadorna, S. mollissima* and the swans are very easily spotted.

4) The accuracy of flock size estimates has been checked in a large number of cases, and the results reported earlier (JOENSEN 1968) are generally valid for experienced observers. Since 1968 estimates of very large flocks (10,000–50,000 *A. marila* and *S. mollissima)* have been checked with photographs in about 25 cases. In half of the cases, the visual estimates were within ± 25% of the actual number, but in half of the cases the discrepancy was greater and most often the flock size was under-estimated by the observer. Under-estimates were particularly found with very large flocks of 30,000–50,000 birds, and this tendency is probably linked with a degree of caution on the part of the observers. In other words, even the most experienced observer does not really believe the existence of such huge concentrations, and his caution will reduce the size of the estimate.

All checks were made in excellent weather, and there is no doubt that the tendency to under-estimate huge assemblies of birds becomes even more pronounced in less favourable weather (see below). The results of comparisons suggest that species frequently occurring in large flocks are generally under-estimated (*A. marila, S. mollissima* and *M. nigra* in particular). No doubt the low numbers of *S. mollissima* recorded in the first two country-wide surveys (Nov. 1967 and Jan. 1968, JOENSEN 1968) can partly be ascribed to this factor. Although in later surveys observers have become aware of this tendency and probably produce better estimates, the bias towards under-estimation of huge flocks is still a reality.

5) The weather is a factor which considerably influences recording efficiency (JOENSEN 1968), particularly of seaducks during their flightless period in summer (JOENSEN 1973 a). Most surveys are therefore conducted in favourable weather conditions. However, some flights were conducted during less favourable weather, particularly during country-wide surveys (see p. 21) carried out to cover all relevant waters within the shortest possible period. Since the alternative often was to omit an area from the surveys, it was decided that even a flight under rather poor conditions would supply some valuable information. In some cases a poor survey could be replaced by a survey later in the month under better conditions, but this was not always practicable. The recording efficiency drops considerably with reduced visibility and light, with increased wind and wave action, and with precipitation. The worse the conditions are, the fewer birds are recorded, and the sensitivity varies from species to species. For *Cl. hyemalis, M. nigra, M. fusca, B. clangula* and *M. serrator* a significant drop in efficiency already starts at windforce 3–4 (Beaufort scale), and again *T. tadorna, S. mollissima* and the swans provide a contrast, although the recording efficiency of these species is also affected by the weather. By intensifying the aerial survey (routes closer together, and repeat coverage of particular areas) it is often possible to compensate for the low recording efficiency, but not for all species.

In summary, the following points are important for understanding the accuracy of aerial surveys: Since birds are invariably overlooked, all estimates must be regarded as minimal. Under-estimates are much more common than over-estimates and vary with the species, the degree of gregariousness and the weather. The best overall estimates are probably obtained for the swans and for species generally occurring in flocks of 100–1,000 birds (e.g. *A. platyrhynchos, A. acuta, A. penelope, T. tadorna, A. ferina* and *M. merganser*). Species mostly occurring in very small numbers and with a scattered distribution are often overlooked (e.g. *A. clypeata, Cl. hyemalis, M. serrator* and *M. albellus*). Large flocks are generally under-estimated, and particularly those species which frequently occur in concentrations of tens of thousands are under-estimated (*A. marila, M. nigra* and *S. mollissima*). Weather conditions considerably influence the recording efficiency, and for many species estimates obtained in poor weather are not comparable to estimates obtained in favourable (good to excellent) weather (see p. 17).

It is characteristic for all the various factors reducing accuracy (= recording efficiency) that there is no possibility of numerical correction. Although aircraft survey is the only method by which a large proportion of the waterfowl in Danish waters can be counted the data obtained must be regarded as minimal and very approximate. Comparisons of results from different surveys should

therefore only be made in cases where weather conditions and the degree of coverage are the same, and even in such cases apparent differences in bird numbers present should only be considered reliable when there is a considerable difference between estimates.

AERIAL SURVEYS, SEPT. 1966–JAN. 1973

The present report describes data obtained from aerial surveys during Sept. 1966 to Jan. 1973. In this 6½-year period a total of approx. 950 hours were spent in the air, of which actual survey time comprised approximately 750 hours, the rest covering transportation time between airfields and coasts. Survey activities are illustrated in Table 3–4, and Appendix 1 p. 198 gives information on each flight in the months Oct.–April. Similar information on surveys during summer (May–Sept.) was given in a previous report (JOENSEN 1973 a, Appendix 1).

The weather conditions for each aerial survey were evaluated and described with a Roman numeral code as follows; III: Excellent weather, i.e. visibility more than ten km, no precipitation, very little or no wind and no wave action (both during summer and winter very high recording efficiency possible for nearly all species). – II: Good weather, i.e. visibility more than three km, no precipitation, wind force not exceeding 3–4 (Beaufort scale) or causing only little wave action (recording efficiency during winter high for most species, although somewhat reduced for some species, see p. 16). – I: Poor weather, i.e. visibility less than three km, combined with precipitation and/or strong winds and much wave action (recording efficiency reduced for most species). Light conditions, particularly the amount of disturbing reflection, have also been considered in this classification. The degree of coverage of subdistricts has been described in Appendix 1 as 1 = less than 25% of the waterfowl habitats covered (mostly transects), 2 = 25–75% covered, or 3 = 75–100% covered.

Country-wide surveys

More than half of the total flying time was used in nine country-wide surveys, where results from two or three aircraft operating simultaneously were combined with data from ground counts to illustrate the distribution and size of total populations. It was intended to cover as large an area as possible within the shortest possible period. Although some surveys covered more than one month, in this report they are referred to as Nov. 1967, Jan. 1968, Nov. 1968, Jan. 1969, March 1969, Nov. 1969, Jan. 1970, Jan. 1971 and Jan. 1973. A survey was also begun in Jan. 1972, but owing to adverse weather only one-third of the relevant areas could be covered.

The two first country-wide surveys were described in an earlier report (JOENSEN 1968), and here only a brief account of all surveys is given. Background information is provided in Table 4, and the areas covered with aircraft in the last seven surveys are indicated on maps Fig. 2.

Coverage: With the exception of March 1969, when some important waters in the south-eastern part of the country could not be covered, all country-wide surveys included most of the important fresh-water habitats and also practically all important salt-water areas within 5–8 km of coasts. Only some coasts of little importance were left out in some surveys

(west coast of Jutland north of Blåvandshuk, and some coasts of NE. Sealand and Bornholm). For the large majority of species, which are confined to the habitats mentioned, all relevant haunts were covered. A possible exception is *A. platyrhynchos*, which occasionally occurs in inland waters omitted from the survey (particularly in Nov., see p. 68). The coverage of offshore waters further away from the coasts varied much and was generally less complete. In Nov. 1967, Jan. 1968 and Nov. 1969 fewer areas were surveyed and generally more superficially than in the other five surveys. In all surveys some shallow offshore areas were omitted, particularly in the northern and central Kattegat. For species occurring

cont. p. 21

Year	May–Sept.	Country-wide surveys Jan., March and Nov.	Other surveys Jan.–April and Oct.–Dec.	Total
1966	3/2	–	7/6	10/8
1967	22/21	44/42	26/21	92/84
1968	24/21	108/91	10/9	142/121
1969	51/44	178/125	31/23	260/192
1970	62/51	54/44	54/39	170/134
1971	41/35	69/50	39/29	149/114
1972	5/3	–	40/29	45/32
1973	not includ.	74/55	not includ.	74/55
Total	208/177	527/407	207/156	942/740

District	Jan.	Feb.	March	April	May-Sept.	Oct.	Nov.	Dec.	Total	No. in country-wide surveys
A	6	3	4	2	11 (12)	3	4	3	36 (37)	9
B	6	3	3	3	13	3 (4)	4	3 (4)	38 (40)	9
C	7	1	2	1	14 (16)	3 (4)	4	1	33 (36)	9
D	–	–	–	–	1	–	–	–	1	–
E	7	1	3	1	12	1	3	1	29	9
F	7	2	3	–	13	4	3	3 (4)	35 (36)	9
G	5	–	1	1	–	–	2	–	9	8
H	2	–	–	–	–	–	–	–	2	2
J	5	–	1	–	3	–	3	–	12	9
K	5	–	–	–	4	–	3	–	12	8
L	–	–	–	–	–	–	–	–	–	–
M	6	–	1	1	6	–	3	–	17	9
N	5	1	1	–	5	–	3	–	15	9
O	6	–	1	1	4	–	3	–	15	9
P	–	–	–	–	–	–	1	–	1	1
R	6	–	1	–	–	–	2	–	9	8
S	6	1	1	–	7	1	3	1	20	9
T	2	–	–	–	–	–	1	–	3	3

Table 3. Summary of aerial surveys Sept. 1966 – Jan. 1973. Top: The number of flying hours / survey hours in May–Sept. (see JOENSEN 1973 a p. 39, Appendix 1), country-wide surveys (see Table 4), and other surveys Jan.–April. – Bottom: The number of months in which aerial surveys were conducted in each district (in cases of more than one flight in one month of a year the number of flights is given in brackets). For details see Appendix 1 p. 198.

District	November 1968 ASM	W	GC	TU	January 1969 ASM	W	GC	TU	March 1969 ASM	W	GC	TU	November 1969 ASM	W	GC	TU	January 1970 ASM	W	GC	TU	January 1971 ASM	W	GC	TU	January 1973 ASM	W	GC	TU
A	118	e	12	53	125	e	16	54	117	g	12	46	203	g	12	46	140	g	6	60	220	g	12	59	141	e	16	56
B	72	e	5	39	75	g	7	41	129	g	5	34	160	e	4	37	90	g	6	51	74	g	8	38	194	e	5	37
C	454	ge	56	116	310	g	58	116	294	e	54	112	428	gp	45	108	282	e	51	126	388	ge	60	119	500	ge	35	113
D	–	–	3	3	–	–	2	2	–	–	1	1	–	–	4	4	–	–	3	3	–	–	6	6	–	–	6	6
E	343	g	19	66	287	e	18	68	234	e	10	58	318	g	14	65	260	e	15	65	430	g	17	65	386	g	10	65
F	404	g	35	120	344	g	32	124	280	g	41	98	308	g	20	92	495	gp	27	117	390	g	31	113	641	g	17	114
G	19	e	59	64	6	e	69	69	15	e	44	44	5	e	55	58	15	e	53	57	73	ge	58	75	5	g	49	51
H	–	–	7	7	4	e	8	13	–	–	5	5	–	–	5	5	–	–	2	2	16	g	6	12	–	–	4	4
J	292	e	54	98	269	g	48	96	115	g	50	78	440	g	39	90	405	g	44	100	274	ge	44	94	275	e	31	98
K	290	e	22	62	226	e	15	63	–	–	21	21	270	g	21	60	173	g	18	60	190	g	16	50	303	ge	15	59
L	–	–	10	10	–	–	8	8	–	–	8	8	–	–	5	5	–	–	5	5	–	–	7	7	–	–	4	4
M	249	g	18	54	174	e	23	53	34	g	15	26	248	g	20	53	128	g	28	56	175	g	24	48	204	g	14	53
N	123	g	11	37	152	e	10	40	55	g	7	33	225	g	8	38	186	g	14	44	160	g	14	41	236	g	13	42
O	276	g	24	58	256	e	25	55	133	e	20	33	267	gp	26	57	165	g	26	60	178	g	32	57	268	g	24	62
P	5	e	9	11	–	–	9	9	–	–	9	9	–	–	14	14	–	–	10	10	–	–	13	13	–	–	16	16
R	170	g	38	53	128	e	32	50	53	e	30	34	85	g	43	58	95	g	40	55	119	e	42	55	65	g	40	49
S	213	g	1	40	209	e	1	46	276	g	2	43	180	g	6	40	183	g	7	43	298	g	4	45	108	g	5	38
T	–	–	15	15	80	g	10	20	–	–	7	7	–	–	8	8	–	–	14	14	–	–	16	16	–	–	14	14

Totals:						
Aerial survey, hours	50:28	44:05	28:55	52:17	43:37	49:45	55:26
Flying time, hours	63:19	60:45	40:15	77:25	54:00	68:52	74:02
Ground-count units	398	391	341	349	369	410	318
Total count units	906	927	690	838	928	913	881
Weather: no. coastal sub-district with							
excellent	18	24	16	4	12	8	17
good	23	18	19	32	28	31	24
poor	–	–	–	5	2	–	–

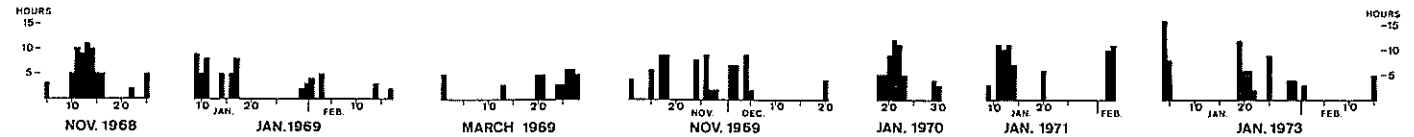


Table 4. Data on survey activities and weather conditions during country-wide surveys. – ASM: No. minutes of aerial survey. – W: Weather conditions (e excellent, g good, p poor, see p. 17. – GC: No. units covered in ground-counts. – TU: Total no. units covered. – For geographical districts see Fig. 1 p. 11. – The diagram below shows distribution of aerial surveys.

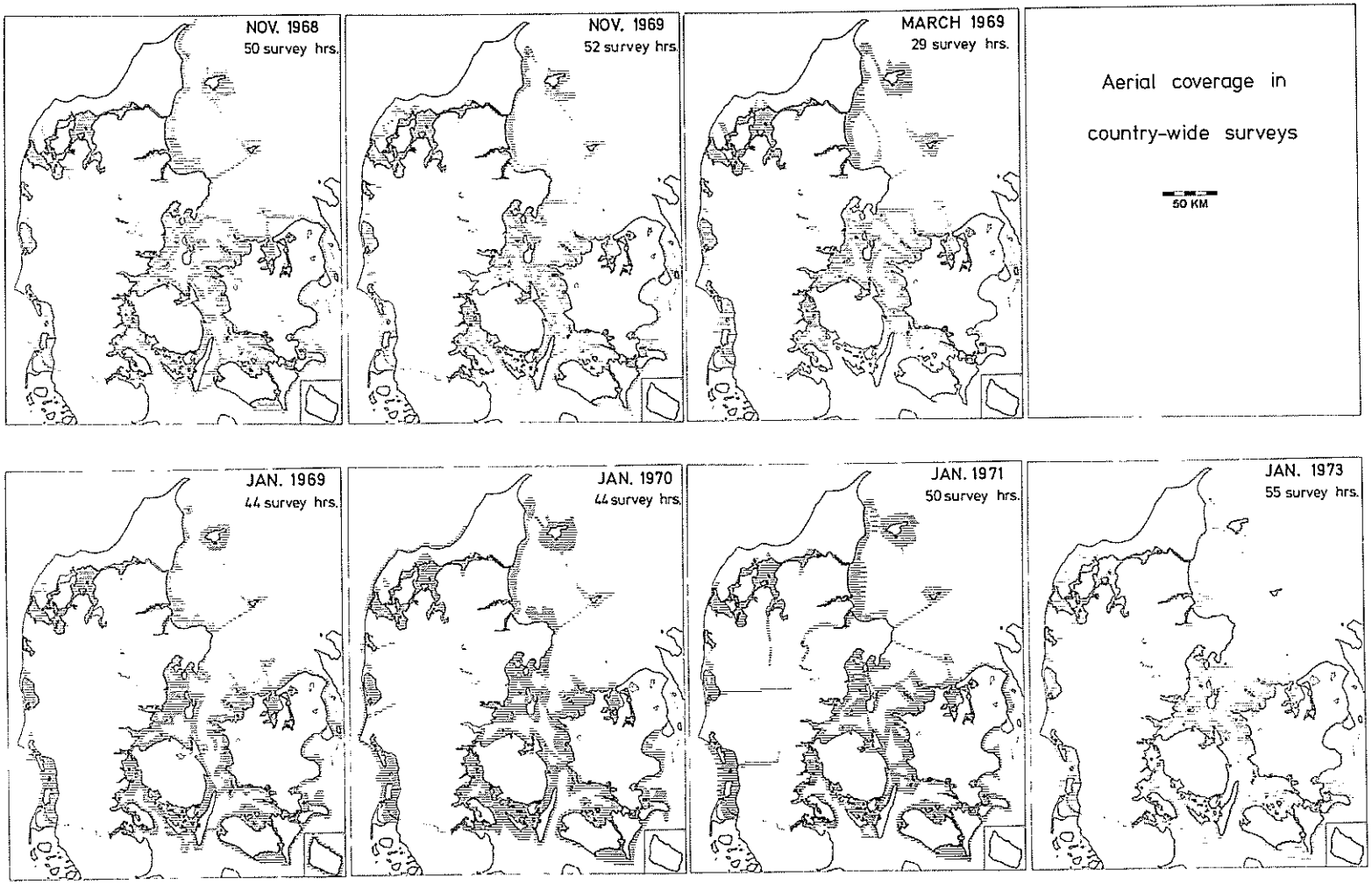


Fig. 2. Aerial coverage (hatched areas) in seven country-wide surveys.

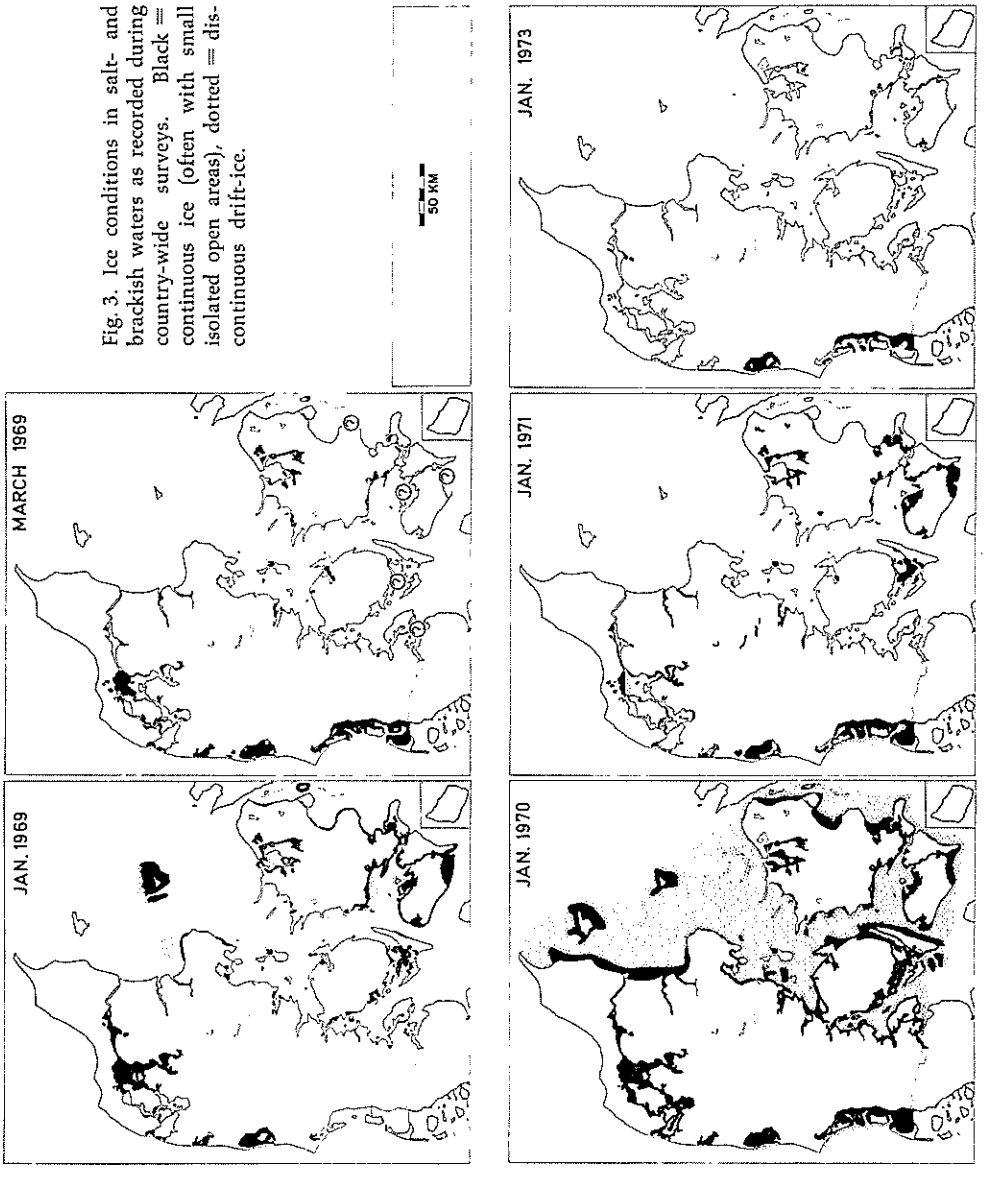


Fig. 3. Ice conditions in salt- and brackish waters as recorded during country-wide surveys. Black = continuous ice (often with small isolated open areas), dotted = discontinuous drift-ice.

in these habitats *(Cl. hyemalis, M. nigra, M. fusca* and *S. mollissima* in particular) some important concentrations may well have been omitted from the country-wide surveys.

Weather conditions varied considerably (Table 4). They were very favourable in Jan. 1969, but generally less favourable in Jan. 1970, Jan. 1971 and in particular Nov. 1969. The variation in aerial survey time (44–55 hours, except for March 1969), was caused by the fact that adverse weather prolongs the flying time necessary for satisfactory coverage,

while extensive ice-cover reduces it (Fig. 3).

Duration of the surveys varied from two weeks (Jan. 1970, Nov. 1967) to six weeks (Jan. 1969, Nov. 1969 and Jan. 1973). Bird movements in the course of the survey can obviously influence the accuracy of estimates for total populations, but it was possible only in a few cases (e.g. sudden changes in the ice situation) to consider possible shifts in the populations in connection with the detailed description of bird numbers (Chapter IV). In general this factor has been excluded from the analysis.

Appendix 2 p. 199 gives information on the number of waterfowl recorded in each district in the last seven country-wide surveys, and total numbers are summarized in Table 5.

Other aerial surveys

Table 3 gives information on the annual, monthly and geographical distributions of all aerial surveys. It is seen that apart from the country-wide surveys which covered all parts of the country, survey activities varied considerably from district to district. In the Waddensea (district A) and the fiords of western Jutland (B, particularly Ringkøbing Fjord Bb) a very large number of surveys were conducted. During three years (Nov. 1968–Oct. 1971) A+Bb were surveyed in all except ten months (see Fig. 74 p. 134). The Limfjord (C) has also been very frequently surveyed although in many cases not completely. In Oct. 1969, Sept. 1970, and Oct. 1971 complete surveys were conducted in districts A, B, and C (see p. 24). In the Kattegat (districts E, F, and S) a large number of surveys were conducted, but in other waters, counts from aircraft outside the country-wide surveys were few, most of them being conducted during May–Sept. in connection with a study of moulting seaducks.

Preparation and presentation of count data

Preparation of count data

The amount of data obtained in waterfowl population surveys in Denmark during 1965–1973 is extremely large. Records of about fifty million ducks, swans and coot constitute the basis of the present report. Naturally it is neither possible nor reasonable to present all details, and only some examples and the major conclusions from a thorough analysis of the entire material are given in the present paper.

Treatment of all data was made manually, i.e. without the help of a computer. This is particularly an advantage in the first phases of a study where methodological problems are to be solved. At the same time this method prevents full use of the data, because some of the more sophisticated analyses are too comprehensive to be made manually.

To understand the use made of the material, a brief description of the data treatment is given.

Monthly ground counts: Observation reports were normally received immediately after the count. By the end of a count season, data from each month were transferred to summary tables, each comprising one locality. A master-list of count localities was prepared for each season, and for each species a similar list including all records was compiled. Finally, a list of all geographical units with infor-

	Nov. 1967	Jan. 1968	Nov. 1968	Jan. 1969	March 1969	Nov. 1969	Jan. 1970	Jan. 1971	Jan. 1973
A. platyrhynchos	1216	899	1738	1436	857	1442	895	1124	1270
A. crecca	174	1	206	3	5	167	x	5	5
A. acuta	38	x	21	3	2	56	–	x	1
A. penelope	476	4	415	41	77	261	x	7	30
T. tadorna	72	10	205	204	262	91	28	187	130
A. ferina	125	27	83	35	22	57	101	30	71
A. fuligula	509	1254	794	1835	1000	953	1962	1327	947
A. marila	35	75	450	510	333	392	1064	441	809
Cl. hyemalis	6	26	27	36	22	20	122	59	110
M. nigra	172	48	864	787	405	1286	1054	954	1481
M. fusca	224	215	374	147	39	244	183	228	67
S. mollissima	1537	1856	5827	5339	2651	3213	5420	3348	4508
B. clangula	185	637	782	574	312	363	914	415	670
M. serrator	76	16	327	196	132	220	169	188	117
M. merganser	4	132	22	159	101	26	282	228	232
C. olor	411	422	505	674	310	497	692	436	489
C. cygnus	10	99	38	47	63	27	108	78	57
F. atra	1263	1249	2699	2072	898	2070	1593	1048	1425
A. querquedula	22	–	12	–	–	43	–	–	11
A. strepera	6	5	3	–	2	–	–	–	5
A. clypeata	1790	3	62	2	46	272	21	15	17
N. rufina	4	–	–	–	2	3	–	–	–
M. albellus	11	357	138	250	56	7	425	501	206
C. columbianus	213	248	459	427	177	1051	407	729	1113
Total (× 100)	6554	6975	1,5385	1,4106	7496	1,1398	1,4595	1,0114	1,2431

(× 100)

Table 5. The total number of ducks, swans and coot recorded in Denmark in nine country-wide surveys 1967–1973. For details in Nov. 1967 and Jan. 1968 see JOENSEN 1968 p. 24–27. Details for later surveys are given in Appendix 2, p. 199. For the numerous species figures are rounded to nearest hundred, and x indicates 1–49 birds. For scarce species the actual numbers are given. – Approx. ten million waterfowl were recorded in these nine surveys.

mation of count activities in every season was made.

Aerial surveys: For each aerial survey (one aircraft in one day) a report was prepared, with information on the number of each species recorded in each geographical unit covered. Such reports also include information on weather, flight schedule, type of aircraft and crew members, and a map showing the flying route. In addition a summary table with species totals in sub-districts was prepared.

Country-wide surveys: For each country-wide survey a list comprising all geographical units in the country with information on the number of each species recorded was prepared, and summary tables for sub-districts and districts were compiled. Data from surveys in Jan. have been used in the European scheme organized by the International Waterfowl Research Bureau (see ATKINSON-WILLES 1972).

Presentation of count data, the maps
Most of the information from waterfowl counts is presented in maps, of which two types have been used; a) species distribution in country-wide surveys, and b) summary distribution maps based on all count data.

Species-distribution maps for the first two country-wide surveys in Nov. 1967 and Jan. 1968 have been published previously (JOENSEN 1968). The present report comprises species maps for the seven later surveys, omitting only species which occur in very small numbers. For dabbling ducks, the results of combined aerial-ground coverage in Oct. 1969, Sept. 1970 and Oct. 1971 in western, northern and central Jutland have also been presented in maps (comprising districts A, B, C, H and sub-districts Gb, Gd and part of Da).

The species-summary maps are based on all count data from the months Sept.–April (May) and illustrate the main habitats and their relative importance. For species typically occurring in well-defined areas (e.g. dabbling ducks in most districts) black dots have been used. A symbol for 1,000–2,500 birds indicates that this number has been recorded regularly (annually), whereas records of more than 2,500 birds are scarce. For species with a more continuous distribution in salt-water areas (most diving ducks) different degrees of shading have been used to illustrate the relative density of birds. Here only the areas regularly visited by large concentrations are shown, while smaller flocks regularly (and in some species large flocks occasionally) occur outside the shaded areas. Finally, for some species both dots and shading have been used in summary maps.

Population indices

MONTHLY COUNT INDICES

Fig. 4 shows monthly population indices for fourteen species in seven count seasons, expressed as percentage of total numbers observed in each month. The index is based on data from monthly ground-counts and includes only localities covered in all eight months (Sept.–April). Species occurring in very small numbers or mostly confined to open waters are not included. Table 6 gives the basic data. Altogether records of 4.7 million birds have been used, but the size of the material varies considerably from species to species and must be considered in drawing conclusions. The indices give an approximate picture of general trends in numbers throughout the count season in the localities concerned. Although some indices are based on data from a large variety of habitats, they are not necessarily typical of the populations in the whole country. Particularly for dabbling ducks the low values in spring are caused by the fact that the birds are more scattered than in autumn, and that a larger proportion of the total population is found outside the important haunts. Conclusions should therefore be made with caution, and in general be limited to tendencies typical for several count seasons.

The use of ground-count data from inland and coastal habitats introduces a systematic error of under-estimating numbers in months when such areas are ice-covered, particularly Jan. and Feb. In fact

	1966/67		1967/68		1968/69		1969/70		1970/71		1971/72		1972/73	
	Loc.	Ducks	Loc.	Ducks	Loc.	Ducks	Loc.	Ducks	Loc.	Ducks	Loc.	Ducks	Loc.	Ducks
A. platyrhynchos	43	1846	111	1899	144	1551	99	1299	158	1817	147	1653	148	1683
A. crecca	25	246	70	521	77	128	56	114	88	312	86	126	80	144
A. acuta	17	132	38	115	32	18	26	18	35	59	35	16	38	19
A. penelope	21	477	58	322	57	145	43	217	70	405	61	169	61	188
A. clypeata	11	34	34	22	29	6	23	8	32	15	43	18	34	17
T. tadorna	36	181	76	83	99	58	66	46	114	86	101	91	125	91
A. ferina	17	180	49	257	71	116	47	116	61	155	79	223	69	217
A. fuligula	34	778	101	2303	109	1247	84	1942	119	1492	119	1454	113	1799
A. marila	16	31	22	157	28	59	30	88	28	96	27	10	22	11
B. clangula	28	71	79	222	79	233	73	209	100	433	96	333	99	344
M. merganser	24	28	67	88	78	74	60	69	81	116	82	61	79	68
C. olor	33	94	109	533	120	381	89	324	136	373	128	387	138	449
C. cygnus	22	15	45	39	50	25	48	47	52	30	57	23	45	17
F. atra	38	487	102	1860	127	1430	94	1800	134	1742	134	1501	136	2641

Table 6. The data used for monthly count indices for selected species 1966/67 – 1972/73. Loc.: the number of localities covered in eight months, where the species was recorded. – Ducks: total number of birds of the species recorded in these localities (× 100).

for many species, peak numbers are present in Denmark in these months, although wintering further away from the coast and outside the range of ground counts.

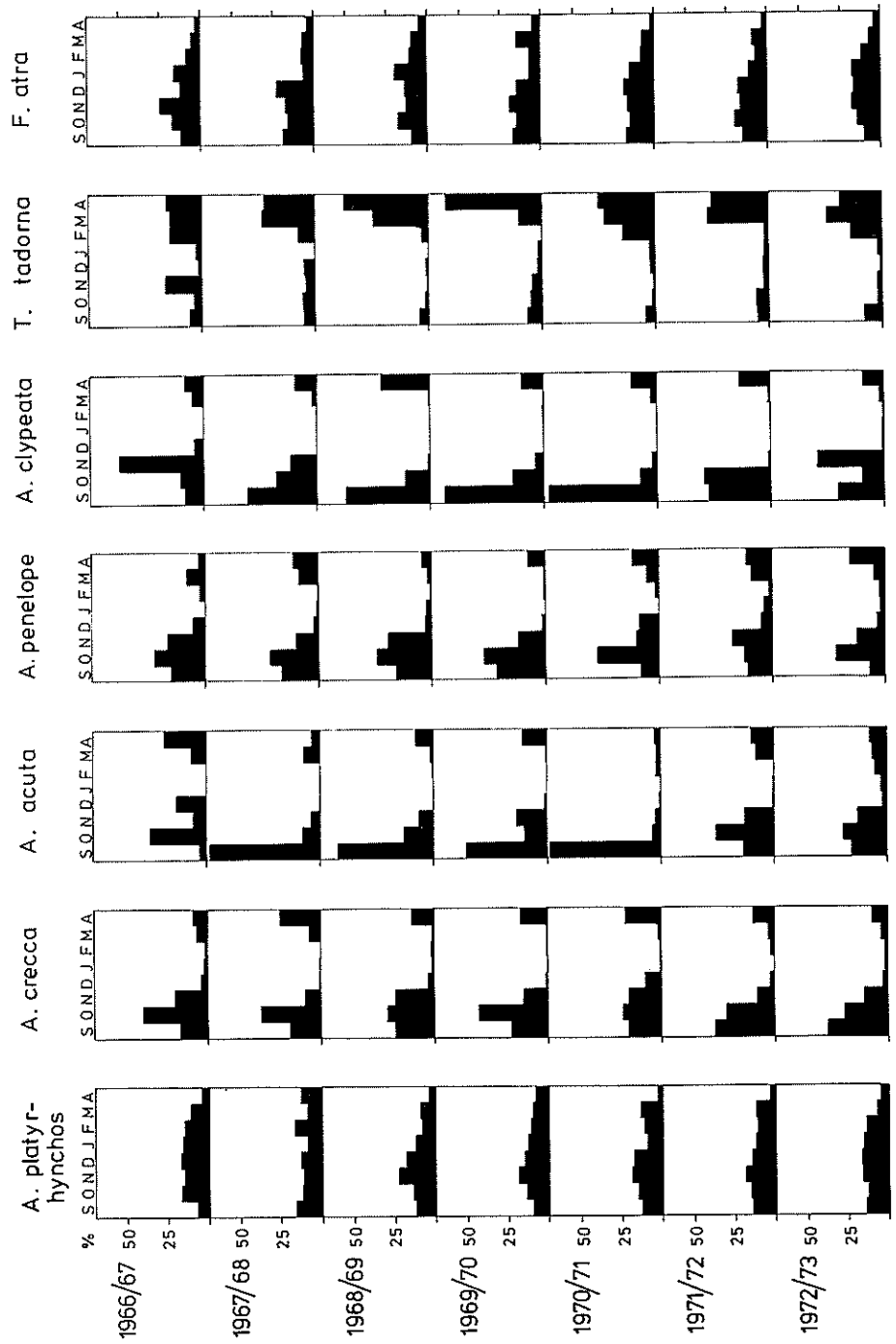
ANNUAL MID-WINTER INDICES

From the point of view of future waterfowl population studies in Denmark, it was essential to evaluate the possibility of obtaining annual population indices by means of smaller samples than those obtained in country-wide surveys, in which intensive ground coverage was combined with large-scale aerial surveys. The problem can be expressed as follows: is it possible to get a reliable impression of population levels during mid-winter by using only a) intensive ground counts in all parts of the country, or b) combined ground-aerial surveys in some restricted parts of the country.

In later years, annual indices have been established for the total European populations of several species using data from mid-winter counts (ATKINSON-WILLES 1972). From most countries only ground-count data are available, and in several areas not all important haunts were covered. The indices obtained are thus based on the assumption that population levels in the localities covered are representative of trends in the total populations. As far as is known, this assumption has never been subject to thorough analysis. The Danish material comprising nearly one hundred-percent coverage of several species in successive winters thus provides an excellent opportunity to compare the results of selective counts with those of total coverage.

Representativeness of ground counts

Comparisons have been made between results of ground counts only and the totals obtained in combined ground-aerial surveys in Jan. 1969, 1970, 1971 and 1973. In these country-wide surveys, the ground activities included a very large


A. platyrhynchos
A. crecca
A. acuta
A. penelope
A. clypeata
T. tadorna
F. atra
S O N D J F M A
%
50
25
1966/67
1967/68
1968/69
1969/70
1970/71
1971/72
1972/73

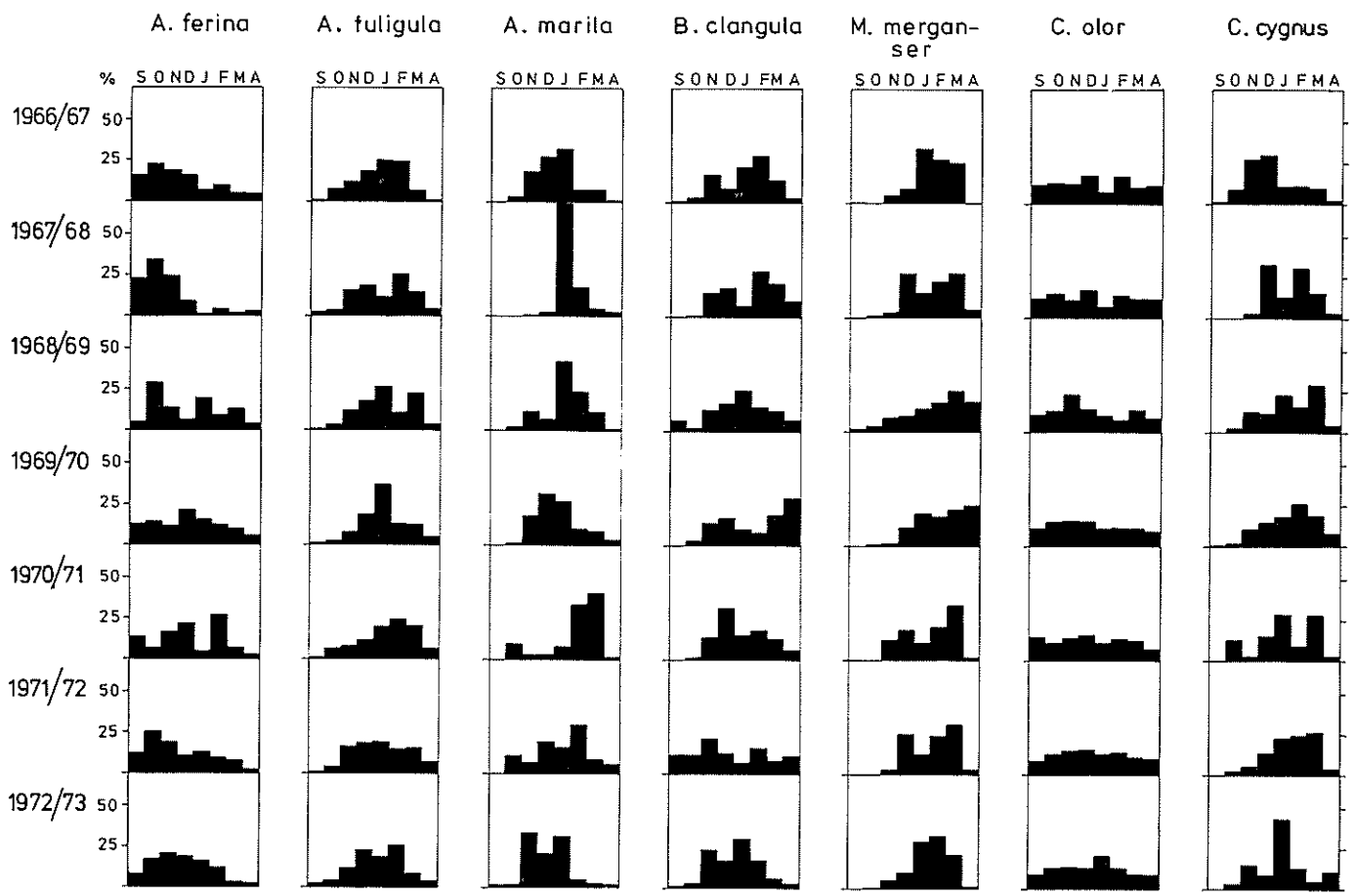


Fig. 4. Monthly count indices for fourteen waterfowl species during 1966/67 – 1972/1973. Based on records from ground counts and including only localities covered in all eight months (Sept.–April), see p. 12 and Table 2. Columns show monthly distribution of all birds recorded, as a percentage.

	Jan. 1969	Jan. 1970	Jan. 1971	Jan. 1973
A. platyrhynchos	23	33	32	29
T. tadorna	2	3	3	20
A. ferina	85	25	75	57
A. fuligula	23	54	43	66
A. marila	7	4	4	2
Cl. hyemalis	12	28	33	14
M. nigra	1	1	2	2
M. fusca	1	1	–	2
S. mollissima	1	1	2	4
B. clangula	14	6	30	19
M. serrator	11	14	13	16
M. merganser	14	12	9	14
M. albellus	87	100	99	87
C. olor	12	13	17	26
C. cygnus	25	11	21	23
C. columbianus	37	4	1	1
F. atra	22	17	38	38
All species	11	14	17	17

Table 7. The percentage of grand totals recorded in ground counts in four country-wide surveys in January.

proportion of inland and coastal habitats which are important for waterfowl and can be surveyed effectively from the ground.

Table 7 shows for each species the proportion of the population (% of grand total) recorded in all ground counts, the rest being recorded in aerial surveys. Only a negligible proportion of typical seaducks are observed from the coasts, and for these a ground-count index is meaningless (*A. marila, M. nigra, M. fusca* and *S. mollissima*). For several coastal species also a rather large proportion was omitted from the ground counts (e.g. *T. tadorna, B. clangula, M. serrator, M. merganser* and *C. olor*).

Annual indices were calculated for six species for the grand total (results of country-wide surveys) and ground counts (Table 8), 1969 being given the value of 100. Ground-count data consist of records from 425 localities covered in two or more years, comprising approximately three-quarters of all birds recorded in ground counts. Three ground-count indices have been calculated, based respectively on a) 150 localities covered in all four years, b) the same 150 plus those covered in 1969+1970, 1969+1971 and 1969+1973, c) the same 150 plus those covered in 1969+1970, 1970+1971 and 1971+1973 (the last calculation method being used in the European scheme (ATKINSON-WILLES 1972)). The 150 localities contained the large majority of birds recorded, and there is little difference between indices based on this and on the slightly larger samples.

The best correlation between the grand total indices and ground-count indices is found for *A. platyrhynchos*, but even for this species significant discrepancy occurs, e.g. when the population level in 1973 was over-estimated in ground counts. For the five other species, there was no correlation at all between the two sets of indices. These species are less uniformly distributed along Danish coasts than *A. platyrhynchos*, and the results are very much influenced by the respective inclusion or omission of a few very large concentrations.

Combined ground-aerial surveys in selected districts

The possibility of obtaining indices representative for the whole country by conducting ground and aerial surveys in a limited number of districts is illustrated by Table 9. For the six important species treated, the variation for each district in the proportion of the grand total is considerable. Although differences from year to year will balance out by the inclusion of several districts, it has not been possible to select a combination of districts which both hold a consistent proportion of the grand total of several species, and represent a marked reduction in survey

activities. In other words, with a few exceptions (districts H, L and T) omission of a district in a country-wide survey will imply the omission of large and unpredictable proportions of several species.

In Jan. 1972 the country-wide survey could not be completed due to adverse weather conditions, and only ten sub-districts were satisfactorily covered with aircraft (Appendix 1, p. 198). It was found that with the possible exception of *A. platyrhynchos*, grand totals could not be estimated with reasonable accuracy by extrapolation from the numbers in the ten sub-districts, however desirable this might be. The variation in their share

		Jan. 1969	Jan. 1970	Jan. 1971	Jan. 1973	Sample %
A. platyrhynchos	1	100	62	78	88	
	2	100	79	88	105	17–22
	3	100	82	93	112	19–26
	4	100	82	89	102	20–27
A. ferina	1	100	289	86	203	
	2	100	90	87	146	22–71
	3	100	86	83	138	22–74
	4	100	86	78	134	22–74
A. fuligula	1	100	107	72	52	
	2	100	241	148	171	18–61
	3	100	238	145	173	20–62
	4	100	238	139	161	20–62
B. clangula	1	100	159	72	117	
	2	100	34	66	122	3–16
	3	100	34	70	129	4–19
	4	100	34	62	107	4–19
M. merganser	1	100	177	143	146	
	2	100	103	65	123	5–12
	3	100	113	85	133	8–14
	4	100	113	68	132	6–14
F. atra	1	100	77	51	69	
	2	100	64	126	217	10–33
	3	100	69	81	212	11–36
	4	100	69	121	199	11–36

Table 8. Population indices of six species in four years. 1) indices based on grand totals from combined ground-aerial surveys. 2) indices based on ground records in 150 localities covered in all four years. 3) indices based on the 150 localities plus those covered in the following pairs of years: 1969+1970, 1969+1971, 1969+1973. 4) indices based on the 150 localities plus those covered in the following pairs of years: 1969+1970, 1970+1971, 1971+1973. – Far right column indicates range of the size of the samples (as percentages of grand totals).

District	*Anas platyrhynchos*	*Aythya fuligula*	*Somateria mollissima*	*Bucephala clangula*	*Cygnus olor*	*Fulica atra*
A	6–21	–	9–15	–	–	–
B	3–12	–	–	0– 5	2– 7	–
C	8–17	–	–	30–53	2– 6	6–17
E	8–15	–	16–34	5–12	3– 6	–
F	4– 7	3–12	21–31	5–13	6–17	2–14
J	6–13	9–25	5–13	8–14	3– 4	8–16
K	2– 5	6–12	5–13	6–10	6– 9	5–19
M	6–11	7–19	–	4– 8	24–36	16–34
N	1– 5	4–14	8–16	–	2– 3	2– 6
O	5– 9	6–23	–	7–13	17–30	7–16
R	6– 8	15–35	–	1– 3	8–12	7–11
S	2– 4	4– 6	3–13	2– 8	2– 4	0– 6

Table 9. Variations in six species populations of certain districts, expressed as percentage proportion of the total population in four country-wide surveys in Jan. (1969, 1970, 1971, 1973). Only figures for important districts are given.

of the grand total in other surveys (Jan. 1969, 1970, 1971 and 1973) was 1–27% in *A. marila*, 38–79% in *M. nigra*, 10–87% in *M. fusca*, 33–53% in *S. mollissima*, 25–43% in *B. clangula*, 20–37% in *M. merganser*, 5–12% in *C. olor*, 13–49% in *C. cygnus*, and 9–18% in *F. atra*. The ten sub-districts comprised 23.9%, 25.2%, 25.6% and 26.4% respectively of all *A. platyrhynchos* in the four Jan. surveys.

It must be concluded that in Denmark it is not possible to establish annual mid-winter population indices for all important species (with the possible exception of *A. platyrhynchos*) on the basis of either intensive ground counts alone, or combined ground-aerial surveys in selected districts. This most disappointing fact from a methodological viewpoint is linked with the existence of large proportions of the waterfowl populations in areas which cannot be surveyed from the ground, and with a considerable variation in their distribution. Both factors apply to the great majority of species occurring in Denmark and surrounding waters, and the distribution pattern in winter is primarily influenced by the highly variable ice-conditions. The four years considered include a very cold winter (Jan. 1970), a very mild one (Jan. 1973) and two fairly normal ones (Jan. 1969 and 1971), and it is seen from Fig. 3 p. 21 that the pattern of ice-cover varies considerably. Increased ice-cover causes birds of most species to move further out to sea, and increasing proportions are thus omitted from ground counts. However *A. fuligula* under such circumstances tends to concentrate in harbours and is thus subject to better ground coverage.

Chapter II

The waterfowl kill survey

The shooting of waterfowl in Denmark has a long tradition, and today it represents some of the most popular shooting in the country. More than three-quarter million ducks, geese and coot are bagged annually, representing one-fifth of the total game bag. Sixty thousand, or nearly half of all sportsmen, take part in waterfowl shooting.

In this chapter the methods used to obtain information on the size of the annual kill, its species composition, and geographical distribution, will be described. However, to illustrate the background for waterfowl shooting in Denmark, some basic information on the provisions of the Game Act and the methods practised in waterfowl shooting is given.

WATERFOWL AND THE GAME ACT

The Game Act of 1967 (with only minor changes compared to the previous regulations) permits shooting of various waterfowl in the following periods:

16. Aug.–31. Dec. Dabbling ducks: *A. platyrhynchos, A. crecca, A. querquedula, A. acuta, A. penelope* and *A. clypeata.*

16. Aug.– 29. Feb.: *A. ferina and F. atra.*

1. Oct.–29. Feb. Diving ducks: *A. fuligula, A. marila, Cl. hyemalis, M. nigra, M. fusca, S. mollissima, B. clangula, M. serrator* and *M. merganser.*

1. Aug.–31. Dec. Geese: *A. anser, A. fabalis fabalis, A. fabalis brachyrhynchus, A. albifrons* and *B. canadensis.*

The following *Anatidae* which occur regularly in Denmark are fully protected: *A. strepera, T. tadorna, N. rufina, M. albellus, C. olor, C. cygnus, C. columbianus, B. leucopsis* and since 1972 *B. bernicla,* as well as all other species not given open seasons (see list above). In severe winters, the Minister of Agriculture can administratively ban or restrict shooting in coastal waters. This was done for example in February 1970.

There is no bag-limit on any game in Denmark. The shooting rights on land belong to the landowner, and in fresh water normally to the adjacent landowners; the landowner may let the shooting rights. Salt-water areas are in general open to all Danish sportsmen, and shooting of waterfowl from motor-boats with a maximum speed of 10 knots is legal in the period 1. Oct.–29. Feb. In general shooting is prohibited between sunset and sunrise, but waterfowl flighting is legal from 1½ hours before sunrise to 1½ hours (in Dec. 1 hour) after sunset. There is no restriction on the sale of killed game during the open seasons. Finally all sportsmen must possess a general shooting licence valid for one year. New sportsmen must pass an examination.

THE MAIN TYPES OF WATERFOWL-SHOOTING

In Denmark waterfowl-shooting is performed in two widely different ways, although several variations occur. The mallard *(A. platyrhynchos)*, which is the most widespread species comprising half of all ducks killed, is shot in many types of habitat more or less incidentally. In this species as well as other dabbling ducks and some diving ducks *(A. ferina* and *A. fuligula* in particular, and locally *A. marila, B. clangula, M. serrator* and *M. merganser)* most birds are shot in duck flighting when sportsmen are seated at the shores of ponds, lakes or on seacoasts, or in small punts in the water (often well camouflaged) and using decoys. Most ducks are shot in dawn- or dusk-flights, but also frequently during the day (particularly in the case of diving ducks) while between feeding and roosting areas. Flighting is predominantly linked with travel to and from water, although feeding flights to fields are also often utilized (mallards and geese). In the early part of the shooting season mallards are often shot rising from ponds. Another specialized type of flighting occurs in the Waddensea, where sportsmen are seated in well-concealed hides on the tidal flats, this method being legal only in areas more than five hundred metres from the coast. Finally, shooting of diving ducks from the edge of the ice, performed by relatively few sportsmen mainly in SE. Denmark, should be mentioned.

Quite a different type of shooting is carried out from motor-boats at sea, and accounts for the large majority of the kill of the true seaducks *(Cl. hyemalis, M. nigra, M. fusca* and *S. mollissima)* and locally also for a considerable number of other diving ducks. The following categories of motor-boats are used: 1) Small punts or dinghies (1–2 persons), usually with a small outboard motor, operating near the coast. – 2) Larger, mostly open boats (15–20 ft., 2–3 persons), with an inboard motor, often specially designed for seaduck shooting, operating in open waters. – 3) Larger cabin boats and small fishing-boats, designed for other purposes, but occasionally used by parties of 4–5 or more sportsmen, in open waters. In motor-boat shooting the sportsman is mobile and can approach ducks on the sea. The birds are generally shot when they rise, and the shooting of sitting ducks is considered to be unsporting. In later years shooting of such birds as mallards from very small, powered boats on shallow water along shores has become common in many areas, where shooting was previously performed only from rowed or poled punts.

Different weather conditions favour the two main types of shooting; dabbling ducks are generally most successfully shot on overcast, windy and rainy days, when the birds fly low. In contrast, shooting from motor-boats can only be practised when there is little or no wind and good visibility, both from the point of view of safe navigation, and because even winds of force 2–3 (Beaufort scale) usually cause all birds to rise at a considerable distance from the boat. This reaction is also quite normal during perfect weather, but at least some birds may remain until they are close enough to be shot at.

Shooting ducks in flight and shooting from motor-boats both require great skill, but in addition successful shooting in offshore waters requires great experience in approach technique and also favours those sportsmen who have boats specially designed for seaduck shooting.

The official bag-record

The official Danish bag-record, which was started in 1941/42, is based on annual information from nearly all sportsmen. The procedure of collecting and treating the data has been described by STRANDGAARD (1964), and here only a brief summary is given: A questionnaire is attached to the compulsory shooting licence, on which the sportsman must give information on the numbers of each game species (or group of species) killed in each county in a fiscal year (1. April–31. March). This questionnaire is returned to police stations when the licence is renewed the next year. In central offices of approximately 70 police-districts the information from the sportsmen residing in those police-districts is collated, and summary tables are sent to the Game Biology Station together with the original questionnaires. At the Station the figures are corrected for the difference between the number of licences issued and returned. The average correction factor is about + 15%. Thus figures are obtained showing the total kill by sportsmen residing in each police district of each species in each county, and totals for species and counties are obtained by addition. From 1970 all data were transferred directly to magnetic tape for automatic processing, and by working back on data from earlier years a satisfactory degree of accuracy has been found in data originally treated manually.

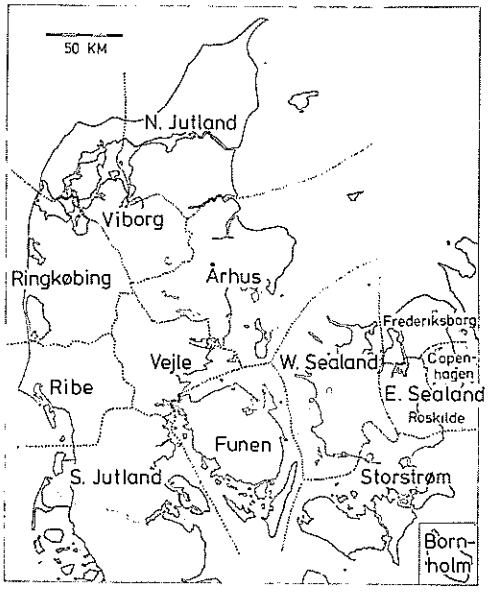


Fig. 5. The counties of Denmark since 1970.

The correction for non-returned licence-questionnaires was originally introduced to make results from different geographical units comparable. It was based on the assumption that the kill by sportsmen not returning information was comparable to the reported kill, but recently STRANDGAARD (1972) has demonstrated that for some species the correction somewhat overemphasizes the kill, and that the true figure lies between the non-corrected and corrected numbers. Considering the size of the correction factor, the error cannot however change the orders of magnitude, and furthermore the error is constant from year to year and region to region.

The information given by sportsmen comprises their bag, but not normally non-retrieved killed or crippled birds. The magnitude of this additional loss is not known for Denmark. It probably varies considerably with the type of shooting, the experience of the sportsman, weather conditions and other factors. In N. America, the additional non-retrieved kill in dabbling ducks has been estimated to be approximately 25% of the bag (CRISSEY 1970). Even if this figure is smaller in Denmark, there is no doubt that the bag-record under-estimates the total loss due to shooting.

DUCKS IN THE BAG-RECORD

In the period 1941/42–1950/51 ducks in the bag-record were only separated in two categories, dabbling ducks and diving ducks. From 1951/52 diving ducks were divided into »eiders« and »other diving ducks«, and from 1959/60 dabbling ducks were divided into »mallards« and »other dabbling ducks« (see Fig. 6). The bag record thus gives direct information for the two most important species on the annual size of the kill in each county, and this aspect has been treated separately in Chapter IV (p. 68 and 109). The two other categories however comprise several species, and here the species composition has been studied through supplementary surveys.

Species composition among »other dabbling ducks« was studied by statistics of a game firm (1969/70–1971/72), see p. 45–46. Species composition among »other diving ducks« has been studied by a questionnaire survey to sportsmen (from 1966/67 onwards), see p. 36–44.

Up to 1969/70 the administrative division of Denmark comprised twenty-three counties, but from 1970/71 the number was reduced to fourteen, primarily by combining counties in the old system; the new counties are shown in Fig. 5. In the present report all data concerning the bag have been transferred to the new division, and furthermore three small counties (Copenhagen, Frederiksborg and Roskilde) have been combined into one unit (E. Sealand). In the survey concerning »other dabbling ducks« the number of units has been reduced by combining Vejle-Århus and N. Jutland-Viborg counties.

Tables 10–11 and Fig. 7 give various information on the size and distribution of the bag of the four categories of duck. Table 10a illustrates the range and average kill of each category in later years

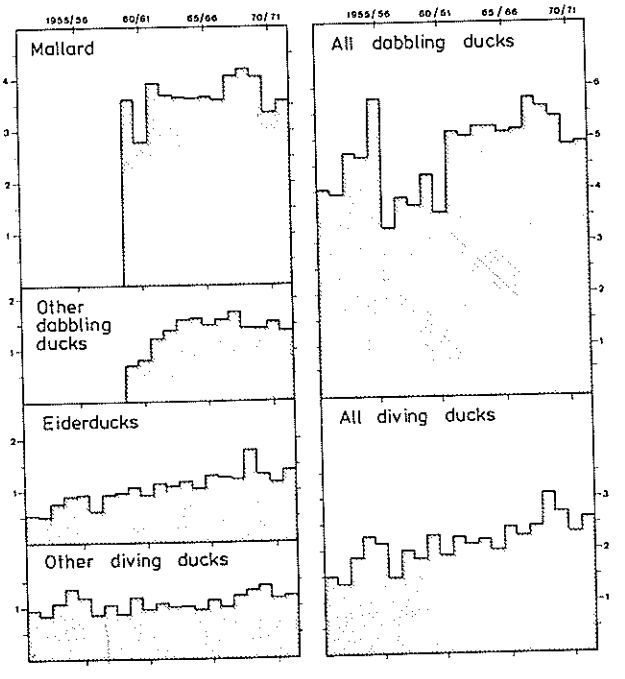


Fig. 6. The total kill (× 100,000) of four categories of duck in Denmark since 1951/52. (Information from the official bag-record).

and the number of sportsmen engaged. Table 10 b illustrates the number of sportsmen who bagged various combinations of the four categories of duck.

Fig. 7 illustrates the percentage distribution of the total kill and the sportsmen, according to the size of the bag of the individual sportsman. The average bag per sportsman is much higher for diving ducks than for dabbling ducks, viz. mallards 6, »other dabbling ducks« 8, eiders 13, and »other diving ducks« 15. Successful sportsmen (> 10 birds bagged) account for a much higher proportion of diving ducks (76% and 80%) than of dabbling ducks (57% and 59%).

Table 11 illustrates the relation between the sportsmen's residence (county) and location of their shooting (county), expressed in percentage of ducks, both in relation to the ducks killed in the county considered and to the sportsmen residing there. Over the whole country, 97–98% of the ducks are killed in either the county of residence (81–90%) or the neighbouring counties (8–16%). There is however considerable difference from county to county, influenced by the »density« of sportsmen and the availability of duck shooting; two extreme examples illustrate this tendency:

1) Ringkøbing county in W. Jutland is extremely rich in »other dabbling ducks«.

× 1000	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	Average
Mallards	359	405	419 (56)	403 (53)	334	357 (49)	380 (53)
Other dabbling ducks	158	173	141 (16)	140 (15)	154	136 (15)	150 (15)
Eiders	127	124	179 (12)	132 (10)	116	140 (10)	136 (11)
Other diving ducks	101	124	129 (10)	140 (10)	118	122 (9)	122 (10)
Total	745	826	868 (64)	815 (60)	722	755 (56)	788 (60)

Table 10 a. The total kill of each of four categories of duck in six seasons, and the number (thousands) of sportsmen bagging each category in three seasons (in brackets). (Data from the official bag-record).

No. sportsmen (× 100)		Diving ducks: Nil	Eiders	O-div.d.	Eiders + O-div.d.	Eiders and/or O-div.d.
Dabbling ducks	Nil	(634)	19	8	10	38
	Mall.	347	28	17	15	60
	O-dabb.d.	22	2	3	2	8
	Mall. + O-dabb. d.	75	9	24	19	51
	Mall. and/or O-dabb. d.	443	39	44	36	119

Of 60,012 duck shooting sportsmen 56,245 (94%) bagged dabbling ducks, 11,918 (20%) bagged diving ducks, 53,334 (89%) bagged mallard, 15,494 (26%) bagged »other dabbling ducks«, 10,447 (17%) bagged eiders, and 9,859 (16%) bagged »other diving ducks« – solely or in combination with other categories.

Table 10 b. The number of sportsmen (hundreds) in 1969/70 who bagged various combinations of the four categories of duck given in game licences. Mall. = mallards, O-dabb. d. = »other dabbling ducks«, eiders, and O-div. d. = »other diving ducks«. Based on reports from 88% of all licence holders to the official bag-record.

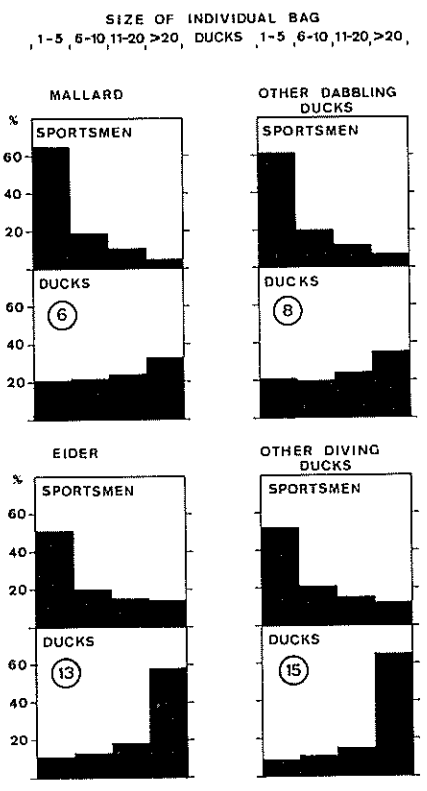


Fig. 7. The percentage distribution of sportsmen and ducks according to the size of the individual sportsman's bag, and the average bag per sportsman (in circles). (Data from the bag-record 1968/69).

Sportsmen residing here collect 97% of their bag in their home county. At the same time this county attracts sportsmen from other areas, and 28% of the total kill in the county is accounted for by sportsmen residing in other counties. 2) E. Sealand (three counties) have few »other dabbling ducks«, but many sportsmen reside here. The area includes the capital of Copenhagen, and contains about one-quarter of all inhabitants and one-tenth of all sportsmen in Denmark. No less than 38% of their kill of »other dabbling ducks« is bagged outside, i.e. in neighbouring counties (27%) or even further away (11%). E. Sealand does not attract many sportsmen from other parts of the country, and they only kill 3% of the birds bagged in E. Sealand.

The tendency of sportsmen residing in cities (particularly Copenhagen) to seek shooting opportunities away from home, characteristically in areas with very good duck-shooting, is found in results for all four categories of duck, although it is more pronounced in dabbling ducks than in diving ducks. This difference is probably linked to the fact that the shooting of diving ducks is more dependent on bigger boats, which mostly lie in a harbour within reasonable distance of the sportsman's home. It should also be mentioned that in later years it has become increasingly difficult to obtain shooting rights on land, particularly for sportsmen residing in cities (STRANDGAARD 1964).

»Other diving ducks« 1966/67 - 1970/71

The species composition among »other diving ducks« was studied by a questionnaire survey to sportsmen, starting with the shooting season of 1966/67. In the first season the main objective was to evaluate the feasibility of obtaining detailed information from sportsmen, and for 1966/67 questionnaires were sent to all sportsmen in about half (32) of the police-districts, who had reported > 10 birds bagged to the bag-record. The reply rate and the quality of the information was very good, and for the following season (1967/68) a very large sample was taken. Questionnaires were sent to all sportsmen in all 73 police-districts who

	I			II			I			II		
	A	B	C	A	B	C	A	B	C	A	B	C
	Other dabbling ducks						Mallard					
a. Bornholm	97	–	3	92	–	8	95	–	5	98	–	2
b. E. Sealand (cd)	92	7	1	62	27	11	96	4	–	57	33	10
c. W. Sealand (bd)	74	25	1	94	4	2	73	26	1	94	5	1
d. Storstrøm (bc)	83	16	1	90	8	2	77	22	1	95	2	3
e. Funen (fh)	93	4	3	95	1	4	95	2	3	97	1	2
a–e. Islands	86	13	1	83	12	5	85	13	2	83	12	5
f. S. Jutland (egh)	82	16	2	97	2	1	90	8	2	96	2	2
g. Ribe (fhj)	88	8	4	72	26	1	84	11	5	81	17	2
h. Vejle (efgjk)	92	6	1	36	61	3	91	4	5	66	32	2
j. Ringkøbing (ghkl)	72	25	3	97	3	–	79	16	5	94	5	1
k. Århus (hjlm)	77	19	3	72	25	3	92	3	5	91	6	3
l. Viborg (jkm)	71	21	8	80	19	1	76	19	5	88	11	1
m. N. Jutland (kl)	87	10	3	86	13	1	95	2	3	95	4	1
f–m. Jutland	79	17	4	81	18	1	87	9	4	89	10	1
Denmark total	81	16	3	81	16	3	86	11	3	86	11	3
	Other diving ducks						Eider					
a. Bornholm	98	–	2	99	–	1	96	–	4	97	–	3
b. E. Sealand	95	4	–	81	15	4	98	1	1	76	18	6
c. W. Sealand	79	20	1	96	3	1	82	17	1	98	1	1
d. Storstrøm	92	7	1	95	4	1	78	21	1	93	5	2
e. Funen	94	4	2	98	–	2	94	2	4	99	–	1
a–e. Islands	92	7	1	93	5	2	91	7	2	91	7	2
f. S. Jutland	88	11	1	92	5	3	84	15	1	93	6	1
g. Ribe	80	17	3	77	18	5	86	12	2	85	11	4
h. Vejle	96	3	1	72	27	1	94	5	1	72	27	1
j. Ringkøbing	88	10	2	93	6	1	73	23	4	52	38	10
k. Århus	83	15	2	93	6	1	86	11	3	97	2	1
l. Viborg	85	12	3	86	13	1	42	36	22	29	62	9
m. N. Jutland	91	6	3	89	10	1	93	2	5	91	7	2
f–m. Jutland	87	11	2	87	12	1	87	10	3	87	11	2
Denmark total	90	8	2	90	8	2	89	9	2	89	9	2

Table 11. The relationship between residence of sportsmen and the distribution of their kill (percentage of ducks). Data from 1970/71. – I: Ducks killed in the county, and their percentage distribution according to residence of sportsmen. – II: Sportsmen residing in the county and the percentage distribution of their kill. – A: The same county. – B: Neighbouring counties (see brackets in left column). – C: Other counties.

had reported > 10 birds bagged, and in addition to all sportsmen in six police-districts who had reported 1–10 birds bagged. After a statistical evaluation of this large sample (see p. 41) it was decided that the routine survey in the following seasons should include 50% of the successful sportsmen (> 10 birds bagged) in alle police-districts, selected at random.

The present report includes data from five successive seasons, 1966/67–1970/71.

METHOD

Questionnaires and replies

Questionnaires were sent to sportsmen approximately 15 months after the termination of the season in question, and a large number of replies were received in the following weeks. About two months after the first mailing a reminder was sent to those who had not yet replied (about 50%), and about three months later all information was filed and calculations made. In the questionnaire, the sportsmen were first requested to give information about the detailed species composition of their bag of »other diving ducks«, as well as the exact location of the shooting. Secondly, they were asked to give general information concerning the occurrence of diving ducks, particularly of birds contaminated with oil, of the kind of shooting practised, and the month of the shooting.

Table 12 gives a summary of the questionnaire survey in the five seasons. Altogether 8,400 questionnaires were distributed, of which 6% were not received by the sportsmen. A total of 6,300 replies (75%) were sent to the Game Biology Station, of which about 6,000 contained detailed information on species-composition. About two-thirds of the letters included information on the exact locality of the kill, and one-third had information

	No. questionnaires mailed	Sample		
		Sportsmen	Ducks	% of total kill
1966/67, 100%				
Islands	947	737	21,432	57.8
Jutland	614	479	11,854	40.7
Total	1,561	1,216	33,286	46.6
1966/67, 50%				
Islands	479	378	11,082	26.2
Jutland	313	239	6,347	21.8
Total	792	617	17,429	24.4
1967/68, 100%				
Islands	1,616	1,154	35,515	44.9
Jutland	825	590	14,501	32.4
Total	2,441	1,744	50,016	40.4
1967/68, 50%				
Islands	773	612	17,984	22.7
Jutland	430	337	7,076	15.8
Total	1,203	949	25,060	20.2
1968/69, 50%				
Islands	835	595	22,186	27.7
Jutland	557	391	10,059	20.7
Total	1,392	986	32,245	25.0
1969/70, 50%				
Islands	876	602	22,929	25.4
Jutland	535	355	9,464	19.0
Total	1,411	957	32,393	23.1
1970/71, 50%				
Islands	892	632	19,071	28.0
Jutland	716	507	12,534	25.3
Total	1,608	1,139	31,605	26.9

Table 12. Data on the questionnaire survey concerning »other diving ducks« 1966/67 – 1970/71. For details see text. In 1966/67 only 32 police-districts were included in the survey, in other years all districts.

concerning the above mentioned secondary questions. The very high reporting rate indicates both great familiarity with diving ducks and deep interest in the survey. It should be emphasized that the survey included only successful sportsmen (> 10 birds) who are experienced in this type of shooting.

The sample (percentage of total kill for which information on species was obtained) was 47% in 1966/67 (only the 32 police-districts) and 40% in 1967/68. In both years 100% of the successful sportsmen were contacted. In later seasons, when 50% of the successful sportsmen were contacted, the sample was 23–27%.

For the present report only data on species composition have been treated in detail. Information on the relation between residence of sportsmen and the location of their kill has been used as background to the calculation procedure. Data on birds contaminated with oil has been used in connection with special studies of this problem (JOENSEN 1972 b).

Estimation of species composition

Estimation of species kills is based on the assumption that the composition of the sample and of the total bag are identical. This assumption is equivalent to the statistical principle of maximum likelihood. Thus for each unit, the composition of the total kill has been estimated by simple extrapolation from the sample.

The police-districts have been used as geographical units. In a few cases 2–4 small police-districts were combined, and the total number of units was thus 62. Totals for larger regions and the whole country were obtained by addition of estimates from the units.

The survey comprised nine species of diving ducks (*A. ferina, A. fuligula, A. marila, Cl. hyemalis, M. nigra, M. fusca, B. clangula, M. serrator* and *M. merganser*), and in addition a small number of »other species«, i.e. birds incorrectly listed as »other diving ducks« by the sportsmen in their report to the bag-record (see below).

ACCURACY OF THE MATERIAL

The accuracy of the material was influenced by several factors. Two of these have already been discussed, a) the probable over-estimate of total kills introduced by correcting for non-returned licence-questionnaires (p. 33), and b) omission of non-retrieved kill and loss by crippling caused by shooting (see p. 33). In the following the reliability of information from sportsmen, the problems connected with the use of police-districts as units, and the statistical aspects of the data are discussed.

Information from sportsmen

One of the reasons for selecting successful sportsmen only was that they are experienced, and show great interest in diving ducks. Most experienced diving-duck shooters know the different species very well, and it is assumed that errors caused by wrong determination of species are generally negligible, although the destinction between *M. serrator* and *M. merganser* should particularly be considered with some caution.

Although the sportsmen possess familiarity with the species, achieved by field experience, their knowledge on taxonomic classification is often less pronounced. As a result some sportsmen have included other species in their record for »other diving ducks«. Approx. 1.5% of the kill are other species, which in 1967/68 showed the following composition (sample 1,160 birds): *Alcidae* 38% (*Alca torda* 29%), *Anas* spp. 33%, *F. atra* 15%, *Podiceps* spp. 5%, *Gavia* spp. 4%, *P. carbo* 2%, others and unknown 3%. Most are diving birds, but the presence of many dabbling ducks suggests that in the bag-record the categories »other dabbling ducks« and »other web-footed birds« may include some diving ducks, and consequently the total number of diving ducks shot is under-estimated. The error

is probably of the order of a few percent and thus insignificant as compared with other factors influencing the accuracy of the material.

The impression from a very large number of replies with detailed supplementary information is that many sportsmen, and in particular the keen and successful ones, keep thorough records of the species composition etc. of their bag. No doubt most of the information received is correct in regard to species composition in the season concerned. Some sportsmen frankly replied that they had no detailed records, and it is likely that the majority of this category of sportsmen are to be found among the approximately 25% who did not reply to the questionnaire. We cannot however exclude the possibility that among those supplying information there are some whose information refers to the average composition of their bag in later years, rather than to the actual season in question. This suspicion is supported by the fact that for practical reasons questionnaires were distributed as long as 15 months after the termination of the season, and with another season in between. The inclusion of such »average compositions« will equalize differences from season to season; the error is probably of little importance.

By including only successful sportsmen ($>$ 10 birds bagged) a high degree of accuracy of information was secured. However, this selection raises the question of whether there are systematic differences in the composition of bags of successful and occasional sportsmen. In six police-districts in 1967/68 both categories were contacted. The data were however insufficient for a satisfactory evaluation of the problem, but certain tendencies were discerned. When comparing the two sets of data, evident differences were found; occasional sportsmen take a fairly random sample of the species, whereas successful sportsmen specialize to a much higher degree on the most numerous species in the area. The error introduced by selecting only successful sportsmen is however considered of little importance because the specialization is directed towards different species in various regions of the country, and occasional sportsmen (1–10 birds bagged) account only for approximately 25% of the total kill. Thus when comparing data from all sportsmen with data from only successful sportsmen (in the six police-districts) no significant differences in composition were found.

Police-districts as calculation units

The estimates were made separately for each of 62 units, most of which comprised only one police-district, and it was basically assumed that all sportsmen residing in a unit bagged all their »other diving ducks« within the unit or the adjacent waters. Although the use of larger regions (e.g. counties) would have been more simple, the police-district units were chosen for the following reasons: 1) The composition of the bag often varies considerably between neighbouring police-districts, as a consequence of great variation in the composition of the population. – 2) The sample percentage varies considerably between neighbouring police-districts. In calculations based on larger regions of several police-districts, this would have implied an over-estimation of species which are dominant in police-districts with high sample percentages; while in police-districts with low sample percentages minority species in particular would be under-estimated. By using police-districts as calculation units, an optimal accuracy is achieved concerning the species composition of the total kill. At the same time however, a bias concerning the geographical distribution of the kill is introduced.

The relation between sportsmen's residences and the distribution of their kill was discussed on p. 35 (see also Table 11). For the whole country, it was found that 90% of the bag was killed in the county of residence, and further studies (information from the questionnaire survey) show that approximately 80% was killed in or just outside the police-district of residence. The method used to illustrate the geographical distribution of the kill thus exaggerates the kill around cities (particularly around Copenhagen, with approximately 25%), and at the same time there is a tendency to equalize geographical differences in species composition. However neither source of error significantly changes the general distribution pattern as illustrated by the method used.

Statistical reliability

The statistical reliability of the material has been evaluated by comparison between results obtained in surveys comprising respectively 100% and 50% of the successful sportsmen in

1967/68, and by calculating the 95% confidence-limits of estimates in units (police-districts), larger regions and the whole country.

Comparison of data from 100% and 50% surveys

In 1967/68 questionnaires were sent to 100% of the successful sportsmen. Later this material was reduced by random selection to a sample corresponding to the 50% sample of succeeding seasons. The two samples resulted in reports from 78% and 40% respectively of the successful sportsmen (see Table 12). For both samples the calculation procedure described p. 39 was followed, and estimates for each species in the whole country are given in Table 13.

In five species there is less than 2% difference between the two estimates for the whole country. Differences on a regional basis are greater, but equalize on addition.

In four species there is considerable difference between the two estimates. Thus in the reduced sample (50%), *M. nigra* and *M. fusca* are under-estimated and *B. clangula* and *M. serrator* are over-estimated. On a police-district basis these errors show systematic tendencies.

It is not possible to explain these discrepancies with certainty. However, an investigation based on data from Funen 1967/68 of the distribution of the bag of *M. nigra* and *B. clangula* per sportsman provides a possible explanation. The bag of *B. clangula* is fairly evenly distributed among many sportsmen, and only a small proportion of the bag is killed by specialists. In contrast, a considerable proportion of *M. nigra* shot are killed by only a few sportsmen, who record extremely large bags of this species (> 50 birds). When the sample comprises less than 50% of the sportsmen, a species mainly shot by specialists is likely to be under-estimated in most police-districts, because few or none of these specialists are included in the samples. In a few districts, however, there will be a considerable over-estimation because several specialists are included. If the distribution per sportsman of the two species *(M. nigra* and *B. clangula)* found in Funen is typical for the whole country, a systematic under-estimation of *M. nigra* can be expected. The over-representation of other species, which are more uniformly distributed per sportsman *(B. clangula)* should then be ascribed to the calculation method, which implies summation of all species to a known total.

	100%	50%	Difference %
A. ferina	5,615	5,671	+1.00
A. fuligula	33,367	33,686	+0.96
A. marila	6,519	6,515	−0.06
Cl. hyemalis	11,882	12,106	+1.89
M. nigra	20,183	19,012	−5.80
M. fusca	11,342	10,411	−8.21
B. clangula	20,771	21,972	+5.78
M. serrator	6,597	7,170	+8.69
M. merganser	4,565	4,561	−0.09

Table 13. Estimated total kill of species in the category »other diving ducks« in 1967/68, based on a survey of 100% of the sportsmen and a randomly selected 50% sample of these (both cases only include sportsmen with more than 10 birds reported to the bag-record).

The extent to which concentration on a particular species influences the value of the sample is not thoroughly known, and would require a country-wide study covering more than one season of the relationship between sportsmen and the size of their kill of each species. Consequently the explanation given above is only a tentative one.

Reliability of estimates for police-districts

The evaluation of reliability of estimates in police-districts is based on 95% confidence-limits. These were calculated for each species separately, with all other species combined. Hereby the problem was reduced to the normal confidence-limit problem, implying however a general under-estimation of reliabilities. Confidence-limits of 315 species estimates (35 police-districts) have been calculated in three seasons (1967/68 – 1969/70).

The value of the 95% confidence-limits for a species estimate (E) in a police-district is calculated as

$$E + \frac{b \pm \sqrt{b^2 - 4ac}}{2a}$$

where $a = 1 + \frac{3.8416}{n}$

$$b = 2\frac{x}{n} + \frac{3.8416}{n}$$

$$c = \left(\frac{x}{n}\right)^2$$

n = total sample, x = species sample.

For each species in a police-district the reliability of the estimates is thus dependent on

the numerical size of the sample, and the frequency of the species. For simplification each of these factors was divided into four groups; for sample size: $<$ 250, 250–499, 500–999, $\geqslant$ 1,000, – and species frequency: $<$ 5.0%, 5.0–9.9%, 10.0–24.9%, $\geqslant$ 25%). These groups when combined give a total of 16 categories. All confidence-limits calculated were transformed to ratios between upper and lower confidence-limits, and all values were grouped in the 16 categories. The average and range of distribution of the ratios was analyzed within each category, and in Table 14 A the approximate averages are given. Values were rounded up, and particularly for small samples and minority species they are very approximate.

From Table 14 A it is seen that high reliability (ratio $\leqslant$ 1.5) in the present material is found in all cases where a species comprises $\geqslant$ 25% of the total kill, or where a species comprises 10.0–24.9% and the sample is $\geqslant$ 500, or where the species frequency is 5.0–9.9% and the sample $\geqslant$ 1,000. In contrast, very low reliability (ratio $\geqslant$ 3.0) is found where the species frequency is $<$ 5% and the sample $<$ 1,000, and where the frequency is 5.0–9.9% and the sample $<$ 250. It should be emphasized that although the ratio between upper and lower confidence-limits is high in these cases, the confidence-interval in terms of birds is relatively small, generally $<$ 100 birds.

For each species, the percentage distribution of the total estimated kill in the 16 categories according to species frequency and sample size in each police-district is shown in Table 14 B. Table 14 C summarizes the percentages of total estimated kill found in police-districts with very high and very low reliability (ratios of $\leqslant$ 1.5 and $\geqslant$ 3.0 respectively). There is considerable variation from species to species in the overall reliability and thus in the possibility of evaluating such events as annual variation on the police-district level.

It must be emphasized that the above-described evaluation of reliability is purely statistical and thus only valid in principle if the sportsmen shoot the various species randomly. The method does not take account of possible systematic deviations from randomness, e.g. 1) a systematic combination of certain species, and 2) any differences in the distribution pattern of the various species per sportsman (see p. 41). Since it is likely that both types of deviation from random shooting occur, the whole statistical evaluation must be considered with caution and only used as an approximation.

Because of this, and of several more or less indefinable factors influencing the representativeness of the sample, it was decided that a requirement for postulating differences (both on the police-district level and for larger regions and the whole country, see below) should be that there was no overlap between confidence-intervals of the estimates considered.

Reliability of estimates for larger regions and the whole country

The exact formula for computation of the 95% confidence-limits for police-districts is given above (see p. 41), but it is troublesome to utilize this formula in defining confidence-limits of estimates for larger regions and the whole country (sum of police-district estimates). It is however reasonable to assume that an estimate (h) of a species frequency is normal-distributed with expectation π (the true frequency) and variance $\frac{h\,(1-h)}{n}$ (n = sample size). Following this assumption, the variance of an estimated kill of a species in a police-district is

$$VA = N^2 \frac{h\,(1-h)}{n},$$

where n is the sample size. The confidence-limits are thus

$$N \cdot h \pm 2\sqrt{VA}$$

where N is the total kill. Differences between such approximate 95% confidence-limits and the limits as calculated from the exact formula in fact amount only to a few percent.

By introducing this approximation, 95% confidence-limits for estimates of the kill in larger regions and the whole country are expressed as

$$\text{Estimate} \pm 2\sqrt{VA}$$

where VA for the whole country (62 units) is

$$VA = \sum_{i=1}^{62} N_i^2 \cdot \frac{h_i\,(1-h_i)}{n_i}$$

In Table 15, all species estimates for the islands, Jutland and the whole country are given with their corresponding confidence-limits.

Table 14. Data on statistical accuracy of police-district estimates for »other diving ducks«.

A.
Average ratio between upper and lower 95% confidence-limits in each of 16 categories of district, according to the size of sample and frequency of the species concerned. (Based on data from 35 districts 1967/68–1969/70).

Frequency of species	Size of sample 0–249	250–499	500–999	⩾ 1000
< 5%	(6.00)	5.00	3.00	2.00
5.0– 9.9%	3.00	2.50	1.75	1.50
10.0–24.9%	2.50	1.75	1.50	1.25
⩾ 25%	1.50	1.30	1.20	1.15

B.
Percentage distribution of the total estimated kill in the 16 categories of district, according to size of sample and frequency of the species concerned, 1968/69.

Species frequency %	Size of sample 0–249	250–499	500–999	⩾1000	Total
A. ferina					
< 5	4	6	20	7	37
5.0– 9.9	9	6	35	4	54
10.0–24.9	–	–	–	9	9
⩾ 25	–	–	–	–	–
Total	13	12	55	20	
A. fuligula					
< 5	–	–	1	–	1
5.0– 9.9	1	1	2	–	4
10.0–24.9	3	4	6	5	18
⩾ 25	4	15	43	15	77
Total	8	20	52	20	
A. marila					
< 5	2	3	15	4	24
5.0– 9.9	4	13	15	9	41
10.0–24.9	6	2	11	13	32
⩾ 25	3	–	–	–	3
Total	15	18	41	26	
Cl. hyemalis					
< 5	2	4	11	1	18
5.0– 9.9	2	4	12	15	33
10.0–24.9	4	5	7	–	16
⩾ 25	3	–	15	15	33
Total	11	13	45	31	
M. nigra					
< 5	–	1	4	1	6
5.0– 9.9	1	2	3	3	9
10.0–24.9	4	11	14	–	29
⩾ 25	8	2	25	21	56
Total	13	16	46	25	
M. fusca					
< 5	2	2	7	1	12
5.0– 9.9	3	2	7	–	12
10.0–24.9	5	8	18	21	52
⩾ 25	3	8	13	–	24
Total	13	20	45	22	
B. clangula					
< 5	–	–	1	2	3
5.0– 9.9	1	3	6	–	10
10.0–24.9	5	4	10	8	27
⩾ 25	6	18	36	–	60
Total	12	25	53	10	
M. serrator					
< 5	2	5	9	3	19
5.0– 9.9	4	5	20	10	39
10.0–24.9	6	8	16	3	33
⩾ 25	–	–	9	–	9
Total	12	18	54	16	
M. merganser					
< 5	4	5	20	6	35
5.0– 9.9	3	11	10	3	27
10.0–24.9	4	4	16	12	36
⩾ 25	2	–	–	–	2
Total	13	20	46	21	

C.
Summary: Percentage of total estimated kill in police-districts with low and high ratio between upper and lower 95% confidence-limits.

	⩽ 1.50	⩾ 3.00
A. ferina	13	63
A. fuligula	88	2
A. marila	25	24
Cl. hyemalis	55	19
M. nigra	73	7
M. fusca	63	15
B. clangula	78	2
M. serrator	38	21
M. merganser	33	32

PRESENTATION OF THE RESULTS

Table 15 and Fig. 8 show the total estimated kill of each species in the five seasons concerned (1966/67 – 1970/71). In 1966/67 the survey only comprised 32 police-districts. For each species the proportion in these districts of the total kill was compared for the four later seasons. The values were so close that the 1966/67 data could be extrapolated to the total kill of that year. The estimates for 1966/67 should of course be considered with caution, particularly for *A. marila* and *M. fusca*.

For all five seasons, the estimates used are based on a sample corresponding to a questionnaire survey sent to 50% of the successful sportsmen. By doing so possible systematic errors introduced by the reduction of the sample size (see p. 41) are constant in all the shooting seasons.

The detailed geographical distribution of the kill in four seasons (1967/68 – 1970/71) is shown in species maps in Chapter IV. For each unit (police-district) the estimated kill was rounded off to the nearest hundred, and estimates of 1–49 birds are not indicated.

Fig. 9 shows the average size and species composition of the kill of »other diving ducks« in 12 counties, based on the addition of estimates for units within the county.

		A. ferina	*A. fuligula*	*A. marila*	*Cl. hyemalis*	*M. nigra*	*M. fusca*	*B. clangula*	*M. serrator*	*M. merganser*	Other species	Total
1966/67	Total	39	207	57	126	203	112	154	57	29	23	1007
1967/68	Islands	34±2	277±5	44±3	106±4	105±4	55±3	93±4	39±3	24±2	15	791
	Jutland	23±3	60±3	22±2	15±2	85±4	50±3	127±5	33±3	21±2	12	447
	Total	57±3	337±6	65±4	121±4	190±6	104±5	220±6	72±4	46±3	27	1238
1968/69	Islands	32±2	299±5	49±3	79±3	101±3	55±3	104±4	39±2	32±2	12	803
	Jutland	20±2	58±3	25±2	15±2	85±4	48±3	148±4	41±3	28±2	19	487
	Total	52±3	357±6	74±4	95±3	186±5	102±4	252±5	80±4	60±3	31	1290
1969/70	Islands	32±2	349±6	100±4	107±4	89±4	47±3	111±4	37±3	25±2	7	904
	Jutland	21±2	58±4	31±3	13±2	100±4	43±3	146±5	43±3	38±3	5	498
	Total	52±3	407±7	131±5	121±4	189±5	90±4	257±6	80±4	63±4	11	1401
1970/71	Islands	28±2	255±5	46±2	84±3	66±3	34±2	106±4	31±2	21±2	11	682
	Jutland	18±2	47±3	22±2	15±2	98±4	39±3	171±4	42±3	33±2	9	495
	Total	46±3	302±5	68±3	99±3	164±5	73±4	278±5	73±4	54±3	20	1177

Table 15. The estimated kill and 95% confidence-limits (× 100) of each species in the category »other diving ducks« in five seasons (1966/67 – 1970/71). (Based on questionnaire surveys of 50% of the successful sportsmen, for 1966/67 in 32 police-districts (see above), and for other years all police-districts).

»Other dabbling ducks« 1969/70 - 1971/72

The species composition among »other dabbling ducks« was studied for three successive seasons using statistics of the game firm of MØLLER & MELGAARD, Copenhagen. This firm receives game from sportsmen in all parts of Denmark. For the present study the files of the firm were examined, and for each communication including *A. crecca, A. acuta, A. penelope* or *A. clypeata,* data on the species, number, and month, as well as the county of residence of the sportsman were obtained. In the files *A. querquedula* were listed as *A. crecca,* but probably comprised a very small proportion of the birds bagged very early in the shooting season (see p. 72).

The data were arranged according to the county of residence of the sportsmen. Some county-samples were very small, and in such cases adjacent counties were combined. This was only done when there was found to be great similarity in the habitats and in the occurrence of dabbling ducks in the counties in question. In the present study ten geographical units have been used, five in the islands and five in Jutland (see Fig. 9). The calculations are based on the assumption that the composition of the bag taken by sportsmen residing in a county is identical with the total kill in that county, based on data from the bag-record.

The sample was 5,900 in 1969/70, 9,800 in 1970/71 and 5,300 in 1971/72. Its distribution and the estimated composition of the kill in each unit is given in Table 17.

The geographical distribution of the kill is illustrated in species maps (Chapter IV p. 70, 74, 78, and 80), and the average size and species composition in each county unit is given in Fig. 9 p. 49.

ACCURACY OF THE ESTIMATES

The reliability of the estimates is influenced by 3 factors; errors in the sampling procedure, the use of counties as geographical units, and the statistical variation.

Representativeness of the sample

It is assumed that in general the composition of the sample illustrates the composition of the total bag, although the representativeness of the sample has not yet been tested, e.g. by comparison of information from sportsmen with the present data. Some particular factors which may influence the representativeness of the *A. clypeata* sample should however be mentioned.

1) While the three other species are considered to be equally edible, *A. clypeata* ranks lower in the opinion of many sportsmen, and this may lead to a higher proportion of this species being sent to the game firm. 2) On the other hand, this tendency may be counteracted by the fact that the price paid by the game firm is lower for *A. clypeata* than for the three other species, thus causing its under-representation in the sample. 3) Lastly, the very early part of the shooting season is undoubtedly under-represented in the material (see p. 51), and since *A. clypeata* is predominantly shot early in the season, this may have caused its under-representation compared to the three other dabbling duck species, which are bagged to a much higher degree later in the autumn. The factors mentioned suggest that estimates for *A. clypeata* should be considered with more caution than those of the other species.

Counties as geographical units

For the country as a whole, approximately one-fifth of the kill is bagged outside the county of residence of the sportsmen involved, and particularly sportsmen residing in E. Sealand take a considerable proportion (38%) of their kill outside E. Sealand (see Table 11 p. 37). The error caused by this distribution pattern is however considered relatively unimportant, since the great majority of birds were sent in by sportsmen, who bag most of their ducks near home.

In »other diving ducks« the species composition often varied over short distances, and therefore police-districts were used as geographical units (see p. 40). Practically all dabbling ducks are shot in duck-flighting, and during dusk- and dawn-flights the birds disperse widely from their daytime haunts (see p. 168). Consequently the composition of the kill is uniform over much larger areas than is the case for diving ducks, suggesting that the county distribution forms a realistic basis for calculations.

Statistical reliability

The evaluation of the statistical reliability of estimates is in principle the same as for »other diving ducks« (see p. 41). For each county unit, the reliability depends on the size of the sample and the frequency of the species concerned. Only in three units (Bornholm, W. Sealand and E. Jutland) is the sample less than 500 birds. Table 16 gives the distribution of county-frequencies and the distribution of 95% confidence-intervals, expressed as the ratio between upper and lower confidence-limits. The criterion for postulating a difference between two estimates should be that there is no overlap of their respective confidence-intervals.

The reliability of estimates for larger regions or the whole country is calculated as 95% confidence-limits from the formula mentioned under »other diving ducks« (p. 42), which implies at least some equalization of over- and underestimates on the county level. In Table 17 the numerical confidence-limits are given for the major regions (the islands and Jutland) and for the whole country.

	Frequency of species (%)				
	≤ 5.0	5.0–9.9	10.0–24.9	≥ 25.0	Not present in sample
A. crecca	–	–	2	28	–
A. penelope	–	1	12	16	1
A. acuta	3	16	10	1	–
A. clypeata	10	13	5	–	2

	Ratio of upper/lower 95% confidence-limit		
	< 1.5	1.5–2.9	≥ 3.0
A. crecca	28	1	1
A. penelope	21	7	1
A. acuta	9	17	4
A. clypeata	6	17	5

Table 16. Data on reliability of species estimates for »other dabbling ducks«, 1969/70 – 1971/72. Top section: The distribution of counties in four categories of species-frequency (see also p. 42). Bottom section: The number of counties in three categories of ratio between upper/lower 95% confidence-limit.

Season		Total kill (× 100)	Sample (× 100)	Estimated kill, no. ducks (× 100) *A. crecca*	*A. acuta*	*A. penelope*	*A. clypeata*
1969/70	Islands	537	21	311 ± 12	43 ± 7	136 ± 10	45 ± 7
	Jutland	864	38	370 ± 17	97 ± 11	357 ± 17	39 ± 8
	Total	1400	59	682 ± 21	141 ± 13	493 ± 20	84 ± 10
1970/71	Islands	544	37	336 ± 9	41 ± 5	117 ± 8	50 ± 5
	Jutland	993	61	512 ± 14	96 ± 9	344 ± 13	41 ± 6
	Total	1537	98	849 ± 17	137 ± 10	461 ± 15	91 ± 8
1971/72	Islands	514	25	307 ± 10	39 ± 5	100 ± 8	67 ± 7
	Jutland	849	28	450 ± 18	84 ± 11	273 ± 16	42 ± 9
	Total	1363	53	757 ± 21	123 ± 12	373 ± 18	109 ± 12

Table 17. The estimated kill of »other dabbling ducks« in the islands, Jutland and the whole country in three seasons. Total kill, according to the bag-record. Sample: no. ducks received by a game firm. 95% confidence-limits are given.

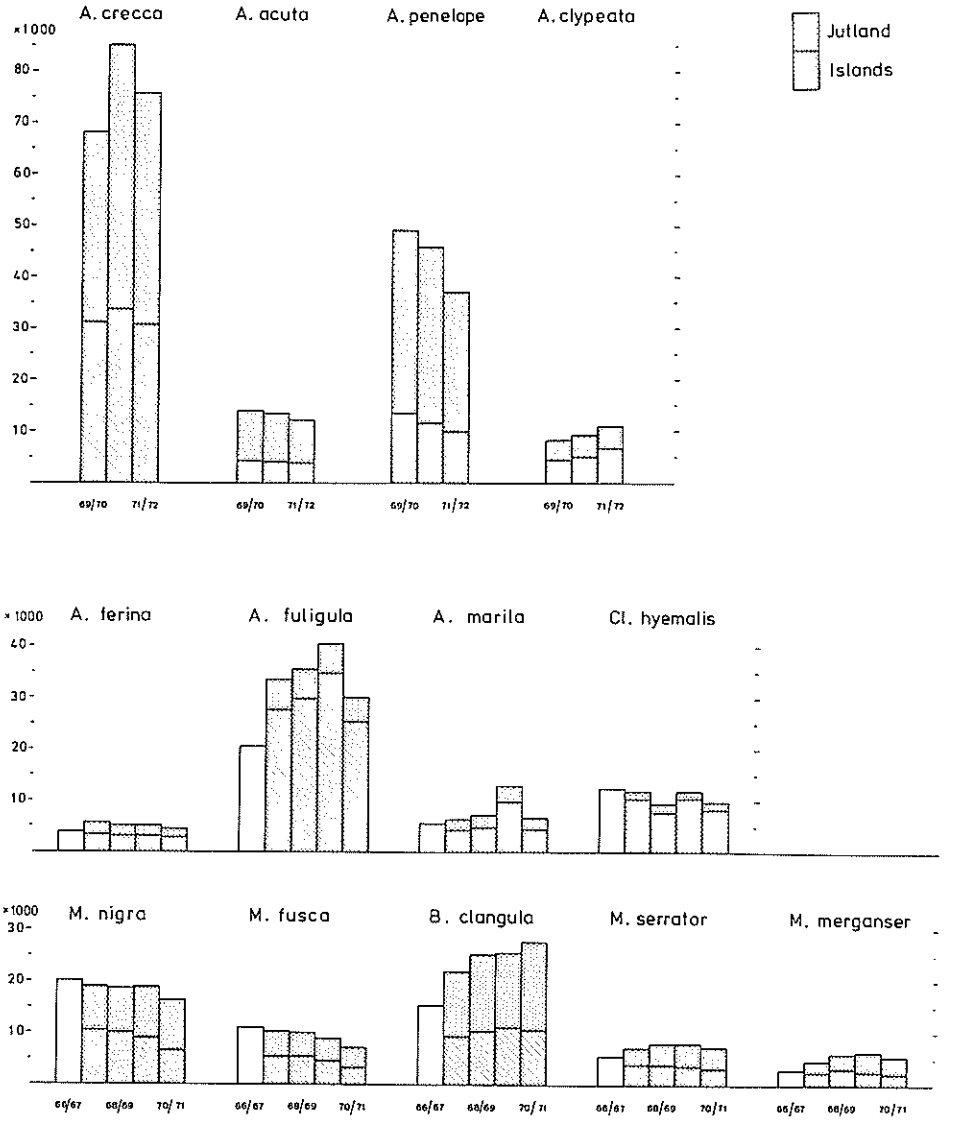


Fig. 8. The estimated kill of »other dabbling ducks« (3 seasons) and »other diving ducks« (5 seasons, see p. 44).

Summary on the accuracy of the kill survey

The accuracy of the waterfowl kill survey is influenced by errors in the sampling procedure and the statistical variation. The following sampling errors have been mentioned above: 1) *The official bag-record:* a) correction for non-returned licence questionnaires, b) omission of the non-retrieved kill and crippled loss, and c) errors in the information from individual sportsmen. – 2) *The survey concerning »other diving ducks«:* d) wrong species determination, e) wrong shooting season, f) the use of police-districts as calculation units, and g) omission of information from occasional sportsmen. – 3) *The survey concerning »other dabbling ducks«:* h) under-representation of the early part of the shooting season, j) under- or over-representation of certain species, and k) the use of counties as calculation units.

Although several factors cannot be evaluated objectively, most are considered to be of little importance, and presumably do not significantly change the general picture of size, composition, and geographical distribution of the bag. Furthermore the sampling procedure itself was constant, implying that possible errors were also constant.

The statistical reliability is primarily determined by the size of the sample, and in order to minimize this factor very large samples were taken, particularly for »other diving ducks«. Statistically the best data available are for *A. fuligula,*

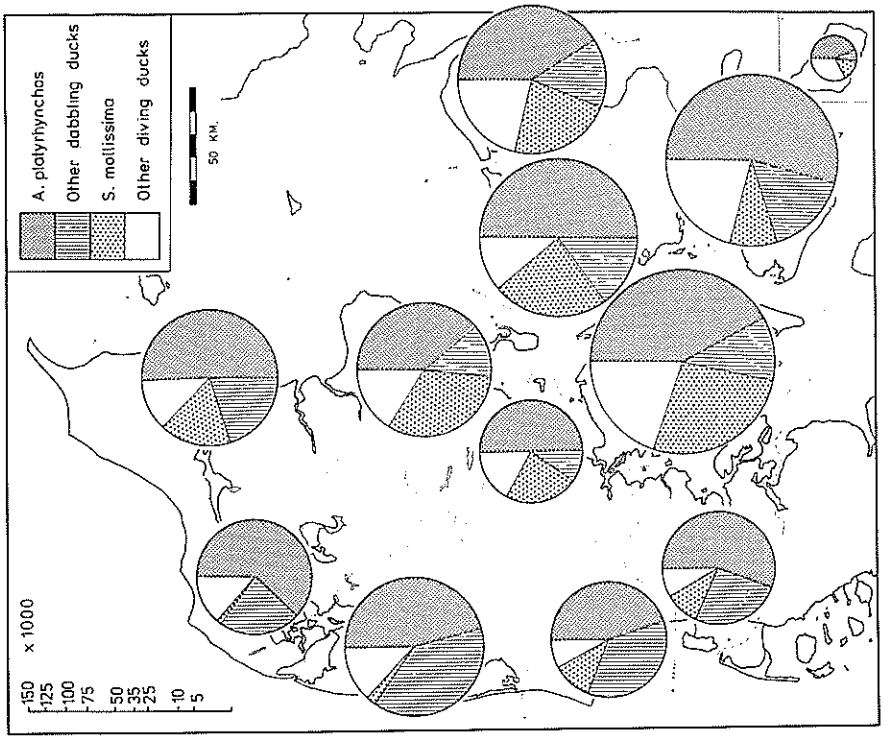


Fig. 9, see text p. 49

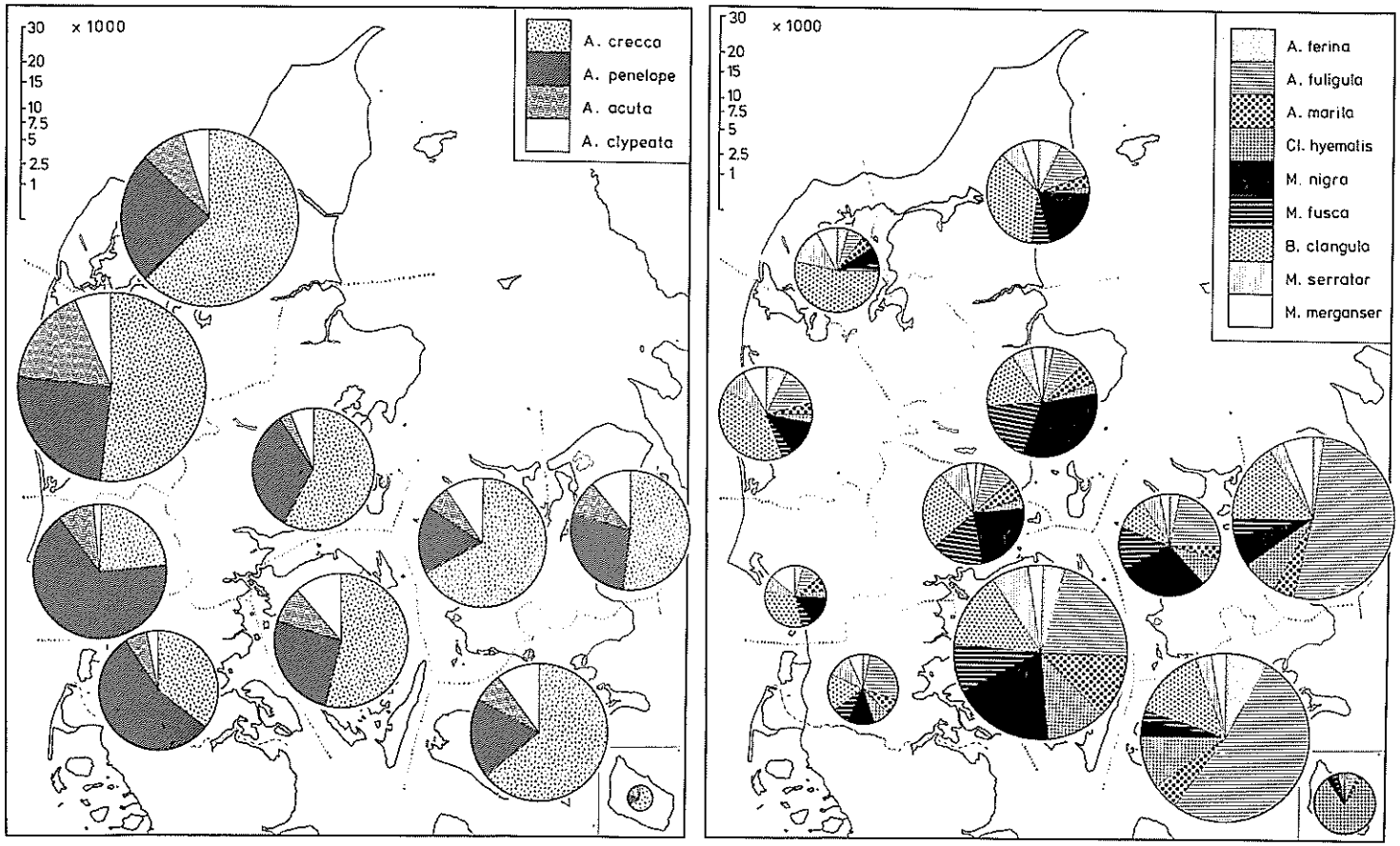


Fig. 9. The average size and species composition of the bag of ducks in the counties of Denmark. Top left: the four categories in the bag-record, 1967/68 – 1971/72 (see Table 10a). Bottom left: »Other dabbling ducks« 1969/70 – 1971/72 (see Table 17). Bottom right: »Other diving ducks« 1967/68 – 1970/71 (see Table 15). Scales refer to circle diameter (in thousands).

County	Total bag ×1000	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
		A. platyrhynchos					
Bornholm	8	44	*Cl. hyemalis* 25	*S. mollissima* 18	*A. crecca* 4	*A. fuligula* 1	*A. acuta* 1
E. Sealand	83	40	*S. mollissima* 24	*A. fuligula* 11	*A. crecca* 7	*A. penelope* 4	*B. clangula* 3
W. Sealand	88	50	*S. mollissima* 25	*A. crecca* 9	*M. nigra* 3	*A. penelope* 2	*M. fusca* 2
Storstrøm	108	53	*A. fuligula* 11	*A. crecca* 10	*S. mollissima* 10	*B. clangula* 3	*A. penelope* 3
Funen	125	42	*S. mollissima* 27	*A. crecca* 5	*A. fuligula* 4	*M. nigra* 4	*B. clangula* 3
Vejle	37	49	*S. mollissima* 23	*A. crecca* 6	*B. clangula* 5	*M. nigra* 4	*M. fusca* 3
Århus	67	39	*S. mollissima* 33	*A. crecca* 7	*M. nigra* 5	*A. penelope* 4	*M. fusca* 3
N. Jutland	69	52	*S. mollissima* 17	*A. crecca* 13	*A. penelope* 5	*B. clangula* 4	*M. nigra* 2
Viborg	48	60	*A. crecca* 15	*B. clangula* 8	*A. penelope* 6	*M. serrator* 2	*A. acuta* 2
Ringkøbing	70	46	*A. crecca* 20	*A. penelope* 10	*A. acuta* 7	*B. clangula* 5	*A. clypeata* 2
Ribe	45	47	*A. penelope* 22	*S. mollissima* 11	*A. crecca* 8	*A. acuta* 3	*B. clangula* 3
S. Jutland	48	57	*A. penelope* 13	*S. mollissima* 10	*A. crecca* 9	*A. fuligula* 2	*B. clangula* 2
Total	797	48	*S. mollissima* 17	*A. crecca* 10	*A. penelope* 6	*A. fuligula* 4	*B. clangula* 3

Table 18. The six most important duck species and their percentage contribution to the total duck bag in each county (average for shooting seasons 1967/68 – 1971/72).

B. clangula and *M. nigra*, for which 88%, 78% and 73% of the total kill respectively fall in police-districts with high reliability for these species. The corresponding figure for *M. fusca* is 63%, and for *Cl. hyemalis* 55%. For *A. marila*, *M. serrator* and *M. merganser* the figure is 25–40%, but at the same time 20–33% of the total kill fall in police-districts with very low reliability. The overall reliability for *A. ferina* is much lower than for other species, as 63% of the total kill fall in police-districts with very low reliability (see Table 14 C).

For »other dabbling ducks« the reliability is very high for *A. crecca* in nearly all counties, and for *A. penelope* in most of them, while estimates for *A. acuta* and *A. clypeata* generally are much less accurate. See Table 16. The survey does not include *A. querquedula*.

The average size and composition of the duck kill in the counties of Denmark is illustrated in Fig. 9 p. 49. In Table 18 the six most important species and their percentage contribution to the total duck kill in each county are listed.

The size, annual variation and distribution of the kill are discussed for the various species in Chapter IV, and in Chapter VI p. 167–172.

Monthly kill index (1968/69 - 1972/73)

The monthly distribution of the kill of all duck species (except *A. querquedula)* and of coot can be illustrated by data from the game dealers of MØLLER & MELGAARD, Copenhagen, which were also used in the analysis of species composition in the bag of »other dabbling ducks« (see p. 45–46). The use of such data for a monthly kill index requires that the distribution of ducks shot and sold to game dealers is identical to the distribution of the total kill. Comparison of the information from the questionnaire survey concerning »other diving ducks« and the game dealer statistics shows that the distribution is approximately the same in both sets of data. Some possible sources of error should however be mentioned; 1) Notable changes during a season in the price paid for ducks have only in a very few cases changed the motivation of sportsmen to sell their bag (e.g. *A. platyrhynchos* Nov. 1972). 2) The large majority of birds are sold freshly shot, which implies registration in game dealer records in less than a week after shooting. A small, although in later years increasing proportion, is however frozen when received, suggesting that there has been considerable delay before registration. Although some sportsmen apparently empty their deep-freezers at the end of the shooting season, this bias will probably not significantly change the representativeness of the information. 3) The most important error is caused by the fact that very early in the season, shot birds become tainted within a few days, and it must be assumed that many sportsmen will not take the risk of the birds losing their value during transport to the game dealers. It is reasonable to consider that in particular birds from Aug. and early Sept. are under-represented in the material, and this introduces a bias for dabbling ducks, *A. ferina* and *F. atra.*

Table 19 gives the size of the samples used for monthly kill indices. For most species seasonal samples comprise several hundred or some thousand birds, but in *A. ferina, A. marila* and *Mergus* spp. in particular some seasonal samples are very small.

Fig. 10 shows the monthly percentage

× 100	1968/69	1969/70	1970/71	1971/72	1972/73
A. platyrhynchos	204	168	177	231	156
A. crecca	32	27	53	27	33
A. acuta	4	5	8	5	5
A. penelope	?	23	31	17	22
A. clypeata	3	3	6	4	4
A. ferina	?	5	2	2	2
A. fuligula	21	58	14	12	6
A. marila	2	10	1	2	2
Cl. hyemalis	6	5	8	4	13
M. nigra	24	13	10	4	9
M. fusca	9	5	5	2	4
S. mollissima	97	44	42	58	49
B. clangula	5	9	7	3	3
Mergus spp.	8	9	2	2	1
F. atra	54	79	26	39	52

Table 19. The number of duck and coot received from sportsmen by the game firm of MØLLER & MELGAARD, Copenhagen, 1968/69 – 1972/73. (Numbers in hundreds). The data has been used to evaluate the monthly distribution of the kill of each species, and in the analysis of species-composition of »other dabbling ducks« (see p. 45).

distribution of each species for birds sold to the game dealers in each of five seasons. The very few *A. querquedula* received in the first weeks of the shooting season are included in the figures for *A. crecca*. Since the game dealer does not separate the two species of mergansers, the indices have been established by combining this information with data on species composition in the production survey (see p. 54–63). In 1968/69 *A. penelope* and *A. ferina* were not always separated (the same popular name »brunnakke« (= brown-neck) applies to both species), and are thus not included.

Considering the possible errors in the material, particularly the under-representation in Aug.-Sept. of dabbling ducks, *A. ferina* and *F. atra* (with an equivalent over-estimation in later months), and taking into account the small samples of some species, it must be concluded that the monthly kill indices in Fig. 10 are rather approximate and that conclusions not only should be drawn with caution but should primarily concern tendencies in alle five seasons. The indices are discussed under each species in Chapter IV (p. 64–129).

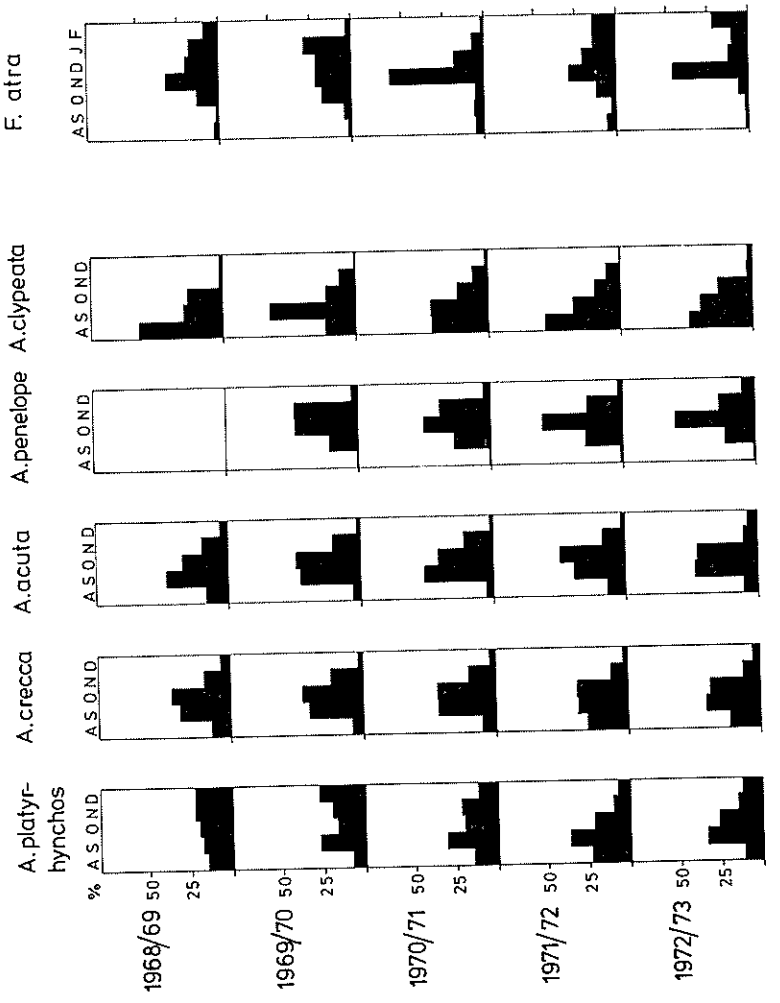


Fig. 10, see text p. 53

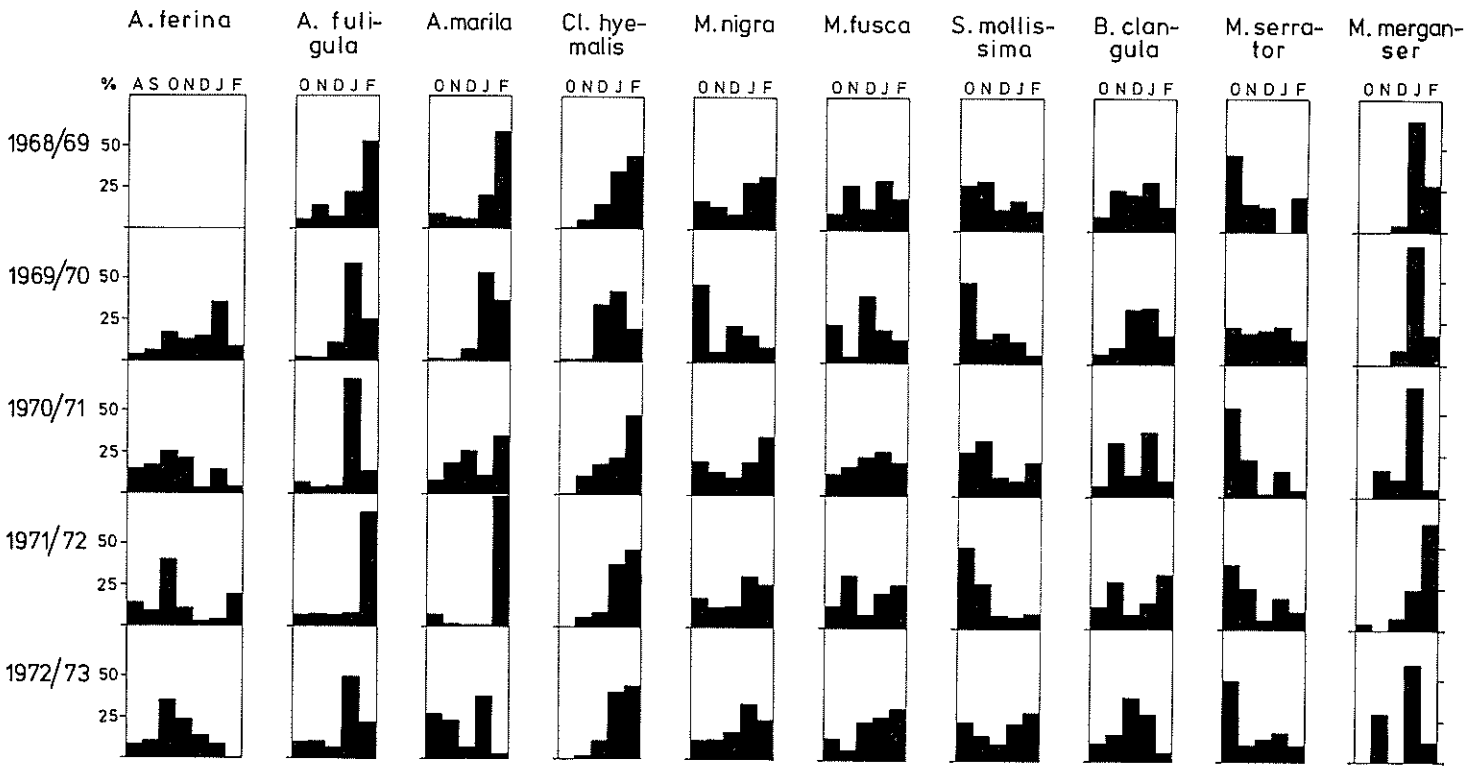


Fig. 10. The monthly kill index, based on statistics of a game dealer in Copenhagen, 1968/69 – 1972/73, see p. 51 and Table 19. Columns indicate the monthly distribution (percentage) of all birds sold to the game dealer. A = Aug., S = Sept. etc.

Chapter III

Production survey

The age- and sex-composition of diving ducks have been studied over five seasons (1968/69–1972/73), and in the three last seasons, data on age composition in dabbling ducks (except *A. platyrhynchos)* have also been obtained. The main purpose was to study annual variation in the production of young, and to correlate this with the population size and the annual kill. Most data were obtained by examining bagged birds, and for three species of seaducks *(S. mollissima, M. nigra* and *M. fusca)* birds killed in oil disasters were also examined.

It is well known that the different age- and sex-categories are not equally vulnerable to shooting, and therefore the composition among bagged birds differs from that of the wild population. The most obvious bias is created by the higher vulnerability of juvenile birds, which particularly early in the shooting season are inexperienced, and more easily shot than adult birds. Probably over-representation of juveniles in the bag occurs in all species of waterfowl, although the magnitude of this error may vary considerably and depends for example on the method of shooting. The ratio between adult females and males in the bag is often also biased, and quite considerably so for species in the present material as a result of specialized shooting methods practised. For *Cl. hyemalis* and *M. nigra* it is well known by sportsmen that a female sitting on the water will attract males. Many experienced sportsmen take advantage of this behaviour by using the female as a »live decoy«. Without doubt the extreme predominance of males in the bag of these two species is a result of this specialized type of shooting, but similar factors may well influence the materials of other species also.

In North America this bias has been thoroughly studied, and by comparison of recovery rates of ringed birds of different categories it has been possible to correct for differences in shooting vulnerability and thus calculate the actual composition of the wild population (Crissey 1964, 1970). In the present study such corrections could not be made, and it is only possible in three species of seaducks to compare the biased bag-composition with a material of birds killed by oil, which is presumably more representative (see p. 169). In general however the composition in the material of bagged birds must be considered as index values primarily illustrating the relative variation in annual production.

It should also be emphasized that a sample from Denmark alone is probably quite insufficient for an evaluation of the overall composition of many species. The fact that age- and sex-categories of a species may differ in respect of migration patterns and winter distribution (Nilsson 1970), implies that at least a fairly representative part of the area frequented should be sampled.

Diving ducks

MATERIAL FROM GAME FIRMS (Oct.–Feb., 1968/69 – 1972/73)

The composition of the bag was studied by examining ducks shot by sportsmen and sold to game firms. In 1968/69 material was obtained at one game firm and from 1969/70 at two game firms in Copenhagen, comprising whole birds examined by staff of the Game Biology Station during visits to the firms. From 1970/71 additional samples of wings were received from firms in other parts of the country, particularly from Svendborg (S. Funen) and Århus (E. Jutland).

Determination of diving ducks

The determination as to age- and sex-categories is based on external characters only, and follows criteria described by several authors, among whom particularly SCHIØLER (1925–26), HØRRING (1919), WITHERBY (1948), CARNEY (1964) and BAUER & VON BLOTZHEIM (1968–69) should be mentioned. For some species detailed descriptions of external characters for ageing and sexing are still lacking, and additional experience was obtained from skin specimens with information on internal characters (gonads) from the Zoological Museum, Copenhagen, and from a collection established at the Game Biology Station for reference purposes.

The characters used in the present study vary much from species to species, and also depend on whether the whole bird or only one wing is available. The characters most frequently used are: 1) The general plumage colouration pattern (whole birds). – 2) The presence or absence of juvenile-type tail feathers (in most species these are replaced by adult-type feathers in the course of the shooting season). – 3) Colouration of the wing. – 4) The shape and degree of fraying and wear of wing feathers, particularly of tertials (the innermost secondaries).

In addition to these characters which have general application in all species, differentiation in some species is supported by additional specific characters, such as shape and colouration of particular feathers and measurements of the wing, tarsus and bill.

It must be emphasized that in some species, distinction between all relevant categories is difficult, or at least in part of the season not possible, particularly when only the wing is available for examination. Furthermore, during visits to game firms in Copenhagen the investigator often had to handle several hundred birds within a few hours, and thus had little opportunity to make a detailed examination of the more difficult birds. These factors have determined the number of categories into which the various species have been separated:

S. mollissima were initially separated into four categories: ad. ♂♂, ad. ♀♀, juv. ♂♂ and juv. ♀♀ (in wing samples juveniles cannot be sexed). Furthermore, ad. ♂♂ were separated into three age-groups, viz. 17–21 months, 29–33 months and > 40 months-old birds. This distinction is based on the amount of black or dark-brown colouration on the fore-edge of the wing, which falls into three distinct and rarely confused categories (see JOENSEN 1973 a). It must however be stressed that it has not yet been possible to check the validity of this character by examination of birds of known age (e.g. birds ringed as juveniles).

For *A. ferina*, *A. fuligula*, *A. marila* and *B. clangula*, which are represented in the material almost exclusively by whole

birds, four categories were distinguished; ad. ♂♂, ad. ♀♀, juv. ♂♂ and juv. ♀♀.

For *Cl. hyemalis, M. nigra, M. fusca, M. serrator* and *M. merganser*, distinction was made between four categories as above whenever possible, but very often juvenile birds could not be sexed (e.g. in most wing samples), and in the results presented only three categories have been used: ad. ♂♂, ad. ♀♀ and juv.

Material

The total number of diving ducks examined in the five seasons was 28,500 (3,500–7,200 per year). Some wing-samples which could not be aged were not included (totalling about 300). Tables 20–23 illustrate various distributional aspects of the material.

In all seasons except 1972/73 most material was obtained at game dealers in Copenhagen (Table 20), and for several species practically all data was obtained there. The number of visits to Copenhagen was 13–18 per season, and in 18 out of 25 months 3–4 (or 5) visits were made. Nearly all birds were examined on Tuesdays, when large numbers of ducks shot in the preceding week-end are received.

Table 19 shows that the number of diving ducks sold to game dealers has been decreasing in later years. This tendency can be ascribed to several factors. The market value of diving ducks is low compared to other game, and has not followed the general inflationary trend, postal costs have increased, and deep-freezers have become more common in private homes in later years. Altogether, the motivation for sportsmen to sell diving ducks bagged has been reduced somewhat.

Although the effort to obtain material was very similar in the five seasons, the samples varied considerably in size, and a few comments on the representativeness of the material are given below.

Table 21 gives the number of months in which various sample sizes were obtained, and Table 22 shows the seasonal and composite monthly samples of each species. *S. mollissima* accounts for nearly half of all birds examined, and both the seasonal and monthly samples were sufficient for detailed analyses of the composition of the kill of this species. For *A. fuligula, Cl. hyemalis, M. nigra, M. fusca* and *B. clangula* all seasonal samples exceeded 100 birds, but monthly samples were frequently rather small. For *A. ferina, A. marila, M. serrator* and *M. merganser* about half the season samples were less than 100 birds, and two-thirds of the monthly samples comprised 0–25 birds.

Table 23 shows the geographical distribution of the material according to the county of residence of the sportsmen, which is generally identical with the county of the kill (see p. 35–37). Nearly two-thirds of the material is from the islands, and with the exception of Bornholm, all counties are well-represented. About one-third of the material is from Jutland; one county (Århus) accounts for the large majority and three species comprise 93% of the sample *(S. mollissima, M. nigra* and *M. fusca)*.

For *A. fuligula, A. marila, Cl. hyemalis, M. nigra, M. fusca* and *S. mollissima* most of the important shooting areas are represented in the material. However for *A. ferina, B. clangula, M. serrator* and *M. merganser* there is an obvious lack of material from some of the important haunts, particularly in N. and W. Jutland.

In the present report data from all parts of the country have been combined without distinction being made between the various regions. It is most probable that in some species more than one breeding population is involved and that they

visit different regions of Denmark (see p. 159), and as a result of different breeding conditions, they may for example show differences in such factors as the proportion of juveniles. Since no regional distinction has been made, the present material only gives a very approximate picture of the overall composition of the bag.

The results of the study are presented in Fig. 11 (p. 58–59). For each species

Cont. p. 60

	1968/69	1969/70	1970/71	1971/72	1972/73	Total
Oct.	4	4	4	4	3	19
Nov.	2	1	2	3	3	11
Dec.	4	3	3	3	2	15
Jan.	1	3	4	2	3	13
Feb.–March	3	2	5	4	3	17
Total	14	13	18	16	14	75
No. diving ducks examined in Copenhagen	49	72	50	48	17	237
No. wings from other game-dealers (×100)	–	–	15	15	17	48
Total no. examined	49	72	66	63	35	285

Table 20. The number of visits (weeks) to game-dealers in Copenhagen, and the origin of the material of diving ducks examined in five shooting seasons (Oct.–Feb., 1968/69 – 1972/73).

	Size of sample (no. birds)					
	0	1–10	11–25	26–50	51–100	>100
A. ferina	1	7	8	5	4	–
A. fuligula	–	–	8	2	7	8
A. marila	4	12	–	5	1	3
Cl. hyemalis	2	9	5	–	3	6
M. nigra	1	2	2	5	5	10
M. fusca	2	1	3	8	9	2
S. mollissima	–	–	–	–	3	22
B. clangula	–	2	9	5	4	5
M. serrator	1	8	7	5	3	1
M. merganser	8	10	2	4	–	1
Total	19	51	44	39	39	58

Table 21. The frequency (no. months) of various monthly sample sizes of ten duck species in game firm material obtained over 25 months.

	1968/69	69/70	70/71	71/72	72/73	Five seasons Oct.	Nov.	Dec.	Jan.	Feb.	Total	%
A. ferina	85	207	128	162	52	171	57	84	152	170	634	2.2
A. fuligula	525	2831	900	1211	411	226	143	538	2343	2628	5878	20.6
A. marila	57	374	123	138	49	68	26	63	187	397	741	2.6
Cl. hyemalis	139	271	688	150	125	8	49	333	423	560	1373	4.8
M. nigra	390	551	901	321	234	847	185	412	378	575	2397	8.4
M. fusca	194	266	445	205	157	222	145	286	319	295	1267	4.4
S. mollissima	3187	1734	2869	3788	2271	5430	2487	1799	1483	2650	13849	48.5
B. clangula	164	557	381	194	133	122	142	219	576	370	1429	5.0
M. serrator	139	300	98	93	25	162	62	144	149	138	655	2.3
M. merganser	40	156	40	53	16	2	6	30	159	108	305	1.1
Total	4920	7247	6573	6315	3473	7258	3302	3908	6169	7891	28528	
%	17.2	25.4	23.0	22.1	12.2	25.4	11.6	13.7	21.6	27.7		

Table 22. The seasonal and monthly distribution of diving ducks examined at game-dealers during five shooting seasons (Oct.–Feb., 1968/69 – 1972/73).

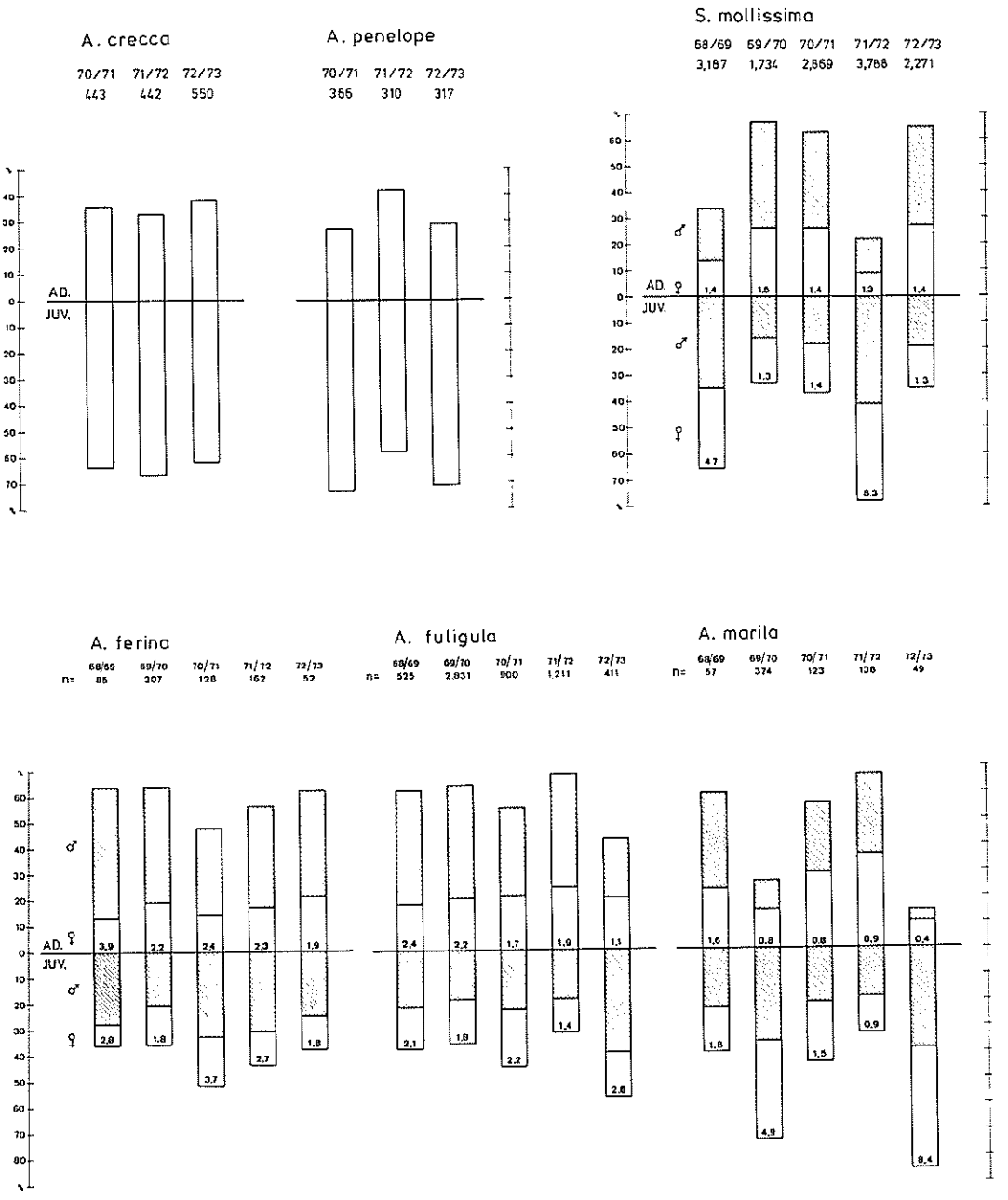


Fig. 11. The age- and sex-composition among bagged *A. crecca* and *A. penelope* in three shooting seasons, and all diving ducks in five seasons; the number of birds examined is given below the year. Numbers in open columns indicate 1) no. ad. ♂♂ per ad. ♀ (above center-line), 2) no. juv. per ad. ♀ (bottom of column). In some species juv. ♂♂ and ♀♀ are combined (see p. 56), and in the dabbling ducks ad. ♂♂ and ♀♀ are also combined.

Cl. hyemalis

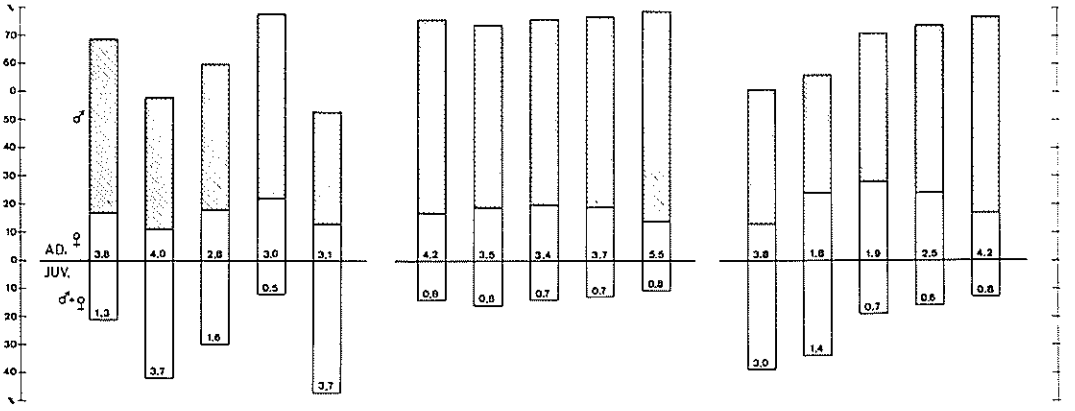
	68/69	69/70	70/71	71/72	72/73
n:	139	271	688	150	125

M. nigra

	68/69	69/70	70/71	71/72	72/73
	390	551	901	321	234

M. fusca

	68/69	69/70	70/71	71/72	72/73
	194	266	445	205	157



B. clangula

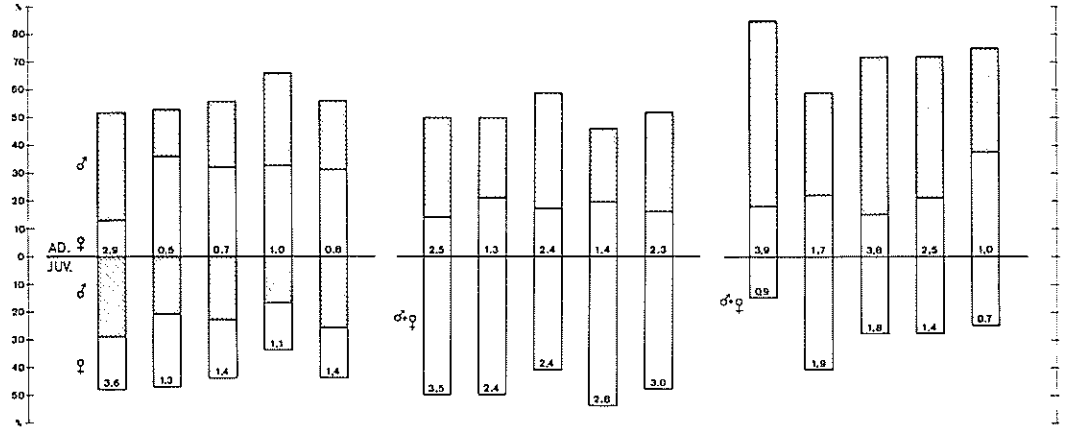
	68/69	69/70	70/71	71/72	72/73
n:	164	557	381	194	133

M. serrator

	68/69	69/70	70/71	71/72	72/73
	139	300	98	93	25

M. merganser

	68/69	69/70	70/71	71/72	72/73
	40	156	40	53	16



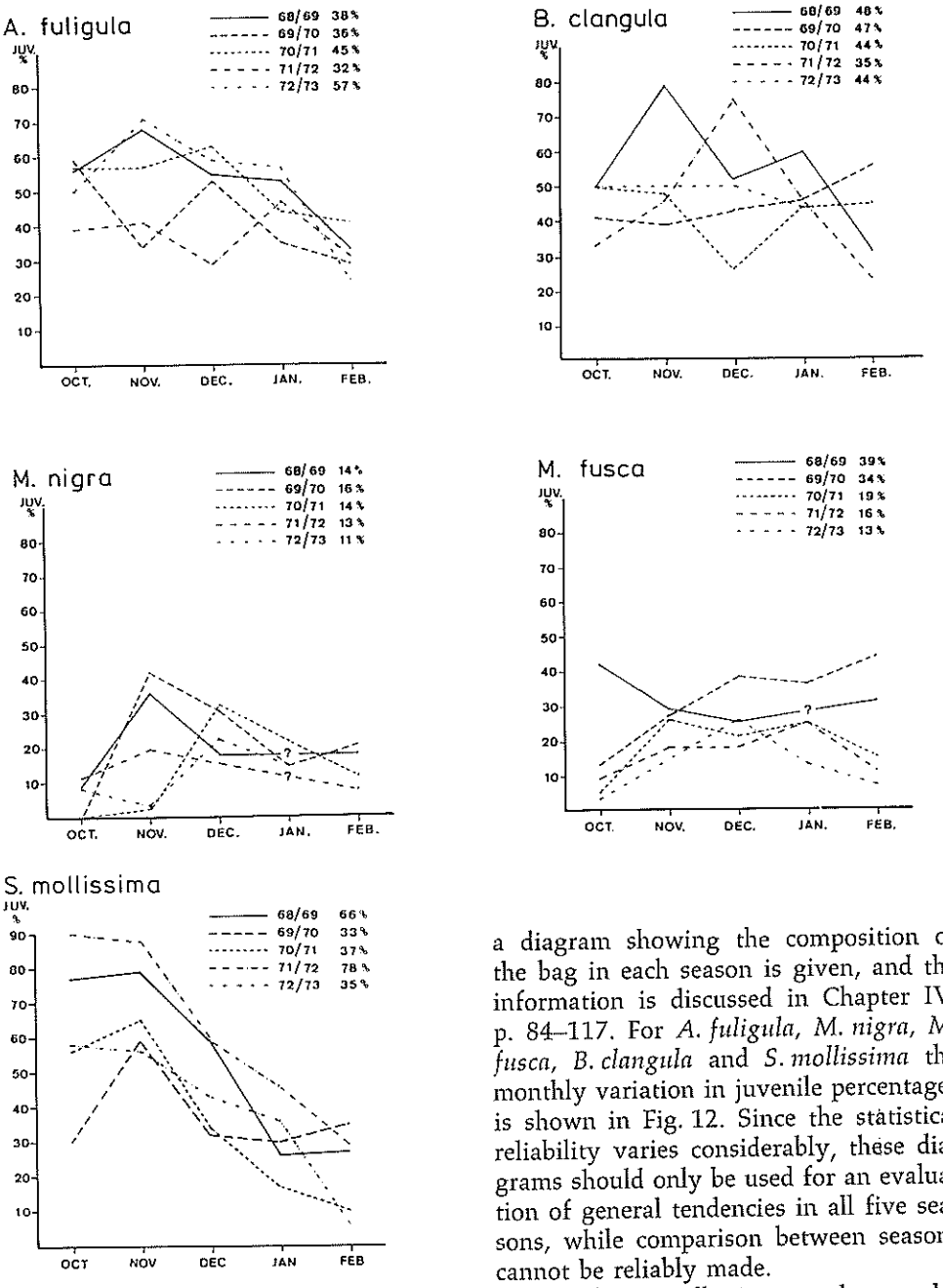


Fig. 12. The monthly juvenile percentage in the bag of five diving-duck species during five shooting seasons. Very small samples are indicated with question marks.

a diagram showing the composition of the bag in each season is given, and the information is discussed in Chapter IV, p. 84–117. For *A. fuligula, M. nigra, M. fusca, B. clangula* and *S. mollissima* the monthly variation in juvenile percentages is shown in Fig. 12. Since the statistical reliability varies considerably, these diagrams should only be used for an evaluation of general tendencies in all five seasons, while comparison between seasons cannot be reliably made.

Only for *S. mollissima* are the samples sufficient for a detailed description of monthly variations in composition in each season. For this species, data from

County / Species	I Born-holm	II E. Sea-land	III W. Sea-land	IV Stor-strøm	?? II–IV	V Funen	?? I–V	Total I–V
A. ferina	–	67	46	229	85	85	6	518
A. fuligula	–	1065	108	1917	1215	650	235	5190
A. marila	–	13	3	129	27	375	24	571
Cl. hyemalis	84	5	138	310	77	460	69	1143
M. nigra	3	28	325	82	42	595	6	1081
M. fusca	–	17	216	152	29	267	1	682
S. mollissima	155	826	1857	851	509	2849	–	7047
B. clangula	1	63	86	461	117	110	–	838
M. serrator	5	16	42	183	78	75	13	412
M. merganser	–	16	30	87	83	8	–	224
Total	248	2116	2851	4401	2262	5474	354	17706
%	0.9	7.4	10.0	15.4	7.9	19.2	1.2	62.1

County / Species	VI Vejle	VII Århus	VIII N. Jut-land	IX Vi-borg	X Ring-køb ing	XI Ribe	XII S. Jut-land	Total VI–XII	Un-known I–XII	Grand total
A. ferina	–	18	1	5	1	2	–	27	89	634
A. fuligula	2	48	2	8	12	28	10	110	578	5878
A. marila	3	74	–	2	7	6	1	93	77	741
Cl. hyemalis	4	23	5	–	2	3	30	67	163	1373
M. nigra	160	816	19	17	13	77	42	1144	172	2397
M. fusca	101	366	11	2	–	3	10	493	92	1267
S. mollissima	531	4120	140	7	32	442	259	5531	1271	13849
B. clangula	2	179	11	26	29	32	3	282	309	1429
M. serrator	10	47	28	28	–	12	4	129	114	655
M. merganser	–	4	–	–	20	7	–	31	50	305
Total	813	5695	217	95	116	612	359	7907	2915	28528
%	2.8	20.0	0.8	0.3	0.4	2.1	1.3	27.7	10.2	100.0

Table 23. The geographical distribution of diving ducks examined at game-dealers during five shooting seasons (Oct.–Feb., 1968/69 – 1972/73), according to sportsmen's addresses.

	1970/71		1971/72		1972/73	
	Sample no. ducks	Juv. %	Sample no. ducks	Juv. %	Sample no. ducks	Juv. %
A. crecca	443	63.7	442	66.7	550	62.0
A. acuta	72	76.4	70	60.0	46	56.5
A. penelope	366	73.0	310	58.1	317	71.3
A. clypeata	34	47.1	79	79.7	28	25.0

Table 24. The number of dabbling ducks examined at game dealers in Copenhagen and the juv. percentage in three seasons (Oct.–Dec., 1970/71 – 1972/73).

the production survey and the monthly kill index have been combined, and the monthly composition of the kill has been estimated (JOENSEN in press).

SEADUCKS IN OIL DISASTERS

Since 1968/69, the Game Biology Station has studied the problem of oil pollution in Danish waters, with particular emphasis on its impact on seaduck populations (JOENSEN 1972 a, 1972 b, 1973 c). In later years large numbers of seaducks have frequently been killed in oil disasters, and on such occasions large samples of birds have been examined. Several species are involved, of which *S. mollissima*, *M. nigra* and *M. fusca* make up the great majority. Only for these species is there sufficient data for an evaluation of age- and sex-composition of populations. The information was obtained by examining contaminated birds which had either died directly as a result of the contamination, or had been killed off (mostly by shooting) when they were resting on the shore severely affected by oil. Although vulnerability to oil may vary from species to species, it is reasonable to assume that within a species all categories are equally vulnerable to oil. Accordingly the composition of individuals among oiled birds gives a more reliable picture of the composition in the wild population than the bag, which is biased by differences in vulnerability to shooting.

Data from one disaster were obtained in 1968/69, and in each of the succeeding four seasons data from two disasters were obtained (Table 25). Altogether, 9,600 *S. mollissima*, 4,600 *M. nigra* and 1,600

	1969 Feb.–Mar. North Sealand	1969 Dec. Læsø–Vendsyssel	1970 Feb.–Mar. E. coast of Jutland	1970–71 Dec.–Jan. S. Kattegat	1971 March Djursland, Anholt	1971–72 Dec.–Jan. S. Kattegat	1972 March Central Kattegat	1972 Dec. Waddensea	1973 Feb. Djursland
S. mollissima, sample	1,154	1,080	947	1,156	19	198	617	4,319	121
Juv. %	24	2	3	6	–	11	27	8	7
Ad. %	76	98	97	94	100	89	73	92	93
Ad. ♂♂ %	63	65	59	60	58	61	68	61	72
Ad. ♀♀ %	37	35	41	40	42	39	32	39	28
M. nigra, sample	343		454	169	77	13	2,153	1,260	97
Juv. %	10		15	29	10	–	9	6	1
Ad. %	90		85	71	90	100	91	94	99
Ad. ♂♂ %	68		58	68	58	77	69	66	66
Ad. ♀♀ %	32		42	32	42	23	31	34	34
M. fusca, sample	143		332	139	119	10	844	20	30
Juv. %	18		12	18	13	–	13	35	3
Ad. %	82		88	82	87	100	87	65	97
Ad. ♂♂ %	63		67	63	56	60	64	77	76
Ad. ♀♀ %	37		33	37	44	40	36	23	24

Table 25. The age- and sex-composition among *S. mollissima*, *M. nigra* and *M. fusca* killed in oil-disasters. For the two *Melanitta* species only whole birds, but not wing samples are included.

		1968/69	1969/70	1970/71	1971/72	1972/73
S. mollissima	Bag	40	32	17	46	22
	Oil	24	2	6	23	8
M. nigra	Bag	18	25	20	10	17
	Oil	10	15	23	8	5
M. fusca	Bag	38	39	21	15	15
	Oil	18	12	15	13	16

Table. 26. The juv. percentage among *S. mollissima*, *M. nigra* and *M. fusca* in the bag and in oil-kills. The proportion in the bag is based on game dealer material from Dec., Jan. and Feb. – In the last four seasons when oil data from two disasters were obtained, mean values have been used.

M. fusca have been examined. For the two last-mentioned species the actual number of birds examined was considerably larger, but in many samples (mainly comprising wings) satisfactory distinction between ad. ♀♀ and juv. could not be made.

Although oil disasters often affect large areas of water they are geographically much more limited in extent than the bag-sample examined at game dealers. Direct comparisons between oil-data and bag-data should therefore only be made for the same general area and for the same months. However, the bag data is generally insufficient for such detailed comparisons. In Table 26 the juv. percentages found in oil material is compared with the corresponding percentages from the bag (total sample in Dec.-Feb.) of each season. In nearly all cases, the juv. percentage is considerably higher in the bag, and this supports the above suggestion that oil kills are more representative of the composition of the wild population than is the bag-composition. However since the material is partly derived from different regions, it is unrealistic to use the two sets of data in an evaluation of possible correction factors.

The composition of samples of oiled birds is discussed for each species (Chapter IV, p. 99, 103 and 109.

Dabbling ducks 1970/71 - 1972/73

In three seasons (Oct.–Dec., 1970/71 – 1972/73) dabbling ducks (except *A. platyrhynchos)* were examined at game dealers in Copenhagen. This study was only a sideline of the diving-duck survey, and dabbling ducks were therefore only examined when time permitted. Consequently the samples were rather small, and a large proportion of the birds have only been aged but not sexed. Furthermore, the most important species *(A. platyrhynchos)* was completely omitted. It should also be emphasized that the first 1½ months of the shooting season (Aug.–Sept.) are not represented in the material.

About 900 dabbling ducks were examined in each season (Table 24). The samples of *A. crecca* and *A. penelope* comprised 300–550 birds annually, whereas the samples of *A. acuta* and *A. clypeata* comprised far fewer birds and were insufficient for detailed conclusions. The age composition of *A. crecca* and *A. penelope* is illustrated in Fig. 11 p. 58, and further comments are given in Chapter IV p. 69 and 77.

Chapter IV

The status of the different species in Denmark

In this chapter the information obtained in the study during the years 1965–1973 is described species by species for twenty duck and three swan species and the coot, all regularly occurring in Denmark. Among *Anatidae* only geese and a few duck species which have been recorded only a very few times have been omitted.

In the description, the following treatment has been accorded each species, a) A brief introduction summarizing the general distribution within Europe, and a definition of its status in Denmark. – b) The available information on distribution and population size is summarized for species breeding in Denmark. – c) A summary of existing data is given for species which undergo summer wing-feather moult in Denmark. – d) Results obtained in the present study concerning monthly variation in occurrence, distribution pattern, habitat selection and population size, are summarized in the section »Occurrence during autumn, winter and spring«. Details are also provided in two types of maps, showing the distribution recorded in the last seven country-wide surveys (see p. 24), and summarizing all existing count data (see p. 24). Further details on numbers recorded in country-wide surveys are given in Table 5 p. 23 and Appendix 2 p. 199. – e) Results of the study concerning the size of the annual kill and its geographical and monthly distribution are summarized in the section »Shooting«, with remarks on conditions under which birds were bagged. Geographical distribution is shown in maps and the monthly distribution in Fig. 10 p. 52–53. – f) The main results for species treated in studies on age- and sex-composition of the bag and oil-kills are summarized in the section »Composition«, and basic data are given in Figs. 11 and 12 p. 58–60. This chapter thus mainly comprises the presentation of information, whereas certain items are treated later in the discussion p. 152–174.

In addition to the results obtained in the present study, much information in literature has been utilized in summarizing species accounts. In addition to specific reports mentioned in the text, the following sources in particular have provided valuable information: ATKINSON-WILLES (1963, 1969, 1972), BAUER & VON BLOTZHEIM (1968–69), FERDINAND (1971), SALOMONSEN (1963 a, 1963 b, 1972), SCHIØLER (1925–26) and VOOUS (1960).

It should first be emphasized that the use of reports on waterfowl counts in other European countries is limited to a few cases only, where a direct comparison is realistic. Secondly, ringing data illustrating the migration pattern of local breeders and the origin of winter visitors has only been used in cases where such data has already been subject to scientific evaluation before publishing, whereas no attempt has been made to extract data from the many publications comprising only lists of recoveries.

Anas platyrhynchos – Mallard

Fig. 13–15 p. 66–67.

Holarctic, breeding throughout Europe and most of the U.S.S.R. In Europe only the northernmost populations are truly migratory, while breeders in the NW., W. and central regions are mainly resident or wintering south to the Mediterranean. In Denmark, as in many other countries, it is the most widespread and numerous breeding duck, mainly resident, although some winter in NW. Europe. A common visitor during autumn, winter and spring from breeding areas in Fennoscandia and W. Russia.

Shooting season: 16. Aug.–31. Dec.

Breeding and moulting

The mallard breeds in all parts of Denmark and occurs in every type of wetland habitat such as lakes, ponds, moors, streams, brooks, in marshlands particularly with dense vegetation, on small islands, and along sheltered and also occasionally more exposed coasts. The size of the breeding population is not known, but may well comprise tens of thousands pairs.

In addition to wild mallards there is a very large population of semi-domesticated birds breeding freely in parks etc. and more or less dependent on such conditions as artificial feeding. Furthermore, increasing numbers are being raised artificially, mainly for shooting purposes. The number is not known but probably amounts to several tens of thousands annually. The wild, semi-domesticated and handreared mallards cannot be distinguished in the field, and to a great extent mix in the wild.

In summer, moulting birds can be found in most types of wetland habitats, generally in small flocks, although assemblies of up to a few hundred are regularly found in some large lakes and marshlands with dense vegetation. The two most important moulting areas are probably the waters around the small island Klægbanken in Ringkøbing Fjord, where some thousand moulting birds have been recorded, and Vejlerne in the Limfjord area.

Occurrence during autumn, winter and spring

In Aug.–Sept. the mallard is extremely common and numerous all over the country, and a large proportion are found in large and small inland waters. Some foreign birds (mainly juv.) already visit Denmark at this time (SALOMONSEN 1972), and in Oct.–Nov. the number of birds is increased considerably by immigration of birds from Scandinavia and Russia. The species is still widely scattered, but an increasing proportion are found in large flocks in shallow salt water, particularly in N. and W. Jutland in Nov. (Fig. 74 p. 134) where tens of thousands have been recorded. In country-wide surveys in Nov. the districts A, B and C contained about half of all mallards recorded in the whole country. The foreign visitors mainly continue their migration to wintering areas in W. Europe, and the migratory part of the local population leaves Denmark in Nov.-Dec. In most years the numbers found during winter are considerably lower than in the autumn, and especially when many inland waters are ice-covered the birds concentrate around harbours and in shallow offshore salt-water areas, often several kilometres from the coast. As early as Feb. and particularly in March

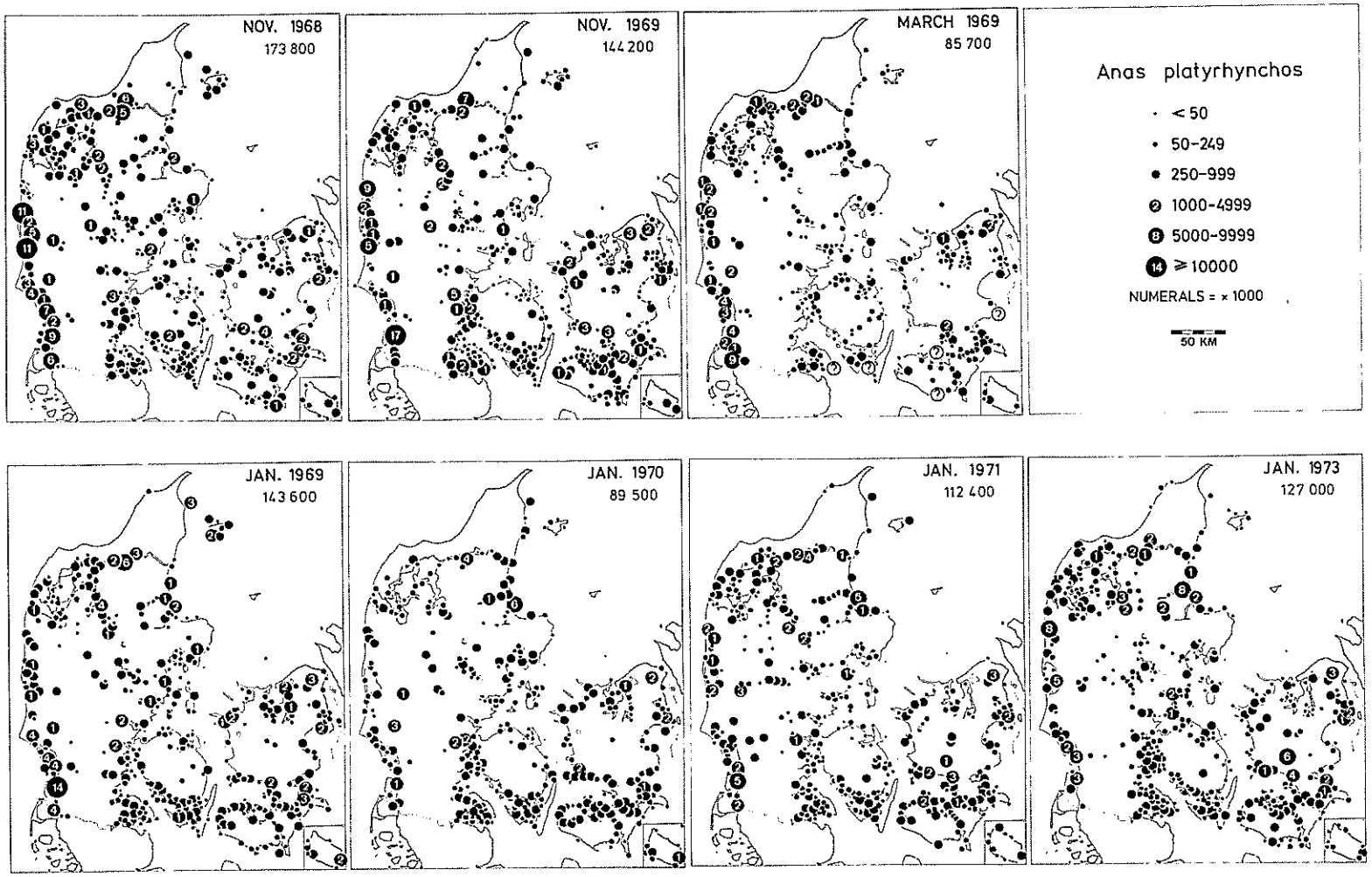


Fig. 13. Distribution of *A. platyrhynchos* in seven country-wide surveys and three complete surveys in W. and N. Jutland (opposite page).

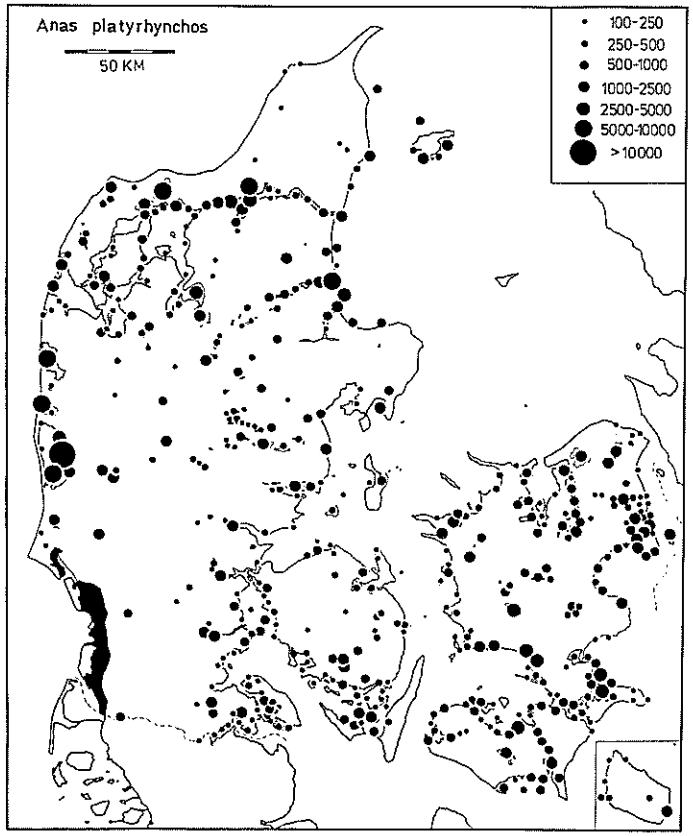
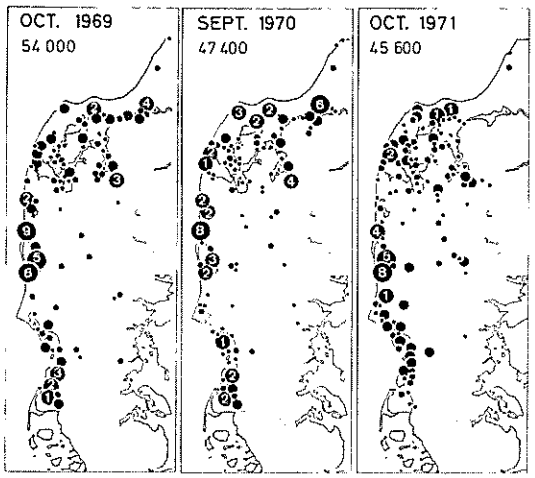


Fig. 14. Summary map for *A. platyrhynchos* showing all areas where more than 100 birds have been recorded regularly during 1965–1973. – Concentrations of more than 5,000 birds can be found in nearly all parts of the Waddensea.

Fig. 13, text p. 66.



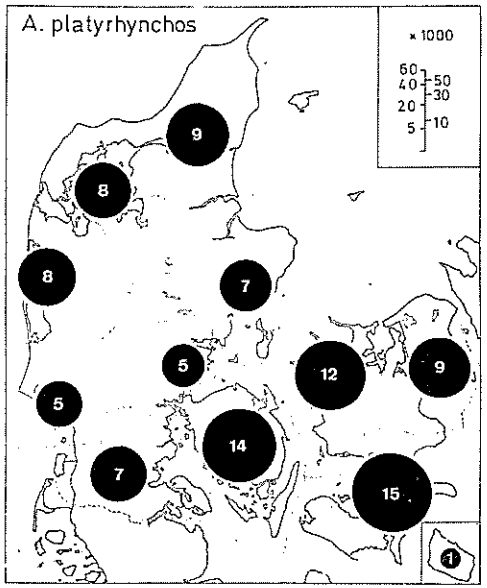


Fig. 15. Distribution of the bag of *A. platyrhynchos* per county (averages of five shooting seasons 1967/68 – 1971/72). Scale refers to circle diameter and represents no. of individuals (thousands). – Numbers in circles indicate percentages of total numbers.

a notable increase is found, when both local and foreign birds return. Numbers are high during most of April, but after the later part of this month only the local breeders remain (Fig. 4 p. 26).

In country-wide surveys in Nov. between 122,000 and 174,000 mallards were recorded. The counts included most of the birds in natural habitats, but may well have omitted some tens of thousands in parks and small lakes particularly of the larger estates. The total population in Nov. probably did not exceed 200,000 (1967 and 1969) or 250,000 (1968). With the limited number of potential habitats, the figures obtained in Jan. are more representative, varying from about 90,000 in 1968 and 1970 to nearly 150,000 in 1969.

Shooting

In all counties the mallard is by far the most important waterfowl, and in later years comprises half of all ducks shot. It is bagged by nearly 90% of the duck-shooting sportsmen and by 40% of all sportsmen (Table 10 p. 35, Fig. 7 p. 36). Information from the bag-record goes back to 1959/60 (Fig. 6 p. 34). In the years 1966–1972 the annual kill varied between 334,000 and 419,000 (average value 380,000). The largest bag was taken in 1968/69, corresponding to very high numbers in country-wide surveys. The geographical distribution of the kill is very uniform (Fig. 15) and shows very little annual variation. Half the individuals are bagged in the islands, and half in Jutland. The largest bags are taken in Storstrøm and Funen counties, comprising nearly 30% of the total kill. The monthly kill index (Fig. 10 p. 52) for the whole country shows a rather uniform distribution throughout the autumn, although there is considerable seasonal variation. In the eastern parts of Denmark the kill is uniformly distributed over the season, while in the Limfjord, W. Jutland and the Waddensea areas the large majority are shot partly in Oct. and particularly in Nov. These latter areas have a comparatively small production, but serve as gathering areas particularly in late autumn (see p. 131).

Anas crecca – Teal

Fig. 16–18 p. 70–71.

Holarctic, mainly in boreal and temperate zones. Breeds throughout Europe, except the southernmost parts, and through most of Siberia. Winters from Denmark and British Isles southwards to the Mediterranean countries including N. Africa. In Denmark the teal is scarce during breeding and moulting, very numerous as an autumn and spring visitor, and scarce again during winter.

Shooting season: 16. Aug.–31. Dec.

Breeding and moulting

The teal breeds on the moorlands of Central and W. Jutland and locally in coastal marshlands, mostly however in very small numbers. The total breeding population probably does not exceed two hundred pairs (L. FERDINAND pers. comm.). In summer, moulting birds occur in a few areas and mostly in small groups, although larger concentrations have been recorded in Vejlerne in N. Jutland (KORTEGAARD in press).

Occurrence during autumn, winter and spring

Some visitors arrive in Aug., but numbers increase considerably in Sept. In most years peak numbers have been recorded in Oct. (but in the Waddensea in Nov., see Fig. 74 p. 134), and during Dec.–Feb. very few remain in Denmark. Birds ringed in Denmark, mostly as migrants, have mainly been recovered in the British Isles and France (SALOMONSEN 1972). Spring migration starts in March, and peak numbers are reached in April, or occasionally early May. Before mid-May numbers decline considerably, and the few birds recorded from late May onwards are probably mostly local breeders (Fig. 4 p. 26).

During Aug.–Nov. and March–May teal occur regularly in a large number of areas all over the country. Fig. 18 shows localities where more than 25 teal have been regularly recorded. Smaller flocks are less regularly found in practically all inland and many coastal water-bodies surveyed. The most important day-time haunts are the densely vegetated lakes and sheltered coastal marshlands of W. and N. Jutland (although in the Waddensea mainly in *Spartina* areas), and in the larger surveys (Fig. 16) 60–90% of the total number were recorded in less than ten localities in W. and N. Jutland, which regularly hold more than one thousand birds each (see also p. 160 and 165).

In Sept. 1970 and Oct. 1971 close to 30,000 teal were recorded in W. and N. Jutland. Since not all parts of the country were covered in these surveys, and some birds are invariably overlooked because of concealing vegetation, the total peak numbers during autumn may have been 40,000–50,000.

Shooting

The teal ranks number three in the bag of ducks. In three seasons, the estimated kill varied between 68,000 and 85,000. With the exception of the Ribe and S. Jutland counties (the Waddensea) the teal is by far the most important species among »other dabbling ducks«. Birds in N. Jutland and Ringkøbing county together account for 40% of the total kill in all three seasons, and only *A. platyrhynchos* is more important (Fig. 9 p. 49). In most other counties also large bags are taken, and only Bornholm is unimportant.

The monthly kill index (Fig. 10 p. 52) shows that most birds are bagged in Sept.–Oct., but probably the sampling procedure under-estimates the kill in Aug.–Sept. (see p. 51). In N. Jutland most teal are shot in Sept.–Oct., and in SW. Jutland in Oct.–Nov. (Table 27 p. 73).

The juv.% of birds bagged in the later part of the season (Oct.–Dec. 1970–1972) shows little seasonal variation, being 60–70% (Fig. 11 p. 58).

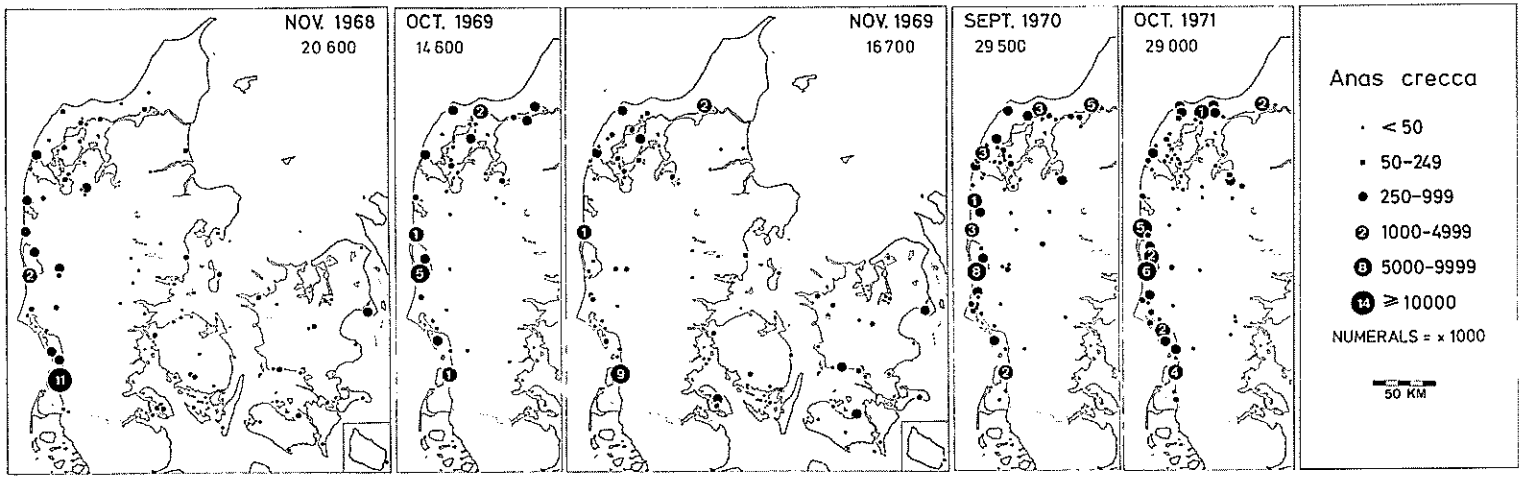


Fig. 16. Distribution of *A. crecca* in two country-wide surveys and three complete surveys in N. and W. Jutland.

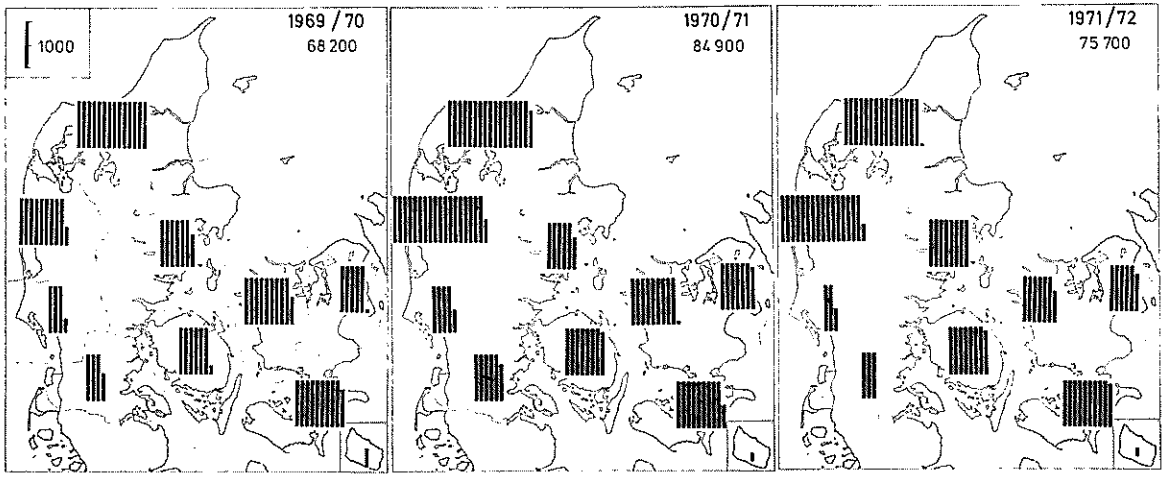


Fig. 17. Distribution of the bag of *A. crecca* per county in three shooting seasons.

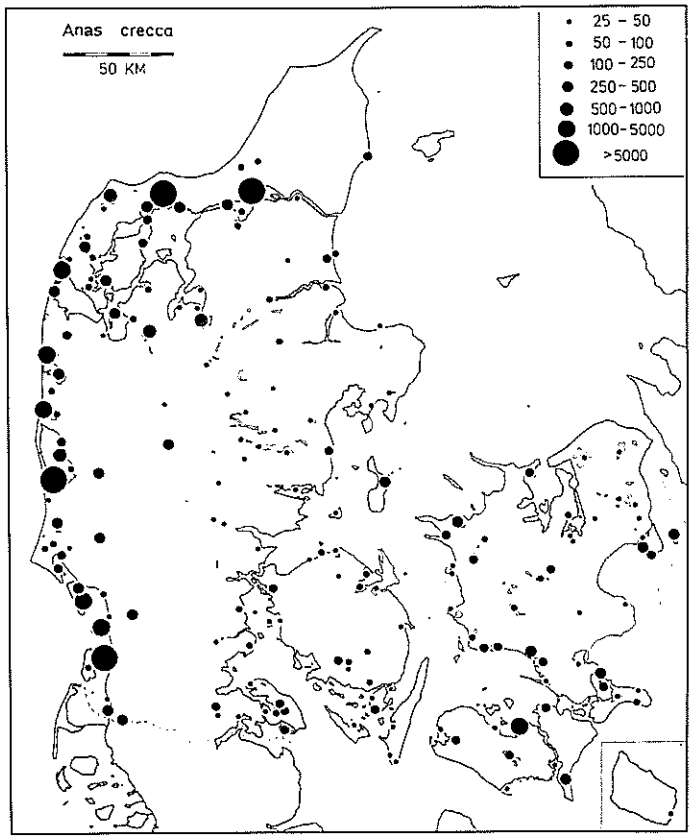


Fig. 18. Summary map for *A. crecca* showing all areas where more than 25 birds have been recorded regularly during 1965–1973.

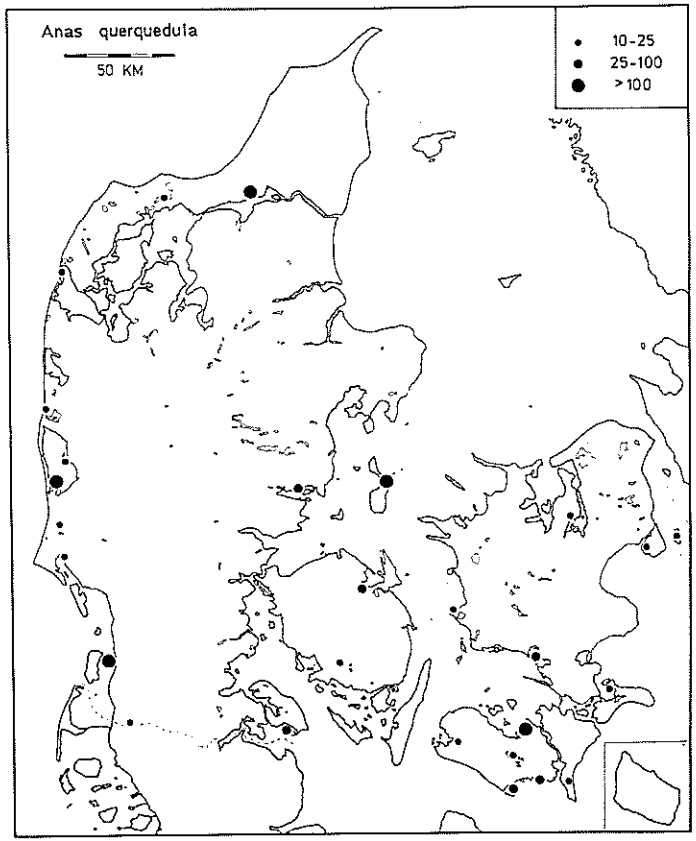


Fig. 19. Summary map for *A. querquedula* showing all areas where more than ten birds have been recorded regularly during 1965–1973.

Anas querquedula – Garganey

Fig. 19 p. 71.

Palaearctic, mainly in temperate and boreal zones. Breeds in England and southern Fennoscandia, and in Central Europe and U.S.S.R. Winters locally in S. Europe, but mainly in tropical Africa and Asia. In Denmark a scarce breeder, a widespread but rather scarce visitor in autumn and spring, and rare during winter.

Shooting season: 16. Aug.–31. Dec.

Breeding

A very scarce breeder in most parts of the country, occurring in lakes and coastal marshlands. The breeding population is probably about two hundred pairs (L. FERDINAND pers. comm.).

Occurrence during autumn, winter and spring

The monthly distribution of all garganey recorded in ground counts during 1965–1973 (total 5,400) is: Sept. 46%, Oct. 21%, Nov. 2%, Dec.–Feb. 1%, March 3%, April 27%. However, supplementary observations in W. and N. Jutland indicate that peak numbers occur in Aug. and May. Only fifty birds were recorded in Dec.–Feb., all in the relatively mild winters of 1966/67, 1970/71 and 1972/73.

The garganey mostly occurs as a minority member in flocks of *A. crecca*, and is often overlooked. Furthermore, the most important months were not included in the general waterfowl counts. Therefore the map Fig. 19 showing areas of regular occurrence, must be considered to be very incomplete. In addition to the thirty localities marked, irregular records of small flocks of 1–10 birds have been made in about seventy areas. The species occurs both in inland and coastal waters, but all larger flocks have been observed in coastal marshlands or very shallow sheltered salt- and brackish waters.

Shooting

In the kill survey concerning »other dabbling ducks« the garganey is included in the material for *A. crecca* (see p. 45), and the size of the annual bag can only be guessed at. Probably the kill does not exceed a couple of thousand birds, and may well be less than one thousand, practically all birds being bagged in Aug. and early Sept.

Anas strepera – Gadwall

Fig. 20 p. 73.

Holarctic, mainly in temperate zone. Breeding from Central Asia to E. Europe, locally in NW. Europe (Iceland, British Isles, Holland, N. Germany, Denmark and Sweden). Winters from British Isles through S. Europe to Central Africa. In Denmark a very scarce and irregular breeder since 1940's, in south-eastern parts. Protected since 1967.

The gadwall is probably often overlooked in waterfowl counts, and the present study comprises records of only 250

Anas querquedula – Garganey

Fig. 19 p. 71.

Palaearctic, mainly in temperate and boreal zones. Breeds in England and southern Fennoscandia, and in Central Europe and U.S.S.R. Winters locally in S. Europe, but mainly in tropical Africa and Asia. In Denmark a scarce breeder, a widespread but rather scarce visitor in autumn and spring, and rare during winter.

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Breeding

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Anas strepera – Gadwall

Fig. 20 p. 73.

Holarctic, mainly in temperate zone. Breeding from Central Asia to E. Europe, locally in NW. Europe (Iceland, British Isles, Holland, N. Germany, Denmark and Sweden). Winters from British Isles through S. Europe to Central Africa. In Denmark a very scarce and irregular breeder since 1940's, in south-eastern parts. Protected since 1967.

The gadwall is probably often overlooked in waterfowl counts, and the present study comprises records of only 250

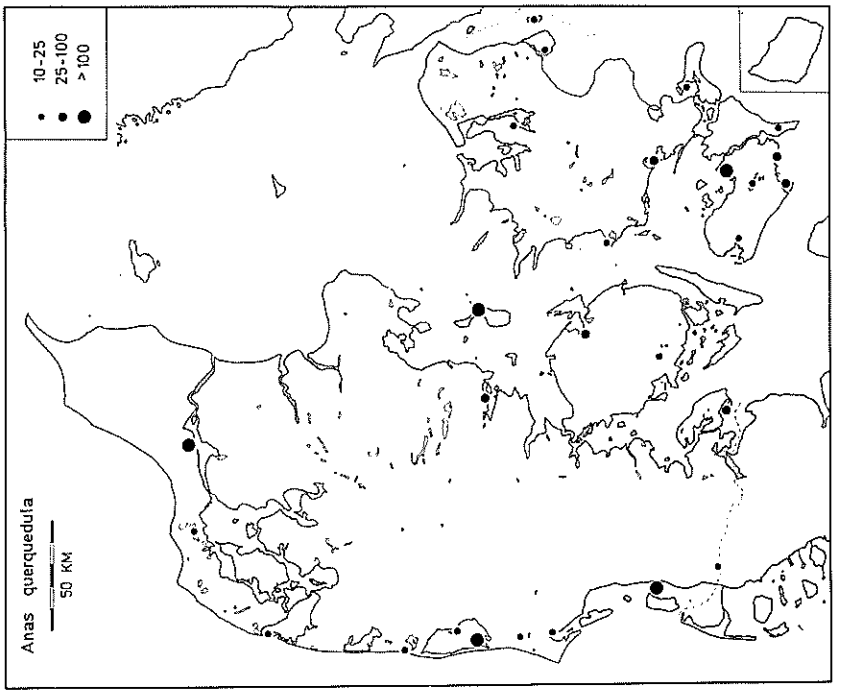

Fig. 19. Summary map for *A. querquedula* showing all areas where more than ten birds have been recorded regularly during 1965–1973.

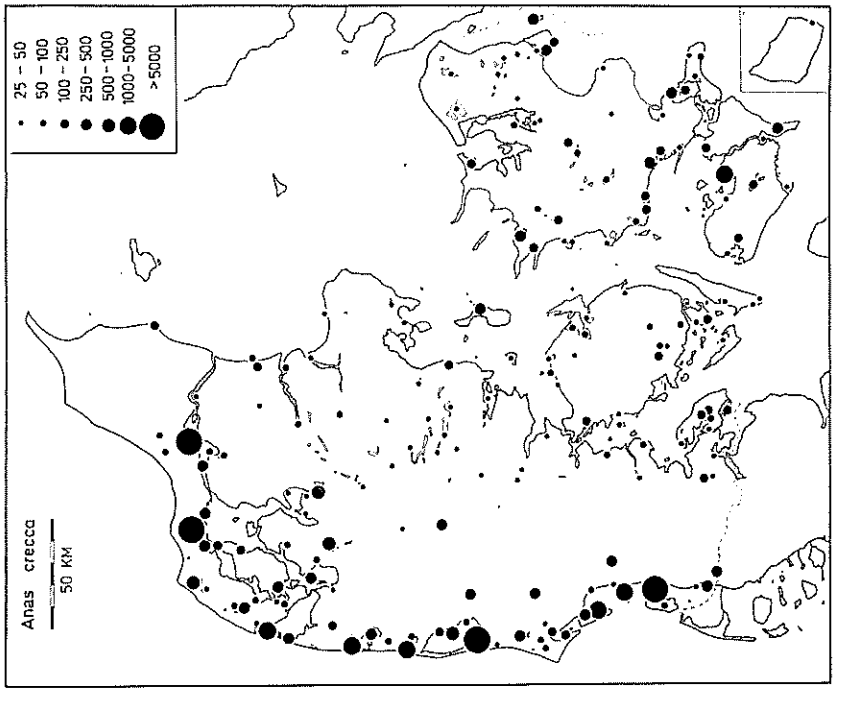

Fig. 18. Summary map for *A. crecca* showing all areas where more than 25 birds have been recorded regularly during 1965–1973.

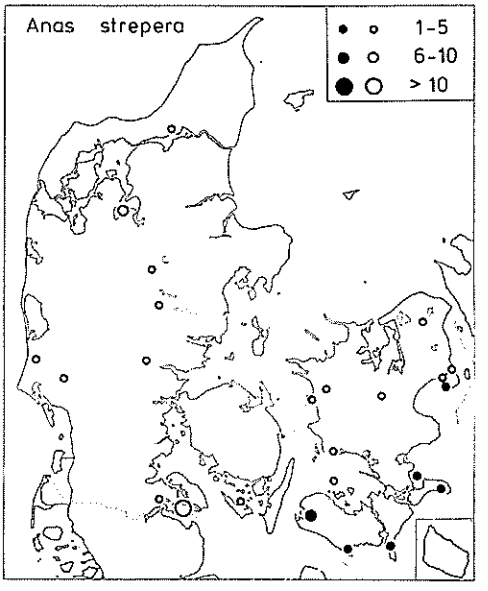

Fig. 20. Localities where *A. strepera* was observed either regularly (solid circles) or irregularly (open circles) during the present study.

birds, of which more than half were observed in the game reserve Nakskov Indrefjord (W. Lolland). The species has been observed for more than three years in only a few other south-eastern localities (Fig. 20, solid circles), and there are a few irregular records from other parts of the country (open circles). The monthly distribution of the birds observed is: Sept. 16%, Oct. 13%, Nov. 8%, Dec. 5%, Jan. 9%, Feb. 8%, March 10%, April 31%.

Species	*A. crecca*					*A. penelope*				
Month Season County	A.	S.	O.	N.	D.	A.	S.	O.	N.	D.
1969/70										
N. Jutland and Viborg	3	40	39	15	3	–	16	43	35	6
Ringkøbing	5	35	38	18	4	–	2	76	15	7
Ribe	3	40	29	22	6	3	44	29	23	1
S. Jutland	2	23	26	46	3	–	13	21	64	2
1970/71										
N. Jutland and Viborg	3	32	46	12	7	–	31	30	30	9
Ringkøbing	3	36	42	17	2	2	33	46	19	–
Ribe	4	31	36	20	9	–	21	57	19	3
S. Jutland	1	15	48	30	5	–	8	36	51	5
1971/72										
N. Jutland and Viborg	10	41	28	19	2	2	9	49	33	7
Ringkøbing	7	42	43	5	2	–	17	36	31	16
Ribe	22	34	24	13	7	3	32	53	12	–
S. Jutland	25	42	13	16	4	1	18	36	40	4
1972/73										
N. Jutland and Viborg	5	21	37	21	16	–	2	65	20	12
Ringkøbing	4	45	34	13	3	–	37	33	21	9
Ribe	5	21	51	6	17	–	17	59	19	5
S. Jutland	13	18	38	24	7	1	1	5	49	44

Table 27. The monthly distribution (as a percentage of the total) of *A. crecca* and *A. penelope* bagged and sent to a game dealer from four regions of northern and western Jutland in four shooting seasons.

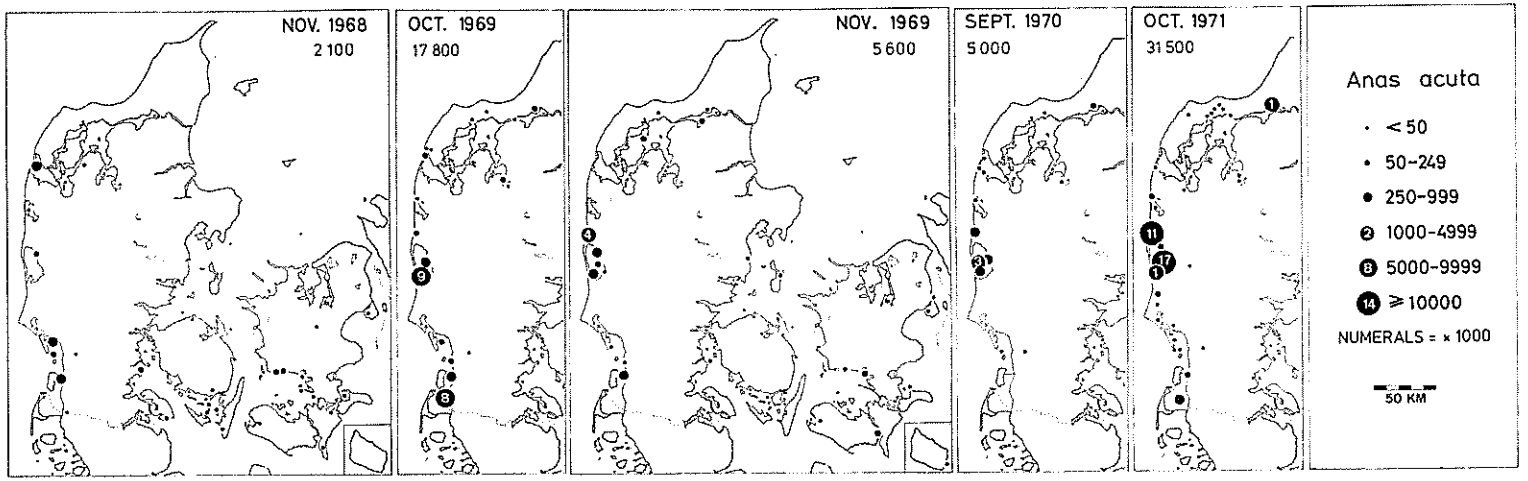

Fig. 21. Distribution of *A. acuta* in two country-wide and three complete surveys in W. and N. Jutland.

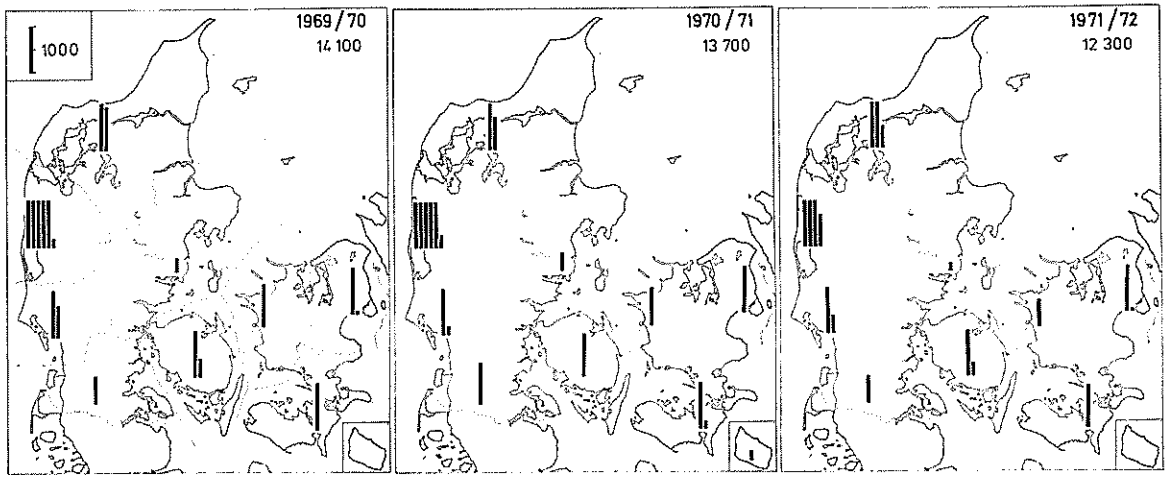

Fig. 22. Distribution of the bag of *A. acuta* per county in three shooting seasons.

Anas acuta – Pintail

Fig. 21–23 p. 74–75.

Holarctic, mainly in boreal and temperate zones. Breeds in Europe north of 50° and throughout Siberia. Wintering from British Isles through W. and Central Europe to S. Europe and N. Africa. In Denmark a scarce breeder, a common and locally numerous visitor during autumn and spring, but very scarce during winter.

Shooting season: 16. Aug.–31. Dec.

Breeding

The pintail is a very scarce breeder, mainly on coastal marshes and on small islands in SE. Denmark. The total number is probably about two hundred pairs (L. FERDINAND pers. comm.).

Occurrence during autumn, winter and spring

As early as Aug., numbers in excess of the breeding population have been recorded in several areas, particularly in eastern parts of the country. It is known from the monthly count index (Fig. 4 p. 26) and aerial surveys in W. and N. Jutland that peak numbers are found in late Sept. and during Oct. Numbers found in Nov. are much smaller, and very few pintail are seen during Dec.–Feb. The totals in Jan. 1969 and Jan. 1973 were 300 and 100 birds respectively for the whole country. From early March numbers increase, and peak numbers occur in April. From mid-May very few pintail remain in Denmark.

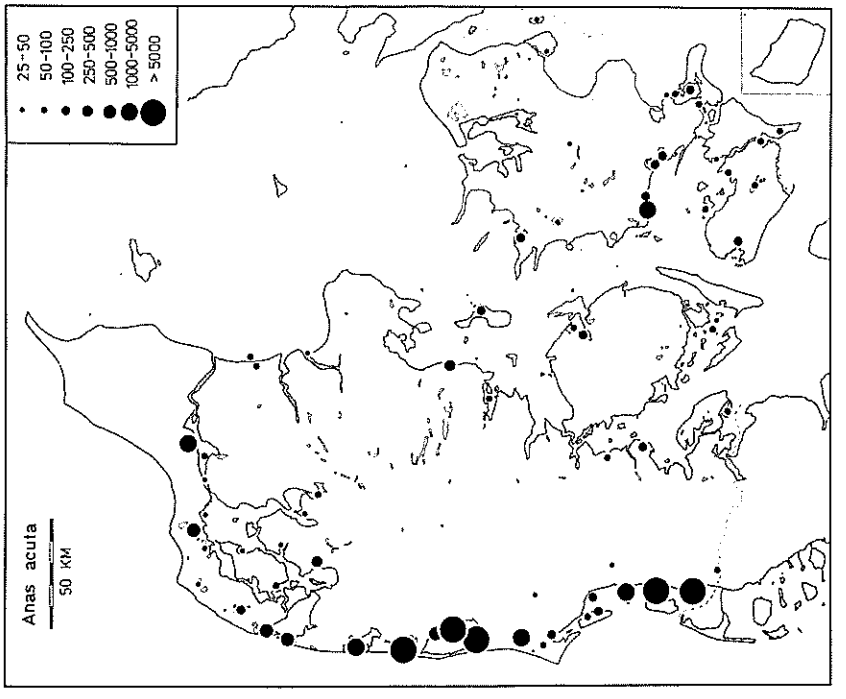

Fig. 23. Summary map for *A. acuta* showing all areas where more than 25 birds were recorded regularly during 1965–1973.

The number of localities regularly visited by pintail (Fig. 23) is considerably smaller than by the nearly equally numerous *A. crecca*. There are a few regular haunts in the islands, the most important being Basnæs Nor, SW. Sealand. The main migration route is through N. and W. Jutland, and the most important area is Ringkøbing Fjord, where many thousand birds (up to 17,000) stay for 4–6 weeks. Notable flocks are also seen in Ulvedybet, Vejlerne, Nissum Fjord, Vest Stadil Fjord, Fiilsø and some areas of the Waddensea, but mostly only for shorter periods.

In Oct. 1969 and Oct. 1971 18,000 and 32,000 pintail respectively were recorded in W. and N. Jutland, and in most years the largest number occurring simultaneously in the whole country was probably of the order 25,000–30,000.

Shooting

In 1969–1971 the total bag varied from 12,000 to 14,000. In most parts of the country the pintail is rather unimportant compared to *A. crecca* and *A. penelope*, but in Ringkøbing Fjord and surrounding areas large numbers are shot, accounting for 30–40% of the total kill. Two-thirds of the total kill are shot in W. and N. Jutland, most birds being bagged in Sept.–Oct. In Ringkøbing county the bag in these months was 75–85% of the total.

Anas penelope – Wigeon

Fig. 24–26 p. 78–79.

Palaearctic, mainly in boreal zone. Breeds in Iceland, Scotland, Central and N. Fennoscandia, locally south of the Baltic Sea, and throughout U.S.S.R. Winters from Denmark and British Isles through W. Europe to the Mediterranean countries. In Denmark a very common and numerous visitor during autumn and spring, scarcer in winter. Occasionally seen during summer, but breeding has only been recorded a few times.

Shooting season: 16. Aug.–31. Dec.

Occurrence during autumn, winter and spring

The first visitors are seen in late Aug., and numbers increase considerably in Sept.–Oct., with peak records in all parts of the country in Oct. (Fig. 4 p. 26). Many birds are still present in Nov., particularly in the Waddensea. The winter population is generally small and mainly found in W. and N. Jutland. Spring migrants arrive from late Feb., and peak numbers are found in early and mid-April. Few birds remain by early May.

In addition to localities of regular occurrence (Fig. 26) wigeon are found irregularly in a large number of localities. The species is scarce inland and mainly confined to coastal marshes and shallow salt- and brackish-water areas. In the eastern parts of the country few areas regularly have more than five hundred wigeon, and by far the most important haunts are in W. and N. Jutland. Here flocks of more than one thousand are regularly seen in many areas, and more than five thousand birds may be found in Ulvedybet, Nibe Bredning, Vejlerne, Ringkøbing Fjord and large parts of the Waddensea. In Ringkøbing Fjord up to 25,000 (Oct. 1971) and in the Waddensea up to 55,000 (Oct. 1970) have been recorded (Fig. 74 p. 134).

Up to 75,000 wigeon have been re-

corded in W. and N. Jutland in Oct., and probably the peak number present in the whole country is close to 100,000. In country-wide Nov. surveys 27,000–48,000 have been recorded, while numbers in Jan. varied from a few hundred to a few thousand.

Shooting
The total number killed in 1969–1971 was 37,000–49,000, and the wigeon ranks number four in the bag of ducks. With the exception of Bornholm large numbers are shot in all counties, and in the Waddensea wigeon is even more important than *A. crecca* (Fig. 9 p. 49). Two-thirds of the total kill is taken in W. and N. Jutland, and hereof one-third in the Waddensea.

The monthly kill index (Fig. 10 p. 52) for the whole country shows that the largest numbers are shot in Oct., many in Sept. and Nov., while Aug. and Dec. are relatively unimportant. In N. Jutland Oct. is generally the most important month, while in the Waddensea most birds are bagged in Nov., and in the mild winter of 1972/73 also in Dec. (Table 27). The juv.% of bagged birds from Oct.–Dec. varied between 60% and 70% in 1970–1972.

Anas clypeata – Shoveler

Fig. 27–28 p. 80.

Holarctic, mainly in boreal and temperate zones. Breeds from British Isles and W. Europe through S. Fennoscandia, E. Europe and Siberia. Winters from W. and S. Europe to Central Africa. In Denmark a rather scarce breeder and a common visitor in autumn and spring, very scarce in winter.

Shooting season: 16. Aug.–31. Dec.

Breeding
The shoveler breeds in most parts of the country, mainly in coastal marshes but locally also inland. In most areas it is very scarce, the total breeding population probably not exceeding five hundred pairs (L. FERDINAND pers. comm.). Moults in scattered groups in fresh- and brackish water.

Occurrence during autumn, winter and spring
In Aug.–Sept. the species is very widespread but mostly occurs as small groups. In Oct.–Nov. the birds concentrate in a few areas before numbers drastically decline in late Nov. During winter (Dec.–Feb.) the shoveler is extremely scarce. A slight increase occurs in March in some years, but most spring visitors and local birds arrive in April and May (Fig. 4 p. 26). A few concentrations can be found after mid-May, but mostly only local birds remain.

Since Aug. and May are not included in the general waterfowl survey and the shoveler is often overlooked (see p. 15), the number of localities where more than ten birds occur regularly is underestimated (Fig. 28). The species is found in all parts of the country, mostly in small groups, but occasionally there are several hundred together. During 1965–1973 there were five observations of more than one thousand birds, seven of 500–1,000, and about fifty of 100–500. Most large concentrations have been recorded in the marshlands, coastal mea-

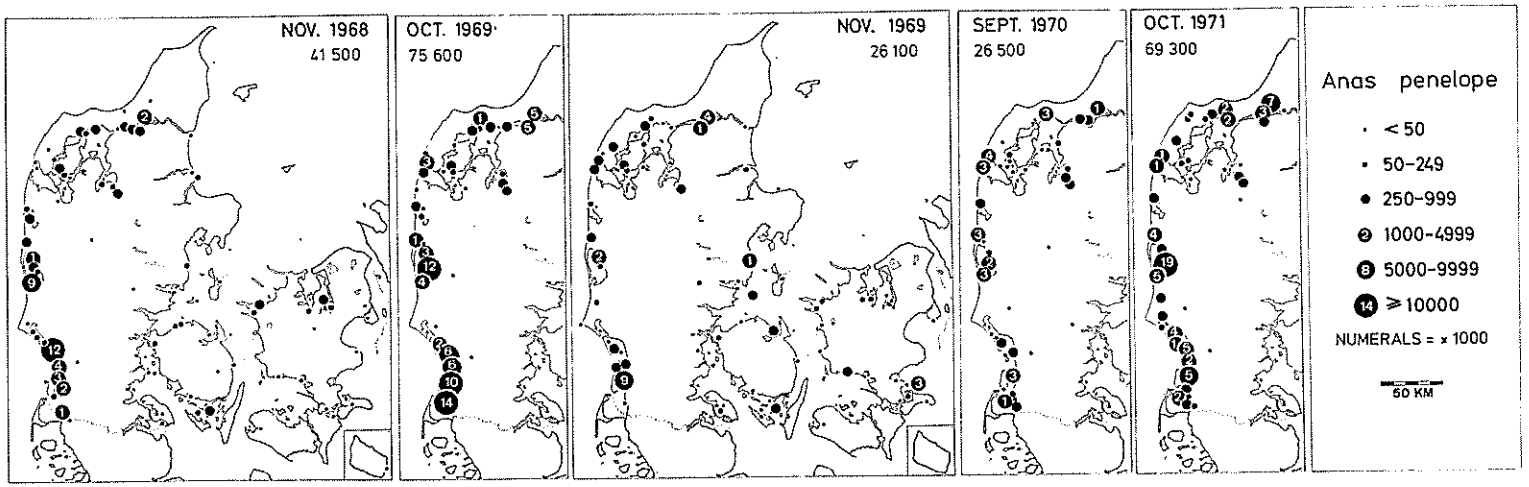

Fig. 24. Distribution of *A. penelope* in two country-wide and three complete surveys of W.and N. Jutland.

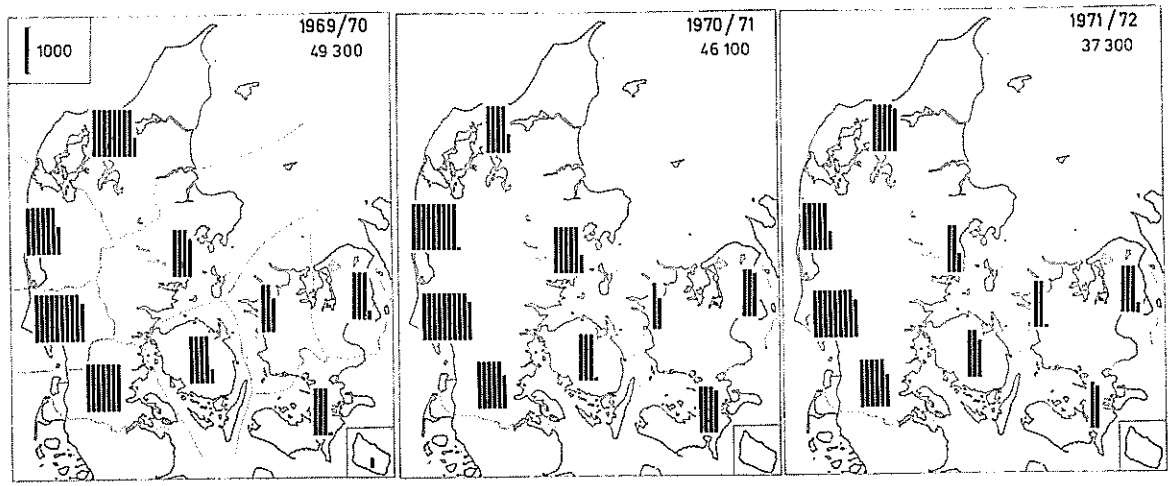

Fig. 25. Distribution of the bag of *A. penelope* per county in three shooting seasons.

dows and sheltered coastal waters of W. and N. Jutland, the most important areas being Ringkøbing Fjord and the waters around the Rømø Dam in the Wadden-sea. The species only occurs regularly in a few inland waters.

The peak population in Aug.–Sep. can only be estimated approximately and probably seldom exceeds 5,000.

Shooting

The estimated kill in 1969–1971 varied between 8,400 and 10,900 individuals, a little more than half being shot in the islands. The species is unimportant in all counties, particularly Bornholm, Ribe and S. Jutland (Fig. 9 p. 49). The monthly kill index (Fig. 10 p. 52) shows that most shoveler are shot in Aug.–Sept. (some also in Oct.), but very few later in the season. The estimates for both the size and monthly distribution of the kill must be considered with caution (see p. 45 and p. 51).

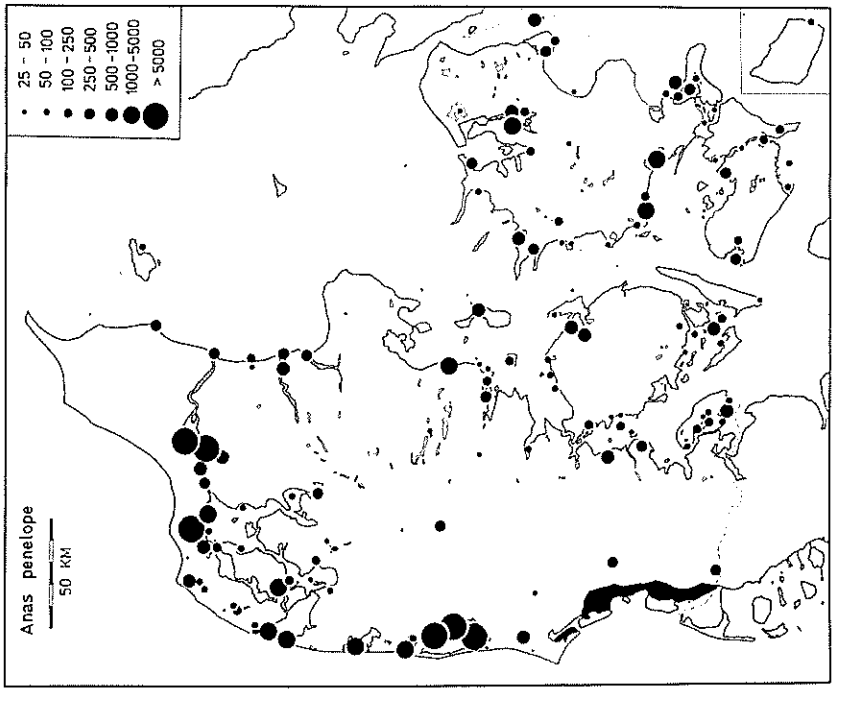

Fig. 26. Summary map for *A. penelope* showing all areas where more than 25 birds were recorded regularly during 1965–1973. Concentrations of more than 5,000 can be found in most parts of the Waddensea.

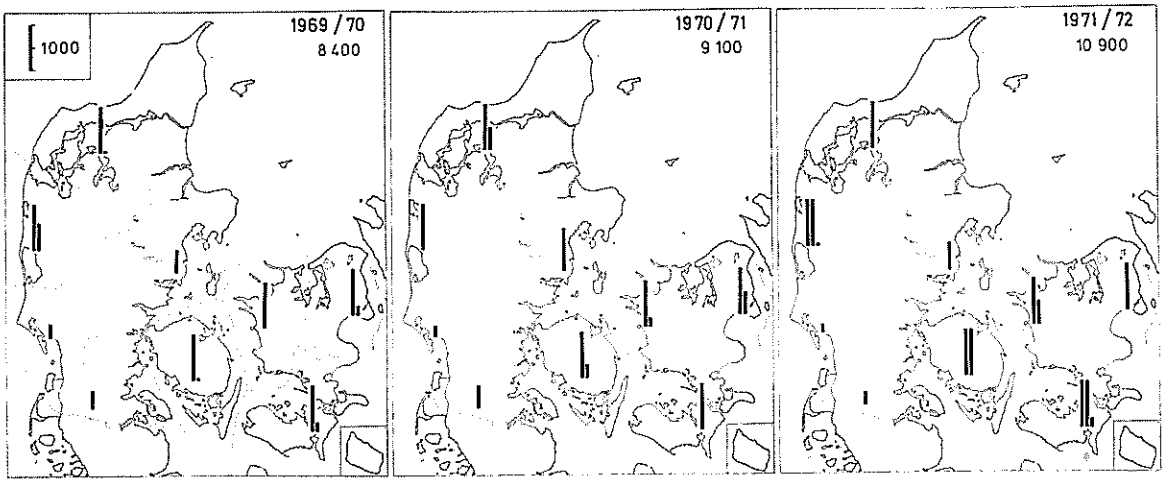

Fig. 27. Distribution of the bag of *A. clypeata* per county in three shooting seasons.

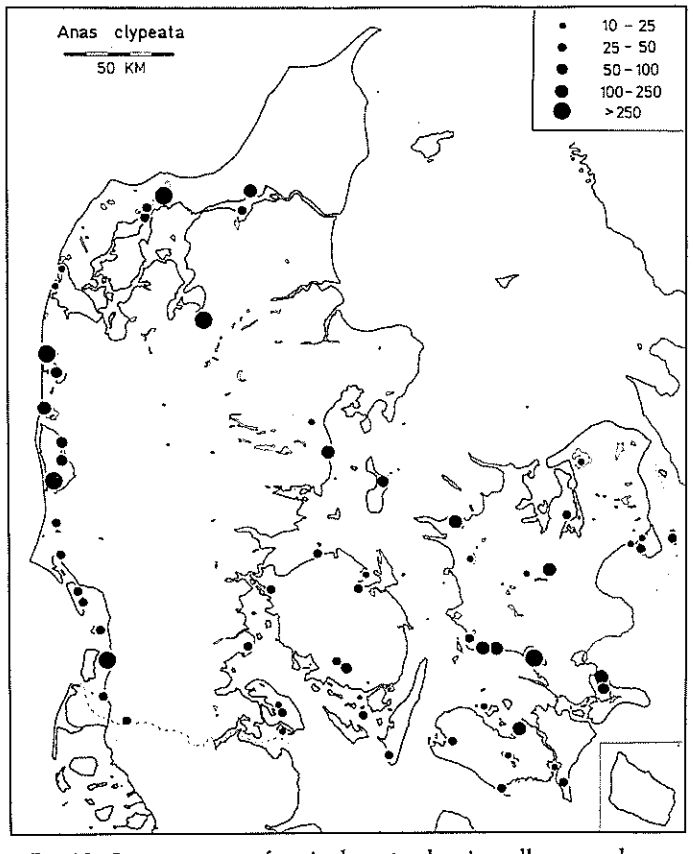

Fig. 28. Summary map for *A. clypeata* showing all areas where more than ten birds were recorded regularly during 1965–1973.

Tadorna tadorna - Shelduck

Fig. 29–30 p. 82–83.

Breeding discontinuously in S. and W. palaearctic, in Europe along coasts of the British Isles, the North Sea, the W. Baltic Sea, in S. and W. Norway and locally in the Mediterranean. Winters in Denmark, British Isles, and in W. and S. Europe. In Denmark a common breeder, irregular moulter in summer, locally numerous in autumn and winter and very numerous and widespread in spring. Protected since 1931.

Breeding and moulting

The shelduck is a very common breeder along all coasts and in many inland waterbodies (POULSEN 1959). The species has increased considerably in numbers in the last decades. The size of the breeding population is not known, but probably comprises some thousand pairs.

The main moulting areas of the shelduck are in the German Waddensea, where concentrations of up to one hundred thousand birds have been found (GOETHE 1961, OELKE 1969). In the southernmost part of the Danish Waddensea up to a few thousand occur throughout the summer, and some probably moult there. Moulting birds in the Waddensea include both one-year old non-breeders and adults from large parts of the NW. European breeding areas. The moult migration takes place from June until Sept. (LIND 1957, OELKE 1969).

Occurrence during autumn, winter and spring

In Aug.–Sept. the number of shelduck in Denmark outside the Waddensea is very small, because adults are at the moulting areas and some juv. have already left on their autumn migration. Later in the autumn birds from the Waddensea spread northwards, and become increasingly numerous in the W. Jutland fiords, the Limfjord and particularly along the east coast of Jutland, especially Mariager and Randers Fjord. This latter area together with the Waddensea constitutes the most important wintering area in Denmark. From late Feb. the number of shelduck increases considerably, and during March-April numbers in the Waddensea decline and the birds disperse along all Danish coasts (see map for March 1969, Fig. 29). Foreign breeders and one-year old non-breeding birds probably constitute a large proportion of the dispersed population, and in late April and May the numbers decline, leaving mainly local breeders.

Outside the breeding season the shelduck is almost exclusively confined to coastal waters, and the main concentrations are found on tidal sand- and mud-flats, often several kilometres from the shore, as are found in the Waddensea and along the eastern coast of Jutland.

The figures obtained in country-wide surveys are very accurate. There is considerable annual variation, e.g. in Nov. between 7,000 and 21,000, and in Jan. between 1,000 and 20,000. In the Waddensea in particular numbers wintering vary greatly, being influenced by the degree of ice-cover of the tidal flats. The smaller population wintering in Mariager and Randers Fjords is more constant. The largest number ever recorded was 26,000 in March 1969, but since some important areas in the southern part of the country were omitted from this survey, the actual number may well have been of the order of 30,000–35,000. Although fewer birds are present in the Waddensea the overall population in Danish waters is probably even larger in April.

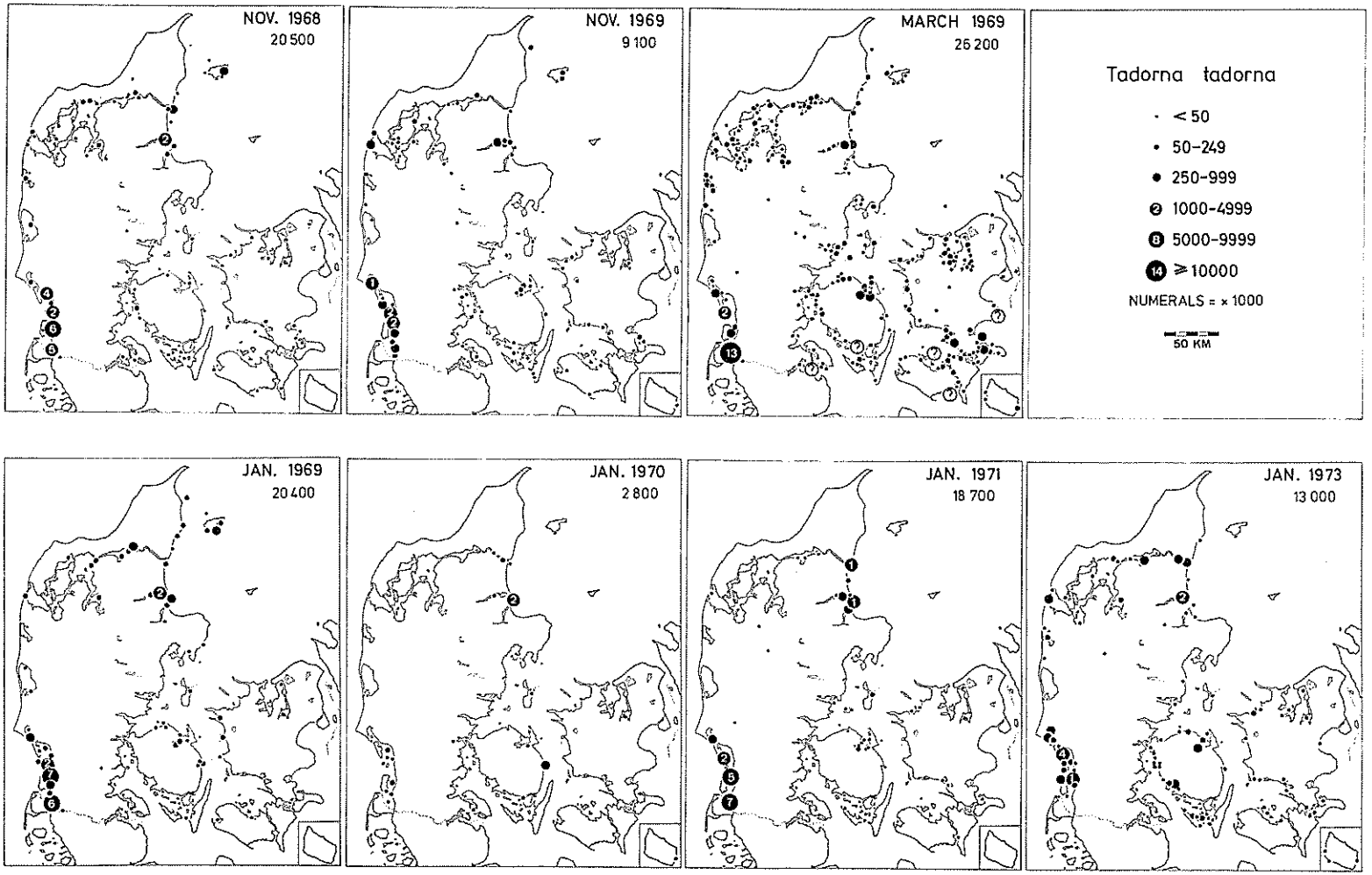

Fig. 29. Distribution of *T. tadorna* in seven country-wide surveys and three complete surveys in W. and N. Jutland (opposite page).

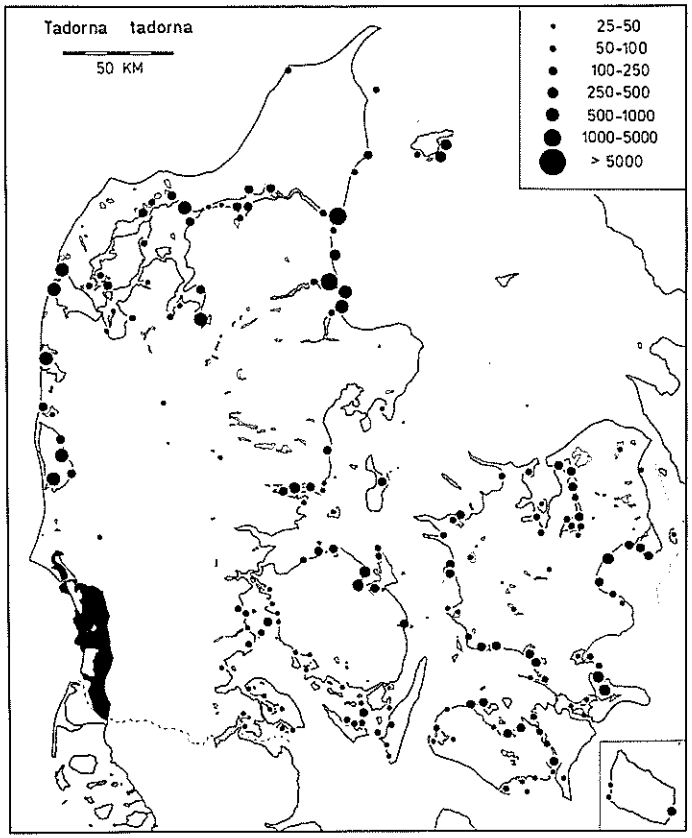

Fig. 30. Summary map for *T. tadorna* showing all areas where more than 25 birds were recorded regularly during 1965–1973. Concentrations of more than 5,000 can be found in most parts of the Waddensea.

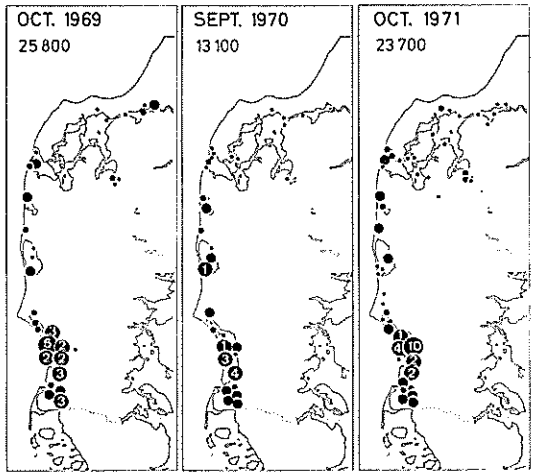

Fig. 29, text p. 82.

Aythya ferina – Pochard

Fig. 31–33 p. 86–87.

Palaearctic, mainly in temperate zone. Breeding from British Isles through southern Fennoscandia, Central and south-eastern Europe and U.S.S.R. to Mongolia. Winters from Denmark and British Isles through W. and Central Europe to the Mediterranean, Black and Caspian Seas. In Denmark a widespread but rather scarce breeder and a common visitor during autumn, winter and spring.

Shooting season: 16. Aug.–29. Feb.

Breeding and moulting

In the 19th century the species expanded its breeding range in NW. Europe and has bred in Denmark since 1860. The breeding distribution about 1966 was described by HANSEN (1967). The total population was estimated to be 350–700 pairs, of which one-third bred in two areas (Vejlerne in N. Jutland and Nakskov Indrefjord, W. Lolland), while the rest was rather uniformly distributed over most of the country, mainly in small lakes with dense vegetation. It moults mainly in small groups in breeding areas, and in N. and W. Jutland occasionally in larger flocks of up to one hundred birds.

Occurrence during autumn, winter and spring

The Danish breeders are mainly migratory and winter in the British Isles and SW. Europe, but birds from Sweden, Finland and Russia pass through on migration and many stay during winter (SALOMONSEN 1972). The monthly count index shows considerable annual variation, but generally peak numbers are recorded in Oct.–Nov. (Fig. 4 p. 27). With the exception of 1969/70 numbers recorded in the winter months are generally lower than during autumn. In March–April the winter and spring migration visitors leave Denmark, and only local breeders remain.

The pochard occurs in all parts of Denmark, but the majority of birds are found in relatively few localities in the Limfjord area and in the south-eastern parts of the country. These regions (districts C, M and O) contained 50–85% (average 70%) of the birds recorded in eight country-wide surveys. During the severe winter of Jan. 1970, 70% of the birds were found in the Lillebælt and the South Funen Archipelago (districts J and K).

In the Limfjord the most important area is Ulvedybet, where almost every year 4,000–7,000 birds have been recorded during autumn. In most winters few pochard stay in the Limfjord area.

In the south-eastern part of the country the Maribo lakes in Central Lolland are the most important haunts, and 3,000–4,000 birds are recorded here nearly every autumn. When these ice over in the winter the birds move to nearby salt water (e.g. Guldborgsund, Storstrømmen and Gaunø-Dybsø Fjords).

Large flocks are also regularly found around Copenhagen, particularly in the harbour, but elsewhere in Denmark there are few important haunts. The species is very scarce in SW. Jutland and on Bornholm.

In autumn and spring the pochard mostly occurs in lakes with dense marginal vegetation. During winter the main haunts are in salt- and brackish water, mostly very close to the shore.

The figures obtained in country-wide surveys are considered to be very accurate. They vary considerably, from 5,700

to 12,500 in Nov. and from 2,700 to 10,100 in Jan.

Shooting
During 1967/68–1970/71 the estimated annual kill varied between 4,600 and 5,700, and the pochard and *M. merganser* are the least important diving ducks bagged (Fig. 9 p. 49). Most birds are probably shot incidentally on dabbling duck flighting. A little more than half the total bag is taken in the three counties of Storstrøm, N. Jutland and Ringkøbing, where the species comprises 7–8% of the total bag of »other diving ducks«, compared to 1–4% in other counties. In most years peak numbers are shot in Oct., but in 1969/70 they were in Jan. when the numbers present were larger than normal.

Composition
The rather small sample examined (Fig. 11 p. 58) indicates a rather stable juv.% among bagged birds (37–52%, with the highest value in 1970/71). Males predominate in both ad. and juv., comprising 71% and 64% respectively.

Aythya fuligula – Tufted Duck

Fig. 34–36 p. 88–89.

Palaearctic, mainly in boreal and temperate zones. Breeds in Iceland, the British Isles, in N. and N. Central Europe and through N. and Central U.S.S.R. Winters in N., NW. and Central Europe and around the Mediterranean, Black and Caspian Seas. In Denmark a widespread but rather scarce breeder since 1900, and an extremely numerous winter visitor.

Shooting season: 1. Oct.–29. Feb.

Breeding and moulting
The tufted duck breeds in lakes and ponds in all parts of Denmark, is locally common (N. Jutland, S. Funen, S. Sealand and Lolland), but in most areas scarce and irregular. The total population probably does not exceed five hundred pairs. During summer small numbers of moulting birds have been recorded on many lakes, but there is no evidence of larger concentrations in particular waters.

Occurrence during autumn, winter and spring
The local population is partly resident and partly migratory to W. Europe. Large numbers of birds breeding in Scandinavia and the U.S.S.R. visit Denmark, some on passage to winter quarters further south and south-west; but many stay in Denmark throughout the winter (Salomonsen 1972). In Sept.–Oct. the species is rather scarce (Fig. 4 p. 27), but increases from Nov. onwards, and peak numbers occur in Jan.–Feb. From late Feb. or mid-March the birds disperse, and the few remaining by mid-April are probably mainly local breeders.

The tufted duck is the most numerous and in many inland waters the only diving duck occurring regularly. The species is found in both shallow and deep lakes and small ponds, and concentrations of many thousand birds are found in several fresh-water bodies. However the large majority of birds winter in sheltered and shallow coastal waters, mostly rather close to the shore, but during periods of extensive ice-cover often several kilometres from the coast (see Joensen 1968 p. 19).

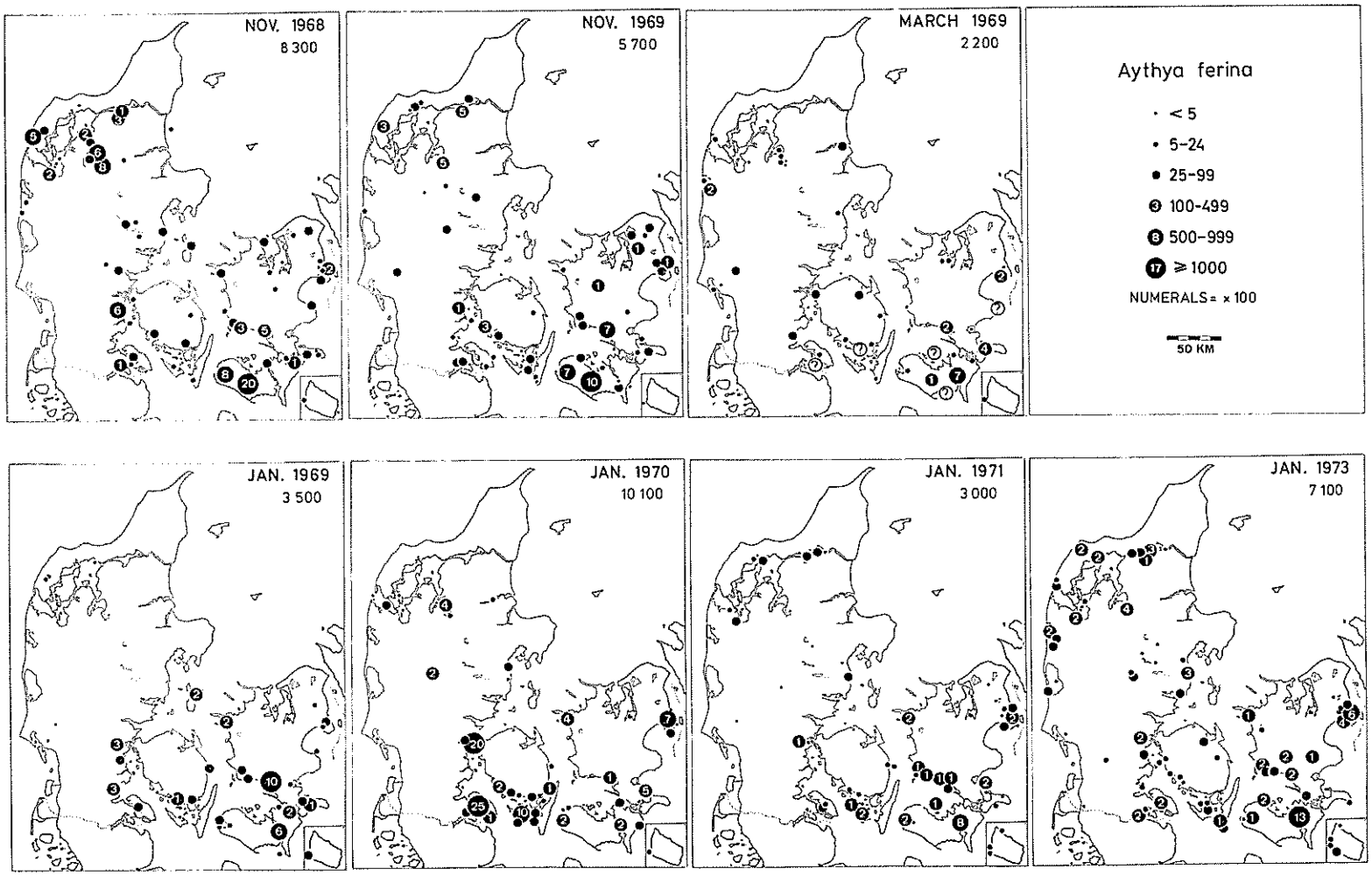

Fig. 31. Distribution of *A. ferina* in seven country-wide surveys.

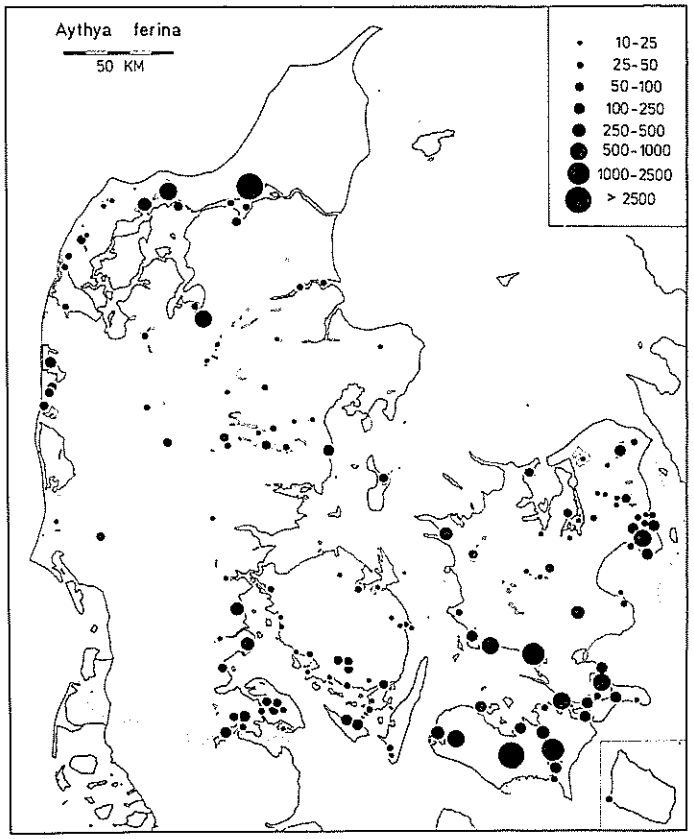

Fig. 32. Summary map for *A. ferina* showing areas where more than ten birds were recorded regularly during 1965–1973.

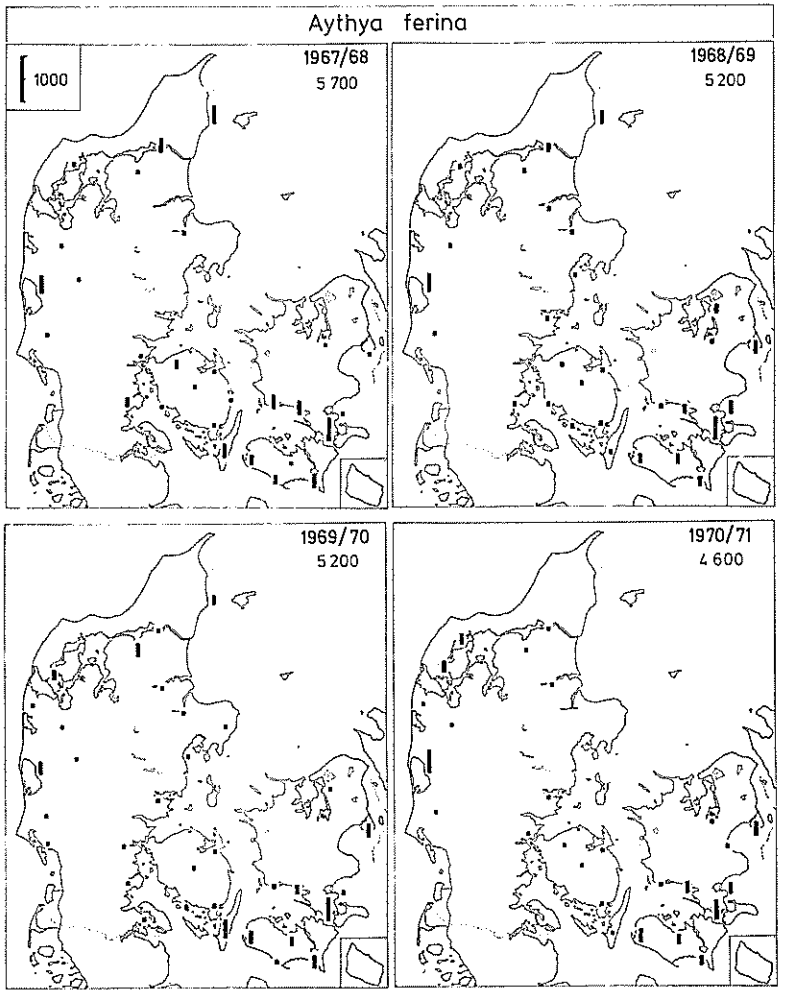

Fig. 33. Distribution of the bag of *A. ferina* per police-district in four shooting seasons.

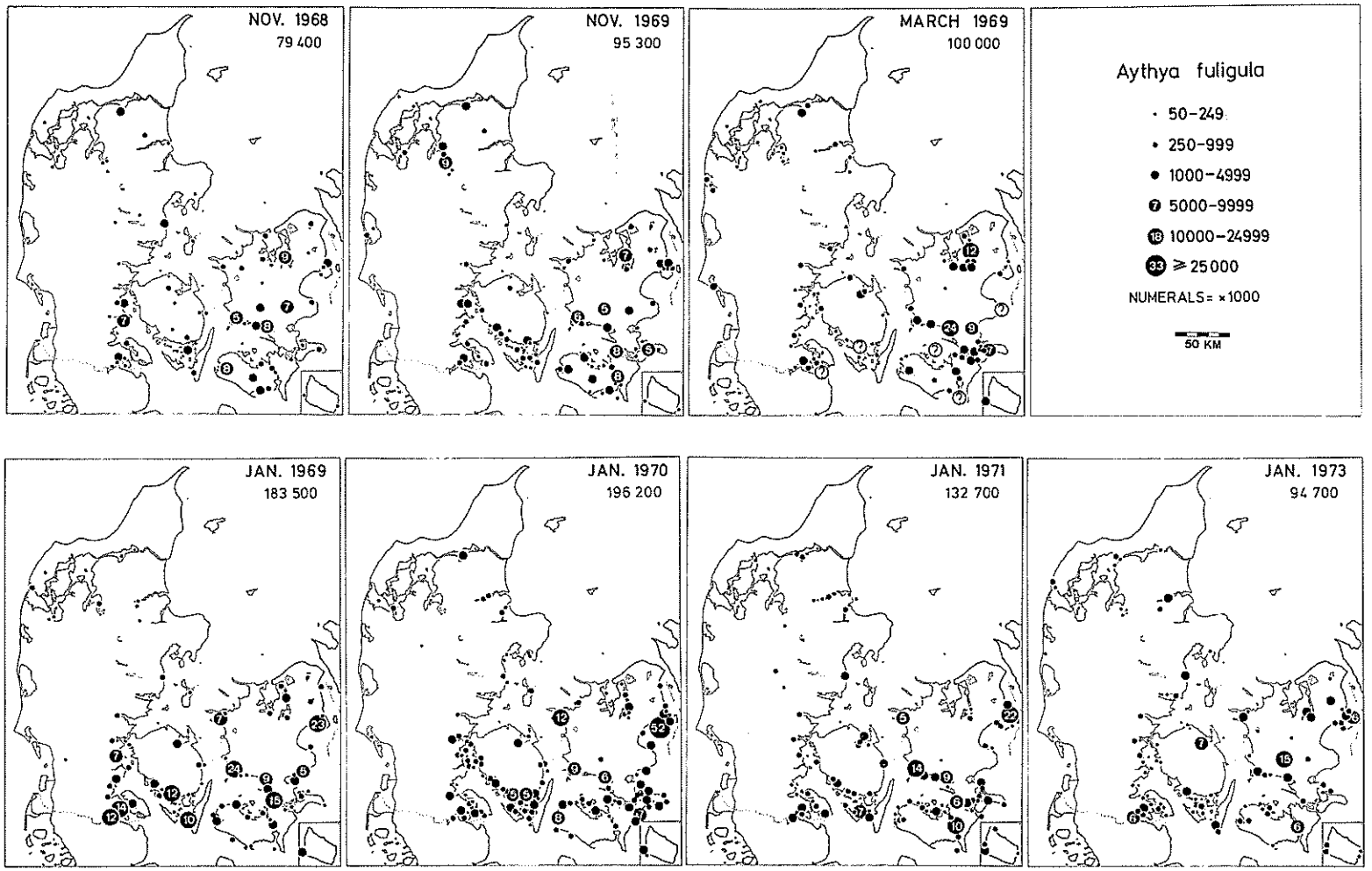

Fig. 34. Distribution of *A. fuligula* in seven country-wide surveys.

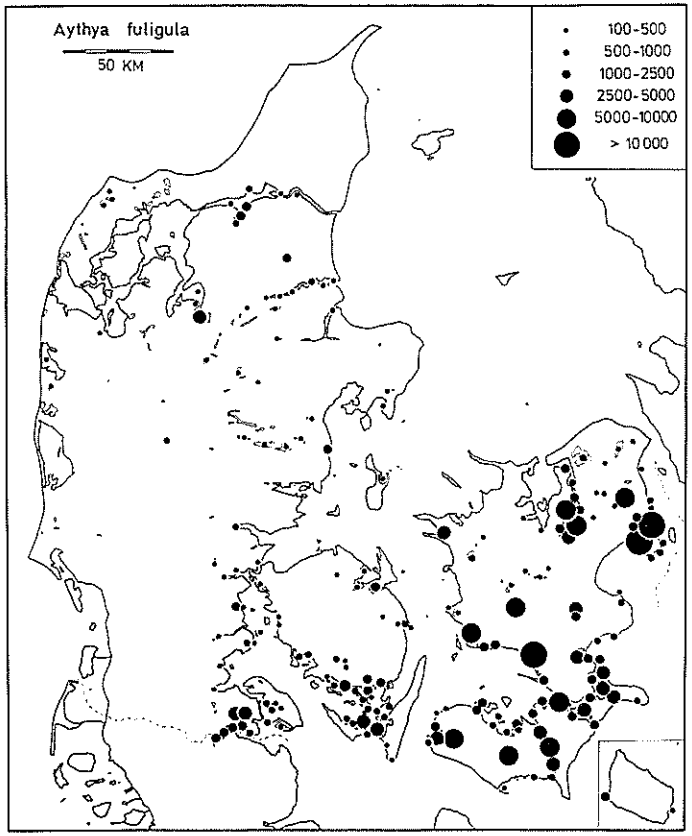

Fig. 35. Summary map for *A. fuligula* showing areas where more than 100 birds were recorded regularly during 1965–1973.

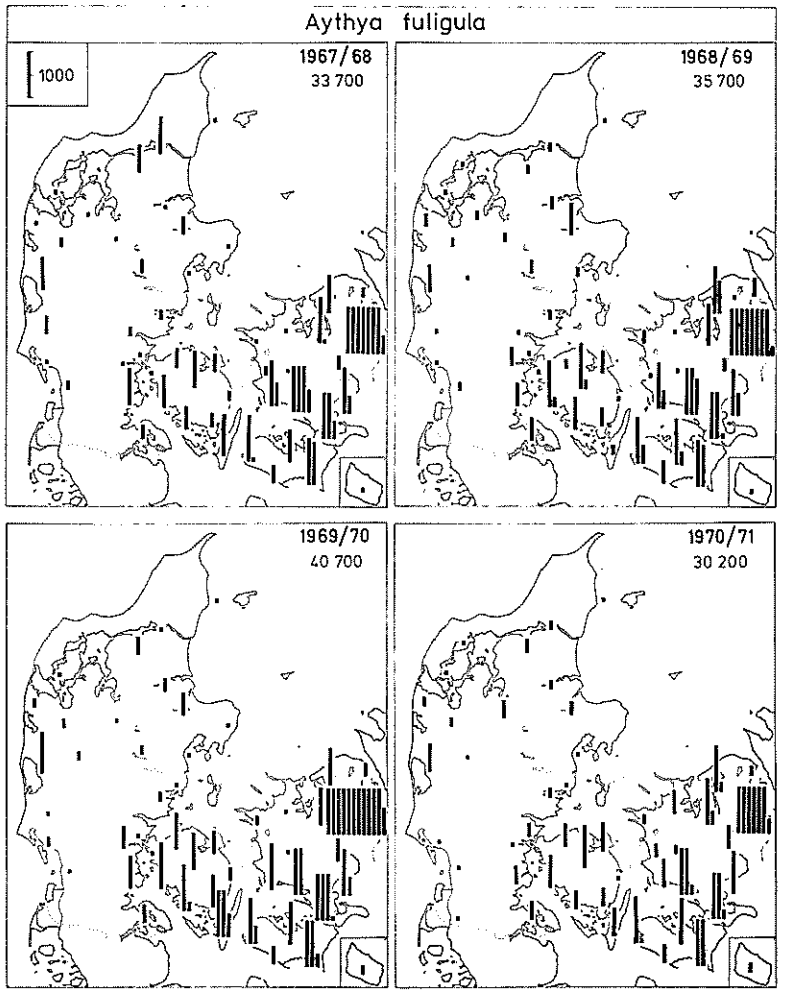

Fig. 36. Distribution of the bag of *A. fuligula* per police-district in four shooting seasons.

Although widespread throughout Denmark, most tufted ducks winter in the southern and eastern parts of the country, particularly in and around S. Sealand, Lolland-Falster-Møn (districts M and O) and E. Sealand (district R). These two areas included 30% and 20% respectively of all birds recorded in country-wide surveys.

The Lillebælt (J) and the South Funen Archipelago (K) also regularly hold notable concentrations (20%), while other parts of the country, particularly W., N. and Central Jutland are relatively unimportant. The species is very gregarious, and half the birds recorded in country-wide surveys were in flocks of more than 5,000 birds. Up to 55,000 have been recorded in the harbour of Copenhagen and adjacent waters, and the fiords and sounds of S. Sealand regularly hold notable concentrations.

Although huge concentrations are difficult to assess accurately from aircraft (see p. 15), the figures obtained in country-wide surveys are considered fairly accurate. In Nov. numbers varied between 51,000 and 95,000, while numbers in Jan. were twice as large, varying from 95,000 in the very mild winter of Jan. 1973 to nearly 200,000 in the severe winter of Jan. 1970.

Shooting

The tufted duck is the second most important diving duck, and in one county (Storstrøm) even more important than *S. mollissima*. In four seasons the total estimated kill varied between 30,000 and 41,000, with the largest bag taken in the severe winter of 1969/70, when the population was very large (and even in spite of the reduced shooting season, see p. 31). The distribution of the kill shows very good agreement with the count records. On average 33% were shot in Storstrøm county, 31% in E. Sealand, 14% in Funen, while the whole of Jutland only contained 16% of the tufted ducks bagged. In the south-eastern regions the species is bagged by a very large proportion of the diving duck hunters. Many of these indulge in rather specialized flight shooting, which is often very profitable particularly when coastal waters are partly ice-covered. The monthly kill index shows that 72–84% (average 80%) of tufted ducks are shot in Jan.–Feb. (Fig. 10 p. 53.

Composition

The large material of birds examined shows a juv.% in the bag varying from 36% to 57%, with high values in 1970/71 and 1972/73. In four seasons males comprised 63–70% of the adult birds, while in one season they were only slightly in excess of females (53%). Among juv., males comprised 52–70% (average 57%). Fig. 11 p. 58.

Aythya marila – Scaup

Fig. 37–39 p. 92–93.

Holarctic, mainly in boreal zone. Breeds in Iceland, N. Scotland, the archipelagoes of the Baltic Sea and through northern Fennoscandia and U.S.S.R. Winters in NW., W. and locally in S. Europe. In Denmark a rare breeder, scarce and local summer visitor, and very numerous in winter.

Shooting season: 1. Oct.–29. Feb.

Breeding and moulting

In 1963 the scaup was recorded breeding for the first time (on Falster, HANSEN 1964), and a very few pairs have bred irregularly in the south-eastern parts of the country since then. In later years 500–1,000 moulting birds have been recorded in the S. Limfjord, mainly adult females which are flightless in Sept.–Oct. Only very small numbers moult irregularly in other waters (JOENSEN 1973 a).

Occurrence during autumn, winter and spring

The scaup occurs in both fresh-, brackish- and salt-water habitats. The species is found regularly in some larger lakes, mostly however in small numbers. The large majority of scaup occur at sea, often several kilometres from the coast and outside the range of ground observation. The monthly count index (Fig. 4 p. 27) is based on rather little data, mainly from the S. and SE. regions, and is not representative of the whole country. In the Limfjord the first autumn migrants arrive in early Sept., and later in this month and in Oct. thousands can be found both here and along the east coast of N. Jutland, occasionally as far south as Kalø Vig (sub-district Fa). Around Sealand the first autumn migrants occur in late Oct., but generally in much smaller flocks. Numbers increase steadily in Nov.-Dec., and peak numbers occur in Jan.-Feb. In mid-winter most scaup are found in the S. Kattegat and particularly the Lillebælt. In March the birds disperse over most Danish waters, and spring migration starts late in this month and terminates in early May.

The scaup is the most gregarious of all waterfowl in Denmark. In most country-wide surveys a very large proportion of the total number were found in a few huge, dense concentrations. In the last seven surveys nearly 60% of the total were in thirteen flocks, each with more than ten thousand birds. Most of these huge assemblies have been recorded in the Lillebælt, including the largest flock of 40,000 in Jan.–Feb. 1969. Often such flocks stay in the same area for several weeks, but only during daytime. During the night the birds are widely scattered over large waterbodies.

In the first two country-wide surveys (Nov. 1967 and Jan. 1968), several typical haunts were not covered, and although later surveys were much more complete in this respect, it cannot be excluded that some flocks, even very large ones, were omitted. Furthermore, very large assemblies are likely to be under-estimated (see p. 16) and the numbers recorded are therefore minimal. They vary from 40,000–50,000 to more than 100,000, the largest number being recorded in Jan. 1970.

Shooting

In the period 1967/68–1970/71 the total estimated kill was about 7,000 in three seasons, although nearly twice as large in 1969/70, corresponding to the very large numbers present in Jan. 1970. In most parts of the country the species is relatively unimportant, the only exception being Funen, where in three seasons 33–39% and in 1969/70 50% of the total kill was taken (Fig. 9 p. 49). In this area most scaup are shot on flightings during dawn, day and dusk, and some experts have very successful shooting. Most scaup are bagged in Jan.–Feb. (Fig. 10 p. 53).

Composition

The rather small material examined shows considerable and significant variation in the juv.% among bagged birds (Fig. 11 p. 58). In two seasons (1969/70

Fig. 37. Distribution of *A. marila* in seven country-wide surveys.

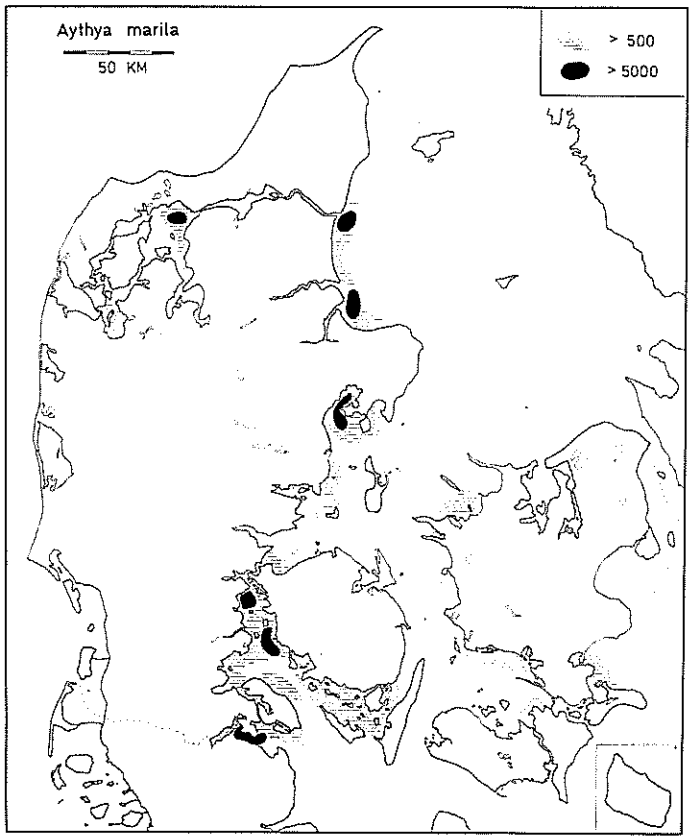

Fig. 38. Summary map for *A. marila* showing areas where concentrations of more than 500 or 5,000 birds respectively occur regularly during Sept.–April. Even large flocks are occasionally found outside the marked areas.

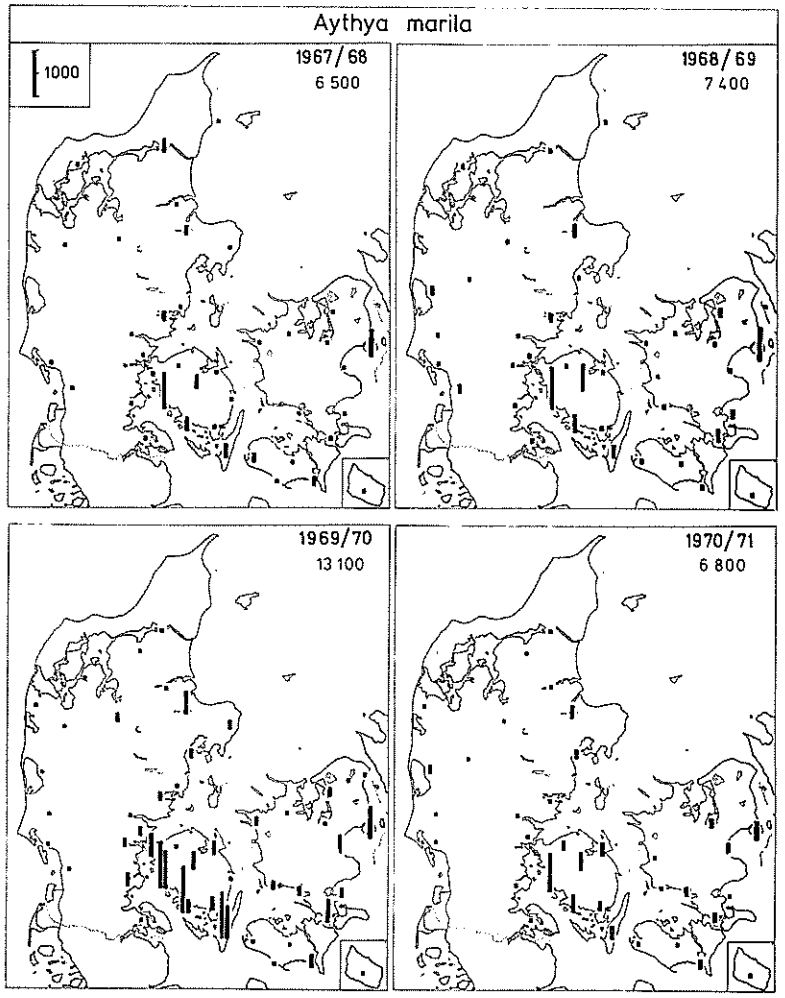

Fig. 39. Distribution of the bag of *A. marila* per police-district in four shooting seasons.

and 1972/73) the juv.% was much higher than in the other three. In 1969/70 there is correpondence between a large population, high juv.% and a large total kill, and in 1972/73 between the two first mentioned parameters. Among ad. birds female numbers dominate slightly in four out of five seasons, while in juv. birds the two sexes are in equal proportions.

Netta rufina – Red-crested Pochard

Fig. 40 p. 94.

Breeds mainly in Central Asia, discontinuously and sporadically in S. Europe and since 1900 in Central Europe north to Denmark. Started breeding in 1940 in Nakskov Indrefjord (W. Lolland), where a very small population has bred since then. Only few breeding records elsewhere in SE. Denmark. The Danish breeders mainly winter in S. France and Spain (PREUSS 1965). Protected.

In the present study 159 birds were recorded, of which nearly 80% were in Nakskov Indrefjord, while the species is extremely rare in other parts of Denmark. 13% of the birds were seen in Sept., 9% in Oct.–Nov., 3% in Dec.–Jan., 16% in Feb.–March, and 60% in April.

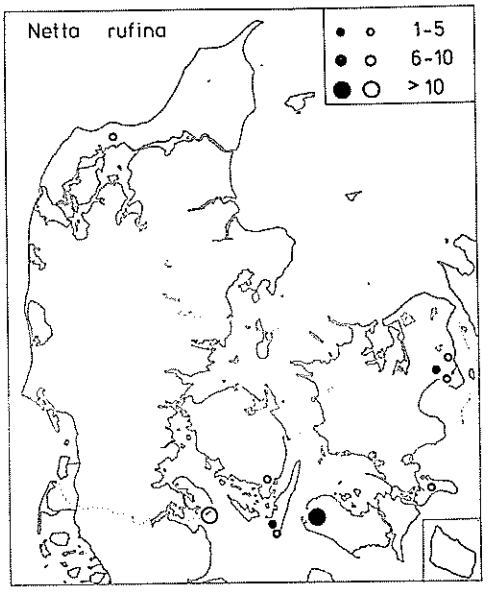

Fig. 40. Localities where *N. rufina* was observed regularly (in more than 3 seasons during 1965–1973) (solid circles) and irregularly (open circles).

Clangula hyemalis – Long-tailed Duck

Fig. 41–43 p. 96–97.

Holarctic circumpolar, mainly in tundra but locally also in boreal zone. Breeds in Iceland, N. Scandinavia and through northernmost U.S.S.R. Winters in N. and NW. Europe. In Denmark a very scarce non-breeding summer visitor and a widespread and locally numerous winter visitor in marine habitats.

Shooting season: 1. Oct.–29. Feb.

Occurrence during autumn, winter and spring

The long-tailed duck arrives very late in Danish waters. The monthly distribution of all birds observed in ground counts during 1965–1973 (total 44,000) is: Sept. 0.1%, Oct. 0.3%, Nov. 5.1%, Dec. 8.3%, Jan. 32.5%, Feb. 15.8%, March 14.3%, and April 23.5%. The peak in Jan. is probably representative, whereas the relatively large proportion in April is due to a few observations of unusually large flocks in SE. waters, where long-tailed ducks concentrate before spring migration. In early May a few small flocks may be seen, but after mid-May the species is rare.

Long-tailed ducks are very difficult to observe from aircraft (see p. 15), and furthermore the species occurs in several offshore waters not included in aerial surveys (see Fig. 2 p. 20). The information obtained both on numbers and distribution therefore gives a minimal description of its occurrence. During winter the species is found in all Danish waters except the fiords of W. Jutland and the central and eastern Limfjord. The main wintering areas are however found in the Baltic Sea, and here probably only a small proportion are in Danish territorial waters (MATHIASSON 1970). Around Bornholm the long-tailed duck is by far the most numerous waterfowl species, and it predominates along the more exposed coasts of Møn, Falster and Lolland. In the S. Lillebælt and the S. Funen Archipelago large numbers were also recorded in some winters. The long-tailed duck occurs more scattered and more often on deep water far from coasts than other duck species, and is only occasionally found in more sheltered bays, such as the Issefjorden. It is the only species regularly found on waters 15–20 m deep, and this is linked with the fact that planktonic organisms comprise a greater proportion of its food than in other diving ducks (MADSEN 1954). In country-wide surveys in Jan. between 3,600 and 12,200 birds were recorded, but the total number in Danish waters may well be several times larger.

Shooting

During 1967/68–1970/71 the annual kill varied between 10,000 and 12,000. The geographical distribution of the bag is very similar to the distribution of birds recorded in Jan. surveys. 15–20% of the birds are bagged at Bornholm, and here the long-tailed duck comprises 80% of all »other diving ducks« being even more important than *S. mollissima* (Fig. 9 p. 49). Also in E. Sealand, Storstrøm and Funen counties large numbers are shot, but elsewhere the species is unimportant, only 14% of all long-tailed ducks being shot around the coasts of Jutland. About 80% of the birds are bagged in Jan.–Feb. (Fig. 10 p. 53).

Composition

The juv.% in bagged birds varies considerably (Fig. 11 p. 59), from 12% in 1971/72 to 42% in 1969/70 and 47% in 1972/73. The size of the total kill and the juv.% correspond in the three seasons for which both types of data are available. Among adult birds males comprise 76%, as opposed to 55% among juv. birds (90 examined).

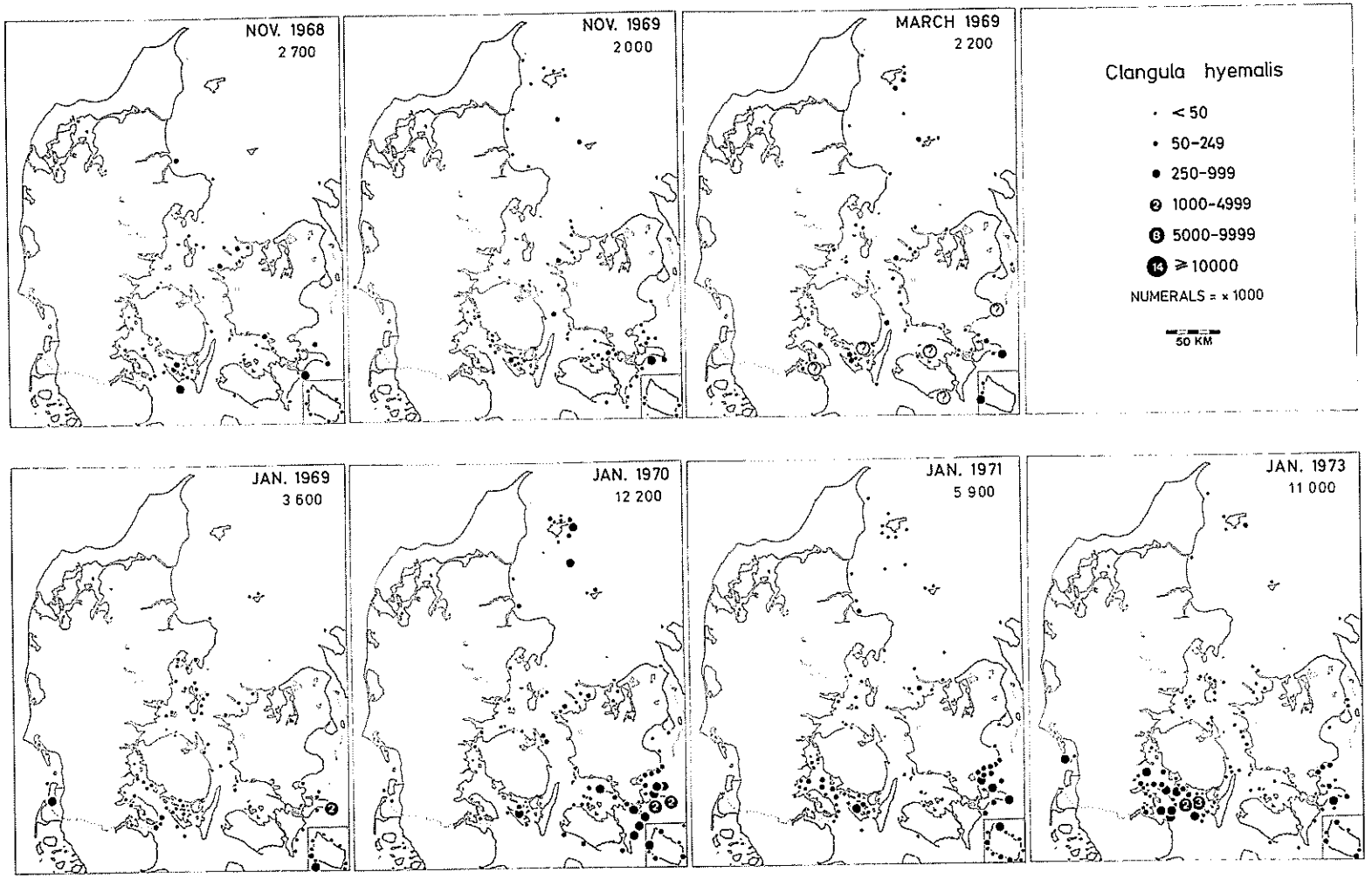

Fig. 41. Distribution of *Cl. hyemalis* in seven country-wide surveys.

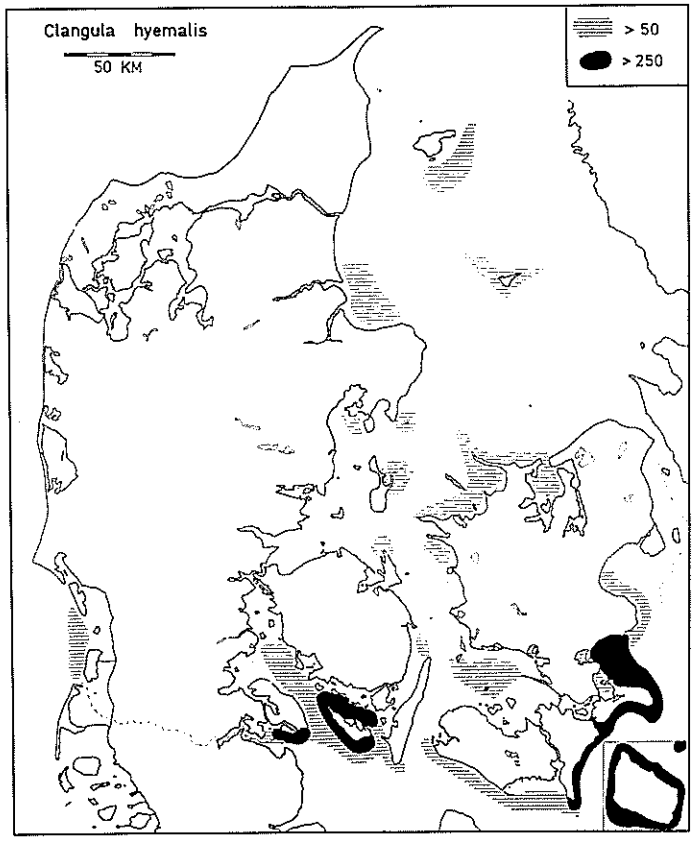

Fig. 42. Summary map for *Cl. hyemalis* showing waters where flocks of more than 50 or 250 birds respectively are regularly seen during winter. Such flocks are occasionally found outside the marked areas.

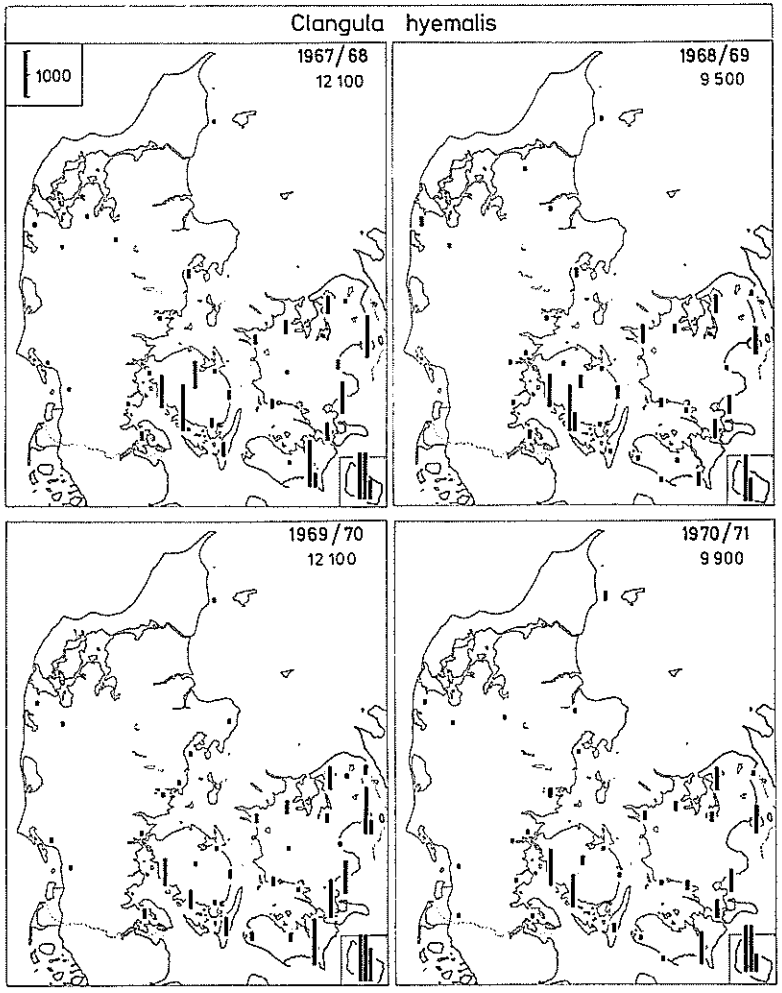

Fig. 43. Distribution of the bag of *Cl. hyemalis* per police-district in four shooting seasons.

Melanitta nigra – Common Scoter

Fig. 44–46 p. 100–101.

Holarctic, mainly in boreal zone. Breeds in Iceland, Scotland, northern Fennoscandia and discontinuously in northern U.S.S.R. Winters along sea-coasts of NW. and W.Europe south to NW. Africa. In Denmark a very numerous non-breeding visitor throughout the year.

Shooting season: 1. Oct.–29. Feb.

Moulting

In summer, mass movements take place through the Baltic Sea to moulting areas in the Kattegat and in particular to the North Sea. Substantial numbers of possibly up to two hundred thousand moult in Danish waters, but more birds are thought to moult elsewhere in NW. European waters, perhaps in the southern North Sea. Moulting birds in Danish waters include all age- and sex-categories, and the moult takes place from late June to Oct., with adult females moulting in the later part of this period (JOENSEN 1973 a).

Occurrence during autumn, winter and spring

By early Sept. most ad. males and juv. birds have completed their wing-feather moult, and in the following months vagrant flocks can be seen in all Danish waters, particularly the Kattegat and the North Sea. The pre-moult migration of adult females takes place in Sept.–Oct. and moulting birds are found widely scattered in most waters. The true autumn migration, comprising both ad. birds and the juv. produced that year, starts in late Oct. and continues into Nov. Numbers staying in Danish waters vary considerably, but generally remain high throughout the winter until the spring migration in late March and early April (JOENSEN 1973 a).

With a few exceptions (see below) the common scoter is exclusively confined to marine habitats, mostly in open waters several kilometres from the coast and outside the range of ground observations. Among *Anatidae* only *Cl. hyemalis* is regularly found further out to sea and on deeper water. The geographical distribution of the common scoter is illustrated in the country-wide survey maps (Fig. 44), and the map summarizing all information from aerial surveys during Oct.–April. It must be emphasized that in some waters aerial surveys could only cover relatively small proportions of the potential habitat, and therefore all numbers recorded are minimal, and the overall picture of the relative value of the various waters is approximate.

Although south-eastern waters of Denmark are passed by huge numbers of migrating common scoters, large flocks have seldom been recorded resting here, the main haunts being in the Kattegat and along the North Sea coast. The south-western Kattegat (district F and S) has been fairly thoroughly surveyed, and in country-wide surveys since Nov. 1968 between 6,000 and 36,000 birds were recorded there. However much larger concentrations have been found in the northern Kattegat off the east coast of Jutland and around Læsø. In the former area the birds often occur in distinct flocks, while particularly in waters south-east of Læsø the scoters are often distributed continuously over extensive areas of water ($> 200\ km^2$). In some surveys it was not possible to determine the limits of these huge assemblies, and the estimates are certainly minimal. In country-wide surveys since Nov. 1968 between 12,000 and 73,000 birds were recorded,

and in three surveys numbers exceeded fifty thousand.

In the waters west of the Waddensea islands where large numbers of moulting birds occur in summer, huge flocks have also been recorded on several surveys during the winter. The largest number was recorded in Dec. 1972, when two flocks together estimated at 200,000 common scoters were found west of Rømø and Skallingen.

In three country-wide surveys the grand total exceeded 100,000. The actual numbers which could occur simultaneously in waters surrounding Denmark can only be guessed at, but probably a figure of the order of some hundred thousand birds is not unusual. The duration of the birds' stay is often rather short; the common scoter is extremely mobile, and huge concentrations have disappeared within a few days. Some movements, often across Jutland, have been recorded during gales when the birds seek less exposed waters, and occasionally occur in small flocks in brackish fiords, e.g. in W. Jutland, and even in very small numbers in fresh-water lakes.

The number of common scoters passing S. Finland on spring migration has been estimated at 1.5 million (Bergman & Donner 1964), and the winter population along European coasts must be considerably larger. Both during the summer moult and in winter, Danish waters probably hold only the northernmost and relatively small part of the total population. There is still very little evidence of the existence of large concentrations in other European waters, but this may well be due to the lack of aerial surveys over potential offshore areas.

Shooting

The common scoter ranks fourth among diving ducks (after *S. mollissima*, *A. fuligula* and *B. clangula*), and during 1967/68–1970/71 the total kill varied from 16,400 to 19,000. A large proportion of the bag is shot by a relatively small number of experts, and most birds are bagged around Funen and in the Kattegat. In the counties of W. Sealand and Århus the species comprises 29% and 34% respectively of the kill of »other diving ducks« (Fig. 9 p. 49). The two most important areas where concentrations occur, southeast of Læsø and the waters west of the Waddensea, are too remote for intensive utilization by sportsmen. The monthly kill index shows considerable variation from season to season.

Composition

In all five seasons the juv.% in bagged birds was very low (11–16%, Fig. 11 p. 59). When considering only the months of Dec.–Feb. when juv. are present (see above), greater variation is found (10–25%), and even more pronounced differences occurred in a material of oil-killed birds (6–23%, Table 25–26 p. 62–63). Of ad. birds in the bag, males comprise four-fifths against two-thirds among oil-killed birds. Males comprised 57% of 227 juv. birds killed by oil and examined internally.

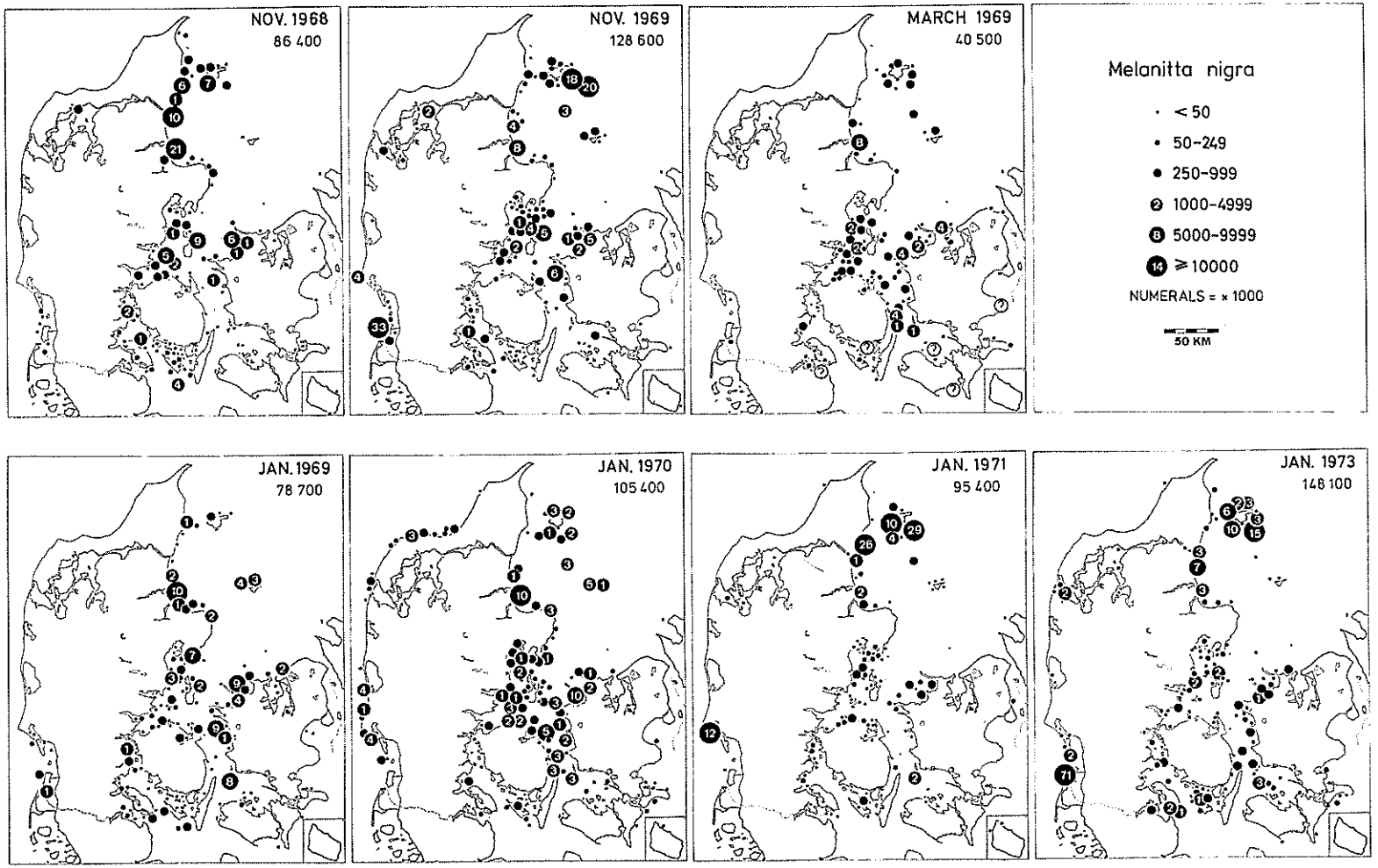

Fig. 44. Distribution of *M. nigra* in seven country-wide surveys.

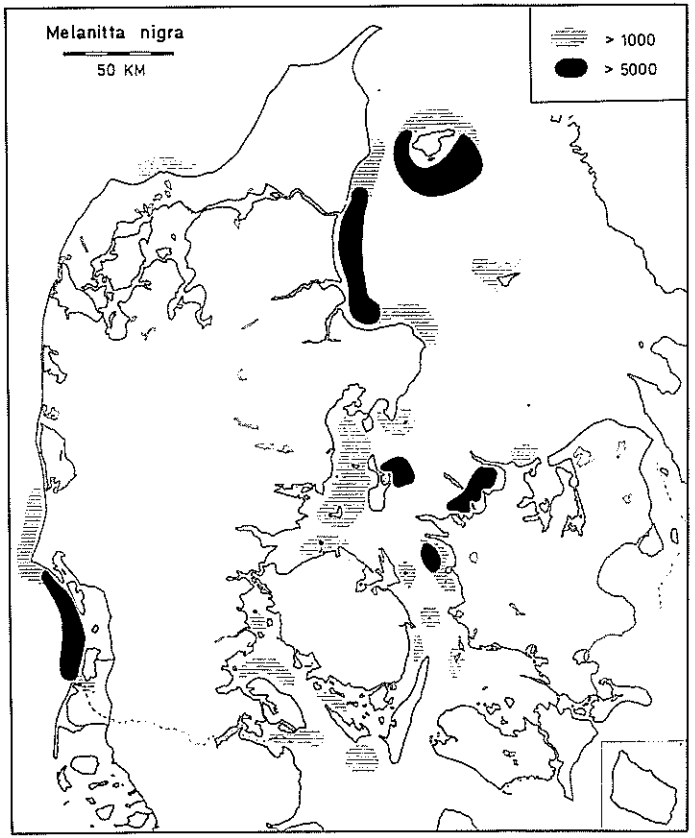

Fig. 45. Summary map for *M. nigra* showing areas where concentrations of more than 1,000 or 5,000 birds respectively are regularly found during Oct.–April. Even large flocks are occasionally found outside the marked areas.

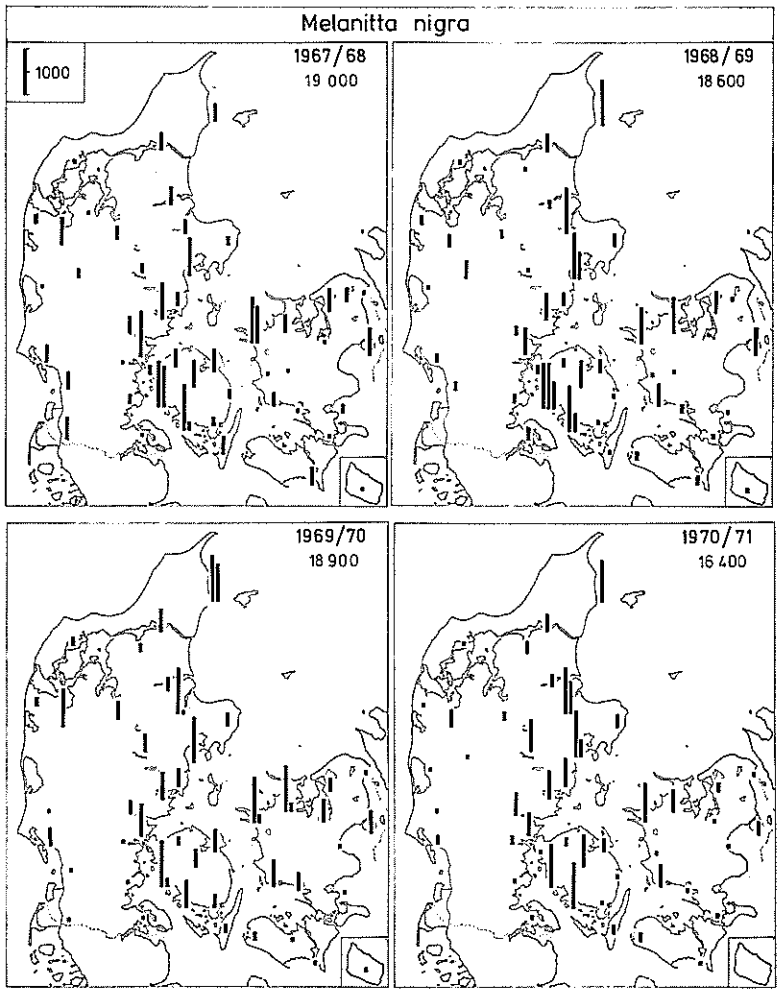

Fig. 46. Distribution of the bag of *M. nigra* per police-district in four shooting seasons.

Melanitta fusca – Velvet Scoter

Fig. 47–49 p. 104–105.

Holarctic, in boreal zone. Breeds in northern Fennoscandia and the archipelagoes of the Baltic Sea, in northern Russia and northern and Central Siberia. Winters along coasts of NW. and W. Europe south to the Iberian peninsula. In Denmark a very common and locally numerous non-breeding visitor throughout the year.

Shooting season: 1. Oct.–29. Feb.

Moulting

The number of velvet scoters completing a summer wing-feather moult in Danish waters has been roughly estimated as 60,000 birds. The majority are ad. males concentrated in a few areas in the Limfjord and Kattegat, while smaller numbers of ad. females and possibly also juv. moult widely dispersed. Most ad. males moult in Aug., while flightless ad. females are found in Sept. and early Oct. (JOENSEN 1973 a).

Occurrence during autumn, winter and spring

The true autumn migration to Danish waters takes place from late Oct. until early Dec. Numbers during winter vary considerably, but mostly remain high until the spring migration in April–May.

The velvet scoter is exclusively confined to marine habitats, and is mostly found some kilometres from the coast and outside the range of ground observations. The species is generally found closer to the coast and on shallower water than *M. nigra*. Fig. 48 shows the main regular concentration areas during Oct.–April. The species is very gregarious, and in country-wide surveys three-quarters of the birds were in a few flocks each of more than one thousand, and occasionally more than ten thousand. The main haunts are in the Kattegat, and the waters north of Djursland and east of Himmerland are particularly important for the species. The occurrence of large flocks outside the Kattegat is irregular. However in Jan. 1970, some of the main haunts in the Kattegat were ice-covered and most birds were found further south. The species is scarce along the W. coast of Jutland. In the Central Limfjord, the most important moulting area, large flocks can be seen in Sept.–Oct., occasionally in Nov., but numbers during winter are small. The south-eastern waters are passed by large numbers of migrating birds, but they seldom stay there.

The results obtained in aerial surveys are probably more representative than for *M. nigra*, but it is very likely that some important concentrations in areas not covered were omitted. The numbers recorded in country-wide surveys varied considerably, from 7,000 in Jan. 1973 to 37,000 in Nov. 1968. Considering the size of the moulting population, it can be concluded that most velvet scoters winter outside Danish waters, although few large concentrations have hitherto been found.

Shooting

During 1967/68–1970/71 the annual kill varied from 7,300 to 10,400, 70% of which were bagged in the waters around Funen and in the SW. Kattegat, and in the latter area the species ranks number two or three among »other diving ducks« (Fig. 9 p. 49).

The monthly kill index shows great seasonal variation (Fig. 10 p. 53).

Composition
Among bagged birds the juv.% has decreased from 39% in 1968/69 to 13% in 1972/73 (Fig. 11 p. 59). The trend is however less pronounced in a material consisting of bagged birds from Dec.–Feb., and among oil-killed birds (Table 25–26 p. 62–63). Among ad. birds males comprised 70% in the bag and 64% in oil-kills. Among one hundred oil-killed juv. sexed on internal characters males and females were in equal proportions.

Somateria mollissima – Eider

Fig. 50–52 p. 106–107.

Holarctic, in coastal areas of tundra, boreal and temperate zones. Breeds in N. Russia, Spitsbergen, Iceland, Scotland and N. Ireland, Norway, Sweden, Finland, Estonia, Denmark, NW. Germany, the Netherlands and locally in NW. France. Mostly resident, but the Baltic population winters in Denmark and S. North Sea (Waddensea). Winters also along coasts of England and NW. France. In Denmark a locally numerous breeder, very numerous during summer moult, and the most numerous waterfowl in Danish waters during autumn, winter and spring.

Shooting season: 1. Oct.–29. Feb.

Breeding
In this century the eider has expanded its breeding range and increased considerably in several areas in NW. Europe, including Denmark and the Baltic Sea. The Danish breeding population was estimated at 1,500 pairs in 1935, 3,500 in 1960 and 7,500 in 1970. Three colonies have comprised the majority of birds throughout this period, but since 1950 several new sites have been occupied. Most colonies are on small, isolated, and often protected islands, although breeding on the mainland of Jutland and the larger islands has become more common. The main breeding colonies in 1970 were Stavns Fjord (Samsø, S. Kattegat) 2,000 pairs, Saltholm (Øresund) 1,600 pairs, Christiansø (E. of Bornholm) 1,500 pairs, Hov Røn (S. Kattegat) 500–600 pairs, Mandø (Waddensea) 400 pairs, and Læsø – Nordre Rønner (N. Kattegat) 350 pairs (JOENSEN 1973 b).

Moulting
Danish waters contain several important moulting areas, which are visited during summer both by local birds and by large numbers from the Baltic Sea and probably S. Norway. The juv. (one-year old) eiders wintering in Danish waters stay there to a great extent throughout the spring, mainly in south-eastern waters, and in June-July they disperse to the moulting areas. About 1st July, large numbers of ad. males perform their moult migration from the Baltic Sea to Danish waters, where they congregate in large flocks in the SW. and N. Kattegat and the Waddensea. Moulting takes place from late July into August. Ad. females perform their migration over a longer period, and moult while widely scattered in Danish waters in Sept. and early Oct. The total number of moulting eiders has been roughly estimated at a quarter million, but actual numbers may be larger (JOENSEN 1973 a).

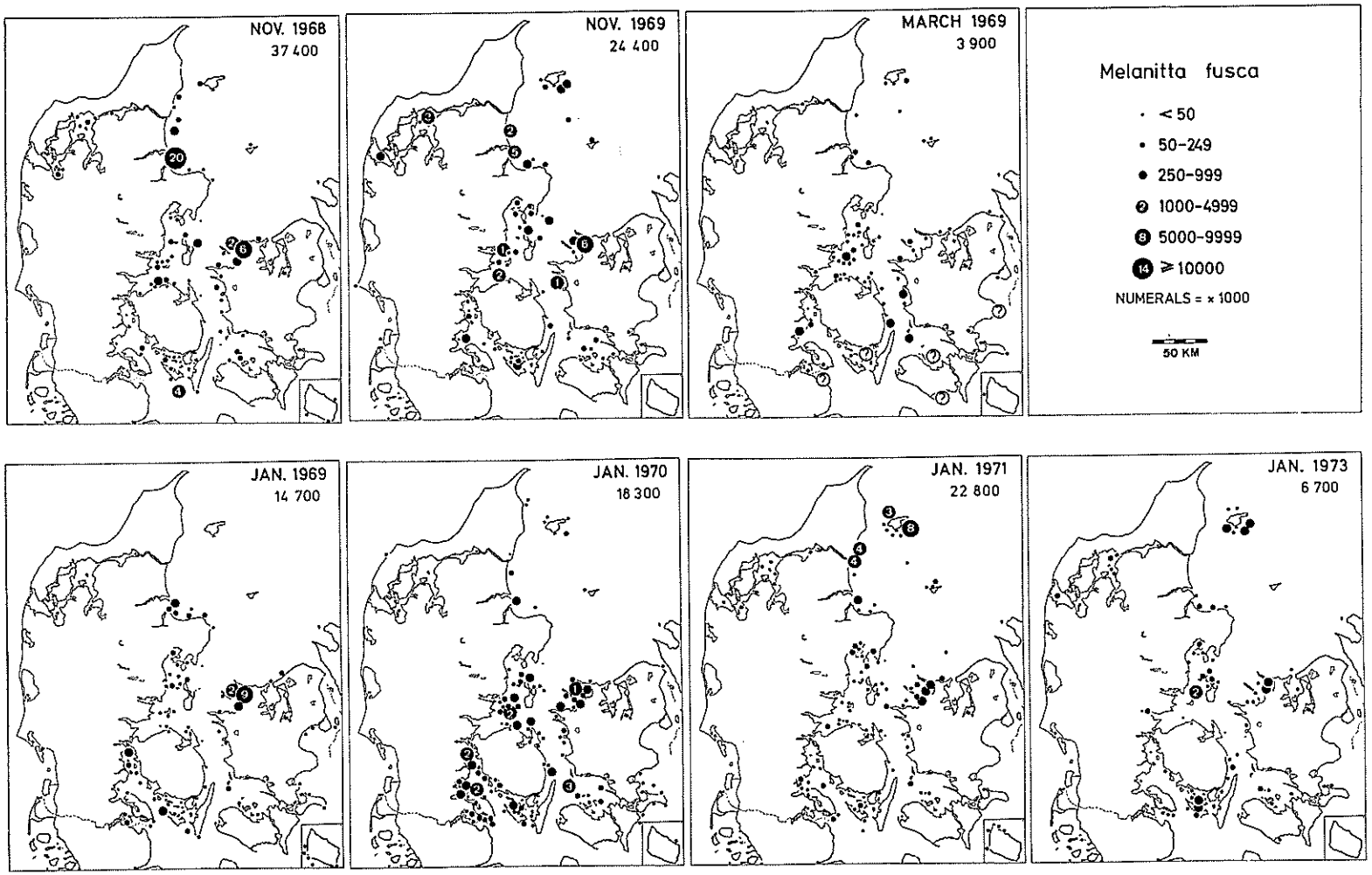

Fig. 47. Distribution of *M. fusca* in seven country-wide surveys.

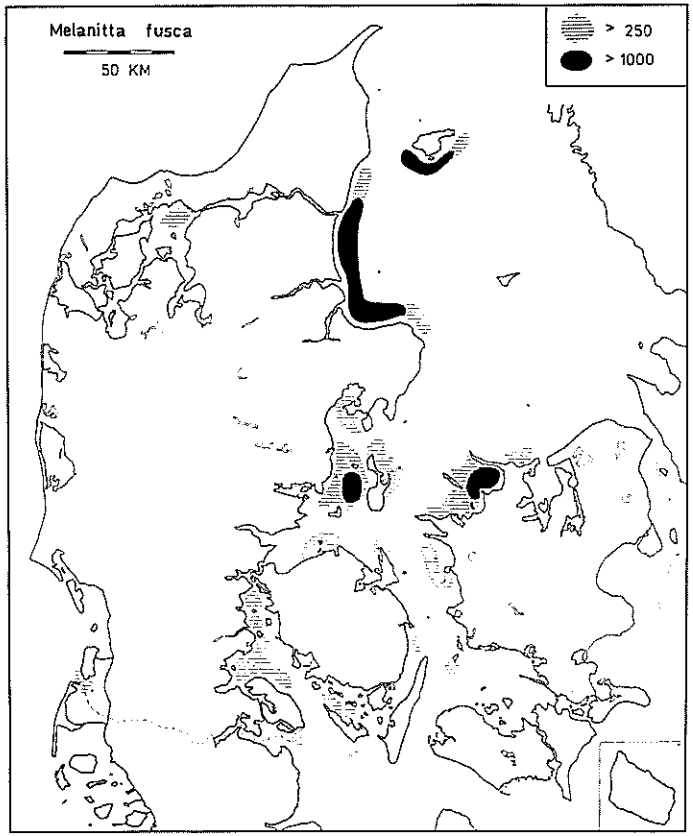

Fig. 48. Summary map for *M. fusca* showing areas where concentrations of more than 250 or 1,000 birds respectively are regularly found during Oct.–April. Even large flocks are occasionally found outside the marked areas.

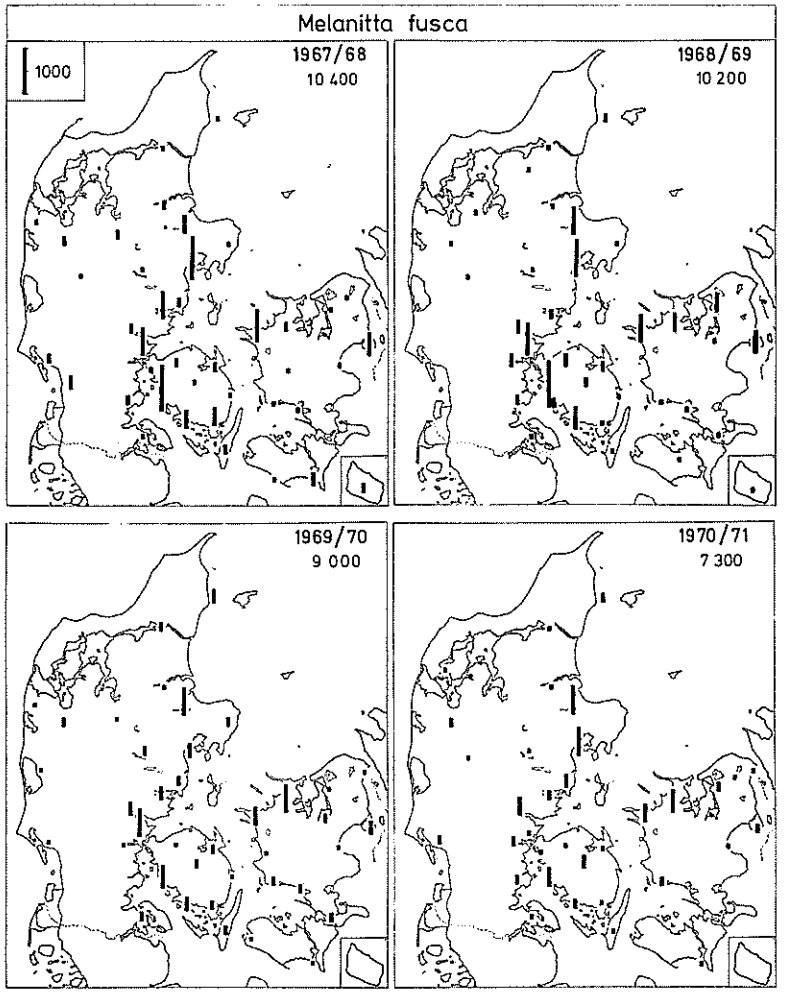

Fig. 49. Distribution of the bag of *M. fusca* per police-district in four shooting seasons.

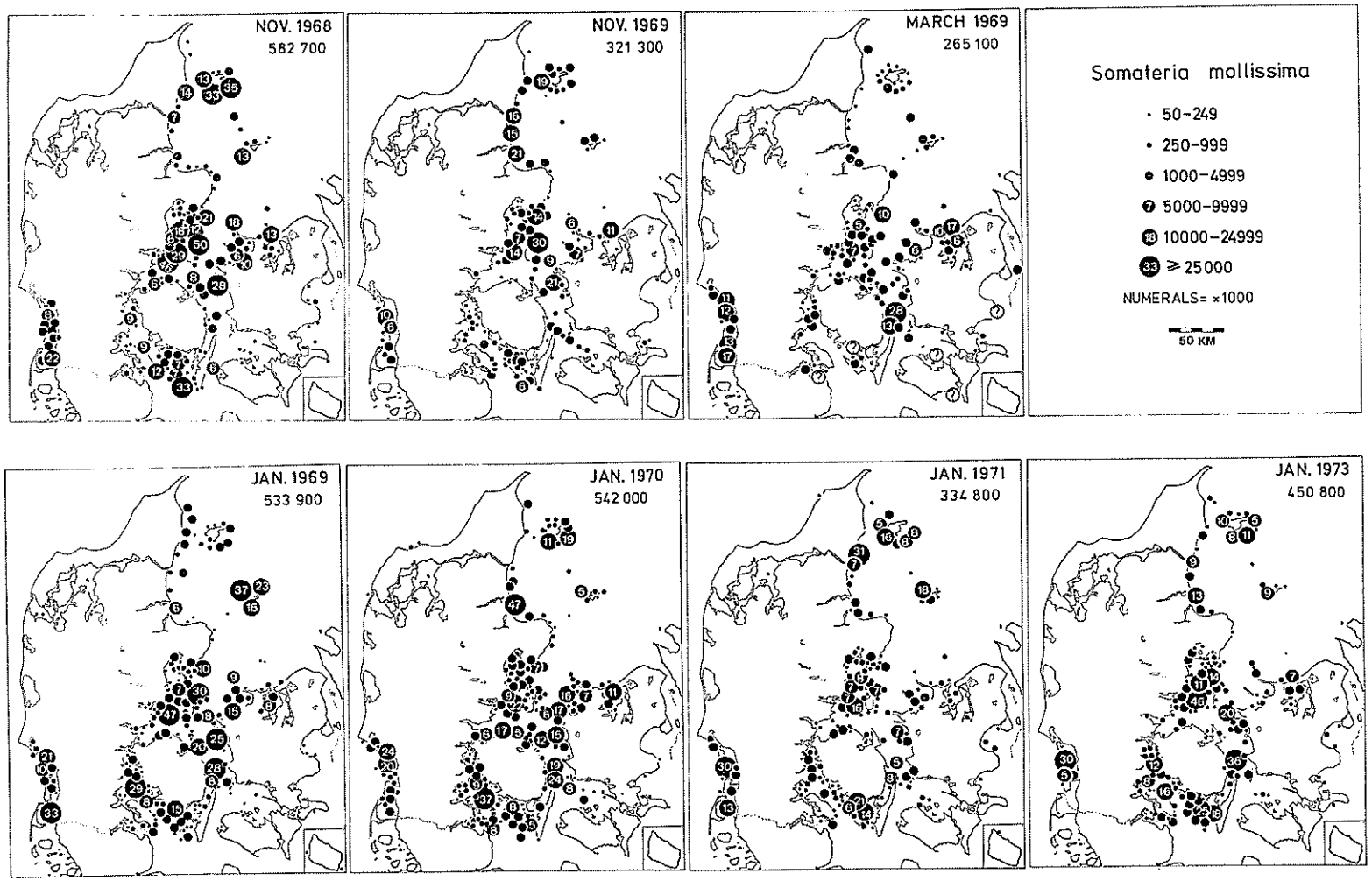

Fig. 50. Distribution of *S. mollissima* in seven country-wide surveys.

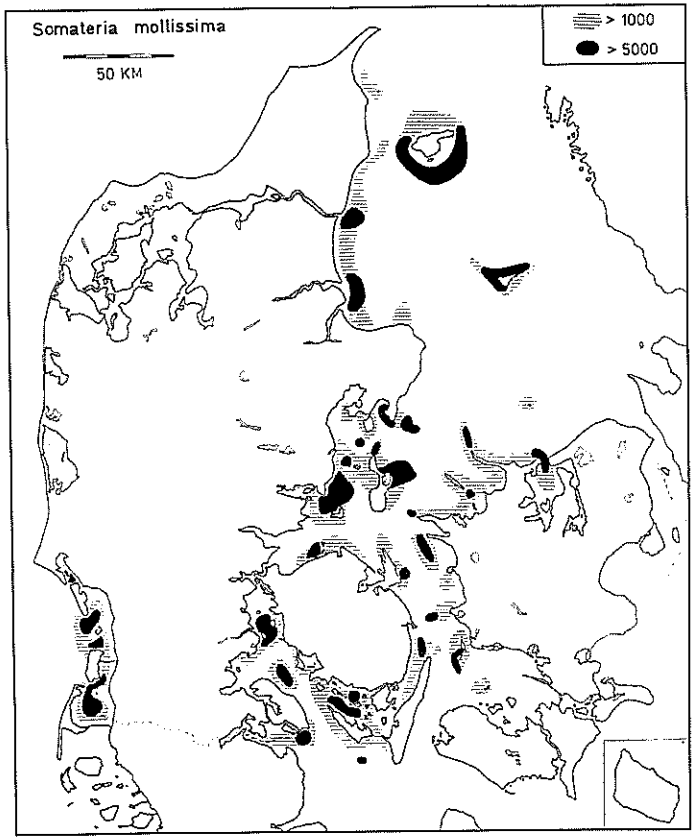

Fig. 51. Summary map for *S. mollissima* showing waters where flocks of more than 1,000 or 5,000 birds respectively are regularly found during winter (Nov.–March).

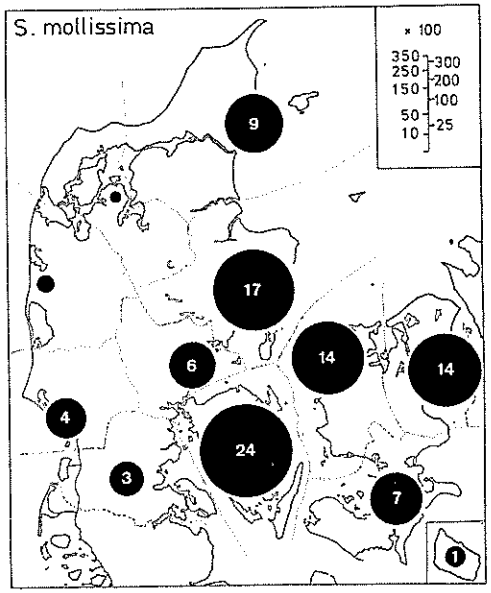

Fig. 52. Distribution of the bag of *S. mollissima* per county (average for five seasons 1967/68 – 1971/72). Scale refers to circle diameter and represents no. of individuals (thousands). Numbers in circles indicate percentage of total numbers.

Occurrence during autumn, winter and spring

Ringing data show that Danish eiders are resident, and that birds breeding in the Baltic Sea have their main wintering grounds in the central waters of Denmark, while birds from S. Norway have been recovered in the N. Kattegat (PALUDAN 1962, JOENSEN 1973 a).

The peak of the autumn migration from the Baltic Sea comprising the juvenile production of the year occurs between mid-Oct. and mid-Nov. In most years the number of juv. birds arriving earlier is probably small, and the main migration has terminated by late Nov. Impressive movements can be observed at several locations, for example at Ottenby and Kalmarsund in SE. Sweden and at Falsterbo in southernmost Scania. From here large flocks move into Danish waters mostly in directions in between NW. and SW. In Køge Bay and Fakse Bay the flocks ascend to fairly high altitudes and cross Sealand in a west-bound migration. Some birds follow the coast of the Øresund southwards, and continue westwards at Gedser, the southern point of Falster. Although few aerial surveys have been conducted in the Øresund in autumn, there is good evidence that the large majority of birds passes directly across this area, and the few, generally small roosting flocks mainly consist of juv. eiders.

From late autumn until March, the eider is by far the most numerous waterfowl in the Storebælt, the S. Funen Archipelago, the Lillebælt, the entire Kattegat and the Waddensea. It is much scarcer around Bornholm, in the Øresund, around Lolland, Falster and Møn, in the Limfjord (only occurring in the westernmost part) and along the entire North Sea coast north of Blåvand.

The numbers recorded in country-wide surveys vary considerably, and most of the variation must be ascribed to methodological factors such as difficulties in assessing large flocks (see p. 16), and insufficient coverage of potential habitats in some waters (see p. 21). Such factors were responsible for the low numbers in Nov. 1967 and Jan. 1968, but also in later surveys the numbers recorded were minimal. In three surveys, more than half a million eiders were located. The actual size of the winter population can only be guessed at, but probably three-quarters of a million is a realistic figure.

The eider is exclusively marine and mainly confined to exposed coasts and open waters, and its occurrence in narrow fiords is irregular and in brackish- and fresh-water areas very unusual. From Fig. 50 it is seen that a very large proportion of the birds are found several kilometres from the coast, and thus outside the range of ground observation. Although the distribution pattern is more consistent than for example that of *M. nigra* and *M. fusca*, large flocks are occasionally found outside the main haunts shown in black in Fig. 51. The eider is extremely gregarious, often occurring in flocks of tens of thousands, and in the seven last country-wide surveys (see Fig. 50) 86 assemblies each with more than 10,000 birds comprised 60% of all birds recorded. At Svanegrunden in the S. Kattegat concentrations estimated at 50,000 birds have been regularly recorded.

In the Kattegat eiders are often found together with *M. nigra* and *M. fusca*, but most groups, in particular the large flocks, are on shallower water of less than 5 m, often over shoals with rich beds of the common mussel *(Mytilus edulis)*, which is the principal food item (MADSEN 1954). In the Waddensea eiders are found in sloughs between and behind the islands,

thus being distinctly separated from *M. nigra* occupying waters further west.

Shooting

The eider is the second most important duck for shooting, comprising more than half of the diving ducks bagged in later years. The annual kill has been steadily increasing over the two last decades for which there are data available in the bag-record (Fig. 6 p. 34). There is a considerable annual variation, but the trend shows that the kill is approximately twice as large in later years as in the early 1950's. Today eiders are bagged every year by well over ten thousand sportsmen (Table 10 a p. 35), but nearly 60% are bagged by less than two thousand very successful sportsmen (each shooting >20 birds), including 150 sportsmen with bags exceeding one hundred birds (Fig. 7 p. 36). The large majority of eiders are shot out at sea from motorboats, although flight shooting – occasionally with decoys – is practised in some areas. The considerable variation in the annual kill in later years (between 116,000 and 179,000 during 1968/69–1971/72) has been discussed in a previous report (JOENSEN in press), and it has been suggested that both the level of annual production and the weather conditions during the shooting season influence the size of the kill.

The geographical distribution of the kill in later years shows little annual variation, approximately two-thirds of the birds being bagged in waters around Funen and in the S. Kattegat. Most of the bag in the Øresund is taken in the autumn, and very few eiders are bagged at Bornholm, the Limfjord, or Ringkøbing county.

The monthly kill index (Fig. 10 p. 53) shows that a large proportion of the bag is taken in Oct.–Nov., although in some years Jan.–Feb. are also very important in this respect.

Composition

Nearly 14,000 bagged and 10,000 oil-killed eiders were examined in five seasons (1968/69–1972/73). The juv.% of both materials varied considerably being high in two seasons (1968/69 and 1971/72) and low in three. Among ad. birds males predominate (55–60% in the bag, 62% among oil-killed birds), and among juv. birds males are slightly in excess in the bag (52%), females in oil-kills (53%). See Fig. 11 p. 58, and JOENSEN (in press).

Bucephala clangula – Goldeneye

Fig. 53–55 p. 110–111.

Holarctic, mainly in boreal zone. Breeds in most of Fennoscandia and from N. Germany through northern and Central U.S.S.R. Winters in NW., W. and Central Europe. In Denmark a common and locally numerous non-breeding summer visitor, and a very widespread and numerous winter visitor.

Shooting season: 1. Oct.–29. Feb.

Moulting

The occurrence of goldeneye moulting in summer in Denmark has been described by JEPSEN (1973) and JEPSEN & JOENSEN (1973). The total number of moulting birds has been estimated at a minimum of 12,000–14,000, most of which are found in the Limfjord where Hjarbæk Fjord is the most important area. Num-

thus being distinctly separated from *M. nigra* occupying waters further west.

Shooting

The eider is the second most important duck for shooting, comprising more than half of the diving ducks bagged in later years. The annual kill has been steadily increasing over the two last decades for which there are data available in the bag-record (Fig. 6 p. 34). There is a considerable annual variation, but the trend shows that the kill is approximately twice as large in later years as in the early 1950's. Today eiders are bagged every year by well over ten thousand sportsmen (Table 10 a p. 35), but nearly 60% are bagged by less than two thousand very successful sportsmen (each shooting > 20 birds), including 150 sportsmen with bags exceeding one hundred birds (Fig. 7 p. 36). The large majority of eiders are shot out at sea from motorboats, although flight shooting – occasionally with decoys – is practised in some areas. The considerable variation in the annual kill in later years (between 116,000 and 179,000 during 1968/69–1971/72) has been discussed in a previous report (JOENSEN in press), and it has been suggested that both the level of annual production and the weather conditions during the shooting season influence the size of the kill.

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Bucephala clangula – Goldeneye

Fig. 53–55 p. 110–111.

Holarctic, mainly in boreal zone. Breeds in most of Fennoscandia and from N. Germany through northern and Central U.S.S.R. Winters in NW., W. and Central Europe. In Denmark a common and locally numerous non-breeding summer visitor, and a very widespread and numerous winter visitor.

Shooting season: 1. Oct.–29. Feb.

Moulting

The occurrence of goldeneye moulting in summer in Denmark has been described by JEPSEN (1973) and JEPSEN & JOENSEN (1973). The total number of moulting birds has been estimated at a minimum of 12,000–14,000, most of which are found in the Limfjord where Hjarbæk Fjord is the most important area. Num-

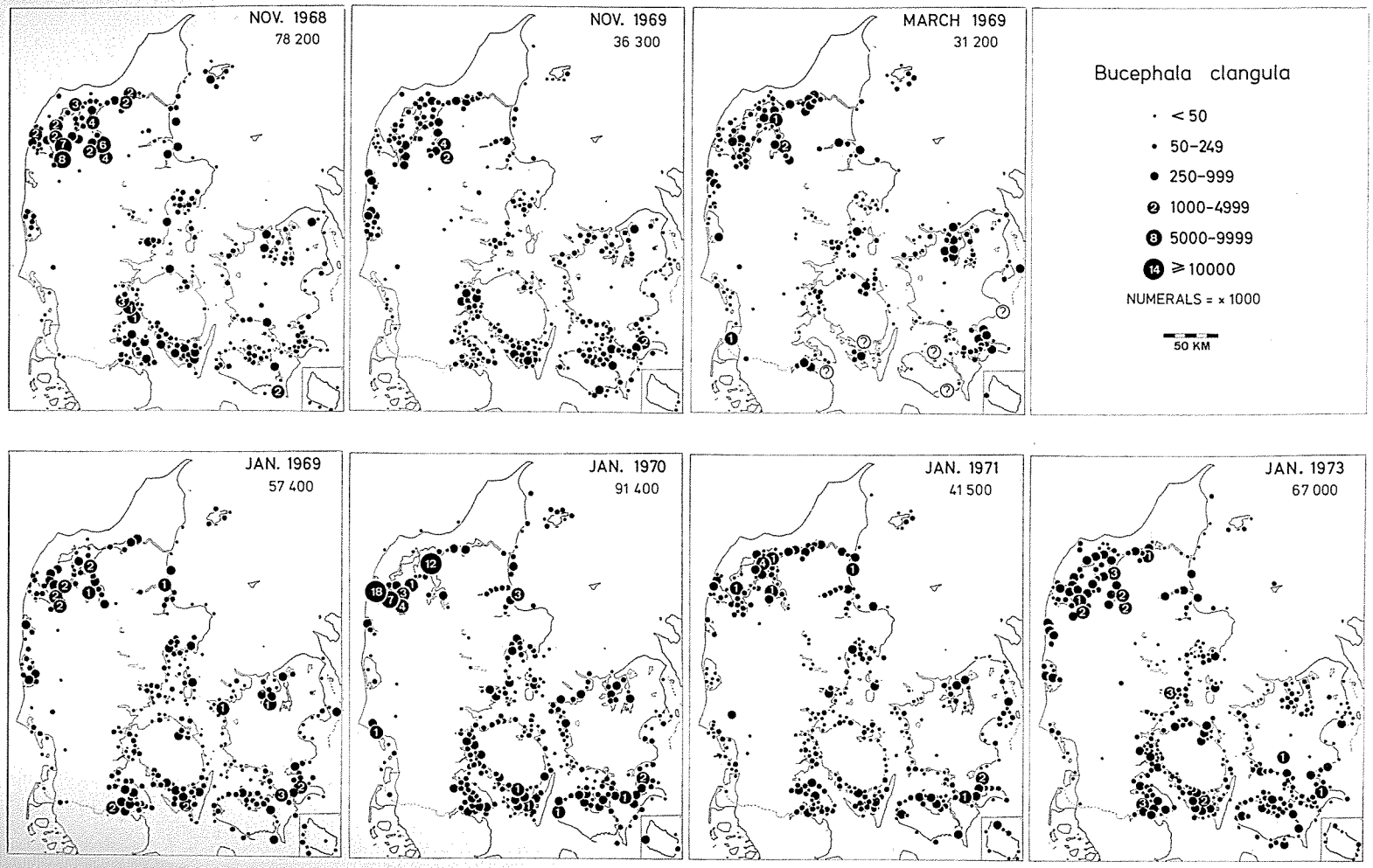


Fig. 53. Distribution of *B. clangula* in seven country-wide surveys.

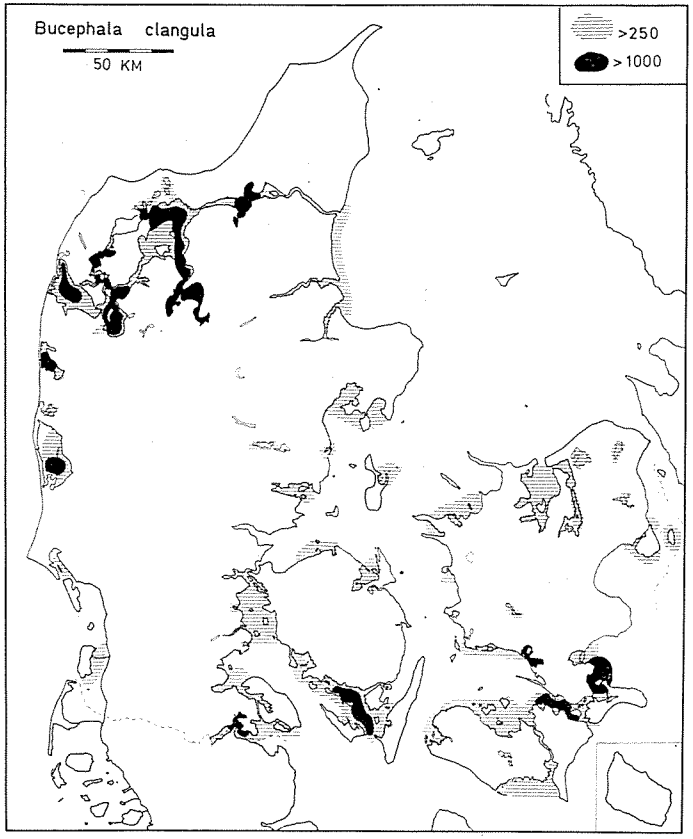


Fig. 54. Summary map for *B. clangula* showing areas where flocks of more than 250 or 1,000 birds respectively are regularly found during Oct.–April.

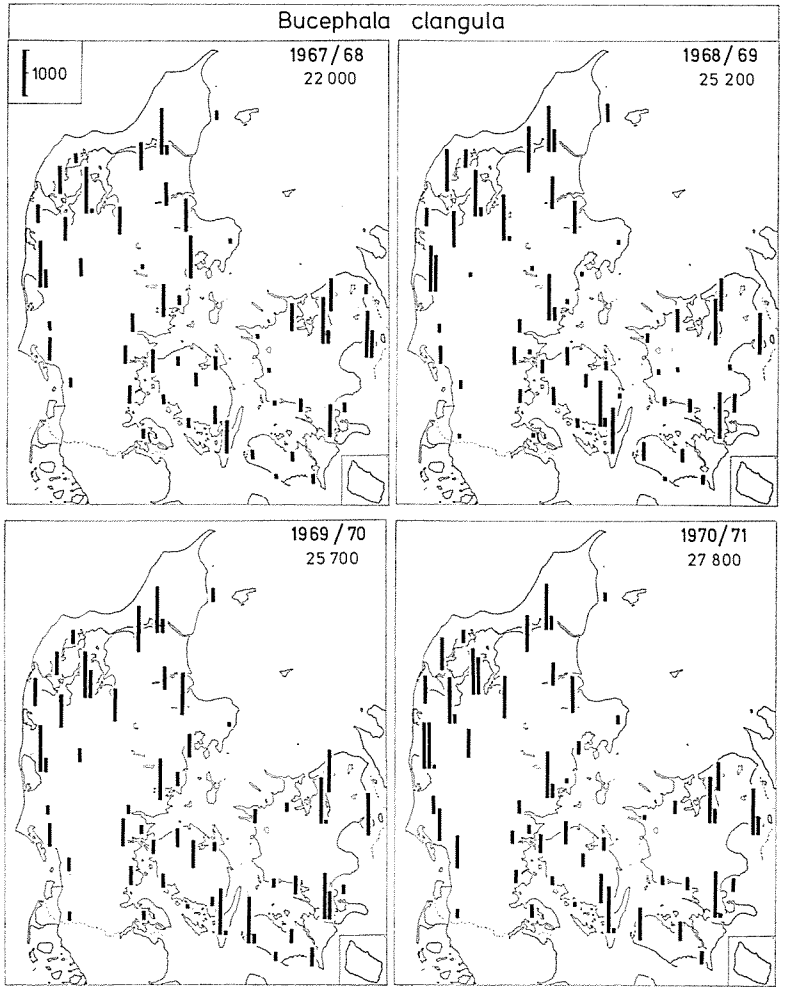


Fig. 55. Distribution of the bag of *B. clangula* per police-district in four shooting seasons.

bers are smaller elsewhere in Jutland (some lakes and Ringkøbing Fjord) and very few have been recorded in the eastern and south-eastern parts of Denmark. The wing-feather moult takes place from June to Sept. in the following sequence: juv. ♂♂, ad. ♂♂, juv. ♀♀ and ad. ♀♀.

Occurrence during autumn, winter and spring

In Sept.–Oct. most goldeneye occur in and near the moulting areas, and in most years autumn migration to Denmark starts late in Oct., and the number of birds increases until Jan.–Feb. The intensity of migration and time when peak numbers are present varies; in 1967/68 and 1969/70 numbers in Jan. were 3–4 times larger than in Nov., but in 1968/69 more birds were found in Nov. From late March the birds tend to disperse, and spring migration commences. Most birds leave Denmark during April, although in early May large numbers are also found widely scattered particularly in the Limfjord and south-eastern waters of Denmark. Only few goldeneye occur after mid-May.

During Oct.–April the goldeneye is found in all parts of Denmark and is by far the most ubiquitous diving duck. Most birds occur in salt water, particularly in sheltered fiords, bays and archipelagoes. The most important areas are the Limfjord, the Lillebælt and S. Funen Archipelago and waters around S. Sealand, Lolland, Falster and Møn. These areas comprised 65–90% (average 75%) of all birds recorded in country-wide surveys in Nov. and Jan. Particularly in the Limfjord concentrations with thousands of birds comprising 20–63% of the total (average 40%) are frequently seen. In other areas mentioned large total numbers also occur, but generally the birds are more dispersed.

In Ringkøbing and Nissum Fjords, and in the fiords and bays of E. Jutland and N. Sealand large numbers have also regularly been recorded. The numbers found along exposed coasts and in open waters are mostly small, for example the areas of Bornholm, the Storebælt, most of the Kattegat, the North Sea coast and the Waddensea.

Although it mainly occurs in sheltered waters, the species is not confined to areas near the shore. Here mostly small flocks occur, while larger concentrations are found 1–5 km further out. Thus in the Limfjord most large flocks have been recorded in the central parts of the different sections, mostly outside the range of coastal observation. The depth of the water in such daytime haunts often exceeds five metres. At dusk and dawn the birds disperse to shallower water and also visit lakes in the marshlands surrounding the Limfjord.

The goldeneye frequently visits inland waters, particularly large and deep lakes and rivulets. Numbers are however mostly very small, and only in a few areas are more than a few hundred seen regularly (Fig. 54).

The goldeneye is an extremely mobile duck and movements over long or short distances are frequent. For example during cold spells, when the Limfjord rapidly becomes covered with ice, mass movements towards waters in south-eastern Denmark have been recorded.

Weather conditions considerably influence the recording efficiency of aerial surveys (see p. 16), and not all figures obtained in country-wide surveys are directly comparable. The numbers recorded in Jan. vary from fifty to nearly a hundred thousand goldeneye; largest numbers were recorded in the severe winter of 1969/70, when all districts had unusually high numbers and nearly half

the birds were concentrated in a few ice-free areas in the central and western Limfjord.

Shooting
The goldeneye ranks number three in the bag of diving ducks. During 1967/68–1970/71 the annual estimated kill increased from 22,000 to 27,800. The species is shot by a very large number of sportsmen, often rather incidentally during dusk and dawn flights, but also in large quantities by sportsmen concentrating on this species and shooting over decoys during day-time. The bag is uniformly distributed over most of the country, but its relative importance varies. In Sealand and Funen it ranks number two and comprises 14%, while in N. and W. Jutland it is first, comprising 40% of the kill of »other diving ducks« (Fig. 9 p. 49). The monthly kill index shows that Oct. is a relatively unimportant month, while larger but varying proportions are bagged in each of the subsequent months from Nov. to Feb. See Fig. 10 p. 53.

Composition
There is little variation in the juv.% in the age composition among bagged birds during five seasons. Among ad. birds females predominate in most years (average 57%), while in juv. birds the sex-ratio is equal (Fig. 11 p. 59).

Mergus serrator – Red-breasted Merganser

Fig. 56–58 p. 114–115.

Holarctic, mainly in boreal zone. Breeds in Iceland, Scotland, Ireland, around the Baltic Sea, in Fennoscandia and through northern and Central U.S.S.R. Winters along coasts in NW., W. and S. Europe. In Denmark a common breeder, locally numerous during summer wing moult and very widespread in winter.

Shooting season: 1. Oct.–29. Feb.

Breeding and moulting
The red-breasted merganser breeds along all coasts in Denmark, most often along sheltered coasts and archipelagoes, while it is scarce and irregular along the North Sea coasts and in the Waddensea. It breeds also in brackish fiords, and locally in lakes of coastal marshlands (e.g. Vejlerne, N. Jutland, KORTEGAARD 1968). The exact size of the breeding population is not known, but comprises some thousand pairs.

The presence of moulting birds during summer has been described by JOENSEN (1973 a). Large concentrations are found in the central Limfjord, where ad. males are fligthless in July–Aug. Smaller numbers including the widely-scattered ad. females occur in other waters. The total number of moulting birds in flocks is about 12,000, and including females the total is estimated to be of the order 20,000 birds, most of which are probably of local origin.

Occurrence during autumn, winter and spring
The majority of local breeders are probably resident, and in addition visitors from other breeding areas occur in Danish waters (SALOMONSEN 1972). There is a considerable annual variation in the occurrence of peak numbers during autumn, winter and spring. Birds seen in Sept.–Oct. are probably mainly local breeders, but numbers increase consi-

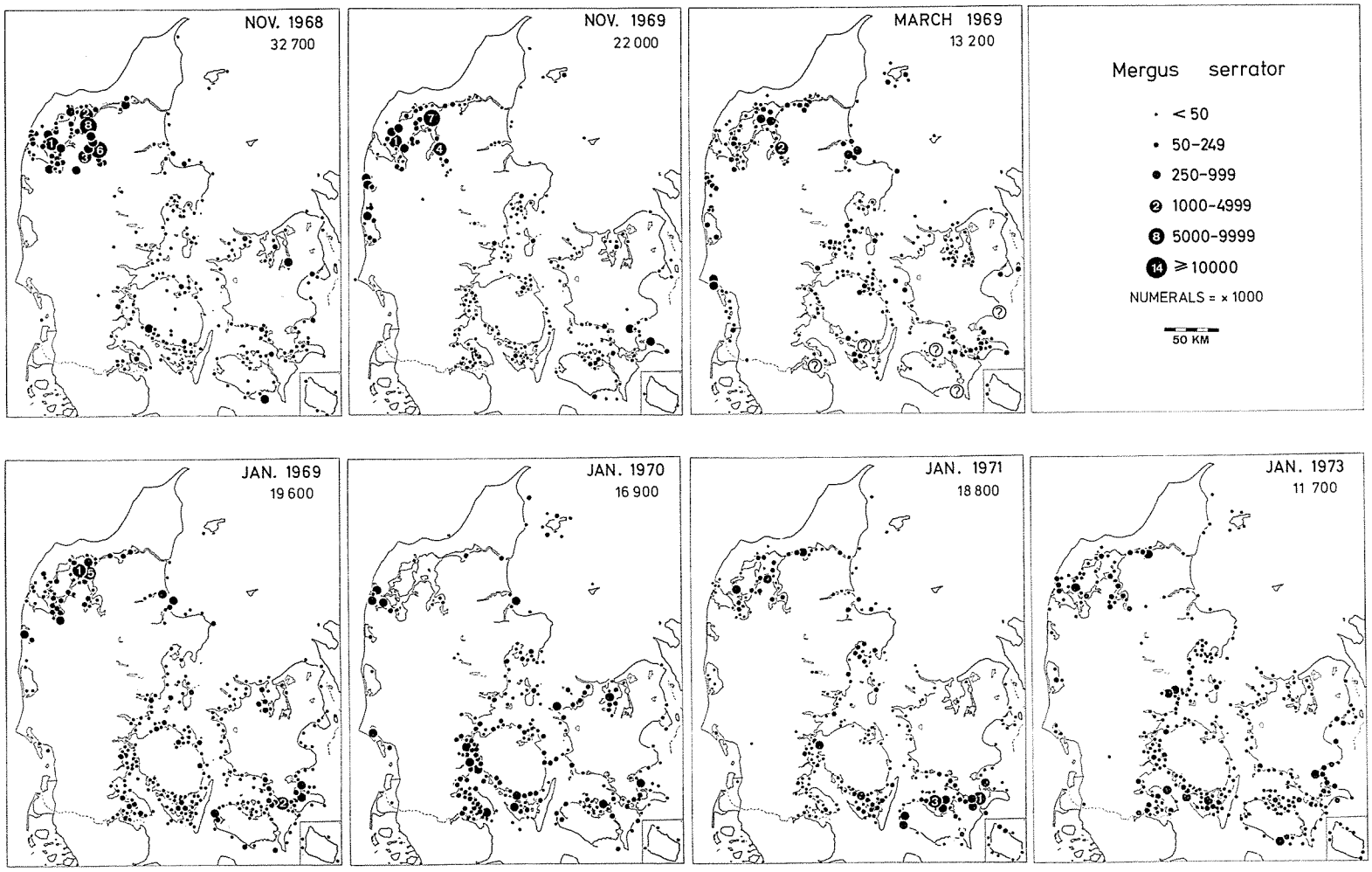


Fig. 56. Distribution of *M. serrator* in seven country-wide surveys.

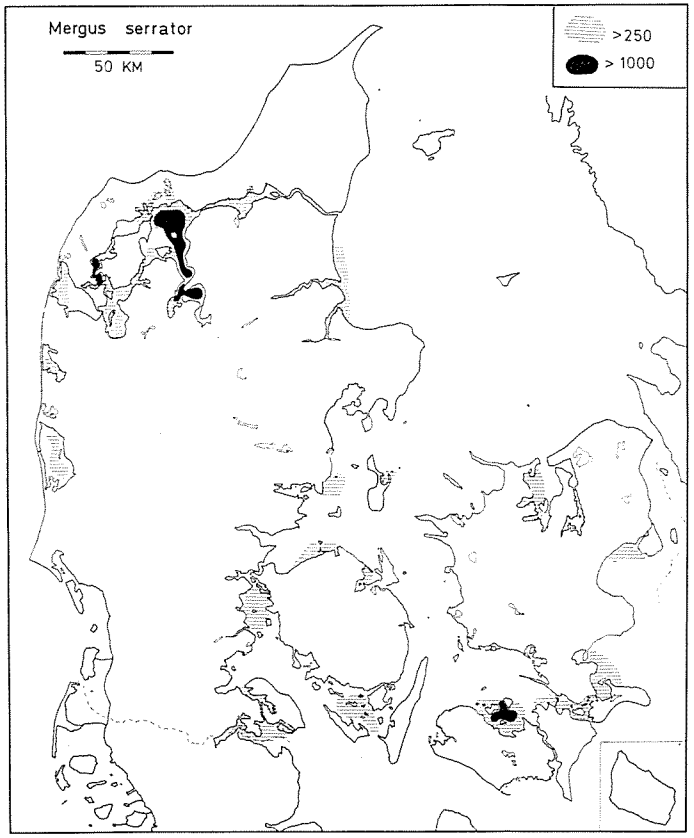


Fig. 57. Summary map for *M. serrator* showing areas where concentrations of more than 250 or 1,000 birds respectively are regularly found during autumn, winter and spring.

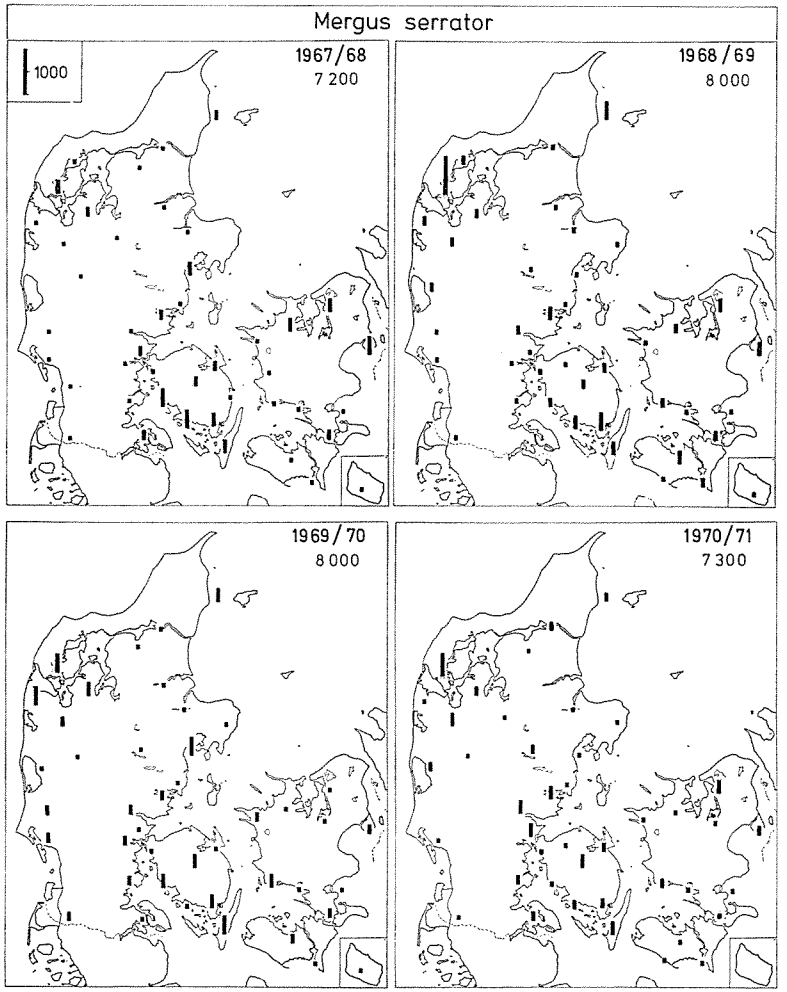


Fig. 58. Distribution of the bag of *M. serrator* per police-district in four shooting seasons.

derably in Nov., when more birds have been recorded than in Jan. (Table 5 p. 23). Numbers then remain relatively high until March, and spring migration takes place during March–April. By late April only local breeders remain.

The red-breasted merganser is almost exclusively confined to salt- and brackish water. Only on lakes in marshlands surrounding the Limfjord are large flocks regularly seen in fresh water, while lakes and rivulets in other parts of the country are only visited very irregularly by single birds and small groups. In salt- and brackish water the species occurs in all parts of the country. In autumn the Limfjord is the most important haunt, with three-quarters of the grand totals obtained in country-wide surveys in Nov. Numbers diminish there with increasing ice-cover, and a simultaneous increase has been noted in the south-eastern parts of the country. The second most important area, S. Sealand-Lolland-Falster-Møn contained 6% of the grand totals in Nov. but 29% in Jan. In the map Fig. 57 only areas where large concentrations are annually found have been shown. In other waters such flocks are occasionally seen, but mostly the birds occur widely scattered in smaller groups. The species is found in all types of salt-water habitat, although it is mostly very scarce in the open sea more than 10 km from the coast. The largest concentrations are found in sheltered waters, such as fiords and archipelagoes, where red-breasted mergansers occur both near the coast together with *M. merganser* and further out together with *B. clangula.*

The species is rather difficult to count from aircraft (see p. 15), and the figures obtained must be regarded as minimal, and much of the variation in total numbers recorded can be ascribed to the weather conditions during the surveys. The largest number (33,000) was recorded in Nov. 1968, and numbers in Jan. varied between 12,000 and 20,000.

Shooting

Both *M. serrator* and *M. merganser* are shot by a relatively large number of sportsmen, although the total kill is rather small. Mergansers are much less favoured for eating than other diving ducks, and a large proportion of the bag is probably taken incidentally during shooting of other waterfowl. In four seasons the total kill of the red-breasted merganser varied between 7,200 and 8,000, and was rather evenly distributed over the country. In the whole country the species ranks number seven and comprises 6% of the total kill of »other diving ducks«, and only in the Limfjord (where it is number two, comprising 14%) is there a tendency by sportsmen to concentrate on the species (Fig. 9 p. 49). The monthly kill index (Fig. 10 p. 53) indicates a pronounced peak in Oct., probably as a result of many birds being shot incidentally during dabbling duck flightings in this month.

The material of aged and sexed birds from the bag is rather small, showing a relatively high and uniform juv.%. Males comprise two-thirds of the ad. birds (Fig. 11 p. 59).

Mergus merganser – Goosander

Fig. 59–61 p. 118–119.

Holarctic, mainly in boreal zone. Breeds in Iceland, Scotland, around the Baltic Sea, through most of Fennoscandia and the northern and Central U.S.S.R. Win-

ters in NW. Europe (south to Bretagne), in Central Europe and the Black and Caspian Seas. In Denmark a very scarce breeder and a widespread and locally numerous winter visitor.

Shooting season: 1. Oct.–29. Feb.

Breeding

A very small population, probably of the order 25 pairs, occurs near sea coasts in the southern and eastern parts of the country. The species has never been known as a common or widespread breeder, but was formerly more frequent and also occurred locally inland. There is no indication of foreign birds moulting in Danish waters during summer (JOENSEN 1973 a p. 3).

Occurrence during autumn, winter and spring

In Sept.–Oct. very few goosanders are recorded. Numbers increase slightly in Nov., but the large majority of birds arrive in Dec.–Jan., and in most parts of the country numbers remain high until March (Fig. 4 p. 27). The main spring migration takes place before mid-April, and few birds are recorded later in this month and in early May.

The goosander occurs in inland and coastal waters throughout Denmark. In lakes and streams the species is the second most numerous diving duck during winter after *A. fuligula*, and in several lakes hundreds are recorded almost annually, e.g. more than five hundred in Flyndersø (sub-district Cf), Mossø (Gc) and Furesø (Ra). However, most goosanders are found in salt- and brackish water up to 1–3 km from the coast, particularly in the Limfjord, the fiords of W. Jutland and around S. Sealand-Lolland-Falster-Møn, which together contained 40–75% of all birds recorded in country-wide surveys in Jan. Large concentrations occur less regularly elsewhere in Danish waters.

In the fiords of W. Jutland and the Waddensea, large, very dense concentrations have been recorded almost annually (up to 9,000 in Dec. and 5,000 in Feb.-March). Their occurrence in the Waddensea is mostly very brief, indicating passage by birds wintering further south in Europe.

In the Limfjord the goosander and the red-breasted merganser are found in very much the same habitats and often occur in mixed flocks. Elsewhere in Denmark the goosander is generally closer to the shore, and in more distinct concentrations.

The figures obtained in country-wide surveys are considered very accurate. In Nov. surveys 400–2,600 birds were recorded, while numbers in Jan. varied from 13,200 to 28,200, the largest number being recorded in the severe winter of 1969/70.

Shooting (see also *M. serrator)*

In four seasons the total estimated kill varied from 4,600 to 6,300, the largest number being shot in the severe winter of 1969/70. The bag was rather uniformly distributed over the whole country, and only in NE. Sealand and Ribe county, is the goosander more important than the red-breasted merganser (Fig. 9 p. 49). Most goosanders are shot in Jan.–Feb. (Fig. 10 p. 53).

The material of bagged birds examined is very small, a total of 305 in five seasons, and only in 1969/70 there is significantly higher juv.% than in the other years. Males comprised two-thirds of ad. birds bagged (Fig. 11 p. 59).

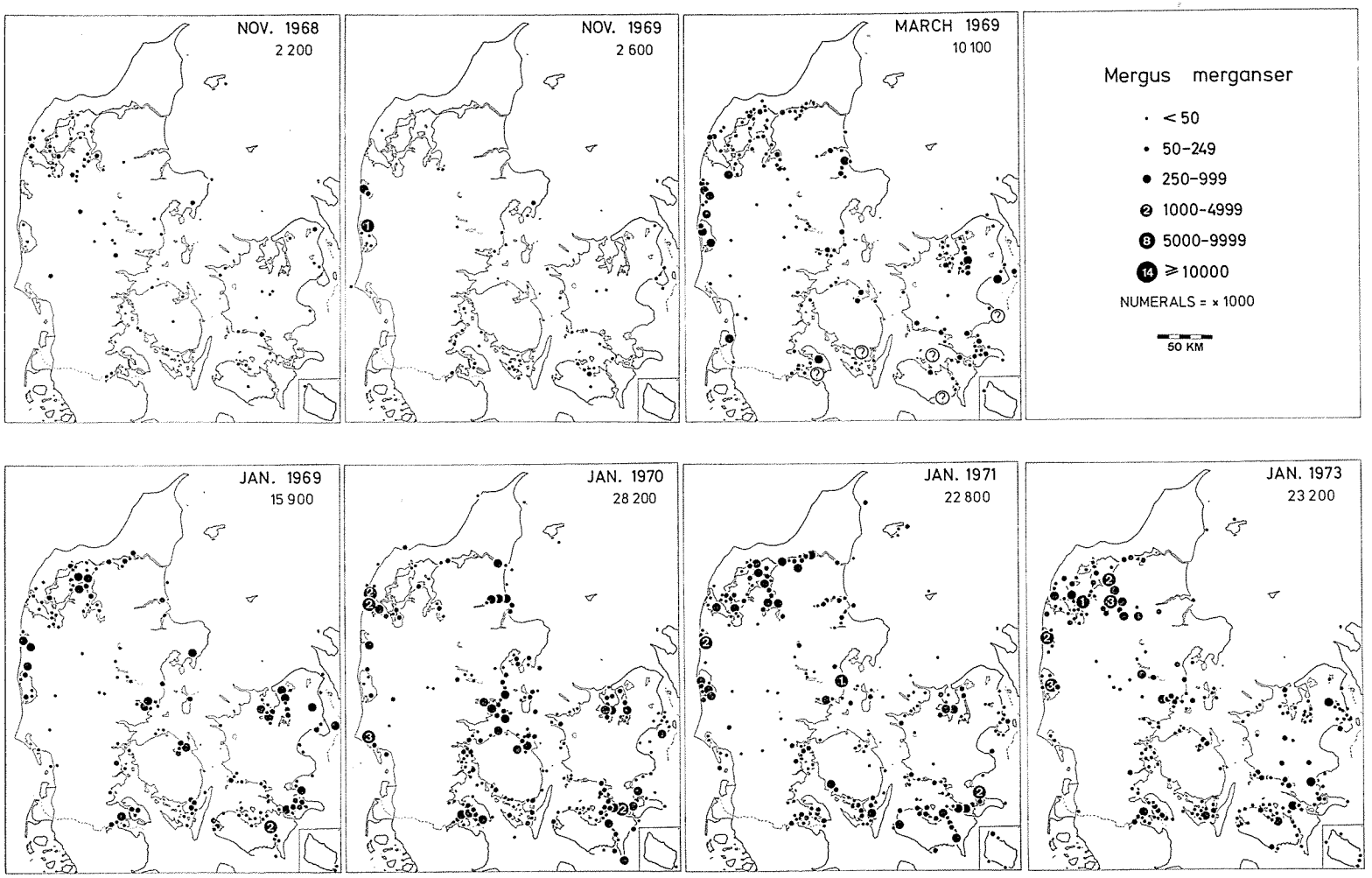


Fig. 59. Distribution of *M. merganser* in seven country-wide surveys.

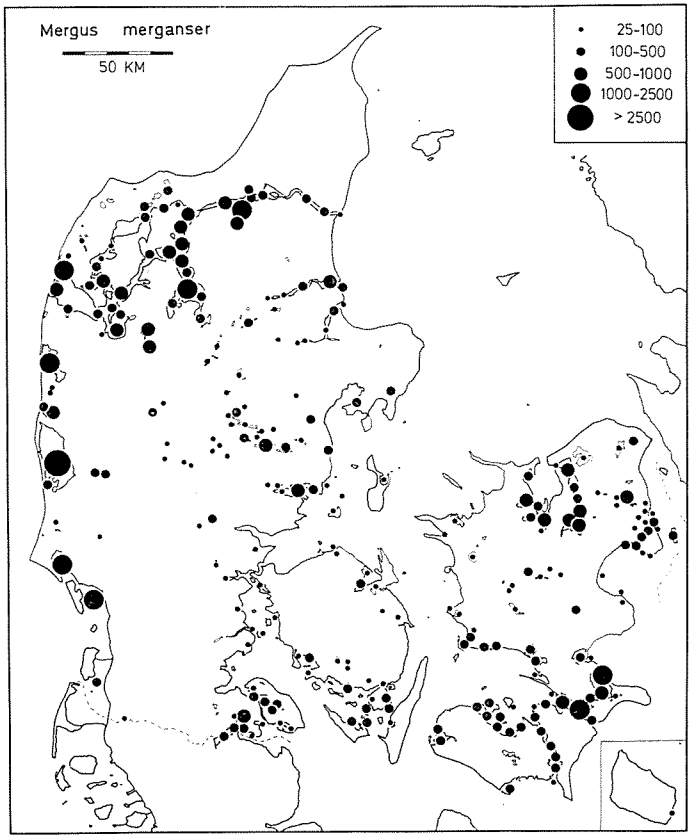


Fig. 60. Summary map for *M. merganser* showing localities where more than 25 birds have been recorded regularly during 1965–1973.

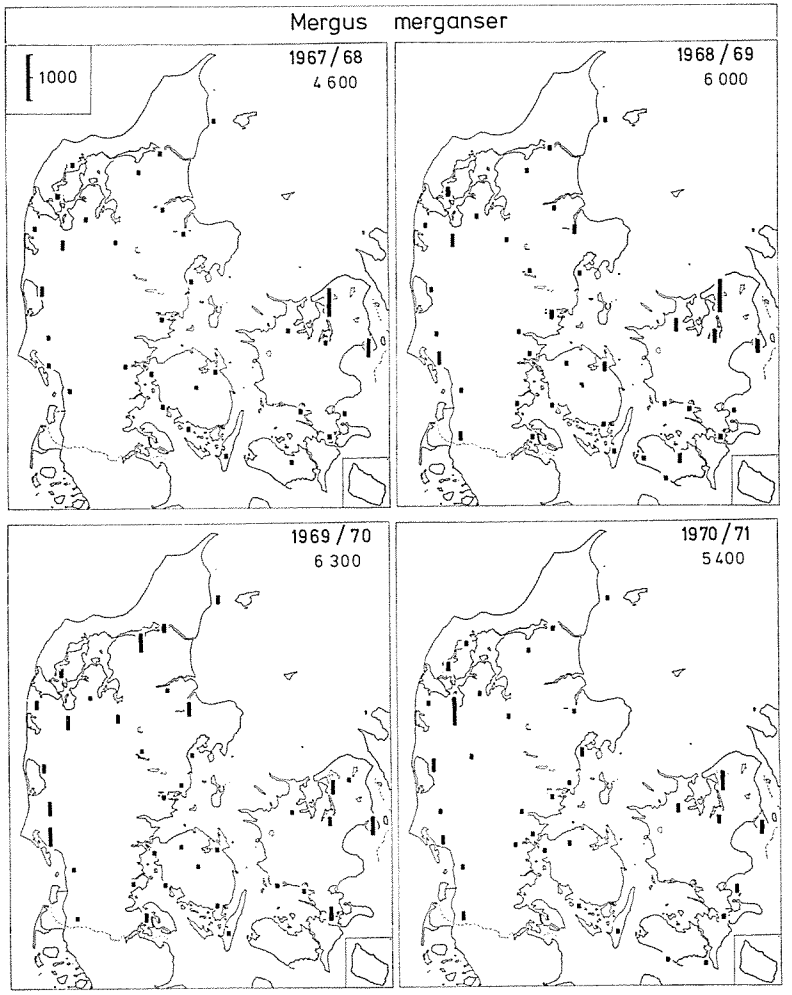


Fig. 61. Distribution of the bag of *M. merganser* per police-district in four shooting seasons.

Mergus albellus – Smew

Fig. 62 p. 120.

Palaearctic, in boreal zone. Breeds from northernmost Fennoscandia (scarce) through northern U.S.S.R. Winters in NW., Central and SE. Europe. In Denmark a scarce winter visitor. Protected since 1967.

The monthly distribution of all smew recorded in ground counts during 1965–1973 (total 4,600) is: Sept. 0%, Oct. 1%, Nov. 3%, Dec. 11%, Jan. 52%, Feb. 22%, March 10%, and April 1%. The map Fig. 62 shows the distribution of all records of the species. Only in the harbour of Copenhagen (particularly the southern part around Sjællandsbroen) are large numbers seen every winter. The following peak numbers have been recorded there in Jan.–Feb.: 1966 140, 1967 110, 1968 290, 1969 160, 1970 410, 1971 180, 1972 210, and 1973 150 (see also PEDERSEN 1972). Outside Copenhagen, very few localities are regularly visited by small groups, but there is an irregular occurrence of small and occasionally larger flocks in coastal areas and inland waterbodies all over the country, particularly in SE. Denmark.

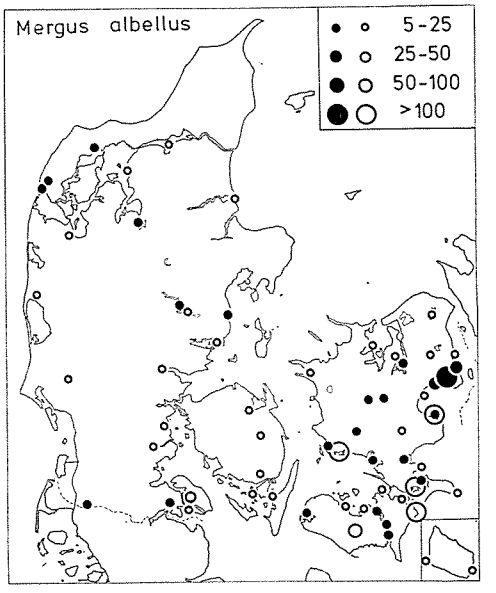


Fig. 62. All records of *M. albellus* during 1965–1973. Solid circles indicate regular occurrence, open circles irregular occurrence.

Cygnus olor – Mute Swan

Fig. 63–64 p. 122–123.

Palaearctic, in temperate, boreal and steppe zones. Breeds discontinuously in Central Asia, locally in SE. Europe and in NW. Europe (British Isles, the Netherlands, Germany to Estonia and in Sweden and Denmark). Mostly resident. In Denmark a common resident breeder, locally numerous during summer moult, and very numerous during winter. Protected.

Breeding

The breeding population has increased considerably in the last fifty years, from 3–4 pairs in 1925, to 35 in 1935, 385 in 1945–50, 758 in 1954 and 2,740 in 1966 (BLOCH 1971). In 1966 nearly three-quarters of the population bred in the islands, where two areas (S. Funen and Lolland-Falster) each contained 15% of

the total population. The species is very common inland in lakes and ponds, but an increasing proportion breeds in salt- and brackish water, often in colonies. In 1966 40% bred in coastal habitats, and eleven colonies (each with 20–90 pairs) comprised 450 pairs or 17% of the total population (BLOCH 1970, 1971).

Moulting

In summer 1968, Danish waters were surveyed by aircraft (ANDERSEN-HARILD 1971), and 37,000 moulting mute swans were recorded there and along the Swedish Øresund coast. Presumably they were all non-breeding 1 to 5-year old birds. Most birds occurred in a few large concentrations in shallow salt water, often far from the coast, e.g. more than half were in waters around S. Sealand-Lolland-Falster-Møn, and nearly 30% in the Øresund. 8% were south of Funen, and the only large flock in Jutland was in Ringkøbing Fjord, comprising 4%.

Occurrence during autumn, winter and spring

The monthly count index (Fig. 4 p. 27) shows a very uniform population during autumn, winter and spring. The relatively low values in Jan.–Feb. of most winters are caused by ice-cover at many ground count sites, and as a matter of fact the population is largest in these two months, when local breeders are supplemented by visitors from the Baltic breeding areas.

During April–Sept. mute swans are common inland, but as early as Aug.-Sept. most birds move to salt waters and stay there until the next spring. The species always occurs in shallow water, mostly in sheltered fiords and archipelagoes, although occasionally several kilometres from the nearest coast. The map Fig. 64 shows localities where flocks of 50, 250 and 1,000 birds respectively occur regularly during autumn, winter and spring. Outside these areas few birds are generally found. The most important area is that of the waters around S. Sealand-Lolland-Falster-Møn, which contained 46–54% (average 51%) of the grand totals recorded in country-wide surveys. Other areas of importance are Roskilde Fjord, the waters around Saltholm, Odense Fjord, the S. Funen Archipelago, Mariager Fjord, Nissum Fjord and Ringkøbing Fjord. Only 7–19% of the mute swans counted in country-wide surveys were in Jutland. Remarkably few concentrations are found in the Limfjord, where the species is occasionally outnumbered by *C. cygnus*, and in the Waddensea very few birds occur.

The figures obtained in country-wide surveys are generally very accurate. The population varied from 45,000–50,000 in Nov. to 40,000–70,000 in Jan., with the largest numbers recorded in the severe winter 1969/70. Later this winter many thousand swans died of starvation, and both the exceptional mortality and the fact that many pairs did not breed in the following summer explain the low numbers recorded the succeeding winter (ANDERSEN-HARILD 1970 and pers. comm.).

Cygnus cygnus – Whooper Swan

Fig. 65–66 p. 124–125.

Palaearctic, in boreal zone. Breeds in Iceland, scattered in northern Fennoscandia and through northern U.S.S.R. Winters in NW. Europe south to England and Belgium, and the Black and Caspian Seas. In Denmark a common and locally nu-

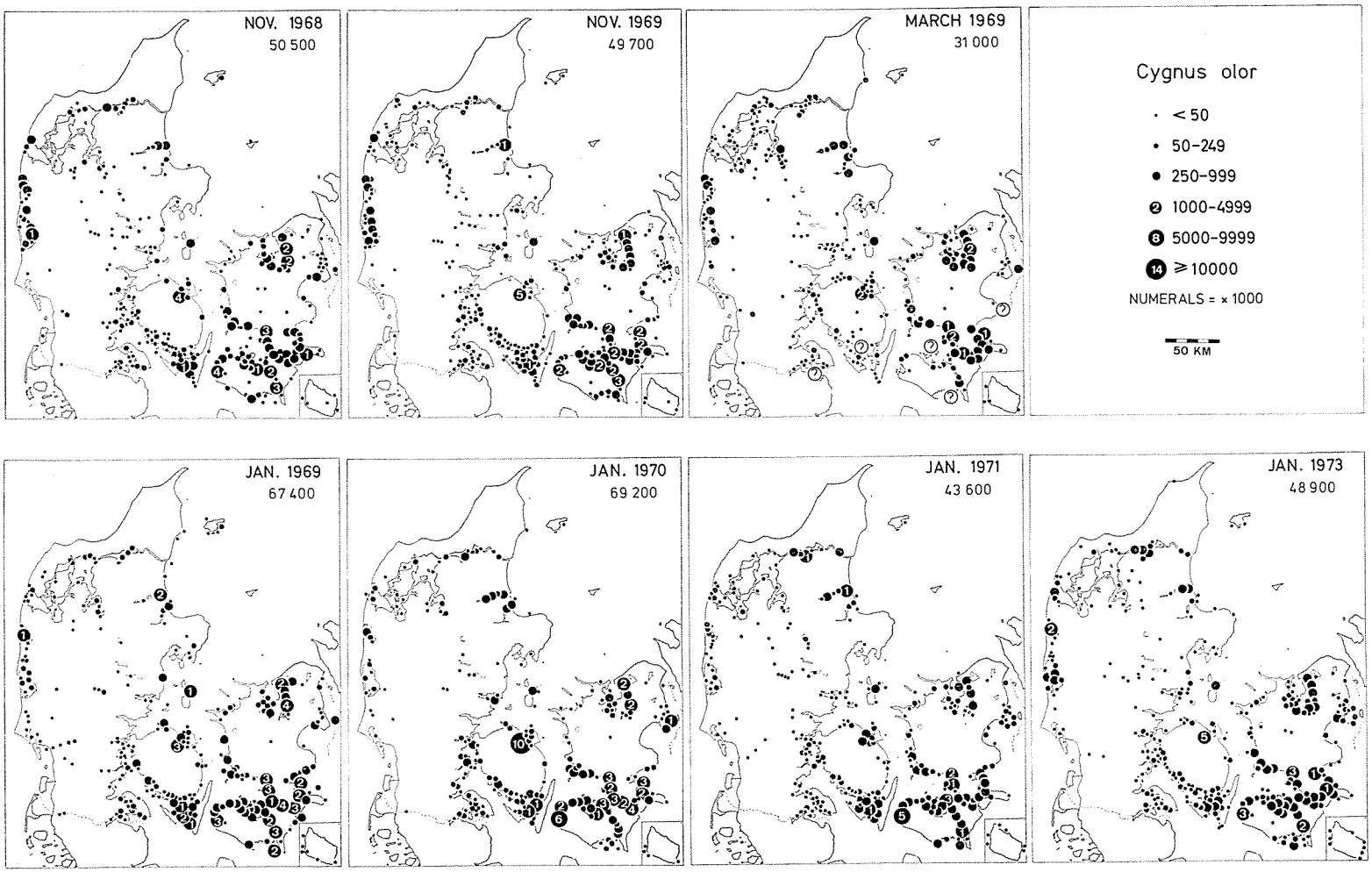


Fig. 63. Distribution of *C. olor* in seven country-wide surveys.

merous visitor in late autumn, winter and spring. Protected.

Occurrence during autumn, winter and spring

In most years the first migrants arrive in Oct. and numbers increase in subsequent months. The monthly count index (Fig. 4 p. 27) is based on rather little data, but it is known from aerial surveys covering the main haunts more completely that peak numbers occur in Jan. Numbers remain high in Feb. and usually in March also, but are considerably reduced about mid-April. In W. and N. Jutland small flocks are regularly seen in late April, but very few stay until mid-May.

Whooper swans occur in all parts of Denmark, but the main concentrations are found in W. and N. Jutland and in waters around S. Sealand-Lolland-Falster-Møn; few birds occur between these two areas. The species is frequently found inland, particularly along streams and in larger lakes, and more often than other swans it will feed on grassland up to a few kilometres from water. However such habitats mostly contain small numbers, and the large majority of birds occur in shallow and sheltered salt- and brackish water, mostly together with mute swans, but often a little further out in deeper waters.

The figures obtained in aerial surveys are generally representative, although in some cases (particularly in Jan. 1969 in SE. waters, see p. 15) the population was under-estimated. In country-wide surveys in Nov. 1,000–3,800 have been recorded, and in Jan. between 5,700 and 10,800 (excluding 1969). About ten thousand were present in Danish waters in the two coldest winters, while numbers were low in the very mild winter of Jan. 1973.

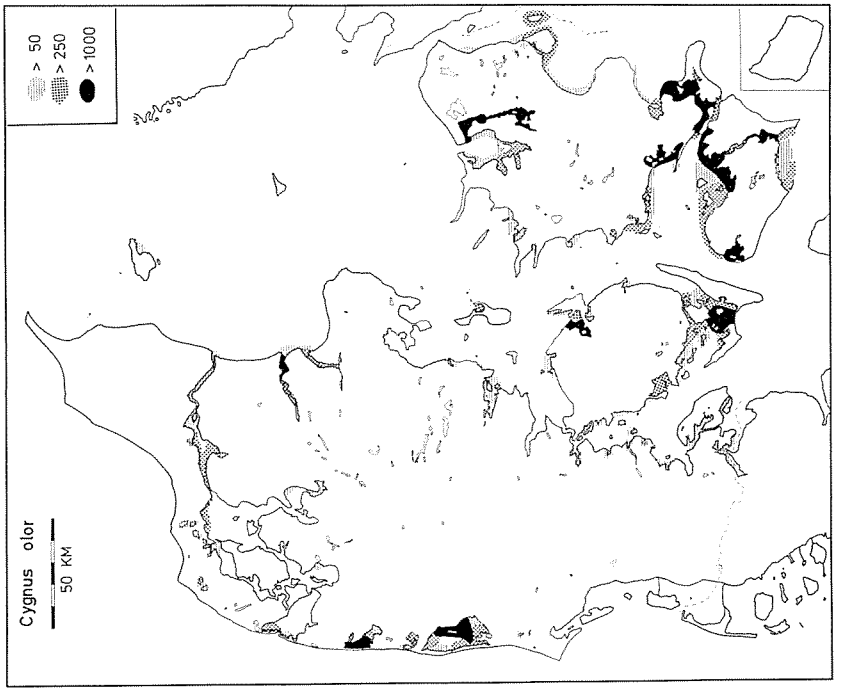


Fig. 64. Summary map for *C. olor* showing areas where flocks of more than 50, 250 or 1,000 birds respectively are found regularly during autumn, winter and spring.

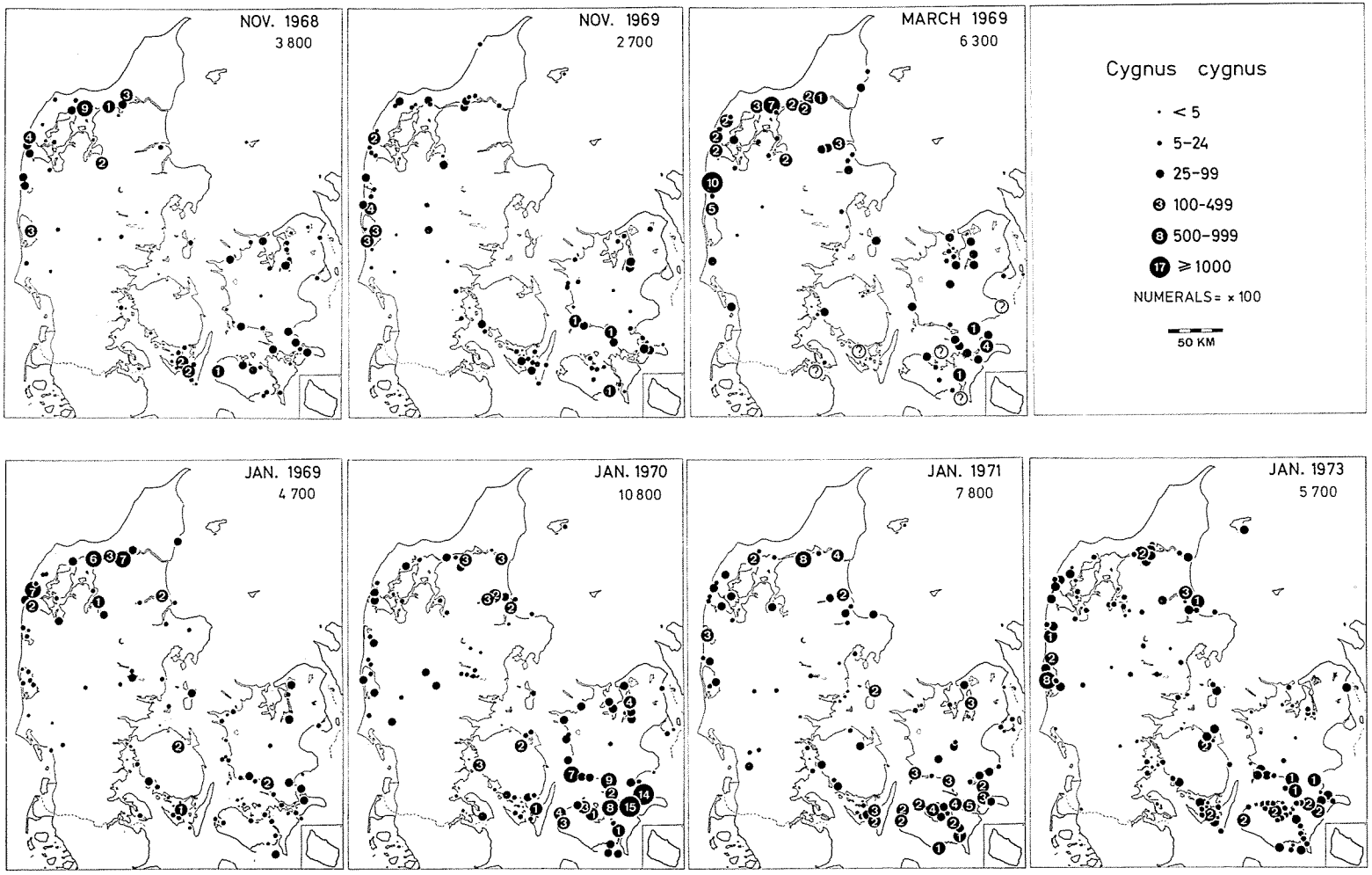


Fig. 65. Distribution of *C. cygnus* in seven country-wide surveys.

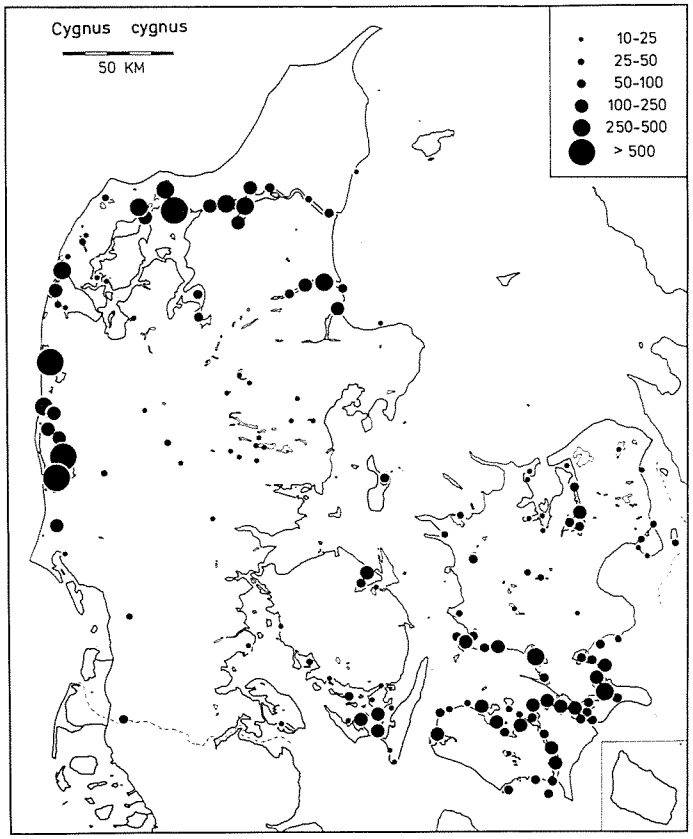


Fig. 66. Summary map for *C. cygnus* showing areas where more than 10 birds were recorded regularly during 1965–1973.

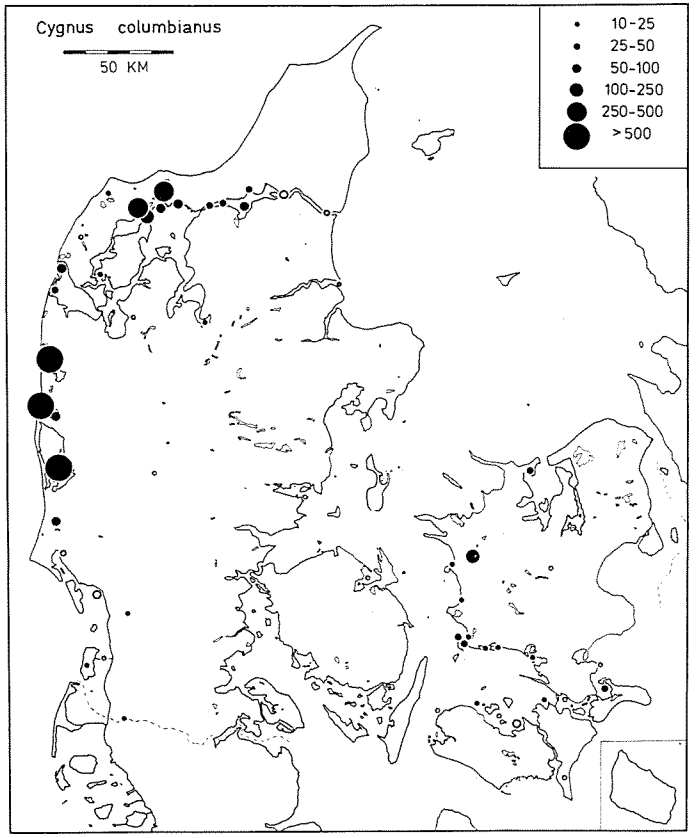


Fig. 67. Summary map for *C. columbianus* showing areas where more than 10 birds were recorded regularly during 1965–1973. Irregular records are marked with open circles.

Cygnus columbianus – Bewick's Swan

Fig. 67 p. 125.

Holarctic, in tundra and boreal zones. Breeds in northernmost U.S.S.R. from Kola peninsula eastwards. Winters in NW. Europe (mainly British Isles and the Netherlands) and at the Caspian Sea. In Denmark a locally common visitor in autumn and spring, but scarce in most winters. Protected.

Occurrence during autumn, winter and spring

The main migration route passes through N. and W. Jutland where the species frequents a rather small number of localities. The first migrants are seen in Oct., numbers increase in Nov. and decrease again in Dec. Few are found in W. and N. Jutland in winter, but spring migrants arrive in March and peak numbers occur late in this month and in early April. From mid-April numbers decrease again, and few birds are recorded by early May.

The main habitats are as follows: Ringkøbing Fjord, where up to 800 were recorded in Dec., 400 in March and 1,200 in April. Vest Stadil Fjord 800 in Nov., 250 in Dec., 150 in Jan., 200 in March, Nissum Fjord 200 in Jan., 900 and 1,800 in March, and Vejlerne-Lønnerup Fjord and adjacent waters in the Limfjord 800 in Oct., 360 in Nov., 430 in Jan., 300 in March. Flocks of 100–200 are regularly seen in Fiilsø, Agger-Harboøre Tanger and in Nibe Bredning. The largest flocks are generally recorded in spring.

Outside W. and N. Jutland, bewick's swan only occurs regularly in a very few localities. The most important is Tissø in W. Sealand, where up to 150 have been recorded in autumn. See also SCHELDE (1961). In the map Fig. 67 irregular occurrences of more than 10 birds are also indicated.

Numbers of bewick's swan are probably somewhat under-estimated in country-wide surveys (see p. 15), and vary from a couple of hundred to well over a thousand. The largest number recorded in Jan. was in the very mild winter of 1972/73, and peak numbers present in W. and N. Jutland during migration are 2,000–3,000.

Fulica atra – Coot

Fig. 68–70 p. 128–129.

Widespread in the Old World. Breeds in most of Europe, north to W. Norway, Central Sweden and S. Finland. Winters in most of its breeding range, except Central Russia and Finland. In Denmark a very common breeder and very numerous during autumn, winter and spring. Shooting season: 16. Aug.–29. Feb.

Breeding and moulting

At the turn of the last century, the coot expanded its range in Denmark and increased considerably in numbers (SALOMONSEN 1963). Today it is a very common breeding bird in all types of fresh-water habitats, in brackish fiords and coastal marshlands, and occasionally in shallow salt water. The size of the breeding population is not known, but comprises many thousand pairs. During the wing moult in summer, birds occur widely scattered in their breeding habitats, although larger concentrations are occasionally found (FOG 1969).

Occurrence during autumn, winter and spring

Coot breeding in Denmark are either resident or migrate to W. Europe, and outside the breeding season large numbers of coot from northern breeding areas migrate through Denmark or winter there (Salomonsen 1972, Fog 1969). The species occurs in all types of wetlands except the open sea, but from late autumn to March the large majority are found in salt- and brackish waters, mostly shallow stretches in sheltered fiords or archipelagoes. As early as Sept. large flocks can be found in most parts of the country, and numbers increase in subsequent months. Peak numbers usually occur in Nov. although during the winter months numbers remain very high. In late March a significant reduction in numbers takes place, and by mid-April probably only local breeders are present in Denmark.

The coot is common throughout Denmark, but the large majority occur in two areas, W. and N. Jutland and the south-eastern waters. In Ringkøbing Fjord up to 40,000 have been recorded in Oct., but numbers later in the autumn and in winter are much smaller. In the Limfjord, the largest concentrations are found in Nibe Bredning and Hjarbæk Fjord, and in the former area numbers remain high during most winters (see Fig. 68). In the south-eastern parts of Denmark, particularly the waters around S. Sealand-Lolland-Falster-Møn, large concentrations occur from Oct. to March and peak numbers are usually recorded in Jan. In country-wide surveys this region contained 27–53% (average 45%) of the total Danish winter population, with the lowest value in the mild winter of 1972/73 and the highest in the severe winter of 1969/70. Large numbers are also found in the Lillebælt-S. Funen Archipelago, e.g. in Jan. 25% of the grand total, and concentrations occur less regularly in several fiords and harbours in the eastern parts of Denmark. The coot is very gregarious outside the breeding season. In country-wide surveys in Nov. and Jan. more than half the birds recorded were in flocks of more than five thousand, and 23 flocks with more than ten thousand birds comprised one-third of all coot recorded.

In country-wide surveys during Nov. and Jan. all important habitats of the coot were covered, and although estimates of the very large concentrations are rather approximate, the figures obtained are considered fairly realistic. In Nov. between 125,000 and 270,000 were recorded, the largest number being in 1968, while populations in Jan. ranged from 105,000 to 207,000.

Shooting

Information in the official bag-record on the kill of coot goes back to 1968/69, and in this and the following three seasons the total kill was 79,000, 83,000, 57,000 and 62,000 respectively with the largest bag taken in the severe winter of 1969/70. The coot is bagged by about ten thousand sportsmen (result for 1968/69), of whom two-thirds shoot 1–5 birds, only five hundred more than 20 birds, and very few reported more than one hundred birds bagged. The large majority of coot are shot rather incidentally, although in the south-eastern part of the country some types of specialized coot shooting occur. The geographical distribution of the kill shows very little annual variation; one-third of the bag is taken in Storstrøm county, well over one-third in other parts of Sealand and on Funen, while the species is not very important throughout Jutland, the largest bags being taken in Ringkøbing county. The monthly kill index (Fig. 10 p. 52) shows that few coot are bagged in Aug.–Sept., and in four seasons out of five peak numbers were killed in Nov.

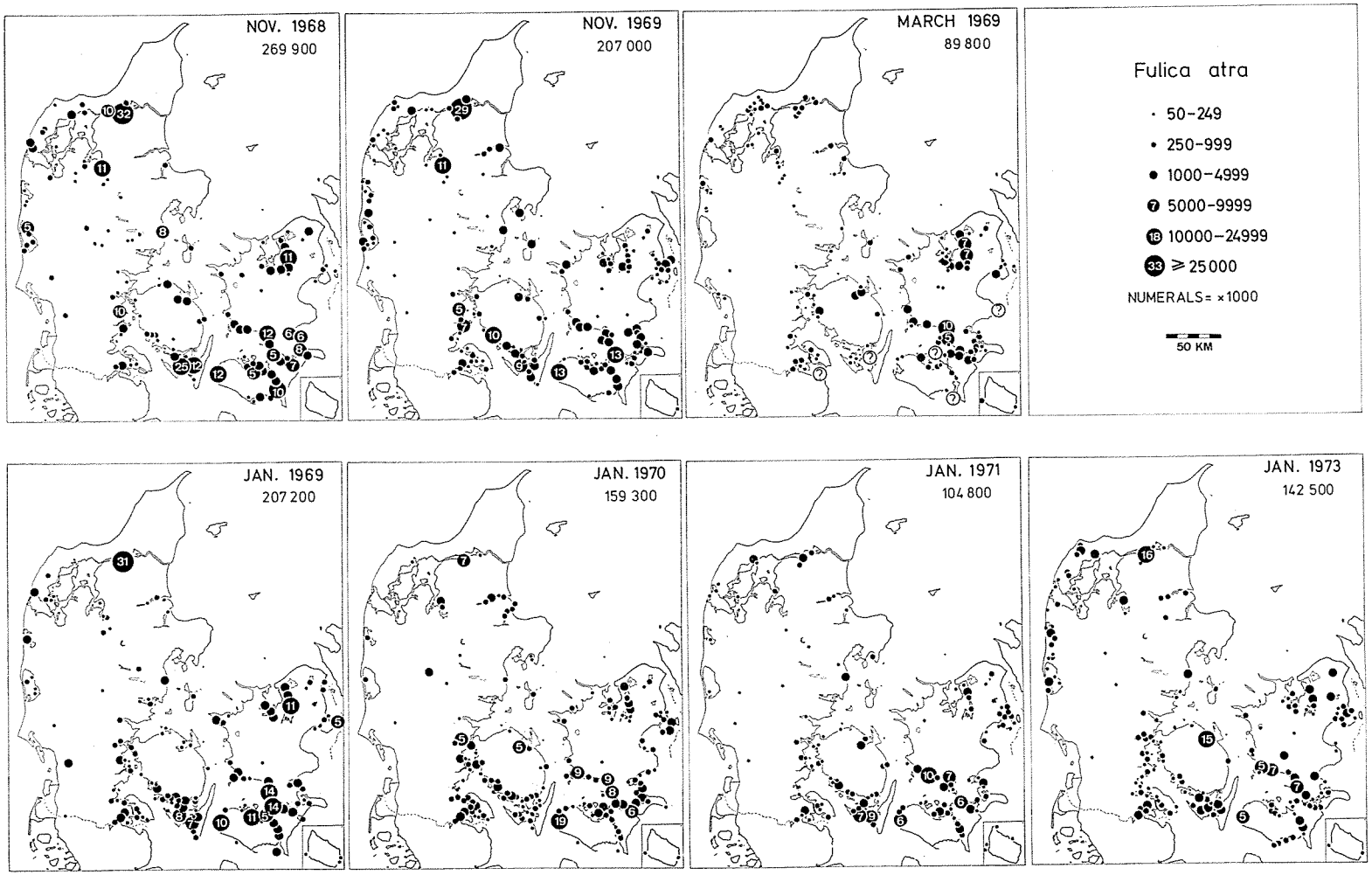


Fig. 68. Distribution of *F. atra* in seven country-wide surveys.

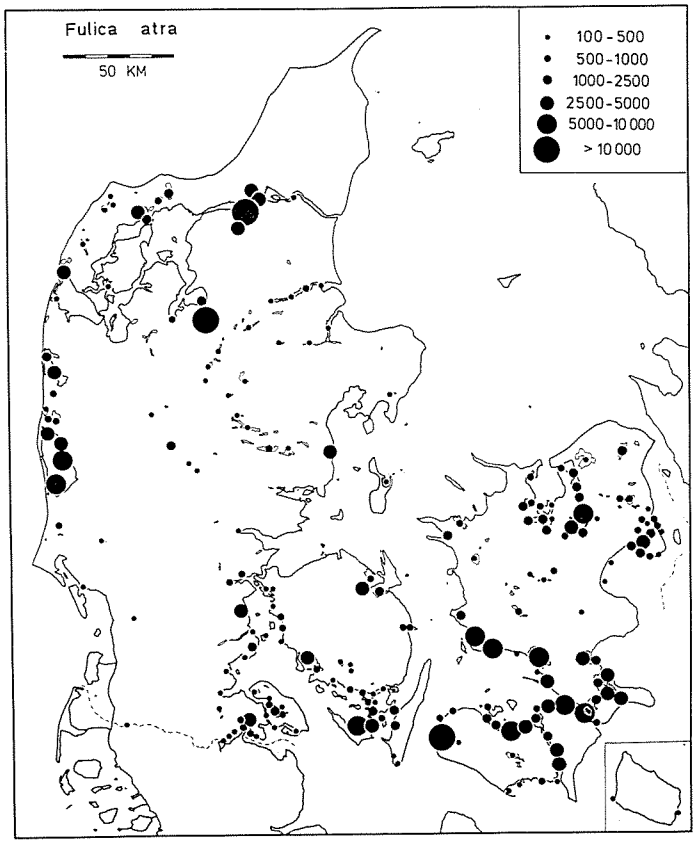


Fig. 69. Summary map for *F. atra* showing all areas where more than 100 birds were recorded regularly in Sept.–April during 1965–1973.

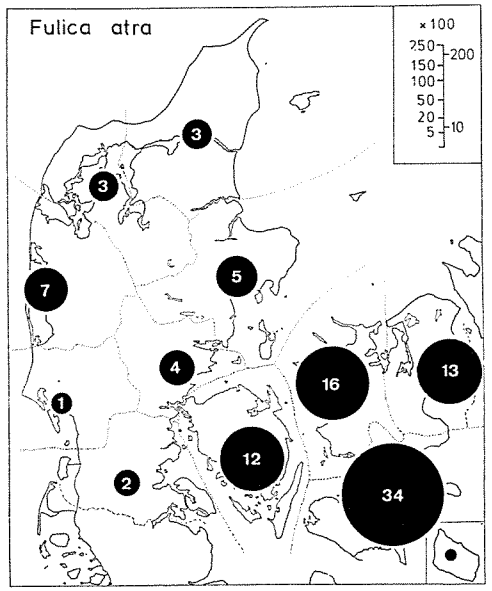


Fig. 70. Distribution of the bag of *F. atra* per county (average for four seasons 1968/69 – 1971/72). Scale refers to circle diameter and represents no. of individuals (thousands). Numbers in circles indicate percentages of total numbers.

Chapter V

Important waterfowl haunts in Denmark

This chapter outlines the results of the study in 1965–1973 concerning the importance of different wetlands for wintering waterfowl during Sept.–May. It should be emphasized that no information from earlier studies has been used, and that areas are described as they were during the study period. Furthermore, no attempt has been made to consider their potential importance in relation to other types of utilization, e.g. eventual prohibition of traffic and shooting. The information is summarized in the map Fig. 71, where different symbols have been used to illustrate the relative value of the different wetlands. This evaluation is primarily based on quantitative aspects, but species diversity has also been considered, and greater importance has been attached to some of the species with a rather limited distribution and small populations than to the more widespread and abundant waterfowl. Fig. 72 shows the distribution of shallow salt- and brackish waters, and Fig. 73 contains the majority of place names referred to in this chapter.

For the purpose of the study, Denmark and its surrounding waters were divided into thirteen regions, each of which includes one to three districts (see Fig. 1 p. 11) and comprises a natural geographical and topographical area. For each region the main habitats and the most important aspects of the waterfowl communities have been described in an introduction, followed by a list of the most important waterfowl haunts. The description of each site includes a very brief definition of the habitat and the approximate area of waterfowl habitat in km^2, and a list of the most important species. In most cases and unless otherwise stated, the figures given indicate the »regular population«, that is, the peak numbers recorded annually (or almost annually). In cases where maximum numbers are considerably larger than the regular numbers, the former are also given.

Although this chapter mainly concerns the occurrence of ducks, swans and coot in Denmark during Sept.–May other important aspects have also been mentioned, e.g. important concentrations during the wing moult in summer and the occurrence of roosting geese. The last mentioned is based on the information by Fog (1967, 1971) on the main roosting areas of *B. bernicla, A. fabalis, A. fabalis brachyrhynchus,* and *A. albifrons,* whereas data on the main haunts for the most numerous goose species *A. anser* have not yet been treated and are therefore not included in the present survey.

With the exception of a few small and unimportant areas, all wetland game reserves and some scientific reserves are included in the text, and unless otherwise stated, the shooting of waterfowl in these areas is prohibited.

THE WADDENSEA AND ADJACENT PARTS OF THE NORTH SEA

District A

The North-west European Waddensea extends from N. Holland in the Netherlands along the NW. German coast to Skallingen in Denmark. This unique waterfowl habitat is characterized by vast tidal mud- and sand-flats between the European mainland and a protecting barrier of small islands, and comprises altogether an area of 7,000–8,000 km², of which 600 km² are in Denmark. In the Danish Waddensea the difference between ebb and flood varies from about one metre in the northern part to about two metres in the southern part. The region is comprised of the following main types of waterfowl habitat: 1) Reclaimed areas, now existing as meadows and fields behind dykes (e.g. Højer Enge, Ballum Enge and Tarp Enge). 2) Coastal marshlands on the mainland and along the east coast of Skallingen, Fanø, Mandø and Rømø. In many places there is luxuriant salt marsh vegetation, and many small more or less permanent waterbodies. In some places there are small-scale reclamation projects with fascines, e.g. along the dam between Jutland and Rømø and south of Højer. 3) Tidal mud- and sand-flats comprising most of the area between the mainland and the islands; these are flooded at high tide and mostly dry or with very shallow water during low tide. 4) Sloughs between the islands, which branch off eastwards, and have deep water during both flood and ebb. 5) Barren sand-banks around and to the west of the islands, dry during normal high tides. 6) Open waters west of the islands, with shallow areas (< 10 m depth) extending 8–15 km out into the North Sea.

The Waddensea contains two game reserves, Albuebugten east of Fanø (9 km²) and the Jordsand reserve including the southernmost one-sixth of the Danish Waddensea (100 km²). In addition, shooting and access are prohibited in a zone on both sides of the Rømø dam (ca. 25 km²).

The Waddensea and adjacent parts of the North Sea represent some of the most important haunts for waterfowl in Denmark. The area is unimportant as regards swans and coot, but all species of dabbling ducks and some diving ducks occur there in notable concentrations. In addition, the tidal flats hold some of the largest numbers of *B. bernicla* in Denmark, and some of the reclaimed areas and coastal marshlands are visited by large flocks of *A. f. brachyrhynchus;* no other habitat in Denmark has so many waders and gulls as the Waddensea.

Dabbling ducks

The most numerous and widespread dabbling ducks are *A. platyrhynchos, A. penelope* and *T. tadorna.* Some areas are also important for *A. crecca,* and occasionally large flocks of *A. acuta* and *A. clypeata* are found. In summer *T. tadorna* is very common, probably occasionally moulting in the southernmost part of the Danish Waddensea, whereas the numbers of other dabbling ducks are negligible. From Aug. numbers increase, and in the periods Sept.–Dec. and March–April huge concentrations containing several species can be found in almost all parts of the Waddensea. In mid-winter mostly only *A. platyrhynchos, T. tadorna* and a small number of *A. penelope* remain, but even these species can be extremely scarce during cold spells when the tidal flats are frozen.

Peak numbers of dabbling ducks were recorded in the autumn. In aerial surveys (see Fig. 74) more than 50,000 birds were recorded in eight surveys, and more than 75,000 in three surveys, including the record of 86,000 in Nov. 1968. The number of *A. platyrhynchos* regularly exceeds 20,000 (the highest number being 38,000 in Dec. 1972), while *A. penelope* regularly exceeds 20,000 (38,000 in Oct. 1969, and 54,000 in Oct. 1970), and *T. tadorna* regularly exceeds 10,000 (records being 22,000–24,000 in Sept.–Oct. 1969 and 1971). In spring the numbers of *A. platyrhynchos* and *T. tadorna* are smaller, and relatively few *A. penelope* are found. At low tide *A. platyrhynchos, A. penelope* and *T. tadorna* are widely scattered over the sand- and mud-flats, often along sloughs, while *A. crecca, A. acuta* and *A. clypeata* are more confined to the sheltered coastal areas. During flood most *T. tadorna* move to the dry sand-banks west of the islands, but other dabbling ducks concentrate along the coast, and the most important areas of concentration are the Rømø Dam, Højer, Mandø, Kammerslusen, Skallingen and Tarp Enge. During westerly storms when the water rises above normal level, very impressive concentrations are found in these areas, particularly along the Rømø Dam, where more than fifty thousand can shelter. In very rough weather large flocks move to neighbouring areas, e.g. Ribe Holme, Ballum Enge and Højer Enge, where

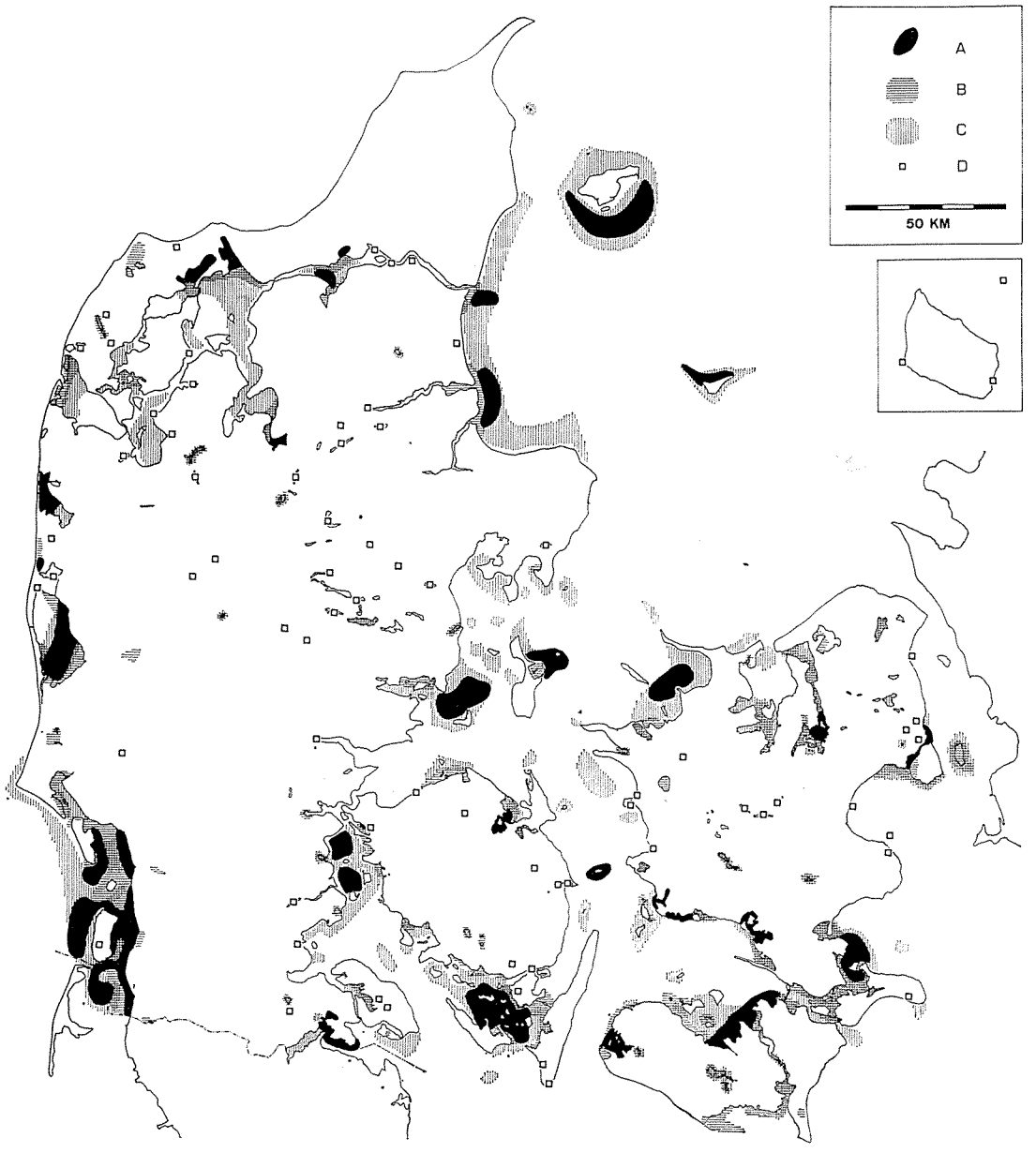


Fig. 71. The main haunts of dabbling ducks, diving ducks, swans and coot during Sept.–May in Denmark and surrounding waters.

A (black) shows areas of extreme importance, with regular occurrence in several months every year of either

1) more than 15,000 birds with at least two of the above categories represented in very large numbers, or

2) more than 25,000 birds of only one of the categories (in most cases seaducks).

B and C (hatching) show very important areas with regular occurrence of one or more of the following:

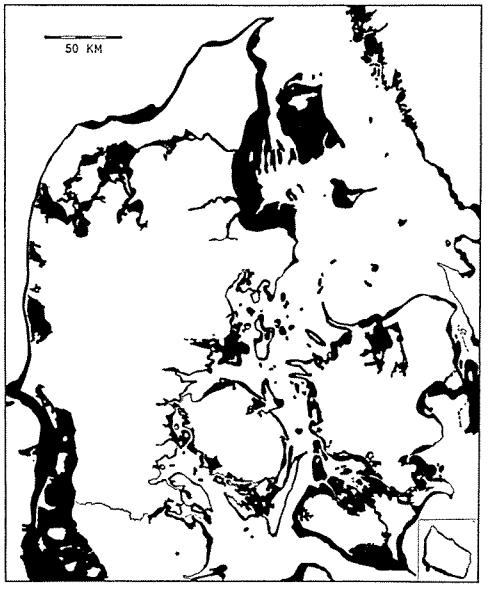
B (horizontal hatching) $>$ 1,500 *A. platyrhynchos*, $>$ 750 other dabbling ducks, $>$500 *C. olor*, $>$ 250 *C. cygnus*, and/or $>$ 100 *C. columbianus*.

C (vertical hatching) 2,000 diving ducks and/or 2,000 *F. atra*.

In cases where hatching covers large continuous areas several such concentrations may occur.

D (open squares) show inland and isolated coastal areas with regular occurrence of a variety of species, generally in rather small flocks but occasionally in large ones.

Fig. 72. The distribution of salt- and brackish water of less than 10 m. depth. Practically all other waters are less than 50 m. deep. The Waddensea is the only salt-water area in Denmark with a true tide, but along all other coasts changes in the water level (1–2 m.) caused by the wind frequently occur.



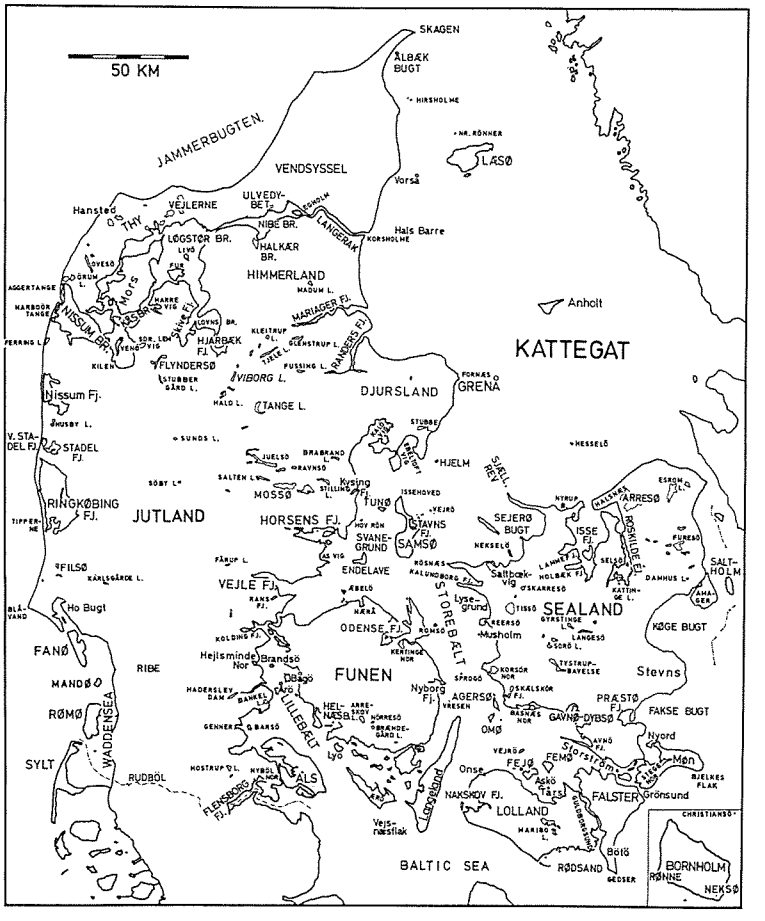


Fig. 73. The position of most of the place names mentioned in the text, Chapter V.

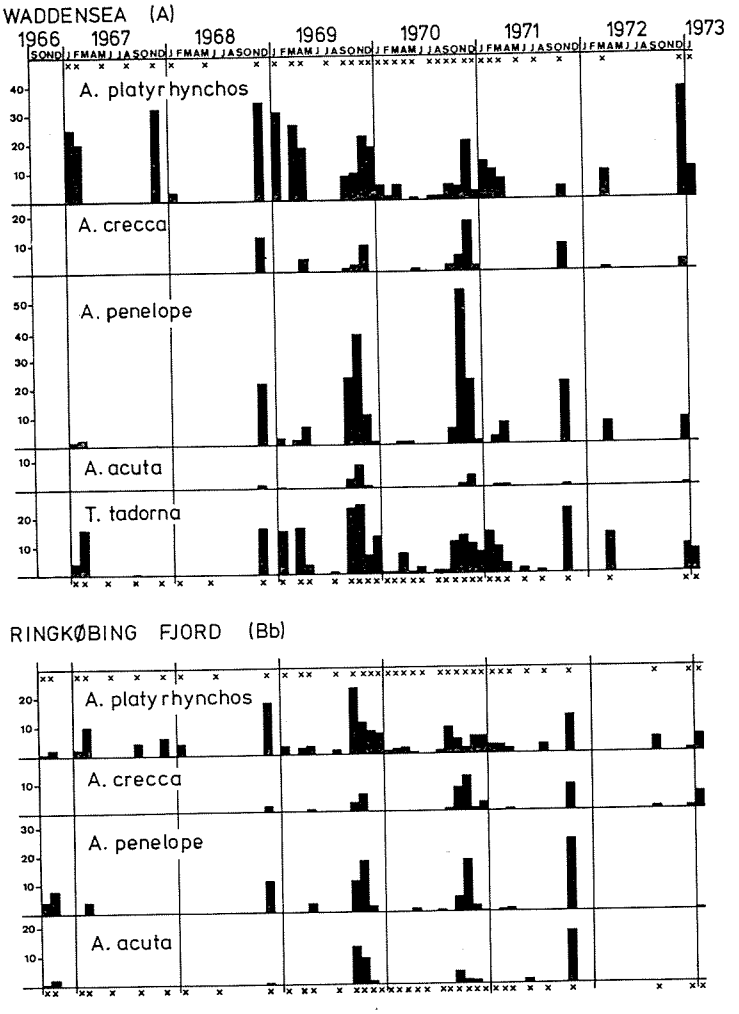


Fig. 74. Numbers of dabbling ducks (thousands) recorded during Sept. 1966 – Jan. 1973 in aerial surveys of the Waddensea (district A) and Ringkøbing Fjord (sub-district Bb). x indicates months with aerial surveys.

the birds occupy fields and meadows together with large flocks of waders. Without doubt movements to more distant and sheltered waters also take place, for example to the shallow coastal coves along the east coast of Jutland where unusually large flocks of *A. penelope* have been found in very rough weather, but these mostly disappear again when conditions in the Waddensea improve.

Diving ducks

Most diving ducks are very scarce in the Waddensea and waters to the west, for example compared to the waters around Sealand and Funen. Only *S. mollissima*, *M. nigra* and *M. merganser* regularly occur in large numbers.

S. mollissima is very common most of the year. In summer about 30,000 individuals undergo wing moult, mostly in waters around Jordsand but also between Rømø and Mandø. In autumn, winter and spring the species is more numerous and widespread, although mainly confined to the sloughs and waters around the dry sand-banks west of the islands. In eleven aerial surveys more than fifty thousand birds were recorded, including record values of 74,000 in Jan. 1969, 83,000 in Dec. 1969, 70,000 in March 1970 and 74,000 in Dec. 1972. Most mi-

gration to and from the Waddensea is across the Jutland peninsula, although movements along the west coast of Jutland are also regularly observed.

M. nigra occurs in the open North Sea west of the Waddensea, mostly several kilometres from the coasts. In summer huge numbers have been recorded moulting, and also in autumn, winter and spring notable concentrations are regularly found here, including the record of an estimated 200,000 in Dec. 1972. Only a relatively small proportion of the potential habitat has been covered in all aerial surveys, and possibly numbers present can be much larger (see p. 99). Generally *M. nigra* are widely separated from *S. mollissima*, although regularly a few hundred and occasionally a few thousand are found in the outermost parts of the sloughs between the islands.

Large concentrations of *M. merganser* regularly occur in winter and spring in the northern and central parts of the Waddensea, but mostly the birds only stay for a short period.

FIORDS AND LAKES OF W. JUTLAND

District B

The main waterfowl haunts in the westernmost part of Jutland between the Waddensea and the Limfjord comprise two shallow brackish fiords (Ringkøbing Fjord and Nissum Fjord), separated from the North Sea by a narrow isthmus, and two lakes (Fiilsø and Vest Stadil Fjord) with extensive surrounding fields. These wetlands represent some of the most important gathering areas in Denmark for dabbling ducks, *C. cygnus* and *C. columbianus*. *B. clangula*, *M. serrator* and *M. merganser* regularly occur in large numbers but most diving ducks are scarce and irregular; *F. atra* is very numerous during autumn migration. In addition, the entire Spitsbergen population of *A. f. brachyrhynchus* and all *B. b. hrota* wintering in Europe sojourn here during migration.

Fiilsø is a shallow lake, most of which was reclaimed in the 1940's. Today only about 2.5 km² remain surrounded by extensive fields and willow swamps. The area used by waterfowl is approx. 20 km². Several thousand *A. f. brachyrhynchus* roost in autumn and spring, and in addition dabbling ducks occur in large numbers, regularly between 2,000 and 3,000, occasionally 6,000–8,000, the most important being *A. acuta* (regularly 1,000–2,000, occasionally 3,000–5,000), and *A. platyrhynchos* (regularly 1,500), while *A. crecca* and *A. penelope* are less common (300–600). It is also a rather important area for *C. cygnus* (regularly 150–300) and *C. columbianus* (regularly 50–100, in spring occasionally 200–400).

Ringkøbing Fjord is about 325 km², less than four metres deep, and with adjacent coastal meadows (the peninsula Tipperne) and reedbeds on its eastern shore. It includes the scientific reserves Tipperne and Klægbanken which, including surrounding waters where shooting is prohibited, cover an area of 35 km². The reserves are very important breeding grounds for waders and ducks, and in summer a few thousand *A. platyrhynchos* and *C. olor* and a few hundred *B. clangula* and *M. serrator* undergo wing moult in the fiord. Large numbers of *A. f. brachyrhynchus* and *B. bernicla* are present in autumn and spring.

In Aug.–Nov. and March–May large concentrations of dabbling ducks occur, mainly in the central, eastern and southern parts of the fiord, around Klægbanken and Tipperne. In aerial surveys (see Fig. 74) more than 25,000 dabbling ducks have regularly been recorded in autumn, and occasionally as many as 50,000 are present, including the largest flocks of *A. acuta* in Denmark. In spring the total number of dabbling ducks regularly exceeds 10,000, and occasionally 25,000. During cold spells in winter the fiord is almost completely ice-covered within a few days, and under such conditions few dabbling ducks remain. The most important diving duck is *M. merganser*, which regularly occurs in dense concentrations of 3,000–5,000 birds. *B. clangula* is also numerous (regularly 1,000–2,000), and several hundred *M. serrator* occur, whereas *A. ferina* and *A. fuligula* are very scarce and other diving ducks extremely irregular. The three species of swans occur in large numbers, including the main concentrations in Denmark of *C. cygnus* and *C. columbianus* in spring. In autumn several thousand *F. atra* roost in the fiord, and up to 40,000 have been recorded.

Vest Stadil Fjord; this is a shallow lake 5 km² in area, surrounded by meadows, reedbeds and extensive fields (total area of waterfowl habitat approx. 20 km²). More than ten thousand *A. f. brachyrhynchus* are recorded regularly, and in addition large concentrations of dabbling ducks occur, regularly including 6,000–8,000 *A. platyrhynchos*, 3,000–5,000 *A. crecca*, 6,000–8,000 *A. acuta*, 1,000–3,000 *A. penelope*, 100–300 *A. clypeata*, and 300 *T. tadorna*. Occasionally much larger flocks are present in the area. Diving ducks are scarce, including only 50–200 *A. ferina* and *M. merganser*. Both *C. cygnus* and *C. columbianus* are regularly found in flocks of hundreds, although for shorter periods than in Ringkøbing Fjord and Nissum Fjord.

Stadil Fjord is a brackish-water fiord between Vest Stadil Fjord and Ringkøbing Fjord, and of relatively little importance for waterfowl. Only a few species regularly occur in larger numbers: *A. platyrhynchos* (100–200), *B. clangula* (100–300), *M. merganser* (400–700), *C. olor* (150–300), *C. cygnus* (100–150), and *F. atra* (600–800), but total numbers seldom exceed a thousand birds.

Husby-Nørresø consists of two connected lakes 2.5 km² in area between Vest Stadil Fjord and Nissum Fjord. These are relatively important for some dabbling ducks, *A. ferina* (regularly 200–300) and *F. atra*, but the total number of waterfowl rarely exceeds 500.

Nissum Fjord is approximately 85 km² in area and is a brackish fiord surrounded by coastal marshes and reedbeds in the southern part. Felsted Kog is a game reserve (17 km²) with restricted shooting (JEPSEN 1972). The fiord contains important breeding areas for waders, and is a very important roosting area for *A. f. brachyrhynchus* and *B. b. hrota* in spring. In autumn and spring several dabbling ducks regularly occur in notable concentrations, mainly in the northernmost very shallow Bøvling Fjord: 5,000–7,000 *A. platyrhynchos*, 1,000 *A. crecca*, 1,000–2,000 *A. acuta*, 2,000–4,000 *A. penelope*, 200–400 *A. clypeata*, and 750 *T. tadorna*. Diving ducks are mainly confined to the central and southern parts, including the regular occurrence of 100–200 *A. ferina*, 100–300 *A. fuligula*, 1,000–1,500 *B. clangula*, 300–500 *M. serrator*, and 1,500–2,500 *M. merganser*. Large concentrations of all three swan species are regular, for example 1,000–2,000 *C. olor*, 400–1,000 *C. cygnus*, and 500–1,000 *C. columbianus*, and a few thousand *F. atra* are recorded nearly every autumn.

THE LIMFJORD AND THY-VENDSYSSEL

Districts C and D

The Limfjord is a very serrated fiord system, extending through the Jutland peninsula and connecting the North Sea with the Kattegat. The area contains more varied waterfowl habitats than any other part of Denmark, including several reclamation projects which were never completed. The habitats of the fiord can roughly be divided into three types: 1) Coastal lagoons, formerly branches of the fiord system and now separated from the Limfjord by dams, ranging from fresh-water lakes with extensive surrounding meadows and reedbeds to deeper brackish fiords with little marginal vegetation. – 2) Shallow salt-water areas in the Limfjord, often around small islands and islets, and with adjacent meadows. – 3) Central parts of the wider fiord sections, mostly between five and ten metres and locally up to fifteen metres deep. In addition the few important inland waters in Thy and Vendsyssel and just south of the Limfjord are considered here.

The Limjord has a variety of waterfowl species occurring in important concentrations. In summer the main moulting areas of *B. clangula*, *M. serrator*, *M. fusca*, and *A. marila* are found here, and flocks of the two last-mentioned species can also be observed in autumn. However throughout winter and spring the true seaducks are very scarce, being confined to the westernmost part, where *S. mollissima* and *M. nigra* occur in small groups. In autumn and spring large concentrations of several dabbling ducks, *A. ferina*, *C. cygnus*, *C. columbianus* and *F. atra* occupy the coastal lagoons and shallow salt waters, but in most winters when such habitats are ice-covered these species are relatively scarce. Throughout the autumn, winter and spring the central parts of the fiord system are dominated by *B. clangula* and *M. serrator*. In country-wide surveys in Jan. between 13,000 and 50,000 *B. clangula* have been recorded, representing two-fifths of the total Danish population. Peak

numbers of *M. serrator* are found in late autumn, reaching three-quarters of grand total recorded in country-wide surveys in Nov., and large flocks are also regular in winter. In mid-winter between 3,000 and 10,000 *M. merganser* have been recorded.

Although *B. clangula* and the mergansers mainly occupy relatively open salt waters during daytime, they regularly perform dusk and dawn flights to coastal lagoons, and occasionally stay here during the daytime, particularly in rough weather. In contrast species which mainly occupy coastal lagoons (dabbling ducks and *A. ferina)* perform dusk and dawn flights to surrounding areas, both the more open stretches of the Limfjord and inland waterbodies in northern and probably also Central Jutland.

The western Limfjord and Thy

Harboør Tange, Agger Tange, Krik Vig and Fjordgrund (total area of waterfowl habitat approx. 80 km²). The westernmost part of the Limfjord comprising the two peninsulas Harboør Tange and Agger Tange (with meadows and coastal lagoons) and the shallow salt waters to the east are a very important waterfowl haunt. Many waders breed on the peninsulas, and in spring 3,000–4,000 *A. f. brachyrhynchus* occur here. In autumn, winter and spring dabbling ducks are very numerous, mainly in the lagoons, but also in the shallow parts of the Limfjord, including the regular occurrence of 2,000–3,000 *A. platyrhynchos* and *A. crecca*, 1,000 *A. acuta*, 3,000–6,000 *A. penelope*, and 1,000 *T. tadorna*. In the lagoons (mainly on Agger Tange) and in Krik Vig a few hundred *C. olor*, 400–700 *C. cygnus*, and smaller flocks of *C. columbianus*, 1,000–2,000 *M. merganser* and a few thousand *F. atra* are regularly seen, and on deeper water in the western Limfjord thousands of *B. clangula* and several hundred *M. serrator* occur, particularly when central parts of the Limfjord are ice-covered. Fladesø and Ørumsø, two shallow lakes 9 km² in area and north of Krik Vig are relatively unimportant for waterfowl, although in Ørumsø a few hundred dabbling ducks and small flocks of diving ducks, swans and coot regularly occur.

Venø Bugt and Kås Bredning; these form a very important area for diving ducks, including several thousand *B. clangula*, and hundreds of *A. marila*, *M. serrator* and *M. merganser*, all mainly confined to open water. In Kås Lake (0.7 km²), the coastal lagoons Sdr. Lem Vig (4 km²) and the game reserve Kilen (4 km²) and the shallow coastal waters in Nørskov Vig (1 km²), Harre Vig (4 km²) and the game reserve Klosterfjord (2 km²) many other species occur, mostly in rather small flocks, although several hundred *A. platyrhynchos*, *A. crecca* and *A. penelope* are occasionally found.

Flyndersø, Skallesø and Stubbergård Lake; these three lakes of 8 km² area east of Venø Bugt are visited by 1,000–2,000 *A. platyrhynchos*, 500–2,000 *A. crecca*, 1,000–2,000 *M. merganser*, and small flocks of several other species. The largest numbers are generally found in Flyndersø.

Waters from Jegindø to Visby Bredning and Dragstrup Vig, including the small coastal lagoons Glomstrup Vig (1 km²) and Doverkil (0.2 km²), the shallow coastal waters around Agerø and neighbouring islets, the narrow fiords Skibsted Fjord and Næs Sund and more open stretches north of Jegindø and in Visby Bredning; large concentrations of dabbling ducks regularly occur, particularly around Agerø (2,000–3,000 *A. platyrhynchos*, 300–500 *A. crecca*, 2,000–3,000 *A. penelope*, and 300–500 *T. tadorna)*, and the deeper waters hold 2,000–4,000 *B. clangula* and *M. serrator* and several hundred *M. merganser*.

Ovesø; this lake of 5 km² is north of Visby Bredning. It is a gathering area for *A. fabalis* (regularly 200–400), *A. platyrhynchos* (500–1,000), *A. crecca* (200–400), *A. acuta* (75–150), *A. penelope* (200–300), *A. ferina* (50–150), *C. cygnus* (25–50, occasionally 150), and *F. atra* (100–250). In Villerslev Mose (0.2 km²) and Nørhå Lake (0.7 km²) at the southern and northern ends respectively of Ovesø, several species occur, mostly in small numbers.

Nors Lake (4 km²), Vanned Lake (4 km²) and the adjacent Hansted game reserve (36 km²) with several small ponds, is regularly visited by *A. fabalis* (100–300), *A. platyrhynchos* (1,000–3,000), *A. crecca* (300–600), *A. penelope* (500–1,500), *A. fuligula* (200–400), *B. clangula* (50–100), *C. cygnus* (25–75), and *F. atra* (250–500).

The Central Limfjord and Hanherred

Vejlerne (a scientific reserve with restricted shooting, 60 km²) and Lønnerup Fjord (2 km²), are a series of coastal lagoons surrounded by extensive meadows and reedbeds. In several respects they form a unique waterfowl habitat with many breeding waders, ducks and geese

and also they are an important moulting area for ducks and *A. anser* (PALUDAN 1965, 1973). In autumn, winter and spring they are one of the most important gathering areas for dabbling ducks in Denmark. More than 5,000 *A. platyrhynchos*, 5,000 *A. crecca*, 500 *A. acuta*, 5,000 *A. penelope*, 250 *A. clypeata*, 200 *T. tadorna*, 500 *A. ferina*, 400 *C. cygnus*, 300 *C. columbianus*, and 3,000 *F. atra* are found regularly, and occasionally much larger concentrations occur. Occasionally a few thousand *B. clangula* and *M. serrator* visit the lakes in Vejlerne.

The northern part of Løgstør Bredning, comprising shallow coastal waters south of Vejlerne from Sennels to Aggersborg, with several small islets and coastal meadows. This is a very important area for most of the species occurring in Vejlerne-Lønnerup, and probably also very much the same birds moving regularly between the lagoons and the salt-water areas. The most important species in Løgstør Bredning are *A. penelope*, *A. platyrhynchos* and the yellow-billed swans.

The waters from Central Løgstør Bredning to Skive Fjord and Lovns Bredning, and between Mors and Fur; in summer the largest Danish concentrations of moulting *A. marila*, *M. fusca* and *M. serrator* are found here, and in autumn, winter and spring thousands of *A. marila*, *B. clangula*, *M. serrator* and *M. merganser* regularly occur in offshore waters. In shallow coastal waters (e.g. Dråby Vig, Lovns Bredning and Bådsgård Vig) several hundred *T. tadorna*, *A. platyrhynchos* and occasionally other dabbling ducks occur.

Hjarbæk Fjord; this is a brackish fiord, 28 km² in area and a game reserve since 1967. It is the most important moulting area in Denmark for *B. clangula*. In autumn, winter and spring several species of ducks gather here, and are found in increasing numbers since the area was declared a reserve. In later years the following numbers have regularly been recorded: 2,500 *A. platyrhynchos*, 500 *A. crecca*, 500 *A. penelope*, 250 *A. clypeata*, 500–1,000 *T. tadorna*, 500–1,000 *A. ferina*, 2,500 *A. fuligula* (occasionally up to 10,000), 300–400 *A. marila*, 3,000–4,000 *B. clangula*, 100–500 *M. merganser*, 50–100 *C. cygnus*, and 7,000–16,000 *F. atra*. In the small Ørslev Kloster Lake (0.4 km²) at the north end of the fiord, several species occur, mostly in small numbers.

The eastern Limfjord between Aggersund and Ålborg

Ulvedybet; a coastal lagoon of 7.5 km² and a game reserve. Very important for ducks, with the following concentrations regularly recorded: 5,000 *A. platyrhynchos*, 5,000 *A. crecca*, 5,000 *A. penelope*, 1,000 *A. acuta*, 100 *A. clypeata*, 5,000–7,000 *A. ferina* (the most important gathering area in Denmark), 200–500 *A. fuligula*, 1,000–2,000 *B. clangula*, 100–300 *C. cygnus*, and 2,000–5,000 *F. atra*. Numbers are occasionally much higher, e.g. 15,000 *A. platyrhynchos*, 5,000 *B. clangula*, and 12,000 *F. atra*, and in later years peak numbers of all species recorded on one day were between 16,000 and 22,000.

Nibe Bredning, comprising the shallow waters around the islets Troldholme, Vår Holm and Klosterholm, the open stretches between Gjøl, Øland and Nibe, and the coastal lagoon Halkær Bredning (6 km²); at the town of Nibe there is a small game reserve (1.3 km²). The area is extremely important for dabbling ducks, diving ducks, swans and coot. The following numbers have regularly been recorded in the whole area: 5,000–8,000 *A. platyrhynchos*, 500–750 *A. crecca*, 5,000 *A. penelope*, 400–600 *T. tadorna*, 200–400 *A. ferina*, 2,000–3,000 *A. fuligula*, 2,000–4,000 *B. clangula*, 300–500 *M. serrator*, 1,000–2,000 *M. merganser*, 500–1,000 *C. olor*, 500–1,000 *C. cygnus*, and 20,000 *F. atra* (up to 42,000).

Vendsyssel

The land north of the eastern Limfjord contains few lakes but several extensive moorlands, nowadays mainly cultivated, but some still with permanent waterbodies. The main areas are Råbjerg Mose, Store Vildmose and Koldmose-Vedsted Kær. Rather little information is available on inland waters in Vendsyssel (see p. 12), but the data does not suggest that any of the sites regularly hold larger flocks, and thus they are not qualified to be included on the map Fig. 71.

THE NORTH SEA COAST BETWEEN BLÅVAND AND SKAGEN

Districts B, C and D

The very straight coastline between Blåvandshuk and Skagen has a comparatively steep profile. Along most stretches the ten metre depth contour lies 1–2 km out at sea, and only around Blåvandshuk and along the north coast of Thy and Hanherred do shallow areas extend further out.

Although many ducks follow the coast on their migration movements very few sojourn, *M. nigra* being the only regular species, occurring both during summer moult and at other seasons. The most important haunts of this species are in the areas with shallow water mentioned above, while numbers congregating elsewhere are generally small. Occasionally small groups of *M. fusca, S. mollissima* and *Cl. hyemalis* are found on the water, but altogether the unprotected North Sea coast is the least important gathering area for *Anatidae* in Danish waters.

THE NORTHERN KATTEGAT

District E

The northern Kattegat between Skagen in the north and Grenå, Djursland, in the south is a relatively uniform region. On its western border three narrow fiords extend into the Jutland peninsula, and along the coast they are connected by very shallow tidal zones. The most important habitats as regards bird numbers are however the huge areas of shallow offshore water along the coasts of Djursland, Himmerland and Vendsyssel and around the islands Læsø and Anholt. More than 4,000 km² of open water with a depth of less than ten metres are found here, in many places extending more than fifteen kilometres out to sea.

The fiords and Himmerland

The outermost parts of Randers Fjord, Mariager Fjord and Langerak (the easternmost part of the Limfjord) are important areas for many species of waterfowl, particularly waders, *B. bernicla* and dabbling ducks. Total numbers found in the whole area regularly comprise more than 10,000 *A. platyrhynchos*, 1,000–1,500 *A. penelope*, and 2,000–3,000 *T. tadorna*, the area being the most important haunt outside the Waddensea for the last mentioned species. Large numbers of dabbling ducks can be found in all three fiords, and also between Langerak and Korsholmene, and along the Kattegat coast outside and between Mariager and Randers Fjords. However, the outermost part of Mariager Fjord generally holds the largest flocks, and this area also contains the largest wintering concentrations of *C. olor* (1,500–2,500) and *C. cygnus* (300–500) in E. Jutland. Other species occurring regularly are 500–1,000 *M. merganser* and several hundred *M. serrator* and *B. clangula. A. ferina, A. fuligula* and *F. atra* are mostly found in rather small numbers (up to a few hundred) mainly in the interior parts of the three fiords, for example in the small game reserve at Hobro (3 km²).

Himmerland contains the small lake of Madumsø (2 km²), with a regular occurrence of 1,000 *A. platyrhynchos* and 1,000–2,500 *A. fuligula*. In the small ponds in Lille Vildmose 500–1,000 *A. platyrhynchos* and 200–300 *A. crecca* are regularly observed, and on adjacent pastures a few hundred *A. fabalis* are found.

Open waters in the N. Kattegat

Four seaduck species are extremely abundant in the offshore waters of the N. Kattegat, viz. *S. mollissima, M. nigra, M. fusca* and *A. marila*. The first three are very widespread in the region throughout the year (including large numbers undergoing wing moult in summer), while *A. marila* is confined to waters off the east coast of Jutland, where several thousand occur in autumn. In addition *Cl. hyemalis* is widespread, but mostly found only in small flocks. Up to 200,000 seaducks have been recorded in the N. Kattegat in country-wide surveys, but since only relatively small parts of the potential habitat were covered (see p. 18), actual numbers may be considerably higher.

Large numbers of seaducks pass Skagen, the northernmost point of Jutland, during migration, but the number of birds resting in the adjacent waters seldom exceeds a few hundred or at the most a few thousand. In addition the Ålbæk Bugt and waters around the islets Hirsholmene (a scientific reserve) are relatively unimportant, except for *A. platyrhynchos* (up to a few thousand in the latter area). Further south large con-

centrations can be found almost everywhere, but the large majority of birds occur in three extensive areas described below.

Around the island of Læsø both *S. mollissima*, *M. nigra* and *M. fusca* are found in very large concentrations, and most regularly between the south coast and the shoals Mellemgrund–Kobbergrund and Søndre Stenrøn, where up to 40,000 *M. nigra*, 8,000 *M. fusca*, and 80,000 *S. mollissima* have been recorded.

Around the island of Anholt, particularly along the north coast and on the shoal extending in a north-westerly direction, up to 20,000 *M. nigra* and 80,000 *S. mollissima* have been found. The impression is that birds often move between the waters of Læsø and Anholt.

In offshore waters off the east coast of Jutland between Voerså and Gerrild, the three main species are extremely abundant. *S. mollissima* is mainly confined to a few areas, for example waters between Korsholmene and Hals Barre and areas east of Mariager Fjord, and here dense flocks with tens of thousands are regularly found, while numbers present elsewhere seldom exceed a few thousand. The two *Melanitta* species are less predictable in this respect, and can be found in dense flocks or widely scattered over the whole area marked with hatching in Fig. 71. Total numbers of *M. nigra* often exceed 20,000, and up to 20,000 *M. fusca* have been recorded.

THE SOUTHERN KATTEGAT AND THE STOREBÆLT

Districts F, S and N

The region comprises waters between Djursland, E. Jutland, N. Funen, N. Langeland and W. and NW. Sealand east to Hesselø and Halsnæs. The region has a much greater variety of waterfowl habitats than the northern Kattegat, and comprises coastal lagoons, both straight and serrated coastlines with deep and shallow fiords and bays, about forty islands and islets of which only fifteen are inhabited, and large stretches of open water with many shallow shoals. Seaducks are the most numerous, but several important areas for coastal species are also found. In addition to three game reserves treated below, the region comprises small game reserves at Ebeltoft (2 km²), Vejle Fjord (2 km²), Fredericia (1.4 km²) and Fogense Enge (2.6 km²).

Coastal waterfowl habitats

Kysing Fjord is a brackish lagoon of 3 km² and a game reserve. It is a very important haunt particularly for dabbling ducks in autumn, including the regular occurrence of 1,000–2,000 *A.platyrhynchos*, 100–250 *A. crecca*, 250 *A. acuta*, 1,000–1,500 *A. penelope*, and 100 *A. clypeata*. Several diving ducks are also abundant, including more than 100 *A. ferina*, 1,000–1,500 *A. fuligula*, 250 *B. clangula*, 200–400 *M. merganser*, and in addition some of the largest concentrations in E. Jutland of *F. atra* (2,000–3,000).

Horsens Fjord; this is a very shallow fiord with three small islands (Hjarnø, Alrø and Vorsø) and several islets. In autumn up to 500 *A. penelope* are found, particularly in the northern part, where also several hundred *T. tadorna* and thousands of waders occur in spring. In winter *A. platyrhynchos* is the most abundant species along the coast (regularly 1,000 and occasionally 3,000 occurring), while *B. clangula* (1,000, occasionally 2,000–3,000) and *M. merganser* (500–1,000) are mostly found in deeper central parts of the fiord.

Stavns Fjord, Samsø; a shallow fiord with several small islets, 18 km² in area, and a game reserve with shooting restricted to Oct.–Dec. inclusive. On the islets the largest breeding colony of *S. mollissima* in Denmark is found (2,000 pairs in 1970). In autumn and spring there are numerous dabbling ducks (regularly 500–1,000 *A. platyrhynchos*, 500 *A. crecca*, 100 *A. querquedula* and *A. acuta*, and 500 *A. penelope*). From late autumn to March *B. clangula* and *M. merganser* are the most abundant, mostly a few hundred birds, but occasionally more than a thousand occur. Throughout the year *C. olor* is numerous (300–700), and in winter 50–200 *C. cygnus* visit the fiord. In spring large flocks of waders and a few hundred *B. bernicla* roost.

Nærå Strand – Æbeløholme, N. Funen; shallow coastal waters with the regular occurrence of 1,000 *A. platyrhynchos*, 100–200 *A. crecca*, 100–150 *A. penelope*, 20–80 *A. clypeata*, 200–400 *T. tadorna*, a few hundred *B. clangula* and *M. serrator*, 50–100 *M. merganser*, 100–400 *C. olor*, and occasionally more than a thousand *F. atra*. Seaducks are numerous in adjacent deeper waters (see p. 142), and *A. albifrons* occurs regularly on the estate of Gyldensteen.

Odense Fjord, N. Funen (65 km²), is a rather closed fiord with several islets and large shallow areas in the southern and north-eastern parts. In autumn and spring the two most numerous dabbling ducks are *A. penelope* (regularly 500, occasionally 1,000), and *T. tadorna* (500–1,000), but much larger numbers are present in winter, including 3,000–10,000 *C. olor*, 150 *C. cygnus*, several thousand (up to 15,000) *F. atra*, and between a few hundred and a thousand *B. clangula*, *M. serrator* and *M. merganser*. Occasionally a few hundred *S. mollissima* shelter in the northern part of the fiord.

Kertinge Nor – Kerteminde Fjord; a brackish and shallow lagoon (9 km²) connected to the Storebælt. It is visited by many species, mostly however in rather small numbers. The largest concentrations are found in winter, when 1,000 *A. fuligula*, 200–400 *B. clangula*, 500 *C. olor*, and 1,000 *F. atra* regularly occur.

Skælskør Fjord and adjacent areas, SW. Sealand, is comprised of the brackish lagoon Skælskør Nor (3 km², partly a game reserve), the narrow Skælskør Fjord (3 km²), the marshland Borreby Mose (1 km²) and stretches of open shallow coastal waters outside the fiord. They form an important gathering area, particularly in midwinter when many thousand *A. fuligula* and *F. atra*, several hundred *A. ferina*, *B. clangula*, *M. merganser* and *C. olor* occur. Also 50–100 *C.columbianus* and a few hundred *C. cygnus* are regularly seen, some in and just outside Skælskør Fjord itself, but most occur around the small island of Egholm further west.

Korsør Nor (8 km²) is a shallow coastal lagoon with a regular occurrence of 200–300 *A. platyrhynchos*, 30–75 *T. tadorna*, 25–30 *A. ferina*, 500–1,500 *A. fuligula*, 200–300 *B. clangula*, 150–300 (occasionally 550) *C. olor*, and 750–1,500 (occasionally 2,500) *F. atra*.

Tudeå, Reersø (Vejlen and Flasken) on W. Sealand, Nyborg Fjord and Holckenhavn Nor on E. Funen regularly hold a variety of species, including dabbling ducks, diving ducks, swans and coot, mostly in small flocks.

Kalundborg Inderfjord, comprising the harbour and adjacent shallow waters in the eastern part of Kalundborg Fjord (4 km²) is a game reserve. It is an important area in autumn and spring for *A. platyrhynchos* (1,000–2,500), *A. penelope* (250), and smaller flocks of other dabbling ducks. In winter *A. fuligula* is the most numerous species (3,000–4,000 and occasionally more than 10,000), and 250 *A. ferina* and 1,000–2,500 *F. atra* are also regularly found.

Saltbækvig; a shallow coastal lagoon, with surrounding reedbeds and meadows (total 25 km²). Several hundred *A. anser* and a few hundred *A. fabalis* regularly occur, and in autumn and spring dabbling ducks are numerous (1,000–2,000 *A. platyrhynchos*, 300–600 – on one occasion 5,500 – *A. crecca*, 500–1,000 *A. penelope*, 200–300 *A. acuta*, 150–300 *A. clypeata*, and 50–100 *T. tadorna*). Diving ducks in winter include 200–500 *A. fuligula*, and small groups of *C. cygnus* (25–75) are regularly seen. In two shallow bays along the coast a few hundred *T. tadorna* and large flocks of waders are found in spring.

Hov Vig, Issefjord; a small lagoon (1 km²) with 200–400 *A. platyrhynchos*, *A. crecca* and *A. penelope* present in autumn and spring. In addition 50–100 *A. ferina*, 200–400 *F. atra*, and 25–75 *C. columbianus* occur regularly. The area is one of very few regular haunts of the last-mentioned species in eastern Denmark.

The southern parts of Issefjorden, including the shallow inlets Lammefjorden, Holbæk Fjord and waters from Orø to Tempelkrogen; large numbers occur particularly in winter, including several hundred *A. platyrhynchos*, *B. clangula*, *M. merganser* and *C. olor*, and also a few thousand *F. atra*.

Open waters of the S. Kattegat and Storebælt

The open waters hold much larger concentrations of waterfowl than the coastal areas, comprising however only a few species af seaducks, the three most numerous being *S. mollissima*, *M. nigra* and *M. fusca*. All three are numerous during the wing moult in summer, but much larger numbers are found in autumn, winter and spring. *S. mollissima* is by far the most widespread and numerous, in winter surveys being recorded in numbers varying from 110,000 to 300,000. *M. nigra* is also very common (10,000–50,000), while *M. fusca* is confined to a few areas (3,000–11,000). *A. marila* is a regular visitor in autumn and occasionally in winter, particularly in waters off E. Jutland, and *Cl. hyemalis* is widespread but mostly recorded in rather small numbers.

The region comprises four extremely important haunts where more than 25,000 seaducks are almost permanently found in autumn, winter

and spring, and in addition many areas with thousands regularly occurring.

The most impressive concentrations in Denmark of *S. mollissima*, regularly exceeding fifty thousand, are found in waters between Gylling Næs and Endelave, including large shoals with beds of the common mussel *(Mytilus edulis)* at Svanegrunden (20 km² less than 4 m deep) and Møllegrunden (10 km²). In the northern part of this area *M. nigra* and *M. fusca* are also common, and thousands of *A. marila* visit waters around Endelave.

In the waters east of Samsø around the islets Kyholm, Lindholm, Vejrø and Bosserne more than 30,000 seaducks have regularly been recorded. Between Sejerø, Nekselø and the coast of Sealand 25,000 are regularly found, of which *M. nigra* and *M. fusca* make up the majority. Shoals around the island Sprogø in the Central Storebælt regularly hold huge assemblies of *S. mollissima* and occasionally *M. nigra.*

In addition to the four main seaduck haunts, thousands occur regularly and more than ten thousand occasionally in the following areas (main species given in brackets): southern parts of Kalø Vig and Ebeltoft Vig *(S. mollissima, M. fusca* and *A. marila)*, waters around Hjelm *(S. mollissima)*, Mejlflak *(S. mollissima* and *M. nigra)*, south of Tunø *(M. nigra* and *M. fusca)*, Tunø Knob *(S. mollissima)*, Issehoved *(S. mollissima)*, Ringebjerg Sand, W. Samsø *(S. mollissima)*, around Æbelø *(S. mollissima, M. nigra* and *M. fusca)*, north of Fynshoved *(S. mollissima)*, Romsø *(S. mollissima)*, Vresen *(S. mollissima* and *M. nigra)*, around Omø and Agersø *(S. mollissima* and *M. nigra)*, Musholm *(S. mollissima)*, south of Asnæs *(S. mollissima* and *M. nigra)*, Røsnæs *(S. mollissima)*, and Nyrup Bugt – Grønnerevle – northern Issefjord *(S. mollissima)*. In several other areas not marked on Fig. 71 a few thousand seaducks are occasionally found, e.g. at Hesselø.

CENTRAL JUTLAND

Districts G and H

The total number of standing fresh-water bodies in Jutland probably exceeds a thousand, but the great majority are very small ponds, bogs and temporarily flooded marshes. Only about one hundred permanent lakes are larger than 0.25 km² and a mere twenty-five larger than 2 km², including only four of more than 5 km². The number of watercourses is also large, but most are rather short and narrow brooks, and less than ten small rivers are more than fifty km long. Inland waterbodies in Jutland have changed considerably in the last hundred years; many ponds have been filled in, and a large number of permanent and temporarily flooded marshes have been drained, including the valleys of nearly all small rivers, which nowadays are to a great extent regulated by dykes. In moorlands however, new permanent waterbodies have been created as a result of peat-digging in this century. In later years artificial ponds have been established in increasing numbers.

In previous chapters the important fresh-water habitats of western and northern Jutland have been treated. Here a brief description of waterfowl haunts in Central Jutland is given, mainly covering the districts G and H, but also including a few localities in E, F and A. Most lakes in this region are found in the northern and eastern parts which were glaciated during the last Ice Age, particularly in lateral moraine areas and in valleys created by sub-glacial streams. In contrast few lakes are found in the heathland plains of western Jutland, where bogs and streams with their surroundings are the most important waterfowl haunts.

Compared to the surrounding areas of sea and coastal lagoons, waters in the central parts of Jutland are of little importance for day-visiting waterfowl. In country-wide surveys the districts G and H comprised 0.5–1.5% of the total number of ducks, swans and coot recorded in the whole of Denmark. It must however be emphasized that many inland waters are regularly visited particularly by dabbling ducks on feeding flights during dusk and dawn, and accordingly the results of day-time counts in the present study under-estimate the value of these waterbodies (see p. 166).

The most numerous and widespread species is *A. platyrhynchos*, which in country-wide surveys comprised approximately two-thirds of all waterfowl recorded in districts G and H. The species is a regular visitor to a large number of lakes and marshes and an occasional visitor to most ponds and bogs. Few other species are regular and widespread, the most common being *A. crecca, A. fuligula* and *F. atra.* In addition *A. ferina, B. clangula, M. merganser, C. olor* and *C. cygnus* are typical inland visitors, however confined to a limited number of localities. Other species, for example *A. penelope, T. tadorna* and *A. marila* are found regularly only in very few

localities, and of the typical marine species there are extremely few records, mainly consisting of *M. nigra* in some of the larger lakes.

In the map Fig. 71, seven localities regularly holding large quantities of waterfowl are indicated by hatching and are described in this chapter. Of the nineteen localities marked with open squares, indicating regular occurrence of a variety of species, only those which regularly hold larger flocks of one or more species are included in the following text. The districts G and H comprise three wetland game reserves, Holstebro (1.2 km²), Bønstrup Lake (0.2 km²) and Ribe Lake (1.4 km²); only the latter is important for waterfowl.

Lakes in the moraine areas of NE. Central Jutland

Stubbe Lake (4 km²), S. Djursland, is a rather shallow lake with sporadic marginal vegetation, and is regularly visited by 500–1,000 (occasionally 2,000) *A. platyrhynchos*, 150–300 *A. fuligula*, 250–350 *M. merganser*, and 100–200 *F. atra*.

Fussing Lake (2.5 km²), W. of Randers, has little marginal vegetation, and regularly holds 500–1,000 *A. platyrhynchos*, 30–75 *A. crecca*, 10–25 *A. ferina*, 250 *A. fuligula*, 25–100 (occasionally 200) *B. clangula*, 50–250 *F. atra*, and small flocks of *M. merganser*, *C. olor* and *C. cygnus*.

Glenstrup Lake (4 km²), S. of Hobro; a deep lake with sporadic marginal vegetation, regularly holding a few hundred (occasionally a thousand) *A. platyrhynchos* and *A. fuligula*, and several other species in small flocks.

Kleitrup Lake (1.5 km²), SW. of Hobro, with sporadic marginal vegetation, regularly holds 250–500 *A. platyrhynchos*, 250–500 *A. fuligula*, and small flocks of *A. ferina*, *B. clangula*, *M. merganser* (occasionally 250) and *F.atra*.

Tjele Lake (4 km²), SW. of Hobro, is a long narrow lake with a fringe of reed. Together with the surrounding fields it forms the most important gathering area for *A. fabalis* in Jutland (800–1,200 in autumn). In addition the lake regularly holds 100–300 *A. platyrhynchos*, 100–200 (occasionally 400) *M. merganser*, and several other species in small flocks (e.g. *C. cygnus*).

The Viborg Lakes of Nørresø and Søndersø, 2 km² in area, are two lakes with fringes of reed, regularly holding 500–1,000 *A. platyrhynchos* and small flocks of several other species.

Hald Lake (4 km²), S. of Viborg, a lake with little marginal vegetation. It is regularly visited by 1,500–2,500 *A. platyrhynchos*, 10–25 *A. ferina*, 100–400 *A. fuligula*, 100–350 *F. atra*, and small flocks of *B. clangula*, *M. merganser* and *C. cygnus*. Occasionally much larger concentrations occur there, and also the small lakes Vedsø (1.5 km²) and Vintmølle Lake (0.2 km²) further north are occasionally visited by fairly large flocks of the above species.

Tange Lake (6 km²), SE. of Viborg, is a shallow reservoir with some marginal vegetation, and regularly contains 300–600 *A. platyrhynchos*, 5–25 *A. ferina*, 50–300 *A. fuligula*, 20–50 *B. clangula*, 10–50 (occasionally 300) *M. merganser*, 10–30 *C. cygnus*, and 100–200 *F. atra*.

Salten Langesø (3 km²), S. of Silkeborg, a long, narrow and deep lake with little marginal vegetation, regularly holding 250–1,000 *A. platyrhynchos*, 25–50 *A. crecca*, 100–200 *A. fuligula*, 25–50 *B. clangula*, and 200–500 (occasionally 800) *M. merganser*.

Mossø (16 km²), W. of Skanderborg, is the largest lake in Jutland, with very deep central parts and reedbeds and marshes along some shores. The most important inland gathering area in the region, it regularly holds 1,000–2,500 *A. platyrhynchos*, 25–75 *A. crecca*, 75–100 *A. ferina*, 400–600 *A. fuligula*, 20–30 *A. marila*, 200–400 *B. clangula*, 700–1,200 *M. merganser*, 20–50 *C. olor*, 25–50 *C. cygnus*, and 500–1,000 *F. atra*.

Wetlands in the heathland plains of W. Central Jutland

Sunds Lake (1 km²), N. of Herning; a shallow lake with some marginal vegetation, regularly holding 300–700 *A. platyrhynchos*, 25–50 *A. crecca*, 30–40 *T. tadorna*, 100–200 (occasionally 400) *M. merganser*, and 10 *C. cygnus*.

Søby Lake (1 km²), S. of Herning; a shallow Lake with little marginal vegetation, regularly visited by 1,000–2,000 *A. platyrhynchos*, 200–300 *A. crecca*, 250–500 *A. penelope*, 50–100 *A. ferina*, 800–1,200 (occasionally 2,000) *A. fuligula*, 200 *B. clangula*, 50–100 *M. merganser*, and 10–40 *C. cygnus*.

Borris, E. of Skjern, is a heath with bogs and marshes along the rivers Omme Å and Skjern Å (waterfowl habitat approx. 3 km²). It is regularly visited by 2,000–3,000 *A. platyrhynchos*,

500–1,000 other dabbling ducks (mainly *A. crecca*, but occasionally also *A. penelope*), 100–200 (occasionally 400) *M. merganser*, 20–40 *C. cygnus*, and several other species in small flocks.

Karlsgårde Lake (1 km²), E. of Varde, is a reservoir with some marginal vegetation, regularly holding 1,000–1,500 (occasionally 3,500) *A. platyrhynchos*, 200–300 *A. crecca*, 25–100 *A. acuta*, *A. penelope* and *T. tadorna*, 25–75 *A. ferina*, 50–100 *A. fuligula*, 100–250 *B. clangula*, 50–100 *M. merganser*, and 150–300 *F. atra*.

Wetlands in Central S. Jutland

Ribe Game Reserve (1.4 km²); a shallow lake with adjacent reed-beds and marshes along the Ribe river (total area 2 km²). It regularly holds 400–800 (occasionally 2,500) *A. platyrhynchos*, 250–500 *A. crecca*, 150–300 *A. penelope*, 25–75 (occasionally 250) *C. cygnus*, 10–20 *C. columbianus*, and 100–400 (occasionally 2,000) *F. atra*.

Haderslev Dam (2 km²); a long and shallow lake with some marginal vegetation, regularly holding 1,000–1,500 *A. platyrhynchos*, 100–250 *A. fuligula*, and a few other species in small flocks.

Hostrup Lake (3 km²), S. of Åbenrå; a shallow lake surrounded by marsh- and moorland with small bogs. It regularly holds 1,000–2,000 *A. platyrhynchos*, 100–300 *A. crecca*, occasionally other dabbling ducks, at times up to 500 *A. fuligula*, and regularly 200–300 *F. atra*.

Rudbøl Lake (1 km²) and reed-swamps along the river of Vidå (S. of Tønder), total waterfowl habitat approx. 2 km². It is regularly visited by 300–600 (occasionally 1,200) *A. platyrhynchos*, 300–600 *A. crecca*, 50–100 *A. acuta*, 250–500 *A. penelope*, 25–50 *A. clypeata*, 20–50 *M. merganser*, 50–100 *C. cygnus*, 10–15 *C. columbianus*, and 100 *F. atra*.

THE LILLEBÆLT AND THE SOUTH FUNEN ARCHIPELAGO

Districts J and K

The waters of the Lillebælt and the South Funen Archipelago are in respect to waterfowl habitat even more chequered and varied than the southern Kattegat. The coastline is very serrated, with several closed brackish lagoons and with both fairly open and sheltered fiords and bays. The region contains about 65 islands, of which four are large and densely populated (Als, Ærø, Tåsinge and Langeland), thirteen are smaller with several farms or a village, while ten small islets only have one farm and about thirty-five islets are uninhabited. There are several shoals both around islands and in more open waters.

The region comprises some of the most important waterfowl haunts in Denmark, both for seaducks typical of the rather open waters and for species generally confined to shallow and sheltered coastal areas, including relatively important haunts for dabbling ducks. In the four last country-wide surveys in Jan. between 180,000 and 300,000 waterfowl or one-fifth of the grand total were recorded in the Lillebælt and the South Funen Archipelago. The species recorded in largest numbers were *S. mollissima* (60,000–100,000), *A. marila* (35,000–65,000 – about three-quarters of the grand total), *F. atra* (30,000–45,000), *A. fuligula* (20,000–70,000), *B. clangula* (6,000–14,000), *A. platyrhynchos* (4,000–15,000), and *C. olor* (4,000–8,000).

The northern Lillebælt

Kolding Inderfjord is a game reserve (2.4 km²) comprising the harbour of Kolding and adjacent shallow coastal waters. *A. platyrhynchos* (regularly 2,000, occasionally 3,000–5,000) is the most abundant species, but a few hundred *A. fuligula* and *F. atra* and smaller numbers of other species are also regularly found.

Hejlsminde Nor, a brackish lagoon and game reserve, of 2.5 km². One of the most important roosting areas in E. Jutland for several species of dabbling ducks, including the regular occurrence of 1,000 *A. platyrhynchos*, 75 *A. crecca* and *A. acuta*, and 700–800 *A. penelope*. It is also important for *A. ferina* (300), *A. fuligula* (1,000–2,000), *B. clangula* (occasionally 500), and *F. atra* (regularly 2,000–3,000, occasionally several thousand birds).

Bankel Sø; a brackish lagoon surrounded by meadows, of 3 km² area. A very important area particularly for dabbling ducks, occurring in approximately the same numbers as in Hejlsminde Nor and occasionally in much larger flocks. In addition 300–400 *A. ferina*, 500–700 *A. fuligula*, a few hundred *B. clangula*, and about a thousand *F. atra* are regular visitors.

Gamborg Sø; a coastal lagoon with reed-beds and meadows and a game reserve (1.2 km²). 500–700 *A. platyrhynchos* and a few hundred other dabbling ducks (mainly *A. crecca* and *A. penelope)* occur regularly in autumn, and small groups of several diving ducks and *F. atra* (200–300) are found in winter.

Coastal areas of W. Funen, comprising the shores and adjacent shallow waters in Gamborg Fjord, Føns Vig, Tybrind Vig and south of Wedellsborg Hoved (Sdr. Åby Bredning, Emtekær Nor and Aborg Minde), regularly hold several hundred *A. platyrhynchos* and *B. clangula* and up to a few thousand *A. fuligula* and *F. atra.* At Wedellsborg about one hundred *A. albifrons* roost in autumn and spring.

Offshore waters in the northern Lillebælt; the central waters between Fænø in the north and waters south of Alrø include large shallow shoals, which are extremely important for seaducks. The most numerous species in winter is *A. marila,* occurring in assemblies of tens of thousands in all parts of the area, but most regularly in Mosvig and north of Brandsø. Also a few thousand *M. nigra, M. fusca, B. clangula* and *M. serrator* and some hundred *S. mollissima* are found here, but the last-mentioned species in particular is much more abundant further south between Brandsø, Bågø and Årø, especially around the small islets of Linderum and Bastholm and on the shoal of Rødegrund.

The southern Lillebælt

Augustenborg Fjord and adjacent areas; this shallow fiord (20 km²) and its adjacent areas including the small game reserve Augustenborg Lillehav (0.6 km²), the coastal lagoon Ketting Nor (0.8 km²), and the densely vegetated lake Mjang Dam (0.8 km², a state forest reserve), regularly hold a few thousand waterfowl. Several hundred *A. platyrhynchos, A. penelope, A. ferina, B. clangula, M. serrator, M. merganser* and *F. atra* roost in the fiord, and the adjacent areas hold up to a few hundred dabbling ducks mainly *A. platyrhynchos, A. crecca* and *A. penelope.*

Flensborg Fjord and Nybøl Nor. This sheltered fiord system is one of the most important gathering areas in the region, with several species occurring in large concentrations. In the westernmost part of Flensborg Fjord (partly in German territorial waters) and particularly in Nybøl Nor large flocks are regularly found, consisting of *A. platyrhynchos* (2,000), *A. ferina* (300), *A. fuligula* (2,000–5,000 also regularly seen in the adjacent lakes of Gråsten), *B. clangula* (1,000–3,000), *M. serrator* (200–400), *M. merganser* (600–800), *C. olor* (200–300), and *F. atra* (2,000–4,000). At the mouth of Flensborg Fjord from Broagervig to Heltsbanke these species occur in smaller flocks, but several hundred *M. nigra, M. fusca* and *S. mollissima* and several thousand *A. marila* regularly occur here.

Hartsø; a small lake with reed-beds and meadows (1.2 km²) on the peninsula of Kegnæs, southern Als. It is one of the most important haunts in E. Jutland for dabbling ducks in autumn and spring, with the regular occurrence of several hundred *A. platyrhynchos,* 200–400 *A. crecca* and *A. penelope,* and 50–100 *A. querquedula, A. acuta, A. clypeata* and *T. tadorna.*

Bredgrund and the south coast of Als and Kegnæs; a shallow area extending many kilometres into open water, with several thousand *S. mollissima* and *M. nigra,* and hundreds of *A. marila, Cl. hyemalis, M. fusca* and *B. clangula* regularly occurring.

Helnæsbugten, SW. Funen; a shallow bay (60 km²) with notable concentrations of several species particularly in the northern part, including several hundred *A. platyrhynchos, A. fuligula, B. clangula, M. merganser* and *C. olor,* 3,000–4,000 *F. atra,* and occasionally many thousand *A. marila.*

Shoals in the Central Lillebælt, including Lillegrund-Langgrund, Hesteskoen and Søndre Stenrøn between Helnæs and Als. Several thousand *S. mollissima,* and some hundreds *Cl. hyemalis* occur regularly, and occasionally up to a few thousand *M. nigra* and *A. marila* occur.

The South Funen Archipelago

Between the south coast of Funen and the islands of Lyø, Ærø, Langeland and Tåsinge large concentrations of waterfowl are found almost everywhere, particularly in the central part shaded black in Fig. 71. In this area approximately two-thirds of the total numbers in district K were found in surveys in Jan. The most important species (maximum numbers in brackets) were: *S. mollissima* (45,000), *F. atra* (30,000), *A. fuligula* (16,000), *A. marila* (15,000), *B. clangula* (4,000), *C. olor* (4,000), *A. platyrhynchos* (3,000), and *Cl. hyemalis* (3,000). In addition most other waterfowl species occur in important concentrations at other times of the year. Although both seaducks and coastal species often occur in the

same areas and occasionally in mixed flocks, there are certain differences in their main distribution pattern. *Cl. hyemalis*, *M. nigra* and *M. fusca* are mostly found in peripheral waters, for example along the south coast of Ærø and on the isolated offshore shoal of Vejsnæs Flak. *S. mollissima* is also numerous here, but in addition large assemblies are found at Billes Grunde south of Avernakø and in waters north and south of Drejø, while up to a few hundred can be found in all other parts of the archipelago. *A. marila* is mainly confined to the rather deep waters between the islands. *B. clangula* and *M. serrator* are generally widely scattered over the area, although they occur in dense flocks particularly around Drejø. *M. merganser* is generally found only in a few coastal areas at Ærø, Tåsinge and along the south coast of Funen. Large concentrations of *A. fuligula* and *F. atra* can be found in nearly all coastal waters, and also in some areas further out. *A. platyrhynchos* is common along all coasts, but the largest flocks of this and other dabbling ducks (mainly *A. crecca* and *A. penelope)* occur around the small islets between Birkholm, Strynø and Ærø. The swans (mostly *C. olor)* are concentrated between Tåsinge, Birkholm, Strynø and Ærø, where large flocks also undergo wing moult in summer.

The South Funen Archipelago comprises three small coastal game reserves, at the towns Fåborg (2 km²), Svendborg (2 km²) and Ærøskøbing (0.7 km²). They all have a variety of species, but compared to other parts of the region contain relatively small numbers of birds. The most important species in the reserves are *A. platyrhynchos* (150–300), *A. ferina* (25–50), *A. fuligula* (200–500, in Svendborg Reserve regularly up to 1,000), *B. clangula* (25–100), and *F. atra* (200–400). The coastal lagoon of Vejlen (0.5 km²) on Tåsinge is visited by many species, however mostly in small numbers. On southern Langeland there are several coastal lagoons of the same character, the two most important being Tryggelev Nor (0.5 km²) and Keldsnor (1 km²).

CENTRAL FUNEN

District L

Compared to Jutland and Sealand there are relatively few inland waterbodies on Funen, and most are very small ponds. *A. platyrhynchos* is by far the most numerous waterfowl, occurring regularly in flocks of hundreds in many waterbodies, including several small ponds at the larger estates. Other species are rather scarce and mostly confined to a few localities. The most important waterfowl haunts are:

Dallund Lake (0.7 km²) a game reserve, regularly holding 200–400 *A. platyrhynchos*, small flocks of other dabbling ducks (occasionally 150 *A. crecca)*, 150–300 *A. ferina*, and 200–500 *A. fuligula.*

Vomme Lake (0.3 km²), with a regular occurrence of 300–600 *A. platyrhynchos*, small flocks of other dabbling ducks, 20–50 *A. ferina*, 100–400 (occasionally 2,000) *A. fuligula*, 50–100 *M. merganser*, and small flocks of *C. olor*, *C. cygnus* and *F. atra.*

Arreskov Lake (3.3 km²), Nørresø (0.7 km²) and Brændegård Lake (1.1 km²), three shallow lakes with dense marginal vegetation. They are the most important waterfowl habitats of Central Funen, with a regular occurrence of 1,500–3,000 *A. platyrhynchos*, 100–300 *A. crecca*, 50–75 *A. clypeata*, occasionally flocks of other dabbling ducks, 100–150 *A. ferina*, 500–1,000 (occasionally 2,500) *A. fuligula*, 25–75 *M. merganser*, 50–150 *C. olor*, and 250–500 (occasionally 3,500) *F. atra.*

Hvidkilde Lake (0.6 km²), with a regular occurrence of 500–1,000 *A. platyrhynchos*, 25–75 *A. crecca*, 25–50 *A. penelope*, 10–40 *A. ferina*, 750–1,500 *A. fuligula*, and 25–50 (occasionally 100) *M. merganser.*

S. SEALAND – LOLLAND – FALSTER – MØN

Districts M and O

The south-eastern part of Denmark comprising the Storstrøm county has a great variety of waterfowl habitats, including straight and exposed coasts facing the Baltic Sea, serrated coastlines with shallow bays and narrow fiords and straits, archipelagoes and off-shore shoals. Of sixty-five islands and islets, nearly two-thirds are uninhabited. Topographically the region has

much in common with the Lillebælt and the S. Funen Archipelago.

In most country-wide surveys between 175,000 and 220,000 waterfowl were recorded in this region, comprising about one-seventh of the grand total. Many species occur in large and important concentrations, but three species comprise about three-quarters of total numbers, viz. *F. atra*, *A. fuligula* and *C. olor*. The number of *F. atra* recorded in contry-wide surveys varied between 33,000 and 100,000, or roughly one-third of the Danish wintering population. With the exception of 1973, when only 13,000 *A. fuligula* were recorded, numbers in Jan. varied between 45,000 and 53,000, or roughly one-third of the grand total. *C. olor* has very important moulting areas, and in winter between 19,000 and 37,000 or half the total Danish population, have been recorded. In addition the region holds between one-third and two-thirds of the wintering *C. cygnus* population. Furthermore, very important areas for most other species exist, including several autumn and spring haunts for dabbling ducks. The region thus has much in common with the Lillebælt and the S. Funen Archipelago, but in respect of seaducks the two regions are very different. *Cl. hyemalis* is numerous along Baltic Sea coasts and in other open waters in both regions, but in the districts M and O *A. marila* is generally only seen on passage in autumn and in limited numbers. The large scale migration of *S. mollissima*, *M. nigra* and *M. fusca* passes across S. Sealand-Lolland-Falster-Møn, and in early summer flocks of *S. mollissima* mainly consisting of juv. birds gather in the region. However in autumn, winter and spring the three seaducks mentioned occur in very small numbers and very briefly.

As seen in Fig. 71 important waterfowl haunts are almost continuous along most coasts of the region, but have been divided into the following major sections;

Basnæs Nor – Holsteinsborg Nor; a shallow fiord system (18 km²) around the island Glænø, and coastal lagoons at Sevedø (1 km²); part of the area is a game reserve (10 km²). A very important area for several waterfowl, including the regular occurrence of 2,000–4,000 (occasionally 5,000–8,000) *A. platyrhynchos*, 200–500 *A. crecca*, 1,000–1,500 *A. acuta*, 1,000–1,500 *A. penelope*, 200–300 (occasionally 650) *A. clypeata*, 300–600 *A. ferina*, 500–1,500 *A. fuligula*, 100–250 *M. merganser*, 500–1,000 *C. olor*, 100–200 *C. cygnus*, several thousand *F. atra*, and a few hundred *A. fabalis*.

Karrebæk Fjord, Gavnø and Dybsø Fjord; a shallow fiord (total 35 km²), nearly completely separated from the sea by the islets Enø and Dybsø and including a game reserve of 10 km². An extremely important area for practically all coastal species. The following numbers are regularly present in the whole area: 3,000–6,000 *A. platyrhynchos*, 500 *A. crecca*, 100–150 *A. acuta*, 1,000–2,500 *A. penelope*, 200–300 *A. clypeata*, 200 *T. tadorna*, 700–1,500 *A. ferina*, 10,000–12,000 (occasionally up to 25,000) *A. fuligula*, 500–1,500 *B. clangula*, 200–400 *M. merganser*, 1,000–3,000 *C. olor*, 200–400 (occasionally 900) *C. cygnus*, and 7,500–10,000 *F. atra*.

Avnø Fjord is an open fiord of approximately 20 km² between Knudshoved Odde and the peninsula Avnø, with large stretches of shallow water. It is an important area in winter for a few species, particularly when Karrebæk – Gavnø – Dybsø are ice-covered. Most abundant species are *F. atra* (3,000–5,000, occasionally up to 14,000), *A. fuligula* (1,000–2,000), and *C. olor* (1,000–3,000).

Præstø Fjord; a shallow fiord of 20 km². The most numerous and regular species are *A. fuligula* (3,000–4,000, occasionally 6,000), *M. merganser* (up to 400), *C. olor* (up to 1,000), and *F. atra* (2,000–4,000, occasionally up to 11,000). Several other species occur in variable but smaller numbers.

Jungshoved – Nyord – Stege Bugt – Stege Nor; a large shallow area totalling approximately 150 km², and comprising open waters east of Jungshoved, very shallow banks with small islets between Jungshoved and Nyord, the shallow bay Stege Bugt, and the closed brackish lagoon Stege Nor. It forms an extremely important gathering area for almost all coastal species occurring in Denmark. The largest concentrations are found around and north of Nyord, while e.g. in Stege Nor few species are abundant *(A. fuligula, C. olor* and *F. atra)*. The total number of waterfowl present in the whole area often exceeds 20,000, and the following numbers are regularly found: 3,000–5,000 *A. platyrhynchos*, 300–400 *A. crecca*, 1,000–1,500 *A. penelope*, 200–300 *A. clypeata*, 300–600 *T. tadorna*, 500–800 *A. ferina*, 3,000–6,000 *A. fuligula*, 2,000–3,000 *B. clangula*, 500–700 *M. serrator*, 1,000–1,500 *M. merganser*, 2,000–4,000 *C. olor*, 300–600 (up to 1,400) *C. cygnus*, and 4,000–6,000 (up to 17,000) *F. atra*. In the eastern peripheral waters several hundred, and occasionally more than a thousand *A. marila*

gather in autumn, and in winter up to a few thousand *Cl. hyemalis* have been found here, particularly on the shoals of Hollændergrund – Gyldenløves Flak, and also along the coasts of Møn, e.g. on Bjelkes Flak.

Storstrøm – Ulvsund – Grønsund, the straits between Sealand, Falster and Møn east of the Storstrøm Bridge. The total area of water is about 140 km², and includes large shallow parts in bays and between islets as well as deep straits with fairly strong currents. It forms a very important area for diving ducks, swans and coot, particularly when more sheltered water-bodies in the region are ice-covered. Considerable movements between this and neighbouring areas are regular. The following regular and maximum numbers have been recorded in the whole area in winter: 1,000–2,000 *A. platyrhynchos*, 500 *A. ferina*, 6,000–8,000 (15,000) *A. fuligula*, 1,000–2,000 (4,000) *B. clangula*, 500–1,000 (2,500) *M. serrator*, 1,000–2,000 *M. merganser*, 2,000–4,000 (9,000) *C. olor*, 300–500 (2,500), *C. cygnus*, and 6,000–10,000 (18,000) *F. atra*. At the shoal of Tolken in the easternmost part of Grønsund up to a few thousand *Cl. hyemalis* regularly occur.

Waters north of Lolland-Falster, between the Storstrøm Bridge and Rågø-Vejrø comprise large continuous waterfowl habitats. A very important dabbling duck haunt is Tårs Vig, Kallø Grå and the shallow lagoon of Fladet, a game reserve of 0.7 km², where the following numbers are regularly recorded: 2,000–3,000 *A. platyrhynchos*, 800–1,500 *A. crecca*, 300–500 *A. penelope*, 100–150 *A. clypeata*, and 200–300 *T. tadorna*. Elsewhere in the waters north of Lolland-Falster diving ducks, swans and coot are the most abundant waterfowl, and the following numbers have been recorded in the whole area in Jan. surveys: 100–200 *A. ferina*, 1,500–3,000 *A. fuligula*, 2,000–5,000 *B. clangula*, 500–4,000 *M. serrator*, 500–1,500 *M. merganser*, 3,500–6,000 *C. olor*, up to 700 *C. cygnus*, and up to 17,000 *F. atra*. The shoals around Vejrø are the only area in the region with a regular occurrence of *S. mollissima*, *M. nigra* and *M. fusca*, consisting of up to a few thousand birds.

Nakskov Fjord, comprising the open fiord (50 km²) with several islands and islets, and to the east the game reserve Nakskov Indrefjord, a coastal lagoon of 1.5 km² with reedbeds. The reserve is a very important breeding area for ducks, being the only permanent breeding locality for *A. strepera* and *N. rufina* in Denmark, and in autumn, winter and spring the following numbers have regularly been recorded: 1,000–2,000 *A. platyrhynchos*, 100–200 *A. crecca*, 100–200 *A. acuta*, 50–200 *A. penelope*, 25–50 (occasionally 200) *A. clypeata*, 700–1,000 *A. ferina*, 4,000–8,000 *A. fuligula*, and 200–300 *F. atra*. In the open Nakskov Fjord diving ducks, swans and coot predominate, and the following numbers were recorded in Jan.: Up to 200 *A. ferina*, up to 8,000 *A. fuligula*, up to 1,000 *B. clangula*, up to 500 *M. serrator* and *M. merganser*, 4,000–7,000 *C. olor*, 200–700 *C. cygnus*, and 5,000–19,000 *F. atra*. Figures for swans include the coast between Nakskov Fjord and Onse Vig further north.

Guldborgsund, from Klodskov to Tågense, total area 50 km², includes two game reserves at Nykøbing Falster (3 km²) and Frejlev Vig (0.3 km²). In autumn a few thousand *A. platyrhynchos*, a few hundred *A. penelope*, and smaller numbers of other dabbling ducks are regular visitors in Bredningen, but peak numbers of waterfowl are found in mid-winter, when the following maximum numbers have been recorded in the whole area: 1,300 *A. ferina*, 11,000 *A. fuligula*, 1,000 *B. clangula*, 2,000 *M. merganser*, 5,000 *C. olor*, 350 *C. cygnus*, and 15,000 *F. atra*.

Rødsand etc.; a large shallow area south of Lolland, with notable concentrations of waterfowl most regularly found in the westernmost part around Hyllekrog and in the northern part, in continuation of Guldborgsund. The area last mentioned includes the game reserve Nysted Nor (1 km²). Most abundant are *A. platyrhynchos*, *A. fuligula*, *B. clangula*, *C. olor* and *F. atra* (each up to a few thousand in the whole area). *B. bernicla* and *A. fabalis* are regular visitors to the shallow waters and reclaimed areas at Hyllekrog respectively.

Maribo Lakes; these four lakes of 12 km² on Central Lolland are particularly important for *A. ferina* in autumn (2,000–3,000 regularly, 4,000 occasionally). In addition the following species are abundant: *A. platyrhynchos* (500–1,500), *A. crecca* (100, occasionally 300), *A. fuligula* (4,000–7,000), and *F. atra* (200–300, occasionally 2,000).

Bøtø Nor; a marshland on S. Falster and a game reserve (0.7 km²). It is an important area for *A. fabalis* and several dabbling ducks, with a regular occurrence of 300–600 *A. platyrhynchos*, 300–600 *A. crecca*, 50–150 *A. acuta*, 100–250 *A. penelope*, and 25–75 *A. clypeata*.

E. SEALAND

District R

The region comprises most of the counties of Copenhagen, Frederiksborg and Roskilde, with a variety of waterfowl habitats, including the shallow Roskilde Fjord, the straight open coastlines between Halsnæs and Copenhagen and Køge Bugt – Stevns, the island of Saltholm in the Øresund, the harbour of Copenhagen and adjacent waters, and several large lakes. The waterfowl fauna in autumn, winter and spring resembles that of S. Sealand–Lolland–Falster–Møn with *A. fuligula, C. olor* and *F. atra* as the most numerous species, and few seaducks, particularly in winter when *S. mollissima, M. nigra* and *M. fusca* are almost absent and only *Cl. hyemalis* is found in the Central Øresund.

Roskilde Fjord, a shallow and narrow fiord of about 130 km², with about twenty islets and several inlets comprising three game reserves at Roskilde (9 km²), Møllekrogen (0.5 km²) and the adjacent lake of Selsø (1.5 km²). The fiord together with Selsø, Kattinge Lakes (1 km²) and Arresø (41 km²) comprises the sub-district Rb. In the last seven country-wide surveys between 6,000 and 43,000 waterfowl (mean 24,000) were recorded here, including the following numerous species: 2,000–19,000 *F. atra*, up to 17,000 *A. fuligula*, 2,400–6,900 *C. olor*, up to 5,000 *A. platyrhynchos*, up to 1,000 *M. merganser*, and up to 600 *B. clangula* and *C. cygnus*. Concentrations can be found in all parts of the fiord, but most often north of Bognæs and around Eskildsø and Jyllinge Holme. Flocks of *A. fuligula* regularly visit the adjacent Kattinge Lakes (2,000–5,000, and occasionally up to 17,000), and Selsø (3,000–5,000, and occasionally up to 11,000). In autumn and spring the last mentioned area is an important gathering area for dabbling ducks (100–200 *A. platyrhynchos*, 50–200 *A. crecca*, and 500–1,500 *A. penelope*). Arresø, the largest lake in Denmark, is regularly visited by 1,000–2,000 *A. platyrhynchos*, small flocks of other dabbling ducks, 200–600 *A. fuligula*, 200–300 *B. clangula*, and 50–150 (occasionally several hundred) *M. merganser*.

Saltholm is a low lying island with several ponds and surrounded by large shallow waters. It is a very important breeding area for *S. mollissima* (1,600 pairs in 1971), several dabbling ducks, waders and gulls, and moulting area for *C. olor*. In autumn and spring many dabbling ducks congregate, including 1,000–2,000 *A. platyrhynchos*, 300–600 *A. crecca*, 700–1,100 *A. penelope*, and 25–100 *A. clypeata*. In winter several hundred, and occasionally a few thousand, *B. clangula, M. merganser, C. olor* and *F. atra* occur.

Waters around Copenhagen and Amager, from Svanemøllebugten in the north to Greve Strand in the south, including two game reserves (Aflandshage 1.7 km² and Kalvebodstrand 25 km²) and the harbour of Copenhagen, where shooting is prohibited; these form a very important area for several species, particularly in mid-winter when the following numbers have been recorded in the whole area: 1,500–3,000 *A. platyrhynchos*, 100–1,000 *A. ferina*, 8,000–55,000 *A. fuligula*, 500–1,000 *B. clangula*, 200–1,000 *M. merganser*, 500–1,500 *C. olor*, and 3,000–10,000 *F. atra*. The area also holds the largest winter concentration of *M. albellus* in Denmark (see p. 120). Large flocks of waterfowl can be found in nearly all parts of the area, but most permanently around Refshaleøen–Prøvestenen–Christianshavns Vold and Sjællandsbroen–Kalveboderne. The Kalvebodstrand reserve, a reclaimed marshland, is a very important breeding and gathering area for waders and dabbling ducks, including the regular occurrence in autumn and spring of 1,000–3,000 *A. platyrhynchos*, 200–400 *A. crecca*, and 200–400 *A. penelope*. Several lakes in the Copenhagen area hold a variety of waterfowl; the most important is Damhussø (0.5 km²), where the following numbers are frequent: 300–600 *A. platyrhynchos*, 100–200 *A. ferina*, 2,000–3,000 and occasionally 5,000 *A. fuligula*, 50–100 *B. clangula*, 25–50 *M. merganser*, and 500–1,000 and occasionally 5,000 *F. atra*. Other lakes with several species in smaller flocks are Sortedam–Peblingesø, Gentofte Lake and Utterslev Mose.

Furesø, a lake of 9 km² with the regular occurrence of 500–1,500 *A. platyrhynchos*, 25–100 *A. ferina*, 3,000–6,000 and occasionally 10,000 *A. fuligula*, 200–300 and occasionally 800 *B. clangula*, 200–700 *M. merganser*, and 500–1,000 and occasionally 2,000 *F. atra*. Occasionally large flocks are also found in the adjacent Farum Lake (1 km²).

Esrom Lake, 17 km², is a rather deep lake and a game reserve with a regular occurrence of 2,000–3,000 *A. platyrhynchos*, 100–200 *A. ferina*, 200–400 *A. fuligula*, 50–100 *A. marila*, 100–350 *B. clangula*, and 1,000–1,500 *F. atra*.

CENTRAL SEALAND

District P

The central parts of Sealand comprise three important lake areas where large flocks of waterfowl occur regularly in autumn, winter and spring. In addition several lakes have a variety of species, which mostly occur however in relatively small flocks.

Tissø (13 km²), with a regular occurrence of several hundred *A. fabalis*, 1,500–2,500 *A. platyrhynchos*, 200 and occasionally 500 *A. crecca*, 50–200 *A. penelope*, 50–100 and occasionally 400 *A. ferina*, 200–300 and occasionally 750 *A. fuligula*, 50–75 *C. cygnus*, and 100–200 *C. columbianus* in autumn, the largest numbers recorded regularly in eastern Denmark.

Tystrup-Bavelse Lake (7 km²), with a regular occurrence of several hundred *A. fabalis*, 2,000–3,000 and occasionally 7,000 *A. platyrhynchos*, small numbers of other dabbling ducks, occasionally up to 450 *A. ferina*, 4,000–6,000 and occasionally 15,000 *A. fuligula*, 200–300 and occasionally 1,200 *B. clangula*, 20–50 *C. cygnus*, and 500–1,000 and occasionally 2,500 *F. atra*.

Gisselfeld-Bregentved Lakes; several small lakes (total 1.5 km²), the most important areas being Ulse Lake, Søtorup Lake and Nielstrup Lake. There is a regular occurrence of 1,000–1,500 *A. platyrhynchos*, occasionally 250 *A. crecca*, 200–300 and up to 1,600 *A. ferina*, 2,000–3,000 *A. fuligula*, 25–50 *B. clangula*, and 100–200 *F. atra*.

Skarresø (2 km²), regularly holding 500–1,200 *A. platyrhynchos*, 50–150 and occasionally 250 *A. crecca*, 100–200 and occasionally 500 *A. fuligula*, and small flocks of several other species.

Gyrstinge Lake (2 km²) is a shallow lake with some marginal vegetation, regularly visited by 400–600 and occasionally 1,200 *A. platyrhynchos*, 10–50 and occasionally 100 *A. ferina*, 300–600 and occasionally 1,400 *A. fuligula*, 50–100 and occasionally 300 *B. clangula*, 50–200 and occasionally 400 *M. merganser*, 25–50 and occasionally 100 *C. cygnus*, and 100–250 *F. atra*.

Haraldsted Langesø (2.5 km²) is a long shallow lake with some marginal vegetation. There is a regular occurrence of 200–600 and occasionally 1,200 *A. platyrhynchos*, 25–75 *A. crecca*, small flocks of other dabbling ducks, 100–300 *A. fuligula*, 25–50 *B. clangula*, 25–50 *M. merganser*, 25–50 *C. cygnus*, and 100–300 *F. atra*.

Valsølille Lake (1 km²), a game reserve until 1970. There is a regular occurrence of 600–1,200 *A. platyrhynchos*, 100–300 *A. crecca*, 100–200 *A. clypeata*, small flocks of other dabbling ducks, 50–100 and occasionally 200 *A. ferina*, up to 350 *A. fuligula*, 25–50 *M. merganser*, and 200–800 *F. atra*.

Gjorslev Møllesø (0.2 km²), on Stevns (sub-district Ra), regularly holds 500–1,500 *A. platyrhynchos*, 25–75 and occasionally 200 *A. crecca*, 25–100 and occasionally 600 *A. ferina*, 500–1,500 and occasionally 2,000 *A. fuligula*, 50–100 *B. clangula*, 50–100 *M. merganser*, and 50–100 and occasionally 200 *F. atra*.

BORNHOLM

District T

The island of Bornholm in the Baltic Sea, widely separated from the rest of Denmark, is the only rocky part of the country. Along the west, north and east coast the profile is very steep, while along the south coast shallow water extends further out to sea. The coastline is rather straight offering little shelter for waterfowl, and there are very few bodies of water in the interior of the island; altogether Bornholm has little suitable waterfowl habitat compared to most other parts of Denmark. The most numerous species in winter is *Cl. hyemalis*, found in flocks of several hundreds along all coasts, but mostly widely scattered in offshore waters. Other seaducks also occur both during migration and in winter, but only in small numbers. The region comprises

one scientific reserve (Græsholm) and two game reserves (Neksø 1.3 km² and Ølene 1.5 km²). The most important concentration areas are:

Ertholmene, a group of small islands NW. of Bornholm, including the scientific reserve of Græsholmen. An important breeding area for seabirds, with one of the largest colonies of *S. mollissima*, comprising 1,500 pairs in 1971. The number of seaducks in autumn, winter and spring is mostly rather small.

Neksø-Snogebæk, SE. Bornholm, has a relatively shallow coast, and includes a game reserve and the small bog of Hundsemyre, and is regularly visited by 500–1,500 *A. platyrhynchos*, 25–50 *A. crecca*, 25–75 *A. penelope*, 50–150 *T. tadorna*, 100–200 *A. fuligula*, small numbers of several other diving ducks, and 100–200 *F. atra*.

Finally, the harbour of Rønne, W. Bornholm, regularly holds 200–400 *A. platyrhynchos*, 25–30 *A. ferina*, 1,000–2,500 *A. fuligula*, small flocks of several other diving ducks, and 100–200 *F. atra*.

Chapter VI

Discussion and conclusions

Populations of waterfowl in Denmark

BREEDING POPULATIONS

The populations of breeding waterfowl have changed considerably in Denmark in the last hundred years. Positive changes include the immigration of four species, which have extended their range in NW. Europe *(A. strepera, A. ferina, A. fuligula* and *N. rufina)*. Furthermore four species have increased considerably in range and numbers *(T. tadorna, S. mollissima, C. olor* and *F. atra)*. Negative changes include a reduction in the small population of *M. merganser*, and in addition it is a common impression that the number of dabbling ducks has been reduced as a result of the destruction of breeding habitats. A possible exception is *A. crecca*, for which new habitats have been created in this century (see p. 142).

The list of waterfowl recorded breeding in Denmark comprises fifteen ducks, one swan and the coot. The available information on the size of the present breeding populations has been summarized in Table 28. Unfortunately it was not possible to estimate the populations of the two most numerous species, *A. platyrhynchos* and *F. atra*. Four species are represented with some thousand pairs, and for two of these, *T. tadorna* and *M. serrator*, the exact number is not known, whereas the estimates for *S. mollissima* and *C. olor* are very accurate. Most breeding species are much scarcer, including six ducks with some hundred pairs each *(A. crecca, A. querquedula, A. acuta, A. clypeata, A. ferina* and *A. fuligula)*, and three occurring regularly but in very small numbers *(A. strepera, N. rufina* and *M. merganser)*. Two species breed irregularly *(A. penelope* and *A. marila)*. The total population of all species except *A. platyrhynchos* and *F. atra* is of the order of 20,000 pairs.

From an international point of view few species occur in significant numbers. The Danish population of *C. olor* is probably the largest in Europe, and the country also contains a relatively large proportion of the *T. tadorna* and *M. serrator* breeding in Europe. For all other species however, breeding individuals in Denmark make up a very small proportion of the total European populations.

MOULTING POPULATIONS

In summer, Danish waters hold substantial concentrations of several species of waterfowl undergoing wing moult. In particular, the numbers of seaducks and *C. olor* are uniquely high compared to numbers known to moult elsewhere in Europe. The total number of moulting seaducks has been estimated as the order of half a million, of which *S. mollissima* and *M. nigra* make up the majority. The latter species probably moults in much larger concentrations in other European waters (southern North Sea?), but there is still a lack of evidence on this point. *M. fusca* is also very abundant and more numerous during the moult than during

autumn, winter and spring. In addition, smaller numbers of *A. marila* and *B. clangula* of foreign origin and *M. serrator* mainly of local origin moult in Danish waters (SALOMONSEN 1968, JEPSEN 1973, JEPSEN & JOENSEN 1973, JOENSEN 1973 a). Concentrations of moulting *C. olor* (40.000) are probably the largest in Europe. The information on dabbling ducks, and *A. ferina* and *A. fuligula* is rather scarce, but it is the impression that with the exception of a few concentrations of some thousand *A. platyrhynchos* and *A. crecca* in W. and N. Jutland (FOG & JOENSEN 1970) they are mostly widely scattered over the breeding areas and consist mainly of local breeders. A few thousand *T. tadorna* moult irregularly in the southern part of the Danish Waddensea, but much larger concentrations are found further south in NW. Germany.

POPULATIONS DURING AUTUMN, WINTER AND SPRING

The total numbers of waterfowl occurring during autumn, winter and spring are substantially larger than the breeding and moulting populations, as Denmark is situated on a very important flyway for migratory waterfowl. The main breeding areas for most species comprise Fennoscandia, the Baltic region, N. Russia and NW. Siberia, and their main winter range extends from the southern Baltic Sea and S. Norway through Denmark, N. Germany, the Netherlands and the British Isles to France and the Iberian peninsula. Most species are confined to Europe in winter, although some dabbling ducks extend their range into N. Africa and *A. querquedula* winters almost exclusively in Central Africa. The winter populations in NW. Europe also include many waterfowl from Iceland and some from Greenland. These latter birds mainly winter in the British Isles, but some species probably also occur regularly in Denmark.

Seasonal variations

The following seasonal variations are characteristic for the different categories of waterfowl:

Dabbling ducks: A. platyrhynchos occurring in Denmark comprise local birds which are mainly resident, and large foreign populations, with peak numbers found in late autumn and a less pronounced peak in early spring. For other *Anas* species peak numbers occur in autumn and are less pronounced in spring, while numbers during most winters are either small or negligible. Peak numbers of *A. querquedula* occur in Aug., *A. clypeata* in Aug.–Sept., *A. crecca* and *A. acuta* in Sept.–Oct., and *A. penelope* in Oct.–Nov. *T. tadorna* has a limited range in autumn and most winters, the species being much more numerous and widespread in spring with peak numbers occurring in late March and April (see p. 81).

Diving ducks: With the exception of *N. rufina* peak numbers of all diving ducks occur either in late autumn or in winter. *M. fusca, S. mollissima* and *M. serrator* occur in peak numbers in late autumn, but numbers remain high in most winters until early spring. *A. fuligula, A. marila, Cl. hyemalis, B. clangula, M. merganser* and *M. albellus* have a definite population peak in mid-winter, and there is considerable annual variation for *A. ferina* and *M. nigra.*

Swans: The number of *C. olor* is rather stable throughout the year, although peak numbers are generally recorded in mid-winter, when the local resident population is supplemented by birds breeding elsewhere in the Baltic region. For Denmark as a whole, peak numbers of *C. cygnus* occur in mid-winter, although birds migrating through W. and N. Jutland are most numerous here in late autumn and in spring. In the same regions peak numbers of *C. columbianus* are found in autumn and spring, while winter populations are mostly small.

Coot: Peak numbers of *F. atra* are found in late autumn, but populations remain large throughout winter and early spring.

In autumn and winter the different species show varying degrees of gregariousness during daytime (see p. 15 and Chapter IV). While *A. platyrhynchos, B. clangula* and *M. serrator* for example are generally widely scattered, most other diving ducks are extremely gregarious, and a large proportion of the total population is found in a few substantial and dense flocks. There is also considerable seasonal variation for all species. In general, gregariousness is most pronounced in late autumn and particularly in winter, when ice conditions reduce the amount of suitable habitats for many species. In spring however, most species are much more scattered than in autumn. Although the total number of *A. crecca* and *A. clypeata* visiting Denmark is much smaller in spring than in autumn, and the duration of their stay probably shorter (which reduces the chance of them being recorded in monthly counts), they are more widespread in spring, and for example more often found in inland waters. The tendency to occur more dispersed is probably a function of pair formation in winter and early spring, but possibly external factors, e.g. less disturbance than in autumn, also play an important role (see p. 163).

Peak populations in an international perspective

At present it is not possible to estimate the total number of waterfowl visiting Denmark during the course of a year. We know that for a few species (e.g. *C. olor)* the peak numbers recorded are almost identical with the total number of visitors, but for all other species the numbers found at one time in the country make up only a proportion of the total flow of birds through Denmark. For species terminating their migration in Denmark this proportion is probably large *(A. fuligula, A. marila* and *S. mollissima),* but for species mainly seen on passage numbers are certainly only a very small proportion (most dabbling ducks, *A. ferina, M. nigra* and *M. fusca).* However by comparing peak numbers found in Denmark with the total estimated flyway population, an approximate picture of the importance of the country for various species is established. At present estimates are available on the total number of most species wintering in N., NW., W., SW. and Central Europe based on the counts organized by IWRB (ATKINSON-WILLES 1972). The figures are given in Table 28, but it must first be emphasized that they are very approximate, secondly that for some species a proportion of the flyway population winters outside Europe, and thirdly that the mid-winter populations are much smaller than initial populations at the end of the breeding

	Breeding pairs	Moulting × 1000	Peak number in Autumn × 1000	Winter × 1000	Spring × 1000	Annual kill (average) × 1000	Flyway population wintering in Europe × 1000
A. platyrhynchos	tens of thousands	mostly local	200–250	100–150	–	330–420 (380)	1,550
A. crecca	< 200	mostly local	40–50	–	–	68–85 (76)	260
A. querquedula	< 200	?	?	–	?	?	–
A. acuta	200	mostly local	25–30	–	–	12–14 (13)	70
A. penelope	irregular	?	75–100	4	–	37–49 (44)	485
A. clypeata	< 500	mostly local	< 5	–	–	8–11 (9)	63
T. tadorna	some thousand	irregular	10–25	1–20	30–35	P.	105
A. ferina	350–700	mostly local	6–13	3–10	–	5–6 (5)	235
A. fuligula	< 500	mostly local	50–100	100–200	–	30–40 (35)	530
A. marila	irregular	0.5–1.0	–	40–100	–	7–13 (8)	145
Cl. hyemalis	nil	nil	–	?	–	10–12 (11)	?
M. nigra	nil	200	.....	100–200+	.....	16–19 (18)	?
M. fusca	nil	60	22–37+	7–23+	–	7–10 (9)	?
S. mollissima	7,500	> 250	.....	750		115–180 (136)	?
B. clangula	nil	12–14	20–80	40–100	–	22–28 (25)	142
M. serrator	some thousand	20	10–33	12–20	–	7–8 (8)	40
M. merganser	< 25	–	–	15–30	–	5–6 (6)	75
M. albellus	nil	nil	–	0.2–0.5	–	P.	5
C. olor	3,000	40	–	40–70	–	P.	120
C. cygnus	nil	nil	–	6–11	–	P.	17
C. columbianus	nil	nil	1–2	–	2–3	P.	6
F. atra	many thousand	mostly local	125–270	100–200	–	57–83 (70)	?

Table 28. Summary of information on the breeding, moulting and autumn, winter and spring peak populations of ducks (except *A. strepera* and *N. rufina*), swans and *F. atra* in Denmark, the estimated kill in Denmark, and the estimated flyway populations wintering in Europe (except Italy, the Balkan, Austria, Czechoslovakia, Rumania and central and southern Russia) (cf. ATKINSON-WILLES 1972). Data from the late 1960's and early 1970's. P = protected species.

season, particularly for species subject to intensive shooting.

In successful country-wide surveys, 1.0–1.5 million ducks, swans and coot have been recorded in Denmark (Table 5 p. 23). Bearing in mind that estimates for most species are generally minimal, and that for some species (seaducks in particular), large numbers may have been left unrecorded, it is realistic to estimate the normal winter population (Nov.-Feb.) to be close to two million birds. *S. mollissima*, estimated at three-quarter million, comprises about one-third, and other diving ducks account for more than one-quarter, with the regular occurrence of more than one hundred thousand *A. fuligula* and *M. nigra*, and more than fifty thousand *A. marila* and *B. clangula*. *A. platyrhynchos* is by far the most numerous dabbling duck with an estimated peak population of up to a quarter million, but in autumn *A. crecca* and *A. penelope* are also extremely abundant. *C. olor* constitutes the majority of 50,000–80,000 swans, and finally the occurrence of up to a few hundred thousand *F. atra* should be mentioned.

For several species, peak numbers recorded in Denmark make up a large proportion of the total estimated flyway population (cf. ATKINSON-WILLES 1972). The country regularly holds about half and occasionally more than half of all *A. marila*, *B. clangula*, *M. serrator*, *C. olor*, *C. cygnus* and *C. columbianus*, and although substantial resident populations of *S. mollissima* are found elsewhere in NW. Europe, the occurrence of most of the Baltic population of this species in Denmark should be mentioned in this connection. Denmark regularly holds one-third of the flyway population of *T. tadorna*, *A. fuligula* and *M. merganser*, and probably *F. atra* also belongs to this category.

The peak numbers of *A. acuta* recorded in Denmark are very large compared to the total population in Europe in winter. Peak numbers of other dabbling ducks in Denmark make up a smaller proportion, but the fact that the annual kill is larger than peak numbers for three species (see p. 68, 69, 79) indicates that these peak numbers make up only a small proportion of the total flow of birds into Denmark. It is tentatively estimated that at least one-third of the flyway population of *A. crecca* and *A. penelope* visit Denmark in autumn, while for *A. clypeata* the proportion is much smaller.

Only for *A. ferina* and *M. albellus* are the numbers recorded in Denmark very small compared to the flyway population. Furthermore, numbers of three seaduck species *(Cl. hyemalis, M. nigra* and *M. fusca)* are questionable in this respect, because there is a lack of accurate information on the size of the total populations.

Changes in the non-breeding populations

While long-term trends in breeding populations have been studied for several species, there is little data from earlier decades on non-breeding populations to be compared with the results of the present study. Most earlier reports cover limited areas, and in most cases the habitats there have changed, which implies that conclusions applying to the overall population levels cannot be made. Furthermore, many earlier reports mainly describe unusual situations (e.g. occurrence of large concentrations) rather than illustrate the normal conditions. Such information

must therefore be considered with caution, and only few conclusions concerning long-term trends can be drawn.

In the last decades *C. olor* and *T. tadorna*, as one would expect, have become more widespread and numerous in autumn, winter and spring. In the eastern parts of the country where reclamation of coastal marshlands has been very widespread, it seems well documented that some dabbling ducks, particularly *A. penelope*, are scarcer and confined to fewer areas than 30–60 years ago. In 1929–1931 regular counts of waterfowl were conducted at the reserve of Tipperne in Ringkøbing Fjord (TÅNING 1933–36), and comparison with data obtained in later years suggests that in this part of the country the number of dabbling ducks occurring in autumn and spring is largely unchanged. About 1930 *C. olor* was scarce in Ringkøbing Fjord, while today it is very numerous. The numbers of *C. cygnus* and *C. columbianus* occurring in the fiord have possibly decreased slightly over the last forty years.

In evaluating annual variations in the numbers of waterfowl in Denmark during 1965–1973, several aspects must be borne in mind. Firstly, variations in numbers recorded in Denmark can be ascribed to annual changes in the total flyway population (as a result of varying production and mortality) and/or variations in migration patterns, such as the migration routes and the length of the birds' visits to various areas. For the truly migratory dabbling ducks, Denmark represents only a small staging post on a long migration route, and it is probable that the numbers recorded are influenced more by the duration of stay of the ducks than by the total number of individuals passing through and resting. Secondly, the rather unusual methodological problems connected with waterfowl counts in Denmark must be borne in mind. Both the general distribution pattern (see Fig. 71 p. 132) and the considerable variation in local occurrence (see p. 162) imply that the population level can only be studied by aerial surveys covering most or all potential habitats. Furthermore, the results obtained in aerial surveys are very approximate and for some species constitute a considerable under-estimation of the actual values (e.g. for *M. nigra*, *M. fusca* and *Cl. hyemalis*).

Autumn and spring populations

For dabbling ducks occurring mainly on passage, practically all haunts show considerable annual variation in the numbers recorded both in autumn and spring. When comparing the autumn results for larger regions (e.g. W. and N. Jutland) however, there is little annual variation in the population figures. Variations in spring are much more pronounced, probably as a result of the birds being more scattered and occurring for shorter periods than during autumn (see p. 154). The opposite seems to be the case for *C. columbianus*, where numbers recorded in autumn show considerable annual variation, while the large flocks found in spring are more constant in number.

Mid-winter populations

Studies on annual variations in mid-winter populations must be limited to the following species, for which figures obtained in country-wide surveys are considered reasonably accurate (species for which this may not be entirely true are indicated by question marks): All *Anas* species, *T. tadorna*, *A. ferina*, *A. fuligula*, *A. marila??*, *B. clangula*, *M. serrator??*, *M. merganser*, *M. albellus*, *C. olor*, *C. cygnus??* and *F. atra*. The five winters in which the country-wide surveys were conducted (Jan. 1968, 1969, 1970, 1971 and 1973) exemplify the considerable variation in climatic conditions of the

Danish winter. Three winters were close to normal in respect to cold and ice-cover (Jan. 1968, 1969 and 1971, see Fig. 3 p. 21 and Table 1 p. 11), while one was unusually mild (Jan. 1973) and one extremely severe (Jan. 1970). Although thick ice covered all inland and most coastal waters and drift-ice could be found over vast offshore waters in the severe winter of 1969/70, most stretches of water still had potential settling areas for waterfowl in openings created by currents.

The largest mid-winter populations of most *Anas* species and *T. tadorna* were recorded in Jan. 1969, when there was little or no ice in most important areas in W. and N. Jutland. In the subsequent severe winter, *A. platyrhynchos* and *T. tadorna* were much scarcer, and numbers of other *Anas* species were negligible. In the very mild winter of Jan. 1973 dabbling ducks were fairly numerous, and the highest mid-winter level was recorded for *C. columbianus*.

The largest numbers of five species of diving ducks and two swans *(A. ferina, A. fuligula, A. marila, B. clangula, M. merganser, C. olor* and *C. cygnus)* were found in the severe winter of Jan. 1970. This was probably a result of conditions elsewhere in the Baltic region being even more severe than in Danish waters (NILSSON 1968, 1973), although for *A. marila* and *M. merganser* it is also correlated with pressumed high juvenile production in the previous summer (see Fig. 11 p. 58–59).

The severe weather in Jan.–Feb. 1970 killed unusually many *C. olor,* and the weakened condition of the survivors led to poor reproductive success in the following breeding season. The same factors are possibly also responsible for the low numbers recorded in Jan. 1971 of some other species *(A. ferina, A. fuligula, A. marila, B. clangula* and *F. atra),* although reduced reproduction is not apparent in the material of bagged birds (see Fig. 11 p. 58–59).

Distribution and habitats

The distribution of non-breeding waterfowl in Denmark is influenced by several factors, the most noticeable being 1) traditions and the pattern of migration routes over the country, 2) occurrence of suitable habitats, and 3) weather, disturbance and other more or less recurrent factors. The primary objective of the study of 1965–1973 was to present quantitative information on populations throughout the country, and to evaluate the importance of different wetlands for waterfowl during the daytime. Although it was not the intention to conduct studies on the more detailed ecology of the different species, the information collected forms an excellent basis for future work of this kind. Here only some very general information concerning main distribution patterns, habitat selection, and factors influencing local occurrence is briefly discussed.

General distribution patterns

Distribution maps for the different species were presented in Chapter IV, and Table 29 gives a summary of the main distribution pattern, seen from a quantitative point of view. Distinction was made between four types of geographical distribution, viz. a) uniform, b) mainly in W. and N. Jutland, c) mainly in SE. Denmark, and d) mainly in central waters (the Kattegat, the Storebælt, the Lillebælt, and the S. Funen Archipelago). In spite of Denmark's small size, few species have a quantitatively uniform distribution over the country. Although most species are

regularly found in all regions, the majority have their main centre of occurrence in particular regions, and some species (particularly the scarcer ones), are even confined to a few localities and rarely found elsewhere *(N. rufina, M. albellus* and *C. columbianus)*. This general distribution pattern is a result of both traditions of the populations and of access to suitable habitats. For species with a very limited distribution, traditions probably play a very important role, while for other species (e.g. some dabbling ducks) the importance of the habitat factor seems obvious. Four species *(A. ferina, M. merganser, C. cygnus* and *F. atra)* are of special interest, as they occur in large numbers in W. and N. Jutland and in SE. Denmark, but are relatively scarce in areas between these regions. There is no apparent lack of suitable habitats here, which suggests that there are two migration routes through Denmark, possibly with birds of different origin, as it has been demonstrated e.g. for *A. platyrhynchos* (Fog 1974) and *B. clangula* (Nilsson 1969).

Habitat selection

Table 29 also gives a summary of the quantitative aspects of habitat selection by the different species. Habitats have

	Distribution				Main habitats				
	Uniform	N. and W. Jutland	SE. Denmark	Central waters	Inland waters	Coastal lagoons	Sheltered coastal flats	Sheltered fiords and archip.	Open sea
A. platyrhynchos	X				X	X	X	x	
A. crecca		X			x	X	x		
A. querquedula	(X)					X	x		
A. acuta		X				X	X		
A. penelope		X				X	X	x	
A. clypeata	X					X	x		
T. tadorna		X [1])				x	X		
A. ferina		X ——	X		X	X	x	x	
A. fuligula			X		X	x		X	
A. marila				X [2])				x	X
Cl. hyemalis			X					x	X
M. nigra				X [3])				x	X
M. fusca				X [2])				x	X
S. mollissima				X [4])				x	X
B. clangula	X				x	x	x	X	x
M. serrator	X					x	x	X	x
M. merganser		X ——	X		x	x	x	X	
C. olor			X		x	x	X	X	
C. cygnus		X ——	X		x	X	X	X	
C. columbianus		X			x	X	X	x	
F. atra		X ——	X		X	X	X	X	

Table 29. Summary of general geographical distribution (left) and habitat selection (right) of non-breeding populations of ducks, swans and *F. atra* in Denmark. In the right section X indicates large numbers or a large proportion of the total population, x regular occurrence but smaller numbers or proportions, while the lack of a symbol indicates that the species is absent or occurs irregularly, with a negligible proportion of the total population. Notes to left section: [1]) uniform in spring, [2]) in autumn also in the Limfjord, [3]) also in waters west of the Waddensea, [4]) also in the Waddensea.

been divided into the following five main categories: 1) Inland waters, including lakes, ponds, bogs, rivers, and streams, 2) Coastal lagoons, comprising shallow fresh-, brackish- and salt-water areas situated on or just behind the coastline, often surrounded by marshlands with flooded meadows and emersive vegetation. – 3) Sheltered coastal flats, e.g. most of the Waddensea and many smaller sand- and mud-flats along open coasts, in fiords, bays and in connection with islands and islets. – 4) Sheltered fiords and archipelagoes with deeper water, e.g. the central parts of fiords in W. Jutland, most of the Limfjord, waters between islands in the S. Funen Archipelago, and the central parts of many fiords in E. Jutland, Funen and Sealand. – 5) The open sea, comprising unprotected waters away from coasts, mostly rather deep, but often with underwater shoals.

Only *B. clangula* is regularly found in all types of habitat, although sheltered fiords and archipelagoes (4) probably hold three-quarters of the total population. Several species occur from inland waters to sheltered fiords and archipelagoes (1, 2, 3, 4), but avoid the open sea. Some dabbling ducks are mainly confined to coastal lagoons and sheltered coastal flats (2, 3). In contrast, five species are typical of the open sea (5), while much smaller numbers are found in sheltered fiords and archipelagoes (4). This latter group comprises *A. marila, Cl. hyemalis, M. nigra , M. fusca,* and *S. mollissima. A. marila* is also found in other types of habitat, even occurring regularly in inland waters, but numbers there make up only a negligible proportion of the total population.

The present study only covered the distribution of waterfowl during the hours of daylight, whereas movements and distribution at night were not included. For many and indeed most waterfowl, movements at night and particularly during dusk and dawn represent a characteristic routine activity. Very pronounced are the movements of some dabbling ducks, which characteristically spend the day in large concentrations in areas where little feeding takes place, but during the dark hours disperse to widely-scattered feeding areas (BALAT 1967, HOCHBAUM 1955, NILSSON 1970, SCHOENNAGEL 1963). It has been demonstrated for *A. crecca* that such movements can involve considerable distances (TAMISIER 1966, FOG 1968), but in general very little is known about the dimensions and significance of these movements. It is realistic to assume that movements between feeding and resting areas have developed as an adaptation to the relatively intensive persecution of waterfowl. For example, in many (although not all) important dabbling-duck haunts in W. and N. Jutland there is an apparent lack of the food items most frequently taken by the birds (cf. SPÄRCK 1958) but the areas are relatively undisturbed (see p. 165). In contrast many small inland water-bodies contain suitable food and are known to be visited by dabbling ducks at night, but generally offer the birds little security.

The general impression from scattered observations is that the most widespread dispersal from coastal daytime resting areas to inland night-time feeding areas is found in *A. platyrhynchos* and *A. crecca,* while other *Anas* species disperse to a higher degree over coastal habitats, particularly lagoons and vegetated shorelines. Dispersal from coastal lagoons and large lakes to many smaller inland and coastal water-bodies is also regular for *A. ferina.* Most and possibly all other diving ducks feed during the day, but at least locally *A. fuligula, A. marila, B. clangula* and *M. serrator* are regularly known to disperse at night. For *A. fuligula,* the dense concentrations found for

instance in reserves become widely scattered along the coasts (see also NILSSON 1970), and the three other species move from relatively remote and deep offshore waters to shallower areas closer to the shores. In typical seaducks regular movements observed in the early morning can probably often be explained as compensation for current drift, but dusk–dawn movements in connection with feeding dispersal are possibly also involved.

Factors influencing local distribution

Although the study made during 1965–1973 was very extensive in character and did not primarily include investigation of factors influencing local distribution, some of the most important aspects are briefly discussed.

The food of some diving ducks

Food requirements are of primary importance for the habitat choice of the different species. The composition of the food in Denmark has been studied for swans, dabbling ducks (SPÄRCK 1958) and diving ducks (MADSEN 1954, 1957). The latter reports in particular give very detailed information, and demonstrate that diving ducks in general should be characterized as opportunistic feeders. Plant material only predominates for *A. ferina*, mergansers are primarily fish eaters, while other diving ducks mainly eat molluscs supplemented by varying amounts of other items (crustaceans, annelids, echinoderms, fishes, plant material etc.). With the possible exception of *M. merganser*, no species show a marked preference for any particular food item, and the general impression is that they take the items most easily available in the area where they currently are gathered.

A comparison between the food composition and the distribution pattern as revealed by the present study is only realistic for species which presumably do most of their feeding in the daytime collecting areas. Among diving ducks this is probably true for *Cl. hyemalis*, *M. nigra*, *M. fusca*, *S. mollissima*, *B. clangula*, *M. serrator* and *M. merganser*. In the Kattegat the first four species occur in the sequence mentioned from the deepest parts to the shallowest shoals, and certain tendencies in their food consumption correspond with their pattern of occurrence. *Cl. hyemalis* on the deepest water is less dependent on bottom molluscs and eats more crustaceans and fishes than the three other species; *M. nigra* mostly disperses over a rather uniform sandy bottom and mainly feeds on relatively few species of molluscs. *M. fusca* has a position both in respect to food consumption and occurrence between *M. nigra* and *S. mollissima*. The last-mentioned species is confined to a large extent to rather shallow shoals, often with many stones, and the epifaunal element is particularly pronounced in its food (*Mytilus*, *Littorina*, *Carcinus*, *Asterias* etc.).

The food of *B. clangula* varies considerably, corresponding with a wide range of habitats regularly visited by the species. There is no data available on the food consumption in true fresh water in Denmark. In brackish habitats the birds consume a large amount of plant material (mainly seeds), although both here and in salt water the diet is largely composed of a variety of animal items, including molluscs, crustaceans and fishes.

The two species of mergansers widespread in Danish waters show notable differences in their diet. For *M. merganser* eels (*Anguilla*) play a very important

role, and this probably implies rather specialized feeding; *Gasterosteus* and other fishes are also important. For *M. serrator* eels is of little importance, while *Gasterosteus* is very important. The fact that crustaceans (mainly shrimps) are important also seems to correspond with the occurrence of *M. serrator* on rather deeper water.

Weather

It is characteristic of most wetlands in Denmark that the number of waterfowl present shows significant daily fluctuations. In many areas normally holding large concentrations, days when practically all the birds have moved to other localities are quite frequent. In contrast many wetlands generally of little importance occasionally hold very large flocks of waterfowl. Movements mostly cover rather short distances, for example within the same lake or fiord, but with the exception of swans and possibly coot all species treated in this report frequently carry out movements over considerable distances. The phenomenon is particularly common in dabbling ducks, the *Aythya* species, *B. clangula*, and *M. nigra*, but is also seen in the more resident birds such as *S. mollissima* which performs mass movements between Læsø and Anholt (60 km) or between the southern and northern Storebælt (50–60 km). From a scrutiny of foreign literature one gets the impression that such movements are more frequent and of greater dimensions in Denmark than in many other areas. This is a result of the fact that most waterfowl normally occur in marine habitats which are exposed both to weather and disturbance by man.

The two most important weather factors causing bird movements are rapid ice-cover and wind. In most marine habitats in Denmark, particularly in eastern and central parts, formation of ice is rather gradual and seldom complete (see p. 158), resulting in fairly gradual and short distance movements by waterfowl. However lakes and some fiord areas, particularly the fiords of W. Jutland and occasionally also parts of the Limfjord, often become completely ice-covered within a few days, and the areas are deserted almost simultaneously by large flocks of waterfowl.

Denmark is situated in the transition zone between insular and continental climates. Thus strong winds are very frequent, and wave action and changes in water levels often result in mass bird movements from exposed marine habitats to more sheltered coastal and inland water-bodies. Dabbling ducks are particularly sensitive to bad weather, but mass movements can be found in practically all species, although in swans they are mostly over rather short distances. The examples described below show the tendencies of such movements.

The Waddensea normally holds tens of thousands of dabbling ducks, at low tide widely scattered over the sand- and mudflats, and at high tide concentrated along the coasts (see p. 131). During strong SW.-NW. gales, the water level rises 1–3 metres above normal, and the birds are prevented from feeding on the flats. First they occupy the shores of the Waddensea, and particularly along the Rømø Dam a very large proportion of the total population of the district can be found. Later the birds move inland, some to neighbouring fields behind the dykes (an untypical habitat) but many to inland waters further away, and even to lagoons along the east coast of Jutland, where the numbers of *A. penelope* in particular increase considerably under such conditions. When the weather improves there is generally a rapid movement back to the Waddensea.

In Ringkøbing Fjord also a gale may initially cause the birds to concentrate in sheltered parts of the fiord and on adjacent fields and meadows, and subsequently they disperse to many inland water-bodies not normally visited by large flocks. In the Limfjord rough weather causes the dabbling ducks and often some diving ducks (e.g. *B. clangula, M. serrator* and occasionally *M. merganser)* to desert the exposed flats and deeper parts of the fiord, while numbers increase in the many lagoons and marshlands around the Limfjord. In eastern parts of Denmark most of the main dabbling-duck haunts are in rather sheltered habitats, and here rough weather often results in concentrations of birds caused by movements from local more exposed habitats, although influx from distant haunts deserted by dabbling ducks also occurs. In several fiords and harbours diving ducks (particularly *A. fuligula, B. clangula* and *M. merganser)* tend to concentrate in the sheltered parts, when wave action becomes strong in their normal, more open habitats. Even the true seaducks occasionally visit closed fiord systems under such conditions, although their compensatory movements for example mostly lead them from the exposed to the sheltered side of an island.

Disturbance

In spite of the fact that the pressure of human traffic is increasing rapidly in Denmark as in all other European countries in practically all types of wetland habitat, the influence of human disturbance for example on the occurrence of waterfowl has hitherto only been rather superficially studied.

In summer increasing numbers of mostly small tourist boats (today several tens of thousands) swarm along Danish coasts. On many small islands with breeding waterfowl, terns and gulls, the pressure is becoming fairly critical and constitutes a threat to the breeding success of several species. A large proportion of the *S. mollissima* breed in protected areas, and in colonies with regular public traffic the breeding success is considerably reduced (JOENSEN 1973 b).

During the moulting period seaducks are extremely sensitive to disturbance, and the most important concentrations are found in waters where boat traffic is limited. In some areas of the S. Kattegat where traffic has increased in later years, the number of moulting birds has decreased, but in general there seems to be no immediate dangers for the moulting seaducks. They still have vast, little-disturbed and apparently suitable habitats at their disposal in the remoter parts of Danish waters (JOENSEN 1973 a).

In the present study several observations illustrating the impact of disturbance by sportsmen in autumn and winter were made, and a few typical examples are given here.

Ringkøbing Fjord is one of the most popular areas for dabbling-duck flighting. At dusk and dawn the number of sportsmen present often amounts to a few hundred, while numbers during daytime are smaller. Most sportsmen shoot from the ground (shores and adjacent meadows), but in addition a few dozen punts are regularly seen, mostly along the vegetated shores before Oct. 1st, but after this date regularly in small numbers further out in the fiord. In the first part of the shooting season the presence of sportsmen generally has little influence on the distribution of dabbling ducks. Consequently large flocks are regularly seen a few hundred metres from the sportsmen. After Oct. 1st, when powered boats may be used for shooting, a few mobile sportsmen can significantly change the local distribution of waterfowl. When disturbed the birds concen-

trate to a much higher degree in the two reserves (Tipperne and Klægbanken) and also move to the more open parts of the fiord. Even the presence of more mobile sportsmen does not however apparently influence the total number of birds occurring in the fiord, but this is probably mainly due to the existence of the two protected areas.

Another example is Kalø Vig, near the city of Århus in E. Jutland, which is primarily a gathering area for seaducks. During summer and early autumn (until late Oct.) tourist boat traffic is extremely intensive, and very few waterfowl occur. Later a few thousand and occasionally several thousand seaducks frequent the bay, but on Saturdays and Sundays with favourable weather for shooting, a small number of sportsmen shooting from motorboats (5–10 boats) can create so much disturbance within a few hours that practically all the birds move from Kalø Vig to more remote waters.

Aerial surveys over the waters between E. Jutland and Samsø show that on days with intensive shooting seaducks tend to concentrate over shoals where most boats are unable to navigate, and in addition that many birds move to very distant waters east of Samsø not normally frequented by seaducks. The pressure of disturbance is most pronounced in Oct.–Nov. when the weather is relatively mild and many types of boats are being used. Later fewer sportsmen are active, mainly those with boats specially designed for seaduck shooting, and it is the impression that they cause less disturbance. Systematic observations of this kind have hitherto only been made in a few areas, but many reports from sportsmen in connection with the diving-duck questionnaire survey (see p. 38) show that movement of seaducks as a result of disturbance by both sportsmen and tourist speed-boats is a widespread phenomenon. One of its consequences is that seaducks become increasingly sensitive and thus more difficult to approach and shoot.

In this connection it is relevant to consider the importance of wetland areas, where shooting is either limited or totally prohibited. The map Fig. 75 shows the most important areas of this type, including forty-three game reserves (established according to the Game Act), three scientific reserves (Tipperne, Klægbanken and Vejlerne, established according to the Nature Conservation Act), and two areas where shooting is prohibited by local bye-laws (the Rømø Dam and the harbour of Copenhagen). It has not been possible to include all areas of the last-mentioned category, nor wetlands where shooting is abolished on the basis of private regulations. However the forty-eight wetlands marked on the map comprise a large proportion of the total area, and also are the most important haunts among protected wetlands.

Altogether the areas comprise approx. 500 km², of which the seven largest account for nearly two-thirds of this area; Jordsand 106 km², Vejlerne 60 km², Hansted 38 km², Tipperne-Klægbanken 35 km², Hjarbæk Fjord 28 km², the Rømø Dam 25 km², and Kalvebod 25 km². Furthermore, nine reserves are 5–20 km² each, twenty-five are 1–5 km², and seven are less than 1 km². The areas include seven inland wetlands and forty-one in different types of coastal habitats; none of them comprise areas of open sea.

In Fig. 75 three symbols have been used to illustrate the relative importance of these habitats for waterfowl in autumn and winter. In nine areas more than ten thousand birds are regularly recorded, and in sixteen more than 2,500, while twenty-three of the reserves are less important. The latter group mainly comprises game reserves near towns, estab-

lished partly to avoid shooting in populated areas.

A comparison between Fig. 75 and the species distribution maps in Chapter IV clearly illustrates that for several species, a large proportion of the total population occurs in protected areas. This tendency is particularly noticeable for dabbling ducks. In autumn counts, the reserves of W. and N. Jutland included approximately 60% of all *A. platyrhynchos* and 80% (range 70–95%) of all other *Anas* species recorded in these regions, and with a few exceptions all first-class haunts (cf. species summary maps) are protected. In E. Jutland, Funen and Sealand the concentration of dabbling ducks other than *A. platyrhynchos* in reserves is even more pronounced in autumn, although in species summary maps this tendency is somewhat obscured by the inclusion of haunts which are primarily important in spring.

Reserves also contain a substantial proportion of the populations of *A. ferina* and *A. fuligula*, the two diving ducks most frequently found in inland and coastal waters. In country-wide surveys in Nov. and Jan. 28–75% (mean 55%) of all *A. ferina* and 33–51% (mean 42%) of all *A. fuligula* were found in reserves. With the exception of *M. albellus* all other diving ducks mainly occur in more open waters, and coastal reserves hold only a small proportion, negligible for seaducks, of the total population.

Several reserves comprise some of the most excellent waterfowl habitats, but without doubt the degree of concentration in these areas by species most exposed to disturbance is also a result of the intensive coastal traffic in general and the overall activities of sportsmen in particular. Without reserves, the opportunity for dabbling ducks in particular to use Denmark as an important staging-point on their autumn migration would

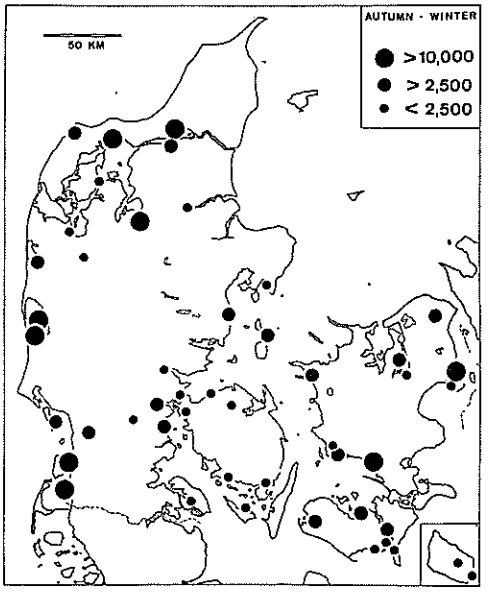


Fig. 75. The relative importance as refuges for waterfowl in autumn and winter of forty-eight wetlands where shooting is prohibited or restricted, and their distribution. See text p. 164.

be considerably reduced, and the absence of refuges would also reduce the sportsmen's opportunity to utilize their sporting potential.

An important question is whether the present number of wetland reserves is sufficient to secure the welfare of large waterfowl populations, in view of the increasing public demand for recreational areas. The present network of reserves includes many valuable coastal lagoons and marshlands, but few inland waters and small islets, and with the exception of the Jordsand reserve no gathering areas for seaducks.

Without doubt the maintenance of rich populations of species breeding in colonies on small islets will require extensive restrictions on public access in spring and summer. More inland wetland reserves would improve conditions for the non-breeding populations of dabbling ducks, which particularly during rough

weather seem to lack suitable, undisturbed habitats. Marine habitats are under increasing pressure from many types of recreational activities, and although the waterfowl have vast areas at their disposal, the disturbance in some of their most important haunts represents a threat to their welfare. The future maintenance of large bird populations together with optimal recreational utilization of their environment will therefore require careful planning. It is not the purpose of this report to advise on the measures to be taken, but obviously some human activities cause great disturbance to birds and are at the same time in conflict with other recreational activities, and must be restricted in many marine areas.

Danish wetlands of international importance

From information presented in the previous chapters (see Fig. 71 p. 132) it is evident that practically all parts of Denmark and the surrounding waters have very important haunts for waterfowl in autumn, winter and spring. The only areas which quantitatively play a minor role are the North Sea between Blåvand and Skagen, waters around Bornholm, and some inland districts with few large lakes (Vendsyssel and S. Jutland). Table 30 gives the approximate area of important wetlands in the different regions, treated in Chapter V. The total area of wetlands of extreme importance, shown in black in Fig. 71, is approx. 2,000 km², and in addition more than 5,000 km² are very important (hatched areas in Fig. 71). The two categories comprise nearly half of the approx. 16,000 km² of salt-water habitat with less than ten metres depth (see Fig. 72 p. 133).

It is noteworthy that inland waterbodies comprise less than one percent of the total area of important wetlands, and hold a maximum of but a few percent of the bird populations present. However, the importance of inland waters is considerably under-estimated by using only information on daytime distribution, and it is most probable that for some species of dabbling ducks the thousands of small lakes and ponds scattered all over the country are just as important as the coastal daytime gathering areas.

In connection with the »Convention of Wetlands of International Importance Especially as Waterfowl Habitat« (RAMSAR, Iran, 1971) the International Waterfowl Research Bureau (IWRB) has recommended (ATKINSON-WILLES 1972, SZIJJ 1972) that areas should be classified as of international importance, if 1) they hold more than 2 ‰ of the total estimated population of waterfowl in the flyway in which they lie, or if 2) they hold more than 10 ‰ of the estimated flyway population of one or more species [1]).

The total winter population of waterfowl in the flyway (excluding the true seaducks) has been estimated at approximately five million, and thus wetlands holding more than 10,000 birds are of international importance. Furthermore, the following species concentrations would qualify a wetland area as being internationally important: *A. platyrhynchos* 10,000, *A. crecca* 2,500, *A. strepera* 100, *A. penelope* 5,000, *A. acuta* 700, *A. clypeata* 650, *N. rufina* 100, *A. marila* 1,500, *A. fuligula* 5,250, *A. ferina* 2,250, *B. clangula* 1,500, *M. serrator* 400, *M. mergan-*

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[1]) In addition to these quantitative criteria the IWRB has suggested that wetlands used by endangered species, representing a vanishing type of wetland, or which are of particular importance for educational purposes etc. should be classified as internationally important.

	Wetland areas of extreme importance (black), km²	Very important areas (hatched) km²	Total km²	Total %	Important only for four seaducks, km²
Waddensea etc.	425	570	1000	14	400
Fiords of W. Jutland	160	145	300	4	–
Limfjord	110	900	1000	14	–
N. Kattegat	350	1000	1350	19	1200
S. Kattegat and Storebælt	300	1100	1400	19	1050
Lillebælt and S. Funen Archipelago	340	460	800	11	300
S. Sealand etc.	250	750	1000	14	20
E. Sealand	50	250	300	4	–
Bornholm	–	–	–	–	–
All inland regions	–	30	30	0.4	–
Total	2000	5200	7200		3000

Table 30. The approximate areas of extremely important and very important wetlands in Denmark, (cf. black and hatched areas in Fig. 71). The right-hand column gives the approximate area which is important only for four species of seaducks *(Cl. hyemalis, M. nigra, M. fusca* and *S. mollissima).*

ser 750, *M. albellus* 100, *T. tadorna* 1,000, *C. olor* 1,200, *C. cygnus* 175, and *C. columbianus* 100.

The distribution of Danish wetlands of international importance can be seen in the species summary maps in Chapter IV. In cases where concentration levels shown differ from those suggested by the IWRB, summary maps generally tend to under-estimate rather than over-estimate the importance of the various areas. In the map Fig. 71 both species diversity and total numbers have been summarized. It is obvious that all areas shown in black are of international importance, and in fact these rank among the most important in the entire flyway. In addition a very large proportion of the areas shown by hatching on the map are of international importance. By using only the species criteria mentioned above and excluding the true seaducks, it is estimated that between 3,000 and 4,000 km² of Danish wetlands can be classified as internationally important. If the four seaduck species of *Cl. hyemalis, M. nigra, M. fusca* and *S. mollissima* are also considered (using the 10,000 criterion) approximately 2,000 km² are added to this figure.

Duck shooting in Denmark

Background information on the official bag-record and the waterfowl kill survey was presented in Chapter II p. 31–53, and the results for different species described in Chapter IV p. 65–129.

The annual kill varies considerably, as is shown by Fig. 6 p. 34 illustrating its size for the main categories back to 1951, but only for *S. mollissima* is there a significant trend over the two decades, during which the average annual kill was doubled. In later years (Table 10 a p. 35) the total annual duck kill varied from 745,000 to 868,000 (mean 788,000), and the proportion of each of the four main categories showed the following variation: Mallard 46–49% (mean 48%), »other dabbling ducks« 16–21% (mean 19%),

eider 15–21% (mean 17%), and »other diving ducks« 14–17% (mean 15%).

Ducks are each year shot by approximately sixty thousand sportsmen, or nearly half of all licence holders. The importance of the mallard is illustrated in Table 10 b p. 35. About ninety percent of duck-shooting sportsmen shoot mallards, and for more than half of them this is the only duck species bagged; only two other Danish game species (pheasant and hare) are bagged by a larger number of sportsmen. The three other categories of duck are shot by much fewer sportsmen, and diving ducks in particular are to a large extent bagged by a small number of specialists (Fig. 7 p. 36). While mallards are bagged by 40% of the licence holders, all the diving-duck species attract the attention of just over 10% of them.

SPECIES COMPOSITION AND GEOGRAPHICAL DISTRIBUTION

Sixteen species of duck are bagged in Denmark, including six dabbling duck and ten diving duck species. The size of the kill in later years has been estimated for fifteen species, and the sequence is as follows, starting with the largest:

	Average annual kill	% of total duck kill
A. platyrhynchos	380,000	48
S. mollissima	136,000	17
A. crecca	76,000	10
A. penelope	44,000	6
A. fuligula	35,000	4
B. clangula	25,000	3
M. nigra	18,000	2
A. acuta	13,000	1.7
Cl. hyemalis	11,000	1.3
A. clypeata	9,500	1.2
M. fusca	9,000	1.2
A. marila	8,500	1.1
M. serrator	7,500	1.0
M. merganser	5,500	0.7
A. ferina	5,000	0.7

The size of the kill of *A. querquedula* is not known, but probably comprises at most a few thousand birds annually. Of the sixteen species, the seven most important comprise 90% of the total kill.

The total kill of ducks is relatively uniformly distributed throughout the country, Bornholm being the only county where a relatively small bag is taken (Fig. 9 p. 48). In general there is good agreement between the species composition of the populations and that of the kill. For example, dabbling ducks make up a very large proportion of the total kill in Viborg, Ringkøbing, Ribe and S. Jutland counties, corresponding with the predominance of these species and the scarcity of diving ducks in these parts of the country. In contrast, the highest proportion of diving ducks is found in Funen, which has greater species diversity than any other part of the country, in Århus county where dabbling ducks are scarce but *S. mollissima* and other seaducks very numerous, and at Bornholm where *Cl. hyemalis* is far the most numerous duck.

A comparison of the distribution of assemblies and of the kill distribution of the individual species also generally gives good agreement, although some discrepancies are explained below;

Dabbling ducks: *A. platyrhynchos* and *A. clypeata* are uniformly distributed throughout the country (Table 29 p. 159), and the kill shows a similar pattern. *A. acuta*, *A. penelope* and *A. crecca* primarily shelter in W. and N. Jutland, but their kill is more uniformly distributed,

particularly for *A. crecca*. Approximately 40% of its bag is taken in the islands, which in autumn probably hold a maximum of 10% of the resting population during daytime. Together with *A. platyrhynchos*, *A. crecca* is the species most typically shot on dusk and dawn flightings, and the distribution of the kill illustrates a considerable dispersal during the dark hours (cf. Fog 1968).

Diving ducks: For the following species there is good agreement between the distribution of the population and of the kill: *A. fuligula*, *A. marila*, *Cl. hyemalis*, *B. clangula*, *M. serrator* and *M. merganser*, the latter three being fairly uniformly distributed throughout the whole country. For three seaducks (*S. mollissima*, *M. nigra* and *M. fusca*) some of the concentrations in remote waters (around Læsø and Anholt and west of the Waddensea) are little exploited. A relatively large number of *M. nigra* and *M. fusca* are shot in the Lillebælt and the S. Funen Archipelago, where few of these birds have been recorded in country-wide surveys (see Fig. 44–49 p. 100–105). In this region many *Melanitta* spp. are shot in flightings in connection with regular dispersal from gathering areas in the central parts of the westernmost Baltic Sea, not covered in the surveys. The kill of *A. ferina* seems more uniformly distributed than the assembled populations do, indicating dusk and dawn dispersal similar to that of dabbling ducks.

AGE- AND SEX-COMPOSITION OF THE BAG

In Chapter III (p. 54) the possible use of the data to study the composition of bagged birds was discussed, and it was suggested that conclusions should mainly concern annual variations.

Juvenile percentage: The juv. % in the bag shows considerable variation from species to species. In *A. crecca*, *A. penelope*, *A. ferina*, *M. nigra* and *M. serrator* there is little annual variation. In *A. fuligula* and *B. clangula*, and particularly in *S. mollissima*, *A. marila*, *Cl. hyemalis* and *M. fusca* there is significant and in some cases considerable annual variation. This is also the case for *M. merganser*, for which however the sample was very small. *A. marila* and *Cl. hyemalis* are apparently highly synchronized, while in other species the synchrony is less noticeable, or non-existent.

Among seaducks killed in oil-disasters the juv. % is, with a few exceptions, smaller than in the bag (Table 26 p. 63). If the composition among oiled birds is tentatively considered identical with that of the wild population, it implies that juv. birds are approximately 1.5–2.0 times as vulnerable to shooting as adult birds.

Fig. 12 p. 60 shows that for *S. mollissima* there is a significant drop in the juv. % in the bag during the shooting season. This is probably due to two things, 1) the fact that juv. birds gradually become more experienced and less vulnerable, and 2) the considerable decimation of their numbers in the early part of the shooting season, when they are much easier to shoot than adult birds (Joensen in press). In *A. fuligula* and *M. nigra* the decrease in juv. % in the bag during the shooting season is also apparent, while in *B. clangula* and *M. fusca* there is considerable annual variation.

Sex ratio: In bagged juv. birds only three species show an equal sex ratio (*A. marila*, *B. clangula* and *M. fusca*), while males predominate in all other diving ducks, varying from 52% in *S. mollis-*

sima to 66% in *A. ferina*. In bagged adult birds females predominate in *A. marila* (54%) and *B. clangula* (57%), while males predominate in all other species: *S. mollissima* 59% (oil kill 62%), *M. serrator* 63%, *A. fuligula* 66%, *M. merganser* 69%, *M. fusca* 70% (oil kill 64%), *A. ferina* 71%, *Cl. hyemalis* 76%, and *M. nigra* 79% (oil kill 66%). Although some of the very high values are probably a result of specialized shooting (see p. 54), both oil-data and field observations show that there is in fact a predominance of males in the populations of these species.

FACTORS INFLUENCING THE SIZE OF THE KILL

The annual variation in the total kill of the different species is illustrated in Table 10 a p. 35 for *A. platyrhynchos* and *S. mollissima* and in Fig. 8 p. 47 for other species. The variation can be expressed as the ratio between the largest and smallest kill in the period investigated and is given below (for »other diving ducks« only the years 1967/68 – 1970/71 are considered): *M. serrator* 1.11, *A. acuta* 1.15, *M. nigra* 1.16, *A. crecca* 1.24, *A. ferina* 1.24, *A. platyrhynchos* 1.25, *B. clangula* 1.26, *Cl. hyemalis* 1.27, *A. clypeata* 1.29, *A. penelope* 1.32, *A. fuligula* 1.35, *M. merganser* 1.36, *M. fusca* 1.42, *S. mollissima* 1.54, and *A. marila* 2.02. For most species there is relatively little annual variation, and for the last two mentioned the high values are due to one year's kill being extraordinarily large compared to the general level.

The size of the kill of a species is influenced by several factors, the most noticeable ones being: 1) the size of the population, 2) the proportion of juveniles, which are particularly easy to shoot, 3) the weather conditions, and 4) human factors, for example the shooting habits of the individual sportsman.

In the present material there are examples of large total kills being correlated with large populations and/or high juv. %, and small bags taken in years when populations are smaller and/or the juv. % was low. For example in 1969/70, the winter population, the juv. % and the total kill of *A. marila* were all approximately twice as large as in other years. Other generally less evident correlations are mentioned for the separate species in Chapter IV. In many cases however such correlations are not apparent, and the general impression is that variations in the annual kill are less pronounced than one would expect, considering the changes in populations and the juv. % they contain.

The number of ducks and the species composition in materials examined at game dealers (see p. 54) often showed that dabbling ducks are most successfully shot in rough weather, while shooting of seaducks, particularly *S. mollissima*, can mainly be practised on days with little wind (see p. 32). In the present material, there are however few obvious examples of total kills being correlated with weather and climatic conditions during a season. The largest bag of *A. fuligula* was taken in the severe winter of 1969/70, in spite of the fact that shooting was already prohibited in early Feb., since the extensive ice-cover favoured a rather specialized and very profitable type of shooting from the edge of the ice, practised by relatively few sportsmen. For *S. mollissima* it has been demonstrated that in the season with a very large total kill (1968/69) the juv. % was high and weather conditions were very favourable,

while in another season with many juv. birds (1971/72) adverse weather conditions prevented the sportsmen from exploiting the many easy birds (JOENSEN in press).

Approximately half of all ducks shot are bagged on Saturdays and Sundays (CLAUSAGER 1974), but in spite of the fact that in some years weather conditions were adverse for practising the like of dabbling duck flighting in successive week-ends during the main shooting period, this did not result in significant reductions of the total kill. This suggests that the shooting habits of the individual sportsman are of decisive importance for his total bag. Although the annual variation in the bag of individual sportsmen has not been studied, it is believed that many sportsmen have certain requirements for success in shooting, which although not defined in terms of number of ducks often result in a bag of a certain fairly constant magnitude.

THE SIZE OF THE KILL IN RELATION TO THE SIZE OF POPULATIONS

A thorough evaluation of the shooting pressure on ducks would require analyses of both ringing data and kill-statistics from most of the countries in the flyway. In several respects, however, the information available is very deficient, and here only a few comments on the size of the kill in Denmark in relation to the populations of ducks are made.

Duck shooting in Denmark is very intensive, and comprises more species than in most other European countries. The size of the total annual kill in the NW. European flyway is not known, but a survey organized by the IWRB recently presented preliminary figures from the following countries: northern U.S.S.R. (including Estonia, Latvia and Lithuania) two million, Finland (including Åland) 250,000, Sweden 175,000, Denmark 800,000, Poland 600,000, DDR 35,000, FDR 320,000, and Spain 230,000 (DOBROWOLSKI & NOWAK 1973). It should be emphasized that some of these figures are very approximate estimates. The total estimated bag in these countries is of the order of 4.5 million, but this does not include the Netherlands, France, Italy and the British Isles, where duck shooting has quite considerable dimensions. The duck kill taken by Danish sportsmen is probably of the order of 10–15% of the total kill of the flyway.

For most countries there is no accurate information on the species composition of the kill, but the impression from many reports in the literature (e.g. SWIFT 1964, SALVERDA 1967, ISAKOV 1970, CARP 1972) is that *A. platyrhynchos* is the most important species in all countries, probably comprising half or more of the total kill. Shooting of this species is based on a wild population primarily breeding in the northern regions of the flyway, while further south increasing proportions consist of birds which are either semi-domesticated or hand-reared mainly for shooting.

The Danish kill of *A. platyrhynchos* comprises both wild, semi-domesticated and hand-reared birds of local origin and migrants of foreign origin. The monthly kill index (Fig. 10 p. 52) shows that 40% are bagged in Aug. –Sept., i.e. before the main influx of foreign birds begins. Since the survey may well have under-estimated the proportion of birds shot in the early part of the shooting season (see p. 51) and local birds are also bagged after Oct. 1st, it may be concluded that probably

half and possibly an even higher proportion of all *A. platyrhynchos* bagged in Denmark are of local origin.

Of the purely wild ducks, the *Anas* species are without doubt subject to the highest shooting pressure. They are an extremely popular shooting item in most countries, and from Table 28 p. 155 it is seen that the Danish bag alone is large compared to the numbers remaining in the flyway after the shooting season. This does not necessarily indicate that the overall populations are limited by shooting, but they may well be locally affected by the shooting pressure. The monthly kill index (Fig. 10 p. 52) shows that 13% of *A. crecca* and 8% of *A. acuta* are bagged in Aug., corresponding to approximately 10,000 and 1,000 birds respectively. By comparing the count data with the kill data it is seen that early in the shooting season, the shooting pressure is extremely heavy. This applies also to the local breeders and their young, and may partly explain why the breeding populations of dabbling ducks other than *A. platyrhynchos* are very small in Denmark.

With the exception of *A. ferina* and *A. fuligula* which are popular shooting items in many European countries, diving-duck shooting in general is much more limited than dabbling-duck shooting. This is due both to protection and to a lack of any tradition in many countries for the rather specialized types of shooting involved. For the species mainly occurring in marine habitats, only Finland, Sweden and Denmark seem to have notable bag numbers, and for most species Denmark accounts for the majority. The NW. European populations of *Cl. hyemalis*, *M. nigra* and *S. mollissima* comprise several hundred thousand birds, and for the first two species the total European kill probably comprises less than 5–10% of the populations. For *S. mollissima* the annual kill amounts to about one-fifth of the estimated population. For *A. marila*, *M. fusca*, *B. clangula*, *M. serrator* and *M. merganser*, the Danish bag probably comprises a significant proportion of the total kill, and when the size of the total flyway population is considered, it is seen that the shooting pressure on these species is fairly moderate, even if their comparatively low breeding potential is considered.

Concluding remarks

The study during 1965–1973 has added to our knowledge on the size, distribution and shooting utilization of the non-breeding waterfowl populations in Denmark. On many occasions the material has proved valuable for land usage, planning etc., and without doubt the future conservation of wetlands and waterfowl will become increasingly dependent on this type of information. Being extensive in character, the study has, however, also emphasized the insufficiency of our present knowledge on many of the mechanisms influencing the populations and their utilization, and such factors can only be elucidated through intensive ecological research on the individual species. In concluding this report some of the most essential points for future research are mentioned.

Mapping and assessing waterfowl populations throughout the flyway form an essential basis for the conservation of a large and differentiated fauna. At present we know where waterfowl concentrate during daytime, but it has also been demonstrated that most species are extremely mobile. Food, weather, disturb-

ance and the traditional habits of the birds are important as factors causing movements. There is, however, a lack of detailed information, and the value of the different wetlands will not be fully understood before such movements have been thoroughly studied. The subject is very complex, but two questions are of particular importance in view of the recent development of the environment and society: 1) the pattern of feeding dispersal by dabbling ducks in particular, and the importance of inland waterbodies for their continued existence and 2) the impact of increasing human disturbance on the distribution and general welfare of waterfowl.

In Denmark, the overall waterfowl populations can only be assessed satisfactorily by combining ground-counts and large-scale aerial surveys. There is no easy method of sampling. When considering future work of this kind it should be borne in mind that 1) estimates obtained in country-wide surveys are very approximate, and minor annual changes in population size are difficult to detect, 2)weather conditions in winter often are unfavourable for this type of survey, and both successful and unsuccessful surveys are expensive in terms both of direct costs and the manpower they occupy, and 3) surveys conducted until now have provided a representative picture of the general distribution and population levels, and further surveys are unlikely to change this picture significantly. On this basis it is suggested that for the time being country-wide surveys in winter are discontinued in Denmark, although this will imply that the international research programme will lack data from a very important wintering area. Winter surveys can eventually be reassumed if information from other sources indicates changes in the waterfowl fauna which need to be checked in detail.

In Denmark, ground-counts alone cannot form a basis for studies of short-term changes in winter populations, but nevertheless they supply essential information on the condition of some of the most important wetlands, many of which are also those most exposed and vulnerable to human activities. It is therefore considered very important to continue monthly ground-counts in a large number of wetlands.

An important objective of maintaining large waterfowl populations is to provide an opportunity for human recreation, including shooting. Furthermore, shooting as one of the most important mortality factors can itself limit the size of the populations. Therefore continuous surveys of the size and distribution of the kill of each species are considered most essential. In Denmark, analysis of the species composition of the annual duck bag has become a routine survey which will be continued in the future. Full use of this type of information can naturally be made only if most or all countries in the flyway participate. Hitherto few countries have presented accurate kill statistics, but it is to be hoped that rapid and considerable progress will be made in this field.

In addition to the general kill survey there is an obvious need for detailed studies on the requirements, habits, performance and general sociology of sportsmen. In the present report it was suggested that human factors are of importance for the actual size of the bag, and such factors must be considered in the future management of waterfowl shooting.

In the present report the data on age- and sex-composition of bagged birds were mainly used in evaluating the conditions for shooting utilization of the

populations. If however such surveys cover larger parts of the flyway, many important biological aspects could also be studied. In North America, breeding conditions and production of ducks vary considerably from year to year, and the study of bag compositions has become an important part of the overall waterfowl population survey. Information in the present report indicates that in some species there is considerable annual variation in the production of young, and further studies on this subject on a flyway scale, when combined with data on mortality (ringing), kill statistics, and population counts, can provide a sound basis for the understanding of the factors regulating waterfowl populations.

Dansk resumé

Andefuglebestandene i Danmark 1965–1973. De ikke ynglende bestande af ænder, svaner og blishøns, og deres jagtlige udnyttelse.

Formålet med undersøgelsen, som gennemførtes i årene 1965–1973, var at tilvejebringe et materiale om 1) de danske andefuglebestandes størrelse og udbredelse udenfor yngletiden, herunder de enkelte rastepladsers betydning, 2) størrelsen, den geografiske fordeling samt månedlige og årlige variationer i jagtudbyttet af de enkelte arter af ænder, 3) årlige variationer i ungeproduktionen, samt 4) mulighederne for løbende at kunne foretage bestandsundersøgelser i Danmark.

I dette arbejde præsenteres de indsamlede oplysninger vedrørende ænder, svaner og blishøns. Gæs er ikke medtaget, da de er genstand for særskilte undersøgelser, foretaget af M. Fog.

MATERIALEINDSAMLING

Andefugletællinger

I årene 1965/66 – 1972/73 gennemførtes optællinger fra land på en række lokaliteter landet over, en gang månedligt fra september til april. Optællingerne blev hovedsageligt foretaget af frivillige tællere. I løbet af otte sæsoner indsamledes oplysninger om mere end 900 forskellige lokaliteter (i alt ca. 18.000 rapporter), og en stor del af de vigtigste indsøer og kystområder blev dækket systematisk igennem de fleste sæsoner. Fig. 1, Tabel 2.

Sideløbende hermed gennemførtes tællinger fra mindre fly langs kyster og over åbne havområder. Flyene blev dels lejet af Vildtbiologisk Station, dels stillet til rådighed af Flyvevåbnet, som med henblik på reduktion af faren for kollisioner mellem fly og fugle ønskede en grundig kortlægning af de permanente rastepladser i Danmark. Flyvningen omfattede i alt 950 timer, hvoraf 750 medgik til tællinger, resten til transport. (Tabel 3, Appendix 1). Halvdelen af flyvetiden blev anvendt i forbindelse med 9 landsdækkende tællinger, hvor man ved at kombinere land- og flytællinger søgte at få et skøn over de totale andefuglebestande. Landsdækkende tællinger gennemførtes i nov. 1967, jan. 1968, nov. 1968, jan. 1969, marts 1969, nov. 1969, jan. 1970, jan. 1971 og jan. 1973 (Fig. 2, 3, Tabel 4, 5, Appendix 2). Tællingernes succes var stærkt påvirket af vejrforholdene, som forhindrede at en tælling kunne gennemføres i jan. 1972.

Kun ved at benytte fly kan man foretage optælling og kortlægning i kystområder og åbne farvande, som rummer en meget stor del af bestandene af de fleste arter. Tællingernes resultater er foruden af vejret påvirket af en række faktorer, f. eks. observatørens erfaringer, fuglearten, fuglenes tendens til at forekomme spredt eller i samlede flokke m.m. Alt i alt må de indsamlede oplysninger betragtes som meget grove. De sikreste resultater opnås for arter, der optræder i søer og langs kysterne i flokke på 100–1.000, mens arter der forekommer meget spredt eller i meget store koncentrationer gennemgående undervurderes. Visse arter af havænder optræder hyppigt i helt åbne havområder, som ikke kunne dækkes tilstrækkeligt ved disse undersøgelser.

Materialet omfatter registrering af

ca. 50 millioner ænder, svaner og blishøns. Det er bearbejdet manuelt og præsenteres summarisk i Kapitel IV. For hver art er fordelingen i hele landet ved de syv sidste landsdækkende tællinger vist på kort. Desuden er for hver art udarbejdet et resumé-kort visende alle lokaliteter, hvor arten regelmæssigt er truffet i større antal, baseret på oplysninger fra både månedlige landtællinger og flytællinger.

På grundlag af oplysninger fra landtællinger i områder, der er dækket alle otte måneder i en tællesæson, er udarbejdet månedlige tælle-indeks, som giver et groft indtryk af arternes relative hyppighed i Danmark fra september til april (Tabel 6, Fig. 4).

Muligheden for at studere årlige variationer i vinterbestandene ved landtællinger alene er vurderet ved at sammenligne landtælle-resultater (beregnet som indeks) med de totale bestande (landsdækkende tællinger). Ligeledes er sammenlignet de enkelte landsdeles andel af hele landets bestand fra år til år. På grund af store forskydninger i bestandenes udbredelse, såvel fra måned til måned som fra år til år, bl. a. forårsaget af varierende isforekomster, er det ikke muligt på gundlag af landtællinger alene eller kombinerede land-fly tællinger i udvalgte landsdele at få et repræsentativt billede af de totale bestandes størrelse. Skøn over landets samlede bestand på et givet tidspunkt kan kun opnås ved intensive landtællinger kombineret med omfattende flytællinger over størstedelen af de omgivende havområder (Tabel 7, 8, 9).

Jagtudbyttets størrelse, sammensætning og geografiske og tidsmæssige fordeling

Jagtudbytteanalysen er baseret på den officielle vildtudbyttestatistik, som giver oplysning om den årlige størrelse og amtsfordeling af udbyttet af gråænder, andre svømmeænder, ederfugle og andre dykænder (Fig. 5, 6, 7, Tabel 10 a, 10 b, 11). For de to kategorier, som omfatter flere arter, er artssammensætningen belyst gennem en spørgebrevsundersøgelse til jægere (andre dykænder 1967/68–1970/71, 6.000 breve, Tabel 12), og ved analyse af statistik over ænder indhandlet til vildtfirmaet MØLLER & MELGAARD, København (andre svømmeænder 1969/70–1971/72, 21.000 fugle, Tabel 17).

I Kapitel II er nærmere redegjort for indsamling og bearbejdelse samt materialefejl og statistisk usikkerhed (Tabel 13, 14, 16). De beregnede jagtudbytter er vist summarisk i Tabel 10 a, 15, 17, 18, samt i Fig. 8–9. Desuden er i Kapitel IV for hver art vist kort over fordelingen og størrelsen af udbyttet i undersøgelsesårene.

På grundlag af et vildtfirmas indhandlings-statistik er udarbejdet et måneds indeks for jagtudbyttet af ænder og blishøns (210.000 fugle), Tabel 19, Fig. 10.

Alders- og kønssammensætning, Fig. 11, 12.

Alders- og kønssammensætningen er først og fremmest belyst for 28.500 nedlagte dykænder undersøgt hos vildtfirmaer i 1968/69 – 1972/73 (Tabel 20, 21, 22, 23). Et mindre materiale på 2.800 nedlagte svømmeænder (undtagen gråand) er undersøgt i 1970/71 – 1972/73 (Tabel 24). For ederfugl, sortand og fløjlsand indgår desuden et materiale af 16.000 fugle omkommet og aflivet ved oliekatastrofer (Tabel 25, 26).

Alders- og kønssammensætningen i et jagtudbytte er influeret af forskelle i de enkelte kategoriers sårbarhed overfor jagt og afspejler derfor ikke direkte sammensætningen i bestanden. Ydermere kan der på grund af eventuelle forskelle i kategoriernes trækmønstre næppe drages slutninger fra en undersøgelse i Danmark alene vedrørende artens samlede bestandssammensætning. Det foreliggende

materiale er derfor først og fremmest benyttet til at belyse årsvariationen i ungeprocenten med henblik på en vurdering af dens indflydelse på det samlede jagtudbyttes størrelse.

DE ENKELTE ARTERS STATUS I DANMARK

I Kapitel IV er for hver art givet en summarisk oversigt over yngleforekomst, optræden i fældningstiden om sommeren, udbredelse og antal efterår-vinter-forår, samt jagtudbyttets størrelse og alders- og kønssammensætning.

Gråand *(A. platyrhynchos)*. Fig. 13–15 side 66. Den talrigeste ynglende andefugl. Betydeligt opdræt. Fælder mest spredt. Den talrigeste svømmeand uden for yngletiden, udbredt i alle landsdele ved ferskvand og kyster. Bestanden kulminerer i november (op til ca. 250.000). Langt den vigtigste jagtbare andefugl i alle landsdele (totale udbytte ca. 380.000). Skydes af 90% af andejægerne.

Krikand *(A. crecca)*. Fig. 16–18 side 70–71. Fåtallig ynglefugl (< 200 par), spredt og oftest fåtallig som fældende. Meget talrig om efteråret med skønnet maksimum i september–oktober på 40–50.000. Fåtallig eller sjælden om vinteren, ret talrig om foråret. Forekommer over hele landet, men de vigtigste rastepladser er søer og kystsumpe i Vest- og Nordjylland. Jagtudbyttet på 68.000–85.000 er ret jævnt fordelt over hele landet, hvilket viser, at spredningen fra de vigtige dag-rastepladser i de mørke timer spiller en stor rolle for jagtudøvelsen.

Atlingand *(A. querquedula)*. Fig. 19 side 71. Fåtallig ynglefugl (<200 par). Efterårsbestanden kulminerer formentlig i august, og artens forekomst er utilstrækkeligt belyst. Sjælden om vinteren. Forekommer over hele landet i ferskvand og kystområder. Jagtudbyttet kendes ikke sikkert, men anslås til maksimalt et par tusinde årligt.

Knarand *(A. strepera)*. Fig. 20 side 73. Yderst fåtallig ynglefugl og gæst på andre årstider. Totalfredet.

Spidsand *(A. acuta)*. Fig. 21–23 side 74–75. Fåtallig ynglefugl (ca. 200 par). Talrig om efteråret med kulmination i september–oktober (25.000–30.000), først og fremmest i ferskvande og kystsumpe i Vest- og Nordjylland. Fåtallig om vinteren. Jagtudbyttet på 12.000–14.000 falder med hovedparten i Vest- og Nordjylland.

Pibeand *(A. penelope)*. Fig. 24–26 side 78–79. Sjælden ynglefugl. Meget talrig trækgæst, fåtalligere om vinteren, med kulmination i oktober–november (ca. 100.000), hvoraf hovedparten findes i Vest- og Nordjyllands kystområder, hvor også størstedelen af jagtudbyttet nedlægges (i alt 37.000–49.000).

Skeand *(A. clypeata)*. Fig. 27–28 side 80. Fåtallig ynglefugl (<500 par). Bestanden kulminerer i august–september og april-maj (om efteråret max. 5.000??). Forekommer i ferskvand og især kystsumpe i alle landsdele. Jagtudbyttet på 8.000–11.000 er jævnt fordelt over hele landet.

Gravand *(T. tadorna)*. Fig. 29–30 side 82–83. Almindelig ynglefugl. Uregelmæssigt fældende i det sydlige Vadehav, men langt talrigere i NV. Tyskland. Bestanden om sensommeren meget lille, men i løbet af efteråret sker spredning især i Vest- og Nordjylland. Vinterbestanden stærkt fluktuerende (især i Vadehavet og Mariager Fjord), og først i løbet af foråret spredes fuglene til alle landets kyster, hvor bestanden i marts–april anslås til 30.000–35.000. Totalfredet.

Taffeland *(A. ferina)*. Fig. 31–33 side 86–87. Fåtallig ynglefugl (350–700 par) og spredt fældende. Bestanden efterår, vinter og forår stærkt fluktuerende (vinter 3.000–10.000) koncentreret i Limfjorden (Ulvedybet) og det sydøstlige Danmark. Jagtudbyttet ca. 5.000 ret jævnt fordelt i landet.

Troldand *(A. fuligula)*. Fig. 34–36 side 88–89. Fåtalligt ynglende (< 500 par) og spredt fældende. Meget talrig uden for yngletiden med

kulmination om vinteren (100.000–200.000), fortrinsvis i større søer og kystområder i landets sydøstlige egne. Jagtudbyttet på 30.000–41.000 viser en lignende fordeling.

Bjergand *(A. marila)*. Fig. 37–39 side 92–93.
Sjælden ynglefugl, fåtalligt fældende i Limfjorden. Uden for yngletiden meget talrig gæst i de centrale farvande, især Lillebælt, med kulmination om vinteren. Bestanden stærkt fluktuerende (40.000–100.000). Ungeprocenten meget varierende. Jagtudbyttet de fleste år ca. 7.000, men i 1969/70 ca. 13.000, overensstemmende med stor bestand og høj ungeprocent det pågældende år.

Rødhovedet And *(N. rufina)*. Fig. 40 side 94.
Yderst fåtallig ynglefugl og gæst. Totalfredet.

Havlit *(Cl. hyemalis)*. Fig. 41–43 side 96–97.
Ikke ynglende vintergæst, kulminerende midvinter, da den træffes i alle farvande og længere til havs end andre andefugle. De fleste er registreret i de sydøstlige farvande som en udløber af hovedvinterkvarteret i Østersøen, men den faktiske bestand er formentlig langt større end det registrerede antal. Jagtudbyttet på 10.000–12.000 årligt nedlægges fortrinsvis omkring Bornholm, Møn, Lolland, Falster og i det Sydfynske Øhav. Ungeprocenten blandt nedlagte fugle varierer meget.

Sortand *(M. nigra)*. Fig. 44–46 side 100–101.
Ikke ynglende gæst. Op imod et par hundrede tusinde fælder i farvandet vest for Vadehavet og i Kattegat, og efterår, vinter og forår overstiger bestanden hyppigt 100.000. Optræder mest langt fra kysterne. Jagtudbyttet på 16.000–19.000 falder fortrinsvis i de centrale farvande. Ungeprocenten blandt nedlagte fugle er meget lav.

Fløjlsand *(M. fusca)*. Fig. 47–49 side 104–105.
Ikke ynglende gæst. Om sommeren fælder ca. 60.000 i Limfjorden og Kattegat. Efterår, vinter og forår registreret i stærkt varierende antal (7.000–37.000), hovedsageligt i ret åbne farvande i Kattegat og Bælterne. Jagtudbyttet på 7.000–10.000 jævnt fordelt i de centrale farvande. Ungeprocenten blandt nedlagte fugle fluktuerende.

Ederfugl *(S. mollissima)*. Fig. 50–52 side 106–107.
Ynglebestanden i stærk vækst og spredning i dette århundrede (7.500 par i 1970). Mindst en kvart million fælder i Kattegat og Vadehavet. Efterår, vinter og forår langt den talrigeste andefugl i danske farvande. Over 500.000 registreret ved flere tællinger, og den samlede vinterbestand anslås til størrelsesordenen tre kvart million, omfattende hovedparten af Østersøens ynglebestand. Overvintrer i havområder omkring Fyn, i hele Kattegat samt Vadehavet. Det årlige jagtudbytte er fordoblet i de sidste tyve år og har i de senere år været omkring 140.000, hvoraf to tredjedele nedlægges omkring Fyn og i det sydlige Kattegat. Arten nedlægges af ca. 11.000 jægere, heraf 60% af ca. 2.000 jægere, der hver nedlægger mere end 20 fugle årligt. Ungeprocenten blandt nedlagte fugle stærkt fluktuerende. Et usædvanligt stort jagtudbytte i 1968/69 faldt sammen med stor ungeprocent og jagtmæssigt gode vejrforhold.

Hvinand *(B. clangula)*. Fig. 53–55 side 110–111.
Ikke ynglende gæst. 12.000–14.000 fælder, fortrinsvis i Limfjorden. Efterår, vinter og forår den videst udbredte dykand, forekommende både i fersk-, brak- og saltvand, dog fortrinsvis i sidstnævnte. Kulminerer sent om efteråret og om vinteren med 50.000–100.000 fugle, hvoraf Limfjorden og de sydøstlige farvande rummer hovedparten. Jagtudbyttet på 22.000–28.000 ret jævnt fordelt over hele landet.

Toppet Skallesluger *(M. serrator)*. Fig. 56–58 side 114–115.
Talrig ynglefugl langs de fleste kyster. Omkring 20.000 fældende, fortrinsvis i Limfjorden. Efterår, vinter og forår stærkt fluktuerende med maksima sent om efteråret (op til 33.000). Forekommer udelukkende i brak- og saltvand. Jagtudbyttet på 7.000–8.000 jævnt fordelt over hele landet.

Stor Skallesluger *(M. merganser)*. Fig. 59–61 side 118–119.
Meget fåtallig ynglefugl. Talrig vintergæst med kulmination midvinter (13.000–28.000). Forekommer både i fersk-, brak- og saltvand, fortrinsvis i Vest- og Nordjylland, samt i de sydøstlige farvande. Jagtudbyttet på 5.000–6.000 jævnt fordelt over hele landet.

Lille Skallesluger *(M. albellus)*. Fig. 62 side 120.
Ikke ynglende vintergæst. Kun regelmæssig i Københavns Havn, hvor nogle få hundrede ses hvert år. Totalfredet.

Knopsvane *(C. olor)*. Fig. 63–64 side 122–123.
Talrig ynglefugl, stærkt tiltagende i dette århundrede (ca. 2.800 par i 1966). Ca. 40.000 fældende især i sydlige og østlige farvande. Bestanden ret konstant året igennem med stigning om vinteren (op til 70.000 registreret), fortrinsvis i de sydøstlige farvande. Totalfredet.

Sangsvane *(C. cygnus)*. Fig. 65–66 side 124–125. Ikke ynglende træk- og vintergæst, fortrinsvis i Vest- og Nordjylland (forår og efterår) og i de sydøstlige farvande (vinter). Vinterbestand op til 10.000. Totalfredet.

Pibesvane *(C. columbianus)*. Fig. 67 side 125. Ikke ynglende, trækgæst i Vest- og Nordjylland (op til 2.000–3.000), fåtallig i andre landsdele. Fåtallig i de fleste vintre. Totalfredet.

Blishøne *(F. atra)*. Fig. 68–70 side 128–129. Meget talrig ynglefugl, mest spredt fældende. Efterår, vinter og forår meget talrig med op til 270.000 registreret. Kulminerende sent om efteråret. Fortrinsvis udbredt i Vest- og Nordjylland og i de sydøstlige farvande. Jagtudbyttet på 57.000–83.000 falder hovedsageligt i de sydøstlige egne. Arten nedlægges af omkring 10.000 jægere, hvoraf langt de fleste kun nedlægger ganske få fugle.

DE VIGTIGSTE RASTEPLADSER I DANMARK

I Kapitel V beskrives andefuglenes forekomst efterår, vinter og forår på en lang række vigtige lokaliteter fordelt på 13 regioner. Oplysninger om nogle arter af gæs er medtaget. Se Fig. 71, 72, 73.

Vadehavet og farvandene vest herfor
Danmarks vigtigste rasteområde for svømmeænder, især om efteråret. Desuden vigtigt fældnings- og vinterkvarter for ederfugl og sortand. Vigtig rasteplads for knortegås og vadefugle.

De vestjyske fjorde
Rummer meget vigtige rasteområder for svømmeænder, sangsvane, pibesvane, stor skallesluger og blishøne, samt kortnæbbet gås og knortegås. Vigtigste områder: Fiilsø, Ringkøbing Fjord (sydlige og østlige dele), Vest Stadil Fjord og Nissum Fjord (nordlige del).

Limfjorden, Thy og Vendsyssel
Et meget varieret område med vigtige rastepladser for svømmeænder, sangsvane og pibesvane (Agger-Harboør, Vejlerne, Ulvedybet og Nibe Bredning). Hvinand, toppet skallesluger og stor skallesluger er talrige i de centrale dele af Limfjorden, taffelanden især i Ulvedybet, blishønen især i Nibe Bredning og Hjarbæk Fjord. Fældningsområde for hvinand, toppet skallesluger, fløjlsand og bjergand.

Nordsøkysten fra Blåvand til Skagen
Uden større betydning for rastende andefugle, idet kun sortand forekommer regelmæssigt i større flokke.

Nordlige Kattegat
Mariager og Randers Fjord, Langerak og kysten herudfor er vigtige rastepladser for svømmeænder og knortegæs. De vidtstrakte åbne havområder udfor Djursland, Himmerland og Vendsyssel og omkring Læsø og Anholt er vigtige fældnings- og vinterkvarterer for ederfugl, sortand, fløjlsand, samt rasteområde for bjergand.

Sydlige Kattegat og Storebælt
Langs kysterne findes flere vigtige rastepladser for svømmeænder, svaner, blishøns m.m., men kvantitativt domineres området ganske af havænderne omkring øer og rev og i de åbne havområder. Den talrigeste er ederfuglen, men også sortand, fløjlsand og bjergand er talrige i vinterhalvåret, de tre førstnævnte tillige i fældningstiden.

De centrale dele af Jylland
Blandt mange hundrede ferskvandsområder i Jyllands indre dele spiller kun et fåtal en større rolle som rastepladser for andefugle i dagtimerne. De vigtigste er Mossø, Hald Sø, Flyndersø, Borris, Søby Sø, Hostrup Sø og Rudbøl Sø, hvor nogle få tusinde andefugle optræder regelmæssigt. For visse arter, specielt svømmeænder, har de ferske vande formentlig stor betydning i forbindelse med fouragering i døgnets mørke timer.

Lillebælt og det Sydfynske Øhav
Området har større artsrigdom end andre egne af landet, idet praktisk talt alle arter forekommer i betydeligt antal. I de lavvandede områder findes meget vigtige rastepladser for svømmeænder, taffeland, troldand, svaner og blishøns. I fjorde og mellem øer træffes store mængder af hvinænder og skallesluger, mens de mere åbne havstrækninger rummer koncentrationer af ederfugl, sortand, fløjlsand, havlit, samt landets største vinterflokke af bjergand.

Indre dele af Fyn
Området rummer kun få vigtige rastepladser.

De største koncentrationer og antal arter findes i søkomplekset Arreskov Sø, Nørresø, Brændegård Sø, på øens sydlige del.

Sydsjælland, Lolland, Falster, Møn

Området rummer flere fjordområder med meget betydelige forekomster af flg. arter: Taffeland, troldand, hvinand, toppet skallesluger, stor skallesluger, knopsvane, sangsvane og blishøne. Langs de eksponerede kyster er havlit dominerende, hvorimod andre havænder er yderst fåtallige.

Østsjælland

Vigtige rasteområder findes i Roskilde Fjord for flere dykandearter, svaner og blishøns, i Københavns Havn og tilgrænsende områder for taffeland, troldand, lille skallesluger, svaner og blishøne. Desuden rummer Kattingesøer, Selsø, Furesø, Arresø og Esrom Sø store flokke.

Centrale Sjælland

De vigtigste rastepladser er Tissø, Tystrup-Bavelse Søer, og Gisselfeld-Bregentved Søer, hvor flere tusinde andefugle raster regelmæssigt. I flere andre søer findes en artsrig fauna, men sjældent store koncentrationer.

Bornholm

I farvandene omkring øen er havlit langt den talrigeste andefugl om vinteren, hvorimod arter som foretrækker mere beskyttede områder er fåtallige.

SAMMENFATNING OG DISKUSSION

Andefuglebestandene i Danmark, Tabel 28.

Ynglebestandene af de to talrigeste arter (gråand og blishøne) kendes ikke, men for alle andre arter tilsammen udgør bestanden ca. 20.000 par. Kun for knopsvane, gravand og toppet skallesluger spiller Danmark en betydelig rolle som yngleområde, mens landets andel af de europæiske bestande af andre arter er beskeden. Flere arter er gået meget frem i dette århundrede, mens visse svømmeænder formentlig er gået tilbage.

For havænder og knopsvane spiller de danske farvande en betydelig rolle i fældningstiden, mens bestandene af andre arter er ret små og overvejende består af lokale ynglefugle.

Bestandene efterår, vinter og forår er for de fleste arter langt større end i yngle- og fældningstiden. For svaner og flere dykænder rummer danske farvande en betydelig del af de samlede vinterbestande på den nord- og vesteuropæiske trækvej, og for flere svømmeænder skønnes en betydelig del af de samlede bestande at passere Danmark under efterårstrækket. For flere dykandearter, samt knopsvane og sangsvane blev de største bestande registreret i isvinteren 1969/70, mens vinterbestandene af svømmeænder var størst i januar 1969, da deres vigtigste rastepladser i Vest- og Nordjylland var isfri.

Kun få arter er jævnt udbredt over hele landet, idet flertallet overvejende optræder i bestemte landsdele, hvilket både skyldes biotopkrav og traditioner. I Tabel 29 er arternes regionale fordeling og vigtigste biotoper groft skematiseret.

Med hensyn til lokal optræden viser næsten alle arter betydelige, ofte daglige variationer i forbindelse med omfattende bevægelser, først og fremmest forårsaget af vejret (isforhold, vind, vandstandsændringer), men tilsyneladende også hyppigt af forstyrrelser, bl. a. fritidssejlads og jagt. Desuden foretager flere arter lokale træk i døgnets mørke timer imellem rasteområder og fourageringsområder.

Fig. 75 viser 48 vandområder, fortrinsvis reservater, hvor jagt og anden færdsel er forbudt eller begrænset. Særlig for svømmeænder er disse uforstyrrede områder en væsentlig forudsætning for fuglenes optræden i Danmark, og dermed også for jagtudøvelsen udenfor reservaterne. Der synes at være behov for flere reservater på øer, hvor søfugle yngler,

samt i ferske vande, hvor svømmeænder kan raste uforstyrret, når f. eks. vejrforholdene fordriver dem fra de mere eksponerede kystområder. Der findes endnu ingen egentlige havreservater, og med den stigende uro på havet synes der at være behov for en regulering.

På kortet Fig. 71 side 132 omfatter de ekstremt vigtige rasteområder (sort) ca. 2.000 km², mens vigtige rasteområder (skraveret) dækker ca. 5.000 km². (Tabel 30). Begge kategorier kan i næsten fuldt omfang betegnes som værende af international betydning for de europæiske andefuglebestande, jvf. de kriterier, som er foreslået af International Waterfowl Research Bureau. Med få undtagelser rummer alle danske farvande rasteområder, som er livsvigtige for Europas andefugle.

Andejagten i Danmark

Omkring 60.000 jægere nedlægger hvert år ænder, heraf størstedelen kun gråand, mens andre arter nedlægges af langt færre jægere. Seksten arter er jagtbare, og der nedlægges årligt over tre kvart million, hvoraf følgende syv arter tilsammen tegner sig for 90%: Gråand 48%, ederfugl 17%, krikand 10%, pibeand 6%, troldand 4%, hvinand 3%, og sortand 2%. Svømmeænder er helt dominerende i jagtudbyttet i Vest- og Nordjylland, mens dykænder især er vigtige på Fyn, i Århus amt og på Bornholm (Fig. 9, Tabel 18). For de fleste arter er der god overensstemmelse mellem deres forekomst og den geografiske fordeling af jagtudbyttet. Især for svømmeænder er der dog en større spredning af jagtudbyttet som udtryk for lokale vandringer i døgnets mørke timer.

I flere tilfælde er der overensstemmelse mellem jagtudbyttets størrelse på den ene side og bestandenes størrelse og/eller ungeprocenten på den anden. Jagtudbyttet udviser dog mindre årlig variation end man skulle forvente, hvilket formentlig skyldes jægernes traditioner.

Da der mangler nærmere oplysninger om jagtudbyttet fra de fleste lande, er det ikke muligt sikkert at vurdere jagttrykket på de enkelte arter. Det er dog sikkert, at jagttrykket på flere svømmeandearter er ret kraftigt, og muligvis er der en sammenhæng mellem jagten i den første del af sæsonen og de beskedne ynglebestande i Danmark. På flertallet af dykænder, som kun jages i få lande, synes jagttrykket at være betydeligt mindre, for visse arter af havænder endog meget ringe.

РЕЗЮМЕ НА РУССКОМ ЯЗЫКЕ

Популяции утиных в Дании с 1965 по 1973 г. Не гнездящиеся популяции уток, лебедей и лысух, и их охотничье использование

Целью исследования, проведенного с 1965 по 1973 г., было получение материалов о 1) численности и распространении датских популяций утиных вне сезона размножения, а также значении отдельных убежищ, 2) численности, географическом распределении и годовых колебаниях охотничей добычи отдельных видов утиных, 3) годовых колебаниях продукции детенышей и 4) возможностях осуществления текущих исследований популяций в Дании.

В настоящем труде представляются собранные сведения об утках, лебедях и *F. atra*. Гуси не включены, так как они являются предметом отдельных исследований, которые провел M. FOG.

Собирание материала

Учеты численности утиных

С 1965/66 по 1972/73 г. от сентября до апреля ежемесячно проводились учеты с суши в ряду местностей по всей стране. Учеты главным образом производились счетчиками-добровольцами. В течение восьми сезонов были собраны сведения из более 900 местностей (всего прибл. 18.000 рапортов), и на большинстве важнейших озер и морских побережий наблюдения проводились систематически в течение большинства сезонов. Фиг. 1, табл. 2.

Параллельно с этим проводились учеты с небольших самолетов вдоль морских побережий и над открытыми участками моря. Самолеты частью были сняты на прокат Станцией Исследования Биологии Дичи, а частью предоставлены в ее распоряжение военно-воздушными силами, с целью уменьшения опасности столкновений самолетов с птицами желавшими основательного нанесения на карту постоянных убежищ птиц в Дании. Общая длительность полетов составляла 950 часов, из которых 750 часов использовались для учетов, а остальное время для транспорта. (Табл. 3, Приложение 1). Половина времени полетов была использована в связи с 9 учетами, охватывавшими всю страну, при которых комбинацией учетов с суши и с самолетов пытались составить себе представление об общей численности популяций утиных.

Охватывавшие всю страну учеты проводились в ноябре 1967 г., январе 1968 г., ноябре 1968 г., январе 1969 г., марте 1969 г., ноябре 1969 г., январе 1970 г., январе 1971 г. и январе 1973 г. (Фиг. 2, 3, Табл. 4, 5, Приложение 2). Успех учетов в высокой степени зависел от метеорологических условий, из за которых не было возможно провести учет в январе 1972 г.

Только при помощи самолетов можно проводить учеты и нанесение на карту у морских побережий и на открытых участках моря, вмещающих очень значительную часть популяций большинства видов. Кроме погоды на результаты учетов влияет ряд других обстоятельств, как напр. опытность наблюдателя, вид птиц, склонность птиц к появлению стаями или вразброс, и пр. В общем, собранные сведения следует считать очень грубыми. Самые надежные результаты получаются для видов, встречающихся на озерах и вдоль морских берегов стаями по 100–1.000, между тем как численность видов, встречающихся либо вразброс, либо очень большими концентрациями, в общем недооценивается. Некоторые виды морских уток часто встречаются на совершенно открытых участках моря,

где при этих исследованиях не было возможности достаточных наблюдений.

Материал включает прибл. 50 миллионов зарегистрированных уток, лебедей и лысух. Он обработан вручную и суммарно представлен в главе IV. Распределение каждого вида по всей стране при семи последних из охватывавших всю страну учетах изображено на картах. Кроме того для каждого из видов разработана суммарная карта, на которой отмечены все местности, где этот вид регулярно встречался в большом количестве, на основании сведений, полученных как ежемесячными учетами с суши, так и учетами с самолетов.

По сведениям, добытым учетами с суши в местностях, где наблюдения проводились в течение всех восьми месяцев сезона учетов, вычислены месячные коэффициенты, дающие примерное представление об относительной частоте встреч видов в Дании с сентября по апрель (Табл. 6, Фиг. 4).

Возможности изучения годовых изменений численности зимних популяций учетами только с суши оценены при помощи сравнения результатов учетов с суши (вычисленных в виде коэффициентов) с численностью общей популяции (по учетам, охватывавшим всю страну). Кроме того сравнялись доли общей популяции страны, которые в каждом из годов находились в отдельных частях ее. На основании учетов только с суши или комбинации учетов с суши и с самолетов в избранных частях страны невозможно получить показательную картину численности общей популяции, так как из месяца в месяц и с года на другой происходят значительные перемещения популяций, между прочим потому, что воды то покрываются льдом, то снова открываются. Оценка общей популяции страны в любой данный момент возможна только на основании интенсивных учетов с суши, комбинированных с обширными учетами с самолетов над большинством окружающих участков моря (Табл. 7, 8, 9).

Численность, состав, географическое распределение и распределение по годам охотничей добычи

Анализ охотничей добычи основан на официальной статистике по добыче дичи, дающей сведения о численности по годам и распределении по областям Дании добычи *A. platyrhynchos*, других настоящих уток, *S. mollissima* и других нырков (Фиг. 5, 6, 7, Табл. 10a, 10*b*, 11). Так как две из этих категорий составляются из нескольких видов, состав добычи по отдельным видам выяснен при помощи писем с вопросами, высланных охотникам (другие нырки 1967/68–1970/71 г., 6.000 писем, Табл. 12) и анализом статистики по уткам, закупленным торгующей дичью фирмой MØLLER & MELGAARD в Копенгагене (другие настоящие утки 1969/70–1971/72, 21.000 уток, Табл. 17).

В главе II более подробно обсуждается способ собирания и обработки, а также недостатки и статистическая ненадежность материала (Табл. 13, 14, 16). Вычисленные величины охотничей добычи суммарно указаны в Табл. 10a, 15, 17, 18 и Фиг. 8, 9. Кроме того в главе IV показаны карты распределения и численности добычи каждого вида в годы периода исследования.

На основании статистики по покупкам одной фирмы, торгующей дичью, вычислен месячный индекс охотничей добычи уток и *F. atra* (210.000 птиц), Табл. 19, Фиг. 10.

Распределение по возрасту и полу, Фиг. 11, 12.

Распределение по возрасту и полу прежде всего выяснено исследованием 28.500 убитых охотниками нырков у торгующих дичью фирм с 1968/69 по 1972/73 г. (Табл. 20, 21, 22, 23). Менее обширный материал из 2.800 убитых настоящих уток (не включающий *A. platyrhynchos*) был исследован с 1970/71

по 1972/73 г. (Табл. 24). Что касается *S. mollissima*, *M. nigra* и *M. fusca*, исследование кроме того охватывает материал из 16.000 птиц, погибших и убитых при нефтяных катастрофах (Табл. 25, 26).

На состав охотничей добычи по возрасту п полу влияет неодинаковая уязвимость отдельных категорий при охоте, и он, следовательно, не является непосредственным отражением состава популяции. Кроме того, в виду возможного неодинакового перелетного поведения разных категорий, с результатов исследования, охватывавшего только Данию, едва ли возможно делать выводы о составе общей популяции. Поэтому, полученный материал прежде всего служил для выяснения годовых колебаний процента молодых особей, с целью получения представления о их влиянии на численность общей охотничей добычи.

Состояние отдельных видов в Дании

В главе IV для каждого отдельного вида даются суммарные сведения о его гнездовании, пребывании в Дании во время летней линьки, о его распространении и численности осенью-зимой-весной, а также о численности и составе по возрасту и полу охотничей добычи.

Кряква (*A. platyrhynchos*) Фиг. 13–15, стр. 66. Самый многочисленный вид из гнездующих утиных. Значительная выводка. Линяет главным образом вразброс. Вне периода гнездования является самой многочисленной из настоящих уток, распространена по всем частям страны у пресной воды и морского побережья. Численность популяции кульминирует в ноябре (до 250.000). Несравненно важнейшая из утиных, на которых охотятся во всех частях страны (общая добыча прибл. 380.000). 90 % всех охотников на уток стреляют ее.

Чирок-свистунок (*A. crecca*) Фиг. 16–18, стр. 70. Гнездует в небольшом числе (< 200 пар.) Во время линьки встречается вразброс и обычно в небольшом числе. Осенью очень многочислен, максимум в сентябре-октябре оценен в прибл. 50.000. Зимой встречается немногочисленно или редко, весной довольно многочисленно. Встречается по всей стране, но важнейшими убежищами его служат озера и болота у морского побережья Зап. и Сев. Ютландии. Охотничья добыча, 68.000–85.000, довольно равномерно распределяется по всей стране, что указывает на большую роль, которую при охоте играют вылеты птиц с важнейших дневных убежищ при наступлении тьмы.

Чирок-трескунок (*A. querquedula*) Фиг. 19, стр. 71.
Гнездует в небольшом числе (< 200 пар). Осенняя популяция вероятно кульминирует в августе. Распространение этого вида недостаточно выяснено. Зимой встречается редко. Встречается по всей стране на пресных водах и у морских побережий. Численность охотничей добычи точно не выяснена, но оценивается в макс. 2.000 за год.

Серая утка (*A. strepera*) Фиг. 20, стр. 73.
В очень небольшом числе гнездует и посещает страну в другие времена года. Охота совершенно запрещена.

Шилохвость (*A. acuta*) Фиг. 21–23, стр. 74–75. Гнездует в небольшом числе (< 200 пар). Многочисленна осенью, с кульминацией в сентябре-октябре (25.000–30.000), главным образом на пресных водах и болотах морского побережья Зап. и Сев. Ютландии. Зимой малочисленна. Наибольшая часть охотничей добычи, составляющей 12.000–14.000, приходится на долю Зап. и Сев. Ютландии.

Свиязь (*A. penelope*) Фиг. 24–26, стр. 78–79.
Редко гнездует. В очень большом числе посещает страну на перелете, в меньшем количестве встречается зимой, кульминирует в октябре-ноябре (прибл. 100.000), большинство встречается у морских побережий Зап. и Сев. Ютландии. Там-же убивается большая часть охотничей добычи, общая численность которой составляет 37.000–49.000.

Широконоска (*A. clypeata*) Фиг. 27–28, стр. 80. Гнездует в небольшом числе (< 500 пар). Популяция кульминирует в августе-сентябре и апреле-мае (осенью макс. 5.000 ??). Встречается на пресных водах и в особенности на болотах у морских побережий всех частей страны. Охотничья добыча, 8.000–11.000, равномерно распределяется по всей стране.

Пеганка (*T. tadorna*) Фиг. 29–39, стр. 82–83. Широко распространенная гнездующая птица. Линяет нерегулярно на южной части морских отмелей у Зап. Ютландии, но в гораздо более значительном числе в Северозападной Германии. В конце лета популяция очен малочисленна, но в течение осени распространяется, особенно по Зап. и Сев. Ютландии. Зимняя популяция сильно колебается (в особенности на морских отмелях Югозап. Ютландии и в Мариагерфиорде), и только в течение весны птицы распространяются по всем побережьям страны, где их численность в марте-апреле оценена в 30.000–35.000. Охота совершенно запрещена.

Красноголовый нырок (*A. ferina*) Фиг. 31–33, стр. 86–87.
Гнездует в небольшом числе (< 700 пар). Линяет вразброс. Популяция осенью, зимой и весной сильно колебается (зимой 3.000–10.000), концентрирована в Лимфиорде (Ульведюбет) и Юговост. Дании. Охотничья добыча, прибл. 5.000, довольно равномерно распределяется по стране.

Хохлатая чернеть (*A. fuligula*) Фиг. 34–36, стр. 88–89.
В небольшом числе гнездует и линяет вразброс. Вне сезона размножения очень многочисленна, с кульминацией зимой (100.000–200.000), главным образом на больших озерах и у морских побережий юговосточных частей страны. Охотничья добыча, 30.000–40.000, распределяется таким-же образом.

Морская чернеть (*A. marila*) Фиг. 37–39, стр. 92. Редко гнездует, в небольшом числе линяет в Лимфиорде. Вне сезона размножения в очень большом числе посещает внутренние участки моря, в особенности Малый Бельт, кульминирует зимой. Популяция сильно колебается (50.000–100.000). Процент молодых сильно колебается. Охотничья добыча в большинстве годов прибл. 7.000, но в 1969/70 г. прибл. 13.000, что соответствует большой популяции и высокому проценту молодых в этом году.

Красноносый нырок (*N. rufina*) Фиг. 40, стр. 94. В крайне небольшом числе гнездует и посещает страну на перелете. Охота совершенно запрещена.

Морянка (*Cl. hyemalis*) Фиг. 41–43, стр. 96–97. Не гнездует, посещает страну зимой, кульминирует в середине зимы, когда она встречается на всех участках моря, дальше от берегов, чем другие утиные. Большинство зарегистрировано на юговосточных водах, куда этот вид распространяется из его главного района зимовки в Балтийском Море, но действительная популяция вероятно значительно больше зарегистрированного числа. Охотничья добыча, составляющая ежегодно 10.000–12.000, главным образом убивается вблизи островов Борнхольма, Мён, Лоллан, Фальстер и в Южно-Фюнском Архипелаге. Процент молодых убитых птиц сильно колебается.

Синьга (*M. nigra*) Фиг. 44–46, стр. 100–101. Не гнездует, посещает страну на перелете. До 200.000 линяют на морских водах к западу от отмелей у Зап. Ютландии и в Каттегате. Популяция осенью, зимой и весной часто превышает 100.000. Встречается главным образом далеко от берегов. Охотничья добыча, 16.000–19.000, главным образом добывается на внутренних участках моря. Процент молодых убитых птиц очень невысок.

Черный турпан (*M. fusca*) Фиг. 47–49, стр. 104. Не гнездует, посещает страну на перелете. Летом прибл. 60.000 линяют в Лимфиорде и Каттегате. Осенью, зимой и весной зарегистрированы сильно колебающиеся числа (7.000–37.000), главным образом на довольно открытых морских участках Каттегата, Большого и Малого Бельтов. Охотничья добыча, 7.000–10.000, довольно равномерно распределяется по морским водам. Процент молодых убитых птиц колебается.

Обыкновенная гага (*S. mollissima*) Фиг. 50–52, стр. 106–107.
Гнездящаяся популяция в этом столетии сильно увеличивается и распространяется (7.500 пар в 1970 г.). По меньшей мере чет-

верть миллиона линяют в Каттегате и на отмелях у Югозап. Ютландии. Осенью, зимой и весной этот вид является несравненно самым многочисленным из утиных на датских водах. При нескольких учетах зарегистрировано более 500.000, и общая зимняя популяция оценивается в прибл. три четверти миллиона, что составляет главную часть всей гнездующей популяции Балтийского Моря. Зимует на морских участках вокруг острова Фюн, по всему Каттегату и на морских отмелях у Югозап. Ютландии. Годовая охотничья добыча за последние двадцать лет увеличилась вдвое, и за последние годы составляла около 140.000, две трети которых были убиты вокруг острова Фюн и на Южном Каттегате. На этот вид охотятся прибл. 11.000 охотников, но 60 % всей добычи достается прибл. 2.000 охотникам, каждый из которых убивает более 20 птиц в год. Процент молодых из убитых птиц сильно колебается. Необычайно большая охотничья добыча 1968/69 г. совпадала с высоким процентом молодых и благоприятными для охоты условиями погоды.

Обыкновенный гоголь (*B. clangula*) Фиг. 53–55, стр. 110–111.
Не гнездует, посещает страну на перелете. 12.000–14.000 линяют, главным образом в Лимфиорде. Осенью, зимой и весной он является самым многочисленным видом из нырков. Встречается как на пресной, так и на солоноватой и морской воде, но главным образом на последней. Кульминирует поздней осенью и зимой, когда его численность достигает 50.000–100.000 птиц, большей частью обитающих в Лимфиорде и на юговосточных участках моря. Охотничья добыча, 22.000–28.000, довольно равномерно распределяется по всей стране.

Длинноносый крохаль (*M. serrator*) Фиг. 56–58, стр. 114–115.
В большом числе гнездится вдоль большинства морских побережий. Около 20.000 линяют, главным образом в Лимфиорде. Осенью, зимой и весной популяция сильно колебается, с максимумами поздней осенью (до 33.000). Встречается только на солоноватой и морской воде. Охотничья добыча, 7.000–8.000, равномерно распределяется по всей стране.

Большой крохаль (*M. merganser*) Фиг. 59–61, стр. 118–119.
Очень малочисленно гнездует. В большом числе прилетает зимой, кульминирует в середине зимы (13.000–28.000). Встречается как на пресных, так и на солоноватых и морских водах, главным образом в Зап. и Сев. Ютландии и на юговосточных участках моря. Охотничья добыча, 5.000–6.000, равномерно распределяется по всей стране.

Луток (*M. albellus*) Фиг. 62, стр. 120.
Не гнездует, посещает страну зимой. Регулярно встречается только в гавани г. Копенгагена, где каждый год можно видеть несколько сот особей. Охота совершенно запрещена.

Лебедь-шипун (*C. olor*) Фиг. 63–64, стр. 122.
Многочисленно гнездующий вид, популяция которого в этом столетии сильно увеличилась (в 1966 г. прибл. 2.800 пар). Около 40.000 линяют, особенно на южных и восточных морских водах. Популяция в течение всего года довольно постоянна, зимой увеличивается (зарегистрировано до 60.000), главным образом на юговосточных морских участках. Охота совершенно запрещена.

Лебедь-кликун (*C. cygnus*) Фиг. 65–66, стр. 124.
Не гнездует, прилетает на перелете и зимой, встречается главным образом в Зап. и Сев. Ютландии (весной и осенью), и на юговосточных морских участках (зимой). Зимняя популяция до 10.000. Охота совершенно запрещена.

Тундровый лебедь (*C. columbianus*) Фиг. 67, стр. 125.
Не гнездующий вид. На перелете посещает Зап. и Сев. Ютландию (до 2.000–3.000), в других частях страны малочислен. В течение большинства зим встречается только малочисленно. Охота совершенно запрещена.

Лысуха (*F. atra*) Фиг. 68–70, стр. 128–129.
Очень многочисленно гнездующий вид. Линяет главным образом вразброс. Осенью, зимой и весной популяция очень многочисленна, зарегирировано до 270.000, кульминирует поздней осенью. Распространен главным образом в Зап. и Сев. Ютландии и на юговосточных морских участках. Охотничья добыча, составляющая 57.000–83.000, главным образом добывается в юговосточных местностях. На этот вид охотятся прибл. 10.000 охотников, большинство которых убивает только очень немного птиц.

Важнейшие места привала в Дании

В главе V даются сведения об обитании утиных осенью, зимой и весной в ряду важных местностей, разбитых на 13 районов. Включены сведения о нескольких видах гусей. См. Фиг. 71, 72, 73.

Сводка и обсуждение

Популяции утиных в Дании, Табл. 28

Численности гнездующих популяций двух самых многочисленных видов (*A. platyrhynchos* и *F. atra*) неизвестны. Общая популяция всех других видов составляет прибл. 20.000 пар. Как местность гнездовья, Дания важна только для *C. olor*, *T. tadorna* и *M. serrator*, между тем как доля этой страны из европейских популяций других видов только незначительна. Численность нескольких видов в течение этого столетия значительно возросла, между тем как у некоторых из настоящих уток она вероятно сократилась.

Для морских уток и *C. olor* датские морские воды играют значительную роль во время линьки, когда популяции других видов довольно малочисленны и состоят главным образом из гнездующих здесь-же птиц.

Осенью, зимой и весной популяции большинства видов гораздо более многочисленны, чем в сезонах размножения и линьки. Лебеди и несколько видов нырков на датских водах составляют значительную часть общих зимних популяций на северозападно-европейском пути перелета, а что касается нескольких видов настоящих уток, можно предполагать, что во время осеннего перелета Данию пролетают значительные части общих популяций. Самые многочисленные популяции нескольких видов нырков, а также *C. olor* и *C. cygnus*, были зарегистрированы зимой 1969/70 г., когда на датских водах было особенно много льда, между тем как зимние популяции настоящих уток были особенно велики в январе 1969 г., когда их важнейшие места привала в Зап. и Сев. Ютландии не были покрыты льдом.

Только немногие из видов равномерно распространены по всей стране, так как большинство их главным образом встречается в определенных частях страны, что объясняется как требованиями к биотопу, так и традициями. В Табл. 29 грубо схематически указаны распространение видов по районам и важнейшие биотопы.

Что касается обитания в отдельных местностях, почти все виды выказывают значительные перемены, часто со дня на другой, в связи с большими перемещениями, прежде всего из за перемен погоды (льда на водах, ветра, повышения и понижения уровня воды), но очевидно также из за нарушения покоя, напр. катанием на лодках или охотниками. Кроме того, некоторые виды предпринимают местные кормовые вылеты в темное время суток, перелетая между дневными убежищами и местами кормления.

Фиг. 75 показывает 48 водных пространств, главным образом заповедников, где охота и другие виды движения запрещены. В особенности для настоящих уток эти спокойные пространства являются важным условием обитания этих птиц в Дании, а следовательно и предпосылкой для возможностей охоты на них вне заповедников. Кажется, что требуются еще добавочные заповедники на островах, где гнездуют морские птицы, а также на пресных водах, где настоящие утки могли бы найти спокойные убежища, напр. когда метеорологические условия принуждают их оставлять более открытые побережья моря. Морских заповедников в собственном смысле еще нет, и ввиду возрастающего движения на море кажется,

что состоит надобность в регулировании его.

На карте Фиг. 71 чрезвычайно важные районы привала (черные) занимают прибл. 2.000 км², а важные места привала (штрихованные) прибл. 5.000 км² (Табл. 30). Обе эти категории вполне могут считаться важными с международной точки зрения для популяций утиных Европы, согласно критериям, предложенным Международным Бюро Исследований Водоплавающих Птиц. За немногими исключениями, все датские морские воды вмещают убежища, жизненно-важные для утиных Европы.

Охота на уток в Дании

Около 60.000 охотников ежегодно убивают уток, большинство из них только *A. platyrhynchos*, между тем как другие виды стреляются гораздо меньшим число охотников. Разрешена охота на 16 видов, и ежегодно убивается более трех четвертей миллиона особей, 90% которых составляется 7 видами:

A. platyrhynchos	48%	*A. fuligula*	4%
S. mollissima	17%	*B.clangula*	3%
A. crecca	10%	и *M. nigra*	2%
A. penelope	6%		

Настоящие утки составляют подавляющее большинство добычи охотников Зап. и Сев. Ютландии, между тем как на острове Фюн, в Орхусской области и на острове Борнхольме главную часть ее составляют нырки (Фиг. 9, Табл. 18). У большинства видов их распространение по местностям довольно хорошо соответствует географическому распределению охотничей добычи. Однако, в особенности охотничья добыча настоящих уток более рассеяна, в чем отражаются местные перелеты птиц в темное время суток.

В нескольких случаях численность охотничей добычи приблизительно пропорциональна численностям популяций и/или процентам молодых особей. Однако, колебания охотничей добычи с года на другой не так сильны, как это можно было бы предполагать, что вероятно объясняется охотничими традициями.

За неимением подробных сведений об охотничей добыче в большинстве других стран, интенсивность охоты на отдельные виды невозможно оценить. Однако нет сомнения в том, что на несколько видов настоящих уток охота ведется довольно интенсивно, и возможно, что состоит связь между охотой в раннюю часть сезона и малочисленностью гнездующих в Дании популяций. Для большинства нырков, на которых охотятся только в немногих странах, интенсивность охоты кажется значительно меньшей, а для некоторых видов морских уток даже незначительной.

Тексты к фигурам

Фиг. 1А. Карта Европы, показывающая расположение зоны исследований, изотермы января (5°, 0°, −5°C), и распределение участков морской воды глубиной менее 40 м (черные).

Фиг. 1В. Подразделение Дании и окружающих ее вод на районы и подрайоны, примененное при учетах водоплавающих птиц.

Фиг. 2. Пространства (штрихованные), над которыми проводились наблюдения с самолетов при семи охватывавших всю страну учетах.

Фиг. 3. Льды на морских и солоноватых водных пространствах во время охватывавших всю страну учетов. Черные: сплошь покрытые льдом (часто с небольшими, изолированными полыньями), пунктирные: прерывный дрейфующий лед.

Фиг. 4. Месячные пересчетные коэффициенты для четырнадцати видов водоплавающих птиц с 1966/67 по 1972/73 г. Основаны на учетах с суши, и включают только те местности, где учет проводился во все восемь месяцев (с сентября по апрель), см. стр. 12 и Табл. 2. Столбы указывают месячное распределение всех зарегистрированных птиц в процентах.

Фиг. 5. Подразделение Дании на области с 1970 г.

Фиг. 6. Общая охотничья добыча (×100.000) четырех категорий утиных в Дании с 1951/52 г. (по официальной статистике охотничей добычи).

Фиг. 7. Процентное отношение распределения охотников и уток к добыче отдельных охотников, и средняя численность добычи за охотника (в кружках). (Данные из статистики по охоте 1968/69 г.)

Фиг. 8. Оценки охотничей добычи «других настоящих уток» (за 3 сезона) и «других нырков» (5 сезонов, см. стр. 44).

Фиг. 9. Средняя численность и состав по видам добычи охотников областей Дании. Вверху слева: четыре категории по официальной статистике 1967/68–1971/72 г. (см. Табл. 9). Внизу слева: «другие настоящие утки» 1969/70–1971/72 г. (см. Табл. 17). Внизу справа: «Другие нырки» 1967/68–1970/71 г. (см. Табл. 15). Масштаб соответствует диаметрам кружков (в тысячах).

Фиг. 10. Месячные коэффициенты охотничей добычи по статистике торгующей дичью фирмы в Копенгагене с 1968/69 по 1972/73 г., см. стр. 51 и Табл. 19. Столбы указывают месячное распределение (в процентах) всех купленных фирмой птиц. A=август, *S*= сентябрь, и.т.д.

Фиг. 11. Распределение по возрасту и полу убитых охотниками *A. crecca* и *A. penelope* за три сезона охоты, и всех нырков за пять сезонов. Число осмотренных птиц указано под годом. Цифры в открытых столбцах указывают: 1) число взрослых ♂♂ за взрослую ♀ (над средней линией), 2) число молодых за взросл. ♀ (внизу столбца). У некоторых видов молодые ♂♂ и ♀♀ объединены (см. стр. 56), а у настоящих уток также объединены взросл. ♂♂ и ♀♀.

Фиг. 12. Месячный % молодых особей в охотничей добыче пяти видов нырков за пять сезонов охоты. Очень небольшие образцы отмечены вопросительными знаками.

Фиг. 13. Распределение *A. platyrhynchos* при семи охватывавших всю страну учетах и трех полных учетах в Зап. и Сев. Ютландии (на противоположной странице).

Фиг. 14. Суммарная карта распространения *A. platyrhynchos* показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 100 птиц. Концентрации более 5.000 птиц встречаются почти во всех частях морских отмелей у Югозап. Ютландии.

Фиг. 15. Распределение по областям охотничей добычи *A. platyrhynchos* (средние числа пяти сезонов охоты 1967/68–1971/72 г.) Масштаб соответствует диаметрам кружков и указывает число особей (в тысячах). Цифры в кружках указывают %% общих чисел.

Фиг. 16. Распределение *A. crecca* при двух охватывавших всю страну учетах и трех полных учетах в Сев. и Зап. Ютландии.

Фиг. 17. Распределение охотничей добычи *A. crecca* по областям за три сезона охоты.

Фиг. 18. Суммарная карта распространения *A. crecca*, показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 25 птиц.

Фиг. 19. Суммарная карта распространения *A. querquedula*, показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 10 птиц.

Фиг. 20. Местности, где *A. strepera* встречалась либо регулярно (сплошные кружки), либо нерегулярно (открытые кружки) в течение настоящего исследования.

Фиг. 21. Распределение *A. acuta* при двух охватывавших всю страну учетах и трех полных учетах в Зап. и Сев. Ютландии.

Фиг. 22. Распределение охотничей добычи *A. acuta* по областям за три сезона охоты.

Фиг. 23. Суммарная карта распространения *A. acuta*, показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 25 птиц.

Фиг. 24. Распределение *A. penelope* при двух охватывавших всю страну учетах и трех полных учетах в Зап. и Сев. Ютландии.

Фиг. 25. Распределение охотничей добычи *A. penelope* по областям за три сезона охоты.

Фиг. 26. Суммарная карта распространения *A. penelope*, показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 25 птиц. Концентрации

более 5.000 птиц встречаются на большинстве участков морских отмелей у Югозап. Ютландии.

Фиг. 27. Распределение охотничей добычи *A. clypeata* по областям за три сезона охоты.

Фиг. 28. Суммарная карта распространения *A. clypeata*, показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 10 птиц.

Фиг. 29. Распределение *T. tadorna* при семи охватывавших всю страну учетах и трех полных учетах в Зап. и Сев. Ютландии (на противоположной странице).

Фиг. 30. Суммарная карта распространения *T. tadorna*, показывающая все местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 25 птиц. Концентрации более 5.000 птиц встречаются на большинстве участков морских отмелей у Югозап. Ютландии.

Фиг. 31. Распределение *A. ferina* при семи охватывавших всю страну учетах.

Фиг. 32. Суммарная карта распространения *A. ferina*, показыающая все местности, где с 1965 по 1973 г. регулярно было заретистрировано более 10 птиц.

Фиг. 33. Распределение охотничей добычи *A. ferina* по полицейским районам за четыре сезона охоты.

Фиг. 34. Распределение *A. fuligula* при семи охватывавших всю страну учетах.

Фиг. 35. Суммарная карта распространения *A. fuligula*, показывающая местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 100 птиц.

Фиг. 36. Распределение охотничей добычи *A. fuligula* по полицейским районам за четыре сезона охоты.

Фиг. 37. Распределение *A. marila* при семи охватывавших всю страну учетах.

Фиг. 38. Суммарная карта распространения *A. marila*, показывающая пространства, где с сентября по апрель регулярно встречаются концентрации более 500, соответственно 5.000 птиц. Даже большие стаи иногда встречаются вне отмеченных пространств.

Фиг. 39. Распределение охотничей добычи *A. marila* по полицейским районам за четыре сезона охоты.

Фиг. 40. Местности, где *N. rufina* встречался регулярно (в более 3 из сезонов с 1965 по 1973 г.) (сплошные кружки) или нерегулярно (открытые кружки).

Фиг. 41. Распределение *Cl. hyemalis* при семи охватывавших всю страну учетах.

Фиг. 42. Суммарная карта распространения *Cl. hyemalis*, показывающая воды, где стаи больше 50, соответственно больше 500 птиц регулярно встречаются зимой. Такие стаи иногда втречаются и вне отмеченных пространств.

Фиг. 43. Распределение охотничей добычи *Cl. hyemalis* по полицейским районам за четыре сезона охоты.

Фиг. 44. Распределение *M. nigra* при семи охватывавших всю страну учетах.

Фиг. 45. Суммарная карта распространения *M. nigra*, показывающая пространства, где концентрации более 1.000, соответственно 5.000 птиц регулярно встречаются с октября по апрель. Даже большие стаи иногда встречаются и вне отмеченных пространств.

Фиг. 46. Распределение охотничей добычи *M. nigra* по полицейским районам за четыре сезона охоты.

Фиг. 47. Распределение *M. fusca* при семи охватывавших всю страну учетах.

Фиг. 48. Суммарная карта распространения *M. fusca*, показывающая пространства, где концентрации более 250, соответственно 1.000 птиц регулярно встречаются с октября по апрель. Даже большие стаи иногда встречаются и вне отмеченных пространств.

Фиг. 49. Распределение охотничей добычи *M. fusca* по полицейским районам за четыре сезона охоты.

Фиг. 50. Распределение *S. mollissima* при семи охватывавших всю страну учетах.

Фиг. 51. Суммарная карта распространения *S. mollissima*, показывающая воды, где стаи больше 1.000, соответственно 5.000 птиц регулярно встречаются зимой (с ноября по март).

Фиг. 52. Распределение по областям охотничей добычи *S. mollissima* (средние числа пяти сезонов охоты 1967/68–1971/72 г.) Масштаб соответствует диаметрам кружков и указывает число особей (в тысячах). Цифры в кружках указывают %% общих чисел.

Фиг. 53. Распределение *B. clangula* при семи охватывавших всю страну учетах.

Фиг. 54. Суммарная карта распространения *B. clangula*, показывающая пространства, где с октября по апрель встречаются стаи больше 250, соответственно больше 1.000 птиц.

Фиг. 55. Распределение охотничей добычи *B. clangula* по полицейским районам за четыре сезона охоты.

Фиг. 56. Распределение *M. serrator* при семи охватывавших всю страну учетах.

Фиг. 57. Суммарная карта распространения *M. serrator*, показывающая пространства, где осенью, зимой и весной регулярно встречаются концентрации более 250, соответственно 1.000 птиц.

Фиг. 58. Распределение охотничей добычи *M. serrator* по полицейским районам за четыре сезона охоты.

Фиг. 59. Распределение *M. merganser* при семи охватывавших всю страну учетах.

Фиг. 60. Суммарная карта распространения *M. merganser*, показывающая местности, где с 1965 по 1973 г. регулярно было зарегистрировано более 25 птиц.

Фиг. 61. Распределение охотничей добычи *M. merganser* по полицейским районам за четыре сезона охоты.

Фиг. 62. Все сведения о появлениях *M. albellus* с 1965 по 1973 г. Сплошные кружки указывают места регулярных встреч, открытые кружки – места нерегулярных встреч.

Фиг. 63. Распределение *C. olor* при семи охватывавших всю страну учетах.

Фиг. 64. Суммарная карта распространения *C. olor*, показывающая пространства, где осенью, зимой и весной регулярно встречаются стаи больше 50, соответственно 250 и 1.000 птиц.

Фиг. 65. Распределение *C. cygnus* при семи охватывавших всю страну учетах.

Фиг. 66. Суммарная карта распространения *C. cygnus*, показывающая пространства, где с 1965 по 1973 г. регулярно было зарегистрировано более 10 птиц.

Фиг. 67. Суммарная карта распространения *C. columbianus*, показывающая пространства, где с 1965 по 1973 г. регулярно было зарегистрировано более 10 птиц. Нерегулярные встречи отмечены открытыми кружками.

Фиг. 68. Распространение *F. atra* при семи охватывавших всю страну учетах.

Фиг. 69. Суммарная карта распространения *F. atra*, показывающая все пространства, где с сентября по апрель 1965–1973 г. регулярно было зарегистрировано более 100 птиц.

Фиг. 70. Распределение по областям охотничей добычи *F. atra*, (средние числа четырех сезонов с 1968/69 по 1971/72 г.) Масштаб соответствует диаметрам кружков и указывает число особей (в тысячах). Цифры в кружках указывают %% общих чисел.

Фиг. 71. Важнейшие убежища настоящих уток, нырков, лебедей и *F. atra* с сентября по май в Дании и на окружающих ее водах.

A (черные): Чрезвычайно важные участки, где в течение нескольких месяцев каждого года регулярно встречаются либо

1) более 15.000 птиц, включающих по меньшей мере две из вышеозначенных категорий в очень больших количествах, либо
2) более 25.000 птиц только одной из категорий (в большинстве случаев: морских уток).

B и C (штрихованные): очень важные участки, где регулярно встречаются либо

B (горизонтальная штриховка) > 1.500 *A. platyrhynchos*, > 750 других настоящих уток, > 500 *C. olor*, > 250 *C. cygnus* и/или > 100 *C. columbianus*,
либо
C (вертикальная штриховка): 2.000 нырков и/или 2.000 *F. atra*. Где штриховка покрывает обширные непрерывные пространства, могут встречаться несколько таких концентраций.

D (открытые клетки): местности внутри страны и изолированные приморские участки, где регулярно встречается разнообразие видов, обычно довольно небольшими, но иногда и многочисленными стаями.

Фиг. 72. Распределение солоных и солоноватых водных пространств глубиной менее 10 м. Глубина почти всех других вод менее 50 м.

Фиг. 73. Местоположение большинства приведенных в тексте главы V географических наименований.

Фиг. 74. Количества настоящих уток (в тысячах), зарегистрированные при учетах с самолетов с сентября 1966 г. по январь 1973 г. на морских отмелях у Ютландии (район A) и в Рингкёбинг-Фиорде (подрайон B*b*). x указывает месяцы, в которые проводились учеты с самолетов.

Фиг. 75. Относительная важность в качестве убежищ водоплавающих птиц осенью и зимой 48 водяных пространств, где охота запрещена или ограничена, и их распределение. См. текст стр. 164.

Тексты к таблицам

Табл. 1. Метеорологические данные о суровости зим с 1965/66 по 1972/73 г. и частоте сильных ветров во время соответствующих сезонов охоты на нырков. По Датскому Статистическому Ежегоднику и сообщениям Государственной Ледокольной Службы. Примечание: «Количество мороза» = произведение средней темп. (°C) в периоды мороза на длительность этих периодов в сутках.

Табл. 2. Число местностей, охваченных учетами с суши в каждом из учетных сезонов с 1965/66 по 1972/73 г. Для каждого района (см. Фиг.1) указано число местностей, охваченных в течение 1–4, соответственно 5–8 месяцев сезона. Внизу указано число местностей, охваченных в течение всех восьми месяцев (применяется для месячных пересчетных коэффициентов). В правой графе указаны проценты географических единиц, из которых получены даные учетов с суши.

Табл. 3. Сводка учетов с самолетов с октября 1966 г. по январь 1973 г. Наверху: число часов полета/часов наблюдений с марта по сентябрь (см. JOENSEN 1973a, стр. 39, Приложение 1), при учетах, охватывавших всю страну (см. Табл. 4), и других учетах с января по апрель. Внизу: Число месяцев, в которых проводились наблюдения с самолетов в каждом из районов (если в течение одного месяца года предпринято больше одного полета, число полетов указано в скобках). О подробностях см. Приложение 1, стр. 198.

Табл. 4. Данные о наблюдательской деятельности и метеорологических условиях при охватывавших всю страну учетах. *ASM*: длительность наблюдений с самолетов в мин. *W*: метеорологические условия (e = превосходные, *g* = благоприятные, p = неблагоприятные, см. стр. 17). *GC*: число единиц, охваченных учетами с суши. *TU*: общее число охваченных единиц. – О географических районах, см. Фиг. 1, стр. 11. Внизу графически изображено распределение наблюдений с самолетов.

Табл. 5. Общее число уток, лебедей и лысух, учтенных в Дании при девяти охватывавших всю страну учетах с 1967 по 1973 г. О подробностях в ноябре 1967 г. и январе 1968 г. см. JOENSEN 1968, стр. 24–27. Подробности последующих учетов даны в Прилож. 2, стр. 199. Численности многочисленных видов округлены на ближайшую сотню, а x означает 1–49 птиц. Для малочисленных видов указаны точные количества. При этих девяти учетах было учтено прибл. десять миллионов водоплавающих птиц.

Табл. 6. Данные, примененные для месячных пересчетных коэффициентов избранных видов с 1966/67 по 1972/73 г. *Loc.*: число местностей, охваченных в течение восьми месяцев, где встречался соответствующий вид. – *Ducks*: общее число птиц соответствующего вида, учтенных в этих местностях (× 100).

Табл. 7. Проценты птиц (от общего числа) учтенных способом учета с суши при четырех охватывавших всю страну учетах в январе.

Табл. 8. Индексы популяций шести видов за четыре года. 1) Индексы, основанные на общих численностях по комбинированным учетам с суши и с самолетов. 2) Индексы, основанные на учетах с суши в 150 местностях, охваченных учетами всех четырех годов. 3) Индексы на основании 150 местностей + местностей, охваченных учетами нижеуказанных годов: 1969 + 1970, 1969 + 1971, 1969 + 1973. 4) Индексы, основанные на тех-же 150 местностях + местностях, охваченных учетами нижеуказанных двух годов: 1969 + 1970,

1970+1971, 1971+1973. Крайняя графа справа указывает амплитуду объёма выборки (в процентах общей численности).

Табл. 9. Колебания популяций пяти видов в нескольких районах, выраженные в процентах общей популяции при четырех охватывавших всю страну учетах в январе (1969, 1979, 1971, 1973 г.). Указаны только цифры для значительных районов.

Табл. 10a. Общая охотничья добыча каждой из четырех категорий утиных за шесть сезонов, и числа (в тысячах) охотников, убивавших птиц каждой из категорий за четые сезона (в скобках). (Данные из официальной статистики по охоте).

Табл. 10*b*. Число охотников (в сотнях), в 1969/70 г. убивших разные комбинации из четырех категорий утиных, указанных в охотничих билетах. *Mall.*:=*A. platyrhynchos*, *O-dabb.d.*=«другие настоящие утки», *S. mollissima*, и *O-div.d.*=«другие нырки». Основано на отчетах от 88% всех владельцев охотничих билетов для официальной статистики по охоте.

Табл. 11. Взаимоотношение местожительства охотников и распределения их добычи (в процентах убитых утиных). Данные за 1970/71 г. – I: Утиные, убитые в пределах области, и их распределение в процентах по местожительствам охотников. – II: Охотники, живущие в области, и процентное распрелеление их добычи. – A: В той-же области. – B: В соседних областях (см. скобки в левой графе). – C: В других областях.

Табл. 12. Данные из анкеты о «других нырках» за 1966/67–1970/71 г. О подробностях, см. текст стр. 39. За 1966/67 г. исследование охватывало только 32 полицейских района, за прочие годы – все районы.

Табл. 13. Оценка общей численности охотничей добычи видов категории «другие нырки» за 1967/68 г., основанная на запросах у 100% всех охотников и случайно выбранном из их ответов 50-процентном образце (в обоих случаях только охотников, подавших для статистики отчеты о более 10 убитых птицах).

Табл. 14. Данные о статистической надежности оценок добычи «других нырков» по полицейским районам.

Табл. 15. Оценка добычи и 95-процентная доверительная граница (×100) для каждой категории « других нырков» за пять сезонов (с 1966/67 по 1970/71 г.). (На основании анкет от 50% из удачных охотников, за 1966/67 г. из 32 полицейских районов – см. стр. 44 – а за другие годы из всех полицейских районов).

Табл. 16. Данные о надежности оценок по видам «других настоящих уток» за 1969/70 по 1971/72 г. Верхняя часть: распределение областей по четырем категориям частоты видов (см. также стр. 42). Нижняя часть: Число областей в трех категориях по соотношению между верхней/нижней 95-процентной доверительной границей.

Табл. 17. Оценка охотничей добычи «других настоящих уток» на датских островах, в Ютландии и по всей стране за три сезона. Общая численность по официальной статистике по охотничей добыче. Образец: количество уток, купленных торгующей дичью фирмой. Доверительные границы 95%.

Табл. 18. Шесть важнейших видов утиных и их процентная доля от общей численности охотничей добычи утиных в каждой из областей (средние числа за охотничьи сезоны с 1967/68 по 1971/72 г.).

Табл. 19. Количество уток и *F. atra*, купленных у охотников торгующей дичью фирмой Møller & Melgaard в Копенгагене с 1968/69 по 1972/73 г. (в сотнях). Данные использовались для оценок месячного распределения каждого вида, и для анализа состава по видам «других настоящих уток» (см. стр. 45).

Табл. 20. Число посещений (раз в неделю) торговцев дичью в Копенгагене, и происхождение материала осмотренных нырков за пять сезонов охоты (с октября по февраль 1969/69 по 1972/73 г.).

Табл. 21. Частота (число месяцев) разных величин месячных образцов десяти видов утиных в материале, полученном от торговцев дичью в течение 25 месяцев.

Табл. 22. Сезонное и месячное распределение нырков, осмотренных у торговцев дичью в течение пяти сезонов охоты (с октября по февраль, с 1968/69 по 1972/73 г.).

Табл. 23. Географическое распределение по адресам охотников нырков, осмотренных у торговцев дичью в течение пяти сезонов

охоты (с октября по февраль, с 1968/39 по 1972/73 г.).

Табл. 24. Число настоящих уток, осмотренных у торговцев дичью в Копенгагене, и проценты молодых особей за три сезона (с октября по декабрь, с 1970/71 по 1972/73 г.).

Табл. 25. Распределение по возрасту и полу у *S. mollissima*, *M. nigra* и *M. fusca*, погибших при нефтяных катастрофах. У двух видов *Melanitta* включены только целые птицы, а не образцы крыльев.

Табл. 26. Проценты молодых особей у *S. mollissima*, *M. nigra* и *M. fusca*, убитых охотниками и погибших от нефти. Пропорция из охотничей добычи основана на полученном от торговцев дичью материале от декабря, января и февраля. В последние четыре из сезонов, когда были получены данные от двух нефтяных катастроф, применялись средние величины.

Табл. 27. Месячное распределение (в процентах общего числа) *A. crecca* и *A. penelope*, убитых охотниками и присланных торговцу дичью из четырех районов Сев. и Зап. Ютландии в течение четырех сезонов охоты.

Табл. 28. Сводка информации о гнездующих, линяющих, осенних, зимних и весенних максимальных популяциях уток (за исключением *A. strepera* и *N. rufina*), лебедей и *F. atra* в Дании, оцененной добыче охотников в Дании, и оцененной численности перелетных популяций, зимующих в Европе (за исключением Италии, Балканского полуострова, Австрии, Чехословакии, Румынии, центральной и южной европейской части СССР). Данные от конца 1960-х и начала 1970-х годов. P = охраненные виды.

Табл. 29. Сводка общего географического распространения (слева) и выбора убежищ (справа) не гнездующих популяций уток, лебедей и *F. atra* в Дании. В правой части, X указывает большую численность или большую долю общей популяции, x – регулярное появление, но менее значительную численность или долю общей популяции, а отсутствие символа означает, что вид либо не встречается, либо встречается нерегулярно, и составляет только ничтожную долю общей популяции.

Табл. 30. Приблизительные площади чрезвычайно важных и очень важных водяных пространств в Дании (ср. с черными и штрихованными пространствами в Фиг. 71). В правой графе указана приблизительная площадь, имеющая значение только для четырех видов морских уток (*Cl. hyemalis*, *M. nigra*, *M. fusca* и *S. mollissima*).

Тексты к приложениям

Приложение 1. Учеты с самолетов с октября по апрель 1966–1973 г. О каждом полете даны следующие сведения: a) дата, *b*) метеорологические условия (I = неблагоприятные, II = благоприятные, но не III = превосходные, см. также стр. 17), c) охваченные учетом подрайоны и интенсивность наблюдений (1 = однократный маршрутный учет, или охвачено меньше 25 % площади убежища водоплавающих птиц, 2 = охвачено 25–75 %, и 3 = охвачено 75–100 %), *d*) общая длительность полета/длительность наблюдений (час/мин). О подразделении датских вод см. Фиг. 1, стр. 11.

Приложение 2. Результаты охватывавших всю страну учетов. Число уток, лебедей и лысух, учтенных в каждом отдельном районе и по всей Дании при семи учетах, охватывавших всю страну. Для многочисленных видов количества указаны в тысячах (с округлением на ближайшую сотню), x означает 1–49 птиц. Для трех сравнительно малочисленных видов указаны точные количества. Для трех редких видов в первой отдельной таблице указано только общее число при каждом из учетов.

Приложение 3. Перечень латинских, английских, датских и русских названий видов и подвидов, обсужденных в этой статье.

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Appendix 1. Aerial surveys Oct.–April, 1966–1973.

For each flight the following information is given: a) date, b) weather conditions (I=poor, II=good, but not III=excellent, see also p. 17), c) sub-districts covered and degree of coverage (1=transect flight or less than 25% of the waterfowl habitat covered, 2=25–75% covered, and 3=75–100% covered), d) total flying time/survey time (hours:minutes). For division of Danish waters see Fig. 1 p. 11.

1966

18. Oct. III, Bb2, Bc3, Bd3, Ca1 (2:30/2:00).
12. Nov. II, Ca1, Cc3, Cd3, Ce2, Cg3 (4:00/3:30).

1967

13.–14. Jan. I–II, Ca2, Cb2, Cc3, Cd3, Ce2, Cg3 (5:30/5:20).
14. Jan. II, Aa3, Ab3, Ac3, Ad3, Ba3, Bb3, Bc3, Bd3, Ca1 (5:00/4:30).
16. Jan. II, Ea1, Eb2, Ec2, Ee2, Ef2, Fa3 (5:00/4:40).
12. Feb. III, Fb2, Fc2, Fd2, Fe3, Na1, Sa1, Sb3 (3:00/2:45).
13. Feb. III, Ba2, Bb2, Bc3, Bd3, Ca2, Cd1, Cf2 (3:30/2:20).
15. Feb. II–III, Aa2, Ab2, Ac2, Ad2 (3:30/1:50).

November 1967, see JOENSEN 1968, total 44:00/41:40 hours. Surveys in all coastal sub-districts except Ch, Da, Ra, Rb.

1968

January 1968, see JOENSEN 1968, total 45:00/40:20 hours. Surveys in all coastal sub-districts except Ch, Da, Mb, Rb.

10. Oct. II–III, Ea3, Eb3, Ec3, Ef1 (3:40/3:20).
19. Oct. III, Fb2, Fc3, Sb3 (2:50/2:30).

November 1968, see Figure 2, Table 4. Total 63:20/50:30. Surveys in all coastal sub-districts except Ch, Da, Ta.

12. Dec. II–III, Fb2, Fc3, Sb1 (1:50/1:40).
19. Dec. III, Fb2, Fc3 (1:30/1:20).

1969

January–February 1969, see Figure 2, Table 4. Total 60:45/44:05 hours. Surveys in all coastal sub-districts except Ch, Da.

March 1969, see Figure 2, Table 4. Total 40:15/28:55 hours. Surveys in all coastal sub-districts except Ch, Da, Ja, Jd, Ka, Kb, Ma, Oa, Ta.

3. April III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3 (4:45/3:45).
24. April III, Bc3, Bd3, Cf2, Ef1, Ga1 (3:25/2:20).
6. Oct. III, Cc1, Ce2, Cf3, Cg3 (3:35/3:00).
11. Oct. III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3 (5:10/4:00).
25. Oct. II–III, Fa2, Fb2, Fc3 (2:45/2:30).
28. Oct. II–III, Bd3, Ca3, Cb3, Cc3, Cd2, Cf2 (4:10/3:05).

November–December 1969, see Figure 2, Table 4. Total 77:25/52:15 hours. Surveys in all coastal sub-districts except Ch, Da, Ta.

13. Dec. II–III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3 (5:00/3:15).
19. Dec. II, Bc3, Bd3, Ca1 (2:35/1:15).

1970

January 1970, see Figure 2, Table 4. Total 49:00/43:35 hours. Surveys in all coastal sub-districts except Ta.

12. Feb. III, Aa2, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3 (3:30/2:50).
27. Feb. II–III, Eb2, Ef2, Fa2 (2:15/1:25).
2. March II, Fa2, Fb2, Fc3 (3:05/2:45).
14. March III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3 (5:20/3:30).
20. March III, Ca2, Cb2, Ce2, Cf2 (6:00/3:00).
2. April II, Ma1, Oa3, Ob3 (5:50/2:30).
20. April II, Ab1, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3 (5:00/4:10).
9. Oct. III, Fb2, Fc3, Fd2 (3:05/2:25).
18. Oct. II, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3, Cf2 (5:55/4:10).
12. Nov. II–III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3 (5:45/5:05).
2. Dec. III, Fa2, Fb2, Fc3 (2:45/2:25).
15. Dec. III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3 (4:55/3:40).

1971

January–February 1971, see Figure 2, Table 4. Total 68:50/49:45 hours. Surveys in all coastal sub-districts except Ch, Da, Ta.

23. Feb. III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3 (7:00/3:40).
10. March II, Eb1, Ef2, Fa1 (1:30/0:55).
30. March II, Aa3, Ab3, Ac3, Ad3, Ba1, Bb3, Bc2 (6:05/4:55).
12. Oct. II–III, Fa3, Fb2, Fc3 (4:15/3:45).
13.–14. Oct. II–III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb3, Bc3, Bd3, Ca3, Cb2, Cc3, Cd2, Ce3, Cf3, Cg3 (18:15/14:25).
3. Dec. II, Ef1, Fa2, Fb2, Fc3 (2:10/1:45).

1972

January, see p. 17. Total 25:05/20:45 hours. Surveys in the following sub-districts: Cc2, Ce2, Cf2, Cg3, Ea1, Eb2, Ec3, Ed1, Ee3, Ef3, Fa3, Fb3, Fc3, Ma1, Oa2, Ob2, Ra1, Sb1.

13. March II, Aa3, Ab3, Ac3, Ad3 (4:55/2:45).
28. March I, Eb1, Ed1, Ee2, Ef1 (2:20/1:55).
7.–8. Dec. III, Aa3, Ab3, Ac3, Ad3, Ba2, Bb2, Bc3, Bd3 (7:15/4:00).

1973

January–February 1973, see Figure 2, Table 4. Total 74:00/55:25 hours. Surveys in all coastal sub-districts except Ch, Da, Ta.

Appendix 2. Results of country-wide surveys.

The number of ducks, swans and coot recorded in each district A–T and the whole of Denmark in seven country-wide surveys. For the common species and the total figures are given in hundreds (rounded to nearest hundred), and x indicates 1–49 birds. For three less common species the actual numbers are given, and for three rare species only the total in each survey is given in the first separate table.

Rare species	Nov. 1968	Jan. 1969	March 1969	Nov. 1969	Jan. 1970	Jan. 1971	Jan. 1973
A. querquedula	12	–	–	43	–	–	11
A. strepera	3	–	2	–	–	–	5
N. rufina	–	–	2	3	–	–	–

NOV. 1968 (× 100)	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	336	297	374	1	71	72	91	24	82	22	39	81	3	109	20	72	30	14	1738
A. crecca	122	29	24	x	1	5	6	–	6	x	3	3	–	1	1	5	1	x	206
A. acuta	10	2	6	–	–	–	–	x	2	x	x	x	–	x	x	x	–	–	21
A. penelope	223	116	52	x	2	4	x	x	2	3	x	1	x	1	x	4	6	x	415
T. tadorna	164	1	7	x	29	1	x	–	1	x	–	x	–	1	–	x	x	–	205
A. ferina	–	x	28	–	x	2	1	–	8	x	x	16	1	22	x	3	1	x	83
A. fuligula	x	1	21	–	5	21	5	2	120	28	11	195	54	90	112	115	12	3	794
A. marila	–	x	193	–	24	52	x	–	175	1	2	1	x	–	–	1	1	x	450
Cl. hyemalis	–	–	x	–	1	1	–	–	1	13	–	1	x	7	–	–	3	1	27
M. nigra	2	–	3	–	481	199	–	–	36	48	–	x	13	x	–	x	82	x	864
M. fusca	–	–	3	–	211	16	–	–	1	44	–	4	1	–	–	–	94	x	374
S. mollissima	518	–	x	–	1287	2102	–	–	320	573	–	67	382	7	–	7	561	1	5827
B. clangula	1	5	499	–	22	34	1	–	91	40	–	19	2	41	1	12	15	1	782
M. serrator	x	–	282	–	4	4	x	x	13	1	1	3	x	7	–	8	3	x	327
M. merganser	–	1	10	–	x	1	5	–	1	x	x	1	–	x	1	2	x	x	22
C. olor	x	39	16	–	13	53	2	1	17	36	x	125	14	110	x	64	16	x	505
C. cygnus	–	4	22	–	x	x	x	x	x	5	–	3	x	2	x	1	1	–	38
F. atra	x	84	617	x	3	124	20	6	194	383	2	505	31	500	6	190	31	1	2699
A. clypeata	1	–	–	–	–	–	4	–	12	–	–	19	–	4	–	2	20	–	62
M. albellus	–	–	35	–	–	–	–	–	–	–	–	6	–	75	3	19	–	–	138
C. columbianus	–	–	427	–	–	–	–	–	2	10	–	–	–	–	–	–	20	–	459
Total (× 100)	1377	578	2163	2	2154	2689	133	33	1070	1198	59	1023	501	898	141	486	858	22	15385

JAN. 1969		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	↑	305	64	228	2	109	100	75	13	85	40	3	87	17	103	3	122	56	25	1436
A. crecca		1	–	–	–	–	1	1	x	x	–	–	–	x	x	–	–	–	x	3
A. acuta		3	–	x	–	–	–	–	–	–	x	–	–	–	–	–	x	–	–	3
A. penelope		20	x	6	–	6	x	–	–	1	2	–	–	x	–	x	–	5	x	41
T. tadorna		153	x	11	–	33	2	–	x	x	x	–	x	2	–	–	x	1	–	204
A. ferina		x	–	1	–	–	2	x	–	7	2	–	12	1	10	–	1	2	x	35
A. fuligula		x	–	14	–	2	51	4	1	465	229	–	344	252	111	x	274	72	15	1835
A. marila		–	–	1	–	20	5	x	–	409	44	–	1	x	1	–	1	28	x	510
Cl. hyemalis		5	–	–	–	x	2	–	–	5	1	–	x	x	17	–	–	x	6	36
M. nigra	(× 100)	17	–	–	–	239	145	–	–	25	12	–	1	178	1	–	21	149	–	787
M. fusca		x	–	–	–	7	8	–	–	8	7	–	x	2	x	–	1	114	x	147
S. mollissima		739	–	2	–	1052	1331	–	–	534	259	–	2	852	2	–	10	555	2	5339
B. clangula		3	25	173	–	31	46	1	x	79	57	–	22	3	76	–	10	44	4	574
M. serrator		x	7	94	–	17	8	–	–	12	6	–	12	3	30	–	2	6	x	196
M. merganser		x	15	27	–	2	21	2	–	8	5	–	6	1	36	–	25	11	x	159
C. olor		1	18	12	–	23	53	2	1	21	60	–	159	19	205	x	82	18	1	674
C. cygnus		x	1	29	–	3	3	1	x	1	1	–	3	x	3	x	2	x	–	47
F. atra	↓	2	24	344	–	8	33	18	18	161	265	x	605	49	192	2	229	119	4	2072
A. clypeata		2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
M. albellus		–	–	1	–	4	16	1	–	36	–	–	1	–	17	–	157	16	1	250
C. columbianus		–	85	297	–	–	–	–	18	–	–	–	20	–	–	–	–	7	–	427
Total (× 100)		1247	155	944	2	1553	1812	103	33	1820	991	3	1254	1380	786	6	781	1179	57	14106

MARCH 1969		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	↑	259	86	180	–	38	43	44	1	24	10	4	35	4	49	x	45	28	6	857
A. crecca		1	1	x	–	x	x	x	–	2	1	–	x	–	x	–	x	–	–	5
A. acuta		x	–	x	–	x	1	–	–	x	x	–	x	–	x	–	–	–	–	2
A. penelope		6	4	50	–	1	10	–	x	2	1	–	x	x	2	–	x	x	–	77
T. tadorna		157	6	21	–	17	20	1	–	4	2	–	7	3	16	x	4	5	1	262
A. ferina		x	3	x	–	x	x	x	–	1	x	–	3	x	12	–	2	x	x	22
A. fuligula		3	7	26	–	11	47	2	x	47	5	x	300	31	301	1	173	35	12	1000
A. marila		–	1	x	–	1	x	–	–	322	3	–	x	x	3	–	x	2	x	333
Cl. hyemalis		–	–	–	–	5	x	–	–	1	4	–	x	1	4	–	x	2	5	22
M. nigra	(× 100)	3	–	x	–	122	83	–	–	7	1	–	x	80	1	–	x	108	–	405
M. fusca		–	–	x	–	3	11	–	–	7	x	–	–	13	x	–	x	3	x	39
S. mollissima		587	–	–	–	262	556	–	–	88	28	–	2	556	4	–	23	547	x	2651
B. clangula		14	18	132	–	16	23	2	x	17	5	–	2	x	28	x	13	40	1	312
M. serrator		11	7	51	–	25	12	–	–	2	5	x	4	4	7	–	3	2	x	132
M. merganser		8	21	16	–	13	6	3	x	5	x	–	3	2	6	x	17	3	x	101
C. olor		1	26	21	–	27	33	1	1	8	5	x	43	10	69	x	48	18	x	310
C. cygnus		x	15	27	–	6	x	x	–	x	x	–	3	1	8	x	2	1	–	63
F. atra	↓	5	10	75	–	13	54	8	1	51	5	x	251	52	106	2	222	40	6	898
A. clypeata		13	–	1	–	–	–	–	–	4	22	–	2	–	4	–	–	–	–	46
M. albellus		–	–	5	–	–	–	1	–	–	–	–	7	–	12	–	31	–	–	56
C. columbianus		56	6	112	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	177
Total (× 100)		1056	205	599	–	560	899	61	3	588	77	5	652	755	617	3	551	835	30	7496

NOV. 1969		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	↑	217	195	214	1	48	40	107	18	155	39	9	122	7	78	26	103	49	12	1442
A. crecca		88	15	30	–	–	1	3	–	6	x	1	12	1	1	2	5	2	x	167
A. acuta		3	49	1	–	–	1	–	–	x	–	–	1	–	1	–	x	–	x	56
A. penelope		98	23	73	–	2	18	1	–	2	4	–	5	x	27	x	1	5	–	261
T. tadorna		64	1	11	–	8	3	x	–	1	1	–	1	x	2	x	x	1	x	91
A. ferina		–	x	14	–	–	–	2	–	6	1	x	16	1	12	1	5	x	x	57
A. fuligula		–	4	139	–	5	6	6	x	119	24	17	147	63	219	71	123	6	2	953
A. marila		–	x	70	x	156	13	x	–	77	32	–	20	1	18	–	4	3	–	392
Cl. hyemalis		–	x	–	–	4	x	–	–	1	2	–	1	1	8	–	x	3	x	20
M. nigra	(× 100)	329	37	28	–	559	149	–	–	18	2	–	6	67	x	–	–	91	x	1286
M. fusca		x	x	31	–	84	40	–	–	6	10	–	2	11	x	–	–	60	–	244
S. mollissima		229	–	x	–	986	931	–	–	102	181	–	14	383	10	–	2	373	1	3213
B. clangula		1	34	138	–	12	11	2	–	42	25	–	28	2	46	x	9	11	1	363
M. serrator		–	27	155	–	3	6	x	–	5	3	–	7	x	11	x	1	2	x	220
M. merganser		–	21	x	–	–	–	x	–	2	1	–	1	x	x	x	x	x	–	26
C. olor		x	37	14	–	16	57	1	x	17	37	–	128	12	125	x	43	11	1	497
C. cygnus		–	11	4	x	x	–	1	–	1	2	–	3	2	2	x	1	x	–	27
F. atra	↓	x	78	470	–	20	104	15	2	318	196	x	432	36	232	3	118	46	1	2070
A. clypeata		149	11	–	–	–	12	–	–	–	–	–	32	–	1	1	–	–	–	272
M. albellus		–	–	–	–	–	–	–	–	2	–	–	–	–	–	2	3	–	–	7
C. columbianus		–	947	68	–	–	–	–	–	–	–	–	–	–	–	36	–	–	–	1051
Total (× 100)		1030	542	1397	1	1903	1379	139	20	876	558	28	946	586	791	105	414	662	18	11398

JAN. 1970		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	↑	52	25	75	–	131	59	64	2	112	41	2	72	43	79	1	76	40	19	895
A. crecca		–	–	–	–	–	–	x	–	x	–	–	–	–	–	–	–	–	–	x
A. acuta		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
A. penelope		x	–	–	–	–	x	x	–	–	–	–	–	x	–	–	x	–	–	x
T. tadorna		4	–	–	–	20	1	–	–	x	x	–	–	3	–	–	–	–	x	28
A. ferina		–	–	4	–	x	1	2	–	56	14	–	4	x	7	–	8	4	x	101
A. fuligula		1	x	46	–	18	55	1	–	172	213	–	227	98	291	4	694	123	19	1962
A. marila		4	–	22	–	16	236	–	–	417	250	–	4	51	15	–	2	44	3	1064
Cl. hyemalis	(× 100)	1	–	–	–	14	2	–	–	x	9	–	8	1	76	–	1	3	8	122
M. nigra		49	55	49	x	346	198	–	–	5	6	–	2	173	2	–	2	165	x	1054
M. fusca		–	–	x	–	6	38	–	–	55	7	–	3	39	1	–	x	33	x	183
S. mollissima		581	–	5	x	1048	1221	–	–	715	296	–	20	849	3	–	2	678	x	5420
B. clangula		19	6	486	–	60	48	1	–	76	51	–	52	10	66	–	7	28	4	914
M. serrator		9	x	13	–	10	16	x	–	53	14	–	15	5	14	–	1	18	x	169
M. merganser		34	8	52	x	20	55	2	–	23	6	–	15	2	39	–	13	12	x	282
C. olor		x	11	11	–	22	116	1	–	27	42	–	237	12	134	x	69	11	x	692
C. cygnus		–	3	6	–	10	2	2	–	3	3	–	30	8	33	x	6	2	–	108
F. atra	↓	x	17	94	–	43	66	19	–	250	84	–	498	102	251	1	136	29	3	1593
A. clypeata		–	–	–	–	–	–	–	–	–	11	–	–	10	–	–	–	–	–	21
M. albellus		–	–	–	–	–	–	1	–	–	–	–	–	–	148	–	272	–	4	425
C. columbianus		–	4	35	–	–	15	13	–	7	–	–	158	110	25	–	–	–	–	407
Total (× 100)		754	126	864	x	1764	2114	93	2	1966	1036	2	1189	1397	1013	6	1020	1191	58	14595

JAN. 1971		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	↑	132	75	189	1	120	41	109	10	73	29	8	127	19	58	19	67	30	16	1124
A. crecca		x	x	1	–	–	x	1	1	x	1	–	–	1	–	–	–	–	–	5
A. acuta		–	–	–	–	–	x	–	x	–	x	–	–	–	–	–	–	–	–	x
A. penelope		–	2	x	–	2	1	–	–	–	2	–	–	–	–	–	–	1	–	7
T. tadorna		141	–	1	–	40	4	x	–	–	x	–	x	–	x	–	x	x	–	187
A. ferina		–	–	2	–	–	1	x	–	2	3	–	6	2	10	–	3	2	x	30
A. fuligula		x	x	9	–	14	49	11	x	124	96	x	225	160	301	2	254	50	32	1327
A. marila		–	–	–	–	22	40	x	–	353	6	–	1	x	1	–	x	15	2	441
Cl. hyemalis		–	–	1	–	3	1	–	–	7	10	–	1	x	26	–	x	2	10	59
M. nigra	(× 100)	120	–	3	x	734	27	–	–	6	8	–	x	26	–	–	1	29	x	954
M. fusca		–	–	1	–	193	8	–	–	4	1	–	1	3	–	–	–	17	x	228
S. mollissima		514	–	x	1	1122	701	–	–	166	424	–	10	282	2	–	11	114	2	3348
B. clangula		7	2	154	–	49	25	3	x	36	23	–	30	4	51	x	14	11	6	415
M. serrator		x	1	30	–	6	11	x	x	13	17	–	68	x	38	–	1	x	3	188
M. merganser		1	31	60	–	11	18	3	x	16	11	x	15	1	41	x	4	13	1	228
C. olor		1	10	20	–	27	26	2	x	17	39	x	157	13	74	x	33	16	1	436
C. cygnus		–	4	13	–	8	2	1	1	1	5	–	18	3	16	1	4	x	–	78
F. atra	↓	x	3	79	x	8	47	6	2	90	200	x	356	61	118	x	70	2	5	1048
A. clypeata		–	–	–	–	–	1	4	–	–	10	–	–	–	–	–	–	–	–	15
M. albellus		1	–	6	–	–	22	1	–	7	–	–	–	–	253	–	204	–	7	501
C. columbianus		–	151	478	–	30	4	4	–	–	2	–	25	10	25	–	–	–	–	729
Total (× 100)		916	130	565	2	2358	1001	137	14	907	875	9	1015	576	739	23	465	304	78	10114

JAN. 1973		A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	Total
A. platyrhynchos	↑	102	157	222	1	142	89	33	5	98	30	4	102	10	78	73	91	21	9	1270
A. crecca		x	x	1	–	x	1	1	x	1	x	–	–	–	–	x	x	–	–	5
A. acuta		–	–	–	–	–	x	x	–	x	x	–	x	–	–	–	x	–	x	1
A. penelope		1	5	18	–	–	3	–	–	x	x	–	3	x	–	–	–	–	–	30
T. tadorna		72	1	10	–	32	5	x	–	5	3	–	1	x	x	–	x	1	x	130
A. ferina		x	3	16	–	–	5	1	x	6	2	x	6	2	14	3	12	1	1	71
A. fuligula		x	1	16	–	32	109	2	x	132	55	–	64	36	70	161	218	36	14	947
A. marila		2	–	x	–	4	187	x	–	567	9	–	–	–	x	x	x	40	x	809
Cl. hyemalis		5	–	–	–	1	2	–	–	29	59	–	x	1	9	–	x	x	4	110
M. nigra	(× 100)	728	x	21	x	505	65	–	–	50	21	–	30	19	4	–	–	38	–	1481
M. fusca		–	–	2	–	22	21	–	–	1	11	–	2	2	x	–	–	6	–	67
S. mollissima		418	–	–	x	733	1399	–	–	513	594	–	6	475	5	–	6	359	x	4508
B. clangula		3	35	218	–	39	85	1	x	89	51	–	51	7	53	12	10	12	2	670
M. serrator		x	1	25	–	1	19	x	x	18	15	–	8	2	20	–	5	2	1	117
M. merganser		1	60	99	–	1	15	11	1	10	6	–	12	1	5	2	6	1	1	232
C. olor		x	36	30	x	15	58	1	x	17	27	–	138	13	102	x	38	13	1	489
C. cygnus		x	13	7	–	7	4	x	x	1	4	–	9	1	8	x	1	x	–	57
F. atra	↓	x	57	235	–	17	195	7	1	137	166	x	231	61	97	28	152	38	2	1425
A. clypeata		2	–	–	–	–	15	–	–	–	–	–	–	–	–	–	–	–	–	17
M. albellus		5	–	–	–	–	25	–	2	8	–	–	–	–	–	14	152	–	–	206
C. columbianus		–	571	456	–	77	–	–	–	–	1	–	–	4	4	–	–	–	–	1113
Total (× 100)		1333	376	926	2	1553	2263	57	8	1674	1053	4	663	631	465	280	541	568	35	12431

Appendix 3. List of scientific, english, danish and russian names of the main species or subspecies treated in this report.

Scientific name	English	Danish	Русский
Anas platyrhynchos platyrhynchos LINNAEUS	Mallard	Gråand	Кряква
Anas crecca crecca LINNAEUS	Teal	Krikand	Чирок-свистунок
Anas querquedula LINNAEUS	Garganey	Atlingand	Чирок-трескунок
Anas strepera LINNAEUS	Gadwall	Knarand	Серая утка
Anas acuta LINNAEUS	Pintail	Spidsand	Шилохвость
Anas penelope LINNAEUS	Wigeon	Pibeand	Свиязь
Anas clypeata LINNAEUS	Shoveler	Skeand	Широконоска
Tadorna tadorna (LINNAEUS)	Shelduck	Gravand	Пеганка
Aythya ferina (LINNAEUS)	Pochard	Taffeland	Красноголовый нырок
Aythya fuligula (LINNAEUS)	Tufted Duck	Troldand	Хохлатая чернеть
Aythya marila marila (LINNAEUS)	Scaup	Bjergand	Морская чернеть
Netta rufina (PALLAS)	Red-crested Pochard	Rødhovedet And	Красноносый нырок
Clangula hyemalis (LINNAEUS)	Long-tailed Duck	Havlit	Морянка
Melanitta nigra nigra (LINNAEUS)	Common Scoter	Sortand	Синьга
Melanitta fusca fusca (LINNAEUS)	Velvet Scoter	Fløjlsand	Черный турпан
Somateria mollissima mollissima (LINNAEUS)	Eider	Ederfugl	Обыкновенная гага
Bucephala clangula clangula (LINNAEUS)	Goldeneye	Hvinand	Обыкновенный гоголь
Mergus serrator serrator LINNAEUS	Red-breasted Merganser	Toppet Skallesluger	Длинноносый крохаль
Mergus merganser merganser LINNAEUS	Goosander	Stor Skallesluger	Большой крохаль
Mergus albellus LINNAEUS	Smew	Lille Skallesluger	Луток
Cygnus olor (GMELIN)	Mute Swan	Knopsvane	Лебедь-шипун
Cygnus cygnus (LINNAEUS)	Whooper Swan	Sangsvane	Лебедь-кликун
Cygnus columbianus bewickii YARRELL	Bewick's Swan	Pibesvane	Тундровый лебедь
Fulica atra atra LINNAEUS	Coot	Blishøne	Лысуха

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Continued cover page 4

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