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Oil Pollution and Seabirds in Denmark  
1935-1968

by  
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Med et dansk resumé: Olieforurening og søfugle i  
Danmark 1935-1968.

Резюме на русском языке  
Загрязнение нефтью и морские птицы в Дании 1935-1968 г.

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## Introduction

There has been pollution of the seas by oil ever since it was first transported by sea, and in recent decades the great increase in amounts of oil transported and consumed has caused a disconcerting increase in the number of cases of oil pollution.

Amongst the damages caused by oil to marine plant and animal communities, the oiling of birds (usually with fatal consequences) is one of the most striking. The effect of oil pollution in reducing bird populations has been shown in several cases in other countries.

In Denmark, pollution of the sea by oil has been a serious problem for decades. Large numbers of seabirds, particularly seaducks have died, causing understandable concern among hunters and ornithologists.

During most of the year, Danish waters contain concentrations of birds (especially seaducks) which are amongst the greatest in Europe. Shooting of waterfowl for sport is of great importance, and this is one reason for the interest given to the oil pollution problem. Recording of oil pollution cases was begun as early as the 1930's, and material is available from the last decades which enables an outline to be given of the nature of the problem in Danish waters.

In 1968 the Game Biology Station began investigations on the populations of diving ducks in Denmark. The studies also included systematic registration of cases of oil pollution with seabirds involved. The objective was partly to estimate the total number of seaducks killed by oil, and hereby evaluate the effect of this mortality factor on populations, and partly to gather data concerning the species- and sex-composition and age-distribution of oiled ducks, which together with data obtained through waterfowl counts and analysis of hunters' bags, could give valuable information on the general state of the populations in various years.

As a background for the studies started in 1968 the present paper will describe oil pollution in Danish waters during the period 1935-1968, as illustrated by a scrutiny of several available sources. In another paper (JOENSEN 1972) the investigations of 1968-1971 will be described, and the problem considered in more detail.

The author thanks ROBERT RUSSEL, M. sc., who translated the manuscript into English.

## Waterfowl Populations, Shipping and Measures against Oil Pollution in Danish Waters

During most of the year, Danish waters contain considerable concentrations of waterfowl. This has particularly been established by mapping and counting of populations, carried out by the Game Biology Station since 1966 (JOENSEN

1968). Later counts of more thorough nature indicate that during the population peaks in autumn and winter, there are about 250,000 dabbling ducks, 1 million diving ducks, 75,000 swans, 150,000 *Fulica atra*, and several hundred thousand

gulls. ATKINSON-WILLES (1969) has illustrated the great importance of Danish waters in the winter distribution of several species in Western Europe. This is especially so for several species of diving ducks, together with *Cygnus olor*, *Cygnus cygnus* and *Fulica atra*. During summer hundreds of thousands of waterfowl (particularly seaducks) moult in Danish waters (JOENSEN 1964, SALOMONSEN 1968). Along the coasts there are many large breeding colonies of gulls and terns, whereas the number of breeding waterfowl is much smaller than the non breeding populations, *Somateria mollissima*, *Mergus serrator* and *C. olor* being the only plentiful coastal breeders.

Danish waters contain some of the busiest shipping traffic in the world. The majority of all sea transport to the Baltic areas passes through the North Sea, the Kattegat, and the narrow waters of the Øresund (Fig. 1, district XIII), the Storebælt (district X), and to a lesser extent the Lillebælt (district IX), to supply a human population of approximately 100 million. In 1967 more than 80,000 ships (over 50 BRT) were recorded passing through the Øresund, the Storebælt and the Lillebælt, and alone 50,000 of these passed through the Øresund (STATISTICAL YEARBOOK 1969).

The consumption of oil has been increasing rapidly for many years. The import of oil products to Denmark illustrates the trend: in 1948 1.1 million tons were imported, in 1959 4.5 million tons, and by 1968 14.2 million tons were imported. Since the establishment of oil refineries in Denmark the import of crude oil has increased greatly, from 20,000 tons in 1948 to 7,680,000 tons in 1968

(STATISTICAL YEARBOOK 1949, 1959, 1969).

Oil tankers have previously been considered as an important source of pollution, and Danish legislation on the prevention of oil pollution has thus been mainly directed towards tankers and other large cargo-boats. As early as the 1930's ships were forbidden to release oil inside Danish territorial waters (i. e. within the limit of 3 nautical miles), but the release of oil outside territorial waters could not be prevented (VEDEL-TÅNING 1951). As a result of the London Convention of 1954, the first Danish Law on the prevention of oil pollution in seas external to Danish territorial waters came into being in March 1956. Together with the alterations resulting from later conventions (laws in 1964 and 1971), the possibilities for lawful release of oil or mixtures containing oil by tankers and other large cargo-boats have been noticeably reduced in all waters around Denmark. In addition, several harbours now have depot facilities for waste oil, and a large part of the tanker tonnage has been using the load-on-top system in later years, thus greatly reducing the need of releasing oil at sea.

Although tankers especially in the past have been a considerable potential source of pollution, it is only fair to mention that some cases of pollution should be ascribed to the considerable number of ships which do not transport, but instead consume oil products, and which produce waste oil from machinery. Finally, it should be mentioned that much waste oil in Danish waters comes from towns, which often release untreated sewage water into the sea.

## Material

The information on cases of oil pollution with seabirds involved has been taken from the following sources, which are described in some detail here to facilitate their appraisal:

1) The first person to collect such information in Denmark was the fishery biologist and ornithologist A. VEDEL-TÅNING. He was very interested in the problem, and through his profession as a fishery biologist he had good opportunity to gain knowledge of pollution at sea. In a review (VEDEL-TÅNING 1951) the occurrence of pollution during 1925-1950 is described.

2) In 1945, »Dansk Havjagtforening« (The Danish Coastal Water Shooting Association) was founded by Dr. BØJE BENZON, with the intention of promoting the protection of salt water game. The Association was very concerned about oil pollution, and during its period of existence (1945-1967), the chairman, Dr. BENZON, recorded cases of oil pollution. Until 1953, only pollution involving birds was recorded, and information was published in annual reports of the Association and in notes in the magazine »Jagtvennen«. From 1954 onwards reports of cases of pollution were gathered systematically from newspapers, shooting associations, the Game Council etc., whether birds were involved or not. Lists were then published in annual reports from the Association »Dansk Havjagtforenings Årsberetninger«, (duplicated).

3) In other shooting journals there are occasionally notes concerning bird disasters. In compiling material for this review, the hunter's journal »Strandjægeren« has been examined from vols. 1-29 (1942-1970). Almost all the cases of pollution mentioned in this journal were also noted in the lists of »Dansk Havjagtforening«, but in several cases important supplementary information on the extent of pollution and species affected was given in »Strandjægeren«. Also the hunters' journals »Dansk Jagttidende« vols. 1-86 (1899-1970) and »Jagt og Fiskeri« vols. 4-41 (1932-1970) have been examined, but contained very little further information.

4) In later years, ornithologists have shown an increasing interest in oil pollution. The journal »Feltornithologen« vols. 1-13 (1959-1971) contained numerous notes and articles giving important supplementary information concerning

the extent of disasters and the species affected. A scrutiny of »Dansk Ornithologisk Forenings Tidsskrift« vol. 1-65 (1906-1971), »Flora og Fauna« vols. 42-75 (1936-1969), and »Danske Fugle« vols. I-VII (1924-1971) gave very little information.

5) Since the end of the 1940's, the Game Council has used money from the Game Foundation to reimburse hunters' expenses in destroying oiled birds. The arrangement is administrated and controlled by the local police, and usually the amount paid covers the cost of two cartridges per bird destroyed. An examination of reports and accounts at the Game Council concerning a series of bigger disasters has given useful information on the extent of pollution and the number of birds destroyed.

It should be mentioned that neither the Danish Institute for Fishery and Marine Research nor the Ministry of Trade, under which oil pollution of the seas belonged, have been systematically recording cases of oil pollution in the period considered.

Sources from the first part of the period (up to and including World War II) are rather few, and it is very possible that several cases of pollution have not been mentioned in the sources considered for this review.

In the years following the war, the most important source of material for this review has been the reports of »Dansk Havjagtforening«. Although extra details of occasional disasters have been found in other sources, the latter contain only very few cases of pollution which are not already described by »Dansk Havjagtforening«. This indicates that the records kept by this Association have been complete, and that where birds have been involved its records have been very efficient throughout the period.

The information from the above sources regarding pollution affecting birds has been collated in Appendix 1, p. 20-24.

The different headings are described briefly:

1) *Year*: The year of occurrence of pollution is known in all cases except one (listed as 1949?).

2) *Month*: In almost all cases the time of year (month) has been determined. However in some cases it is reckoned that oiled birds have been found over a longer period than given by the sources.

3) *Area*: The area concerned is usually given accurately, but supplementary sources indicate that pollution has often affected greater areas than those given in the reports of »Dansk Havjagtforening«. To aid comprehension the waters are divided into districts (Fig. 1).

4) *Category and No. of birds*: Information on the number of birds affected by oil varies greatly. In many cases the only information given by a source is »few, several, some, many, a great many, large flocks, scores, hundreds, thousands« etc. In cases where a definite number is given, this has usually been the number of birds destroyed, and in several cases supplementary sources have revealed that the number of birds destroyed has been greater than the number given in the reports of »Dansk Havjagtforening«. In

only a few cases there is information on the number of oiled birds observed, and in only a couple of cases attempt has been made to estimate the total number of birds lost, on the basis of several observations. In none of the cases there has been systematic counting along all polluted stretches of coast, and information about observations at sea from boats is only available in very few instances. Counting from aircraft was never attempted.

During 1968–1971, intensive examination of oil disasters has indicated that in many cases the number of birds destroyed or found dead is only a small part of the total number of birds lost (JOENSEN 1972). The numbers given in Appendix 1 must therefore be regarded minimum numbers, and in the majority of cases the total number of birds killed by oil has probably been much greater than indicated by the figures.

To aid comprehension, the cases of pollution are divided into 6 categories, A–F:

- A. Disasters with information on more than 10,000 birds.
- B. Disasters with information on 5,000–10,000 birds.
- C. Disasters with information on 1,000–5,000 birds, or described as »thousands« or »several thousand«.
- D. Disasters with information on 100–1,000 birds, or in which the terms »hundreds, many, a great many, large flocks« etc. were used.
- E. Pollution cases with information on less than 100 birds, or in which the terms »some, several, scores« etc. were used.
- F. This category, which for the period 1954–1967 is included in Table 1 and 2 and Fig. 2, comprises cases of pollution where nothing concerning birds was mentioned (most cases), where it was clearly stated »no oiled birds found« (few cases), or where information concerning only a very few birds, e. g. a pair of swans or a brood of ducklings was given (isolated cases).

It is apparent from this classification that the estimates used have been made with caution. It is scarcely wrong to assume that some cases of pollution have been rated too low; for instance, some cases in category »D« have no doubt actually led to the death of more than one thousand birds.

5) *Remarks*: The main information under this heading concerns the species affected in each particular case of pollution. For most cases of pollution this information is very scanty, and in

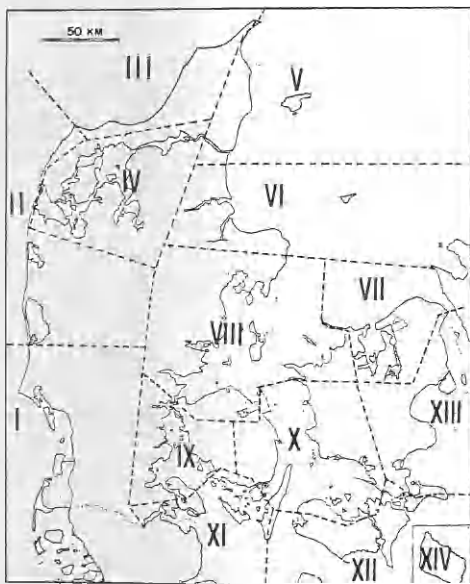


Fig. 1. Denmark divided into the districts referred to in Appendix 1.

Fig. 1. Inddelingen af landet i distrikter, benyttet i Appendix 1.

Фиг. 1. Подразделение страны на районы, примененное в Приложении I.

many cases no information was available at all. Determination of species of destroyed or dead birds has only taken place in a few cases (Table 3, Fig. 5).

Only in very few cases there has been other information regarding e.g. the source of pollution and the amount of oil released.

In the period concerned a few cases of oil pollution in inland waters (lakes and rivulets) have been reported, but this undoubtedly very incomplete information is not treated in the present paper, which describes only the situation at sea.

## Results

### OCCURRENCE OF OIL POLLUTION DURING THE PERIOD 1935-1968

The number of oil pollution cases recorded annually from 1935 up to and including June 1968 is given in Table 1. From 1935 to 1953 only information from cases with oiled birds is included, but from 1954 to 1968 cases of oil pollution which did not affect birds (category F) are also included.

According to VEDEL-TÅNING (1951), only minor cases of pollution were noted in the years 1926-1934, but in each year during 1935-1938 cases of pollution occurred in which hundreds or thousands of birds died. In one year alone (1936), 4 oil disasters occurred. Although the phenomenon was quite new and scarcely drew much attention in those days, it is possible to state (quoting VEDEL-TÅNING) that during the 1930's there were fewer cases of oil pollution than in the following decades.

During World War II (1940-1945) cases of oil pollution in Danish waters went unrecorded, no doubt due to the reduction in communications, especially concerning conditions at sea. However, there can be no doubt that cases of oil pollution did occur, not least in connection with the events of war.

In the years following the war (1946-1949), cases of pollution appeared to be still relatively few in number, but from 1950 on there was a noticeable increase. In some degree this was due to the more systematic recording of pollution, and also to the interest shown by the press

in oil pollution after a series of cases in the Northern Kattegat. The increase in the cases recorded is however undoubtedly also a sign of a real increase in the occurrence of cases of pollution.

During the 1950's, serious disasters involving birds occurred almost every year. 1955 was the year of the greatest bird deaths, whereas 1954 and 1957 were relatively unimportant.

The increase continued in the 1960's, as in each year (apart from 1964, 1967 and 1968), many cases of widespread bird deaths were observed. The reduction in the last years of the period considered was seen as an effect of the preventive measures against oil pollution. However, a series of bird disasters during the following years altered this optimism (JOENSEN 1972).

The increase in the number of cases of pollution during the period 1935-1968 was a direct consequence of the increase in the amount of oil transported through Danish waters. However, judging by the information available, the increase in the amount of oil transported seems to be much greater than the increase in the number of birds killed by oil. From this it can be concluded that the preventive measures initiated to reduce oil pollution (cf. p. 4) during the period have had at least some effect, and that the number of birds killed by oil pollution would have been much greater if these measures had not been taken.

## SEASONAL DISTRIBUTION

During the period 1954-1968 recording of pollution was at its most effective and uniform, and the seasonal distribution of pollution during this time is given in Table 2. In those cases where pollution extended over several months, the initial month has been taken.

The time of occurrence of a total of 97 cases of pollution involving birds has been determined, and it is evident that the greatest number of bird deaths occur in January and February. Over half of the disasters involving birds occurred in

these months, and if only the most serious cases of bird mortality are considered (categories A, B and C), 12 out of 15 (80 %) of these took place in the first two months of the year. Some cases of bird deaths also occur in March (16 %), but in the other months of the year the number of bird deaths is small.

In September to December as a whole only 18 % of the cases of bird deaths have been reported, in spite of the fact that from the end of October bird populations are nearly as large as in January and February. Research during 1968-1971 (JOENSEN 1972) has shown that oiled birds are also found in the autumn months, but that they are more scattered than in winter. This is probably due to the oil on the sea being more spread out than in winter; and because of the higher temperature of the water birds are not as rapidly paralysed, and can thus fly greater distances before dying. The possibility of recording such pollution is thus lessened, and in addition human activity on the beaches is relatively less in the autumn than in the summer.

Year År	A	B	C	D	E	A-E	F	Total I alt
1935			1			1		1
1936			3	1		4		4
1937				2		2		2
1938			1			1		1
1939					1	1		1
1940-1945								?
1946			1	1	1	3		3
1947			3	1	1	5		5
1948						0		0
1949			2			2		2
1950			2	2	1	5		5
1951				2		2		2
1952			2	2	1	5		5
1953			2	4		6		6
1954			1			1	14	15
1955	1	1		6	5	13	11	24
1956				3		3	10	13
1957				2	1	3	3	6
1958			1	3	1	5	10	15
1959			1	4		5	12	17
1960	1		2	5		8	12	20
1961				7	3	10	11	21
1962	1		2	6	3	12	18	30
1963				9	3	12	17	29
1964					3	3	14	17
1965	1			3	3	7	12	19
1966			1	6	3	10	6	16
1967				1	3	4	11	15
1968				4	1	5	9	14

Total I alt	4	1	25	74	34	138	170	308
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Table 1. The number of oil pollutions of different categories in each year in the period 1935-1968. Recording of pollutions with no birds involved (category F) was started in 1954.

Tabel 1. Fordelingen af olieforureninger af de forskellige kategorier i årene 1935-1968. Registreringer af forureninger uden fugle startede i 1954 (kategori F).

Табл. 1. Распределение загрязнений нефтью разных категорий с 1935 по 1968 г. Регистрация загрязнений без пострадавших птиц (категория F) началась в 1954 г.



# Oil Pollution and Seabirds 1935-1968

	Pollutions with birds <i>Forureninger med fugle</i>						Pollutions with no infor- mation on birds	Total <i>I alt</i>
	Category			Kategori			<i>Forureninger uden fugle oplyst</i>	
	A	B	C	D	E	A-E Total <i>I alt</i>	F	
January	3		5	16	4	28	5	33
February	1		3	12	8	24	4	28
March			1	8	7	16	4	20
April				2	1	3	21	24
May				2	2	4	21	25
June				3		3	29	32
July				1	1	2	44	46
August						0	18	18
September				2		2	8	10
October		1		4	2	7	4	11
November				3	1	4	3	7
December			1	1	2	4	2	6
Total <i>I alt</i>	4	1	10	54	28	97	163	260

Table 2. The monthly distribution of cases of oil pollution 1954-1968. Where pollution lasted several months only the initial month has been used.

*Tabel 2. Månedlig fordeling af forureningstilfælde i perioden 1954-1968. I tilfælde, da en forurening varede flere måneder, er kun den første benyttet.*

Табл. 2. Распределение по месяцам случаев загрязнения с 1954 по 1968 г. В случаях, когда одно загрязнение продолжалось несколько месяцев, использован только первый месяц.

## GEOGRAPHICAL DISTRIBUTION

The distribution of all cases of pollution recorded during 1935-1968 is shown on the map, Fig. 2. During the period 1935-1953 only pollution involving birds was recorded, whereas from 1954-1968 all cases of pollution were included. Each case of pollution involving birds is only indicated at one point on the map, and as far as possible at the centre of the pollution. The north coast of Sealand, for example, has been affected by several large disasters indicated in the Kattegat (see also Figs. 3 and 4), and the south coast of Møn and the east coast of Falster have been affected in a similar way

by several cases of pollution in the Baltic. In certain cases of pollution where oiled birds were not recorded, but large stretches of the coast were polluted, (e. g. along the North Sea coast) more than one symbol is given, (up to a maximum of 4 in each case of pollution), on the stretch of coast in question.

In interpreting the geographical distribution of oil pollution as shown on the map of Fig. 2, it should be borne in mind that pollution affecting birds will be noticed almost everywhere it occurs and recorded from all parts of the country. On the other hand, pollution which does not

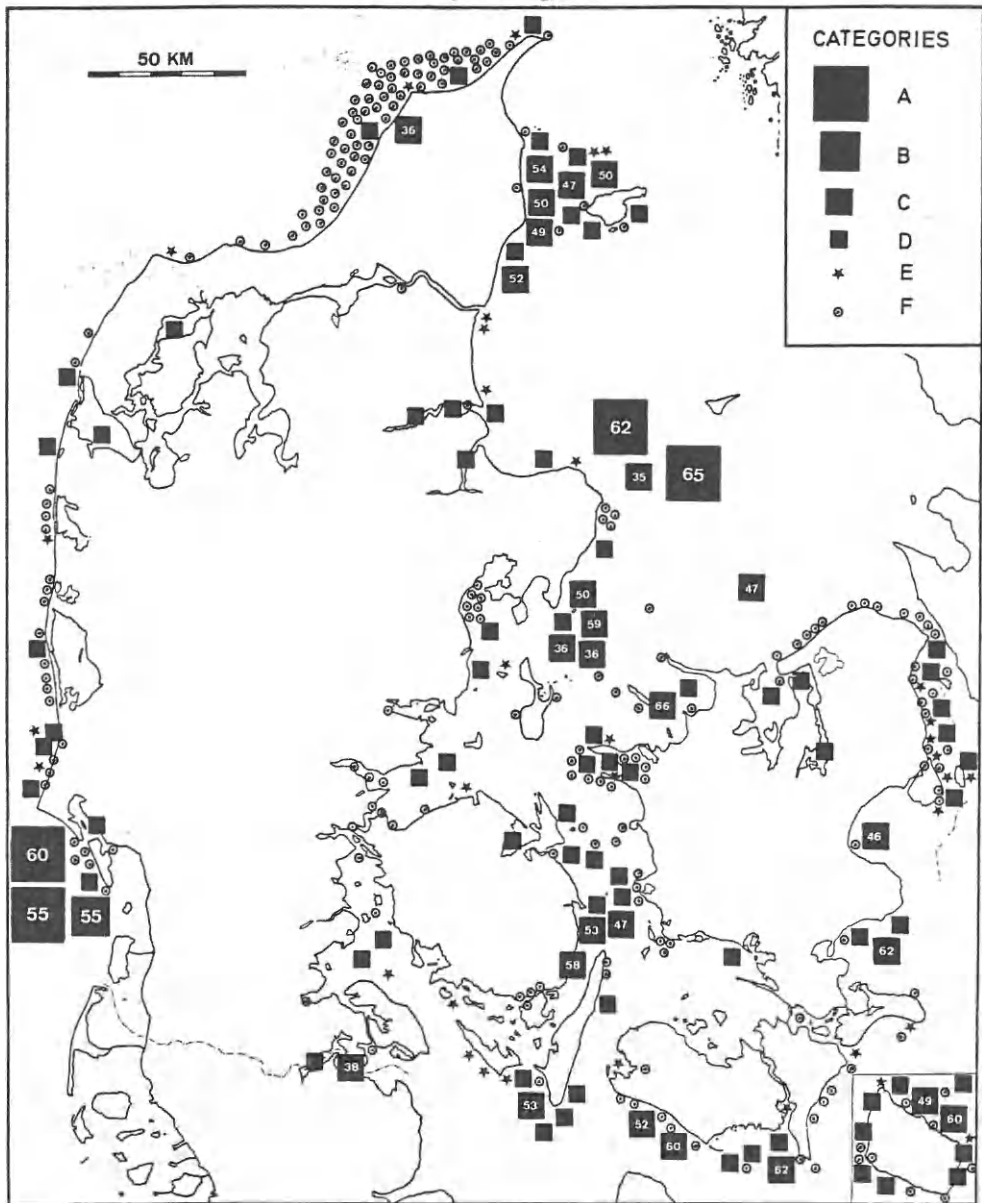


Fig. 2. The geographical distribution of all recorded cases of oil pollution during 1935–1968 (category F only from 1954–1968). The symbols for categories A, B, and C include the year of occurrence.

Fig. 2. Den geografiske fordeling af alle registrerede olieforureninger i perioden 1935–1968 (kategori F kun 1954–1968). I signaturer for kategori A, B og C er anført årstal.

Фиг. 2. Географическое распределение всех зарегистрированных за период 1935–1968 г. загрязнений нефтью (категория F только с 1954 по 1968 г.). В сигнатурах категорий A, B и C указаны годы.

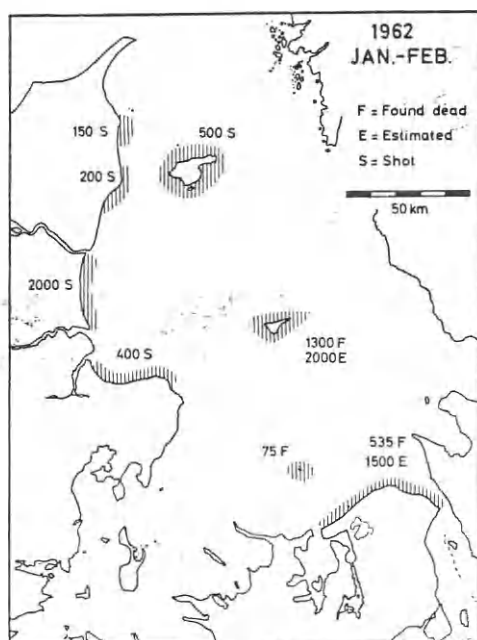


Fig. 3. Areas of the Kattegat in which oiled birds were recorded in the disaster of Jan.-Feb. 1962.

Fig. 3. Områder i Kattegat, hvor der blev registreret olieflugle ved katastrofen i jan.-feb. 1962.

Фиг. 3. Участки Каттегата, в которых были зарегистрированы запачканные нефтью птицы при катастрофе в январе-феврале 1962 г.

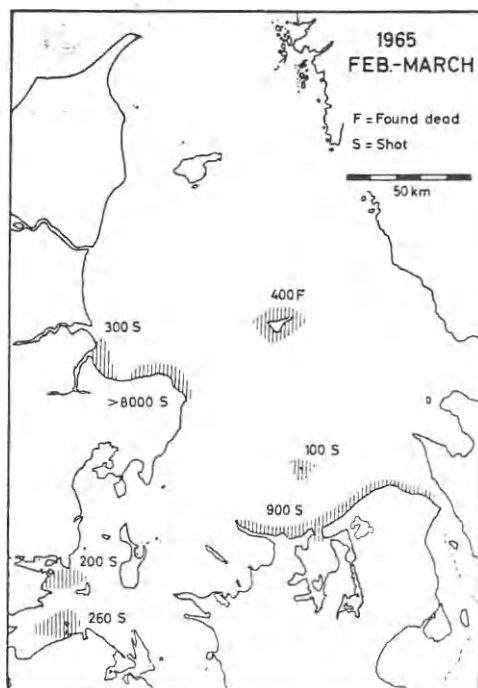


Fig. 4. Areas of the Kattegat in which oiled birds were recorded in two disasters in February and March, 1965.

Fig. 4. Områder i Kattegat, hvor der blev registreret olieflugle ved 2 katastrofer i feb.-marts 1965.

Фиг. 4. Участки Каттегата, в которых были зарегистрированы запачканные нефтью птицы при двух катастрофах в феврале-марте 1965 г.

affect birds is mainly recorded from bathing beaches with much human activity rather than other beaches, and more usually from sandy beaches than from stony ones. This is probably part of the reason for there being more records from the traditional bathing beaches along the North Sea coast of Northern Jutland than along the western coast of Jutland, which has only in later years become an important bathing centre. The fact that only very few cases of pollution have been recorded from the traditional bathing beaches along the northern coast of the

Djursland peninsula is possibly due to the stony nature of the beaches.

Bearing these reservations on the use of the material in mind, it is still possible to conclude from the map that during the period considered, a great number of cases of pollution have occurred in almost all Danish waters. Pollution has been uncommon only in a few shallow, more or less enclosed waters. This is the case for the Limfjord (IV), the Lillebælt (IX), the South Funen Archipelago (northern part of XI), and the Smålandshavet (eastern part of X). These areas are all important

wintering areas for seaducks and other waterfowl.

The majority of the cases of pollution has occurred in more open waters. For example, widespread pollution has been observed almost annually since 1950 at Bornholm (XIV), in the Storebælt (X), the Kattegat (V, VII and VIII), and along the northern part of the North Sea coast (III). In the first three areas mentioned there

has been sizeable bird mortality almost every year. In the southern part of the North Sea coast (I) severe bird mortality has occurred several times. The northern section of this coast (II and III) contains only a few waterfowl during most of the year, and the numerous cases of pollution have thus had much less effect in this area.

### SPECIES COMPOSITION

The only appreciable number of oiled birds determined to species has been from isolated oil disasters during the last part of the period considered. At the disasters in the Kattegat in 1962 and 1965 1798 and 2400 birds were examined respectively, and in 1968 468 birds were determined to species at Bornholm. During the period 1957–1958 the author examined 105 birds along the southern part and the North Sea coast (Henne Strand). Several gulls were not included, as they were often so old that oil could not be traced on the plumage. During the period April 1965–April 1966 several ornithologists surveyed beaches along the North Sea (from Skagen to Blåvand) and a total of abt. 900 birds were examined. A summary has been published by HALD-MORTENSEN (1971). Birds found in the two periods along the North Sea coast have probably been oiled in connection with several cases of pollution. Some species, e. g. *Morus bassanus*, *Fulmarus glacialis* and *Rissa tridactyla* are occasionally found dead along the North Sea coast in rather great numbers, but not killed by oil (JOENSEN 1961). It is possible that some birds of this category have been reported together with oiled birds in the beach surveys.

Data from the above mentioned reports are given in Table 3. For each species the number and for the dominant

species and/or groups also the percentage occurrence has been given.

In the map, Fig. 5, percentages have been used in a visual presentation of species composition.

In most cases of pollution the reports include very little data on species composition. In many cases, however, the dominant species have been mentioned in the reports, and this together with the rather exact data (Table 3) facilitates an evaluation of species composition among birds killed by oil in various parts of Denmark.

#### *Gavia*

Oiled divers have been reported regularly, generally in small numbers, but in the North Sea and especially the Kattegat in greater numbers. In the Kattegat *G. arctica* is much more abundant than *G. stellata*, whereas in the North Sea the opposite is found.

#### *Podiceps*

Oiled grebes (almost exclusively *P. griseigena*) are often reported from the Kattegat and waters further south, but usually in small numbers.

#### *Dabbling ducks*

Oiled dabbling ducks are generally uncommon. Most cases concern a few individuals of *Anas platyrhynchos*, oiled in connection with harbour pollution. Other

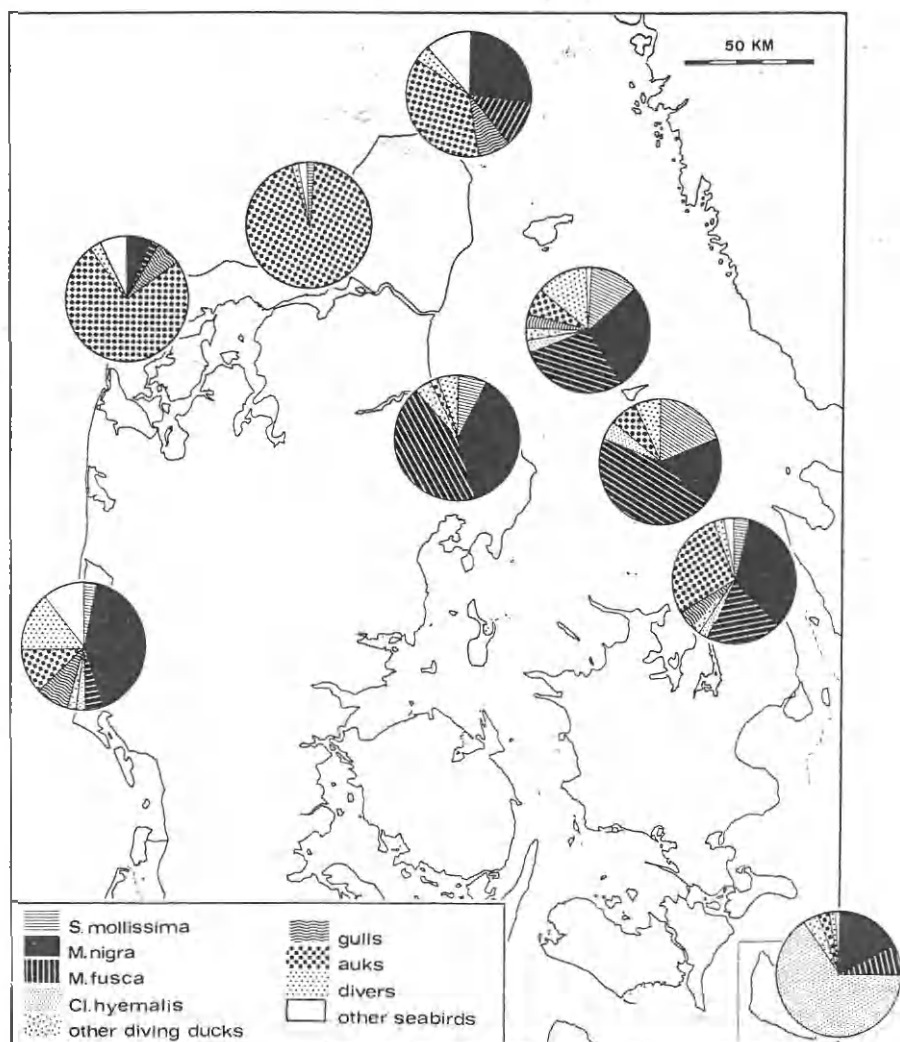


Fig. 5. Species composition among oiled birds, cf. Table 3.

Fig. 5. Artssammensætninger blandt oliefugle, jvf. Tabel 3.

Фиг. 5. Составы по видам пострадавших от нефти птиц, ср. Табл. 3.

*Anas* species were only reported in very few cases.

Populations of dabbling ducks in Denmark are especially large in the autumn, but in general the birds are found in areas such as protected fiords, brackish waters and inland lakes, which are only

seldom affected by oil pollution. The largest populations occur in the Wadden Sea (JOENSEN 1968), but no oiled dabbling ducks have been reported in connection with the large disasters along the southern part of the West Jutland coast (area I).

Area investigated Område undersøgt	1962 Jan.-Feb. North Central Kattegat		1965 Feb.-March Djursland, Anholt N Sjælland		1968 Jan.-Feb. Bornholm		1957-1958 North Sea		1965-1966 North Sea coasts	
	N Sjælland (VII) FO 4 p. 46	Anholt (VI) FO 6 p. 31	Djursland (VI) FO 7 p. 128-129	Anholt (VI) FO 7 p. 64-65	Årsdale, Balka-Duvedde (XIV) FO 10 p. 97	Henne Strand author unpubl.	Skagen- Blåvand Hald-Mortensen FO 1971 p. 186-190			
Source of information Kilde	No. %	No. %	No. %	No. %	No. %	No. %	No. %			
G. immer										
G. stellata										
G. arctica										
Gavia sp.	14	2,6	37 66	13 36 3	3		43 7	5,7		
P. griseigana										
P. cristatus										
Podiceps sp.										
F. glacialis										
M. bassanus										
Ph carbo										
F. atra										
Anas sp.										
A. ferina										
A. fuligula										
A. marila										
CL. hyemalis										
M. nigra										
M. fusca										
S. mollissima										
B. clangula										
M. serrator										
Diving ducks non det.										
Diving ducks total	333 62,2	1068 84,6	1883 92,3	265 73,8	447 95,5	69 65,7	116 13,2			
Cygnus sp.	1									
Larus sp.	1	(12) <sup>1</sup>	1	9		7 <sup>2</sup>	46			
R. tridactyla	25	(6) <sup>1</sup>		2		5	9			



*Aythya fuligula* has only been mentioned a very few times, in spite of the fact that it is extremely numerous in southern waters in winter (JOENSEN 1968). It is a coastal bird and occurs only rarely in more open water, where the majority of pollution cases happen.

#### Swans

Oiled swans were often reported from the south-eastern part of the country, the most important wintering areas, mostly only a few birds, although in a few cases a couple of hundred. Most swans have been oiled in or near harbours. There is no information on species affected, but most were probably *Cygnus olor*.

#### Coots

Oiled coots have only been reported a very few times. The species occurs in large numbers in the south-eastern part of the country, but generally in coastal waters.

#### Gulls

Small numbers of oiled gulls presumably occur with most cases of pollution, but

larger numbers have only been recorded in very few cases.

#### Auks

Oiled individuals of *Alca torda* and *Uria aalge* have often been found in the Storbælt (X), and especially in the Kattegat (V, VI, VII, VIII) and the North Sea (I, II, III), in several cases in rather large numbers. In the Kattegat *Alca torda* is dominant (cf. Table 3), whereas *Uria aalge* is commoner in the North Sea. In the Kattegat *Cephus grylle* was often found in small numbers. The number of dead auks is probably much larger than is indicated by the scanty information available, mainly comprising birds destroyed or found dead on the shore. *Alca torda* and *Uria aalge* are generally to be found far from shore, and it is certain that many birds have died and disappeared without trace.

#### Other species

Occasional other species have been reported affected by oil in very few cases: *Phalacrocorax carbo* (Kattegat), *Morus bassanus* (North Sea), *Fulmarus glacialis* (North Sea), *Branta bernicla*, and waders.

## Discussion and Conclusion

The information available on cases of oil pollution involving birds which took place in Danish waters during the period 1935 to 1968 presumably gives a representative picture of developments during the period, and of seasonal and geographic distribution, and an approximate idea of the composition of species of the killed birds. Results of the analysis of the material can be summarised briefly:

- 1) The number of cases of pollution involving birds has increased during the period, but the increase is not so

great as the increase in amount of oil transported through Danish waters.

- 2) Cases of oil pollution occur throughout the year, but great numbers of birds die especially in the two coldest months, January and February.
- 3) Throughout the period, most Danish waters have regularly been affected by cases of widespread bird mortality.
- 4) Mortality due to oil has mainly affected six species, which in general are found in the sea far from shore: *Somateria mollissima*, *Melanitta nigra*, *Melanitta fusca*, *Clangula hyemalis*,



*Alca torda* and *Uria aalge*. Swans have often been reported oiled, but total numbers killed are comparatively small. Other species which occur in Denmark in large numbers, but mostly confined to fresh- and brackish water and areas close to the coasts, have been reported oiled noticeably few times. This is the case for *Anas platyrhynchos* and other dabbling ducks, *Aythya fuligula*, *Fulica atra* and gulls.

The total number of birds killed has only been estimated in very few cases of pollution, but in these as in the majority of cases the numbers or amounts reported must be considered as absolutely minimal. Investigations during 1968-1971 (JOENSEN 1972) indicate that the number of birds found dead or destroyed often comprises only a small portion of the total number of birds affected by oil. On the basis of the information available it is thus not possible to obtain any reliable idea of the total number of birds killed during the period 1935-1968. Addition of the numbers and amounts given suggests a couple of hundred thousand birds, but it is scarcely incorrect to presume that the real total has been some several hundred thousand birds.

For the period considered, there have

been no estimates either of the winter populations in Danish waters of the species affected by oil, or of the extent of bird mortality due to oil pollution. It is thus impossible to decide whether oil pollution has been affecting bird population size.

The most numerous waterfowl in Danish waters is *Somateria mollissima*, and this species has been affected by oil more often than the other species mentioned. During the whole of the period considered, the breeding populations in Denmark and in the Baltic (from where most of the birds wintering in Denmark come) have been increasing, and not least during the latter part of the period when oil pollution has been at its worst (JOENSEN in prep.).

It is known for *Clangula hyemalis* that tens of thousands of birds have died in connection with several widespread oil disasters in the central part of the Baltic during the period considered. A reduction in this species has been ascribed to mortality due to oil pollution (LEMMETTYNEN 1966, CURRY-LINDAHL 1960).

Nothing in particular is known of changes in the wintering populations of *Melanitta nigra*, *Melanitta fusca*, *Alca torda* or *Uria aalge*, and it is thus not possible to estimate the effects of oil on these species.

## Resumé

### Olieforurening og søfugle i Danmark i 1935-1968.

1) Igennem mange år er der foretaget registrering af olieforureninger i Danmark, hvor fugle var involveret, og denne artikel sammenfatter oplysninger fra »Dansk Havjagtforenings Årsberetninger«, »Feltornithologen« og en række andre kilder (se side 5). Materialet må anses at give et nogenlunde repræsenta-

tivt billede af udviklingen, specielt for perioden efter 1946. I Appendix 1 er samlet oplysninger om alle registrerede tilfælde af forureninger med fugle (se nærmere forklaring side 6).

2) Antallet af olieforureninger og mængden af omkomne fugle har været stigende igennem de sidste årtier (Tabel

1), men stigningen synes at have været mindre end stigningen i olieforbrug og -transport gennem danske farvande, hvilket må ses i sammenhæng med en række foranstaltninger mod olieforurening siden midten af 1950'erne.

3) Olietilsølede fugle er registreret i alle årets måneder (Tabel 2), men de store katastrofer sker hovedsageligt i de koldeste måneder.

4) Næsten alle farvande har været ramt af olieforurening i perioden (Fig. 2), og visse havområder har i de sidste ca. 20 år oplevet massedød blandt fugle næsten hvert eneste år.

5) Forureningerne har hovedsageligt ramt arter, som optræder i de mere åbne havområder langt fra kysterne (Tabel 3, Fig. 5). Især ederfuglen er omkommet i meget stort antal, men også betydelige mængder af sortænder, fløjsænder, havlitter, alke og lomvier er omkommet.

Svaner rammes hyppigt af olie, men som regel kun få fugle. En række arter, som forekommer i meget store bestande, men hovedsageligt i fersk- og brakvand og ganske nær kysterne, er rapporteret påfaldende sjældent, f. eks. gråand og andre svømmeænder, trolldand, blishøne og måger.

6) Det samlede antal fugle, omkommet ved olieforureninger i perioden 1935-1968, omfatter flere hundrede tusinde, men kan ikke anslås nøjagtigere.

7) Da man både mangler sikre bestandsopgørelser og sikre oplysninger om oliekatstrofernes omfang, er det ikke muligt at vurdere olieforureningens betydning for bestandene i perioden 1935-1968. Det skal dog nævnes, at bestandene af den hyppigst ramte art, ederfuglen, har været i fremgang i de sidste årtier i Danmark og Østersøområdet.

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# Резюме на русском языке

## Загрязнение нефтью и морские птицы в Дании 1935-1968 г.

1) В течение многих лет производилась регистрация загрязнений нефтью в Дании, от которых пострадали птицы, и в этой статье сводятся сведения из »Dansk Havjagtforenings Årsberetninger«, »Feltornithologen« и ряда других источников (см. стр. 5). Можно считать, что этот материал дает довольно пока-зательную картину развития, особенно за период после 1946 г.

В Приложении 1 собраны сведения о всех зарегистрированных случаях загрязнения, затрагивавших птиц (см. более подробное объяснение на стр. 6).

2) В течение последних десятилетий число загрязнений и количество погибших птиц росли (Табл. 1), но повидимому рост был не так силен, как рост потребления и транспорта нефти по датским водам, что следует рассматривать в связи с рядом мероприятий против загрязнения нефтью, принятых с середины 1950-х годов.

3) Запаканные нефтью птицы регистрировались во все месяцы года (Табл. 2), но большие катастрофы главным образом случаются в самые холодные месяцы.

4) В течение периода, загрязнению нефтью подвергались почти все морские пути (Фиг. 2), и в некоторых частях моря массовая гибель птиц за последние 20 лет случалась почти каждый год.

5) От загрязнений пострадали главным образом те виды, которые встречаются в наиболее открытых частях моря, далеко от берегов (Табл. 3, Фиг. 5). Погибло особенно большое число *Somateria mollissima*, но погибли также и значительные количества *Melanitta nigra*, *Melanitta fusca*, *Clangula hyemalis*, *Alca torda* и *Uria aalge*. Лебедей (*Cygnus*) нефть застигает часто, но как правило только небольшое число птиц. О ряде видов, встречающихся очень многочисленными составами, но главным образом на пресной или солоноватой воде и у самого берега, заявки получены поразительно редко, напр. об *Anas platyrhynchos* и других видах *Anas*, *Aythya fuligula*, *Fulica atra*, *Larus sp.*

6) Общее число птиц, погибших вследствие загрязнений нефтью в течение периода 1935-1968 г., составляет несколько сот тысяч, но невозможно оценить более точно.

7) Не имея ни надежных подсчетов состава, ни надежных сведений о размерах нефтяных катастроф, значение загрязнения нефтью для составов в течение периода с 1935 по 1968 г. оценить невозможно. Однако, следует упомянуть о том, что составы наиболее часто пострадавшего вида *Somateria mollissima* в Дании и в области Балтийского моря за последние десятилетия увеличились.

Appendix 1. A list of all cases of oil pollution involving birds recorded during the period 1935-June 1968. Further details given in text p. 6. Abbreviations: Th (thousands), Hu (hundreds), LF (large flocks), Ma (many), So (some).

Appendix 1. Liste over alle registrerede olieforureninger med fugle involveret i perioden 1935-juni 1968. Nærmere forklaring se teksten p. 6. Forkortelser: Th (tusinder), Hu (hundereder), LF (store flokke), Ma (mange), So (nogle).

Приложение 1. Перечень всех случаев загрязнения нефтью, затрагивавших птиц, зарегистрированных в течение периода с 1935 по июнь 1968 г. Подробности даны в тексте стр. 6. Сокращения: Th (тысячи), Hu (сотни), LF (большие стаи), Ma (много), So (несколько).

Year	Month	Area	District	Category	No. of birds	Remarks
1935		Kattegat	V/VI/VII or VIII	C	>1000	<i>S. mollissima</i> , <i>M. nigra</i>
1936	1	Samso, Hjeltn	VIII	C	Th	<i>S. mollissima</i> , <i>M. nigra</i>
	11	Saltholm	XIII	D	Ma	swans etc.
	11-12	Hjeltn	VIII	C	Th	diving ducks, gulls, etc.
1937	12	Hirtshals	III			
		Fiederikshavn	V	D	367	shot by one hunter
		Flensborg Fjord	XI	D	Hu	
1938		Broager	XI	C	ca. 2000	<i>S. mollissima</i> and other ducks
1939		Saltholm	XIII	E	ca. 100	<i>S. mollissima</i>
1940-45						no records
1946	1	Koge Bugt	XIII	C	Th	diving ducks
		Korsholmene	V	E	20	found
	11	Issefjord	VII	D	LF	ducks
1947		Vuljers-Bærsmose	I	E	15	found
	1	Sjorø-Langeland	X	C	>2000	
	1-2	Hesselø	VII	C	>1000	<i>S. mollissima</i> etc.
	3-4	Skagen etc.	III	D	Hu	e. g. <i>U. aalge</i>
	12	Larsø	V	C	Th	1200 were shot
						no records
1948						year uncertain
1949?		Bornholm	XIV	C	Th	
	1	Hals-Frederikshavn	V	C	Th	
1950	1	Hjeltn	VIII	C	Th	
	1	Asa Sæby	V	C	Th	
						e. g. <i>S. mollissima</i> , other seabirds, <i>Gavia</i> , <i>U. aalge</i> , <i>C. grylle</i> , <i>A. torda</i>
1951	5	N Bornholm	XIV	D	Ma	<i>S. mollissima</i> incl. broods
	9	Læsø	V	C	Th	
	10-11	Ærø	XI	E	So	
	12	Hals-Frederikshavn	V	D	Hu	
	1	Skagen-Løkken	III	D	Ma	
	1	NW Kattegat	V	D	LF	e. g. <i>S. mollissima</i>

Year	Month	Area	District	Category	No. of birds	Remarks
1952	2	Lolland	XII	C		
	2-3	Årø-Vorså Hou	V	C	Th	
	3	Saksild-Hov	VIII	D	Ma	e. g. <i>S. mollissima</i> ducks
	10	Sj. Odde, Sejerø Bugt	VIII	D	Hu	
	12	S Øresund	XIII	E	So	e. g. <i>S. mollissima</i> , <i>B. clangula</i>
1953	1	Faxe	XIII	D	Ma	mostly <i>Cl. hyemalis</i>
	1	SW Baltic Sea	XI-XII	C	Th	mostly <i>Cl. hyemalis</i> , <i>S. mollissima</i> , <i>A. torda</i>
	2	W Jutland	I-II	D	Hu	
	2	Vresen, Sprogø, Omø	X	C	Th	mostly <i>S. mollissima</i>
	3-4	Langeland-Sprogø	X	D	Hu	mostly <i>S. mollissima</i> and <i>M. nigra</i>
		Åhus bugt	VIII	D	Ma	
	1	Sæby-Frederikshavn	V	C	Th	
1954	1	Mandø-Henne	I	A	>20,000?	Tanker wrecks at Elbe in NW Germany and spills 7000 tons of oil polluting German, Danish and Norwegian Northsea coasts. The estimate of 20,000 lost is a minimum figure for NW German and Danish coasts. In Denmark at least 3000 were killed by hunters. Along Danish coasts mostly <i>M. nigra</i> , also many <i>U. aalge</i> .
1955	1	Bornholm	XIV	D	Ma	50 reported in one area
	2	Hjelm etc.	VIII	D	Ma	
	2	Lolland-Falster-Lyø	XI-XII	D	Ma	
	2-3	Amager	XIII	E	So	swans
	2-4	Laas-Frederikshavn	V	D	LF	
	7	Drogden	XIII	E	So	swans, gulls
	10	Færø-Båvand	I	B	5699	killed by hunters, mostly <i>M. nigra</i>
	10	Lillebælt	IX	E	So	
	10	Hansholm-Lildstrand	III	E	So	
	10	Frederikshavn-Lyngsø	V	D	Ma	
	10	København	VIII	D	Ma	
	12	W Jutland	I-II	E	So	swans
	1	Læsø	V	D	LF	
	1	Djursland-Hurup	VI	D	Hu	350 killed by hunters (mostly <i>M. nigra</i> ) at Gjer- rild only. Hundreds at Hurup
	6	Øresund	XIII	D	Ma	mostly <i>A. platyrhynchos</i>

Year	Month	Area	District	Category	No. of birds	Remarks
1957	1	Drogden	XIII	E	40	killed ( <i>Anas-species</i> )
	3	Henne	I	D	abt. 100	found dead
	6	Nyborg Fjord	X	D	Ma	
1958	1	Lolland-Falster	XII	D	Hu	
	2	Ebeltoft-Hadsund	VIII-VI	D	>500	
	2	Lesø	V	D	Ma	
	3	Nyborg-Svendborg	X	C	ca. 1000	diving ducks, mostly <i>M. nigra</i>
	2-3	Henne	I	E	abt. 50	killed by hunters found dead
1959	1	Holmsland	II	D	Ma	
	1	Marstal	XI	D	Hu	
	2	Hjelm	VIII	C	Th	
	3	Esbjerg-Henne	I	D	500	
	5	Øresund	XIII	D	215	ducks killed by hunters 200 <i>S. mollissima</i> (incl. broods) and 15 swans killed by hunters
1960	1	Rømø-Henne	I	A	>17,000	From Rømø to Henne hunters killed 14,903 (mostly <i>M. nigra</i> ), hereof 7000 on the island Fanø. A few thousand more were killed by hun- ters but not registered by the police. 17,000 is a minimum figure.
1961	1	S Lolland	XII	C	Th	
	1	Pielinger	XIII	D	Ma	
	1-2	Bornholm	XIV	C	>2000	killed by hunters, mostly <i>Cl. hyemalis</i>
	2	Langeland	X-XI	D	>800	killed by hunters
	3	Roskilde Fjord	VII	D	Ma	swans, ducks etc.
	3	Rønæs	VIII	D	Hu	
	4	Løkken	III	D	Ma	
	1	Lolland	XII	D	Ma	
	2	Langeland	XI	D	LF	
	3	Bornholm	XIV	E	>30	killed by hunters, mostly <i>Cl. hyemalis</i>
	3	Rømø-Fanø	I	D	>650	killed by hunters
	3	Skagen	III	E	>70	found along the shore
	9	Lemvig	IV	D	Ma	
	9	Fialtrung	II	D	Ma	
	10	Kalundborg Fjord	VIII	D	Ma	swans
	11	Øresund	XIII	E	20	swans
	12	Mariager Fjord	VI	D	Ma	mostly ducks

Year	Month	Area	District	Category	No. of birds	Remarks
1962	1	Mariager Fjord	VI	D	Ma	swans
	1-2	N and central Kattegat	V, VI, VII	A	>12,000	See Fig. 3. >3250 were shot in Jutland and abt. 3600 were found dead (corrected for shore-lines not surveyed) on Anholt, Hesselø and N Sealand. The figure 12,000 is based on the fact that along the E coast of Jutland very many killed birds were not collected. Undoubtedly a minimum figure. Species composition was studied on Anholt and N Sealand (see Table 3)
	1-2	Kerteminde	X	D	>100	<i>Cl. hyemalis</i> killed by hunters
	1-3	Bornholm	XIV	D	abt. 125	estimated (>700 shot) mostly <i>Cl. hyemalis</i>
	2	Lolland-Møn	XII	C	>3000	swans
	2	Årager	XIII	E	17	ducks
	2	Køge Bugt etc.	XIII	C	ca. 1000	swans
	2	Hammeren, Bornholm	XIV	E	So	swans
	4	Kalundborg	VIII	E	So	swans
	5	Christiansø	XIV	D	Ma	mostly <i>S. mollissima</i>
1963	6	Assens	IX	D	Ma	
	10	Øresund	XIII	D	Ma	e. g. <i>S. mollissima</i> and swans
	1	Thisted Havn	IV	D	Ma	ducks etc.
	1	Lillebælt	IX	D	Ma	diving ducks
	2	Nakskov Fjord	XII	E	17	swans
	2	Skallingen-Vejers	I	D	Ma	
	2	Guldborgsund	XII	E	So	swans
	2	Karrebæksminde	X	D	Ma	e. g. swans
	2	Bornholm	XIV	D	900	diving ducks killed by hunters
	2	Fåborg Havn	XI	E	55	25 swans, 30 ducks and <i>F. atra</i>
1964	3	Kalundborg Havn	VIII	D	Ma	swans
	3	Redvig	XIII	D	Ma	swans
	4	Storebælt	X	D	Ma	swans
	11	Olense	VIII	D	Ma	swans
	12	Hirtshals	III	E	one flock	<i>U. arctic</i>
		Nordre Rønner	V	E	10	found
	3	Håbølle-Hesnes	XII	E	20	diving ducks
	5	Schölan	XIII	E	50	<i>S. mollissima</i>

Year	Month	Area	District	Category	No. of birds	Remarks
1965	2-3	Nordie Rønner	V	E	30	found
		Børnholm	XIV	D	Ma	78 shot in one area, mostly <i>Cl. hyemalis</i>
	2-3	Djursland, Anholt, N Sealand	VI-VII	A	>12,000	estimated (probably a minimum figure). Distribution of birds shot (abt. 10,000) shown in Fig. 4. Species composition on Djursland and Anholt shown in Table 3.
						shot
1966	2-3	Horsens-Æbelø	VIII	D	>460	found dead
	3	Man	XII	E	So	
		Langeland-Lyø	XI	E	So	
	11	Aggertange-Blokkhus	II	D	abt. 800	
	1	Rosnæs	VIII	E	ca. 50	shot
	1	Romsø, Sprøge, Vresen	X	D	ca. 500	shot
	1	N Djursland	VI	D	ca. 500	shot
	1	Juelsminde	VIII	D	Ma	
	1	S Langeland	XI	D	ca. 50	ducks
	3	Børnholm	XIV	D	>800	ducks shot
	5	Hurup	VI	E	So	
	7	E Anager	XIII	D	Ma	gulls
	11	Randers Fjord	VI	D	Ma	ducks
	12	Griben-Sejerø-Rosnæs	VIII	C	>2000	shot
	2	N Djursland	VI	E	So	<i>Cl. hyemalis</i> shot
		Roskilde Fjord	VII	D	Ma	
1967	3	Hov-Tunø	VIII	F	So	
	3	N Funen	VIII	E	So	
	1	Hindsholm-Kerteminde	X	D	>300	mostly <i>S. mollissima</i> , <i>Cl. hyemalis</i> and <i>M. nigra</i>
	1-2	Børnholm	XIV	D	>800	shot, species composition among 468 along the E coast, see Table 3
1968	2	S Langeland	XI	D	>375	birds shot
	3	Korsholme	V	E	>40	



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