Some Results of Herring Gull Ringing in Denmark 1958-1969

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(Med et dansk resumé: Nogle resultater af Sølvmåge-ringmærkning i Danmark 1958-1969)

INTRODUCTION

The general dispersal of Danish Herring Gulls *Larus argentatus* has been described earlier by SKOVGAARD (1920-24, 1925-29), TAANING (1944) and PALUDAN (1953). Ringing of the species has been increasing since these publications, and it is now possible to give a more detailed analysis concerning some aspects of the dispersal and mortality from different gulleries.

MATERIAL

The results in this publication are derived from ringing of Herring Gulls during 1958-1969, carried out by the Zoological Museum, Copenhagen, and the Game Biology Station, Kalø. The ringing has not been part of any special programme on the Herring Gull, and therefore it has been necessary to neglect part of the material. Eight colonies with more than 200 birds ringed annually were selected (see Table 1 and Fig. 1), totalling 11,111 chicks ringed and some 1,300 recoveries up to 1st January 1971.

RESULTS

Dispersal pattern of four colonies.

Jordsand

The dispersal from Jordsand has been described by PALUDAN (1953), and there does not seem to be any changes in the established dispersal pattern. Recoveries in the first year of life (1st August to 31st July) are shown in Fig. 2. Recoveries from later years of the premature period are all within the same area and have not been mapped.

Recoveries of full-grown birds (4 years old, DROST 1952) in the breeding season (May-July) are shown in Fig. 6. Unfortunately this figure tend to be misleading because of the concentration of recove-

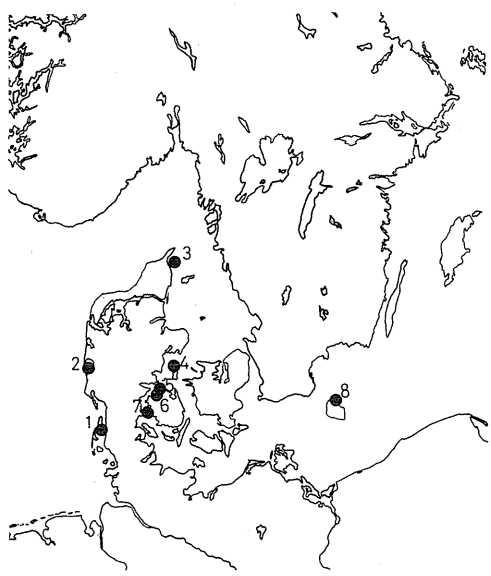

Fig. 1. Geographical position of the eight Herring Gull colonies described in this study. 1: Jordsand, 2: Tipperne, 3: Hirsholmene, 4: Samsø, 5: Ærbelø, 6: Ærbeløholm, 7: Egholm, 8: Christiansø.

Geografisk placering af de i teksten omtalte kolonier.

Table 1. The annual ringing activity in the eight colonies dealt with in this study.

Den årlige ringmærkningsaktivitet i de otte behandlede kolonier.

Name of colony *Koloniens navn*	Size of colony *Koloniens størrelse*	Chicks ringed/year *Unger mærket/år* 1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	Total	Average 1. year recovery rate. *Gennemsnitlig 1. års genmeldingsprocent*
Jordsand	1500 pairs	0	0	560	761	0	742	308	568	633	564	0	14	4.136	8.5%
Tipperne	400 pairs	0	0	0	0	0	0	0	0	0	0	0	306	306	6.8%
Hirsholmene	1500 pairs	0	0	0	0	642	0	0	0	0	1187	1341	0	3.170	7.7%
Samsø	1500 pairs	0	0	0	269	0	301	0	0	0	0	0		570	7.0%
Æbelø	pairs	0	0	0	0	0	0	0	0	0	219	0	297	516	7.9%
Æbeløholm	500 pairs	0	0	0	0	0	0	0	0	0	260	0	400	669	9.4%
Egholm, Bågø	800 pairs	0	0	0	0	0	0	0	0	350	601	0	0	951	10.8%
Christiansø	4000 pairs	295	281	509	0	0	0	0	0	0	0	0	0	1.085	6.5%

Grand total 11.111

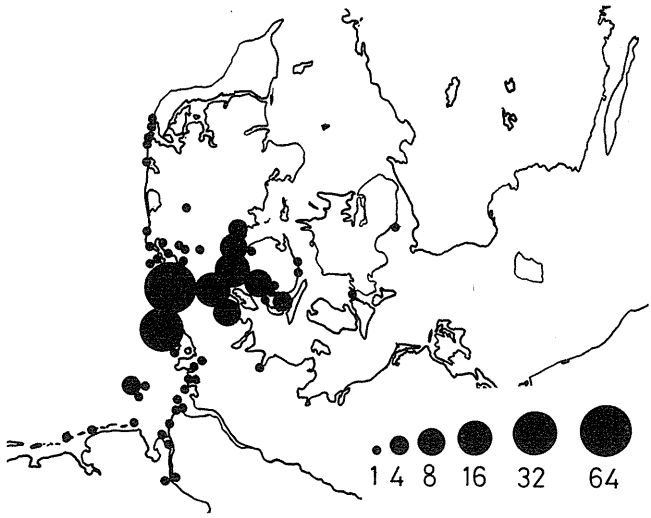

Fig. 2. First year recoveries from Jordsand 1961-65. Recoveries from 1966-67 are omitted but show the same distribution. Symbols of the same magnitude have been used in Figs. 2-5.

1. års genmeldinger fra Jordsand 1961-65. Genmeldinger fra 1966-67 er udeladt men viser det samme mønster. Der er anvendt samme symbolværdier på fig. 2-5.

ries on the islands Amrum, Mellum and Trichen due to intensive population control. Nevertheless, it is obvious that the mature birds normally settle within the area of their juvenal dispersal.

Hirsholmene

This colony is situated within 60 km of the important fishing ports of Frederikshavn, Skagen and Hirtshals, which has a marked effect on the number of nearby recoveries, cf. Fig. 7. The birds are supported with an abundance of food throughout the year, and some may stay there for the rest of their life whilst the general picture of first-year dispersal is as shown in Fig. 3.

On the whole the species must be considered coastal (e.g. WYNNE-EDWARDS 1935), but there is some traffic across Kattegat and Skagerrak of Scandinavian as well as Danish birds. It is here reasonable to regard the daily ferry-connections in the area of great importance as performers of movement, as mentioned by MORTENSEN (1967).

Recoveries from later years of life are still scarce but show the same pattern. Possibly some of the Danish birds reach-

Fig. 3. First year recoveries from Hirsholmene 1962 and 1967-68.

1. års genmeldinger fra Hirsholmene.

Fig. 4. First year recoveries from Egholm 1966-67.

1. års genmeldinger fra Egholm, Bågø.

ing southern Scandinavia stay there for life.

The few recoveries of full-grown birds from the breeding season (Fig. 6) visualize a continued concentration in the area of the ports.

Egholm and Bågø

Juveniles from this colony are mostly recovered in the northern parts of the Lille Belt as seen from Fig. 4. Some cross Jutland to the Waddensea from the northernmost part of the Belt and not, as to be expected, from the southern part. Whether this is due to some constant bias in the recoveries or expresses a general tendency is difficult to determine. One possible reason might be that the colony on Jordsand is the oldest of the two which could have established a division of the area based on tradition. Only a more detailed analysis of the local situation may solve this problem.

The dispersal pattern of older age-classes follow that of first year birds and is not given. No mature gulls have been recovered as yet.

Christiansø

PALUDAN (1953) described the dispersal from this colony, but possibly there has been a minor change since his investigation. In the 1940-ies about 17% of the gulls were recovered in Jutland and North-West Germany as compared to only 10% in the present material. Though the difference is not statistically significant it probably expresses a

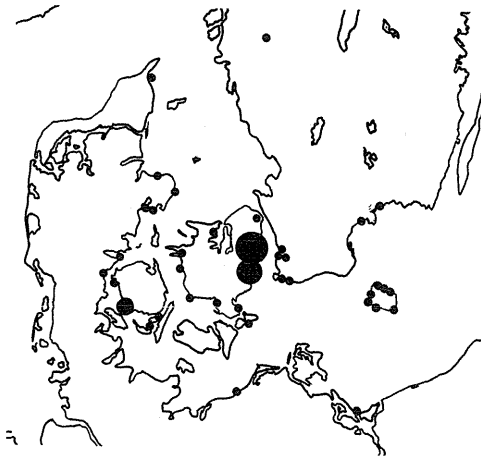

Fig. 5. First year recoveries from Christiansø 1958-60.

1. års genmeldinger fra Christiansø.

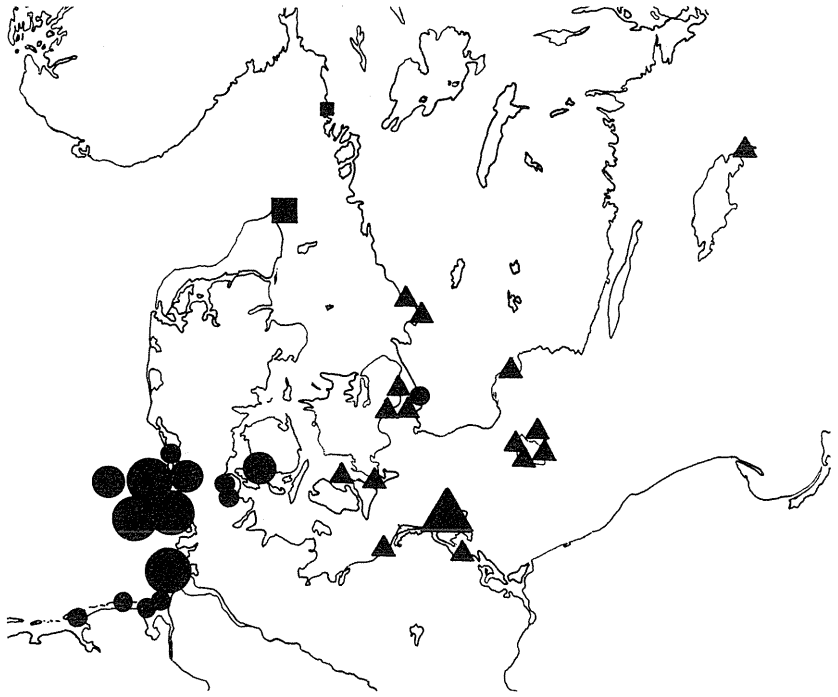

Fig. 6. Recoveries of mature birds from 1 May to 1 August ringed on Jordsand (circles), Hirsholmene (rectangles), and Christiansø (triangles). The largest symbols indicate 8 recoveries, the medium 3 rec., and the smallest 1 rec.

Genmeldinger af adulte fugle fra 1.5. til 1.8. De store symboler viser 8 genmeldinger, de mellemste 3 og de små 1 genmelding.

general tendency. This may be seen in connection with the increase in the easy available food on the large dumps in the Copenhagen area allowing the birds to stay east of their former winter area.

Fig. 5 shows the first year dispersal, and Fig. 8 a scattergram for the colony. Clearly these birds are less stationary than the birds from Hirsholmene. Recoveries from later years of life follow the same pattern of relatively great dispersal and are not given here.

Eight birds were recovered on the breeding grounds at Rügen, DDR, as a result of population control. However, the general picture of mature birds from Christiansø recovered in the breeding season is one of much greater dispersal as compared to the other Danish colonies, cf. Fig. 6.

Death causes of recovered Herring Gulls

The death causes of recovered Herring Gulls have formerly been described by several authors (US: PAYNTER 1947, SMITH 1959, Germany: DROST & SCHILLING 1940, Fenno-Scandinavia: OLSSON 1958, and Denmark: PALUDAN 1953), based on material from a single colony or from a whole country.

The material in investigations on death causes is normally of a very heterogenous character, depending on lenght of the open season, local hunting pressure, density of human population etc., and many papers tend to give an unnecessarily exact classification of these causes. Dealing with the present material the author has used a division of 3 categories: Birds reported shot, birds found dead, and birds trapped and released with ring. The most exact

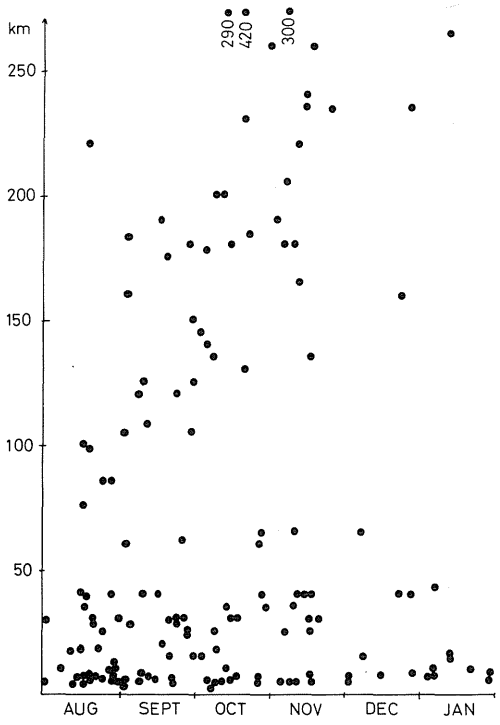

Fig. 7. Scattergram for the gullery on Hirsholmene, visualizing the two different dispersal types from this colony.

De to spredningstyper for kolonien på Hirsholmene.

figures will always be obtained from the last category, but also the category »birds shot« may give reliable figures.

Table 2 gives information on recovery categories from 7 different Danish colonies for the juveniles in their first year. Recoveries outside Denmark are given separately. The reason for this can be seen from the data from the Jordsand colony, Table 3. This colony is situated very close to the border between Denmark and Germany, and this has a major effect on the distribution of recoveries and recovery causes due to differences in shooting pressure. The open season for the Herring Gull in Germany is from 1st August to 31st March, and in Denmark from 16th August to 30th April (prior to 1967 from 1st August). The annual bag of »gulls« in Schleswig-Holstein is estimated to less than 1,000 (R. SCHLENKER; pers. comm.), whereas the Danish bag has been increasing continously up to 232,000 in 1969 (STRANDGAARD 1971). The bag records consider all gull species as a whole, but it is known that the Herring Gull makes up a large proportion of the total.

On average 39% (annual variation from 33 to 45%) of the first year recoveries come from Germany, and the total for all age groups yet recovered is 41.1% (omitting recaptures and recoveries without further information). 19.5% of the birds recovered in their first year in Germany were reported shot as compared to 65% of the birds from Denmark. For older age classes as a whole the percentages are 20.4 and 65.4.

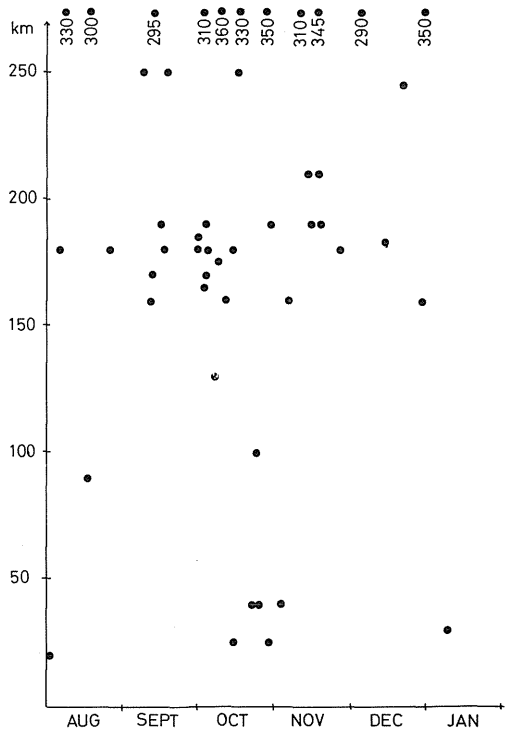

Fig. 8. Scattergram for the gullery on Christiansø, showing the concentration of recoveries at a distance of some 180 km. The large difference in dispersal distance between the Danish *Larus a. argentatus* and the North American *Larus a. smithsonianus* will be seen when comparing Figs. 7 and 8 to the scattergrams given by HOFSLUND (1959) showing recovery distances up to 2,900 km for the American subspecies.

Spredningsdiagram for fuglene på Christiansø. Bemærk koncentrationen i en afstand af ca. 180 km nemlig ved København.

Table 2. Recovery categories from 7 Danish gulleries.
Genmeldingskategorier fra 7 danske kolonier.

Colony *Koloni*	Recoveries from Denmark *Genmeldinger fra Danmark* n	Shot (%) *Skudt*	Found dead (%) *Fundet død*	Recoveries outside Denmark (%) *Genmeldinger udenfor Danmark*
Tipperne	21	72	28	11
Hirsholmene	244	68	32	5
Samsø	40	71	29	5
Æbelø	41	74	26	15
Æbeløholm	63	69	31	10
Egholm	103	71	29	10
Christiansø	70	69	31	18

n = total number of first-year recoveries. *Alle 1. års genmeldinger.*
i) Excluding chicks found dead in the colony and recoveries without further information.
Undtaget er unger fundet døde i kolonierne og genmeldinger uden yderligere information.
ii) Percentual value of n. *Værdi i procent af n.*

Table 3 therefore clearly illustrates the fact that the influence of a single mortality factor (here shooting pressure) may vary considerably from one country to another. On the other hand there is a high accordance between the different colonies concerning the recoveries within Denmark, cf. Table 2.

PALUDAN (1953) found a declining shooting percentage from first to later age classes (66.2 to 47.9%). The same decline is found in this material, cf. Table 4. The most pronounced difference is seen between 3rd and 4th year, where the birds are thought to moult into theri adult plumage. The changes from class to class are not statistically significant (by chi-square test), but the decline as a whole is highly significant ($p < 0.001$).

The explanation to this is probably that the young »brown« birds are often shot for food, while the adult »grey« birds are shot for practice, giving a lower recovery rate for the latter which are often not retrieved. Besides, they may later be recovered as »found dead«. It is also

Table 3. 1. year recoveries from Jordsand 1960-67.
1. års genmeldinger fra Jordsand 1960-67.

Country *Land*	n	Shot (%) *Skudt*	Found dead (%) *Fundet død*	Total i)
Danmark	204	65.0	35.0	200
West Germany	136	19.5	80.5	128
Holland	1		(100)	1
	341			329

n = number of 1. year recoveries used.
n = antallet af anvendte genmeldinger.
i) total number of recoveries reported »shot« or »found dead«.
Samlet antal genmeldt som skudt eller fundet død.

Table 4. The decline in shooting percentage with older age classes. The decline is not statistically significant (by χ^2 test) with classes but the overall decline is highly significant ($p < 0.001$).

Den faldende beskydningsprocent med øget al.der Der er ikke signifikant forskel mellem de enkelte aldersklasser, men det generelle fald er særdeles signifikant med $p < 0.001$).

	n	Shot (%) *Skudt*	Found dead (%) *Fundet død*
1. year of life	715	68.1	31.9
2. year of life	121	63.6	36.4
3. year of life	61	59.0	41.0
4. and later years	105	47.6	52.4

n = The total number of birds reported from Denmark in the recovery categories »shot« and »found dead«. *n = Alle fugle genmeldt som skudt eller fundet død i Danmark.*

reasonable to expect older gulls to get more experienced in their contact with human activity, and they might change their habits due to breeding.

As seen from the table another important mortality factor for mature birds is population control on the breeding grounds, though this factor varies from year to year.

The reason for focusing on these factors is that they are all of great importance in evaluation of life tables for a particular species. They become even more important when life tables for different populations of the same species are compared. One typical example would be the comparison of a Danish and a North American population of Herring Gulls, the American birds beeing protected by law.

This problem has been reviewed by PAYNTER (1966), but a final solution cannot be arrived at until the significance of life tables based on ringing recoveries has been fully developed.

The distribution of first-year recoveries

The main part of the first year recoveries is concentrated in the first month after the young birds leave the colony, though there is some variation in the optimum recovery month from one colony to another, cf. Table 5.

In two cases the optimum is found in August-October (Hirsholmene and Egholm). Here the birds breed almost undisturbed, and the young gulls leave the colony during July, being hunting objects from the start of the open season. On Jordsand breeding is delayed one

Table 5. The monthly distribution of first-year recoveries from 4 colonies given as percent of total number. (–) means no recoveries, (+) less than 1%.

Den månedsvise fordeling af 1. års genmeldinger fra fire kolonier, givet som procent af n. (–) betyder ingen genmeldinger, (+) mindre end 1%.

		Month *Måned*											
	n	8	9	10	11	12	1	2	3	4	5	6	7
Jordsand	353	6	25	24	16	10	4	5	3	3	1	1	2
Hirsholmene	240	26	20	20	13	6	4	3	2	2	2	2	(+)
Egholm	102	27	22	24	9	(-)	6	3	2	2	1	4	1
Christiansø	69	13	18	32	13	7	2	3	3	7	(-)	1	1

n = number of first-year recoveries used.

n = antallet af anvendte 1. års genmeldinger.

month (J. FOG, pers. comm.), and juveniles will not leave the colony till the end of August, giving high recovery rates in September and October. The young gulls from Christiansø leave the colony during July (PALUDAN 1951) but are not really persecuted till they reach Sealand, which obviously happens in October.

The high recovery rate of quite unexperienced birds, revealing 80-90% of 1st year recoveries before January 1st, can only be expected. It is more interesting to find the same high rate (88% in second and 81% in third age group) in the same autumn period. This must be a result of a higher shooting pressure on the species during the autumn, as shot birds constitute such a great part of the recoveries.

HARRIS (1964) found the highest mortality to occur in July for second and later age classes in the English population of Herring Gulls. The same tendency may be found in this material concerning the mature birds, though it is partly due to the population control mentioned above. When these recoveries are excluded the highest recovery rate is still found in the months August-December.

PALUDAN (1953) found a declining recovery rate for first year birds in the period 1916-1942. A corresponding decline has not been found in this material as seen from Fig. 9. PALUDAN (1951) also estimated the total recovery rate to be 8.3%, whilst it is found to be 8.4% for first year birds and probably over 12% for the total of the present material. Paludan excluded all recoveries from August, and this in connection with a better information to the public on the purpose of bird ringing is likely to be responsible for the difference. There seems to be bo indication of a higher mortality rate. Fig. 9 shows some small-scale fluctuations in the same colony over the years, but the general picture is one of stability.

The bag of »gulls« in Denmark has been increasing rapidly over the years considered in this investigation, but it has had no effect on the average first year recovery rate as seen from Fig. 10. Of course the bag records should be taken as an index only, but on the other hand it is consistent with the general assumption that the Danish population of Herring Gulls has been increasing for the last many years.

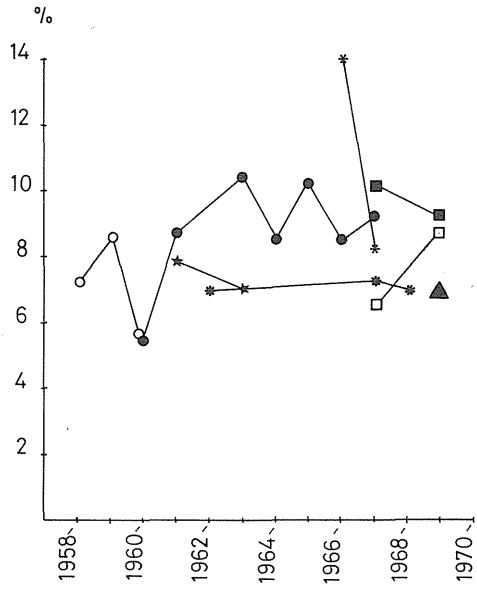

Fig. 9. Annual variations in 1. year recovery rate for eight Danish Herring Gull colonies.

Key to symbols: ● Jordsand, ▲ Tipperne, * Hirsholmene, ⋆ Samsø, □ Æbelø, ■ Æbeløholm, * Egholm, ○ Christiansø.

Årlige variationer i 1. års genmeldingsprocent for otte danske sølvmågekolonier.

CONCLUSION

OLSSON (1958) has shown how Norwegian and Swedish Herring Gulls winter allohiemic (SALOMONSEN 1955) in Denmark, while gulls from the Baltic winter synhiemic, primarily in the Copenhagen area. As seen from Figs. 2-5, Herring Gulls from different Danish colonies tend to winter partly allohiemic. This would also contribute to sustaining micro-geographical distinctions between birds from different colonies, e.g. differences in colour of the bill as found by VOOUS (1961) and variations in mantle colour (BARTH 1966).

A number of authors (GROSS 1940, PAYNTER 1947, TINBERGEN 1953, OLSSON 1958, DROST et al, 1961, and LUDWIG 1963) have found movements back to the natal colony in the third year of life. PALUDAN (1953) could not establish such

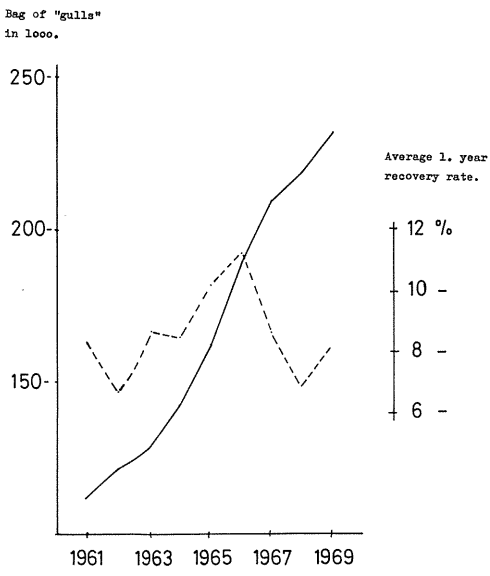

Fig. 10. Average first year recovery rate (dotted line) in relation to the growing bag of »gulls« in Denmark (solid line). Bag records are taken from the annual reports published by the Game Biology Station, Kalø (Dansk Vildtforskning).

Gennemsnitlig 1. års genmeldingsprocent (punkteret linie) sammenlignet med jagtudbyttet af »måger« (ubrudt linie). Opl. taget fra Dansk Vildtforskning.

movements, and from this material nothing can be concluded either. Population control in Germany has given the recoveries of mature birds an uneven distribution, but there is an obvious close connection between the dispersal area of juvenile birds and the places where mature birds settle to breed.

The dispersal area for each colony seems to be determined by the amount of available food in the proximity of the colony. Another factor of importance, especially for the colony on Christiansø, is the winter temperature. It is the only Danish colony situated on the colder side of the 0° C isotherm for January and February, and this is another reason for the birds to go west during the cold period.

Shooting is responsible for the largest proportion of recoveries within the Danish borders, while most birds from other countries (especially Germany) are reported found dead. The shooting pressure is strongest in August-December, especially for immature birds. The tendency is decreasing for adults where more birds are reported found dead or killed during population control. This change is considered due to the fact that the young birds are shot for food, while the adults may to some extent only be shot for practice.

Minor variations are found in the monthly and annual recovery rates for colonies situated in different parts of the country. The variations depend on the time for the birds to leave the colony, the amount of available food, and the density of human population in the proximity of the colony. Still the overall recovery rate tend to be rather stable within each single colony as well as over the years, and it has not so far been influenced by the increase in the Danish bag of gulls.

This study is based on a rather heterogenous material, and a number of aspects could not be considered. On the other hand, the high recovery rate of about 12% opens the possibility to continue this type of investigations in many different colonies by means of ringing only a small number of birds (200-300 annually per colony). In this manner it will be possible to follow any future changes in the Herring Gull population, even on a very local scale.

I want to express my gratitude to cand.mag. N.O. PREUSS, Zoological Museum of Copenhagen, and to mag.scient. J. FOG, the Game Biology Station, Kalø, for handing over the results of Herring Gull ringing carried out by these two institutions. Besides, my special thanks go to Mr. PREUSS for his never failing interest and help during my work.

DANSK RESUME

Nogle resultater af Sølvmågeringmærkning i Danmark 1958-1969

På grundlag af ca. 1300 genmeldinger af Sølvmåger *Larus argentatus,* mærket i årene 1958-69, er der foretaget en analyse af spredning og dødelighed for forskellige danske kolonier.

For fire udvalgte kolonier er der på fig. 2-6 vist genmeldinger af 1. års ungfugle og af adulte fugle i yngletiden (maj-juli). Det ses, hvorledes fuglene er koncentreret i bestemte områder, og denne delvise allohiemiske (SALOMONSEN 1955) spredning og overvintring er med til at danne grundlag for de mikro-

geografiske forskelle, man har påvist mellem forskellige Sølvmåge-populationer (VOOUS 1961, BARTH 1966).

Spredningen fra de enkelte kolonier synes bestemt af mængden af føde i koloniens nærhed. Dette betyder f.eks., at en stor del af bestanden fra Hirsholmene ikke kommer længere væk end til de store fiskerihavne i Nordjylland, mens fuglene fra Christiansø må vandre over betydelige afstande, se fig. 7 og 8.

Størsteparten af de 1. års fugle, der er genmeldt indenfor landets grænser, er meldt som skudte, nemlig 65-70%. De fleste genmeldinger fra udlandet stammer fra dødfundne fugle, ca. 80%. Som det fremgår af tabel 4 falder denne procent dog til under 50 for adulte, udfarvede (4 år og ældre) fugle. Denne forskel må i det væsentligste tilskrives, at de unge, brune måger skydes til føde, mens de grå fugle kun bruges som øvelsesmål. Beskydningen er hårdest i august-december, hvor 80-90% af alle 1-3 års fugle genmeldes. For adulte fugle falder denne procent til omkring 50, fordi flere nu findes døde i sommermånederne, ofte i forbindelse med ungemærkninger i kolonierne.

Det fremgår af tabel 2 og 5 samt fig. 9, at der findes mindre variationer i genmeldingsprocenter og genmeldingsmåneder for 1. års fugle fra forskellige kolonier. Disse variationer er afhængige af, hvornår de unge fugle forlader kolonien, og hvor lang tid der går, før de udsættes for et større jagttryk. Dette sidste gælder specielt for fuglene fra Christiansø, der først beskydes, når de når Sjælland.

For perioden som helhed har der dog været tale om en stabil genmeldingsprocent både for de enkelte kolonier (fig. 9) og for populationen som helhed (fig. 10), selv om det samlede jagtudbytte af »måger« er fordoblet iflg. jagtstatistikkerne.

Et tilfældigt indsamlet ringmærkningsmateriale som det foreliggende vil altid have begrænsede udnyttelsesmuligheder. Det fremgår dog, at man for Sølvmågens vedkommende (takket være den meget høje genmeldingsprocent) kan følge lokale populationsændringer ved blot at mærke 200-300 fugle årligt i hver koloni.

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