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INCREASE OF THE NUMBER OF CORMORANTS *PHALACROCORAX CARBO* WINTERING IN FRANCE AND THE CHANGE OF CONSERVATION STATUS OF THE SPECIES

ABSTRACT: France is an important staging and wintering area for both European races of cormorants: *Phalacrocorax c. carbo* (from Britain and Ireland) and *Ph. c. sinensis* (from Sweden, Poland, Germany and The Netherlands). In January 1992, all French roosts were censused and the wintering population was estimated at 66 000, these occuring at 27 roosts. This compares 14 000 in 1983. The increase of the wintering sinensis population in France triggered a recent change in the conservation status of this race; it can be now killed at all fish-ponds. This change could have some consequences for the dynamics of the European populations in some areas.

KEY WORDS: cormorant, wintering population, number trends, subspecies distribution, habitat change, conflicts with fish-farms, conservation status, France.

1. INTRODUCTION

France is an important migrating and wintering area for both the western European *carbo* race of cormorant from Great Britain and Ireland, and the eastern European *sinensis* race from The Netherlands, Germany, Denmark, Poland and Sweden. However, information about these wintering birds was scarce until recent years (Marion 1983). The first national census of wintering cormorants undertaken in January 1983 recorded 14 000 birds (Pasquet 1983). In January 1989, Marion (1991) estimated this population to be about 24 000 birds by a partial census of (80%) the territory. The aim of this paper is to present the results of an exhaustive national census made in January 1992 which illustrates the change in the number of birds recorded and the areas used by two European races (*carbo* and *sinensis*) since 1982. The conflict that had arisen between these birds and fish-farmers and has resulted in a change of the French legal status of the *sinensis* race in November 1992 is also discussed.

2. METHODS

The size and location of the wintering population of cormorants in France was determined in January 1992 (or December 1991) using data collected by 250 observers from all known night-roosts (n = 270). This included the results of local censuses which were first coordinated in Normandy (part of the roosts only being censused in 1990–91, Debout 1992), in the Central Region (Beignet 1992) and in the Rhône-Alpes Region. In the Rhône-Alpes Region, most of the data were obtained by ornithologists coordinated by CORA (Pont, in litt.). For the few uncounted roosts, local ornithologists were contacted directly, or data were obtained by the hunt-guards of the O.N.C. (Broyer in litt.). At the same time all French observers produced estimates to enable a re-evaluation of the January 1989 census published in Marion (1991). These 1989 and 1992 censuses are compared with the national census undertaken in January 1983 (Pasquet 1983). January was chosen as it is a time when migrating birds were less likely to be moving between areas. Data from the 1989 and 1992 censuses were analysed in relation to the habitat in which the roosts were located (sea, estuaries, coastal ponds, rivers, inland lakes and ponds), and not from the feeding dispersion of the birds.

This paper also summarizes the results obtained by the analysis of 704 recoveries and sightings of cormorants in France (Marion 1995). Sightings were only taken into account one time per bird per winter per wintering area. The location of recoveries were allocated to the same habitat categories, using the same criterion used in the analysis of roost location. The number of birds colour-ringed in colonies and the observations of breeding birds were obtained directly from ringers: M. van Eerden and K. Koffijberg for The Netherlands; J. Gregersen for Denmark; R. M. Sellers, M. Carrier, G. Ekins and D. Andrews for Great Britain and Ireland or from Sellers (1992) for the number of birds ringed in other countries.

3. RESULTS

3.1. WINTER POPULATION

The wintering population reached 66 000 cormorants in January 1992, compared to only 14 000 in 1983. Fig. 1 shows the distribution of the 270 roosts surveyed. This distribution can be divided into eight areas: the most important area was the Saône and the Rhône Valleys and their extension to the Mediterranean coast between the Camargue and the Pyrénées (24% of French wintering population), followed by the population of the Loire Valley (16%). Next were those of the Atlantic coast from south Finistere to the Gironde estuary (11%). This was followed by the Seine Valley and Normandy coastal population, with 7.8%, which was separated from the smaller northern coastal population of Britanny (3.5%). Other isolated areas also held small numbers: Aquitaine (7.6%), Rhine Valley and eastern great lakes (6.4%), and Corsica (4%).

Large changes in wintering areas had occurred since 1983. In 1992 inland sites held 55% of the birds compared to 28%

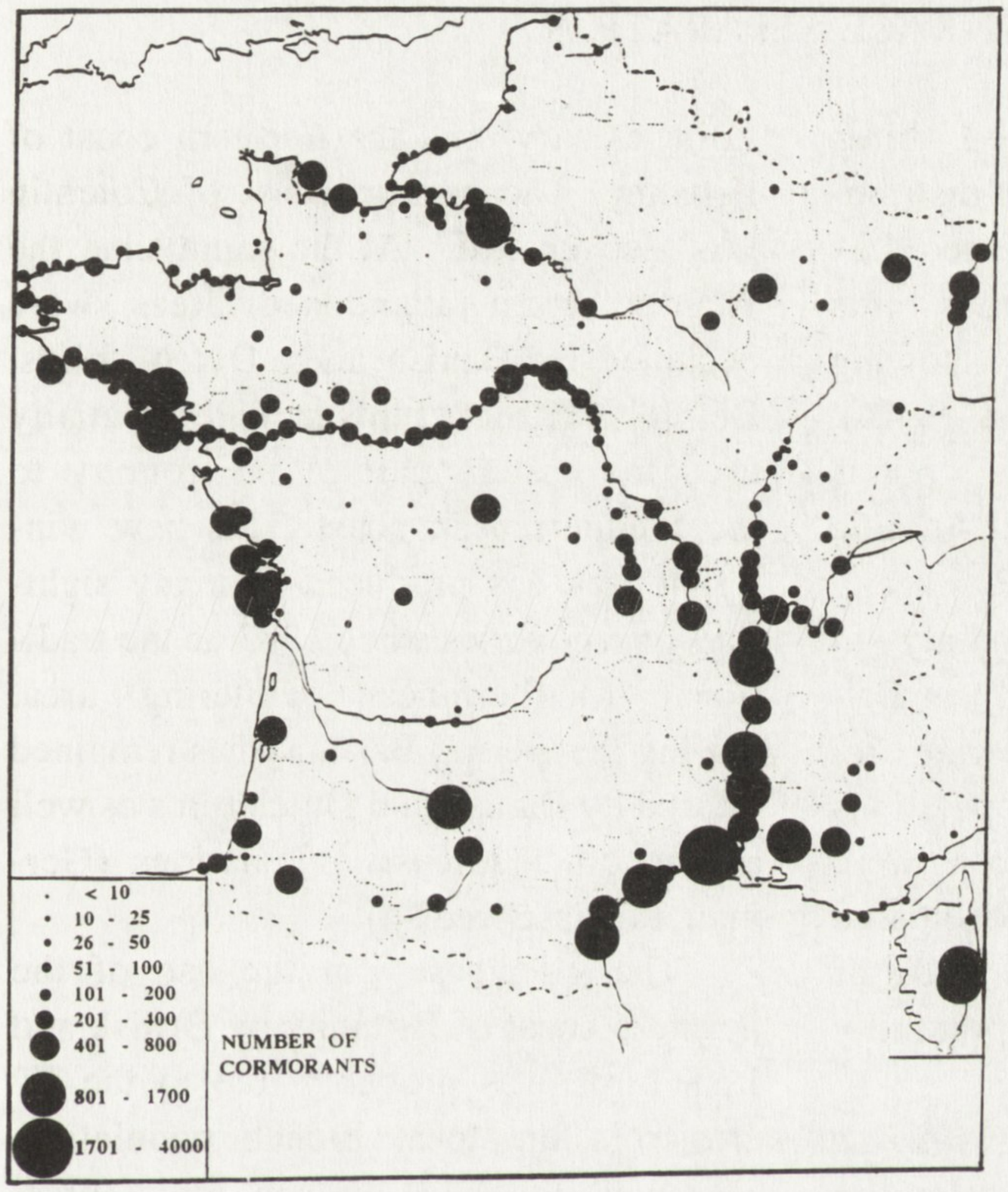

Fig. 1. Distribution of wintering roosts of cormorants during the National census of January 1992

in 1983. The Loire held more than 10 000 birds compared to 5000, and the Rhône and the Saône 8500 birds in 1983 with these rivers now punctuated by one roost every forty kilometres. The increase in inland bird numbers was three times greater than that of coastal birds.

The size of the roosts also varied considerably between regions. The most important roosts were located in the Mediterranean coastal ponds: 4000 in Camargue, 1300 at Thau, 1000 at Leucate, 1690 at the Diana pond and 960 at the Urbino pond in Corsica, and in the Rhône valley: 1000 at Lac du Bourget, 1000–1800 at Merindol on the Durance. Elsewhere, there were only five roosts which held more than 1000 cormorants with three on the Atlantic coast: Gulf of Morbihan, Dumet island in Loire Atlantique, Antioche in Charente Maritime, one on the Loire River (Beaugency) and one on the Garonne River (Moissac). The Rhine and the Seine valleys had only one roost each of 930 cormorants. It is too soon to conclude a relationship between the different roost sizes in each region and the available fish stocks. However, the large artificial lake on the Rhône (created by hydro-electric barrages) appears to have aided the establishment of large roosts, contrasting with the Loire valley where there are only few barrages and fewer and smaller roosts. A similar pattern appears to be true of the Seine, but clearly this river was colonised more recently and a large part of the river is still unused by cormorants. The mean size of cormorant roosts in the Rhône and the Durance valleys was 524 ± 165 cormorants (n = 19 without the Camargue), and only 225 ± 58 (n = 48) in the Loire valley. On the Atlantic coast, mean roosts size was 395 ± 198 (n = 18) between the Morbihan and Gironde estuary, and on the Mediterranean coast (with Camargue and Corsica) the reached 785 ± 627 (n = 13).

3.2. RACE SEPARATION

The recoveries of ringed birds showed some separation in the distribution of the two races (Fig. 2, see Marion 1995 for details). *Sinensis* birds wintered throughout France showing a preference for inland waters (84%), particularly rivers and coastal ponds (Mediterranean coast, and the Atlantic coast between Morbihan to Pyrenees). The *carbo* birds wintered mainly in marine habitats (80%), primarily in Britanny. Similarly, when comparing recoveries from the two French populations 97% of the coastal native birds were recovered in marine habitat, compared to 18% for the inland native birds of Grand-Lieu, in spite of their proximity to the sea.

The pressure of wintering *sinensis* birds seemed to have a buffer effect on wintering *carbo* birds. Before the *sinensis* boom in 1980s, British and Irish recoveries occurred on the northern and southern coasts of Britanny, and all along the Atlantic coast to Arcachon (Fig. 3). But, during the ten last years (Fig. 4), they have been focused on the southern coast of Britanny, abandoning both the southern Atlantic coast under the Loire estuary, and the northern coast of Britanny. The eastern coast of Cotentin was also unused. At the same time the Atlantic coast abandoned areas were occupied by Danish and Dutch birds. Before 1982 these birds had preferentially used the eastern part of the country to the Mediterranean coast. This new wintering area has produced as many sightings or recoveries since 1983 as the traditional Mediterranean wintering area. During this period Britanny has remained unused by Danish and Dutch birds as well as the other *sinensis* populations (German, Polish, Swedish).

The decrease in the use of the northern coast of Britanny by British and Irish birds was probably due to the increase in the local French population. However, the local French birds (presumed *carbo*) have also shown a strong change in their wintering area. Before 1982, these birds used the Atlantic coast below the Loire estuary, crossing over Britanny but not wintering there. Now the use of this southern wintering area has totally ceased to be replaced by the use of Britanny. Thus, the coastal French population (presumed *carbo*) showed

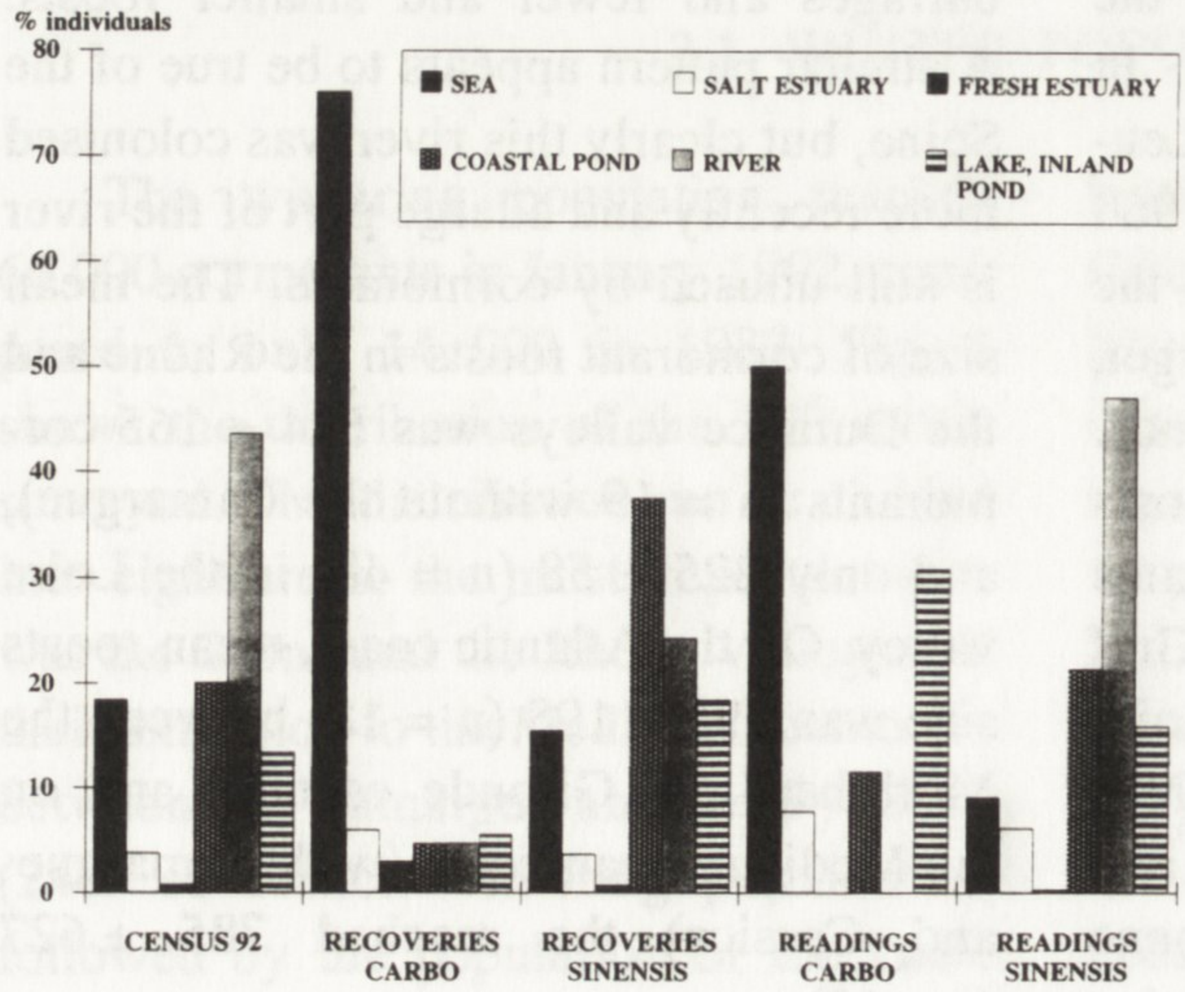

Fig. 2. Comparison between the habitat distribution of wintering cormorants during the 1992 census, and the distribution of ringing recoveries (= recoveries) and sight records (= readings) for the two races from 1983 to 1992 (only data on cormorants ringed abroad are considered)

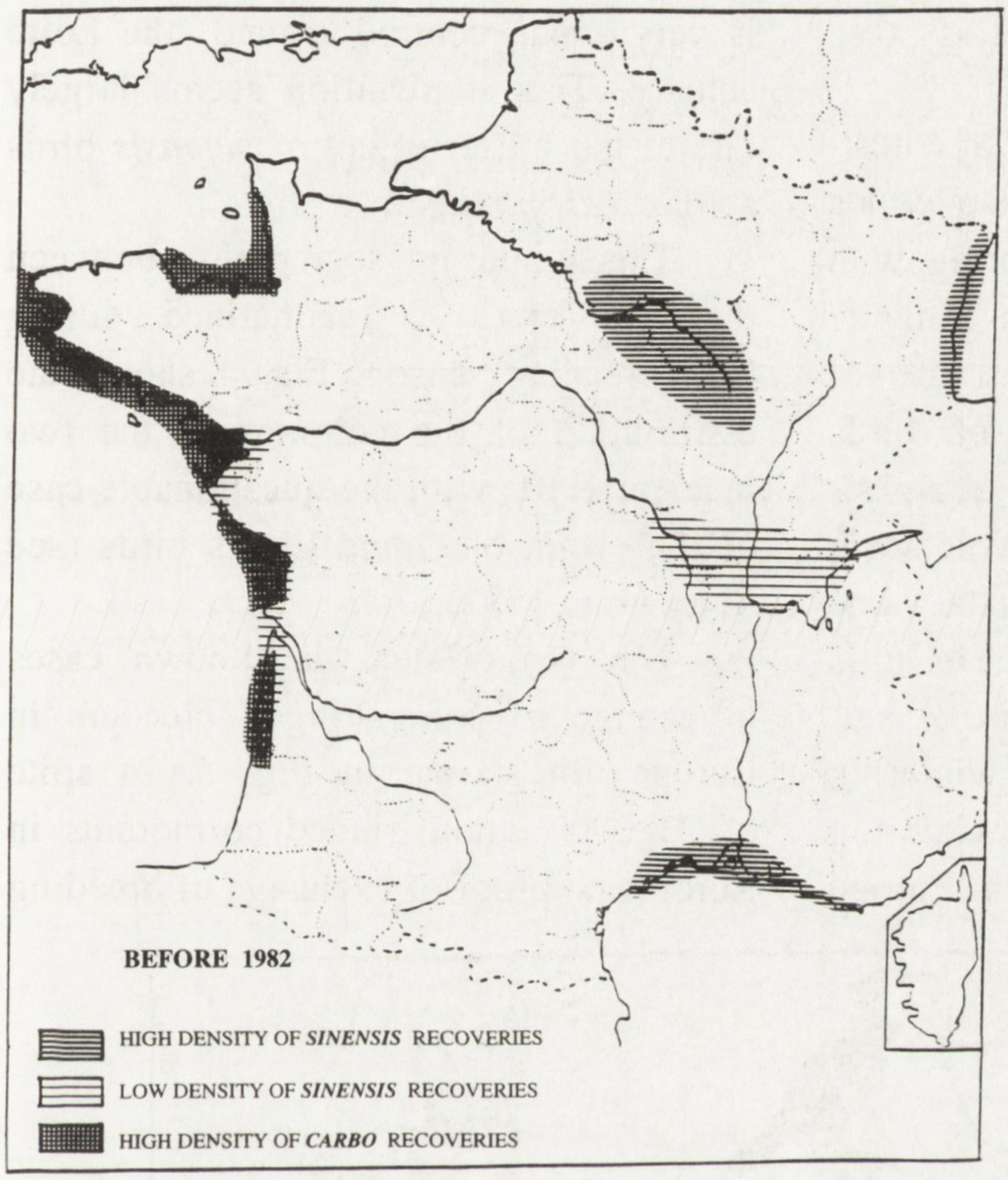

Fig. 3. Distribution of the main wintering areas of *Ph. c. carbo* and *Ph. c. sinensis* in France before 1982 (only data on cormorants ringed abroad are considered)

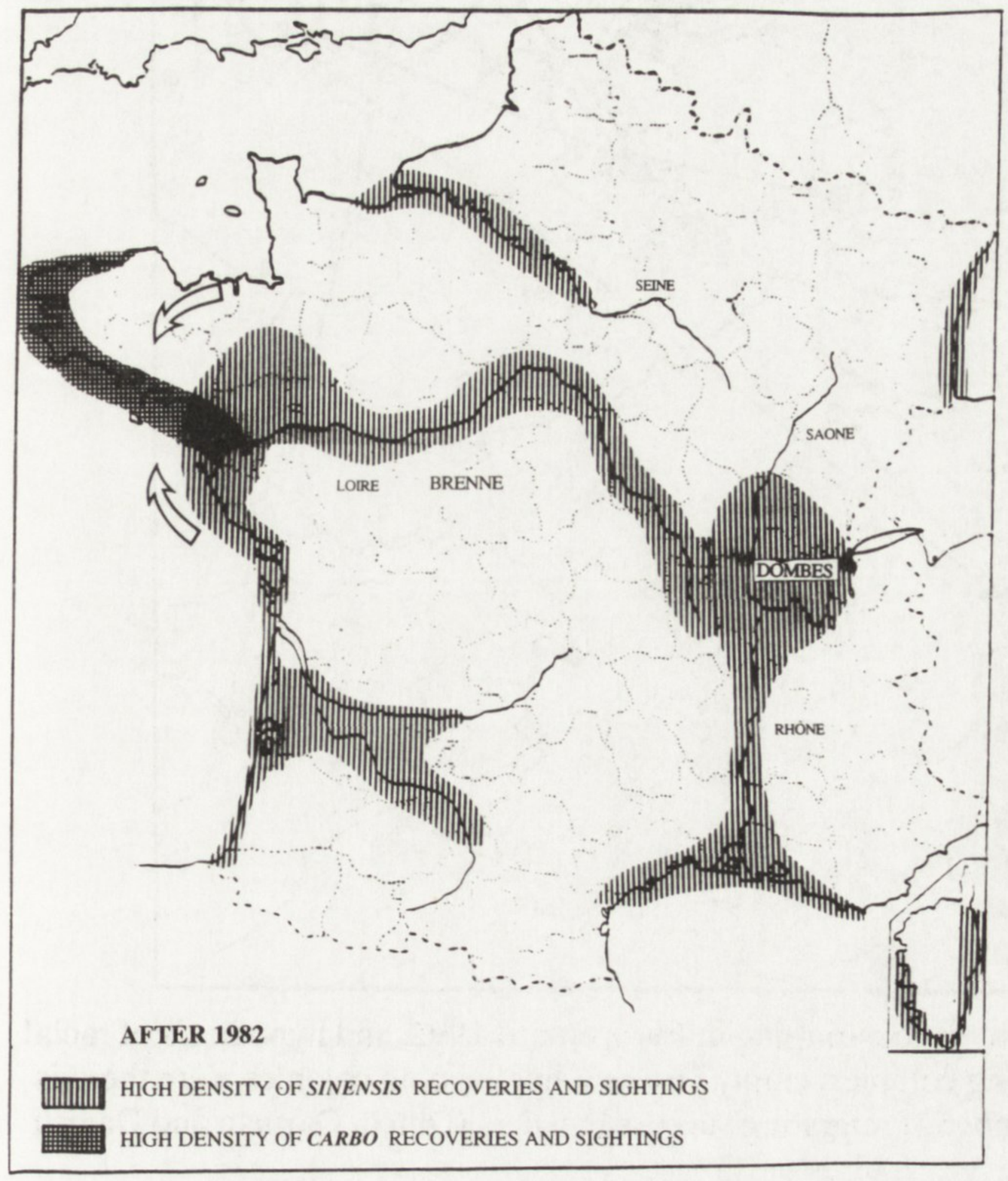

Fig. 4. Distribution of the main wintering areas of *Ph. c. carbo* and *Ph. c. sinensis* in France after 1982, and the buffer effect of *sinensis* birds on *carbo* birds on the Channel and the Atlantic coasts (only data on cormorants ringed abroad are considered).
The northern coast of Britanny was occupied by increasing coastal French population (presumed *carbo*)

the same buffer *sinensis* effect as the Irish and British birds.

Curiously, the new inland tree-nesting population of Grand-Lieu also avoids *carbo* in Britanny while wintering with *sinensis* both on the southern Atlantic coast and in the northern countries of the Netherlands. Recoveries of birds ringed in England at the inland tree-nesting colony at Abberton Reservoir seem to indicate that these birds use the same *sinensis* wintering areas in France as birds from Grand-Lieu (G. Ekins, in litt.).

In spite of the increase in wintering populations, the overlapping of wintering areas of *carbo* and *sinensis* in Europe is very small, centred around the Loire estuary. This segregation seems largely due to the buffer effect of *sinensis* birds against *carbo* birds.

This wintering segregation between the two races is maintained during the 1breeding season. Fig. 4 shows the distribution of the colonies of the two races in 1981, with the questionable case of the origin of Grand-Lieu's birds (see M a r i o n 1983).

Ten years later, the known cases of change of colour-ringed breeders in Europe are shown in Fig. 5. In spite of 23 000 colour-ringed cormorants in Europe, no proof of exchange of breeding

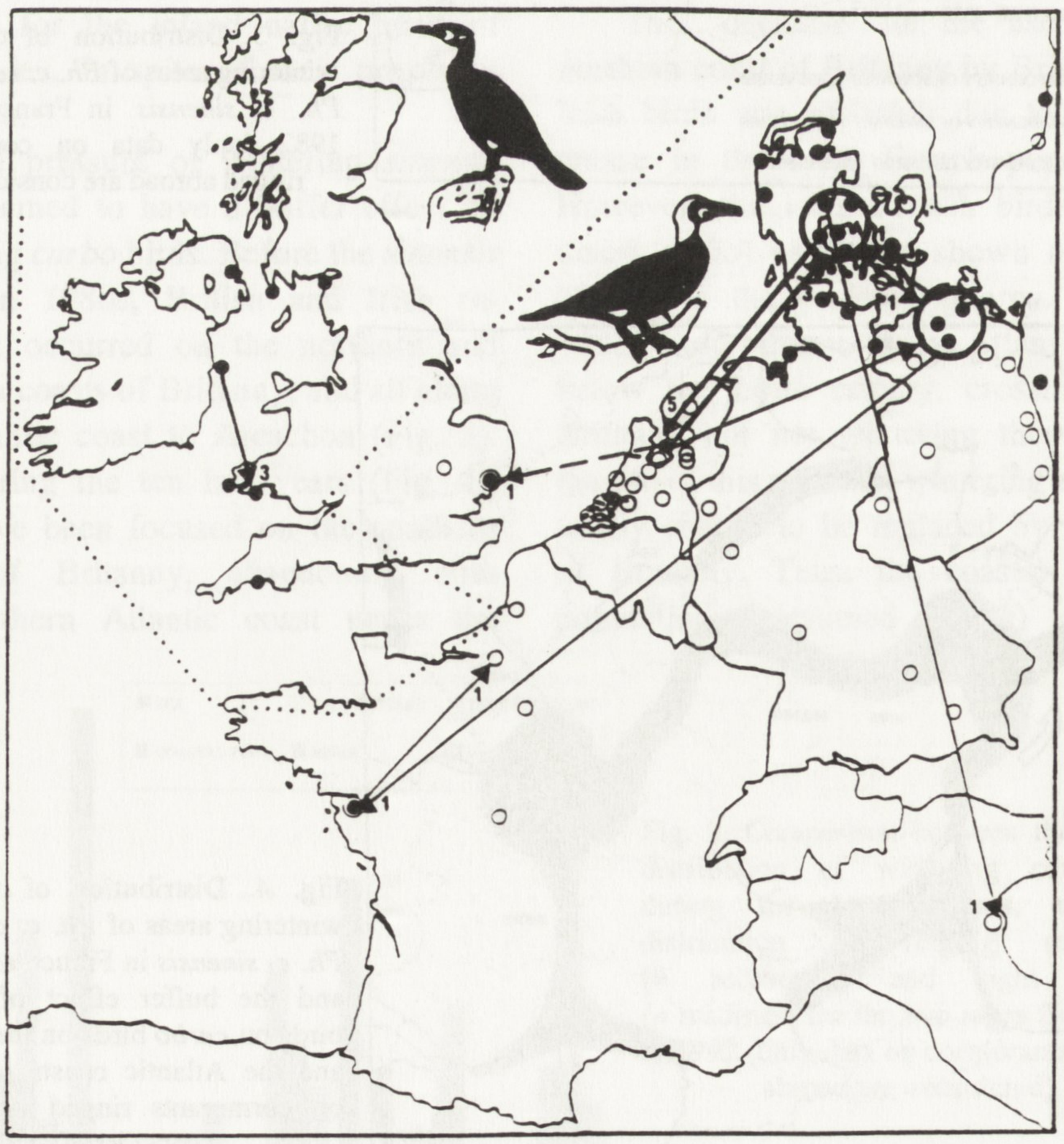

Fig. 5. Exchange of breeders proven by colour-ringing in Europe until 1992, and hypothesis of racial distribution limit; full circles = ringing colonies, empty circles = tree-nesting colonies were there is no ringing, full lines with data = number of migrating success breeders (Dutch, German and Danish birds only)

birds between the two races has occurred. The numbers of exchanges between races within countries were also rare, with only fourteen birds to date. Nevertheless, there are already data showing the origin of new tree-nesting inland colonies like Grand-Lieu and Abberton, which agree with the ecological segregation hypothesis. Thus, we can propose the hypothesis that these colonies indicate the spreading of *sinensis* population into the vacant part of the French and English *carbo* areas. This hypothesis will be tested in subsequent years by a genetic study of cormorants.

3.3. CHANGE OF CONSERVATION STATUS

The increase in the sinensis population has precipitated a great deal of hostility from French inland fish-farmers. In the early 1980s conflict only occurred in the Camargue, where a few fish-farms had recently been created in this old bird-life sanctuary. However, the conditions in the area were not economically or ecologically optimal for fish production and the farms disappeared after few years (Marion 1990). Minor conflicts began to occur in 1985 in experimental fish farms on other bird-life sanctuaries, in the western marsh on the Atlantic coast (Vendée, Charente Maritime, Arcachon). By the end of 1980s the increased wintering population in traditional fish-ponds regions had created severe conflicts in Brenne and Dombes, situated near the main rivers of the Loire and the Rhône. Several cases of below normal production from fish-farms were presented by farmers in Brenne (Muselet 1990, Goyon 1993). However, losses due to the abnormal drought from 1988–1992 were not taken into account in this area while they were considered by fish-farmers in Dombes to have reduced fish production by at least 40%. If such large losses had occurred in numerous local situations (up to 80% of the fish-stock, Marion 1990), the losses attributed to cormorants in Brenne seem even smaller when calculating predation by the indirect method, well known to overestimate intake, (1000 birds for 100 days eating 0.4 kg each = 40 tons consumed from 1200 tons produced = 3%). This level of predation is five times less than the natural mortality traditionally admitted by fish-farmers in France which occurs in the absence of cormorants and drought (Goyon 1993). In addition, the problem of substitution of mortality-factors, that can explain why heavy cormorant predation need not necessarily imply an increase in total fish-farm losses (see Suter 1993, Janda 1993), and other ecological interactions regarding predation (Marion 1990) were not considered by fish-farmers. Nevertheless, the psychological factor of cormorant predation in the area of intensive fish farming played an important role, and these worries were relayed by sport-fishermen and hunters from several regions. As a consequence some French ornithologists, the Office National de la Chasse (O.N.C.) and the Environment Ministry considered that cormorants required less protection within the E.C. This was in spite of the fact that total fish predation attributable to all cormorants and grey herons *Ardea cinerea* throughout France represented only 0.8% of annual fish-farm production (40 000 tons), and that most of this predation occurred outside of fish-farms (Marion 1990). In summary, this position was not based on the predation level, but on the negative effect that cormorants

were having on the traditionally good relationship between fish-farmers and ornithologists. In addition the losses attributable to cormorants on extensive fish-ponds could be resolved by their replacement with intensive and easily protected fish-farms. This was not an option favoured by ornithologists due to the other birds that were dependent on fish-ponds (ducks, grebes, gulls, herons). Thus, in 1991 the French government allowed the O.N.C. to shoot cormorants in Brenne and Dombes, without changing their legal protection status. This was achieved by considering this shooting as a scientific experiment. An European meeting was organized in spring 1992 in Brenne by hunters (local hunters organization and O.N.C.) and the Environment Ministry, in the absence of French specialists on predation, to convince the E.C. to change the legal status of cormorants based on the presumed losses to fish-farm production in France. European scientists and the E.C. did not agree to this change in legal status, and the French government subsequently changed the French status of sinensis birds in November 1992. This change in status was not restricted to Brenne and Dombes but applied throughout France, although there was no evidence for a decrease in fish-farm production at this level. The absence of such a decrease was to be expected considering that at least 95% of wintering cormorants fed outside of fish-farms regions in France in 1992 (see above). *Sinensis* birds (not distinguishable in field from the still protected *carbo* birds) could be now killed on fish-farms, with licences issued by local and national commissions. The conditions applied to these licences were ambiguous and in theory all the owners of the 70 000 ponds in France (more than the total French cormorant population) could shoot cormorants. The consequences of this for the population dynamics of *sinensis* could be significant as adult mortality during wintering seems to be an important factor in the population dynamics of this kind of species. If this is the case, the Dutch population could be most at risk as these birds use French wintering areas more than other European populations (M a r i o n 1995).

4. SUMMARY

France is an important migrating and wintering area for both European races: *Phalacrocorax c. carbo* (Irish and British) and *Ph. c. sinensis* (Swedish, Polish, German, Dutch and Danish). In January 1992, all French roosts were censused and the wintering population was estimated at 66 000 cormorants, occurring on 270 roosts (Fig. 1). This compares 14 000 in 1983. Distribution has changed also since 1983. Inland sites now support 55% of the population instead of 28% in 1983. Analysis of recoveries and sightings from European countries confirms the segregation of habitat and wintering areas between the two races: *sinensis* are wintering mainly at inland waters (84%), while *carbo* – mainly at the coasts (80%) (Figs 2 and 4). It was found that locally breeding cormorants (presumably *carbo*) have changed their wintering area. Before they wintered south of the Loire estuary and presently – mainly in Brittany. In spite of the number increase, both subspecies have avoided the overlapping of wintering grounds (Figs 3 and 4). They remain also separated on breeding grouns (Fig. 5). However, the analysis of the recoveries and sightings about 23 000 colour marked breeding cormorants in Europe has created a base for the hypothesis that *sinensis*, enlarging its breeding area, only exceptionally occupy areas which are situated within the *carbo* area in France or Great Britain, if only find suitable and not occupied by *carbo* sites.

The increase of the wintering *sinensis* population in France triggered a recent change in the conservation status of this race in the country: they can be now killed at all fish-ponds. The conservation status of the *sinensis*

race has been changed though there is no clear evidence for the real predatory impact of the cormorants on fish-farms production. This change could have some consequences for the dynamics of the European populations, particularly the Dutch breeding birds, because the mortality of adults in winter is an important factor in the population dynamics of the species. Additionally, such situation creates a threat for *carbo* birds, which officially are protected, but practically are not distinguishable in the field from *sinensis*.

5.POLISH SUMMARY

Francja jest ważnym obszarem dla wędrujących i zimujących kormoranów obu europejskich podgatunków: *Phalacrocorax c. carbo* (irlandzkie, brytyjskie) i *Ph. c. sinensis* (holenderskie, duńskie, niemieckie, polskie i szwedzkie). Pierwsza ogólnokrajowa ocena liczebności populacji zimującej była wykonana we Francji w roku 1983; stwierdzono wtedy 14 000 ptaków. W roku 1992 stwierdzono zimowanie 66 000 kormoranów, występujących na 270 noclegowiskach (rys. 1). Zmianie uległo także rozmieszczenie ptaków: w roku 1992 na noclegowiskach śródlądowych występowało 55% ptaków, w porównaniu do 28% w roku 1983. Analiza wiadomości powrotnych potwierdza tezę o zróżnicowaniu terenów zimowiskowych obu podgatunków: *sinensis* zimuje przede wszystkim na wodami śródlądowymi (84%), natomiast *carbo* zimuje głównie na wybrzeżach (80%, rys. 2 i 4).

Stwierdzono zmianę terenów zimowiskowych ptaków pochodzących z francuskiej populacji lęgowej (przypuszczalnie *carbo*). Przed okresem gwałtownego wzrostu liczebności europejskiej populacji *sinensis* na początku lat 80., ptaki te zimowały na wybrzeżu atlantyckim, na południe od ujścia Loary. Obecnie zimują głównie w Bretanii.

Mimo wzrostu liczebności oba podgatunki nie spotykają się na wspólnych zimowiskach, jednakże wydaje się, że bardziej ekspansywny *sinensis* wypiera *carbo* z niektórych zimowisk (rys. 3 i 4). Podgatunki te pozostają również rozdzielone w okresie lęgowym (rys. 5). Analiza wiadomości powrotnych o 23 000 kormoranów, kolorowo znakowanych na lęgowiskach europejskich, doprowadziła do sformułowania hipotezy, że kormorany należące do podgatunku *sinensis*, zwiększając zasięg swojego areału lęgowego, nie mieszają się z *carbo*, zasiedlając tylko takie miejsca w obrębie areału *carbo*, które nie są zajęte przez ten podgatunek.

Wzrost liczebności zimujących we Fracji *sinensis* i nasilające się skargi rybaków pod adresem kormoranów spowodowały, że status ochronny tego gatunku został zmieniony. Zezwolono na odstrzał *sinensis* na stawach rybnych w całym kraju, utrzymując prawną ochronę *carbo*. Ochronę podgatunku *sinensis* zniesiono, kierując się głównie względami natury psychologicznej, w sytuacji braku ewidentnych dowodów wyraźnego spadku produkcji ryb, wywołanego przez kormorany. Zaistniała sytuacja może wpłynąć istotnie na poziom liczebności europejskich populacji lęgowych kormorana (szczególnie holenderskiej), spędzających we Francji zimę, gdyż śmiertelność kormoranów w okresie zimy jest istotnym czynnikiem regulującym dynamikę populacji. Dodatkowo, sytuacja taka powoduje zagrożenie dla chronionego *carbo*, w warunkach terenowych nie odróżnialnego od *sinensis*.

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