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Results of bird ringing in Poland. Migrations of dunlin *Calidris alpina*

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Dunlins, belonging mainly to the nominate race *Calidris alpina alpina*, were ringed in Poland between 1960–1980 during their autumn passage at Gdańsk Bay. To the end of 1980 18 118 birds were ringed, about which 372 long-distance recoveries were obtained. In 1978, the ringing of breeding *C. alpina schinzii* was begun in the local breeding colony, where 150 nestlings and adults were ringed. Dunlins ringed in Poland during autumn migrate mainly in the western and south-western directions. Single birds migrate south-east. Their wintering grounds are on the coasts of the whole of Western Europe, in the Mediterranean basin and on the coasts of North-western Africa. Some differences were found between juveniles and adults: the recovery rate of juveniles is higher than that of adults, juveniles migrate more slowly than adults, and the general direction of their migration is more continental. Half of the recoveries of dunlins ringed in Poland concern birds which were killed, by man.

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Результаты кольцевания птиц в Польше. Миграции чернозобика *Calidris alpina*.

Чернозобики, принадлежащие главным образом к номинативному подвиду *Calidris alpina alpina*, кольцевались в Польше осенью на протяжении свыше 20 лет на Гданьской бухте. До конца 1980 окольцовано 18 118 особей, с которых получено 372 дальних возврата. В 1978 году начато кольцевание *C. alpina schinzii*, происходящих из местной гнездовой популяции. На протяжении трех лет окольцовано 150 птиц (птенцов и взрослых). Окольцованные в Польше чернозобики мигрируют осенью главным образом в западном и юго-западном направлении. Единичные особи мигрируют на юго-восток. Зимовки расположены вдоль берегов всей западной Европы и северо-западной Африки. Констатированы различия между неполовозрелыми и взрослыми птицами: неполовозрелые окольцованные птицы обнаруживаются чаще, чем взрослые; неполовозрелые птицы мигрируют

медленнее, чем взрослые, а направление их перелета проходит более континентально. Половина возвратов с чернозобиков окольцованных в Польше происходит от особей, погибших от руки человека.

The dunlin is the most numerous wader species in Europe during autumn migration and has already been the subject of many studies. Within this vast dunlin population it is possible to distinguish a number of races differing slightly in terms of measurements and colouring. However they are extremely difficult to tell apart in the field, particularly during autumn and winter in places where they may occur together. The current criteria used to divide the species into races were described by FERNS and GREEN (1979).

The dunlins which migrate through Poland belong almost exclusively to two races, namely *Calidris alpina schinzii* and *Calidris alpina alpina*. The former has its breeding grounds in Poland and many other European countries (GLUTZ *et al.* 1975), but most of the dunlins encountered around the Baltic during the migration periods belong to the nominate race (MARTIN-LÖF 1958, MASCHER 1966, KAUKOLA and LILJA 1972, ZAJĄC 1980), the breeding grounds of which are spread along the northern coast of Scandinavia, on Spitzbergen, and along the coast of the Barents Sea and the Arctic Ocean (GLUTZ *et al.* 1975). The far-eastern race *C. a. sakhalina*, which occupies the north-eastern part of Eurasia, has been reported in Britain (FERNS and GREEN 1979) and in FRG (OAG Münster 1976), so it may occur sporadically in the Baltic region also.

The existing papers on the migration of European dunlins, based on ringing results have all been published in western countries (NØRREVANG 1955, OGILVIE 1963, MASCHER 1971, FUCHS 1973, PIENKOWSKI and DICK 1975, LESLIE and LESSELLS 1978, HARDY and MINTON 1980, SAUROLA 1980). The present study, which is essentially a summary of the results to date of Polish dunlin ringing, is intended to complement the available papers, especially as there is very little information in the literature about this species in the region of the southern Baltic coast.

MATERIAL AND METHODS

This study was based on 372 long distance (over 100 km) recoveries of dunlins ringed in Poland between 1960–1980 and on 163 recoveries of birds ringed abroad and recovered in Poland. The study includes recoveries reported up to the end of 1980, these comprising 2.05 % of the total number of dunlin ringed.

Dunlins, like other wader species, are ringed in Poland mainly during their autumn passage through Gdańsk Bay at the mouth of the Vistula River (54°21'N, 18°57'E). The ringing of waders at this particular location began in 1960 (GROMADZKA 1981). In each year, catching and ringing has taken place for 1.5 to 2.5 months in July, August and September, by means of wire traps, similar to those used at Ottenby Bird Station. All the foreign recoveries quoted

in this study comprise controls* originating from this area. The majority of the ringed birds were measured and weighed; an analysis of these measurements will be presented in a separate paper.

In recent years waders on autumn passage were ringed further inland also, but so far these have included very few dunlins and, as yet, no recoveries have been obtained.

In 1978 the ringing of breeding *C.a. schinzii* (nestlings and adult birds) was begun on Gdańsk Bay at the mouth of the Reda River (54°39'N, 18°30'E) — currently the area with the densest breeding population of dunlins on the southern Baltic coast (GROMADZKA 1982). During 1978–1980 106 nestlings and 44 adult birds were ringed in this area, but to date only one long distance recovery of these birds has been obtained.

At the time of ringing the birds were divided into three age categories: juveniles — birds in the first year of their life, adult birds — over one year old (ZINK 1973) and full-grown birds — of indeterminate age. This study embraces only the first two categories.

The direction of migration of the particular birds was determined using formula based on a loxodrome (IMBODEN and IMBODEN 1972).

The autumn migration period was considered to be the beginning of July to the end of November; the time spent on the wintering grounds as that between the beginning of December to the end of February; and the period of the spring passage as the months of March, April and May.

THE GENERAL COURSE OF DUNLIN MIGRATION THROUGH POLAND

The largest known concentrations of dunlins on the Polish coast occur on Gdańsk Bay. It should be noted that the Polish coast does not possess such extensive, favourable areas for waders as, for instance, the tidal regions of the Wadden Sea on the North Sea and the estuaries of certain rivers in the British Isles. Gdańsk Bay with, in particular, the areas around the mouth of the Vistula and Reda rivers has for years been the site of regular visits by various wader species, especially during autumn migration. The dunlin is the dominant species amongst them, occurring in numbers of up to 1000 at the same time (Gdańsk Ornithological Station unpub.). Dunlins are also encountered in small flocks around reservoirs in all parts of Poland (TOMIAŁOJC 1972), but at very few places do dunlin flocks as numerous as those on the coast occur (GRABIŃSKI and STAWARCZYK 1981).

Dunlins of the *C.a. schinzii* race from local breeding grounds, the Baltic republics of the Soviet Union and western Finland (GLUTZ *et al.* 1975), begin their passage through Poland towards the end of June. The majority of adult birds leave their breeding grounds immediately after breeding. Juveniles remain in the vicinity of their breeding grounds for some time after acquiring the

* A control is the catching and subsequent releasing of a ringed bird by ringers.

ability to fly (SOIKKELI 1967, E. KRÓL unpub.) and leave by the beginning of August (MASCHER 1966).

Birds of the nominate race begin to appear on the Polish coast in the first half of July. The first wave of large numbers of adult birds is observed in each year around the middle of the month (Gdańsk Ornithological Station unpub.), but similar sightings tend not to occur inland (W. GRABIŃSKI and T. STAWARCZYK unpub.). The proportion of moulting birds among the birds of passage gradually increases from early July. During August the birds passing through Gdańsk Bay are generally at some stage of moult of their primary feathers; in early September nearly 100 % of the dunlins caught were observed to have changed all their primaries (J. GROMADZKA unpub.). The adult birds passing in July appeared to be in a much greater hurry and stopped for shorter periods of time than those which pass in the later weeks (J. GROMADZKA unpub.). In mid-August the juveniles begin to accompany the adult birds and they constitute the majority of the birds passing in September and October. In mild weather conditions they can be observed around the Bay as late as early December.

As mentioned above the July wave of dunlins is not observed inland, the greatest abundance of birds being noted there in September and October, with juveniles predominating (W. GRABIŃSKI and T. STAWARCZYK unpub.). The concentrations of dunlins observed in Poland in spring have not been as large as those seen in autumn. Only small groups of birds are noted in spring around Gdańsk Bay, at the mouth of the Vistula, and small flocks can be seen in April and May near the mouth of the Reda, on the partially flooded shore meadows. Among the birds observed in April, individuals with winter plumage are not uncommon. From the end of March local breeding birds appear in this area and arrivals of these continue up to the end of April (E. KRÓL unpub.). On one exceptional occasion in May 1974 over 400 dunlins were noted in the Polish Baltic coast region, at Łebsko lake (J. BEDNORZ *in litt.*).

RECOVERIES OF *CALIDRIS ALPINA SCHINZII*

The existing data on *C. a. schinzii* are extremely scanty. Of the birds ringed at the mouth of the Reda during the breeding season, 7 were controlled on this area during later breeding seasons (3 birds ringed as juveniles and 4 as adults) and one was shot in autumn in northern France (3 months after ringing). A bird ringed as a juvenile on the western coast of Finland on the 20th of May was controlled at the mouth of the Vistula at the beginning of July, where young birds have been caught each year. Two of these birds were noted as breeding at the mouth of the Reda in the following years and another was controlled after five days in DDR on Müritz lake. The only winter recovery was obtained from the south-western coast of France.

RECOVERIES OF *CALIDRIS ALPINA ALPINA*

The largest number of recoveries of dunlins ringed in Poland (40%) were obtained within the year of ringing (Fig. 1) with peaks in the autumn months (Figs. 2 and 3). 50% of the recoveries concerned birds which perished as a result of human activities (killed, shot etc.) and 20% were found dead due to various

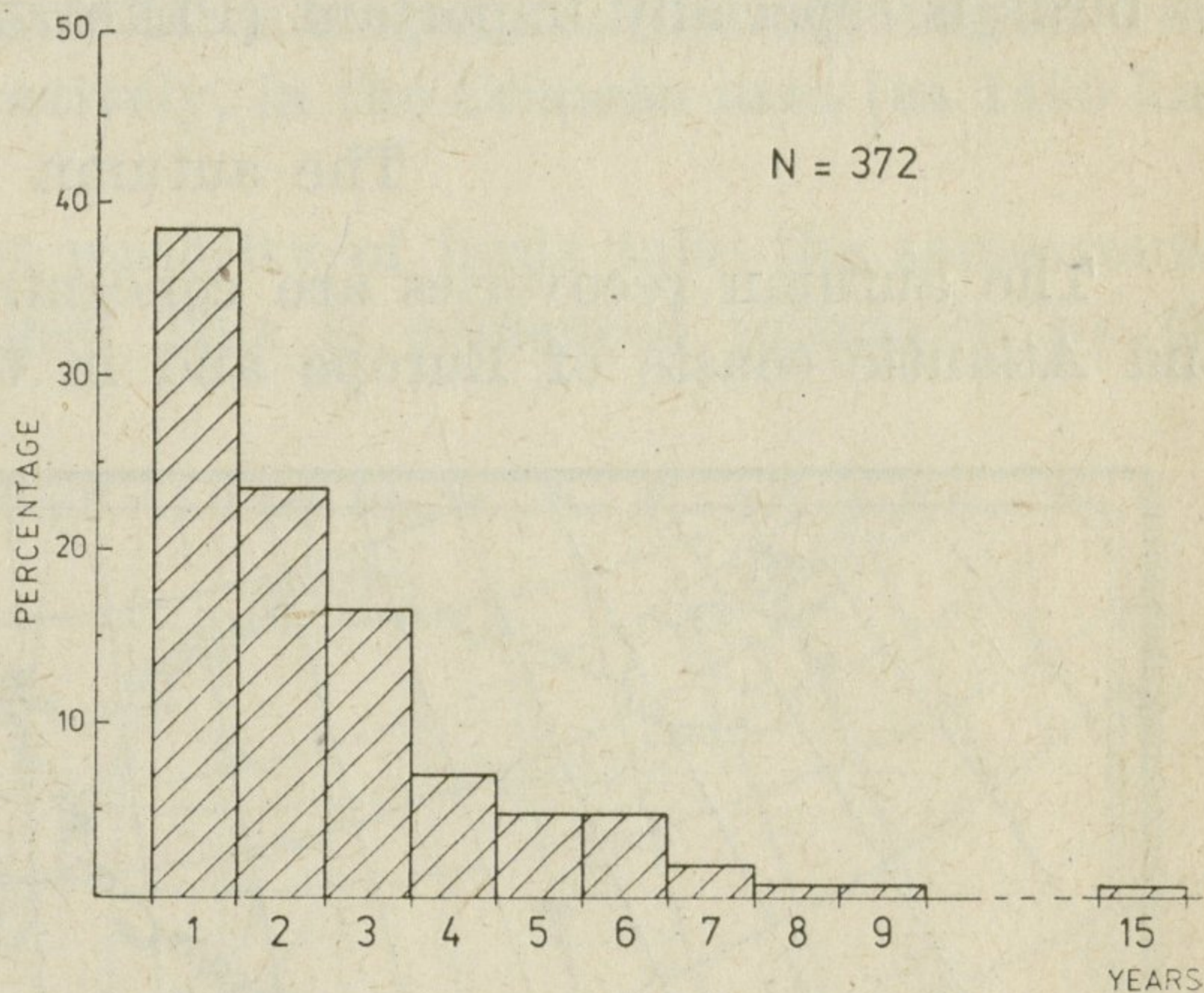


Fig. 1. Percentage of recoveries in each of the years following ringing* of dunlins ringed in Poland.

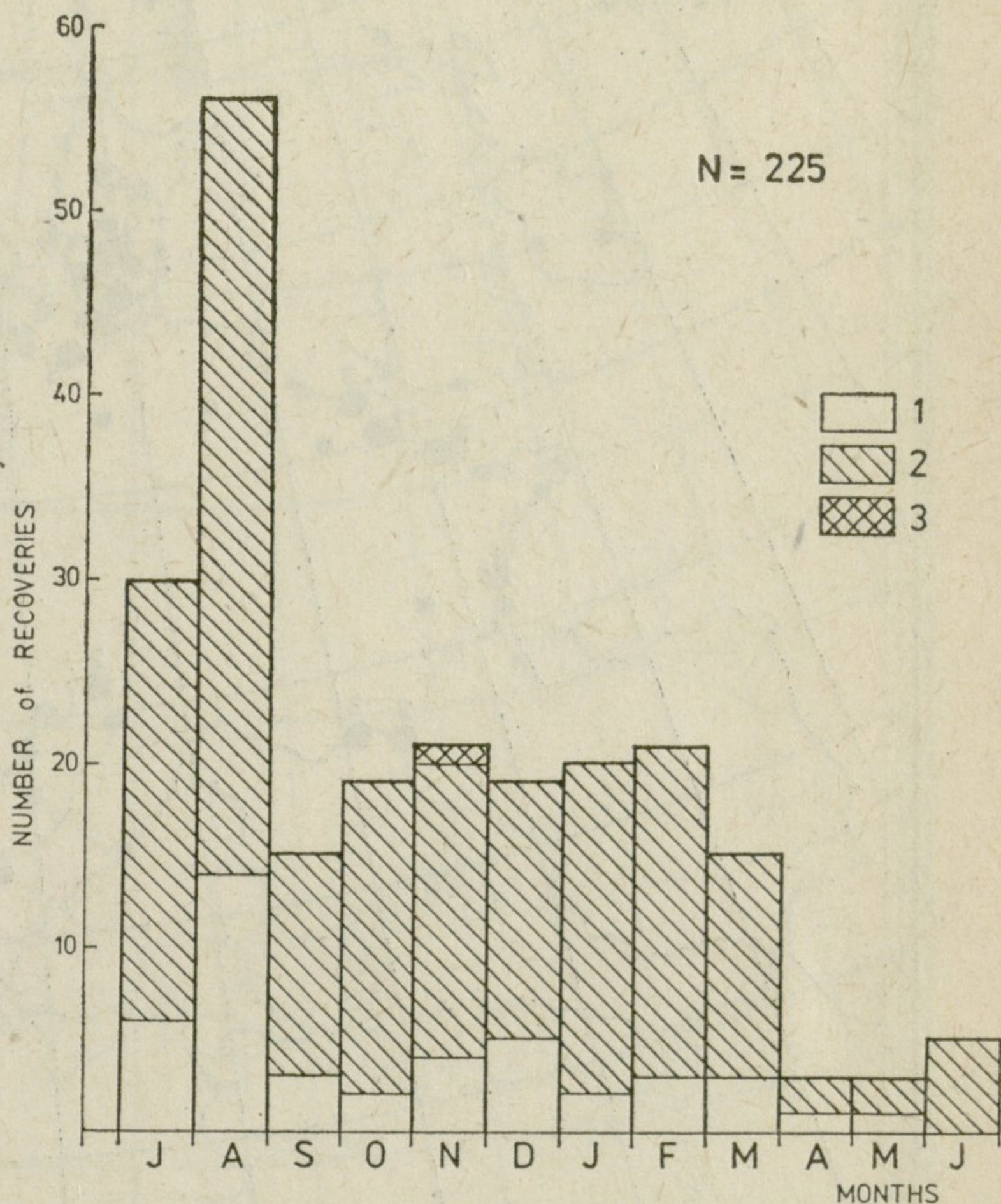
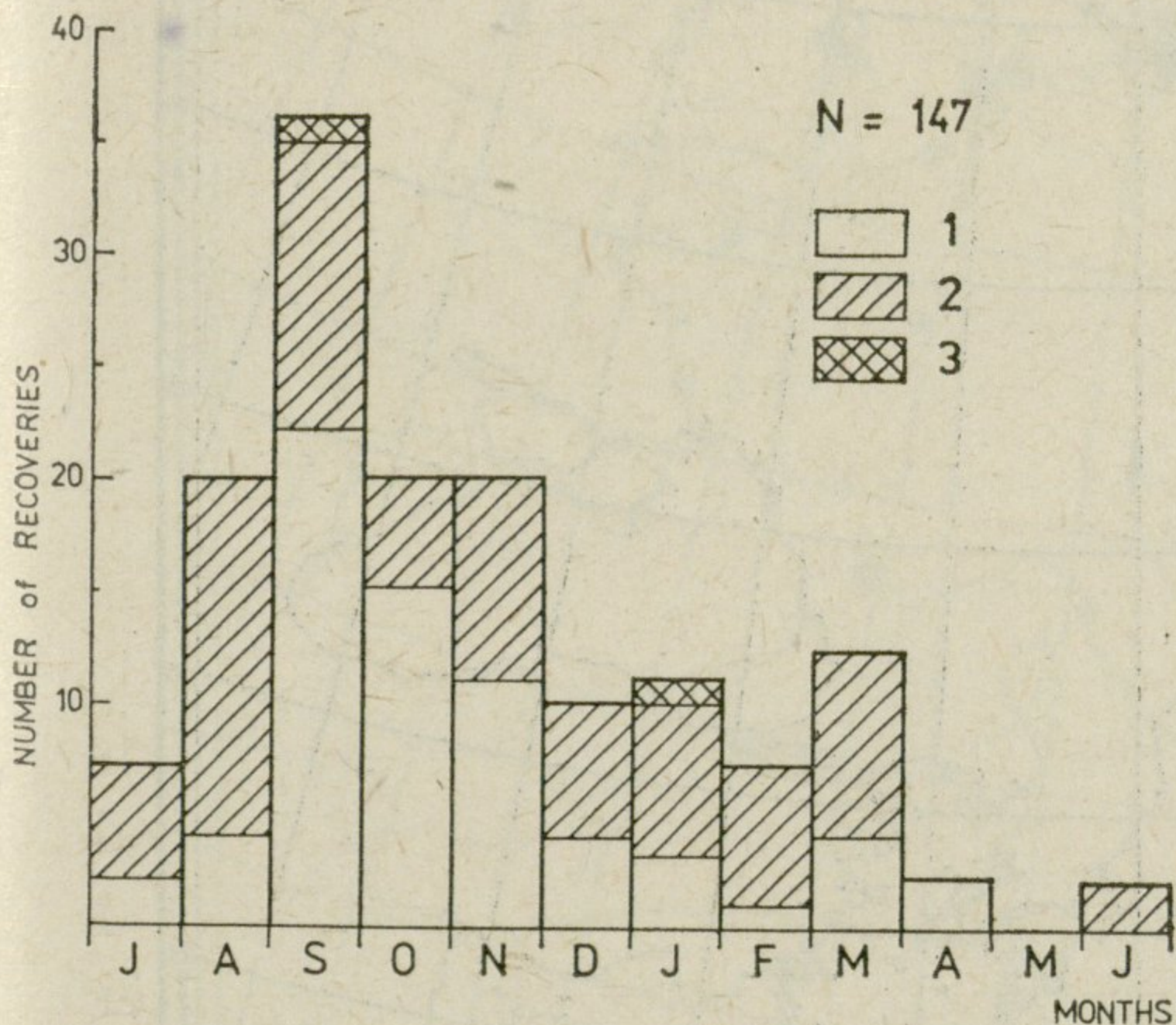


Fig. 2. Recoveries of dunlins recovered within the same year as being ringed. 1 - ringed as juveniles; 2 - ringed as adults; 3 - ringed as full grown birds.

Fig. 3. Recoveries of dunlins recovered in years after that of ringing. 1, 2, 3 - as in Fig. 2.

* Because the vast majority of the birds were ringed during the autumn migration (mainly in the period between July and September) the 1st of July was taken as the beginning of each year. Thus, for instance, a bird ringed in August and recovered in the following July was regarded as a bird recovered in the second year after ringing despite the fact that a whole year had not actually elapsed from the time of ringing.

unknown reasons. Over 25% of the recoveries were controls in various wader ringing places in Europe (mainly in Britain) and in North Africa. Recoveries from France, Spain and Italy came mainly from hunters, while almost all the ones from the British Isles were controls. Obviously it must be remembered that the distribution of recoveries is affected not only by the number of birds ringed, but also by other factors of which the attitude of the local inhabitants to birds is especially important (PERDECK 1976).

The autumn migration

The autumn recoveries are concentrated mainly along the north-western and Atlantic coasts of Europe and in the Mediterranean region (Figs. 4, 5

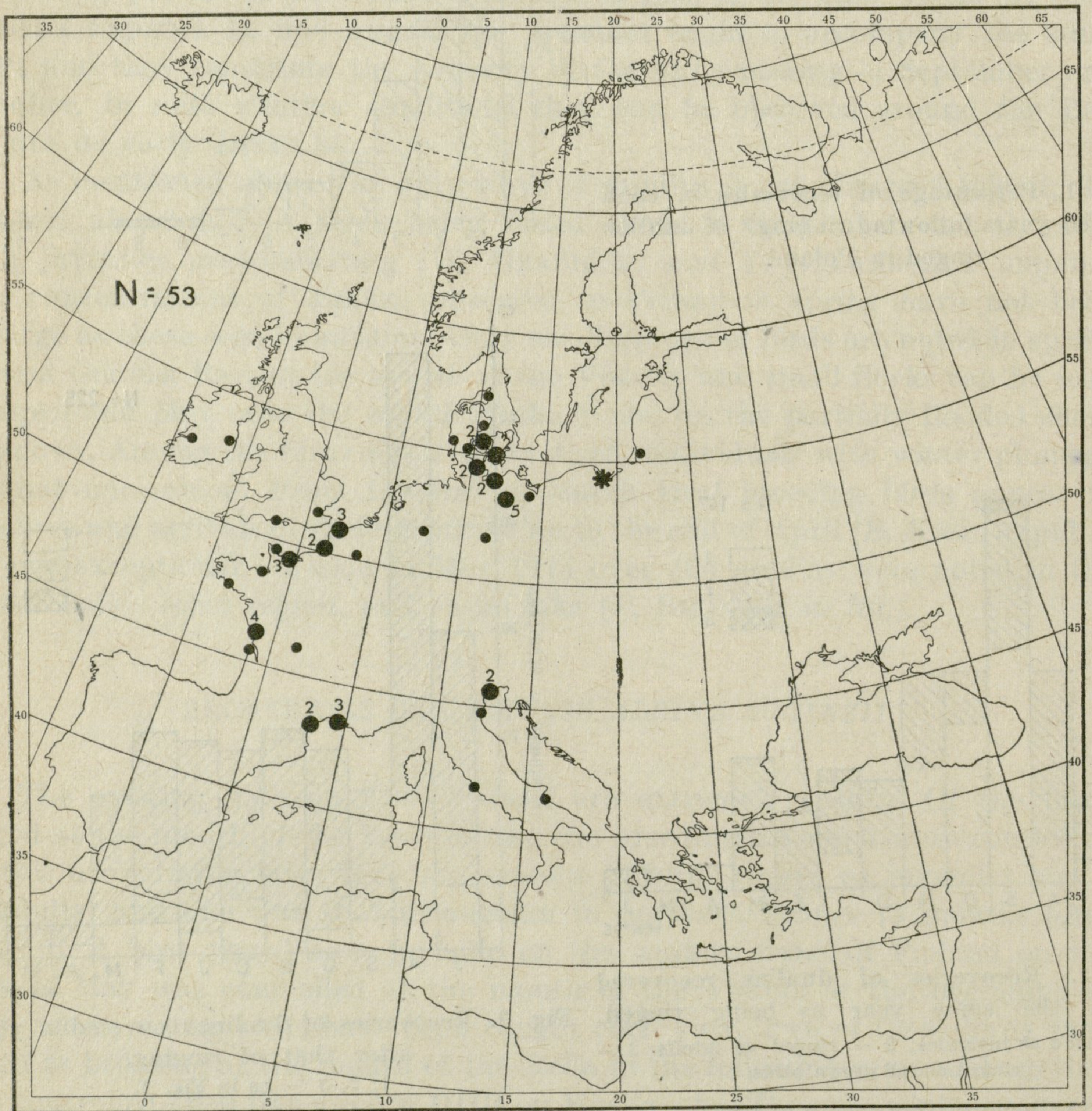


Fig. 4. Autumn recoveries (July-November) of juvenile dunlins recovered within the same autumn as being ringed.

Asterisk — ringing place (mouth of the Vistula); smaller circle — one recovery; bigger circle — more than one recovery; number of recoveries is denoted alongside each recovery point.

and 6). Recoveries from the inland regions of the continent are considerably less numerous; this is most probably connected with the smaller concentration of birds in these areas in comparison to the coast and their more dispersed flight over land (GLUTZ *et al.* 1975).

The furthest dunlin recovery to the south during the autumn of ringing comes from around Rades in Tunisia (ca 2070 km) which the adult bird reached 20 days after ringing (Fig. 5). Two adult birds ringed in July and August were recovered after 10 and 34 days, respectively, in the Crimean area (ca 1400 km) *i.e.* south-east of the ringing area.

Recoveries suggest that the vast majority of birds take the same routes for their subsequent autumn passages. This is evidenced primarily by the

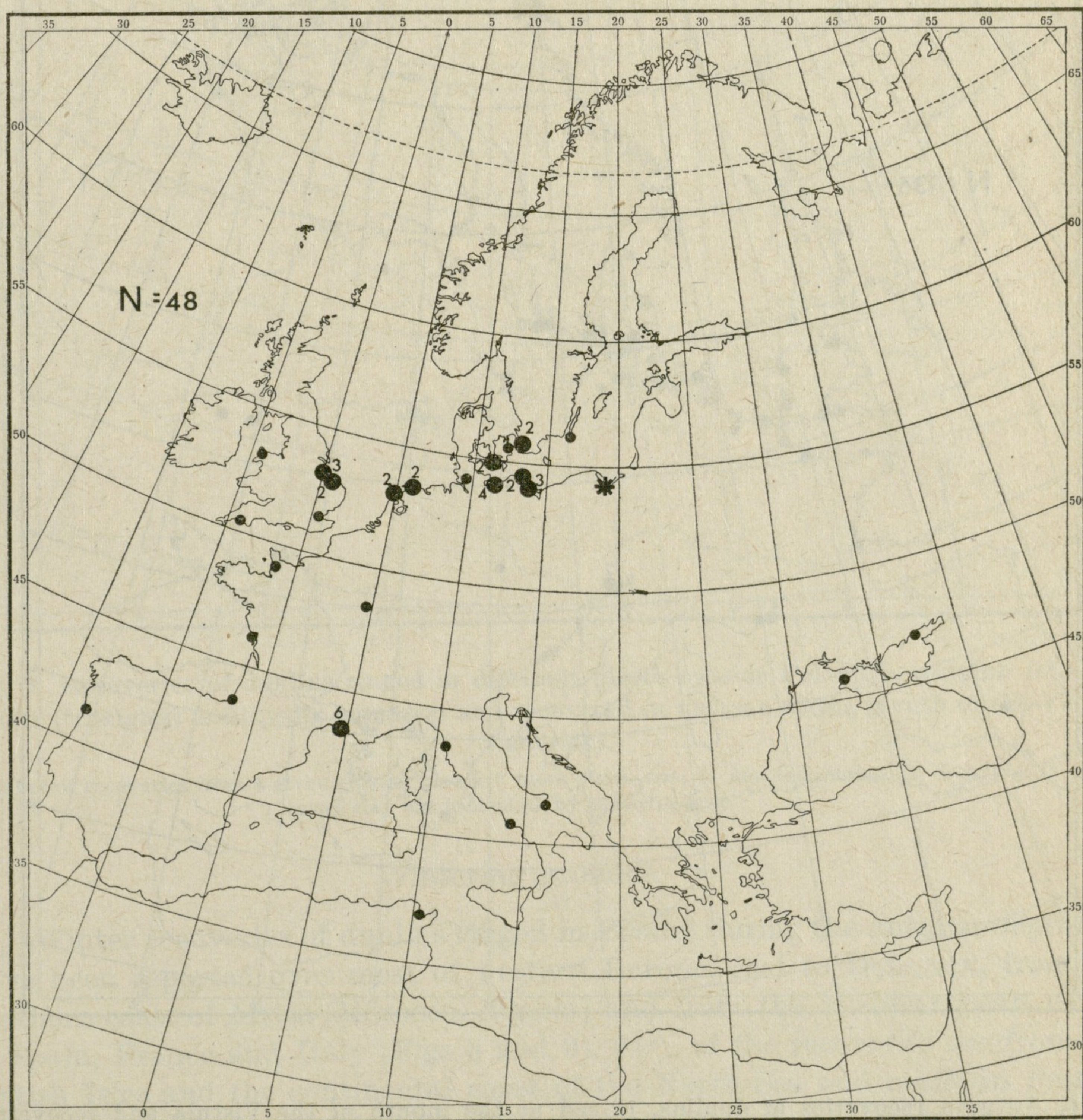


Fig. 5. Autumn recoveries of adult dunlins recovered within the same autumn as being ringed.

Symbols as in Fig. 4.

recoveries of Polish-ringed birds during the subsequent years around the Baltic and along the North Sea coast as far as Great Britain (Fig. 6) as well as by the recoveries of birds ringed in these areas and controlled on Gdańsk Bay (Fig. 7). A change in the route of passage is suggested by recoveries in later autumns in Czechoslovakia, Hungary, central Ukraine, the Black Sea and the Sea of Azov of birds ringed in the autumn on the Gdańsk Bay (Figs. 6 and 7). These recoveries may, however, concern birds which passed over the Baltic in autumn, leading in a south-easterly direction.

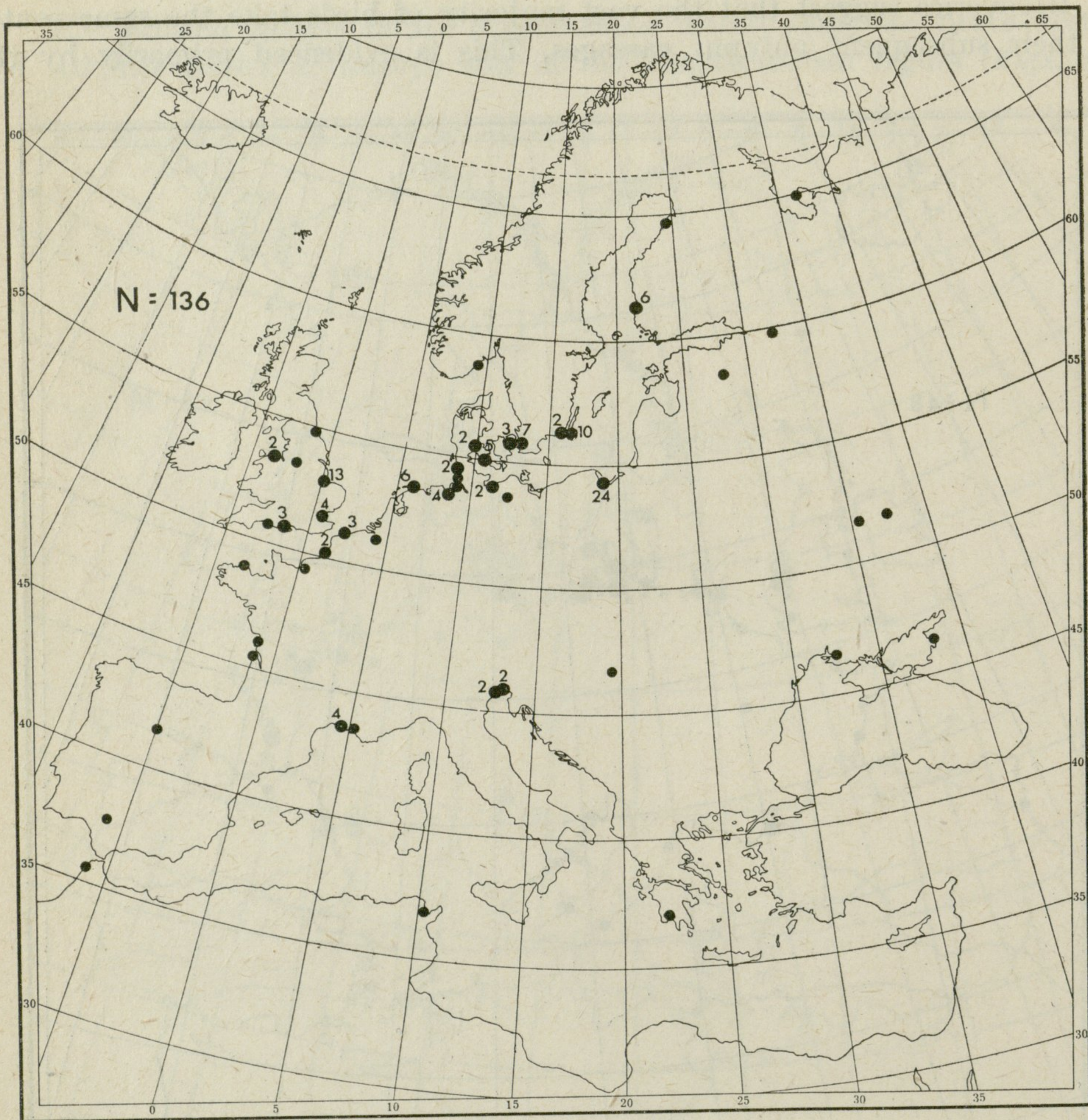


Fig. 6. Autumn recoveries of dunlins, ringed at the mouth of the Vistula and recovered in years subsequent to that of being ringed.

Symbols as in Fig. 4.

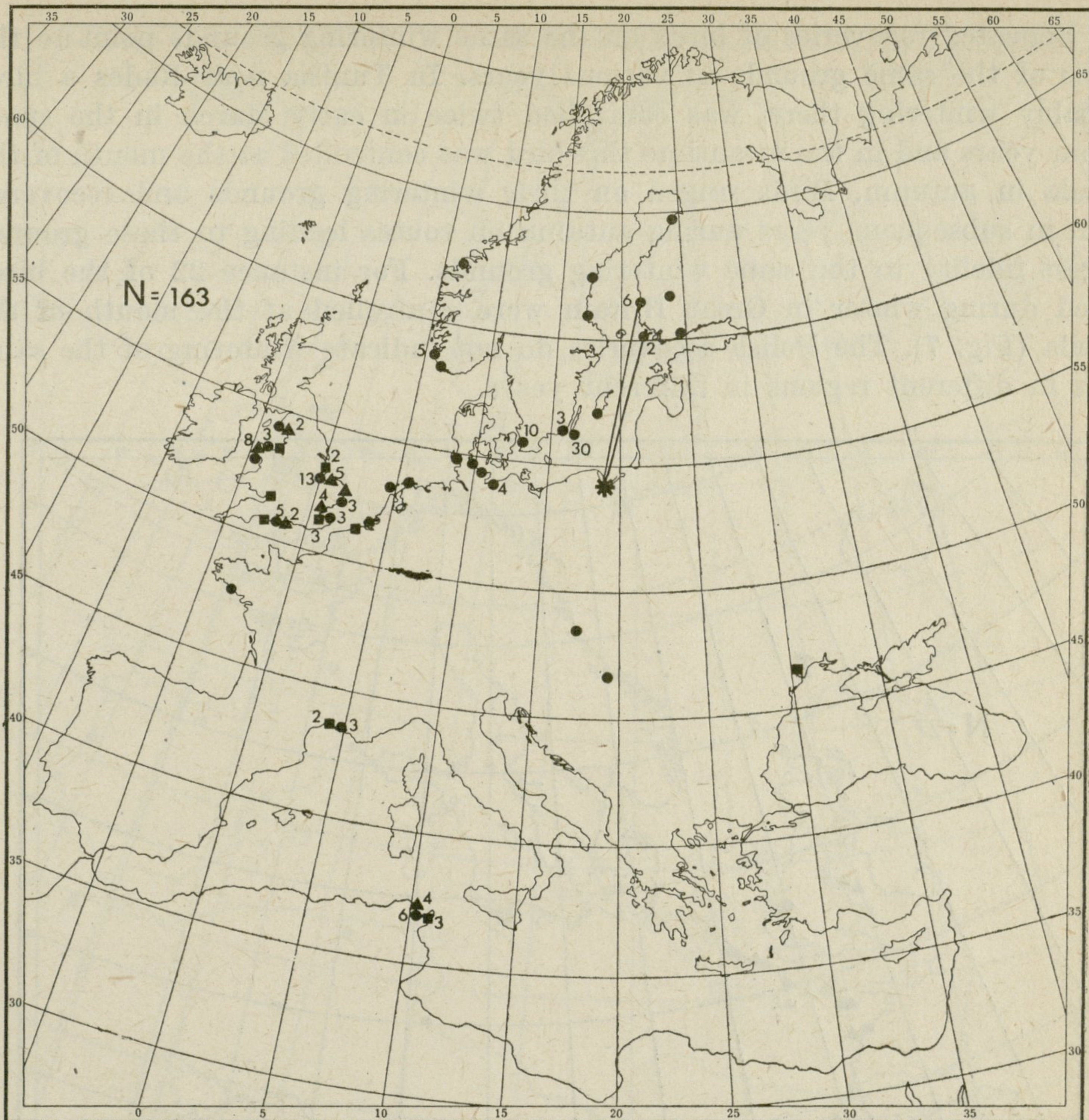


Fig. 7. Recoveries of dunlins ringed in different places outside Poland in autumn (circles), winter (triangles) and spring (squares) and recovered in autumn at the mouth of the Vistula (asterisk).

Number of recoveries from a given ringing place, if more than one, is denoted alongside each point; direct recoveries are indicated by straight lines.

Wintering grounds

Winter recoveries of dunlins ringed in Poland during the autumn migration have been reported over most of western Europe, east to Denmark, from the northern coast of Africa (Morocco, Algeria) and from the Mediterranean coasts of Spain, France and Italy (Figs 8 and 9). 64% of the recoveries are from the British Isles and the continental coast of the North Sea and northern France. The most northerly recovery in winter was on the eastern coast of Scotland (*ca* 58°N), while the furthest south was on the coast of Morocco (*ca* 35°N, Fig. 9).

Repeated recoveries of birds on the same wintering grounds point to the re-use of the same grounds in various years. In Tunisia near Rades a bird, probably wintering there, was controlled twice in early March in the space of four years and in the meantime this bird was controlled at the mouth of the Vistula in autumn. Birds ringed on their wintering grounds and recovered again in subsequent years during autumn on routes leading to these grounds suggest fidelity to the same wintering grounds. For instance 22 of the birds ringed during winter in Great Britain were controlled at the mouth of the Vistula (Fig. 7). The Polish recoveries do not indicate wintering of the same birds in different regions in different years.

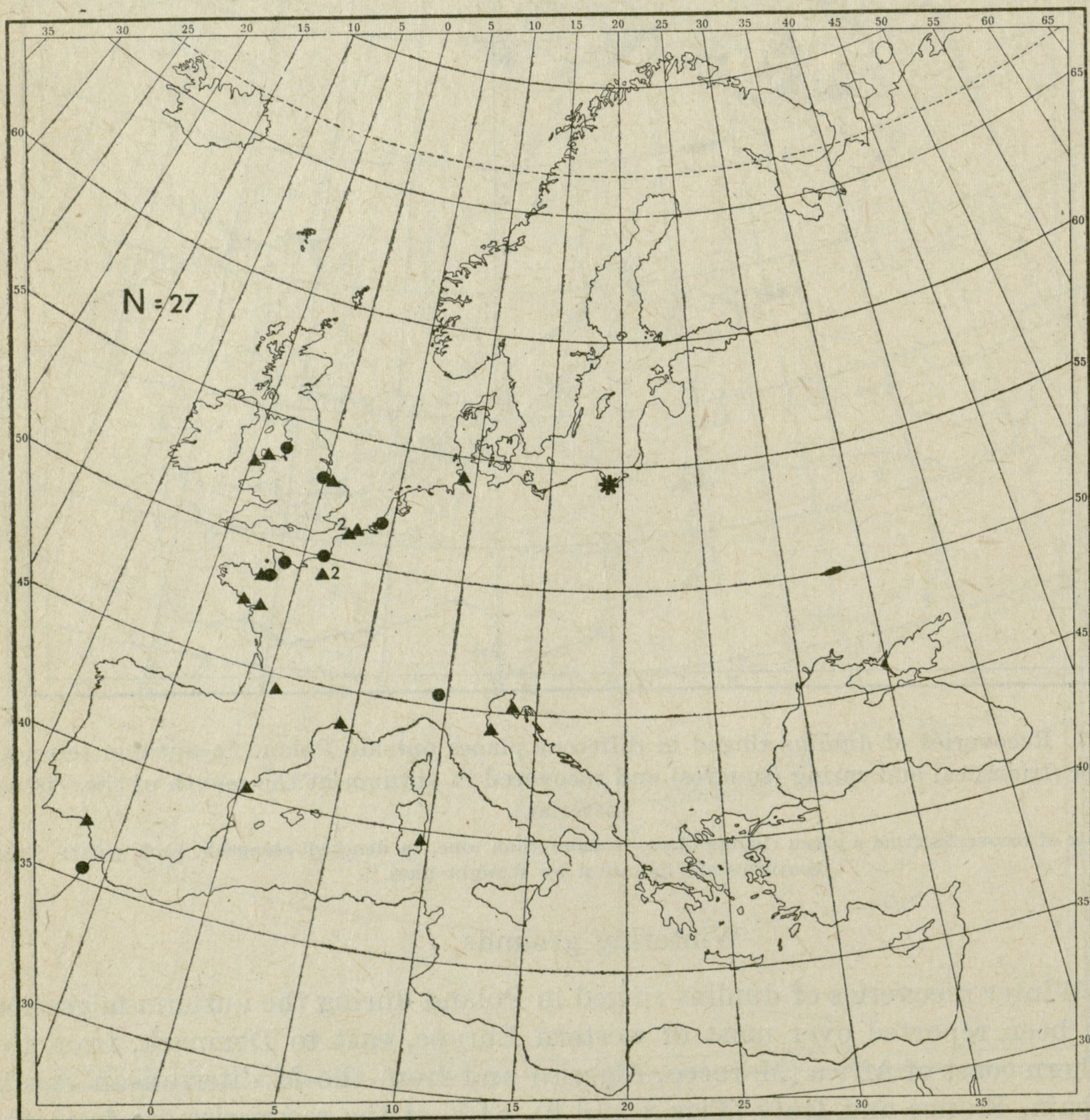


Fig. 8. Winter recoveries (December-February) of dunlins ringed as juveniles (circles) or adults (triangles) and recovered within the first winter after ringing.

Asterisk - ringing place. Number of recoveries, if more than one, is denoted alongside each point.

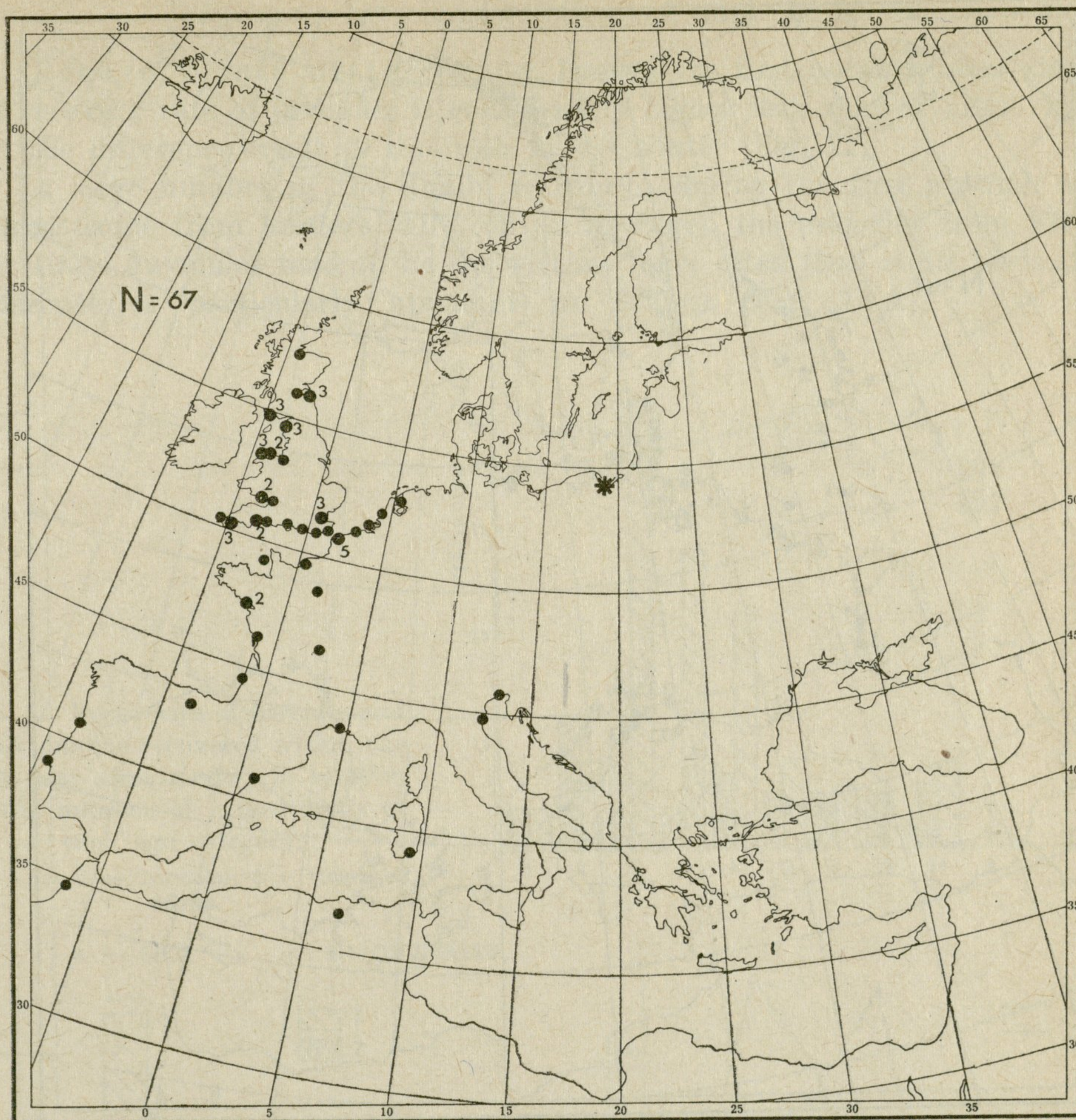


Fig. 9. Winter recoveries of dunlins recovered in subsequent years to that of ringing.

Symbols as in Fig. 4.

The spring migration

The majority of recoveries coming from the spring passage concern birds still in the wintering grounds (Fig. 10). 60% of the dunlin recoveries were obtained in March, the others in April with single ones in May and June. The known recoveries originate exclusively from western and southern Europe and North Africa. There have been no reports of recoveries from Scandinavia, the southern Baltic coast or areas situated to the east of Poland. The concentration of recoveries in FRG and Italy is striking. In the case of FRG most birds were found dead in the region of the mouth of the Weser. As there was no exact information on how long birds had been dead before finding (only one bird

Differences between juveniles and adult birds

Recovery rate of the birds. During the first autumn after ringing the recovery rate of juveniles is considerably higher than that of adult birds, but the difference tends to diminish in the winter (Fig. 11).

A large number of the dunlin recoveries during the first autumn after ringing come from hunters (41% on an average), the majority from France and Italy. Juveniles tend to be the victims more often than adult birds; this difference is particularly apparent in France (Fig. 12 A).

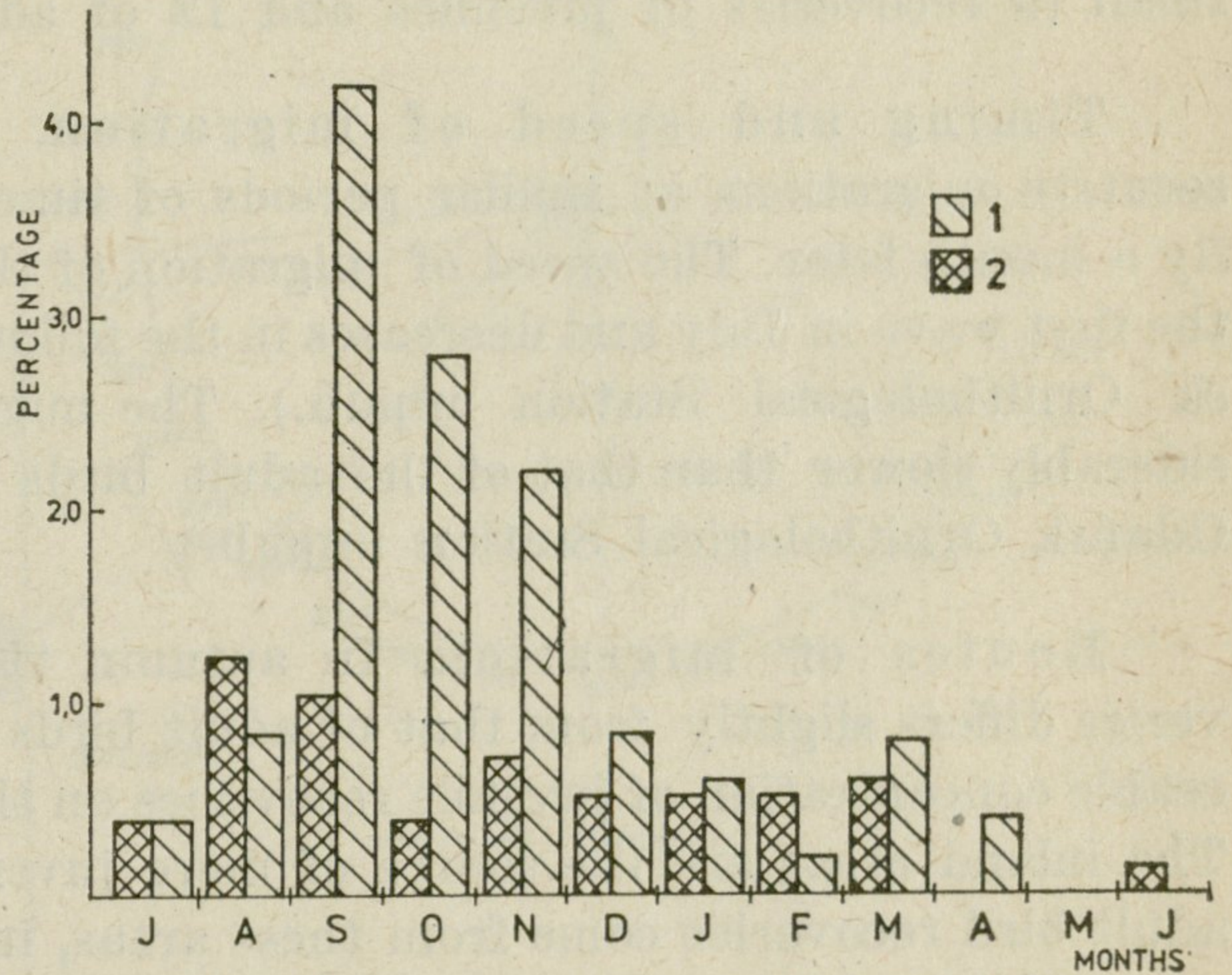


Fig. 11. Recoveries of juvenile and adult dunlins recovered within the first year after ringing in relation to the number of ringed birds of each age category.

1 — ringed as juveniles; 2 — ringed as adults.

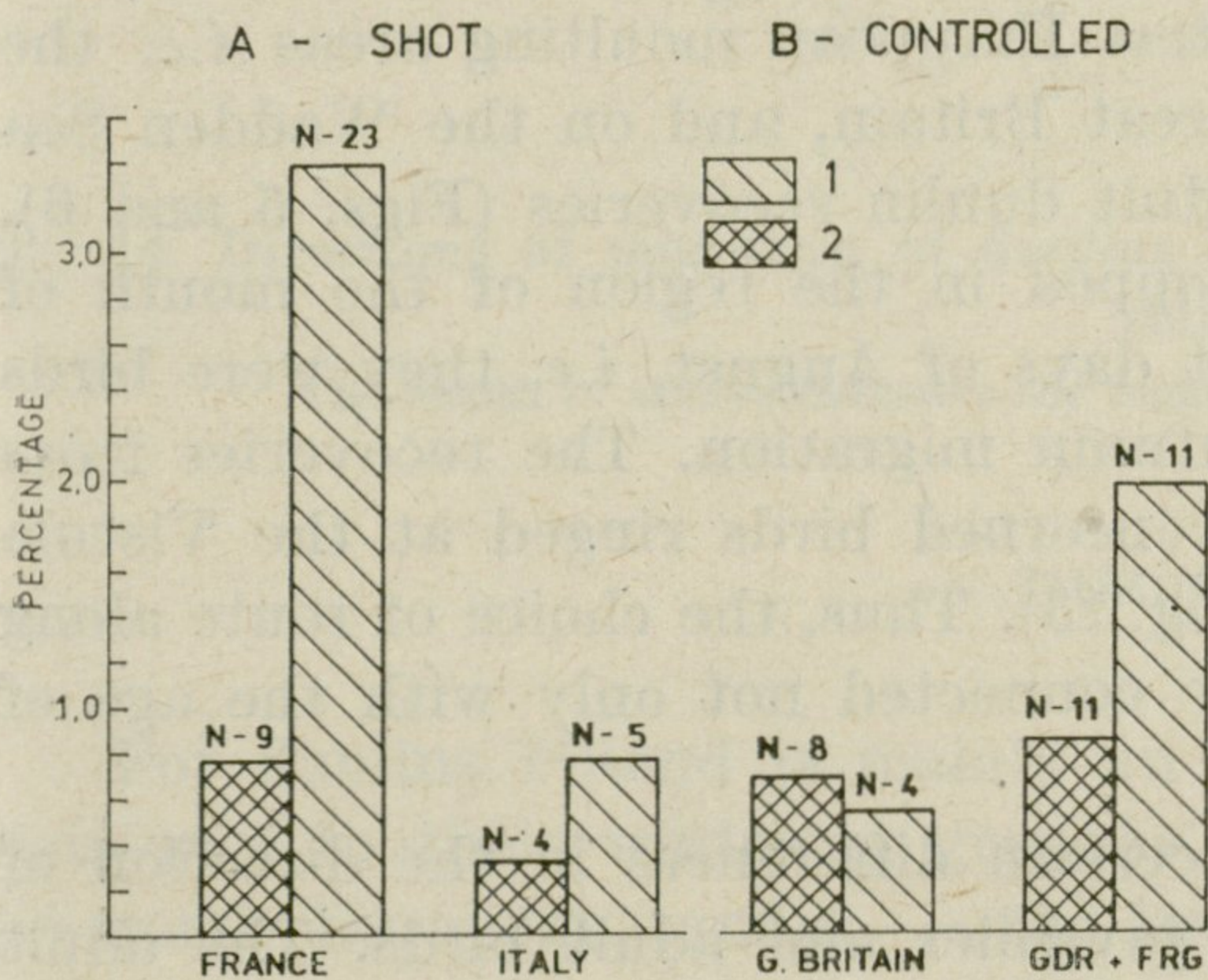


Fig. 12. Recoveries of juvenile and adult dunlins within the same autumn as ringing, shot in France and Italy (A) and controlled in Great Britain, GDR and FRG (B), in relation to the number of ringed birds.

1 and 2 — as in Fig. 11.

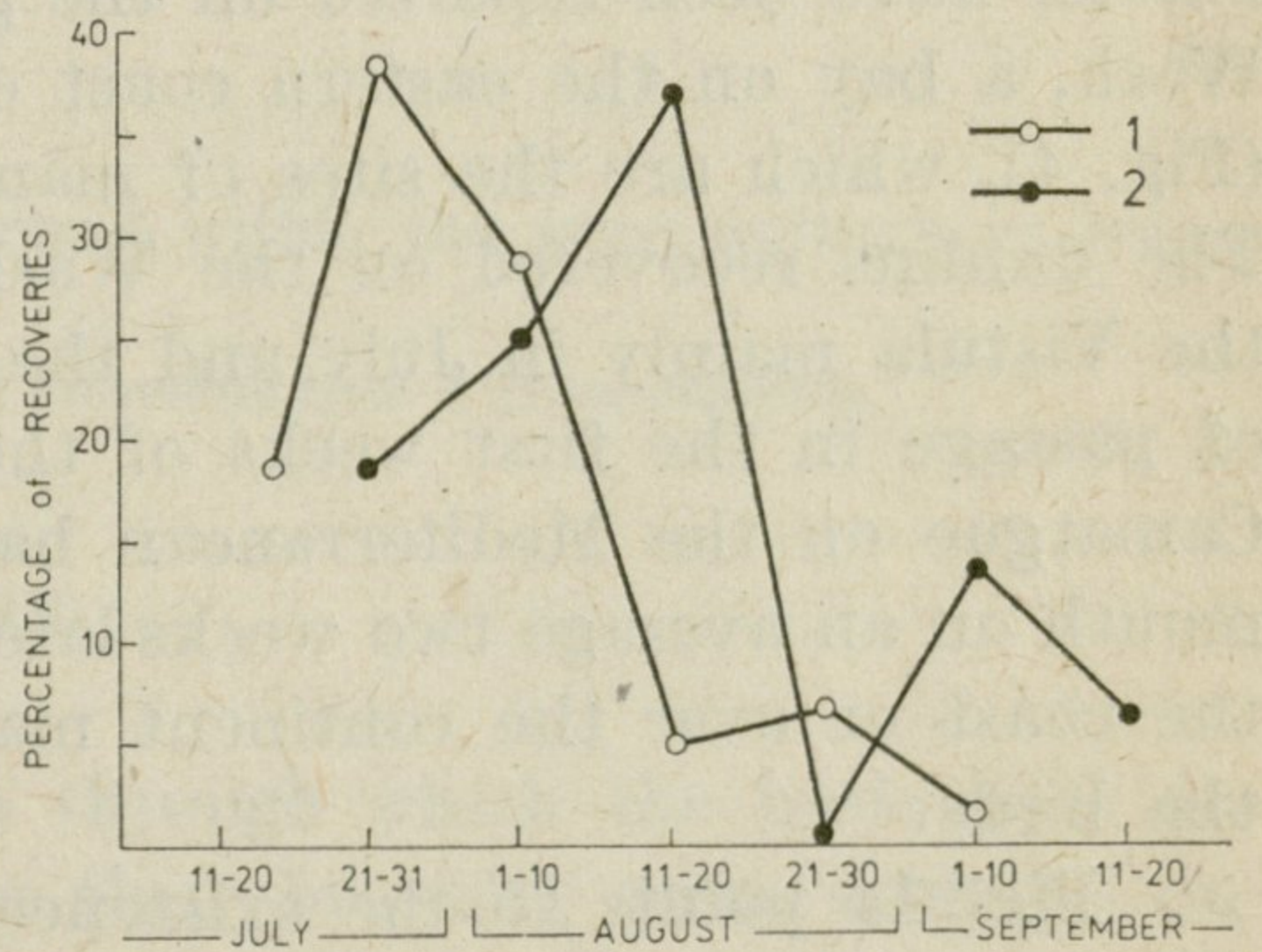


Fig. 13. Recoveries of adult dunlins ringed at the mouth of the Vistula and recovered on the Wash and in the Camargue or ringed on the Wash and in Camargue and controlled at the mouth of the Vistula.

1 — recovered or ringed on the Wash; 2 — recovered or ringed in the Camargue.

The recovery rate of dunlin in different age groups in areas where waders are intensely ringed varies. In GDR and FRG the recovery rate of juveniles is twice as high as that of adult birds, while in Great Britain the recovery rate of the two age groups is the same (Fig. 12 B).

50 % of the winter recoveries obtained during the first winter after ringing come from hunters. During this period, in contrast to the autumn, there is no marked age difference among the birds shot by the hunters; the juvenile recoveries constitute 0.05 % and the adult 0.08 % of the birds ringed. However, it should be noted that the number of recoveries from this period was rather small (9 recoveries of juveniles and 19 of adults).

Timing and speed of migration. Adult dunlins begin their consecutive migrations at similar periods of time, while juveniles on an average fly a month later. The speed of migration of the adult birds is greater among the first wave in July and decreases in the following weeks of the passage (Gdańsk Ornithological Station unpub.). The migration of the juveniles is considerably slower than that of the adult birds (MASCHER 1966, SAUROLA 1980, Gdańsk Ornithological Station unpub.).

Routes of migration. In autumn the distribution of juvenile recoveries differs slightly from that of adult birds (Figs. 4 and 5). There is a noticeable concentration of juvenile recoveries on the north-western coast of France. The inland areas are the source of more juvenile recoveries (9 juvenile and 3 adult bird recoveries come from these areas, including 7 juveniles and 2 adults controlled in GDR, Figs. 4 and 5). No recoveries of juvenile dunlins ringed in Poland have been reported on the greatest European moulting areas *i.e.* the Wash, a bay on the eastern coast of Great Britain, and on the Wadden Sea (Fig. 4), which are the sites of many adult dunlin recoveries (Figs. 5 and 6). The dunlins recovered on the Wash stopped in the region of the mouth of the Vistula mainly in July and the first days of August, *i.e.* they were birds of passage in the first weeks of the autumn migration. The recoveries from Camargue on the Mediterranean have concerned birds ringed at the Vistula mouth on an average two weeks later (Fig. 13). Thus, the choice of route along the coast or over the continent may be connected not only with the age of the birds.

Fig. 14 points to the existence of certain differences in the direction of migration during autumn between the juveniles and adult birds. The adult birds appear to be more concentrated on definite directions: 40 % of the autumn recoveries (from the first autumn after ringing) come from 261°–269° and 13 % from ca 220°. It is not possible to observe such a definite preference for a specific direction among the juveniles.

Wintering grounds. No difference in the distribution of dunlin winter recoveries with respect to age was observed. Even on the French coast the

distribution of recoveries of birds in the various age groups is similar (Figs. 8 and 9). Despite the fact that our winter data are extremely limited, the similarity of directions to the areas of the largest amount of recoveries of dunlins in different age groups is striking (Fig. 15).

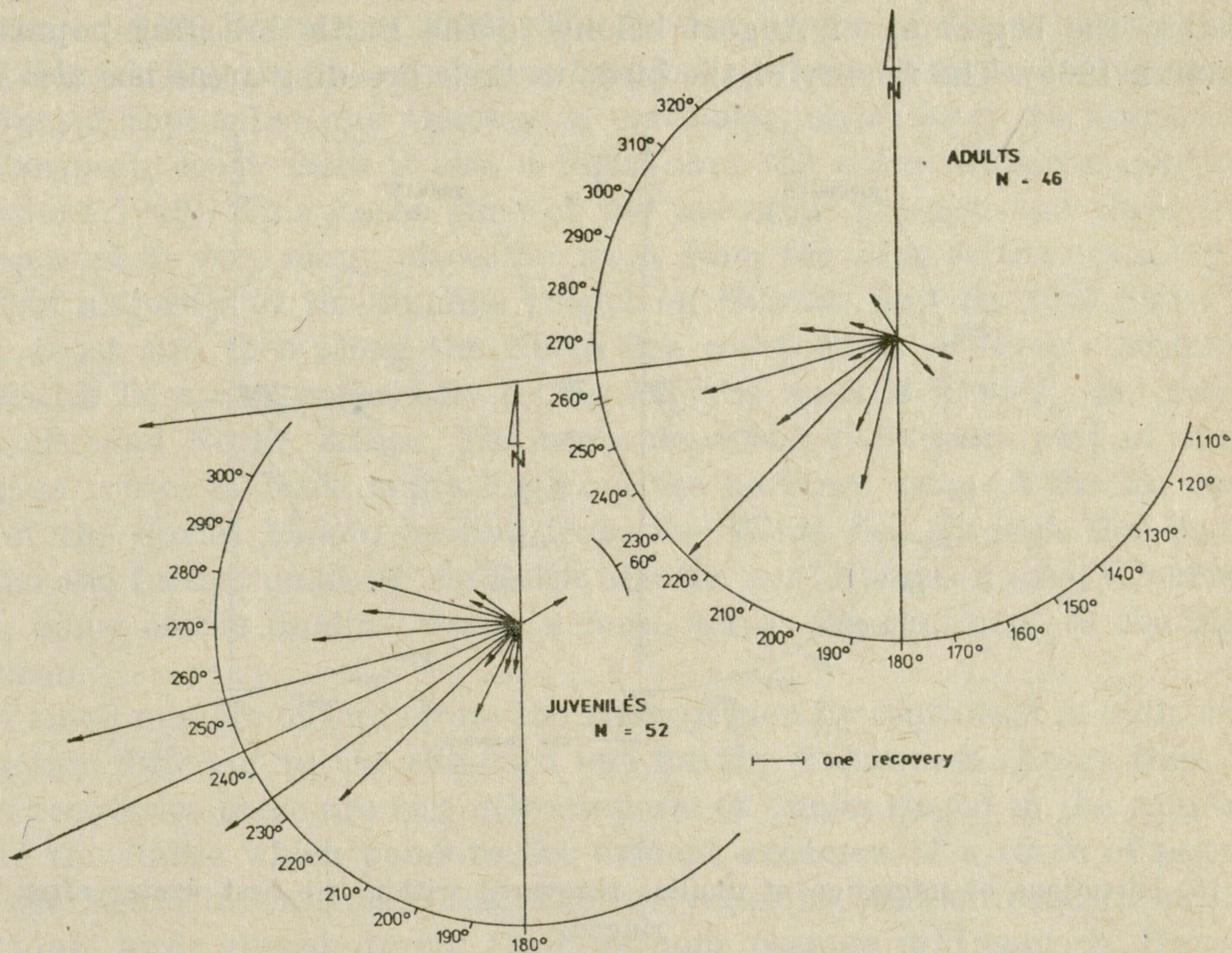


Fig. 14. Directions of migration of dunlins recovered within the same autumn as being ringed.

The length of arrows indicates the number of recoveries from a given direction.

DISCUSSION

For dunlins Poland is mainly an area through which the birds pass on their way to their wintering grounds from their breeding areas situated on the north European tundra — the breeding area of the nominate race.

Migration of *Calidris a. schinzii*

The dunlins belonging to the *C. a. schinzii* race constitute a small percentage of the dunlins encountered on the Polish coast during migration. This is perfectly understandable if one considers that currently the entire southern Baltic coast holds only 1200–1500 nesting pairs (GROMADZKA 1983). Due to

the very limited data on the migration of dunlins which have their breeding grounds in Poland, it is not possible to add anything new to the existing information. The view that the juvenile dunlins observed on the Baltic in July belong to local breeding populations has been confirmed (page 4). It is highly probable that all the juveniles met in this region from the end of the breeding period to the beginning of August belong to the Baltic breeding population (MASCHER 1966). The fidelity of the birds to their breeding areas has also been

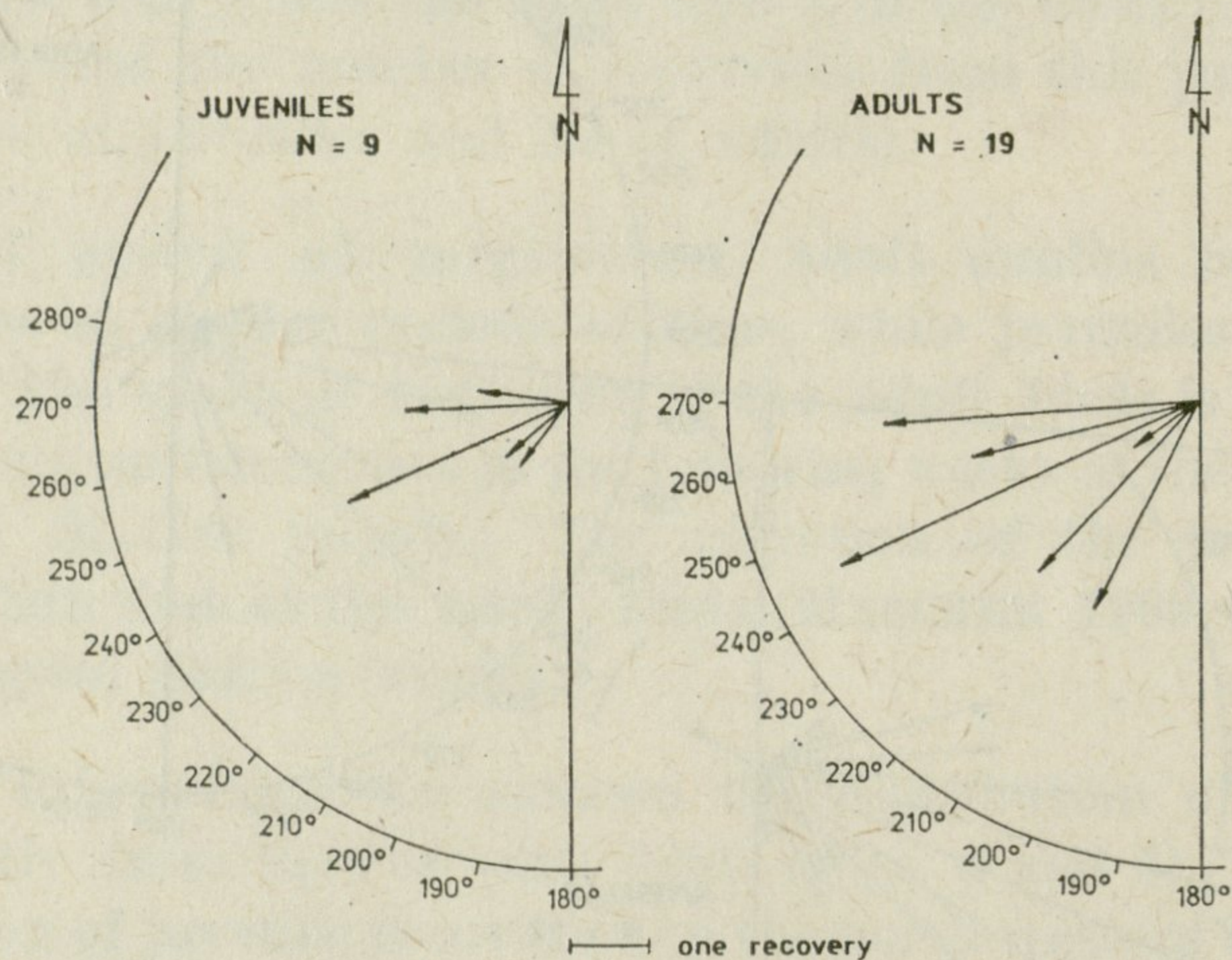


Fig. 15. Directions of migration of dunlins recovered within the first winter after being ringed.

The length of arrows indicates the number of recoveries from a given direction.

confirmed (page 4, SOIKKELI 1967). The wintering grounds of the dunlins which breed in Poland are not known (we have only one winter recovery). The wintering grounds of the *C. a. schinzii* are situated to the southwest of the wintering grounds of the nominate race, *i.e.* mainly on the Atlantic coast of the Bay of Biscay and the west coast of North Africa including Mauritania (GLUTZ *et al.* 1975).

According to PIENKOWSKI and DICK (1975) the Atlantic coast of Morocco and Mauritania are a particularly important moulting and wintering area of the *C. a. schinzii* population from the Baltic basin, western Europe, the British Isles and Iceland. It is estimated that about 200–300 thousand dunlins winter in north-west Africa out of which West European and Baltic dunlins could make up an important part. With this opinion do not agree fully ALERSTAM and HÖGSTEDT (1980). They suppose that dunlins from West Europe and Baltic area wintering in north-west Africa are less numerous, and dunlins wintering there come mainly from Iceland and northern Eurasia.

Migration of *Calidris a. alpina*

Autumn and spring migration. The first July wave of adult birds of the nominate race observed regularly on Gdańsk Bay appears in other Baltic areas too (NØRREVANG 1955, MARTIN-LÖF 1958, MASCHER 1966, KAUKOLA and LILJA 1972, EDELSTAM 1972). The further course of the autumn passage in the Gdańsk Bay region is similar to that in the whole Baltic basin. In autumn, and during September and October in particular, apart from the flight along the European coast there is also a flight over the entire Eurasian continent (USPENSKI 1969). This is the time of the juveniles' passage, and these birds are reported in very many places far away from the coast (GLUTZ *et al.* 1975).

The majority of the dunlins ringed on Gdańsk Bay fly first along the Baltic coast and then along the North Sea coast. Some of them continue to the British Isles while others fly to the Atlantic coast of France, the Iberian peninsula and North Africa. The route described constitutes part of one of the main routes of birds migrating from the northern areas of the European part of the Soviet Union, leading from the White Sea through the Bay of Finland and further on along the Baltic and the west European coast (USPENSKI 1969). Some of the dunlins choose a route across the continent to the Mediterranean.

A small number of birds from the Baltic region fly south-east in a direction completely different to the standard one for the Baltic area. Apart from the Polish recoveries there are also other reports of dunlin ringed in the countries around the Baltic which point to the evident existence of a route of passage from the Baltic to the Black Sea. The recoveries in question concern exclusively adult birds ringed during their autumn passage in Denmark, Sweden, Finland and Poland and reported during the same autumn (in one case in winter) around the Black Sea region (SAUROLA 1980, GROMADZKA 1981a). The geographical origin of the birds which chose this route and their exact destination is unknown. Perhaps they are birds from northern Scandinavia? HALE (1973) argues that *Tringa totanus* coming from northern Scandinavia fly to wintering grounds precisely south-east and winter on the coast of the Arabian Peninsula. A considerable number of dunlins also winter in this region, but their geographical origins are unknown (GLUTZ *et al.* 1975).

The date on the spring passage are the most limited. This passage is faster than the autumn one (NØRREVANG 1955, SAUROLA 1980) and consists of longer stages. This is indicated by, amongst other things, the considerable increase in the body weight of the birds wintering on the British Isles immediately before departing from the wintering grounds between the end of April and the beginning of May (PIENKOWSKI *et al.* 1979). The return to the breeding grounds along other routes not used in autumn remains unclear. There are some facts indicating that through some Black Sea regions spring migration is much more intensive than in autumn (TSCHERNITSCHKO 1982, *in litt.*).

Wintering grounds. The range of the wintering grounds of the particular races have not been determined exactly and it seems that various races may winter together in the same areas (GLUTZ *et al.* 1975). It is thought that *C. a. alpina* winter mainly in western Europe in numbers of about 1200 thousand with about half of that number wintering on the British Isles (PRATER 1976). It was estimated that only a proportion of wintering dunlins in north-west Africa belong to the nominate race (PIENKOWSKI and DICK 1975, MULLIÉ and MEININGER 1981). The number of birds wintering on the northern coast of Africa has not been estimated exactly.

13 birds ringed in Tunisia were caught at the mouth of the Vistula, these constituting 8% of all the dunlins controlled in Poland with foreign rings; further more, 3 birds ringed in Poland were controlled in Tunisia and 4 others were reported in Algeria and Morocco. To my disposal are measurements of 14 such birds. Comparing them with dunlin measurements compiled by GLUTZ *et al.* (1975) or PRATER *et al.* (1977) one can conclude that most of these birds belonged to the nominate race, some could have been *C. alpina schinzii* and some — *C. alpina sakhalina* (the length of 14 bills were: single birds — 29 mm, 30 mm, 32 mm, 33 mm, two birds — 34 mm, six birds — 35 mm, two birds — 36 mm). MULLIÉ and MEININGER (1981) found that in north Egypt most wintering dunlins are of nominate race and some could resemble *C. a. schinzii* and *C. alpina sakhalina*. These authors suggest that dunlins (their measurements) being about the range of *C. a. sakhalina* could represent the race *C. alpina centralis*, which breeds between Taimyr and Kolyma but which is not commonly recognized.

As those is unknown how to recognize different dunlin races it is only possible to say that wintering dunlins in north-west and north Africa are a mixture of birds coming from different breeding areas or belonging to different geographic races.

Fidelity to the migration routes and wintering grounds. The majority of dunlins undertake subsequent passages along the same routes and winter on the same wintering grounds (pages 7 and 8, GLUTZ *et al.* 1975, HARDY and MINTON 1980), but there are cases of individuals choosing different autumn routes and wintering most probably on other wintering grounds (GROMADZKA in press). During spring many birds travel through the same areas as in autumn, but there are also cases when different routes are chosen (GROMADZKA in press). A bird ringed on the Black Sea in spring and controlled in autumn on the Vistula mouth could be regarded as evidence of this. However, it is not out of the question that this bird could have passed through the Baltic region in spring on its route north-west via the Black Sea.

Migration of juveniles and adults. The differences between juvenile and adult birds pointed out in this study relate to the timing, speed and routes of passage. A difference in recovery rate with respect to age was also noted.

Recovery rate. The higher recovery rate of juveniles during the first autumn after ringing (page 13, Figs. 11 and 12) is indicative of their higher mortality in comparison to adult birds. The fact that many of them were recovered in hunting areas suggests that they are particularly susceptible to hunters. It is obvious that during the hunting season the less cautious and less experienced juveniles are killed more frequently. In time, however, the hunting produces greater timidity among the birds, for by winter the percentage of adults and juveniles shot is already very similar. Other wader species also exhibit a greater recovery rate among juveniles compared to adult birds *e.g.* among *Calidris canutus* and *C. ferruginea*, both long-distance migrants (DICK *et al.* 1976, WILSON *et al.* 1980). According to WILSON *et al.* (1980) this is due to the tendency of juveniles to stop more frequently en route. As mentioned above, the speed of passage and thus the frequency and length of stops of the dunlin, which is a short-distance migrant (in comparison to *C. canutus* and *C. ferruginea*, PIENKOWSKI *et al.* 1979), depends not only on the age of the migrating birds but also on the period of migration (page 14).

Assuming that the likelihood of capture by a ringer of a juvenile or an adult bird is the same, the relatively greater number of dunlin juveniles (compared to adults) controlled in inland areas of GDR (far from the coast) may indicate that comparatively more juveniles fly south-east from Gdańsk Bay overland and not along the coast. Additional arguments pointing to the validity of the more continental route hypothesis for juveniles will be discussed later. However, the acceptance of this view makes the fact that there is no difference in the recovery rate between juveniles and adult birds on the British Isles difficult to explain; perhaps we have too few recoveries.

Migration timing and speed. The timing of migration of juveniles and adult birds over various territories en route is known in general. Adult birds undertake subsequent passages at similar periods. Juveniles appear about a month after the first wave of adult birds on the western coast of Finland (KAUKOLA and LILJA 1966) as well as on the east coast of Sweden (MASCHER 1966) and Gdańsk Bay (page 14) and the same difference is later maintained during the following stages of the passage (FUCHS 1973, HARDY and MINTON 1980).

The first stage of the adult birds' passage is relatively fast. During investigations in Finland, Sweden and Poland it was observed that the stopping time of adult birds in this period is considerably shorter than in later periods. Most probably these birds are eager to reach their moulting grounds in western Europe in order to change their plumage before reaching their wintering grounds. The rapid increase in moulting dunlins around the area of the Dutch Wadden Sea (NIEBOER 1972, BOERE 1977) and the east coast of England (MINTON 1966) is well known. The slower passage of adult birds resting and feeding on Gdańsk Bay in the second half of August and in September is most probably

due to the fact that the birds are in a very advanced state of moult (J. GROMADZKA unpub.). These birds begin moulting either near their breeding grounds or on other areas rich in food situated to the east of Poland (KOZLOVA 1962). They continue moulting during their passage and complete their energy resources by feeding at appropriate places en route.

Routes of migration. In the literature one can come across occasional references relating to the possibility of dunlins using different routes of passage depending on age or even within the same age group. SAUROLA (1980) on the basis of an analysis of Finnish recoveries suggests that juvenile dunlins migrate more to the north than adults. Another type of difference was noted with respect to birds ringed in north-eastern Norway and in the Soviet Union near Murmańsk; adult birds appear to choose a shorter route, north-west via the Gulf of Bothnia and Scandinavia. The vast majority of juveniles, on the other hand, fly along the northern and western coasts of Norway (LESLIE and LESSELLS 1978, GROMADZKA in press). However, cases of juveniles taking the route via the Gulf of Bothnia have also been reported. The ringing of juvenile dunlins in central and southern Norway led to the claim that birds ringed in the south fly mainly to the British Isles while those ringed in the centre of Norway are mainly reported on the European coast from Denmark to Spain (FOLKESTAD 1975). The reasons for the above situation are unknown. On page 14 attention was drawn to the fact that adult dunlins reported on the Wash were also observed at the Vistula mouth about two weeks earlier than the birds detected in the Camargue region (Fig. 13). Perhaps the various routes of passage within the same age groups refer to possible distinct populations, as suggested in the case of the Norwegian juveniles by FOLKESTAD (1975). The timing stability of subsequent passages indicates the existence of definite time differences between the migrating groups of birds. This may concern different populations or different sexes. The problem, however needs much more thorough analysis (based, among other things, on biometric measurements) than was possible in this study.

It may be that the differences in passage routes of juveniles and adult birds may be based on differences in migration experience. The more experienced adult birds migrate earlier than juveniles and fly more rapidly in the direction of moulting and wintering grounds already known. Birds which begin to moult on the North Sea coast fly over Poland very quickly, stopping only for short periods of time. Birds which begin to moult in areas to the east of Poland (a different sex?, different populations?) fly less quickly and some of them at the Baltic turn south-west to the Mediterranean. The less experienced juveniles pass even less quickly and, during the passage, keep only to the general west and south-west direction, choosing in a given area the most suitable route — more safe or more appealing in terms of food. Therefore, they are reported in greater numbers more inland than on the coast of the continent. Juvenile *C. ferruginea* are similarly more often met inland than adults (WILSON

et al. 1980). The above suggestions referring to the importance of passage experience of juveniles and adults birds are in some ways similar to the conclusions relating to starlings reached by PERDECK (1958, 1967).

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STRESZCZENIE

[Wyniki obrączkowania ptaków w Polsce. Wędrowki biegusa zmiennego *Calidris alpina*]

Biegus zmienny zamieszkuje strefę tundry północnej Holarctyki. W obrębie tego szerokiego areału lęgowego wyróżnianych jest kilka podgatunków, co do których nie ma jednak pełnej zgodności wśród różnych autorów. Różne podgatunki są trudne do odróżnienia w terenie, zwłaszcza jesienią i zimą tam, gdzie występują razem. Zimowiska ptaków gnieźdzących się w Palearctyce znajdują się w Europie Zachodniej, w Afryce Północnej i w Azji Południowej.

Prawie wszystkie wędrujące przez Polskę biegusy zmienne należą do dwóch podgatunków: *Calidris alpina schinzii* i *C. alpina alpina*. W Polsce i w innych krajach nadbałtyckich, na Wyspach Brytyjskich, na Islandii i skrawku Grenlandii gnieździ się pierwszy z wymienionych podgatunków, zaś większość spotykanych nad Bałtykiem biegusów zmiennych należy do podgatunku nominatywnego i gnieździ się wzdłuż północnych wybrzeży Półwyspu Skandynawskiego, na Spitzbergenie, Grenlandii, wzdłuż wybrzeża Morza Barentsa i Oceanu Lodowatego. Sporadycznie w rejon Bałtyku może zalatywać dalekowschodni podgatunek *C. alpina sakhalina*.

Biegusy zmienne obrączkowane są w Polsce latem i jesienią od ponad 20 lat, przede wszystkim nad Zatoką Gdańską przy ujściu Wisły. W ostatnich latach obrączkowane były one także w kilku miejscach w głębi kraju. Do końca 1980 r. zaobráczkowano 18 118 ptaków, o których uzyskano 372 dalekodystansowe wiadomości powrotne (powyżej 100 km od miejsca obrączkowania). W 1978 r. rozpoczęto obrączkowanie *C. alpina schinzii* w kolonii lęgowej przy ujściu Redy. W ciągu 3 lat zaobráczkowano 150 ptaków (piskląt i dorosłych), o których dotąd uzyskano bardzo niewiele wiadomości powrotnych.

Jesienna wędrowka biegusów zmiennych, obserwowana na terenie Polski, trwa od końca czerwca do końca listopada, a nawet do początku grudnia. Największe koncentracje tych ptaków obserwowano przy ujściu Wisły (do około 1000 osobników), jednakże nad niektórymi zbiornikami w głębi kraju gatunek ten jest spotykany w nie mniejszych ilościach. Biegusy zmienne obrączkowane w Polsce jesienią wędrują głównie w kierunku zachodnim i południowo-zachodnim, wzdłuż wybrzeży europejskich oraz ponad lądem, nad Morze Śródziemne. Pojedyncze ptaki wędrują na południowy-wschód i stwierdzone były nad Morzem Czarnym. Znanych jest też kilkanaście innych przypadków świadczących o tym, że jakaś część ptaków leci znad Bałtyku w kierunku południowo-wschodnim (obráczkowane w Danii, Szwecji i Finlandii). Pochodzenie tych ptaków nie jest znane.

Zimowiska wędrujących przez Polskę biegusów zmiennych znajdują się na wybrzeżach całej Europy Zachodniej, w basenie Morza Śródziemnego oraz na wybrzeżach północnej i północno-zachodniej Afryki. Nie wiadomo do-

kładnie, gdzie zimują biegusy zmienne gnieźdzące się w Polsce. Jedyna zimowa wiadomość powrotna pochodzi z wybrzeży południowo-zachodniej Francji. Nieliczne europejskie zimowe wiadomości nie wyjaśniają dokładnie zasięgu zimowisk różnych podgatunków, a opinie różnych autorów na ten temat są podzielone. Liczba biegusów zmiennych zimujących w Europie Zachodniej oceniana jest na około 1 200 000 osobników, a na wybrzeżach północno-zachodniej Afryki na około 200 000–300 000. Koncentracje biegusów w obrębie innych zimowisk są znacznie mniejsze, lecz dokładne ich liczebności nie są znane.

Większość biegusów zmiennych odbywa kolejne wędrówki tymi samymi trasami, w szerokim tego słowa znaczeniu, tzn. ptaki stwierdzone w jednym roku nad Zatoką Gdańską, a w innym w południowej Szwecji wędrują w kolejnych latach tą samą trasą prowadzącą z obszarów tundry syberyjskiej przez wybrzeża Morza Białego, południową część Bałtyku i dalej na zachód czy południowy-zachód. Znane są pojedyncze fakty świadczące o znacznej zmianie trasy jesiennej wędrówki: ptaki spotykane w jednym roku nad Bałtykiem, w innych latach wędrowały ponad kontynentem euroazjatyckim, w kierunku Morza Czarnego. Być może ptaki te mogą spędzać różne zimy na różnych zimowiskach.

Na temat wiosennej wędrówki wiadomo stosunkowo mało. Wędrówka ta odbywa się szybciej od jesiennej, dłuższymi etapami, w związku z czym jest ona trudniej zauważalna. Wiadomości powrotnych z okresu wiosny jest niewiele, a większość pochodzi jeszcze z terenów zimowiskowych.

Stwierdzono różnice pomiędzy ptakami młodymi i dorosłymi. Wykazalność zaobraczkowanych ptaków jest większa w przypadku młodych, co wynika zapewne z faktu większej presji myśliwych na ptaki młode (około połowa wiadomości powrotnych o biegusach zmiennych pochodzi od myśliwych). Młode ptaki wędrują około miesiąca później od dorosłych, tempo ich wędrówki jest wolniejsze, a ogólny kierunek wędrówki jest bardziej kontynentalny. Nie zauważono związanych z wiekiem różnic w rozmieszczeniu zimowisk.