Migration and survival areas of Caspian Terns *Sterna caspia* from the Finnish coast

Mikael Kilpi & Pertti Saurola

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About 700 recoveries of Caspian Terns ringed on the Finnish coast served to throw light on the migration and the areas used outside the breeding season. Adults and first-year terns head south shortly after the young have fledged. The migration seems to occur in stages and the birds may exploit good feeding sites along the migration route for prolonged periods. The number of recoveries in Africa rises in November. It is argued that the main area utilized by the terns from Finland, and probably the whole Baltic area, is the ununddation zone of the Niger, in Mali.

Although some first-year birds remain in Africa over the summer, many perform a partial return migration. However, first-year terns seldom seem to reach the Baltic. The migration pattern of 3 yr terns in spring resembles that of adults of breeding age.

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Introduction

The Caspian Tern *Sterna caspia* is a cosmopolitan bird, with several disjunctly distributed populations (Dementiev et al. 1969, Voous 1960). The Baltic population is a distinct unit; some 2000—2500 pairs breed roughly between 56° and 65°N on the coasts of Sweden, Finland and the Estonian SSR (Bergman 1980, Staav et al. 1972). Staav (1977a, b) has given a sketchy analysis of the movements of Caspian Terns ringed on the Swedish coast. In the present report we will analyse the Finnish ring recoveries of this species. The aim is to describe the migratory strategy used by the species, and to pinpoint the main areas used in the non-breeding season. We have considered that the Finnish birds represent the whole Baltic population, since within the Baltic, breeding birds disperse readily over long distances (Staav 1979).

Material and methods

In all, 19 300 Caspian Terns have been ringed as chicks in Finland in the period 1913—82, and the recoveries made up to September 1983 amount to 980. The majority of the recoveries are recent, since prior to 1953 ringing was done on a modest scale (1913—52=670, 1953—67=6886 and 1968—82=11 746 birds ringed).

A number of recoveries have been discarded in this analysis: finds of birds reported as sick or decomposed and reports with inaccurate details. We have excluded a sample of 125 re-trapped (controls) adults, which have been treated by Staav (1979). This reduces the number of acceptable recoveries to 701. A breakdown of these by month and ageclass is given in Table 1.

The analysed recoveries consist of two major categories: (a) birds reported as "found" (may have been dead for some time, but not reported as decomposed), and (b) birds reported as "found in fresh condition" (usually shot or trapped). The majority of the recoveries belong to the latter group. Recoveries of the first category have been omitted in some cases, each of which is specified in the text.

We have analysed separately birds aged 1 yr (from

Table 1. Number of recoveries per month and age-class acceptable for this study.

	Month of recovery												
	August	September	October	November	December	January	February	March	April	May	June	July	Total
1-yr	73 (25.8)	75 (26.5)	53 (18.7)	31 (10.9)	14	10	7	7	1	5	1	6	283
2-yr	21 (27.3)	10 (13.0)	11 (14.3)	8 (10.4)	3	5	3	3	3	4	4	2	77
3-yr	27 (31.4)	12 (13.9)	9 (10.5)	6	4	3	2	1	2	4	9	(10.5) 7	86
+3-yr	64 (16.8)	40 (15.7)	31 (12.1)	23	11	7	8	6	16	18	9	22	255

1 August in the year of birth to 31 July in the next year), 2 yr (from 1 August in the second year, and so on), 3 yr and +3 yr. We consider +3-yr birds to be breeders, which is probably a conservative interpretation (Gill & Mewaldt 1983).

In the study we use the term migration to describe the act of moving from one spatial unit to another (see Baker 1978), "survival area" for areas exploited outside the breeding season (including pre-breeding years), and "breeding area" for the area used by +3-yr birds during the breeding season (see also Alerstam & Högstedt 1982).

For the analysis we have separated four area blocks: the breeding area (north of 56°N), Europe (45°—56°N), the Mediterranean (30°—45°N) and Africa (south of 30°).

Results

On the Finnish coast, most Caspian Tern chicks have fledged by about the middle of July (Soikkeli 1973), somewhat later in very northern colonies. Very few recoveries of newly fledged 1-yr terns have been made outside the colonies in July. One bird was found on 15 July 970 km south of the natal colony, all the other recoveries (13) were made closer to the natal colony (max. 223 km). Field observations indicate that soon after fledging 1-yr Caspian Terns accompany their parents to feeding sites in coastal bays and eutrophic lakes (Soikkeli 1973). Staav (1980) showed that a number of family groups are found by bays and lakes close the breeding islets in late summer. Our data indicate that although a few recoveries in August are made outside the direction of expected migration (SE—SW), most birds tend to move in a southerly direction in August (Fig. 1). The occurrence of Caspian Terns in the southern part of the Baltic (Schleswig-Holstein, Poland) in autumn has been studied by Gloe (1980) and Jozefik (1969), who found that the first migrants arrive in late July, and that the numbers culminate in the latter half of August. They state that family groups with at least one parent accompanying the young are common. Our data agree with these findings. Most birds will have left the Baltic by September (Fig. 3). We have followed the movements in the autumn period using recoveries of 1-yr terns (Fig. 2).

The distribution of recoveries of +3-yr terns among the four area blocks in Fig. 3 is similar to that of the 1-yr recoveries, except for a few recoveries of +3-yr terns in Africa in August. These birds were probably nonbreeders. From the recoveries plotted in Fig. 2, we deduce that the Caspian Tern in autum moves slowly and in stages towards the southern part of the survival area. The numbers of recoveries in the Mediterranean begin to build up in September. The first African recovery of a 1-yr bird dates from 16 October, and after the beginning of November the numbers of recoveries from Africa become substantial. The majority of the birds exploit the areas along the route to Africa for some 2—3 months.

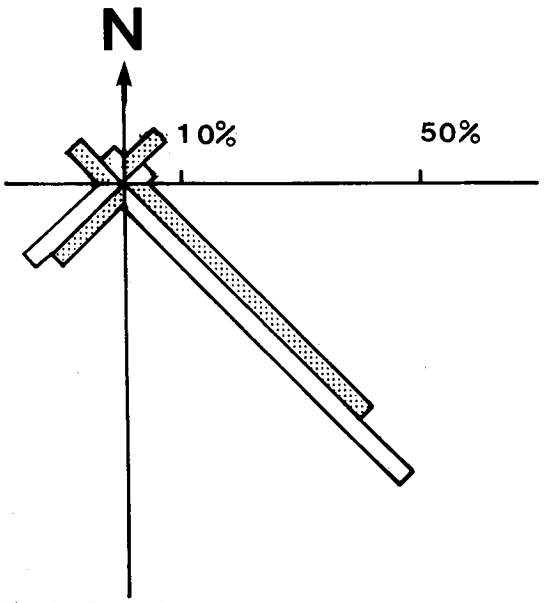

Fig. 1. Proportion of recoveries of 1-yr Caspian Terns in four direction blocks (N—E, E—S, S—W, W—N). Only recoveries of birds found more than 10 km from the natal colony accepted. Open bars denote birds from northern (north of 63°N) colonies (n=31), stippled bars birds from southern colonies (n=38).

The latest recovery of a Caspian Tern in Finland dates from 20 November (+3-yr tern) and the latest recovery of a 1-yr tern is from 25 October; the former recovery is extremely late. Both birds were recovered in fresh condition.

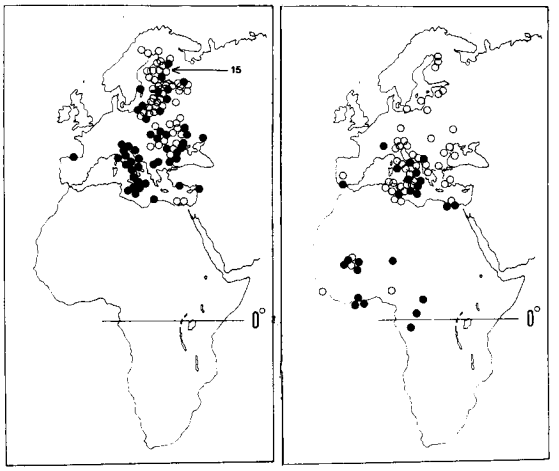

Fig. 2. Recoveries of 1-yr Caspian Terns (more than 100 km from natal site) in August (open circles, left map) September (black dots, left map), October (open circles, right map) and November (black dots, right map).

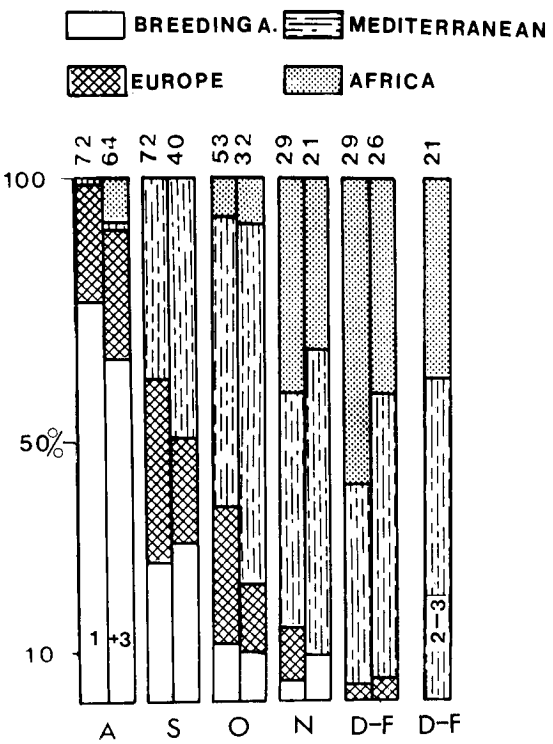

Fig. 3. Proportions of recoveries in four area blocks for 1-yr and +3-yr Caspian Terns in August-February, and proportions of 2—3-yr Caspian Terns in the four area blocks in December-February.

Winter. In Fig. 4 we have plotted recoveries of 1-yr, 2—3-yr (age-classes combined) and +3-yr Caspian Terns in December-February. During the coldest period of the year, the number of recoveries in the southernmost part of the survival area is greatest for all age-classes. The distribution of the recoveries among the area blocks does not differ between the ages (X^2-tests, n.s.). According to our recoveries, the total area used during this period is large, extending from the Black Sea and the Mediterranean, to south of the Equator. The birds recovered farthest south were 1-yr terns (Table 2). The recoveries indicate that coastal river delta areas (the Nile, Niger) are used as well as freshwater bodies. Most inland recoveries come from Mali, from the inundation zone of the Niger (see Moreau 1972), which seems to be an area of great importance. The inundation zone is reached by flight across the Sahara. The importance of this area may be overestimated due to efficient trapping and consequent high recovery rates, but we do not believe this possible bias is serious (see Discussion).

Table 2. Mean distance from ringing site of recoveries of Caspian Terns of different ages in December-February.

Age	N	Mean distance (km)	±S.E.	Range (km)
1-yr	27	4840	309	1742—7234
2+3-yr	20	4375	311	2128—6178
+3-yr	24	4188	297	1639—6425

Spring. The ring recovery data tell little about the timing of the return migration in +3-yr Caspian Terns. The majority of the April recoveries were made in the breeding area (62 %, N=18). Compared with the autumn movements, the migration is fast, with very little exploitation of areas along the route. In June-July the proportion of the recoveries made in the breeding area is 81 %. Two 4-yr and one 23-yr Caspian Tern were trapped in Africa in July; the breeding status of these birds is not known. The breeding dispersal within the Baltic has been treated elsewhere (Staav 1979, Väisänen 1973) and will not be discussed here.

In Fig. 5 we have plotted the recoveries of 1-yr, 2-yr and 3-yr Caspian Terns found in fresh condition during the breeding season from May to July. The samples are small, but indicate clearly that few, if any, 1-yr terns return to the breeding area during summer. These birds seem to exploit the southern part of the survival area. In 2-yr terns there is a tendency to shift towards the north, but few seem to reach the breeding area. Most 3-yr terns return to the breeding area.

If the recoveries of 1-yr terns are plotted for August of the second summer (actually 2-yr birds), the distribution proves to be more northerly than that in the preceding months. There are more recoveries from Europe in August (68.5 %, N=19) than in May-July (10 %, N=10), the difference being significant (X^2=9.0, df=1, P<0.01). This indicates a late northward shift, or partial return movement within the survival area.

Spatial distribution of 2-yr and 3-yr terns in autumn. The proportion of recoveries from the Baltic in August differs between 2-yr and 3-yr Caspian Terns: one out of 19 2-yr terns (5.3 %) vs. 40.7 % (N=27) of 3-yr terns (X^2=7.3, df=1, P<0.01). The proportions of birds found in Europe are larger in August for both age-classes (68.5 % and 44.4 %, 2-yr and 3-yr respectively), but drop in September (10 % 2-yr terns, N=10, no 3-yr terns, N=12), indicating a shift to the Mediterranean somewhat earlier than in 1-yr and +3-yr birds. Thus 2-yr and 3-yr Caspian Terns seem to leave Europe at a time when this area is still exploited by large numbers of 1-yr and +3-yr terns.

In October-November (combined) most 2-yr

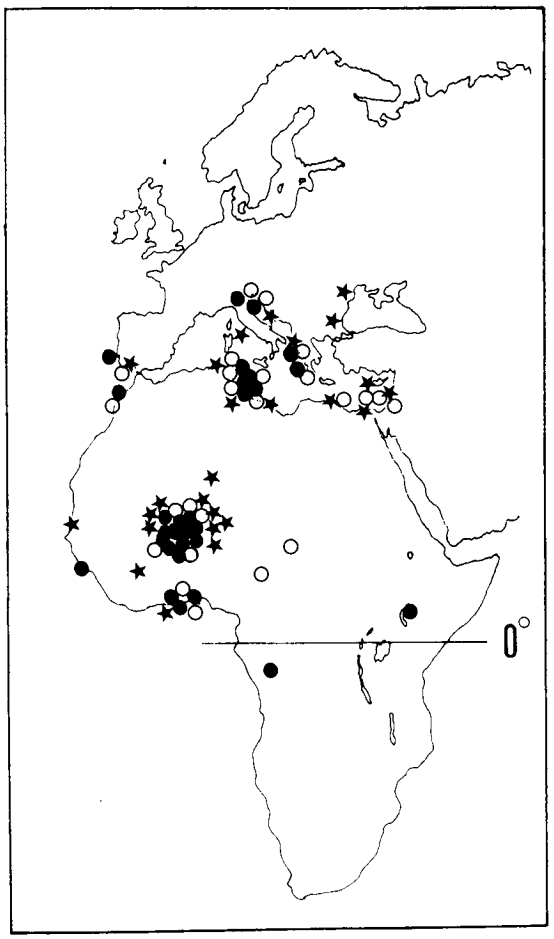

Fig. 4. December-February recoveries of Caspian Terns. Black dots = 1-yr terns, open circles 2—3-yr, and stars = +3-yr terns.

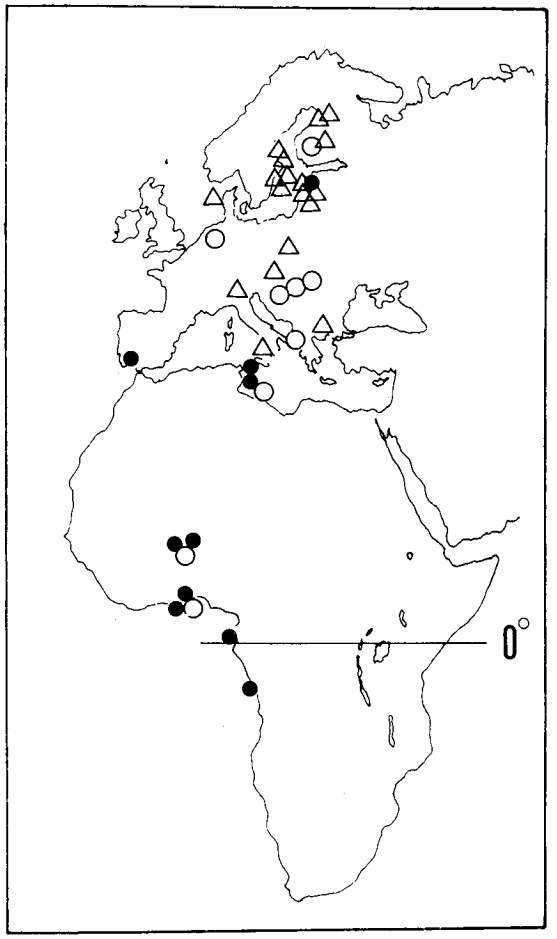

Fig. 5. May-July recoveries of freshly found Caspian Terns (more than 100 km from natal site). Black dots = 1-yr terns, open circles = 2-yr and triangles = 3-yr terns.

terns were found in the Mediterranean. The proportions of 2-yr and 3-yr recoveries from Africa (30 %, N=20, 26.7 %, N=15) do not differ significantly from those of 1-yr and +3-yr terns (19.5 % and 19.0 %). This implies that the Mediterranean and Africa are exploited by all ages to about the same extent in autumn, and there is no early southward movement in 2-yr and 3-yr terns.

Discussion

The Caspian Terns examined here were considered to represent the whole Baltic population, because there is extensive interchange of breeders between the Baltic colonies (Staav 1979), and because no differences were apparent between Finnish and Swedish terns in the distribution outside the breeding season (Staav 1977a, b). The Baltic Caspian Terns breed, and apparently find much of their food in the breeding season, within a brackish-water environment (Koli & Soikkeli 1973, Staav et al. 1973). Once breeding is completed, the birds shift to a freshwater habitat, to which they remain faithful throughout the non-breeding season. The survival area is large, but river deltas, euthrophic lakes and swamp areas are patchily distributed along the migration route. The migration to the southern part of the survival area in autumn takes place in stages, as evidenced plotted on Fig. 2. The birds may spend long periods in suitable feeding habitats. Isenmann (1976) has obtained evidence of flocks remaining in the Camarque in southern France for more than a month. In contrasts, the spring return migration of adult birds is rapid.

Immature age-classes exploit the survival area in the breeding season. Partial return to the

breeding area, or no return movement at all, has been observed in several species of long-range migrants with deferred maturity (Alerstam & Högstedt 1982).

The southernmost part of the survival area, Africa, is exploited mainly during the coldest period of the year, November to April. The ring recoveries indicate that the most important area in Africa is the inundation zone of the Niger in Mali. Field observations made at lakes near Timbuktu have revealed flocks of up to hundreds of birds (Glutz v. Blotzheim & Bauer 1982). We suggest that the bulk of these birds are Baltic Caspian Terns. Recoveries were also made from the delta of the Nile, the Gulf of Gabes, the delta of the Niger, and the coast of Senegal. There is probably some mixing with other populations within the survival area, both locally breeding populations (Mauretania, Voous 1966) and Black Sea populations (Dementiev et al. 1969, Staav 1979). The Mauretanian population is thought to spend the non-breeding season on the coast (Bauer & Glutz v. Blotzheim 1982), and the birds found wintering on the east coast of Africa are also local, or possibly Caspian, populations. We suggest that, apart from the northern (Mediterranean) coast, the coast of Africa is of minor importance for Baltic Caspian Terns.

Swamp areas, such as the inundation zone, are confined to a belt between 10°—15°N in Africa (Moreau 1972). The patches are also very far apart (see map in Curry-Lindahl 1981). As regards food for the terns, the environment is highly seasonal. The Niger floods once a year, starting in July (Morel 1973), when it produces a wealth of habitats for spawning fish. The Baltic Caspian Terns apparently take advantage of this abundance of food, but fish may become scarcer, as the dry season advances. It seems to us that the Baltic Caspian Terns migrate in a very predictable, yet very patchy, environment, taking advantage of seasonal booms in prey production. Morphologically, the Caspian Tern is well suited for long rapid flights, which enables it to use the patches. The severe climate clearly necessitates migration from the breeding area in autumn, but it is not clear why the Baltic is used for breeding by the species. When habitat patches elsewhere are more favourable than the patches currently occupied, selection will favour traits that serve to maximize discovery of new locations: dispersing ability and tolerance of the rigours of migration (Southwood 1977). The present migration strategy of the Baltic Caspian Tern must be seen as the result of dispersal from breeding sites somewhere within the present survival area.

The Caspian Tern seems to have good colonizing ability. It shows behavioural traits connected with unstable breeding habitats (McNicholl 1975), such as group adherence and "deserting flights" (Väisänen 1973). Over distances of, say, 1 000 km (the Baltic), colonization is very rapid (Väisänen 1973). To fully comprehend the spatial dynamics of this species, detailed studies of populations in both breeding and survival areas are needed.

The species treated here is distributed very patchily both in and outside the breeding season. We have argued here that the Baltic Caspian Tern chiefly uses inland lakes and swamp areas in the non-breeding season. The most important area in Africa seems to be the inundation zone of the Niger. We do not believe that this importance is an artefact due to high recovery rates in this area, but a real situation. This opinion is based upon evidence that the species uses freshwater areas extensively. Patches equivalent to the inundation zone are in short supply in Africa as a whole. Thus, it seems that the Baltic Caspian Tern is very vulnerable in winter. The concentration of a large proportion of the total population within a limited area may be disastrous. Most birds recovered in Africa have been intentionally killed by man, and if this killing increases, the Baltic population may face a severe decline.

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Selostus: **Räyskän muutto ja talvialueet**

Kirjoituksessa tarkastellaan räyskän muuttoa suomalaisen rengaslöytöaineiston pohjalta. Aikuiset ja 1-kv räyskät suuntaavat etelää kohti heti loppukesällä. Muuton vaiheittainen edistyminen kohti talvialueita on esitetty 1-kv linnusta tehtyjen löytöjen avulla kuvassa 2. Kuvassa 3 on esitetty eri ikäluokkien löytöosuus eri vyöhykkeissä (pesimäalue >56°N, Eurooppa, Välimeri ja Afrikka) syksyllä ja talvella. Vaikka talvilöytöjä tehdään melko laajalta alueelta, ne tuntuvat keskittyvän tiettyihin melko suppeisiin habitaattilaikkuihin, jokien suistoihin ja järvialueille. Löytömäärien perusteella arvellaan, että Nigerjoen tulva-alue Malissa olisi suomalaisille räyskille tärkeä keskitalvella. Koska Itämeren populaation on suhteellisen yhtenäinen, tämä koskee luultavasti koko populaatiota.

Kuvassa 5 on esitetty pesimäaikaisia löytöjä 2-kv, 3-kv ja 4-kv räyskistä. Löytöjen perusteella varsinkin 2-kv räyskät jäävät kesäksi osittain talvialueille, joskin ne saattavat muuttaa jonkin matkaa pohjoiseen. Syksyllä esi-aikuiset linnut näyttävät muuttavan Euroopasta ja Välimerenalueelta aikaisemmin kuin vanhat ja 1-kv linnut.

Koska Itämeren räyskät tuntuvat talvehtivan vain muutamassa sopivassa habitaattilaikussa, saattavat esim. rajut ympäristömuutokset tai lisääntynyt vaino talvialueilla nopeasti vaikuttaa Itämeren pesivään kantaan.

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