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Differences in prey capture efficiency of adult and juvenile Common *Sterna hirundo* and Arctic *S.paradisaea* terns

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A lower prey capture efficiency of juveniles than adults has been reported in a number of birds, particularly in fish-eating species (e. g. Marchetti & Price 1989). In this note I present data on feeding efficiency of adult and juvenile Common *Sterna hirundo* and Arctic *S. paradisaea* Terns from the east coast of Skåne, southernmost Sweden.

Observations were carried out near Simrishamn in late August and early September 1982. This represents the latter part of the autumn migration period of these terns in South Sweden; usually only small numbers of Common Terns can still be seen after mid-September (Edelstam 1972, Ulfstrand et al. 1974). Apparently, in 1982, the terns were taking advantage of large numbers of small sandeels *Ammodytes* sp. that had become concentrated near the coast. These good feeding conditions probably caused migrating terns to stop for short periods but numbers fluctuated from just a few individuals to many hundreds on different days. Common Terns greatly outnumbered Arctic Terns but under the prevailing conditions it was often impossible to separate juveniles of the two species. However, data on diving rates reported below all refer to Common Terns.

I obtained data on success rate (percent of dives resulting in capture of fish) on four days: on 24 August when flocks of terns were fishing over shallow water near Brantevik south of Simrishamn; on 30 August when small numbers were diving in deep water outside the harbour of Simrishamn; on 5 September, again at Brantevik; and on 7 September when 10–20 terns patrolled the harbour of Simrishamn. On the first occasion I only recorded whether dives were successful or not; on the other three I followed individual terns for as long a period as possible (range 30 – 405 s) to measure diving rates. To reduce effects of short-term changes in weather and, in particular, fish availability, I tried to follow adults and juveniles alternately, but this was not always possible. To reduce bias, I also tried to follow different individuals. It was not possible to measure the proportion of time the two categories of birds spent on different activities (e. g. fishing, resting, preening).

Observations were made from the beach or from a pier with 10 × 50 binoculars or a 20× telescope. Since the fish taken were small, it was sometimes difficult to see whether a dive was successful or not, and a few series had to be discarded for that reason. At times a tern took two small sandeels in the same dive, but it was neither possible to measure how often this happened nor whether adults did so more often than juveniles. Aborted dives, i. e. dives in which the tern never hit the water, were not recorded.

Adults had a higher success rate on all four occasions (Table 1), although the differences attained statistical significance on only two of them. Dunn (1972) found that wintering adult and juvenile Sandwich Terns *S. sandvicensis*, although usually differing in success rate, were equally successful when seining operations made fish easily obtainable. Similarly, Brandt (1984) found that the difference in success rate between adult and juvenile Brown Pelicans *Pelecanus occidentalis* varied between patches, and on general grounds one would expect juveniles to have relatively lower success under conditions when more hunting skill is necessary. There was some tendency in this direction in the present material, the ratio of adult success rate to juvenile success rate being lower on the two days when overall success was higher, but the material is too limited to draw any conclusions.

There were no indications that the lower success rate of juvenile terns was caused by interference from adults. Although some vocalizations occurred, these did not seem to be markedly aggressive; the two age classes were not only fishing in the same area but, especially on 24 August, formed dense aggregations as

Table 1. Success rate (per cent successful dives of all dives recorded) of adult and juvenile terns *Sterna hirundo* and *S. paradisaea*. Differences tested by χ^2-test and Fisher Exact Probability Test.

Framgång (procent lyckade dykningar av alla registrerade dykningar) för gamla och unga fisk- och silvertärnor. Skillnader testade med χ^2-test och Fischer Exact Probability Test.

Date *Datum*	Number (%) of dives by adults *Antal (%) dykningar av gamla*			Number (%) of dives by juveniles *Antal (%) dykningar av unga*			Significance level *Signifikansnivå*	% success ratio ad/juv *% framgång kvot ad/juv*
	Successful *Lyckade*	Unsuccessful *Misslyckade*	N	Successful *Lyckade*	Unsuccessful *Misslyckade*	N		
24 Aug	67 (31.3)	147 (68.7)	214	14 (13.2)	92 (86.8)	106	P<0.001	2.37
30 Aug	15 (62.5)	9 (37.5)	24	60 (35.7)	108 (64.3)	168	P<0.02	1.75
5 Sep	4 (30.8)	9 (69.2)	13	2 (11.1)	16 (88.9)	18	ns	2.77
7 Sep	9 (74.7)	10 (52.6)	19	13 (31.7)	28 (68.3)	41	ns	1.49

a response to high diving rates (Gochfeld & Burger 1982); no segregation by age was seen within these flocks and few, if any, agonistic behaviours were noted.

Juveniles did not compensate for their lower success rate by diving more often (Table 2); however, aborted dives were not recorded. This result agrees with those for Sandwich Tern, Olivaceous Cormorant *Phalacrocorax olivaceus*, Black-headed Gull *Larus ridibundus*, Great Blue Heron *Ardea herodias*, and Herring Gull *Larus argentatus* (Dunn 1972, Morrison et al. 1978, Jönsson 1979, Quinney & Smith 1980, Greig et al. 1983). By contrast, Cook (1978) found that juvenile Grey Herons *Ardea cinerea* made about twice as many attempts per time unit as adults did, but it is uncertain how well this reflected feeding effort. In Brandt's (1984) study, however, juvenile pelicans made more than twice as many dives as adults did, thereby even securing a slightly higher total number of fish than the adults but at more effort. When juveniles do not compensate for a lower success rate by more frequent attempts, they most likely must devote more time to feeding each day than do adults (Dunn 1972, Burger 1980, Marchetti & Price 1989).

Although differential mortality of juveniles has been suggested as a possible explanation of progressively increasing feeding efficiency with age (Orians 1969, Morse 1980), the improvement is almost certainly predominantly an effect of learning. Newly fledged birds are known to be clumsy and to make many mistakes. In most nidicolous species, parental provisioning continues at least to the point when the fledglings have a reasonable chance of surviving on their own (see Davies 1978 for a discussion), species with feeding techniques more difficult to learn often having longer dependency periods (Burger 1980). In my study, the ages of the juvenile terns were unknown and probably varied. Thus, although many juveniles were never seen to be associated with adults, others were still occasionally being fed. A varying age composition among the juvenile terns could partly explain why the difference in success rate between adults and juveniles varied on the four days of observation.

Table 2. Hunting rate (no. of dives/min) of adult and juvenile Common Terns *Sterna hirundo* (no. of dives in parentheses).

Jaktintensitet (antal dykningar per minut) för gamla och unga fisktärnor (antal dykningar inom parentes).

Date *Datum*	Adults *Gamla*	Juveniles *Unga*
30 Aug	2.25 (24)	2.61 (168)
5 Sep	1.99 (13)	2.02 (18)
7 Sep	1.02 (19)	0.89 (41)

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Sammanfattning

Skillnader i fiskeframgång mellan gamla och unga fisk- och silvertärnor

Under fyra dagar hösten 1982 registrerades unga och gamla fisk- och silvertärnors fiskeframgång (procentuella antalet dykningar med fångst) vid Simrishamn i östra Skåne. Vid samtliga tillfällen hade de gamla tärnorna högre framgång än de unga (Tabell 1). De unga tärnorna kompenserade emellertid inte detta genom att dyka oftare (Tabell 2). Således var de sannolikt tvingade att utnyttja en större del av dagen till näringssök, men om så var fallet kunde inte fastställas då det endast var möjligt att följa enskilda tärnor över kortare tid.

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