

Prey selection by parents and chicks of the Little Tern *Sterna albifrons*.

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Abstract - The diet of Little Tern chicks was studied in order to analyze the prey choice of a species that carries single, unbroken prey to its nest. Chicks less than 5 days old were fed with thinner fish than chicks older than 10 days. The average prey size was smaller for younger chicks. Prey left uneaten by chicks included larger, bulkier fish, shrimps and potentially poisonous fish. The parents select prey according to the chicks' ability to swallow, and a further selection is accomplished by the chicks themselves.

Introduction

Most studies on diet and prey choice of central place foragers deal mainly with multiple prey loaders and, to a lesser extent, with single prey loaders which are able to break-up large prey items in order to feed themselves or their chicks (Houston and McNamara 1985). Other species are single prey loaders which do not break the prey; their chicks swallow the prey whole. This constraint is particularly important, because the ability of the chicks to swallow items of increasing size continues throughout their growth, and the adults' optimal prey choice changes accordingly. In this paper we analyze the feeding behaviour of the Little Tern *Sterna albifrons*, as a model for studying diet and prey choice of single prey loaders that do not break food items. Previous studies described the diet of the Little Tern (Glutz Von Blotzheim and Bauer 1982, Cramp 1985, Bogliani *et al.* 1992, Dementev *et al.* 1966), its foraging niche (Isenmann 1979, Dubois 1982, Fasola *et al.* 1989), and chick behaviour (Davies 1981). However no attention has been paid to optimal prey selection performed by the adults in relation to the age of chicks.

Methods

Data were collected in the Comacchio lagoon (North Adriatic coast), a very old 100 km² lagoon, presently banked up at the edges and managed as fish pond. The Little Terns breed on islets in the middle of the lagoon and search for food mainly within 4 km of the colony

(Fasola and Bogliani 1990). Nests are placed mainly on bare ground and beaches covered by empty *Cardium* shells and with patches of halophytic vegetation.

Observations were made from a hide close to 40 nests from 22 June to 5 July 1983. Prey items carried by adults were identified to the lowest possible taxon, and the total length was estimated using bill length as a reference. No adjustment was made for possible systematic bias in the length estimate (Goss-Custard *et al.* 1987). One set of observations was limited to two age classes: chicks younger than five days (179 prey items) and chicks older than 10 days (107 items). Both age groups were observed simultaneously within the same colony, therefore any effect due to the uneven availability of the different prey can be excluded. It was impossible to know the sample size of chicks, because they were usually hidden among vegetation and were observed only when adults arrived with food. For the same reason it was difficult to have an accurate measurement of the handling time; only in few instances it was possible to observe chicks while disgorging food items.

In order to compare abandoned with offered prey, on 2 July 1983 we removed all prey items abandoned near the nests; from 2 July-5 July we carefully searched for recently abandoned prey items twice a day.

Results

Around the nests, 164 abandoned prey were collected; over the same four days, 784 feedings were observed.

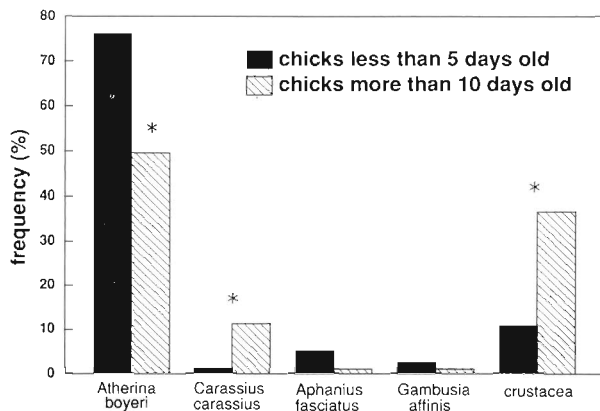


Figure 1 - Relative frequency of different prey fed to chicks aged less than 5 days (n=179) and more than 10 days (n=107). The asterisks indicate a significant difference (χ^2 test, d.f.=1, $p < 0.01$).

Table 1 - Length of the main prey delivered to chicks of different ages (mm).

	age of chicks						t	p
	less than 5 days			more than 10 days				
	mean	sd	n	mean	sd	n		
<i>Atherina boyeri</i>	34.6	6.9	136	47.7	9.5	53	9.3	<0.001
crustacea	40.1	5.7	19	51.4	2.7	39	10.3	<0.001

The frequency of occurrence of different prey items varied with the age of chicks (Figure 1). Young chicks received more Sand Smelts *Atherina boyeri* than older ones ($\chi^2=19.7$, d.f.=1, $P < 0.01$), while the opposite occurred for the Crucian Carp *Carassius carassius* ($\chi^2=12.6$, d.f.=1, $P < 0.01$). Chicks over 10 days were fed with more crustaceans than were chicks less than five days old ($\chi^2=26.1$, d.f.=1, $P < 0.01$). Young chicks received 27% smaller Sand Smelts and 22% smaller Crustacea on average (Table 1).

Overall, chicks less than 5 days old received prey items which being short and narrow were easy to swallow.

Crustaceans are probably difficult for small chicks to swallow as a consequence of the numerous appendages protruding from their bodies.

Abandoned prey was not a random sample of the offered prey. Relatively few thin fish such as Sand Smelt and Mosquito fish *Gambusia affinis* were abandoned; more bulky fish such as the Crucian Carp and Gobiidae and crustacea were overrepresented

(Figure 2). Abandoned fish items were larger, on average, than offered ones (Table 2). Very few attempts at prey disgorging were observed, since chicks often took shelter immediately after receiving prey from the adult and went out of view.

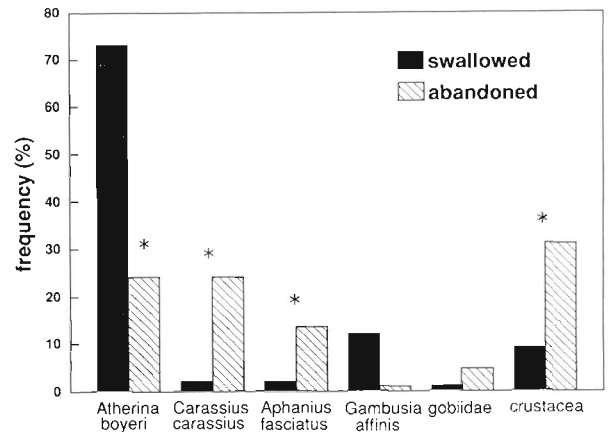


Figure 2 - Relative frequency of different prey swallowed by chicks (n=784) and abandoned uncaten near the nest (n=164). The asterisks indicate a significant difference (χ^2 test, d.f.=1, $p < 0.001$).

Table 2 - Length of the main prey observed and abandoned near the nests (mm).

	offered items			abandoned items			t	p
	mean	sd	n	mean	sd	n		
<i>Atherina boyeri</i>	34.7	20	574	39.9	10.4	40	3.1	<0.01
<i>C. carassius</i>	32.1	4.0	21	43.8	10.4	40	10.3	<0.001
<i>Aphanis fasciatus</i>	26.6	8.5	16	39.5	7.5	21	4.8	<0.001

Discussion

Adults selected prey of various length in relation to their chick's ability to swallow them, older chicks receiving larger prey. Obviously, a large chick is able to swallow a small prey, but this prey would not be an optimal choice for the parents. They may be qualitative differences between the pairs with young and old chicks at the same time, the latter being early layers and probably therefore older, more experienced birds. A change in the length of prey delivered to chicks of varying age has been observed in some

other species, such as the Kingfisher *Alcedo atthis* (Bogliani and Massara 1990), the Sandwich Tern *Sterna sandvicensis* (Veen 1977) and the male Common Tern *Sterna hirundo* (Wiggins and Morris 1987). In the latter species the female did not increase the length of prey as chicks got older. In the Grey Heron *Ardea cinerea*, the maximum size of fish swallowed by chicks increases with chick age (Moser 1986). Furthermore, heron chicks less than 20 days old were fed more frequently with small prey and less frequently with bulky fish than were older chicks, as was also observed with the Little Tern of varying ages in the Comacchio Lagoon. However it is not clear if the Little Tern selects for prey size and prey type according to the age of chicks, or if it simply selects for prey size; the difference in prey species could be due to the fact that small prey include species which are different from larger prey. Few items were not eaten by chicks and these tended to be those which were either more difficult to swallow than average ones, because of their shape. (e.g. fat fish), sometimes with numerous appendages causing handling problems, (e.g. shrimps), or possibly because of their bitter taste, (e.g. *Aphanius fasciatus*), which is poisonous to small mammals (Cavicchioli 1962).

There is no evidence that selection against bulky prey was due to factors other than bulk, but in the crustaceans the proportion of indigestible material they contain may reduce their palatability. This non-optimal foraging by adults would probably warrant investigation. However it seems that the amount of abandoned prey is a small fraction of prey loads brought to the nest by parents.

The difference between abandoned and swallowed prey cautions against the analysis of abandoned prey to estimate the diet of terns, as attempted by some authors (Boldreghini *et al.* 1988, Atwood and Kelly 1984). Abandoned prey are likely to be unwanted by chicks.

Acknowledgements - Thanks are due to SIVALCO, which allowed access to the Valli di Comacchio, to Alberto Meriggi for his criticisms of a draft of this paper and to Robert Coates for checking the English.

Riassunto - I pulcini di Fraticello delle Valli di Comacchio vengono imbeccati dai genitori con pesci piccoli e di forma affusolata quando hanno meno di 5 giorni; in seguito ricevono in maggior misura prede più grandi, più tozze o con appendici. Una parte delle prede portate dagli adulti resta abbandonata a terra. Questa frazione comprende pesci più grandi e di forma più tozza della media, crostacei con lunghe appendici e pesci

potenzialmente velenosi. Gli adulti selezionano le prede in relazione all'abilità dei pulcini di ingoiarle; una ulteriore selezione viene operata probabilmente dai pulcini stessi, che scartano quelle meno idonee.

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