1988 Avocetta 12: 95-99

Comparative analysis of prey caught by the Common Tern *Sterna hirundo* and the Little Tern *Sterna albifrons* on the Po river and delta

Paolo Boldreghini*, Paolo Magagnoli, Silvano Toso****
*** Istituto di Zoocolture, Università di Bologna, Via S. Giacomo 9, 40126 BOLOGNA**
**** Istituto Nazionale di Biologia della Selvaggina, Via Cà Fornacetta 9, 40064 OZZANO EMILIA (BO)**

Abstract - The diet of the Common Tern *Sterna hirundo* and the Little Tern *Sterna albifrons* was investigated in two areas of the Po River Plain by an analysis of prey collected around nests. A high difference between the two areas was found for both Terns. The two species overlapped greatly in the middle Po, while a high trophic segregation existed in the Lagoon of Comacchio. In both areas the Common Tern preyed on larger fish than did the Little Tern.

Key words: diet, Po Plain, *Sterna albifrons, Sterna hirundo*

The feeding habits of the Common Tern *Sterna hirundo* and the Little Tern *Sterna albifrons* have been scarcely investigated in the Mediterranean (Glutz et al. 1983, Cramp 1985) and the literature contains nothing that deals with their feeding behaviour in Italy. Our material on the two species was collected from colonies in two areas: the middle stretches of the Po (i.e. between Piacenza and Casalmaggiore) and the Lagoon of Comacchio (the southern part of the delta). Collection was undertaken, respectively, from 1975 to 1980 and in 1977.

MATERIALS AND METHODS

Prey was collected from the ground around nests, only when it was possible to attribute each fish to a given species of Tern. A limit of this method is the possible difference between the relative importance of each prey-species in predatory habits and in actual diet; in the Little Tern, this difference was low in a study conducted on in the USA (Atwood and Kelly 1984), while it was considerable in Italy (Bogliani, Fasola, Saino, Canova pers. com.).

In the middle Po, collections were carried out at 5-day intervals during most of the breeding season (from mid-April to mid-July) of each year. In the case of the Little Tern, we collected the prey that was offered during courtship and incubation and that which was carried. In the Lagoon of Comacchio, collections were carried out only once or twice in each of the three investigated colonies, in the period between mid-June and mid-July.

The fresh specimens collected were fronzen, whereas the dry fish were preserved in alcohol 70° or formaldehyde 4%. The prey-species, all of which were fish, were identified following Ladiges and Vogt (1968), Luther and Fiedler (1965), Muus and Dahlstrom (1979), Riedl (1963), Solyan (1963), Tortonese (1968, 1970, 1975). We adopted the nomenclature of Tortonese (1970, 1975).

Predation success was estimated by means of observations from two selected sites facing fishing areas in the middle Po during the spring-summer periods of 1980. The observations were carried out six times for two hours (from 10,30 to 12,30), at intervals of seven days.

The diversity of the estimated diet was evalutated by means of the Simpson index in the complementary form 1 -S (Odum 1975). Affinity between the estimated diets was evaluated by means of the index (see Raabe 1952 in Southwood 1966)

$$PS = \sum \min (pi1, pi2)$$

where "min (pi1, pi2)" is the minimum importance value of the prey-species between the two diets.

RESULTS AND DISCUSSION

The relative importance of each species to be preyed on by the two Tern-species in the two areas is reported in Tab. I. The diversity of the LittleTern diet may be regarded as medium-low in the middle Po and medium in the Lagoon of Comacchio, in spite of the small number of prey-species (which could partially depend on the small size of the latter sample). As regards the Common Tern diet diversity demonstrates the same, medium value in the two areas, but the number of prey-species is very different.

The number of species caught in the Lagoon of Comacchio (16) is rather high which is clearly due to the availability of a wider range of the differing habitats (shallow marine coastal water, brackish lagoon, salt-pans, freshwater ponds, rivers, canals) that are useful for feeding activities. Nevertheless, many of them are of very little importance in the overall diet; on the contrary, in the middle Po, the Common Tern fishing exclusively in the river and above all in full stream, preyed on only five species. A comparative analysis of Common Terns' feeding habits in the two study areas shows a very strong difference; only two species out of nineteen are caught in both areas (similarity = 0.02).

TABLE I. Prey caught by Common and Little Terns in the two study areas.

	COMMON TERN				LITTLE TERN			
	Middle Po		Comacchio		Middle Po		Comacchio	
	N	%	N	%	N	%	N	%
Sardinia pilchardus							2	3.03
Engraulis encrasicholus					13	1.57		
Esox lucius			1	0.12				
Rutilus rubilio	21	12.89			120	28.31		
Scardinius erythrophthalmus			34	4.12				
Alburnus alburnus alborella	97	59.51	11	1.33	281	66.88		
Chondrostoma genei	14	8.59			17	4.01		
Chondrostoma soetta	7	4.30						
Carassius sp.			120	12.35			29	43.94
Cyprinus carpio			3	0.36				
Syngnathus abaster			127	15.38				
Aphanius fasciatus			3	0.36			17	25.76
Liza ramada			1	0.12				
Atherina boyeri			19	2.30			16	24.24
Lepomis gibbosus	24	14.70	4	0.48	6	1.42		
Zoosterisessor ophiocehalus			494	59.81				
Platichthys flesus			3	0.36				
Solea lutea			9	1.09				
	163		826		424		66	
Diversity		0.60		0.60		0.48		0.68

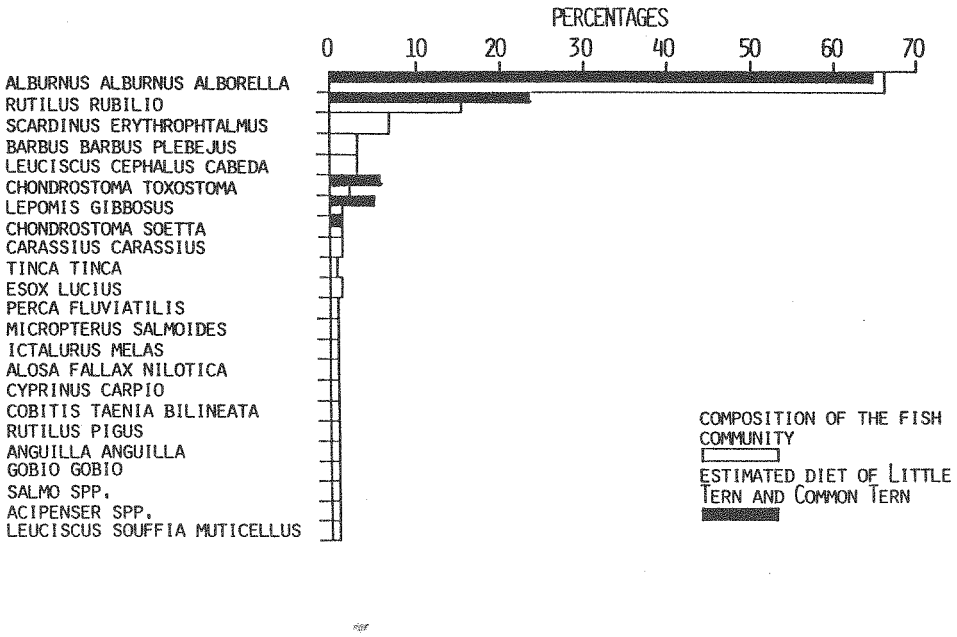

FIGURE 1. Comparison between the relative importance of the prey-species caught by Common and Little Terns and the composition of the fish community in the middle Po.

An even greater difference is found in the feeding habits of the Little Tern since no prey-species is common to both areas. In the middle Po, four prey species out of a total of five are caught by both Terns (similarity= 0.78). In the Lagoon of Comacchio, a similar comparison shows that only four prey- species out of a total of seventeen are taken by both Terns (similarity= 0.15).

Such results show a large overlap in the trophic niches of the Common and Little Terns where the number of available prey-species is lower; on the contrary, high trophic segregation is found were wide environmental and, therefore, considerable prey-species diversities exist.

In the middle Po area, a study on the fish comminity was carried out at the same time (Vitali and Braghieri 1981); it is therefore possible to compare the importance of the prey-species in the overall estimated diet of the Common Tern and the Little Tern relative to that deal the fish that live in this area. As shown in Fig. 1, only five fish-species out of the twenty-three inhabiting the area were caught. Here the two species most heavily preyed on (*Alburnus alburnus alborella* and *Rutilius rubilio*) are also the two most common; however three other species, which are not rare (*Scardinius erythrophtalmus*, *Barbus barbus plebejus*, *Leuciscus cephalus cabeda*), are never preyed on.

Fig. 2 shows the respective distribution in length-classes of the fish preyed on by the two Terns in the middle Po and in the Lagoon of Comacchio.

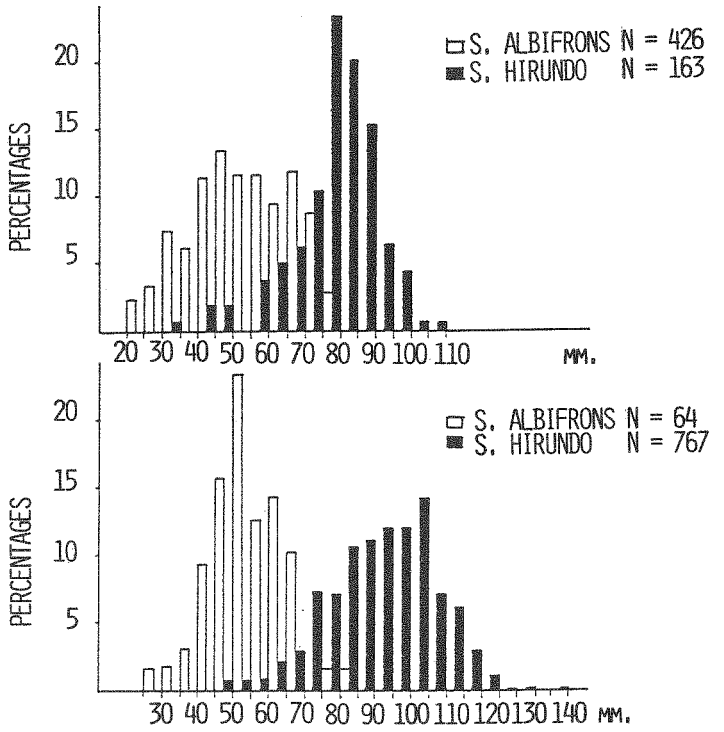

FIGURE 2. Length-classes of the fish preyed on by Common and Little Terns in the two study areas.

In both areas, the Common Tern caught significantly larger fish than did the Little Tern (middle Po: $t = 20.80$, $P < 0.001$; Comacchio: $t = 18.90$, $P < 0.001$). The difference in the size of fish caught by the Little Tern in the two areas is not significant ($t = 1.91$, n.s.). On the contrary, the mean size of fish caught by the Common Tern is significantly higher in the Lagoon of Comacchio than in the middle Po ($t = 11.16$, $P < 0.001$); this fact is due to the high relative importance in the estimated diet of the Common Tern in the Lagoon of Comacchio of *Zoosterisessor ophiocephalus* and of *Syngnathus abaster*, two fish species that are characterized by an unusually low weight/length ratio.

In the middle Po area, the predatory efficiency of the two Terns is very different. Common Terns had a success rate of 50.3% (396 hits out fo 787 attempts), Little Terns had a success rate of only 26.1% (508 hits out of 1942 attempts). These results concur with those obtained by Bogliani (1981) in an upstream stretch of the river Po and confirm the higher efficiency of the Common Tern.

ACKNOWLEDGEMENTS

The Authors thank C. Farioli, F. Montanari, G. Plazzi, G. Semeraro and G. Tosi for the help given in the collection of material, G. Gandolfi, E. Tibaldi and P. Torricelli for advice on the identification of fish-species and S. Keating for reviewing the English.

RIASSUNTO

Analisi comparative delle specie predate da *Sterna hirundo* e *Sterna albifrons* nel corso e nel delta del Fiume Po

- Gli spettri di predazione di *S. hirundo* e *S. albifrons* sono stati studiati attraverso la raccolta delle prede abbandonate nei pressi dei nidi.
- Il confronto fra gli spettri di predazione della medesima specie nelle due aree evidenzia una elevata differenza, sia per la Sterna comune che per il Fraticello.
- Il confronto fra gli spettri di predazione delle due specie nella medesima area evidenzia una larga sovrapposizione nel medio Po, ove minore è la varietà delle specie potenzialmente predabili, e una elevata segregazione trofica nel Delta del Po, ove esiste una ittiofauna assai più diversificata.
- Nel medio Po si constata solo una parziale sovrapposizione, in termini sia qualitativi sia quantitativi, fra lo spettro di predazione complessivo delle due Sterne e la composizione specifica del popolamento ittico.
- Il confronto fra le dimensioni delle prede mostra che in entrambe le aree la Sterna comune preda pesci di dimensioni mediamente maggiori.
- Nel medio Po l'efficienza predatoria delle due specie differisce sensibilmente, a favore della Sterna comune.

FIG 1. Confronto tra la composizione specifica del popolamento ittico e lo spettro di predazione cumulativo di Sterna comune e di Fraticello, nel medio Po.
FIG. 2. Distribuzione in classi di lunghezza delle prede catturate da Sterna comune e Fraticello nelle due aree.
TAB. I. Prede catturate da Sterna comune e Fraticello nelle due aree.

REFERENCES

Bogliani, G. 1981. Aspetti della biologia della Sterna comune *Sterna hirundo* e del Fraticello *Sterna albifrons* nidificanti lungo il Po. Tesi di Laurea, Università di Pavia, Facoltà di Scienze Matematiche, Fisiche e Naturali.

Cramp, S. (ed.) 1985. The Birds of the Western Palearctic, vol. IV. Oxford University Press, Oxford.

Glutz von Blotzheim, U.N., Bauer, K.M. & Bezzel, E. 1983. Handbuch der Vogel Mitteleuropas, band 8: Charadriiformes 3 tail. Akademishe Verlagsgesellschaft, Wiesbaden.

Ladiges, W. & Vogt, D. 1968. Guida dei pesci d'acqua dolce d'Europa fino agli Urali e al Mar Caspio. Labor, Milano.

Luther, W. & Fiedler, K. 1965. Guida alla fauna marina costiera del Mediterraneo. Labor, Milano.

Muus, B.J. & Dahlstrom, P. 1979. Guida dei pesci di acqua dolce. Edagricole, Bologna.

Odum, E.P. 1975. Diversity as a function of energy flow. In: W.H. van Dobben, R.H. Lowe-McConnel (eds.), Unifyng Concepts in Ecology. Junk, The Hague.

Riedl, R. 1963. Fauna und Flora der Adria. Paul Parey, Hamburg und Berlin.

Soljan, T. 1963. Fishes of the Adriatic (Fauna et Flora Adriatica vol. 1, Pisces). Nolit Publishing House, Belgrade.

Southwood, T.R.E. 1966. Ecological methods. Chapman and Hall, London.

Tortonese, E. 1968. Leptocardi, Ciclostomi e Pesci. In: E. Tortonese & B. Lanza, Pesci, Anfibi e Rettili. Piccola Fauna Italiana, Martello, Milano.

Tortonese, E. 1970. Osteichthyes (Pesci ossei) parte 1ª. Fauna d'Italia, 10, Calderini, Bologna.

Tortonese, E. 1975. Osteichthyes (Pesci ossei) parte 2ª. Fauna d'Italia Vol. 11. Calderini, Bologna.

Vitali, R. & Braghieri, L. 1981. Caratteristiche strutturali e dinamiche del popolamento ittico del Medio Po nella zona di Caorso. Riv. Idrobiol. 20: 265-304.

Ricevuto il 17 novembre 1987