

## DIET OF ROYAL (*THALASSEUS MAXIMUS*) AND SANDWICH (*T. SANDVICENSIS*) TERNS DURING THE AUSTRAL WINTER IN THE BUENOS AIRES PROVINCE, ARGENTINA

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### INTRODUCTION

The northern and central part of the coast in Buenos Aires Province (Argentina) presents important roosting areas where several marine bird species aggregate during the austral winter. Punta Rasa (RAMSAR site since 1997), located in Samborombón Bay at the southern border of the Río de la Plata estuary influence, is used by several marine birds as roosting or refuelling area during the non-breeding season or migration. Some of them which breed in the northern hemisphere are most abundant during the austral summer, e.g., 30 000 Common Terns (*Sterna hirundo*), while others which do that in Patagonia are most abundant in winter, e.g., 1 000 South American Tern (*Sterna hirundinacea*). Royal (*Thalasseus maximus*) and Sandwich (*T. sandvicensis*) terns, which breed both north and south of the Punta Rasa region are scarce (groups smaller than 100 birds) but regularly present throughout the year in the Buenos Aires

Province (see Narosky & di Giacomo 1993). Most information concerning *Thalasseus* terns from Argentine coast deals with the status and conservation of Patagonian populations, their breeding biology and intra-interspecific relationships allied with predation or kleptoparasitism (Yorio *et al.* 1994, Quintana & Yorio 1997a, b, Yorio & Quintana 1997). Some information on the food and feeding biology of both tern species was provided by Escalante (1970) and Quintana & Yorio (1997b). In this paper, we present information on the diet of Royal and Sandwich terns, obtained as part of a broader study focused on evaluating the predator-prey relationships between marine birds and fish in Buenos Aires Province.

### METHODS

The diet of terns was assessed by the analysis of regurgitated casts collected from March to December 1998 in nonbreeding grounds at

TABLE 1. Fish prey of Royal and Sandwich terns as by the analysis of otoliths found in pellets from Buenos Aires Province, Argentina.

Fish prey	Royal Tern (n = 33)		Sandwich Tern (n = 29)	
	Frequency %	No%	Frequency %	N%
Argentine anchovy ( <i>Engraulis anchoita</i> )	23.53	20.93	54.55	34.62
Anchovy ( <i>Anchoa mitchilli</i> )	17.65	9.30		
Silverside ( <i>Odontesthes Argentinensis</i> )	29.41	23.26		
Weakfish ( <i>Cynoscion guatucupa</i> )	5.88	13.95	27.27	38.46
Drum ( <i>Paralichthys brasiliensis</i> )	29.41	20.93	9.09	3.85
White Croaker ( <i>Micropogonias furnieri</i> )	5.88	2.33	18.18	7.69
Unidentified	17.65	9.30	36.36	15.38

Punta Rasa (36°20'S, 56°45'W), Buenos Aires, Argentina.

Due to the similarities in pellet morphology of both bird species, samples were taken when only one of them were present in the roosting area. Pellets collected were dried at ambient temperature, dissected and the hard remains identified using a stereo microscope (x 20). Where possible, otoliths were identified to species, using descriptions and illustrations in literature (see Torno 1976), and reference material from our own collection composed by juvenile fish collected in the nearshore of the study areas. Otoliths were separated into right and left and the most abundant was considered to represent the total number of fish present by species in each pellet. Otolith length was used to estimate fish size (total length) and mass using our regressions and those from Torno (1976). Other prey remain as crustaceans or insects were identified using our own collections.

Percentual occurrence (F%) refers to the percentual frequency of samples in which a particular food type appeared, while the importance by number (N%) is the percentage of prey items of one type out of all prey items (see Duffy & Jackson 1986, Rosenberg & Cooper 1990).

## RESULTS AND DISCUSSION

A total of 62 pellets were collected, including 29 of Sandwich Terns and 33 of Royal Terns. The analysis of the casts showed that the diet of both species by occurrence did not differ significantly ( $\chi^2 = 2.05$ ,  $df = 2$ , ns), fish being the main prey (79 and 94 %, respectively), followed by insects (41 and 24%) and shrimps (7 and 3%). However, diet differed significantly between species considering the importance by number ( $\chi^2 = 32.20$ ,  $df = 2$ ,  $P < 0.0001$ ), fish being the most important prey (84%) in Royal terns, followed by insects (15%), while the importance was opposite in Sandwich Terns (insects 53%, fish 44%). The amount of insects (Coleoptera and Odonata in all cases) in the diet of both terns was higher than reported in the literature (see Gochfeld & Burger 1996), and from three to six times higher than results for South American Terns in the study area (Favero *et al.* 2000). Most of the insects were from pellets collected during December for Sandwich Terns and March for Royal Terns.

Forty-four percent of samples contained otoliths. A total of 111 otoliths were recovered and assigned to six species: Argentine anchovy (*Engraulis anchoita*), Anchovy (*Anchoa*

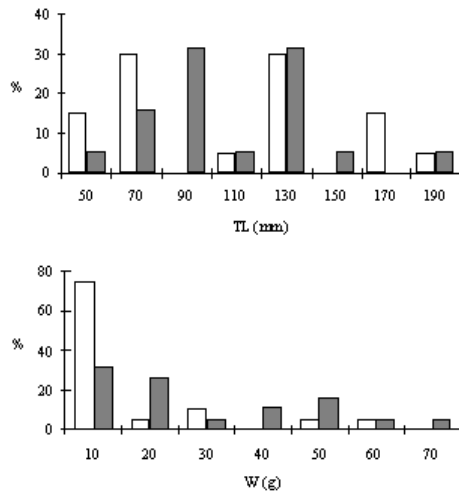


FIG. 1. Length (TL) and weight (W) frequency distribution of fish prey of the Royal (filled bars) and Sandwich (open bars) terns from March to December 1998.

*marinii*), Silverside (*Odontesthes argentiniensis*), Weakfish (*Cynoscion guatucupa*), White Croaker (*Micropogonias furnieri*) and Drum (*Paralichthys brasiliensis*). Argentine anchovy was the most frequent prey in the diet of Sandwich Terns (55%,  $n = 16$ ), whereas Silversides (29%,  $n = 10$ ) and Drum (29%,  $n = 10$ ) prevailed in the diet of Royal Terns. On the other hand, Weakfish was the most important fish by number for Sandwich Terns, while Silversides constituted the most important prey for Royal Terns (Table 1). Both occurrence ( $\chi^2 = 11.40$ ,  $df = 5$ ,  $P = 0.044$ ) and importance by number ( $\chi^2 = 18.43$ ,  $df = 5$ ,  $P = 0.002$ ) of fish prey differed significantly between species.

The mean number of fish ( $\pm$  SD) per sample was  $2.2 \pm 1.6$  (range 1–9,  $n = 51$ ) for Sandwich Terns and  $2.3 \pm 1.3$  (range 1–6,  $n = 71$ ) for Royal Terns ( $U$ -test  $Z = 0.429$ , ns). Neither the average size in total length nor fresh weight differed significantly between tern species ( $Z < 0.814$ ,  $P > 0.42$  in both comparisons):  $98.5 \pm 47.9$  mm and  $10.7 \pm$

$15.6$  g ( $n = 20$ ) for Sandwich Terns and  $97.0 \pm 34.0$  mm and  $11.4 \pm 14.7$  g ( $n = 19$ ) for Royal Terns (Fig. 1). The average prey weight obtained for the latter species correspond to the 15.4 g reported by Erwin (1977).

Although preliminary, the data presented in this study constitute the first detailed information on the diet of *Thalassurus* terns in northern Argentine coast. Previous reports near the study area indicated only silversides (c. 20 cm length) in the diet of both species (Escalante 1970). Similar prey types were reported in the diet of both species in Patagonia, being Argentine anchovies and Silversides the most important fish delivered to chicks (Quintana & Yorio 1997b). The ranges of prey sizes estimated in this study for Royal (37–190 mm) and Sandwich terns (44–183 mm) agree with those reported for the same species in other studies (30–180 mm and 90–150 mm, respectively) (see Gochfeld & Burger 1996). Both Royal and Sandwich terns share almost the same fish prey species with other and much more abundant terns, mainly the South American and Common terns (Mauco 1999, Favero *et al.* 2000). However, the effects of the potential competition between small and large terns could be initially reduced by differences in prey sizes since the former ones always take fish smaller than 76 mm in length (see Favero *et al.* 2000).

The main prey reported in the diet of Royal and Sandwich terns in North America and Africa were Clupeiform (pelagic) fishes (Gochfeld & Burger 1996, Shealer 1996). However, our data show that other (demersal) fishes such as Weakfishes, White croakers, Drums (Sciaenidae) and Silversides (Atherinidae) are also important in the diet of both species in the study area. This fact could be related to the importance of the Samborombón Bay as a reproductive and nursery area for several marine fish species (i.e., juvenile fishes represent about 70% of total fish biomass) (Lasta *et al.* 1994).

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