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REPORT OF THE WORKING GROUP ON BIOLOGY AND ECOLOGY[1]

Daniel Danilewicz, Fernando Rosas, Ricardo Bastida, Juliana Marigo, Mônica Muelbert, Diego Rodríguez, José Lailson Brito Jr., Valéria Ruoppolo, Renata Ramos, Manuela Bassoi, Paulo H. Ott, Glauco Caon, André Monteiro da Rocha, José Luiz Catão-Dias and Eduardo R. Secchi

i. Growth and Reproduction

Compiled by Fernando Rosas, Renata Ramos and Daniel Danilewicz

Growth - The asymptotic lengths of individuals of the southern form of *P. blainvillei* (distributed south of 32ºS) vary between 129.8cm and 136.4cm for males, and between 146.4cm and 161.9cm for females (Kasuya and Brownell, 1979; Walter, 1997; Barreto *et al.*, 2000). The northern form of the species (distributed north of 27ºS), has asymptotic lengths that vary between 113.3cm and 117.1cm for males, and between 128.9cm and 144.7cm for females (Rosas, 2000; Ramos *et al.*, 2000a; Ramos *et al.*, 2000b). These results corroborate the populational differences in body size between the northern (smaller individuals) and southern forms (larger individuals) based on osteological data (Pinedo, 1991) and those from genetic studies (Secchi *et al.*, 1998). These data also suggest populational differences within each of the geographic forms. The asymptotic lengths obtained by Rosas (2000) for franciscanas in an intermediate area (São Paulo and Paraná) of the species' distribution were smaller than those close to the northern limit of its distribution (Ramos *et al.*, 2000a). Additionally, the asymptotic lengths presented by Ramos *et al.* (2000b) from São Paulo were also smaller than those for the more northern Rio de Janeiro coast. The different body sizes observed among the individuals within the northern form might also be due to populational differences, as result of an isolation of the individuals in the northern region of Rio de Janeiro and Espírito Santo (Siciliano *et al.*, 2000).

The fetal growth rate in this species has been estimated to be 7.55 cm/month (Rosas, 2000) and 7.6 cm/month (Ramos *et al.*, 2000a) for the northern form. For the southern form, Danilewicz (2000) estimated a fetal growth rate of 6.94 cm/month. The estimated birth length of the northern form of franciscana has been estimated as approximately 71cm (Rosas, 2000; Ramos *et al.*, 2000a) and between 70 and 80cm in the southern form from Uruguay (Kasuya and Brownell, 1979). Danilewicz (2000) estimated a mean birth length of 73.4cm in Rio Grande do Sul, suggesting that even though there is a marked difference in body size in the adult phase between the southern and northern forms of this species, the birth size is similar.

Reproduction – According to Kasuya and Brownell (1979), the length of sexual maturity of franciscanas from the coast of Uruguay is attained at about 131cm in males and at 140cm in females, with an estimated age at sexual maturity between two and three years for both sexes. Danilewicz *et al.* (2000a,b), and Danilewicz and Secchi (2000) estimated the mean age at sexual maturity of franciscanas from the coast of Rio Grande do Sul at approximately 3.5 years for both sexes. Mean length and weight at sexual maturity in Rio Grande do Sul was estimated at 138.9cm total length and 32.8kg weight, for females and 127.4cm total length and 26.6kg weight, for males (Danilewicz and Secchi, 2000; Danilewicz *et al.*, 2000a). In Rio Grande do Sul, the annual pregnancy rate was estimated to be 0.65, which is equivalent to a birth interval of 1.5 years. This suggests that within the population, half of the females reproduce annually and the other half biannually (Danilewicz *et al.*, 2000b; Danilewicz and Secchi, 2000).

Reproductive parameters of franciscanas of the northern form have been studied by Rosas (2000), Ramos *et al.* (2000a) and Di Beneditto and Ramos (2000). Ramos *et al.* (2000a) and Di Beneditto and Ramos (2000a) estimated that franciscana males from the northern coast of Rio de Janeiro reach sexual maturity at two years, and a total length of 115cm, and the females at three years and a total length of 130cm. Franciscanas of the same form but distributed further south in an intermediate region of the species' distribution (southern coast of São Paulo and coast of Paraná), are sexually mature between 112 and 116cm for males, and between 122 and 126cm for females, with age at sexual maturity for both between four and five years (Rosas, 2000). These results suggest that the populations from Paraná and southern São Paulo, particularly females, attain sexual maturity at smaller sizes, but at an older age, than those inhabiting areas close to the northern limit of the distribution of the species. These differences again suggest populational differences within the northern form of this species (Rosas, 2000).

On the coast of Uruguay and Rio Grande do Sul, more than 90% of ovulations in females occurred in the left ovary (Harrison *et al.*, 1981; Danilewicz, 2000). This, using the reproductive classification index calculated by Ohsumi (1964), would place such animals in the reproductive category "Type III". This ovulation polarity was not observed by Rosas (2000) in franciscanas along the southern coast of São Paulo and coast of Paraná. The left and right ovaries in these animals appeared to mature simultaneously, and as such, females from these populations would be classified as "Type I". Again, these differences also suggest populational variations within the species. However, the polarity of ovulation of franciscanas from the northern limit of the distribution of the species is not known.

[1] A review on genetics of franciscana is presented in detail in the Report of the Working Group on Stocks Identity. Also, information about systematic and taxonomy, evolution, anatomy and histology were not included in this Report.

The gestation period also does not appear to vary between the northern and southern forms of the species, with estimates of between 10.5 and 11.2 months (Kasuya and Brownell, 1979; Harrison *et al*., 1981; Danilewicz, 2000; Rosas, 2000; Ramos *et al*., 2000b). The lactation period has been estimated at 8 or 9 months in individuals of the southern form (Harrison *et al*., 1981; Kasuya and Brownell, 1979), and between 7.4 and 8.5 months in the northern form (Ramos *et al*., 2000b; Rosas, 2000). Given that lactation periods are one of the most highly varying reproductive parameters in mammals, the differences observed between the northern and southern forms do not appear to be substantial.

Brownell (1989), using the equation calculated by Kenagy and Trombulak (1986), estimated that the ratio between the observed and expected testes weight of franciscana individuals from Uruguay, was 0.21. A slightly higher ratio (0.25) was estimated for individuals from the southern coast of São Paulo and coast of Paraná (Rosas, 2000), while those from Rio Grande do Sul were reported to have a lower ratio (0.17; Danilewicz, 2000).

The small relative testes size of franciscana suggests that sperm competition does not occur in this species (Danilewicz, 2000; Rosas, 2000). Nevertheless, the scarcity of information on the social organization of franciscana still precludes any definite statement concerning the species reproductive system (Danilewicz, 2000; Rosas, 2000).

ii. Feeding Habits

Compiled by Ricardo Bastida, Manuela Bassoi and Paulo Ott

During the first year of life three diet categories were defined for *Pontoporia blainvillei* based in an important number of specimens: *lactating*, *mixed-diet* and *solid-diet* specimens (Rodríguez *et al*., 2000; Rivero *et al*., 2000). Previous references, of few juvenile specimens, also indicated about the possibility of different diet categories (Kasuya and Brownell, 1979; Pinedo, 1982; Brownell, 1989).

The total length of lactating individuals vary between 56.8cm and 76.5cm and weight between 2.9 and 8.7kg, while fat tissue constitute between 34.7 and 49.2% of body weight (μ= 40.7; SD= 5.0) (Rodríguez *et al*., 2000; Rivero *et al*., 2000).

The first predation activities of this species start, in the northern areas of Argentina, at a very young age (2.5 - 3 months), and at a length of approximately 75cm and a body weight of 8kg (Rodríguez *et al*., 2000), probably earlier than what it was supposed previously. Kasuya and Brownell (1979) suggested, for Uruguay, that predation activities start when specimens are > 85cm in length and > 8kg in weight, while, for southeastern Brazil, it occurs when dolphins are > 80cm in length (Ramos *et al*., 2000b). Pinedo (1982) found otholits in the stomach of a 83cm male in southern Brazil.

Specimens showing mixed-diet (milk + preys) measured between 78.0 and 94.0cm (μ= 86.4; SD= 5.6) and weighted 8.3 to 11.5kg (μ=9.8; SD= 1.1). These specimens had lower fat tissue than lactating ones, reaching values of 28.6 to 48.0 % of body weight (μ= 39.1; SD= 8.0) (Rodríguez *et al*., 2000).

In Argentina the mixed-diet is composed by milk and a total of five prey species, among them juvenile fishes (mainly *Micropogonias furnieri* and in a lesser extent *Cynoscion guatucupa*), small squids (*Loligo sanpaulensis*), and the shrimp (*Artemesia longinaris*). The small crustacean *Neomysis americana* was the key species for the mixed-diet specimens. However, it was never found in weaned dolphins specimens (Rodríguez *et al*., 2000; Rivero *et al*., 2000).

The feeding independence of individuals from the northern areas of Argentina starts, approximately, at the age of 7 months, when they reach 95cm in length and 13kg in weight. Solid-diet yearling specimens measured between 97.3 and 105.0cm in length (μ=102.8; SD= 2.5) and weighted 13 to 17kg (μ= 15.0; SD= 1.0). The fat tissue of these specimens was between 30.1 and 38.7% of the body weight (μ= 35.5; SD= 3.7). The maximum body circumference was from 60.0 to 68.2cm (μ= 63.9; SD= 2.6) (Rodríguez *et al*., 2000; Rivero *et al*., 2000). According to Kamiya and Yamasaki (1974), very young franciscanas showed blubber mean values of 35.8% of body weight, while in adult specimens mean values go down to 25.5%, being 30.1% the general mean value for the species.

The first analysis on the feeding ecology of franciscana comparing adults, juveniles, males and females was presented by Pinedo (1982). The author concluded that the species preys are basically the same regardless of sex or age class of franciscana. More recent studies also conducted in southern Brazil (Ott, 1995; Bassoi, 1997) arrive to similar conclusions. Although some particular tendencies were noted in the prey composition of males, females and individuals at different maturity classes, these groups seem to share many prey species. However, one of the most noteworthy differences found in many studies was the relative high importance of shrimps in the diet of young dolphins (e.g. Pinedo, 1982; Ott, 1995; Bassoi, 1997; Perez *et al*., 1996). In Argentine waters, the solid-diet of yearling specimens is similar to the diet of older animals of the same area, but shows a lesser number of food items, being *Cynoscion guatucupa*, *Micropogonias furnieri* and *Loligo sanpaulensis* the main preys (Rodríguez *et al*., 2000; Rivero *et al*., 2000).

Trophic studies of juveniles and adults conducted along Argentina, Uruguay and Brazil indicate that franciscanas' diet is composed by, at least, 76 food items (Table 1), belonging to three main zoological groups: fishes (82.8%), crustaceans (9.2%), and molluscs (7.9%) (Pinedo, 1982; Ott, 1995; Bassoi, 1997; Rivero *et al*., 2000; Di Beneditto, 2000). The 84.2% of the food items were correctly identified at species level.

The first references of franciscanas' preys are probably the oldest among South American small cetaceans, and

Table 1. Summary of prey groups, families and species which had been found in the diet of franciscana, *Pontoporia blainvillei*, along its geographical range.

Geographic sector/ region	11-12 Uruguay	10-11 S - RS	12 Uruguay	14-15 S - BA	11 Uruguay	14-15 S - BA	5-6 SP, PR	8-9 N - RS	10-11 S - RS	6 PR	13 N - BA	3 N - RJ	12 N - BA
authors	A	B	C	D	E*	F	G	H	I	J	K	L	M
year/N° of stomachs	1976	1982/277	1986/6	1987/30	1989*	1992/2	1990/2	1995/36	1997/36	1998/12	2000/60	2000/89	1996;2000/62;69
FISHES													
SCIAENIDAE													
Cynoscion guatucupa	x	x		x	x	x		x	x		x		x
Cynoscion jamaicensis								x	x			x	
Cynoscion microlepidotus										x			
Cynoscion virescens												x	
Paralonchurus brasiliensis	x	x			x			x	x	x	x	x	
Macrodon ancylodon	x	x		x	x	x		x	x		x	x	
Micropogonias furnieri		x		x	x	x			x		x	x	
Umbrina canosai		x			x			x	x		x		
Menticirrhus sp.		x							x				
Menticirrhus americanus				x	x	x							
Menticirrhus littoralis								x					
Pogonias cromis											x		
Isopisthus parvipinnis							x			x		x	
Stellifer rastrifer							x	x				x	
Stellifer brasiliensis							x					x	
Stellifer sp.							x					x	
Ctenosciaena gracilicirrhus												x	
Larimus breviceps												x	
POMATOMIDAE													
Pomatomus saltator		x							x		x		
MUGILIDAE													
Mugil platanus											x		
Mugil liza			x										
Mugil sp.									x				
PHYCIDAE													
Urophycis brasiliensis	x	x		x	x	x		x	x		x		
TRICHIURIDAE													
Trichiurus lepturus	x	x			x			x	x			x	
BATRACHOIDIDAE													
Porichtys porosissimus	x	x			x			x	x			x	
STROMATEIDAE													
Peprilus paru		x		x	x	x			x			x	
Stromateus brasiliensis	x				x						x		
SYNGNATHIDAE													
Leptonotus blainvillianus						x							
MERLUCCIIDAE													
Merluccius hubbsi									x				

continued...

References:
Geographic sector/region: (BA) Buenos Aires Province (Argentina); (RS) Rio Grande do Sul State (Brazil); (PR) Paraná State (Bra zil); (SP) São Paulo State (Brazil); (RJ) Rio de Janeiro State (Brazil); (S) South, (N) North.
Auhors: (A) Brownell and Praderi; (B) Pinedo; (C) Praderi; (D) Perez-Macri; (E) Brownell; (F) Bastida *et al.*; (G) Schmiegelow; (H) Ott; (I) Bassoi; (J) Oliveira *et al.*; (K) Rivero *et al.*; (L) Di Beneditto; (M) Perez *et al.*
* Brownell (1989) compiles the results obtained by Brownell and Ness, 1970; Fitch and Brownell, 1971; and Brownell, 1975.

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Geographic sector/	11-12	10-11	12	14-15	11	14-15	5-6	8-9	10-11	6	13	3	12
region	Uruguay	S - RS	Uruguay	S - BA	Uruguay	S - BA	SP, PR	N - RS	S - RS	PR	N - BA	N - RJ	N - BA
authors	A	B	C	D	E*	F	G	H	I	J	K	L	M
year/N° of stomachs	1976	1982/277	1986/6	1987/30	1989*	1992/2	1990/2	1995/36	1997/36	1998/12	2000/60	2000/89	1996;2000/62;69
ENGRAULIDAE							x						
Anchoa marinii	x	x			x	x		x	x		x		
Anchoa filifera										x		x	
Engraulis anchoita	x	x		x	x	x		x	x		x		
Cetengraulis edentulus										x			
Anchoviella lepidentostole												x	
Lycengraulis grossidens		x									x		
OPHIDIIDAE					x								
Raneya fluminensis									x		x		
TRIGLIDAE													
Prionotus sp.									x				
SERRANINAE													
Dules auriga						x							
CONGRIDAE													
Conger orbignyanus					x			x					
Ariosoma sp.					x								
OPHICHTHYIDAE													
Ophicthus cf. gomesii								x					
CARANGIDAE													
Trachurus lathami	x	x			x	x		x	x		x		x
Trachurus sp.				x									
Parona signata						x							
CLUPEIDAE													
Ramnogaster arcuata											x		
Brevoortia aurea				x		x							
Ramnogaster melanostoma			x										
Brevoortia pectinata			x										
Sardinella brasiliensis												x	
Odontognathus mucronatus												x	
Chirocentrodon bleekerianus												x	
Pellona harroweri												x	
ATHERINOPSINAE													
Odonthestes argentinensis											x		
Odonthestes bonariensis		x	x										
Austroatherina incisa				x		x							

continued...

References:
Geographic sector/region: (BA) Buenos Aires Province (Argentina); (RS) Rio Grande do Sul State (Brazil); (PR) Paraná State (Bra zil); (SP) São Paulo State (Brazil); (RJ) Rio de Janeiro State (Brazil); (S) South, (N) North.
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Geographic sector/ region	11-12 Uruguay	10-11 S - RS	12 Uruguay	14-15 S - BA	11 Uruguay	14-15 S - BA	5-6 SP,PR	8-9 N - RS	10-11 S - RS	6 PR	13 N - BA	3 N - RJ	12 N - BA
authors	A	B	C	D	E*	F	G	H	I	J	K	L	M
year/N° of stomachs	1976	1982/277	1986/6	1987/30	1989*	1992/2	1990/2	1995/36	1997/36	1998/12	2000/60	2000/89	1996;2000/62;69
SPARIDAE													
Pagrus pagrus											x		
PERCOPHIDIDAE													
Percophis brasiliensis											x		
BOTHIDAE													
Syacium papillosum									x				
Paralichtys isosceles									x				
CYNOGLOSSIDAE													
Symphurus sp.					x								
NOMEIDAE					x								
Cubiceps sp.0	x												
GOBIIDAE					x								
CEPHALOPODS													
LOLIGINIDAE													
Loligo sanpaulensis		x		x	x	x		x	x	x	x	x	x
Loligo plei							x	x	x	x		x	
Lolliguncula brevis										x		x	
ARGONAUTIDAE													
Argonauta nodosa								x	x				
OCTOPODIDADE													
Eledone gaucha								x					
Octopus tehuelchus											x		
CRUSTACEANS													
SOLENOCERIDAE													
Pleoticus muelleri		x			x				x		x		
PENAEIDAE													
Penaeus paulensis		x			x								
Penaeus spp.							x						
Xyphopenaeus kroyeri												x	
PALAENOMIDAE													
Artemesia longinaris		x			x				x		x	x	
SERGESTIDAE													
Peisos petrunkevitchi											x		
Mysidacea													
Neomysis americana											x		

References:
Geographic sector/region: (BA) Buenos Aires Province (Argentina); (RS) Rio Grande do Sul State (Brazil); (PR) Paraná State (Brazil); (SP) São Paulo State (Brazil); (RJ) Rio de Janeiro State (Brazil); (S) South, (N) North.
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* Brownell (1989) compiles the results obtained by Brownell and Ness, 1970; Fitch and Brownell, 1971; and Brownell, 1975.

were obtained from specimens collected in Argentine waters (Burmeister, 1867, 1869; Lahille, 1899). The first references on the diet of franciscanas from Brazil and Uruguay were published by Carvalho (1961) and Van Erp (1969), respectively. Nonetheless, the first study specifically oriented towards the knowledge of franciscana feeding habits was performed by Fitch and Brownell (1971) and continued afterwards by one of the authors (Brownell, 1975a; 1975b).

Scientific studies with information about feeding habits of franciscana can be divided into three different periods. The first one, characterized by preliminary observations, goes from 1867 to 1969 and includes a total of six papers (Burmeister, 1867, 1869; Lahille, 1905; Cabrera and Yepes, 1940; Carvalho, 1961; Van Erp, 1969) through which a total of 8 food items can be identified along the three countries.

After the trophic studies conducted by Fitch and Brownell (1971) in Uruguay, the number of prey in the franciscana's diet rose to 21. It marks the beginning of the second period, characterized by a growing number of *Pontoporia* feeding studies in all regions. During this period, Pinedo (1982) documented the feeding habits of franciscana from southern Brazilian waters based on a high number of samples (n=257), increasing the identified feeding items to 26 prey species, while Praderi (1984; 1986), Perez-Macri (1987) and Brownell (1989) studies results increased the food items to 36 preys. Bastida *et al.* (1992) compared franciscana´s diet from Argentina, Uruguay and southern Brazil, showing high similarities among them, specially in relation with the dominance of *Cynoscion guatucupa, Micropogonias furnieri* and *Loligo sanpaulensis*. This study can be considered the end of the second period towards the knowledge of the feeding habits of *Pontoporia blanvillei*, and it was mainly oriented to qualitative aspects of the diet.

Feeding studies performed with specimens from northern and southern areas of Rio Grande do Sul State, Brazil (Ott, 1995; Bassoi, 1997) represent the beginning of the third period, in which quantitative aspects of franciscana´s diet are taken into account. These studies confirm previous observations made in the region by Pinedo (1982) and increase the food items to 53 preys, although effects of overfishing in the species diet are detected through temporal changes in the frequency of occurrence of the preys (Bassoi and Secchi, 2000).

Recent studies, developed in the Buenos Aires Province (Argentina) and new localities of Brazil, increases notably the number of food items in the franciscana's diet to 76 different preys (Perez *et al.* 1996, 2000; Oliveira *et al.* 1998; Di Beneditto *et al.* 1998; Di Beneditto, 2000; Rivero *et al.*, 2000; Rodrígues *et al.* 2000) (Table 1). This large number of items was identified along many decades of observations and based on a total of approximately 900 sampled specimens. The high number food items is related to geographical location and ecosystem characteristics as well as to temporal scale and number of samples analysed. This can be clearly observed through Di Beneditto *et al.* (1998) and Di Beneditto (2000) studies, where prey list increases notably. Samples for these studies were obtained from Rio de Janeiro, a northern sampling area not studied before and related with a different marine coastal ecosystem and a different genetic population of franciscana (cf Secchi *et al.*, 1998). Probably, new sampling effort in the northern and meridional (Santa Catariana, Paraná and São Paulo states – Brazil) distribution areas of franciscana would increase the list of prey species.

Praderi (1986) compared the diet composition of franciscana collected along the estuarine and oceanic zones in Uruguay and found some important differences between them. Similar results were observed in studies conducted along the Argentine coast (Pérez Macri, 1987; Rivero *et al.*, 2000). According to Rivero *et al.* (2000), a clear difference in the diet components of franciscana was found comparing the stomach contents of specimens obtained in the estuarial ecosystem of Bahía Samborombón (northern Buenos Aires Province) and adjacent marine coastal ecosystem. Based on the index of relative importance (IRI) values, *Micropogonias furnieri*, *Odonthestes argentinensis* and *Macrodon ancylodon* were the main species for the estuarial area, whereas *Cynoscion guatucupa*, *Loligo sanpaulensis* and *Urophycis brasiliensis* were the principal preys for the marine coastal ecosystem. It seems that differences also exist between adjacent marine ecosystems; for example, specimens obtained in deeper southern waters, near Necochea city, show *Loligo sanpaulensis* and *Trachurus lathami* as main preys (Perez *et al.*, 1996, 2000).

Ott (1995), based on IRI values for the northern area of Rio Grande do Sul State, mentioned *Cynoscion guatucupa*, *Thrichiurus lepturus*, *Urophysis brasiliensis*, *Paralonchurus brasiliensis* as principal fish preys and *Loligo sanpaulensis* among the invertebrates. Seasonal fluctuations can be observed in the franciscana's diet components, which coincide with the pattern variation observed in the abundance of the prey species off southern Brazil in different seasons of the year, indicating that the species may feed opportunistically upon those preys most frequent in the area. Bassoi (1997) and Bassoi and Secchi (2000) arrive to similar conclusions for the southern Rio Grande do Sul, and also noticed that *Micropogonias furnieri*, a very important prey for franciscana more than a decade ago (Pinedo, 1982), has at present a low relative importance in the diet. Bassoi and Secchi (2000) attribute this change as a result of overfishing of the species in almost all its geographical distribution (cf. Reis, 1992; Haimovici, 1998; Bastida *et al.*, in press). Bassoi and Secchi (2000) also concluded that trends in fish stock abundance seem to dictate trends in prey composition of *Pontoporia blainvillei* and that monitoring the feeding behavior of this species may help forecast and understand fluctuations patterns in the recruitment of commercial fishes.

To date there is no information about daily food consumption in both juvenile and adult specimens, although feeding studies carried out in captivity indicate that a 28kg franciscana eats 7 to 12% of total body weight daily. The diet was composed by a variety of fishes and invertebrates of low, medium and high caloric values (Loureiro *et al.*, 2000).

In a near future, caloric studies should be performed, in order to understand nutritional requirements of franciscana, and the feeding strategies in an increasingly competition with coastal fisheries. Also, studies to assess the relationship between the feeding ecology of local franciscana populations and the biological and physical ocean processes are recommended along the species range.

iii. Parasites

Compiled by Juliana Marigo

Epizoits

Only few species of crustaceans are known as epizoits of franciscanas. One is the sessile barnacle, *Xenobalanus globicipitis* (Cirripedia: Coronulidae), which is commonly found on various other species of cetaceans attached to the trailing edge of the flukes (Brownell, 1989). Di Beneditto and Ramos (2000b) presented the first record of the barnacle *X. globicipitis* attached to the fin of one franciscana from the northern coast of Rio de Janeiro, Brazil. The authors mention that epizoits can be used as biological tags, indicating home range and movement patterns of the cetaceans species and populations. Since their colonization can be related to a slower movement of possibly sick animals, their presence may also be useful in further studies on diseased cetaceans (Aznar *et al,* 1994a). Unidentified gooseneck crustaceans have been found attached to the rostrum (at the gum) of an adult female franciscana from Rio Grande do Sul State, southern Brazil (E. Secchi, pers. comm.). The old animal was thin and the presence of these epizoits may be related to the debilitated condition of the host.

The isopod *Cirolana* sp. was found in several occasions in the blowhole and stomachs of franciscanas. It may enter the dolphin's blowhole after death and be ingested because it is infecting the fish consumed by the franciscana. *Cirolana* sp. is known to infect the gill of some fish (e.g. sciaenids). *Nerocila* sp. has also been found on the skin of one dolphin (Brownell, 1989). It is also commonly found on franciscanas by-caught off Rio Grande do Sul State (E. Secchi, pers comm.). Ferreira *et al.* (1998), presented the occurrence of *Riggia* sp. (Isopoda: Cymothoidae) in the vagina of one franciscana in Santos, São Paulo State. Although the authors has considered it as a case of parasitism, it is likely that the crustacean enter the franciscana's body after death.

The common diatom *Cocconeis ceticola* was found in skin samples from 10 franciscanas taken in Uruguayan waters. In addition, a single specimen of a naviculoid diatom, *Navicula* sp., was also found on one animal (Brownell, 1989).

Endoparasites

Dailey and Brownell (1972) observed the presence of *Contracaecum* sp. (Nematoda: Anisakidae) and *Corynosoma* sp. (Acanthocephala: Polymorphidae) in franciscanas incidentally caught off Uruguay. In the same area, Kagei *et al.* (1976) and Praderi (1984) reported *Anisakis typica* (Nematoda: Anisakidae), *Procamallanus* sp. (Nematoda: Camalanidae) and *Corynosoma cetaceum* in the stomachs of franciscanas. Brownell (1975a) analyzed the stomachs of 191 animals by-caught in the Uruguayan shark fishery and identified *Polymorphus (P.) cetaceum* (Acanthocephala: Polymorphidae), *Contracaecum* sp. and the presence of one cestode and one nematode not identified. No parasites were found in the intestines.

Raga *et al.* (1994) described *Hadwenius pontoporiae* (Digenea: Campulidae) found in the small intestines of animals from Argentina. This was the first record of this genus for the South Atlantic. In another study performed by Aznar *et al.* (1994b), *Anisakis simplex, Polymorphus (Polymorphus) cetaceum* and *H. pontoporiae* were observed in 46 franciscanas from Buenos Aires Province, Argentina. *Contracaecum* sp. was also found, with a low prevalence, in franciscanas from Argentina (Aznar *et al.*1995).

In the Atafona region, Rio de Janeiro State, Brazil, Santos *et al.* (1996) found no parasites in the stomachs of 70 franciscanas. Andrade (1996) described the helminthofauna of 53 franciscanas from Rio Grande do Sul State as being composed by: *A. typica, P. (P.) cetaceum, H. pontoporiae, Corynosoma australe* and *Bolbosoma turbinella* (Acanthocephala: Polymorphidae). Marigo *et al.* (1999) found *H. pontoporiae* in the intestines of 68.4% of 19 franciscanas from Paraná and southern São Paulo states.

Recently, based on detailed morphological and geographical analysis, the acanthocephalan *Polymorphus arctocephali* became a junior synonym of *P. cetaceum* (Aznar *et al.*, 1999).

Nematodes are normally encountered in the second stomach and acantocephalans in the third and fourth stomachs, and some acantocephalans and trematodes species in the intestines (Kagei *et al*, 1976; Andrade, 1996; Aznar *et al.*, 2001).

Adult acanthocephalans are typically found in the intestines of vertebrates, however, *C. cetaceum* has been reported in the stomach of franciscanas. Aznar *et al.* (2001) investigated the ecological significance of this habitat by examining data on number, sex ratio, maturity status, biomass, and fecundity of *C. cetaceum* in different parts of the digestive tract of 44 franciscanas and concluded that the stomach should be considered the main habitat for *C. cetaceum.*

The adults of the trematode *H. pontoporiae* are mostly found in the anterior third of the intestines of franciscanas and the niches of immature forms decrease towards the posterior parts of the intestine. In high intensities the distribution of non-gravid worms expands and shift posteriorly. Therefore this trematode seems to exhibit a fixed ontogenic behavior that may result from pressures to make a specific adaptive habitat selection. This ontogenic habitat selection should be considered when interpreting niche shift patterns in order to provide accurate interpretations about competition of immune responses from field data (Aznar *et al.*, 1997a). This pattern of distribution has been observed in franciscanas from Buenos Aires Province, (Aznar *et al.*, 1997a), Rio Grande do Sul (Andrade *et al.*, 1997), Paraná and southern São Paulo states (Marigo *et al.*, 1999).

Most of the information usually refer to the parasites records, collaborating for their use as biological tags, since *Anisakis sp, P. cetaceum, H. pontoporiae* have been indicated as potential tag species (Aznar *et al.*, 1995; Aznar *et al.*, 1997b; Andrade *et al.*, 1997). Little information is provided regarding lesions. But it is fair to assume that most of them do not cause severe harm to their hosts because this is one of the main criteria for their use as biological markers (Mackenzie, 1987).

In Argentina, Raga *et al.* (1994) described *H. pontoporiae* with infection intensity of 8 to 1,023 parasites, with no apparent pathological lesions. One case in Rio Grande do Sul, where 844 *H. pontoporiae* were found in the small intestine, no gross lesions were observed either. Minor gross changes in the texture and coloration of the gastric mucosa were observed to occur only around the location where the proboscis of *P. (P.) cetaceum* was attached, and were not considered severe. However, in some hosts heavily infected by this acantocephalans, mechanic obstruction and scarring of the mucosal surface could be responsible for minor changes in normal digestive process. In the same way, small stomach ulcers were associated with the nematode *A. typica* in 10% of the hosts, but may cause more damage in heavier infections (Andrade, 1996).

In franciscanas from Rio Grande do Sul, the parasite diversity was higher in mature than immature individuals, as well as higher in females than males, although the infection levels did not vary by sex of the host. Also the number of species of the component community was higher than those from Uruguayan and Argentine coasts (Andrade, 1996). Overall, the occurrence of a particular parasite in any geographic locality depends upon the presence of a suitable host, suitable intermediate host(s), and complex biological factors which impart a strict interdependency on the organisms comprising the host-parasite complex (Dailey and Vogelbein, 1991).

iv. Predation

Compiled by Daniel Danilewicz

There is very little information available on the natural mortality of franciscanas. Pilleri (1971), Brownell (1975a) and Praderi (1985) reported that some shark species (*Notorynchus cepedianus*, *Sphyrna* spp., *Galeocerdo cuvieri* and possibly *Eugomphodus taurus*) are predators of franciscanas caught in gillnets set for sharks and probably also on free-swimming dolphins along the Uruguayan coast. The authors' suggestion was later supported by stomach-content analyses of several shark species, as well as by the observations of incidentally caught franciscanas with fresh wounds and scars caused by shark bites. Praderi (1985) found franciscana remains in 17% and 4.3% of the stomachs of sevengill sharks (*N. cepedianus*) and hammerheads (*Sphyrna* spp.), respectively, examined in Uruguayan waters. Monzón *et al*. (1994) proposed that shark attacks could be an important factor in the natural mortality of this species. This study on predation rates of sharks on franciscanas found evidence of previous shark bite scars on dolphins incidentally caught along the Argentine coast. Some authors have suggested that killer whales are potential predators for this species due to the species overlapping distributions (Brownell, 1975; Castello, 1977). Nevertheless, Ott and Danilewicz (1998) reported the first confirmed case based on remains of three franciscanas in the stomach of a female killer whale stranded in southern Brazil.

v. Physiology

Compiled by Glauco Caon, Mônica Muelbert and André Monteiro da Rocha

There has been an increase in the current information about franciscana's physiology. However, the information is scattered and few studies are integrated. Brownell (1989), when reviewing the status of the species, reported that there was virtually no information about their physiology (the exception being the studies on relative haemoglobin mobility in Platanistidae and plasma fractions by DeMonte and Pilleri, 1971; 1977). Even though Brownell´s review of the status of franciscana dolphins is 15 year old and there has been a fair amount of work done recently regarding distribution, incidental mortality rates, parasites, pollution, reproduction and vital parameters estimates (see the Working Group Reports, in this volume), little progress has occurred in terms of general physiology.

Current information about physiological aspects of franciscana, ongoing research and some future prospects to provide a better understanding of the biology and ecology are presented.

Indicators of health and condition

Body Fat Condition

a. Morphometric measurements

Morphometric measurements to estimate body fat condition of franciscanas, such as blubber mass (epidermis and blubber layer), axillary girth and blubber thickness (American Society of Mammalogists, 1961) were used by Caon and Fialho (1999) to estimate body fat condition from franciscanas accidentally caught in gillnet fisheries from Rio Grande do Sul State, southern Brazil. Their results showed that for adults, mean of blubber weight observed was 24.32% (SD = ±1.43; n=8) of total body weight (total length (LT)= 143.5cm ±11.08; n=8). Calve blubber weight represented 33.95% ±4.07% of total body weight (LT = 75.6cm ± 5.77; n=5). Kamiya and Yamasaki (1974) found similar relative blubber weights for Uruguayan animals. The smallest dolphin (0.85 cm) sampled had a blubber weight of about 35.8% of total body weight while blubber weight for the largest specimen represented about 25.5% (1.71 cm).

Caon (1998) used indirect measurements of axillary girth and blubber thickness in his work to estimate fat reserves. Axillary girth measured preferentially between pectoral flipper and dorsal fin has often been used to estimate body fat condition since it shows a high correlation with blubber weight (r=0.95). Blubber thickness has the lowest correlation with blubber weight in all 19 sites analyzed (r extension = 0.02-0.555, most frequent < 0.35; n extension = 36-54), turning unable to use this measurement to estimate body fat condition.

b. Relative Condition Coefficient (Kn)

This coefficient, defined as the relationship between the actual blubber mass and estimated blubber mass (Le Cren, 1951), was used by Caon (1998) to describe seasonal variation on fat reserves available to franciscanas during warm and cold months. In his study, this coefficient oscillated around 1.0, with values above "one" indicating gain in blubber mass while values below "one" corresponded to the lowest levels of energy stores recorded. He also investigated the occurrence of sex differences in energy stores. His results indicated that male energy stores exhibited no change throughout the year (Kn=1 in both warm and cold months) while female energy stores were higher in cold months (Kn=1.09 as opposed to Kn=0.91 in warm months), probably as a result of the female's preparation for the reproductive season. This finding is consistent with the seasonal reproductive pattern exhibited by franciscanas in the southern range of its distribution (Danilewicz *et al.*, 2000b).

Blubber Composition

Recent studies have looked at lipid composition from blubber samples of different regions of *P. blainvillei* from a qualitative standpoint as well as quantitative analysis of lipid contents (Caon and Kucharski, 2000). Preliminary results of this study report on total lipid concentration as well as triglycerids. Extraction of lipids followed the methodology described by Folch *et al.* (1957), using the sulfophosphovanilin method for total lipids and the trinder-enzimatic for triglycerids.

Concentration of total lipid was 369.27 mg/g (SD= ±65.48 mg/g; n=10) to males and 296.85 mg/g (SD= ±33.99 mg/g; n=5) to females. Through the year, including both sexes, this concentration was 357.43 mg/g (SD= ±69.91 mg/g; n=9) in summer/spring months and 318.60 mg/g (SD= ±58.86 mg/g; n=5) in autumn/winter. Triglycerid concentrations were 4.63 mg/g (SD= ±1.69 mg/g; n=3) in males and 7.91 mg/g (SD= ±1.66 mg/g; n=4) in females, and 7.05 mg/g (SD= ±3.01. mg/g; n=3) in cold months to 6.1 mg/g (SD= ±1.03 mg/g; n=4) in warm months.

Total lipid concentration in blubber varied along the Brazilian coast. Concentrations in animals from Rio Grande do Sul State (RS) were 81.30% (373.78 ± 52.34 mg/g; n= 26) higher than in the individuals from Paraná State (206.17 ± 16.63mg/g; n=21), and this difference was significant (P<0.05). Blubber concentration from individuals from RS were also 75.10 % higher than the concentrations exhibited by individuals from São Paulo (213.47 ± 58.38 mg/g; n=5), but given the small sample size of individuals from SP, no significant differences were detected.

Reproduction

Steroid Hormone Concentration

The blubber layer of marine mammals is a suitable tissue for the quantification of reproductive steroid hormones (Atef *et al.*, in press). Most of the available information on reproductive biology of franciscana was obtained from gonadal and body length observations from accidentally entangled individuals (e.g. Kasuya and Brownell, 1979; Harrison *et al.*, 1981; Danilewicz *et al.*, 2000b).

The methodology of hormone extraction was developed by Atef *et al.* (in press) and has been applied to blubber samples of franciscanas by Rocha *et al*. (2000), where preliminary results on hormone concentrations were presented. They found no significant differences among the different classes tested when the data were examined by a Kruskall-Wallis non-parametric test. Nevertheless, his study showed the feasibility of using hormones levels obtained from blubber samples as a tool for reproductive biology research.

Recommendations

It is important that future research in key areas attempt to integrate morphology, histology, endocrinology and ecology so that a better understanding of the key factors affecting the species survival can be gained. With the advance and development of new technologies, it is now possible to infer trophic relationships and diet composition from tissue samples obtained from different individuals and populations. Proper experimental design and standardized collection protocols are important assets for new research programmes (see annex).

Studies to assess fatty acids composition as indicators of food consumption and to identify franciscana populations as well as studies to verify the blubber influence on the thermoregulation process are recommended.

ANNEX

In this annex we present some suggestions for the general procedures to be adopted when collecting and storing blubber samples for the estimation of body fat condition, lipid composition and hormone concentration. Collection of samples and measurements ought to be taken at standard sampling sites and following standard procedures (Geraci and Lounsbury, 1993) in order to make estimates comparable.

Morphometric measurements:

- *Girths* (to the closest cm):

C1 - Girth anterior to pectoral flipper; C2 - Girth posterior to pectoral flipper; C3 - Girth between C2 and C4; C4 - Girth anterior to dorsal fin; C5 - Girth over umbilicus; C6 - Girth posterior to dorsal fin; and C7 - Girth over anus.

- *Blubber thickness* (to the closest mm):

Blubber Thickness							
Region	C1	C2	C3	C4	C5	C6	C7
DORSAL							
LATERAL							
VENTRAL							

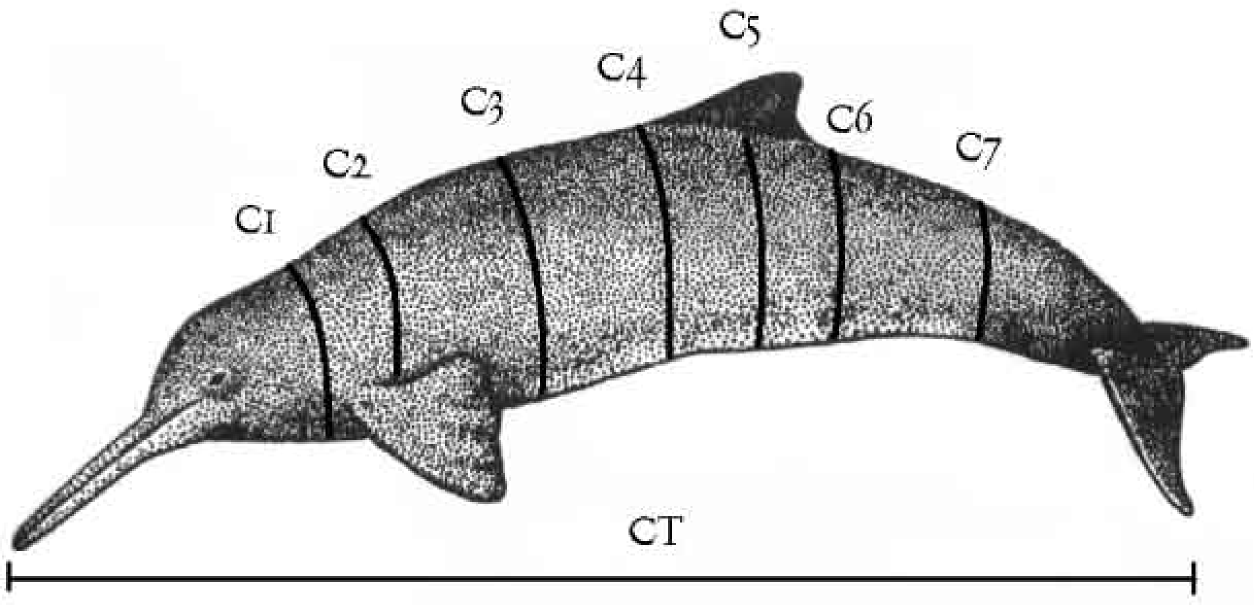
(Black boxes represent the dorsal fin at C5 and the anus at C7)

- *Blubber weight*: An estimate of total blubber weight (tBW) may be obtained through relationship between total body length (TL) and blubber weight adjusted to a regression equation. The blubber is weighted from the area around the ears to the base of the fluke, including the dorsal fin and excluding the flippers. The equation obtained for animals incidentally caught off northern Rio Grande do Sul State is: $tBW=0,0004xTL^{2,0339}$ (Caon, 1999).

- *Blubber samples*: The sampling method and the amount of sample to be obtained will depend mainly on the objectives of the study undertaken. Up to 400g of blubber and attached tissues can be easily obtained which may or may not include the full thickness layer and attached skin and muscle. The samples can be stored in tinfoil, then transferred to a solution of 2:1 Cloroform/Methanol containing 0.005% 2,6-di-ter-butly-4-methyl-phenol (BHT) and then stored frozen until analysis. Sampling could aim at estimating the composition of the blubber layer as a whole, or it could aim at different strata within the blubber layer.

- *Lipid extraction*: Lipid extraction from blubber samples could be performed according to Folch's method (Folch *et al.*, 1957), with sulfophosphovanilin when referring to total lipids, and using the Trinder-enzimatic method to estimate triglycerids and cholesterol. Fatty acid composition of blubber samples should be analyzed according to the methodology described by Iverson (1993), Koopman *et al.* (1996) and Smith *et al.* (1997)

- *Steroid hormone extraction from blubber*: One gram of blubber is to be weighed in a 50ml silanized tube and homogenized in 15ml of an alcohol:acetone (4:1) solution. The homogenate is to be centrifuged for 15 minutes at



Drawn by Daniela Weil (modified from HETZEL, B. and LODI, L. 1993. Baleias, Botos e Golfinhos - Guia de Identificação para o Brasil. Ed. Nova Fronteira. Rio de Janeiro. 279pp).

500G and the supernatant collected in a 15ml silanized tube to be dried in a warm bath (37°C) under a stream of compressed air. The resulting pellet is to be re-suspended in 5ml of an alcohol:acetone solution and centrifuged again for 15 minutes. This supernatant is to be also placed in the 15ml drying tube. After being dried, the extract received 5ml of ether and is to be vortexed and centrifuged for 15 minutes at 500G. The ether is to be transferred to another 15ml silanized tube and dried in a warm bath under a stream compressed air. The ether extract received 3ml of acetonitrile and is to be vortexed. Three milliliters of hexane are to be added to the tube, which is to be vortexed and centrifuged for 15 minutes at 500G. The two layers are to be separated into two new silanized tubes. The tube containing hexane received 2ml of acetonitrile and the other tube containing acetonitrile received 2ml of hexane. The tubes are to be vortexed, separated into new tubes, received acetonitrile or hexane once more and are to be left in a freezer (-20°C) for one hour. Finally, the hexane is to be discharged and the acetonitrile content is to be transferred to a final silanized tube for drying and stocking until it is to be re-suspended. The final samples are to be re-suspended with 5ml of methanol and are to be diluted in 1:2 phosphate saline buffer with gelatin 1% (pH 7,0) for radio immunoassay (RIA) performance. Progesterone and testosterone RIAs are to be performed according to the manufacturer's instructions and are to be counted in a beta counter.

vi. Pollution

Compiled by Diego Rodríguez and José Lailson Brito Jr.

Several studies have been conducted on pollution concentrations in franciscana tissues. These studies have included both heavy metals and organochlorines, and, dolphins from Brazil, Uruguay and Argentina, although no one study has covered animals across the entire distribution area of the species. Sample locations and contaminants determined in each study are summarised in Table 2. Mean concentrations of both heavy metals and organochlorines determined in each study are presented in Tables 3 and 4.

Organochlorines

O´Shea *et al*. (1980) were the first to document organochlorine concentrations in franciscana, analysing blubber, liver, kidney etc tissues from 8 dolphins incidentally taken in Uruguay.

Borrell *et al*. (1990; 1995; 1997) analysed blubber tissue from 74 franciscanas (43 males and 31 females) from Necochea (Buenos Aires Province, Argentina) derived from bycatch between 1988 and 1992. Concentrations of DDTs and PCBs were considered low and not regarded as a threat to this population. Concentrations of PCBs were similar to those found by O´Shea *et al*. (1980) for Uruguay. However concentrations of DDTs were considerably lower than those from Uruguay, suggesting a decrease in exposure in recent years. Variation among age and sex classes was found to be high. No differences were found for tDDT and PCBs concentrations between immature females and males, whereas adult males contained significantly higher concentrations than adult females. No significant differences in concentrations of PCBs were found with age in males, whereas adult females had considerably lower levels than immature females. Total DDT concentrations followed the opposite pattern, with older males containing higher concentrations and no differences

Table 2. Summary of the pollution studies performed on franciscana.

Area	Geographic Sector	Heavy Metals	PCBs	DDTs	Plastics	Reference
Uruguay (UR)	12		x	x		O'Shea *et al.* (1980)
Rio de Janeiro (BR)	4	x				Lailson Brito (2000); Lailson Brito *et al.* (2000; 2002)
Rio de Janeiro (BR)	4	x				Di Beneditto and Ramos (2000a)
Buenos Aires Province (AR)	13/14	x				Gerpe (1996); Gerpe *et al.* (2000; 2002)
Buenos Aires Province (AR)	13/14	x				Marcovecchio *et al* (1990; 1994)
Buenos Aires Province (AR)	13/14		x	x		Borrell *et al.* (1990; 1995; 1997)
Buenos Aires Province (AR)	13/14				x	Bastida *et al.* (2000)
Paraná (BR), Rio Grande do Sul (BR), Uruguay (UR) and Buenos Aires Province (AR)	6/10/12/13/14	x	x	x		Castello *et al.* (1997; 2000)
Rio Grande do Sul (BR)	10	x				Soares (1998)

References: (BR) Brazil, (UR) Uruguay and (AR) Argentina detected amongst females. Metabolic studies of the PCB congeners 174, 149 and 153 revealed a certain degree of metabolization in franciscana for congener 174 and, to a lesser extent, congener 149.

More recently in a study focusing on franciscana from Buenos Aires Province, Argentina and Rio Grande do Sul, Brazil, Castello *et al.* (2000) documented PCB values much higher in females from Buenos Aires Province than those from Rio Grande do Sul. The same samples were found to contain decreasing levels of PCBs with body length. PCB levels in males from both areas were comparable, with an increasing trend with body length. DDE values reported were lower than DDT, suggesting a low degradation rate.

Heavy Metals

Marcovecchio *et al.* (1990; 1994) first analysed 7 franciscanas from northern Argentina for heavy metals, reporting a similar organ distribution of heavy metals to those reported for other odontocete species. Muscle and liver tissues contained the highest concentrations of mercury, whereas the highest concentrations of cadmium were found in kidney tissues.

Gerpe (1996) and Gerpe *et al.* (2000; 2002) analysed several liver, kidney and muscle samples in 18 franciscanas (12 males and 6 females) from northern Argentina for mercury, cadmium, zinc and copper. For all heavy metals, adults contained significantly higher concentrations than

Table 3. Heavy Metal concentrations (mean ± SD, ppm) documented in franciscana.

Area	Age and Sex	Mercury			Cadmium			Reference
		Muscle	Liver	Kidney	Muscle	Liver	Kidney	
Rio de Janeiro State (Brazil)	Pooled		5.38 ± 10,99	1.36 ± 1,08		0.33 ± 0.40	0.29 ± 0.30	(1)
	Pooled	0.17 ± 0.08	1.13 ± 0.85		0.21 ± 0.07	0.11 ± 0.05		(2)
Rio Grande do Sul State (Brazil)	Pooled Females		2.19 ± 3.12	0.31 ± 0.14		0.30 ± 0.44	1.97 ± 3.32	(3)
	Pooled Males		13.97 ± 18.14	0.35 ± 0.19		1.41 ± 1.38	1.94 ± 1.96	(3)
Buenos Aires State (Argentina)	Pooled			0.56				(3)
	Pooled	3.0 ± 1.2	3.8 ± 1.6	1.9 ± 0.7	0.1 ± 0.1	3.3 ± 1.4	9.9 ± 3.9	(4)
	Pooled	0.71 ± 0.62	3.52 ± 2.93	0.65 ± 1.56	0.43 ± 0.41	1.12 ± 0.65	2.64 ± 1.85	(5)
	Pooled Males					ND		(3)
	Pooled Females					ND	0.56	(3)
Rio de Janeiro State (Brazil)	Pooled		38.85 ± 13.0	22.61 ± 9.50		4.19 ± 4.40	4.71 ± 3.80	(1)
	Pooled	27.0 ± 5.1	37.5 ± 8.75		5.2 ± 3.5	6.5 ± 4.7		(2)
Buenos Aires State (Argentina)	Pooled	49.30 ± 4.80	83.40 ± 40.0	79.4 ± 21.4	2.50 ± 1.50	16.0 ± 3.30	14.0 ± 4.90	(4)
	Pooled	10.99 ± 8.44	15.02 ± 9.08	8.82 ± 5.50	1.13 ± 0.75	7.44 ± 6.18	3.35 ± 2.36	(5)
Rio de Janeiro State (Brazil)	Pooled					223.76 ± 109.1	155.65 ± 49.4	(1)
	Pooled				376.5 ± 184.6	549.5 ± 211.2		(2)
Rio Grande do Sul State (Brazil)	Pooled Females		ND					(3)
	Pooled Males		ND					(3)
Buenos Aires State (Argentina)	Pooled Males		ND					(3)
	Pooled Females		ND					(3)
Rio de Janeiro State (Brazil)	Pooled		3.49 ± 1.60	0.85 ± 0.30				(1)
	Pooled					0.44 ± 0.29	0.41 ± 0.21	(2)

References: (ND) non-detectable concentration; (1) Lailson Brito (2000) and Lailson Brito *et al.* (2000; 2002); (2) Di Beneditto and Ramos (2000a); (3) Castello *et al.* (1997; 2000); (4) Marcovecchio *et al.* (1990; 1994); (5) Gerpe (1996) and Gerpe *et al.* (2000; 2002).

Table 4. Organochlorine concentrations (mean ± SD, ppm) documented in franciscana.

Area	Age & Sex	Compound						Reference
		PCB	tDDT	o'p'DDT	p'p'DDT	p'p'DDE	p'p'TDE	
Paraná State (Brazil)	Pooled Sexes	1.28 ± 0.48				1.28 ± 0.90		(1)
Rio Grande do Sul State (Brazil)	Pooled Males	3.49 ± 4.99				3.26 ± 4.64		(1)
	Pooled Females	1.69 ± 1.61				0.69 ± 0.75		(1)
Buenos Aires State (Argentina)	Immature Males	1.92 ± 1.01	1.33 ± 1.55	0.14 ± 0.16	0.38 ± 0.40	0.98 ± 1.08	0.14 ± 0.14	(2)
	Mature Males	2.51 ± 1.25	2.54 ± 2.15	0.23 ± 0.22	0.74 ± 0.68	1.67 ± 1.27	0.21 ± 0.15	(2)
	Pooled Males	3.22 ± 3.98				0.79 ± 0.71		(1)
	Immature Females	1.72 ± 0.73	1.26 ± 0.95	0.12 ± 0.08	0.39 ± 0.31	0.95 ± 0.62	0.16 ± 0.12	(2)
	Mature Females	0.96 ± 0.33	0.51 ± 0.27	0.05 ± 0.02	0.15 ± 0.10	0.30 ± 0.18	0.30 ± 0.18	(2)
	Pooled Females	3.35 ± 1.95				0.75 ± 0.40		(1)

References: (1) Castello *et al*. (1997, 2000); (2) Borrell *et al*. (1990, 1995, 1997).

juveniles, suggesting a bioaccumulation process, but no sexual differences were found. Body and organ burdens were calculated and revealed age-specific differences in accumulation rates. Maximum mercury, zinc and copper burdens in juveniles were found in muscle tissues and maximum burdens for cadmium were found in the liver. Adults, however appeared to show the opposite trend with maximum cadmium burdens in muscle tissues and maximum mercury, zinc and copper burdens in liver tissues. Non-essential heavy metals increased linearly with body length, whereas essential heavy metals fitted to linear length-concentration curves. The one foetus analysed contained significantly lower Zinc and Copper concentrations than its mother, with non-detectable total Mercury and Cadmium concentrations in muscle, liver and kidney. The placenta appears to behave as a barrier to mercury, zinc and copper transference, with some transference of cadmium occurring.

Soares (1998) conducted a methodological study in an effort to determine lead concentrations in the skeletal systems of cetaceans. This study reported low levels (<1.33ppm) of lead in some bones (Skull, Vertebrae, Lower Jaw, Ribs and Scapula) of one franciscana from Rio Grande do Sul, Brazil.

Castello *et al*. (2000) analysed tissues from franciscanas from Brazil (n=23), Uruguay (n=2) and Argentina (n=11) for mercury, lead and cadmium. Low levels of all heavy metals were recorded, however those animals from southern Brazil contained higher concentrations of mercury than those from northern Argentina. Very low (< 0.5ppm) or non-detectable levels of cadmium and lead were found in 47.5% and 95.0% of the dolphins, respectively.

Lailson-Brito (2000) and Lailson-Brito *et al*. (2000; 2002) analysed the liver and kidney tissues of 17 franciscanas from Rio de Janeiro State (Brazil) for the trace metals Fe, Cu, Zn, Mn, Hg, Cd and Pb. All essential trace metals (Fe, Cu, Zn, Mn) were present in higher concentrations in liver tissues than in kidney tissues. No sexual differences in these metals were found. Both mercury and cadmium (renal and hepatic) were positively correlated to body length, whereas hepatic manganese was negatively correlated to body length. A significant positive correlation between heavy metal concentration and age was confirmed for hepatic Hg and Cd, and renal Hg, although renal Cd appeared to also be positively correlated to age. This however was not a significant correlation. A limited transference of metal concentrations was found to occur across the placenta and overall concentrations were influenced by dietary habits of the franciscana.

Di Beneditto and Ramos (2000a) also reported trace metal concentrations (Cd, Zn, Hg, Fe, Cu and Cr) in 7 franciscanas from northern Rio de Janeiro State (Brazil). The organ/tissue distribution found was similar to that in Lailson Brito *et al.* (2000): Hg, Zn, Fe, Cu liver >> kidney; Cd, Cu kidney >> liver. The limited movements of franciscanas recorded in that area and the proximity of the distribution of this population to the mouth of the Paraíba do Sul River, suggests that concentrations found in the tissues of these animals may be related to concentrations of metals deposited in the outflow of the river.

Plastics

Bastida *et al.* (2000) documented the ingestion of plastic debris by franciscana from northern Argentina in 31% of 68 stomach content samples analysed. Cellophane packages were the most frequent items observed (45%), followed by fishing debris (32%) and plastic fragments (16%). This ingestion appeared to begin at the end of the first year of life, coinciding with weaning,. Differences in the items ingested by estuarine and marine dolphins were found, with a higher frequency of fishing-associated debris found in estuarine dolphins (estuarine: 36%; marine: 14%) and cellophane packages in marine dolphins (estuarine: 35%; marine: 72%). These differences were attributed to the presence of high fishing effort in estuarine areas, and a high tourist presence during summer in marine areas. Bassoi (1997) also reported the presence of plastic ingestion in franciscana from Rio Grande do Sul, where 17% of the 36 dolphins analysed had ingested net debris and 6% plastics.

Occasional records of plastic debris ingestion have also been reported from the Santa Catarina (Cremer, pers. comm.), Paraná, São Paulo (Rosas, pers. comm.) and Rio de Janeiro (Ramos and Di Beneditto, pers. comm.) states in Brazil.

vii. Pathology

Compiled by Valéria Ruoppolo• and José Luiz Catão-Dias

The causes of disease and natural mortality of *Pontoporia blainvillei* are poorly known. However, continued incidental mortality in fishing nets occurs throughout most of its range and represents the main threat (Praderi *et al.*, 1989; Secchi *et al.*, in press). Brownell (1989) mentions the occurrence of a single case of multifocal atherosclerotic lesions on the thoracic segment of the aorta and ulcers probably due to parasites in the forestomach of franciscanas. In Brazil, a survey of the infectious, parasitic, traumatic, metabolic and nutritional processes that may contribute or cause the death of these dolphins has been set up recently. Here we give some preliminary results of these investigations.

Since 1997, 84 freshly dead franciscanas, including individuals from strandings and incidental catches in fishing nets along the south and south-eastern coasts of Brazil, were examined for pathological conditions. Fragments of 1-2cm^3 were sampled from the main organs, fixed in 10% formalin and processed according to routine procedures for further histological examination. Whenever possible blood and fluids, as well as culture swabs and organ samples from lesions suspected of infectious etiology, were taken for bacteriological studies. Twenty-one franciscanas were also examined for the presence of metazoan parasites. All samples were stored to create a tissue bank in the Registry of Comparative Pathology of Zoo and Wild Animals, at the University of São Paulo, Brazil.

Gross lesions were observed in eleven animals in good nutritional condition taken in incidental fisheries. The most common external lesions were cuts made by the net entanglement. Internal lesions were mainly observed in the respiratory tract and consisted in lung oedema, emphysema and severe congestion. These findings have been previously described in other cetaceans species that died of asphyxia after entanglement (Kuiken *et al*., 1994; Kuiken *et al*., 1996). Calcified nodules were seen in the lungs of three dolphins, probably as a result of healed infections. Ongoing histological analysis may reveal the nature of the process. Multiple fluid filled cysts were observed in the ovaries of an adult female measuring 130cm, and weighing 21kg. Similar cysts have been reported in other species of cetaceans (Van Bressem *et al*., 1999) and may adversely affect reproduction. The urinary bladder was severely congested in three cases. Other unspecific findings include congestion of the stomach, liver, kidney and central nervous system.

Strains of *Pseudomonas aeruginosa* were cultured from the peripheral blood of a stranded neonate female held in a rehabilitation facility for 3 days, which may have caused its death due to septicemia. Dunn *et al.* (2001) mention Gram-negative isolates from diagnosed cases of marine mammal fatal septicemias, including the genus *Pseudomonas.*

Micrococcus sp. was isolated from the thoracic fluid of a young male accidentally taken in fisheries. The animal had a five cm scar on its abdomen, and the wound was possibly caused by a puncturing object that had ruptured the liver, crossed the diaphragm and reached the thoracic cavity. Fibrinous pleuropneumonia, lymphoadenomegaly of the nodes associated with the respiratory tract, hydropericardium, and ascitis were also observed in this dolphin and may have been a consequence of the healing wound. Fluid filled cysts in the pancreas and a penile hematoma were other necropsy findings. Microscopically, this animal showed cholesterol crystals on the edge of the lung parenchyma and an interstitial mixed pneumonia. *Staphylococcus* sp. was isolated from the lung samples. According to Higgins (2000), multiple bacterial organisms have already been reported as etiological agents in cetaceans, including *Salmonella* spp., *Klebsiella* spp., *Micrococcus* sp. and *Staphylococcus* sp.

At the time of writing all five samples cultured for yeasts and fungi were negative.

The intestinal trematode *Hadwenius pontoporiae* was the only metazoan parasite observed in 15 of the 21 (71.42%) *P. blainvillei* examined for these organisms. The mean intensity of infestation was 25.8 parasites per host. No gross lesions were associated with the presence of the parasites

• Contact e-mail: vruoppolo@hotmail.com.

(for more detailed information, see section on Parasites).

The continuity of studies that can contribute to better understand the natural history of the diseases affecting franciscanas is recommended.

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