



## Distribution, abundance and seasonality of cetaceans sighted during scheduled ferry crossings in the central Tyrrhenian Sea: 1989-1992

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### ABSTRACT

The results of a medium-term survey of cetaceans in the central Tyrrhenian Sea, the first ever all-year-round one to be made in the Mediterranean, are reported. Individuals of *Balaenoptera* sp. were sighted throughout the year, although with significant seasonal differences, in agreement with the hypothesis of a resident population making seasonal migrations around, but remaining inside the Mediterranean Sea. Striped dolphins (*Stenella coeruleoalba*), the most frequently observed species, are present all year round with no significant seasonal differences. Some observations on the presence and group structure of bottlenose dolphins (*Tursiops truncatus*) and Cuvier's beaked whale (*Ziphius cavirostris*) are reported. Individuals of four other species (*Physeter macrocephalus*, *Grampus griseus*, *Globicephala melana* and *Delphinus delphis*) were also sighted.

KEY WORDS: Cetacean - Ecology - Migration.

### ACKNOWLEDGEMENTS

Many people contributed to the success of this survey. We wish to thank: the volunteers who have participated in the observations, the Ente Ferrovie dello Stato (National Railways) and the Environmental Bureau of the Provincial Administration of Rome for sponsoring and supporting the research, and the crews of the ferries and the port staff of Civitavecchia and Golfo Aranci for their logistic help. We especially thank Philip Hammond of the Sea Mammal Research Group of Cambridge, Jonathan Gordon of the International Fund for Animal Welfare (IFAW), and Jeff Lake and Tim Gerrodette of the National Marine Fisheries Service (Seattle and San Diego) for their precious technical support and suggestions about data processing. Finally, we wish to thank the two anonymous referees for their valuable suggestions and contribution to the final draft of the manuscript.

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### INTRODUCTION

Research on the cetological fauna in the Mediterranean Sea has begun only recently by studying both strandings (see reports in «Centro Studi Cetacei», in «Atti Soc. it. Sci. nat., Mus. civ. Stor. nat. Milano» 1987, 1988, 1990, 1991, 1992) and direct sightings at sea (e.g., Giordano, 1983; Gannier & Gannier, 1989, 1990, 1992; Notarbartolo di Sciara *et al.*, 1993; Forcada *et al.*, 1994). Nevertheless, no extensive research at sea had been conducted all year long up to now, the surveys being usually carried out in summer, although a few occasional observations had been made in winter in the Corsican-Ligurian Sea (Palazzoli, 1983; Giordano, 1984; Gannier & Gannier, 1993). Generally speaking, winter stranding frequencies are affected by local meteorological and sea conditions, as well as by occasional diseases and the efficiency of the local survey network.

The abundance, distribution, and seasonality of the Mediterranean cetological species is still very poorly known. For example, the presence of *Balaenoptera physalus* all year long is still debated and some authors consider the specimens as coming from the Atlantic population only in the summer season (Duguy & Vallon, 1977; Viale, 1981). On the contrary, Marini *et al.* (1992b) hypothesized the existence of a relatively isolated stock (*sensu* IWC, 1977) of fin whale in the Mediterranean Sea. This hypothesis seems to be supported by recent results about the difference in genetic characteristics between Mediterranean and Atlantic specimens (Bérubé *et al.*, abstract in «Symposium on Marine Mammal Genetics», La Jolla, California, 23-24 September 1994).

In particular, the Tyrrhenian Sea has been very poorly investigated during sighting cruises, on account of the supposed 'shortage' of cetaceans in that area. To obtain data and relative abundance about their presence there, a sighting survey was carried out over three years, twice a week, and in all seasons. The aims of the research were: 1) to identify the most common species in the central Tyrrhenian Sea; 2) to determine any seasonal differences in the presence of the species; 3) to observe the distribution of the cetaceans in relation to the distance from the coast, the morphology of the sea-bottom and the trophic conditions of the sea; 4) to establish roughly the size of the populations of the most frequent species; 5) to study the behaviour of the animals related to the presence of large ships; 6) to test a sighting methodology and a data analysis system that could be used also in other similar researches.

In this article, the results concerning the first three points are reported; most of the work done in the first year consisted of testing and calibrating the chosen methodologies and materials. Results and evaluations about quantitative analyses of the genus *Balaenoptera* will be reported in a forthcoming paper, because of the complexity of the matter, while results concerning the point 5) with regard to *Stenella coeruleoalba* have already been reported (Angradi *et al.*, 1993). Obser-



variations about the testing of the methods (point 6, above) will be briefly discussed here.

## MATERIALS AND METHODS

Two hundred and forty-seven crossings were made from September 1989 to September 1992 between the harbours of Civitavecchia (north of Rome) and of Golfo Aranci (on the northeastern coast of Sardinia) and back (Fig. 1) on board the ferries of the National Railways. The crossing is about 120 nautical miles (nm) and takes about seven hours. In all, more than 29 000 nm were covered during more than 1 700 hours of observation. A couple of skilled observers inspected the area 360° around the ship: the observations were carried out from decks 11-15 m above sea level. The cruising speed of the ferries was between 15 and 18 knots.

Crossings and observations were carried out in all weather conditions: in the present paper, only the trips made in wind conditions equal to or lower than force 3 (Beaufort scale) for at least 75% of the crossing are considered. In view of this, the number of considered trips is 191 (1374 hours of observation), over more than 23 000 nm. Observations were usually carried out with the naked eye and the sightings were confirmed by 12x50 binoculars. During the crossings, sea and weather conditions were recorded; sighting positions were taken from the GPS (Global Positioning System) of the ferry. The size of groups, the presence of juveniles and some notes on the behaviour of the spotted animals were recorded, too. Chi-square and Kruskal-Wallis tests were used to analyse the spatial and temporal distribution of *Balaenoptera* sp. and *Stenella coeruleoalba*. To further investigate the geographic distribution of those animals, the transect was divided into six segments: two of them («A» and «F») coincide with the continental shelf (maximum depth 200 m), while the others («B», «C», «D» and «E») are 24 nm long, with an average depth, respectively, of 961 m, 1281 m, 1021 m, and 700 m (Fig. 1).

## RESULTS

### Relative abundance of the species

During the whole period of the research, 851 sightings, involving nine species of cetaceans, were recorded (Table I, Fig. 2). Of these sightings, 21.12% were of non-identified (NI) cetaceans: these animals were classified as

«small» (90 sightings), «medium» (19 sightings) and «large» (9 sightings), but on 62 occasions we were unable even to evaluate their size (NI). Out of the total, 747 sightings were recorded during trips carried out in fair sea and weather conditions (see above) and this reduction in number affects most of all the more common species. Sightings of *Stenella coeruleoalba* and of *Balaenoptera* sp. were, respectively, 375 (50.20%) and 116 (15.52% of those recorded in favourable conditions).

### Analysis of the data concerning each species

*Balaenoptera* sp. – It was often very difficult to determine the exact species of the large baleen whales, as the different species (for the Mediterranean, *B. physalus*, *B. borealis*, and *B. acutorostrata*) are very similar to each other when seen from afar, and only rarely were we able to observe the animals quite close. However, when careful observation was possible, the animals were always seen to belong to the *B. physalus* species. This is the only frequent species among the baleen whales to strand along the Mediterranean coasts and to have been observed during other surveys: *B. acutorostrata* is much smaller than *B. physalus*, and *B. borealis* is extremely rare in the Mediterranean (only one stranding along the Spanish coast, Casinos & Filella, 1977). In this perspective, most of the observed animals can be considered as *B. physalus*: in any case, if individuals of other species were observed, the component can be neglected for our purposes. Out of 123 sightings, 90 were of lone animals, 23 of couples, and 8 of groups composed of three animals: only on two occasions was the size of the group larger than three (11 and 6 individuals) (Table II). Calves were observed only in October 1989 (twice) and in May 1991. Five times, in January and June 1990, September 1991, and January and August 1992, some individuals were seen breaching (see Marini et al., 1996). *Balaenoptera* sp. was observed during all the months (Fig. 3): the Kruskal-Wallis test shows highly significant ( $P = 0.0002$ )

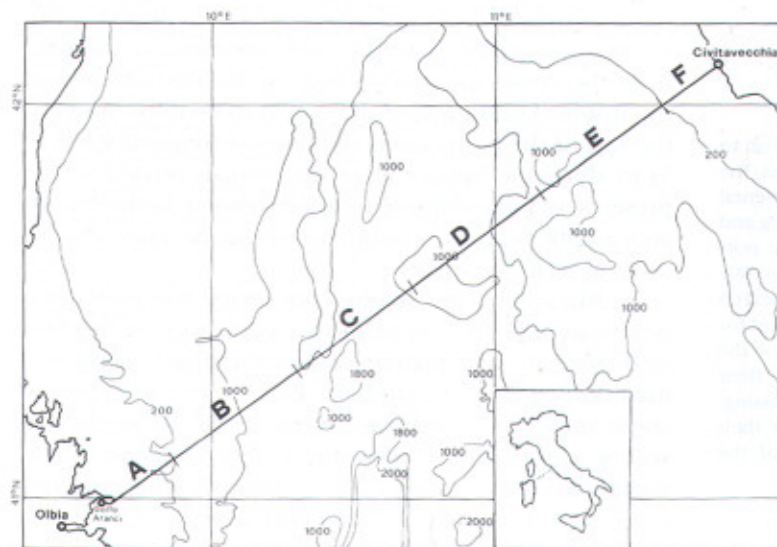


Fig. 1 - The research area and the transect in the central Tyrrhenian Sea.



TABLE I - Total sightings of cetaceans during the 1989-1992 survey in the central Tyrrhenian Sea.

	Trips	S.c.	T.t.	D.d.	G.g.	Z.c.	G.m.	P.m.	B. sp.	sNI	mNI	INI	NI	Total sightings per year
Sep.89	2	6												
Oct.89	8	15	2		3				4	1			2	
Nov.89	10	23	1	1					1	2		1	1	
Dec.89	7	14	1	1					1	2			2	
Jan.90	9	25			1				4		1		2	
Feb.90	7	12							4	4		1	4	
Mar.90	8	16							2	4	1	1	2	
Apr.90	8	14	3						5	4		1	5	
May.90	10	27	4		1				12	9	1	1	4	
Jun.90	8	28				1			7	2	1		5	
Jul.90	10	21	3	1					9	7		1	6	
Aug.90	8	25	2			1			6	8		1	3	
Sep.90	7	7	1						7	1	1		1	1st year
<b>Total 1st year</b>	<b>102</b>	<b>233</b>	<b>17</b>	<b>3</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>62</b>	<b>44</b>	<b>5</b>	<b>7</b>	<b>37</b>	<b>415</b>
Oct.90	8	15		1	1			1	6	3	1		4	
Nov.90	5	8											1	
Dec.90	4	6	1		2					1		1	1	
Jan.91	6	4							4	1		1	2	
Feb.91	4	3								1				
Mar.91	6	8			1		1		2					
Apr.91	4	12			2	1			5	1				
May.91	6	15	3		1		1		4		2		1	
Jun.91	7	12			1	1			3	2			1	
Jul.91	6	6	1		2				5				3	
Aug.91	5	10	3					1		6				
Sep.91	5	15	2						2	1			1	2nd year
<b>Total 2nd year</b>	<b>66</b>	<b>114</b>	<b>10</b>	<b>1</b>	<b>10</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>31</b>	<b>16</b>	<b>3</b>	<b>2</b>	<b>14</b>	<b>207</b>
Oct.91	4	3	2					1	3	1				
Nov.91	6	4	2	1						5				
Dec.91	4	5	4			1				3	1			
Jan.92	8	4							2		2		1	
Feb.92	9	18	1		1				3	4	2		2	
Mar.92	5	12							2				1	
Apr.92	8	8	1					1	2	3			3	
May.92	7	11	4		1	1		1	12		2			
Jun.92	10	21	3						3	3	2		3	
Jul.92	6	9	3	1		2				4				
Aug.92	8	10	3		1				1	4	1		1	
Sep.92	4	4			1	2			2	3	1			3rd year
<b>Total 3rd year</b>	<b>79</b>	<b>109</b>	<b>23</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>0</b>	<b>3</b>	<b>30</b>	<b>30</b>	<b>11</b>	<b>0</b>	<b>11</b>	<b>229</b>
<b>Overall total of sightings</b>														
<b>Overall total</b>	<b>247</b>	<b>456</b>	<b>50</b>	<b>6</b>	<b>19</b>	<b>10</b>	<b>2</b>	<b>5</b>	<b>123</b>	<b>90</b>	<b>19</b>	<b>9</b>	<b>62</b>	<b>851</b>

S.c.: *Stenella coeruleoalba*T.t.: *Tursiops truncatus*D.d.: *Delphinus delphis*G.g.: *Grampus griseus*G.m.: *Globicephala melas*P.m.: *Physeter macrocephalus*B. sp.: *Balaenoptera* sp.Z.c.: *Ziphius cavirostris*

sNI: small-size non-identified cetaceans

mNI: medium-size non-identified cetaceans

INI: large-size non-identified cetaceans

NI: non-identified cetaceans

interseasonal differences, with maximum values in April-May and minimum ones from November to March. A secondary peak in the number of sightings can be observed during the period September-October. In the first year, a maximum in the presence was observed during the summer. The slightly significant difference

( $P = 0.048$ ) between the three years is due to the fairly high number of observations recorded during the summer months of the first year. Concerning the spatial distribution, *Balaenoptera* sp. was observed above the continental shelf only six times during the whole research: the greatest number of sightings (80% of the total)



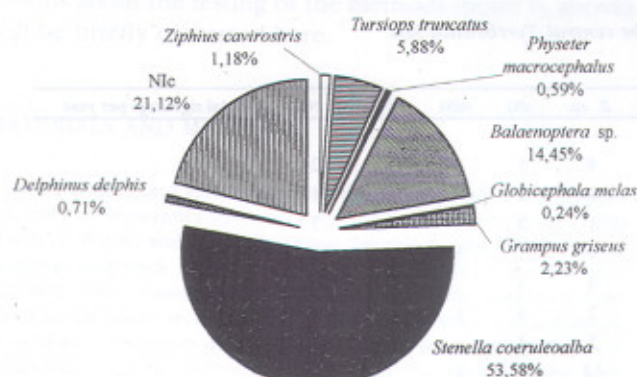


Fig. 2 - Relative abundance of the observed species. Species not identified are denoted as «Nlc».

was recorded in «B», «C» and «D» areas and presents no significant variations in the course of the second and third years, while in the first year there was a significant difference ( $P < 0.001$ ) between the sightings recorded in the «B» and «C» areas and those in the other areas. To evidence any shift in the use of the different areas, apart from the continental shelf ones, a chi-square test was applied to the sightings grouped per season for each year: the result does not show any significant difference.

*Physeter macrocephalus* - We observed individuals of this species only on rare occasions during the whole research. Figure 4 shows the distribution of the sightings. Four times out of five the sightings concerned a lone animal (Table II). In August 1991, a couple was observed: during this sighting one of the individuals was seen breaching.

*Ziphius cavirostris* - The sightings of individuals of this species were recorded prevalently in spring and sum-

TABLE II - Group size statistics for cetaceans observed in the central Tyrrhenian Sea during scheduled ferry crossing between 1989 and 1992.

Species	n	Range	$\bar{X}$	SD	SE
<i>Balaenoptera</i> sp.	123	1-11	1.44	1.18	0.11
<i>Physeter macrocephalus</i>	5	1-2	1.20	0.45	0.20
<i>Ziphius cavirostris</i>	10	1-2	1.70	0.48	0.15
<i>Grampus griseus</i>	19	1-9	4.95	7.92	1.81
<i>Delphinus delphis</i>	6	1-4	2.00	1.41	0.63
<i>Stenella coeruleoalba</i>	456	1-45	7.63	7.65	0.36
<i>Tursiops truncatus</i> (Continental coast)	11	1-18	6.27	4.82	1.45
<i>Tursiops truncatus</i> (Sardinian coast)	33	1-6	2.91	1.89	0.33

n, total number of groups sighted;  $\bar{X}$ , number of animals per group; SD, standard deviation; SE, standard error of the mean.

mer (Table I). Most of the observations were of groups of two animals: sometimes, it was an adult (maybe a female) with a calf, otherwise the individuals were of similar size (see also Marini et al., 1992a) (Table II). In most cases (60%), the animals were not frightened by the ferries, and swam quite slowly; a low and not very substantial blow was observed on a few occasions. Figure 4 shows the distribution of the sightings.

*Tursiops truncatus* - The sightings of this species were recorded, most of all, close to both the continental shelves, and this confirms the coastal habitat of *Tursiops truncatus*. The majority of the observations was recorded close to the Sardinian coast ( $n = 33$ ): only 11 sightings were reported above the peninsular shelf and 6 were observed offshore. In 25 sightings, the school size ranged from three to ten individuals: schools larger than ten individuals were observed only twice (November 1989 and August 1992) and both times in the peninsular coastal waters (Table II). Calves were observed in July, September, and October.

*Grampus griseus* - On 13 occasions out of 19, more than two individuals per group were observed mainly with three to six animals per group (Table II); only once was the total number greater than eight. The animals were never frightened by the ferries and remained uninterested. Figure 4 shows the distribution of the sightings.

*Delphinus delphis* - This species was observed less than expected. Four times out of six, the sightings were reported in relatively shallow areas, close to the continental slopes (Fig. 4). We observed lone animals or small schools (four or five individuals) (Table II): twice some animals associated with larger schools of *Stenella coeruleoalba* were recorded, but we were not able to ascertain whether the two species were together only temporarily (e.g., for feeding purposes) or not. Calves were observed twice (July and October 1990). The individuals did not seem to be frightened by the ferries.

*Stenella coeruleoalba* - Sightings of individuals of *S. coeruleoalba* were recorded throughout the research,

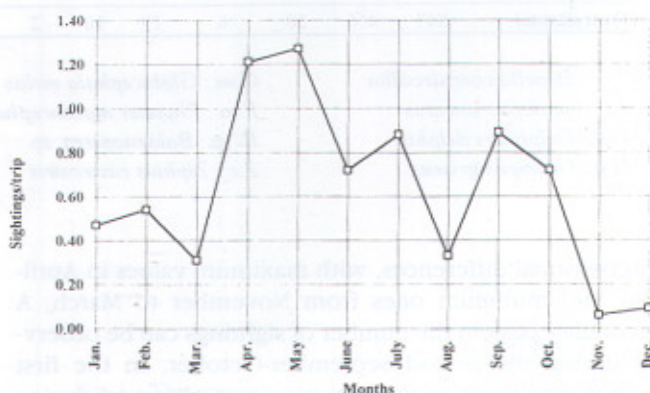
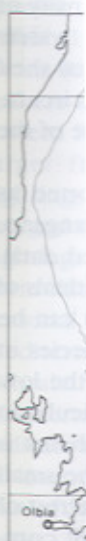


Fig. 3 - Sightings of *Balaenoptera* sp. Data from three years.



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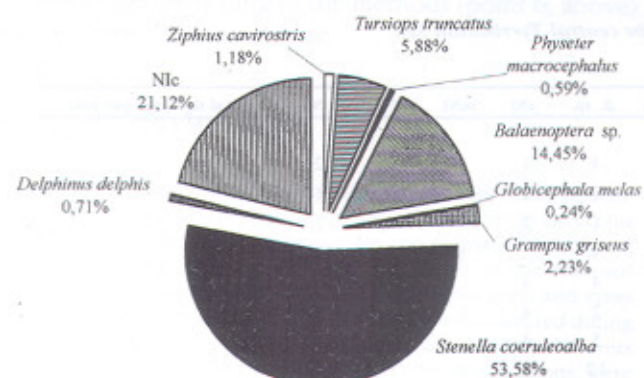


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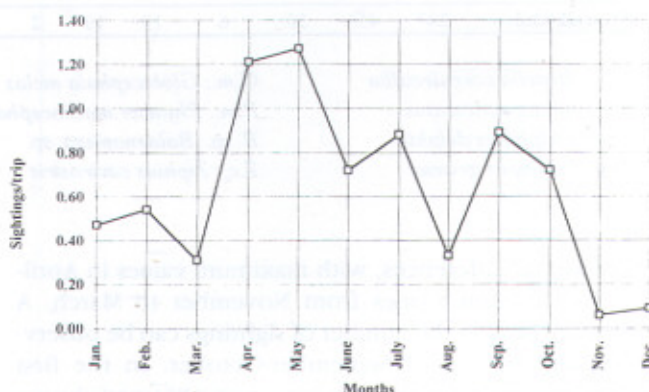


Fig. 3 - Sightings of *Balaenoptera* sp. Data from three years.



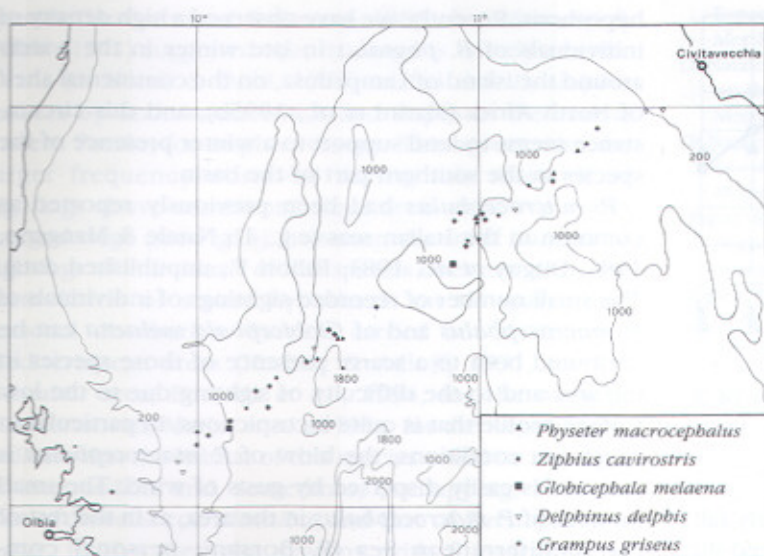


Fig. 4 - Distribution of sightings of some species.

with a higher frequency during the first year. School size was quite varied, lone animals as well as large groups being observed. Calves were observed in all months except September and November 1990 and June 1991 in the first two years: in the third year they were sighted only in December 1991, and March, June and August 1992. The greatest number of calves was observed in August (first year), February (second year) and December and March (third year). The 'attraction' effect of the large ship on *S. coeruleoalba* was observed in 79.3% of the cases (see also Angradi *et al.*, 1993): this made it impossible to evaluate numerically the population with 'transect line' methodology, because it would have brought about an overestimation of the density in the area (see Hammond, 1986, for a review).

Striped dolphins were observed during all the seasons, although with a slight predominance in spring and summer. Figure 5 shows the distribution of the sightings frequencies during the three years. The Kruskal-Wallis test does not show significant differences among the seasons. Individuals of *S. coeruleoalba* were observed within 300 m of the ship in 73.84% of the occasions. Morphological features of *S. coeruleoalba* are very similar to those of *Delphinus delphis* and the species are fairly easily confused at great distance: so, all observed animals whose characteristics were not sufficient to distinguish the species were classified as «Small Non-Identified». Because of the high percentage of sightings of *S. coeruleoalba* compared to the other species of delphinids in this research, it seems right to include the sightings of «Small Non-Identified» dolphins under those of *S. coeruleoalba* (Fig. 5). The Kruskal-Wallis test does not show any interseasonal differences, in this case either. Sightings of individuals of *S. coeruleoalba* were recorded all along the transect, during the whole research, with a minimum in the coastal waters («A» and «F»), this being a pelagic species. Considering the research as a whole, the chi-square test does not show significant differences in the spatial distribution of *S. coeruleoalba*;

however, there is a slightly significant ( $P < 0.05$ ) higher presence of these animals in the western part of the transect in the first year.

#### DISCUSSION

This research is the first one to have been carried out in the Mediterranean Sea outside the summer months and in a continuous way: this enabled observation and evaluation of the seasonal distribution of the cetological fauna in the area. Evidently, some limit was imposed by the kind of boats used. The speed of the ferries and the impossibility to approach or follow the animals made it difficult to identify small-sized species at a long distance. Moreover, it was impossible to carry out the planned photo identification of the individual specimens. As reported above, the attraction to the ships' engines for *Stenella coeruleoalba* made the quantitative evaluation of the population impossible. On the other hand, the noise could be responsible for the scarcity of sightings of individuals of some species, such as *Physeter macrocephalus* and *Globicephala melaena*, that might have been frightened. The presence of the ships does not seem to have affected the behaviour of the other sighted species.

Visibility from the decks was certainly suitable even with non-ideal sea and meteorological conditions and over long distances (up to and over 3 nm, for large-size cetaceans). The choice of using ferry boats as a 'platform of opportunity' proved very satisfactory and useful for other researches along different routes, too: in fact, our group adopted it during a cetological survey in the Aegean Sea in the summer of 1993 and 1994, with good results (Carpentieri *et al.*, 1994).

Many and various points of interest arise from the results that have been summarized above. The presence of individuals of the genus *Balaenoptera* throughout the whole year has been ascertained, with a significant



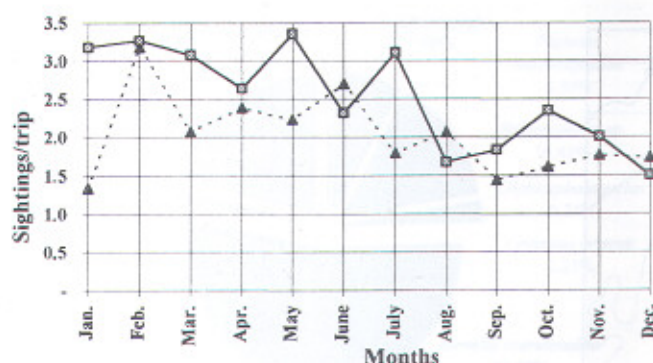


Fig. 5 - Sightings of *Stenella coeruleoalba* (—▲—) and of *S. coeruleoalba* sNI (---■---). Data from three years.

maximum in the spring and in the late summer-early fall, and a minimum in the winter months. The observed differences between the first and the following summers could be explained by the surface temperatures of the water, that were lower in the summer of 1990 (24° C in August) compared to the other summers (26° C in August, both years): this could have induced changes in the development at the level of the primary production, influencing the upper level of the food chain. The same explanation could justify the larger presence both of individuals of *Balaenoptera* sp. and *Stenella coeruleoalba* in the western part of the transect during the first year.

Some strandings of specimens of *Balaenoptera physalus* along the North African coasts have been reported in most of the winter months (Ktari-Chakroun, 1980, 1981; Ben Mustapha, 1986; El Bouali, unpublished data; Lamrini, 1989; Zenasni, 1989). Considering the hypothesis of the existence of a Mediterranean stock of *B. physalus* which would be relatively separated from the Atlantic ones (Marini *et al.*, 1992b), a further framework for the migrations of this species inside the Mediterranean Sea can be put forward. *B. physalus* was mainly observed in the Tyrrhenian Sea in autumn, in the North African waters in winter, in the Tyrrhenian Sea again and with a higher frequency compared to the other seasons, in spring, and in the Ligurian Sea (with very high densities), the Tyrrhenian Sea, the western Mediterranean and the Ionian Sea in summer. This suggests seasonal migrations of this species from the Ligurian Sea, which is probably the primary feeding area (Orsi Relini *et al.*, 1992), to the southern waters, which could represent breeding areas and, perhaps, subsidiary trophic areas: in this perspective, the Tyrrhenian Sea and the western Mediterranean could be transit areas. There is no evidence to support the hypothesis of massive migrations through the Strait of Gibraltar (Viale, 1981); moreover, the absence of sightings of *B. physalus* in that area in winter months (Hashmi & Adloff, 1991), seems to confirm the absence of migration between the Mediterranean Sea and the Atlantic Ocean.

Winter research in the southern waters of the Mediterranean is strongly needed to confirm, or not, our

hypothesis. Recently, we have observed a high density of individuals of *B. physalus* in late winter in the waters around the island of Lampedusa, on the continental shelf of North Africa (Marini *et al.*, 1995b), and this circumstance seems to lend support to a winter presence of the species in the southern part of the basin.

*P. macrocephalus* had been previously reported as common in the Italian seas (e.g., Di Natale & Mangano, 1983; Duguy *et al.*, 1983; Fabbri F., unpublished data). The small number of recorded sightings of individuals of *P. macrocephalus* and of *Globicephala melaena* can be attributed both to a scarce presence of those species in the area and to the difficulty of sighting due to the low surface profile that is quite inconspicuous, in particular in rough sea conditions; the blow of *P. macrocephalus* is low and is easily dispersed by gusts of wind. The small number of *P. macrocephalus* in the area, as in the rest of the Mediterranean Sea (F. Borsani, personal communication), could be imputed to the high impact that the driftnets for the fishing of swordfish seem to have on this species, because of its morphology and behaviour (Di Natale & Mangano, 1989): even if quantitative estimates in the past are lacking, Bolognari's papers (1949, 1950, 1951) surely seem to refer to more 'substantial' stocks.

As far as *Stenella coeruleoalba* is concerned, it appears to be the most common species in this area of the Mediterranean. Evidently, the presence of this species is almost constant throughout the year and along the whole transect, outside the continental shelf areas. This confirms its pelagic habitat that had previously been shown by other authors. Mean school size is surely much smaller than those observed in the western Pacific Ocean ( $x = 101$ , Miyashita, 1992) and slightly smaller than that reported by Forcada *et al.* (1994) for the western Mediterranean ( $x = 13.2$ , except the Alboran Sea, where  $x = 71.7$ ).

*Ziphius cavirostris* was considered rare in Mediterranean waters (Cagnolaro *et al.*, 1983) but the relatively high number of sightings which we recorded suggests a fair frequency of this species in the central Tyrrhenian Sea, particularly in the spring months. Heyning (1989) reports that the pod size of *Z. cavirostris* in the eastern tropical Pacific is mainly from one to four individuals: similarly, the sightings recorded during the present study seem to indicate that the couple constitutes the typical structure of the pods in this area. Data about pod composition by age and sex are lacking.

Individuals of *Grampus griseus* were observed in almost all months, although the presence of calves was recorded only in October, in two different years. Fabbri *et al.* (1992) indicate a relationship between depth, distance from the coast and the presence of *G. griseus* above the continental slope of the Ligurian Sea: on the contrary, our data show that the spatial distribution of the sightings is quite uniform with no preference for particular areas.

*D. delphis* is generally regarded as a pelagic habitat



species (Leatherwood & Reeves, 1983), but Marcuzzi & Pilleri (1971) suggested that its range is mainly coastal. Evans (in Norris & Dohl, 1988) related that *D. delphis* gathers by underwater reliefs and slopes in the central eastern Pacific, for trophic reasons. This agrees with the larger frequency observed during this research of sightings above continental slope areas or above a submerged ridge (see Fig. 4): however, the small number of sightings of individuals of this species does not allow the formulation of a sure hypothesis on its spatial and seasonal distribution. Surveys carried out in different Mediterranean areas (Hashmi & Adloff, 1991, for the Gibraltar area; Forcada *et al.*, 1994, for the western Mediterranean; Marini *et al.*, 1995a, for the Aegean Sea), indicate that the habitat of this species could be regarded as intermediate and, sometimes, overlapping, between that of *Stenella coeruleoalba*, and that of *Tursiops truncatus*. In this area, the syntopy with *S. coeruleoalba* seems to be more frequent, in view of the sightings of mixed schools and absence of observations in coastal waters.

Sightings of *Tursiops truncatus* show a strong 'bipolar' distribution to the two ends of the transects with few sightings in pelagic waters, as pointed out also by other authors. It should be emphasized that the sightings along the continental coast have been recorded mainly in the summer months and with relatively large schools, so that a north-south migration pattern could be suspected. On the other hand, the schools at the Sardinian end have been observed all year long, confirming the results reported by Marini (Ph.D. dissertation, 1994) regarding the presence of a permanent population in that area. The sightings recorded in the Sardinian area show a shift towards deep waters by the animals in the summer months, probably because of the heavy disturbance due to the tourist boat traffic in that season.

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