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TECHNICAL REPORT ON THE STATE OF CETACEANS IN THE MEDITERRANEAN SEA

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INTRODUCTION

The presence of about 20 different cetacean species has been reported in the Mediterranean Sea, about half of which form part of Atlantic populations entering the sea only sporadically. Only nine small cetacean species and three large whales species are sighted frequently in the Mediterranean Sea. They are:

- Balaenoptera acutorostrata (Minke whale)
- Balaenoptera physalus (Fin whale)
- Delphinus delphis (Common dolphin)
- Globicephala melas (Long-finned pilot whale)
- Grampus griseus (Risso's dolphin)
- Orcinus orca (Killer whale)
- Physeter macrocephalus (Sperm whale)
- Pseudorca crassidens (False killer whale)
- Stenella coeruleoalba (Striped dolphin)
- Steno bredanensis (Rough-toothed dolphin)
- Tursiops truncatus (Bottlenose dolphin)
- Ziphius cavirostris (Cuvier's beaked whale)

Species distribution and frequency vary from coast to coast. The Mediterranean Sea can be divided into eastern and western basins, and species diversity and abundance differ greatly in the two areas. For several reasons, cetacean fauna in the western basin is much richer than in the east.

The western basin is subject to a greater Atlantic influence, and species and populations from that ocean occasionally enter the Mediterranean Sea through the Straits of Gibraltar, the only natural route of access from the Atlantic ocean. This has been evidenced by isolated instances of sightings of species such as the humpback whale (Megaptera novaeangliaea) close to the Balearic islands (Aguilar, 1989), ziphiids such as Blainville's beaked whale (Mesoplodon densirostris) or Sowerby's beaked whale (Mesoplodon bidens) stranded on Spanish shores (Casinos and Filella, 1981; Hershkovitz, 1966) and the dwarf sperm whale (Kogia simus) found in Italy (Centro Studi Cetacei, 1988). The harbour porpoise (Phocoena phocoena), once abundant in the Mediterranean, (Graells, 1889; Barcelo, 1875; Companyo, 1863), is now considered to have vanished from this sea, and the last details on their presence there dates back to the turn of this century. Only a very few exceptions exist, such as the case of the individuals found on African coasts in the last few years (Ktari-Chakroun, 1980; Duguy, Casinos et al, 1983) or in Southern Spain (Rey and Cendrero, 1982).

Wildlife richness in the western basin includes not only cetaceans, but also fish and other marine organisms. The Mediterranean Sea contains highly productive areas due to nutrient blooms generated by the winds, creating upwellings in areas like that between the Ligurian sea and the Gulf of Lyons, or the coasts of north Africa. This characteristic increases the concentration of marine organisms, including fish stocks and predators such as cetaceans.

Surface currents, which cross through the Straits of Gibraltar and circulate in the western part of the Mediterranean basin, are also an important factor in explaining the presence of cetaceans there. These currents are used by different shoals of fish, including tuna (Tunidae) and swordfish (Xiphias gladius), to aid them on their migration to breeding or spawning areas. The migrations are followed by predators, including killer whales and sperm whales, which enter the Mediterranean mostly in pursuit of migrating prey. Marine organisms have also been known to enter

the Mediterranean Sea through the Suez canal. Despite the large volume of maritime traffic in this area and the fact that the canal is man-made, which makes this a route of access which is far from ideal for cetaceans, there have been several instances of warm water species such as the Indo-Pacific humpback dolphin (Sousa chinensis), which exclusively inhabits the Indo-Pacific region, entering the canal and even reaching as far as Port Said in the Mediterranean Sea. For the most part, however, these are isolated cases and, save for killer whales and sperm whales, SRtwhich are sighted more frequently, other species cannot be considered part of the Mediterranean cetacean fauna.

It should be noted that there is still a great lack of information concerning the biology, behaviour and abundance of cetaceans in the Mediterranean. Data available so far serves only SRtto give a general overview of distribution and frequency in the different regions. Research has been based mainly on the systematic collection of data on stranded animals, accidental SRtcaptures by various types of fishing gear and information from privately owned vessels of sightings on the high seas. There are very few research programs on cetaceans in the Mediterranean, and they are mostly limited to specific areas and populations. Most data has been obtained for the western basin, while in the east information is very scarce.

1. POLLUTION

1.1 Organochlorines

In recent years, research has revealed an alarming trend in the circulation and accumulation of polychlorinated biphenyls (PCBs) and related organochlorine compounds in the oceans of the world. One consequence of particular concern is that marine mammals, as top predators, ingest relatively large amounts of these compounds, which are concentrated as they pass along the food chain. Although, by their very nature, marine mammals are difficult to study, evidence that they are being severely, and possibly irreversibly, impacted by these substances is growing. Furthermore, it is predicted that the impact already reported is going to become widespread.

PCBs can be taken as a good example of persistent, fat-soluble, ubiquitous environmental contaminants and, to a large extent, this review will focus on them. It should be noted, however, that these are only one family of marine contaminants and that other man-made chemicals may be contributing as much, if not more, to environmental problems. The fact that PCBs have been studied in recent years makes them a group of chemicals on which information is already available (Johnston and Simmonds, 1990). Their position at the top of the food chain means that dolphins have persistent chemicals passed to them via a series of accumulative steps. Organochlorine compounds entering the marine environment are typically hydrophobic and become associated with particles or plankton in the water. These are ingested by larger organisms which, in turn, are eaten by fish. At each step in the food chain the amounts of contaminants accumulated are concentrated. Concentrations of organochlorines reached in dolphins are thousands, if not millions, of times higher than those found in the surrounding sea water (see Table 1).PCB's, DDT (and its derivates) were also found in the subcutaneous fat of Mediterranean fin whales and, in total amounts, were greater than those found in the fat of the same species from NE Atlantic (Focardi S. et al, 1991).Marine mammal blubber, a fat store, is an ideal site for the accumulation of large quantities of lipophilic (fat soluble) chemicals such as PCBs, DDT and others. It is not, however, simply an inert store and there is believed to be continual exchange of chemicals between the blubber and the blood circulating through the body (Reijnders, 1986). This process is greatly accelerated at times when the animal is unable to feed and has to use its stored lipids, or when a female is lactating. Indeed, vast quantities of contaminants may well be passed b marine mammals in the milk to their young. Lactation allows females to shed an important proportion of contaminants which they accumulated prior to giving birth. Recent studies indicate that as much as 80 to 90% of contaminant residues in adult female dolphins may be passed to their first born calf (Tanabe, 1988: Cockcroft et al., 1989).

Recent research also indicates that marine mammals lack certain enzymes which may help terrestrial mammals to counteract PCB exposure to some extent (Tanabe, 1988 and Tanabe et al., 1988). This would make them more susceptible to the effects of contaminants and may relate directly to specific reproductive disorders already reported in some marine mammal populations.

Three main lines of research have exposed the correlation existing between the presence of contaminants and observable effects in marine mammals. One was carried out on the effects of PCBs and DDT on the reproductive abilities of pinnipeds (Reijnders, 1986). Reproductive disorders, such as abortions and pathological changes in the uterus have been observed in Californian sea lions (Zalophus californianus), Baltic ringed seals (Phoca hispida) and, more recently, in grey seals (Halichoerus grypus) living in the highly polluted waters of Mersey Bay in the U.K. (Baker, 1989). Harbour seals (Phoca vitulina) in the Wadden Sea do not show the same uterine pathology but their reproduction is known to also be impaired. In an experimental study, seals fed on highly PCB-contaminated fish were found to have reduced reproductive success, and other disorders which could lead to immuno-suppression (Brouwer et al., 1989).

Another area of pertinent research has focused on the declining population of belugas (Delphinapterus leucas) in Saint Lawrence Estuary. Martineau et al. (1987) concluded that organochlorine contamination should be considered as a prime cause for low recruitment observed within this population. There is ample evidence in the literature of PCBs being strong immunosuppressive agents (Safe, 1984), which may also contribute to mortality.

Studies on other small cetaceans have been carried out by Japanese scientists. They found a negative correlation existing between PCB and DDT levels in the tissues of Dall's porpoises (Phocaenoides dalli) in the North-West Pacific and levels of testosterone (male hormone) (Subramian et al., 1987). This could well affect the reproductive vigour of male porpoises.
Abnormalities in lipid metabolism, such as fatty livers, have also been detected in wild Japanese striped dolphins with high PCB and DDT levels in their tissues (Kawai et al., 1988).
Cockcroft et al. (1989) accepted that mortality of first born South African bottlenose dolphin calves could be caused by high contaminant concentrations in their mother's milk.

1.2 Heavy Metals and Other Pollutants

Organochlorine compounds reach the highest concentrations, but metal pollution is also present in high amounts in cetaceans. These contaminants have been found in the kidney, liver, blubber, muscle, skin, lung and brain tissue (Viale, 1978). Some metals are bioaccumulated by cetaceans as they are unable to excrete them. Different processes taking place in the dolphins metabolism bind lead, mercury and selenium in non biodegradable compounds.

Heavy metal concentrations in cetaceans are higher than in other animals. Dolphin tissues examined from the Mediterranean contained iron concentrations 8 times in excess of the maximum allowed in human diet, and 1,500 times higher in the case of mercury (Viale, 1978). A high proportion of the total concentration of mercury in contaminated marine animals is found as methylmercury (Martoja and Berry, 1980). Levels of methylmercury, the most toxic form of this metal, found in dolphins stranded in the Tyrrhenian coast were considered to be of great concern (Carlini and Fabbri, 1990), (See Table 2.)

1.3 Other pollutants

The impact of other pollutants has hardly been studied, and their effect on cetacean populations is largely unknown. Information is available only for isolated instances of oil contamination , based on dead animals found stranded on the shore with clear evidence of oiling. Particular attention has been paid to animals encased in oil or with oil residues in their buccal cavity or spiracle. Oil derived compounds, perhaps particularly the PAHs which also bioaccumulate in fatty tissues, are of considerable concern.

The excessive local use of pesticides introduces large amounts of pollutants, including HCH, HCB, dieldrin, aldrin, etc...., into the Mediterranean Sea. These compounds are more volatile than PCBs and DDT, and are therefore present at lower concentrations in dolphins, especially those of pelagic lifestyle. Until now, only the direct effects of contaminants on cetaceans have been contemplated, but these and other toxic compounds could also have an effect on the dolphins' prey, and on the ecosystem in general, by reducing its biological diversity and decreasing the food mass, thus indirectly affecting the cetacean fauna.

1.3 Marine mammal mass mortalities.

While the role played by pollution in mass mortalities is likely to remain controversial, considerable concern has been voiced that contaminants could be contributing to the major die-offs which have been witnessed in the last few years (see Harwood and Reijnders, 1988; Simmonds and Johston, 1989; Simmonds, 1991). Since 1987, five major marine mammal mortalities, affecting seals and dolphins, have taken place.

The most recent of these has affected the striped dolphin (Stenella coeruleoalba) population of the western Mediterranean. Dead and dying dolphins started to appear on beaches near Valencia in early July 1990. Since then, hundreds of dead bodies have been found along the Spanish, French and Italian coasts, and on the North African shores opposite. Only a small proportion of the affected animals are thought to have stranded and a full death toll may be several thousand (Aguilar and Raga, 1990).

Although pathogens have clearly been the trigger for some of these mortalities and epidemics have been known to occur in wild marine mammal populations before, the known immuno- suppressive effects of contaminants make it possible that they have contributed to the spread of these events. Immunosuppression could have encouraged the spread of infection. This and the additional chronic effects of organochlorines could hinder, or even prevent, recovery of individuals. Moreover, the effects of contaminants on reproductive systems could further hinder population recovery following mass mortalities.

Table 1

Levels of organochlorine contaminants in the adipose tissue of cetaceans in the Mediterranean.

(ppm lipid basis)

Spp	Place	NO.	Year	ppDDE	ppTDE	opDDT	ppDDT	tDDT	PCB	Ref.
D.d	France	1	1977	75	27		324	426	700	(1)
D.d	Catalo.	1	1978	650	147	7	31	835	2090	(2)
D.d	Catalo. (biopsy)	1	1987	23	5	8		36	92	(2)
S.c.	France	4	1973-77	264	23		62	349	367	(3)
S.c.	France	16		455				455	260	(4)
S.c.	Catalo.	1	1977-79					170	237	(5)
S.c.	Catalo.	17	1984-87	247	26	32	44	349	367	(2)
S.c.	Catalo. (biopsy)	78	1987-88	112	15	17	22	166	326	(2)
S.c.	Catalo.	5	1989	408	43	32	24	507	1320	(2)
S.c.	Catalo.	10	1989	78	8	12	17	115	237	(2)
T.t.	Italia	2	1975	96	34	22	49	201	384	(2)
T.t.	Castell.	1	1978	266	66	63	153	548	892	(2)
T.t.	Catalo.	1	1979	100	36	23	44	203	387	(2)
T.t.	Catalo.	3	1980					150	165	(5)
T.t.	Catalo.	1	1982	51	11	7	21	90	156	(2)
T.t.	Catalo.	1	1985	137	31	9	26	203	609	(2)
T.t.	Catalo. (biopsy)	1	1985	42	28	5	12	87	581	(2)
T.t.	Valencia	2	1988	164	12	8	13	197	490	(2)
T.t.	Catalo.	1	1989	222	30	32	28	312	950	(2)
G.g.	Catalo.	1	1978					133	294	(5)
G.g.	Catalo. (calf)	1	1984	296	106	5	12	419	790	(2)
Z.c.	Catalo.	1	1979					23	36	(6)
Z.c.	Catalo.	1	1985	58	16	8	30	112	200	(2)
Z.c.	Catalo.	1	1989	33	12	3	3	51	98	(2)
M.d.	Catalo.	1	1981	2.87	3.47	1.52	4.72	12.58	5.49	(5)
P.m.	Catalo.	1	1974					133	294	(5)
B.p.	Italia	9	1990	6.52		1.11	1.41	10.11	6.14	(7)

Catalo. = Catalonia
Castell. = Castellon

Table 2

Levels of heavy metals in Mediterranean cetaceans.

ppm fresh weight basis.

Sp	No.	Tissue	Fe	Ti	Cr	V	Hg	Pb	Cd	Se	Ref.
D.d	2	various-	22	0.12	0.04	0.02	5.30	0.16	0.01		(1)
			+380	1.60	0.30	0.10	604	0.21	1.21		
S.c.	2	various-	20	0.50	0.05		1.57				(1)
			+280				2.83				
S.c.	7	liver	-				200			60	(2)
			+				2250			770	
S.c.	6	kidney	-				42			20	(2)
			+				200			94	
T.t.	4	various-	13.6	0.05	0.07	0.01	0.67	0.23	0.03		(1)
			+669	7.30	1.04	2.12	14.60	4.25	2.22		
Z.c.	4	various-	28.3	0.10	0.25	0.20	1.60	0.03	0.02		(1)
			+174	2.65	2.50	3.30	440	8.53	28.37		
Z.c.	1	liver					1343			477	(3)
P.m.	1	various-	18	0.30	0.40	0.30	0.65	0.08	0.02		(1)
			+204	3.16	1.05	2.04	3.70	10.15	28.73		

D.d. Delphinus delphis; S.c. Stenella coeruleoalba; T.t. Tursiops truncatus; G.g. Grampus griseus; Z.c. Ziphius cavirostris; M.d. Mesoplodon densirostris; P.m. Physeter macrocephalus; B.p. Balaenoptera physalus

Organochlorines

(1) Vicente and Chabert, 1978.
(2) Aguilar and Borrell, not published
(3) Alzieu and Duguy, 1978.
(4) Alzieu and Duguy, 1979.
(5) Aguilar, 1983.
(6) Aguilar, Jover & Nadal, 1982.
(7) Focardi, Notarbartolo et al, 1991

Heavy metals

(1) D. Viale, 1978
(2) Y. Thibaud, 1978
(3) R. Martoja & J. P. Berry, 1980.

2. DIRECT AND INCIDENTAL CATCHES

2.1 Direct catches

Despite international agreements signed by many Mediterranean countries (Berne Convention, Bonn Convention, CITES, etc.), and national laws in some of these, cetacean mortality is an established fact in practically every Mediterranean coastal country. These deaths are the result of interactions with fishing activities, commercialization of cetacean meat and blubber, the use of cetacean meat as fishing bait and deliberate slaughter of individuals.

In certain countries, where interaction with the artisanal fishing fleet is high, fishermen often kill large numbers of cetaceans. This practice is actually fairly commonplace throughout the Mediterranean. Every year, dozens of dolphins are stranded on the shores with cuts, gashes or bullet wounds, caused mostly by fishermen in an effort to protect their fishing gear. In France alone, it is estimated that thousands of cetaceans die each year for these reasons (Duguy and Husenot, 1982). In Italy, between 1986 and 1987, 22 cetaceans were found stranded with evidence of bullet or harpoon wounds (Centro Studi Cetacei, 1987). Twelve 12 of them had had their dorsal muscular area removed, to be sold as food. Dolphin-hunting is known to have increased recently, and dolphin meat is sold to fishmongers and restaurants, particularly in Lazio, Toscana, Liguria and Sardegna. In Arbatax harbour there is talk of a small number of vessels carrying out this practice, while in Porto S. Stefano (Toscana) it seems that around 4 vessels capture dolphins as a side activity. Dolphin meat has been found in at least two restaurants and several food stores in the area. There are also cases of sale and consumer use of dolphin meat in Spain, and several fishermen have admitted to capturing these animals for salting and selling.

Several vessels capturing small cetaceans for use as bait are known to exist in harbours of Andalusia and Murcia. This bait is used in deep sea longlining and crustacean fishing. Its smell and texture make it a favorite in the shrimp fishery. It seems that none of these vessels are exclusively dedicated to these particular captures but some fishermen are more efficient than others at later selling the meat for bait.

It can therefore be stated that directed takes of cetaceans by fishermen in the Mediterranean are fairly commonplace and concerns must also be voiced about occasional shootings of cetaceans from recreational vessels as a sport.

2.2 Driftnets

Although the use of driftnets on a large scale in the Mediterranean started back in the late seventies, their use has only really become common over the last few years. At present, some one thousand fishing vessels are known to use driftnets (CFCM/ICCAT, 1990).

Although driftnets are supposed to target specific species, such as swordfish and tunids, their inherent non-selectivity (they entangle any creature which is larger than the mesh size) causes very high mortality of non-target fish and marine animal species, such as sea turtles and cetaceans. The largest driftnet fleet in the Mediterranean is Italian, with over 900 vessels which use nets between 3 and 40 kilometers in length, averaging 14 km per vessel (Di Natale and Mangano, 1990).

Cetacean captures are subject to variation, both in numbers and species, according to fishing grounds and seasons. The Italian vessels normally fish between the southern Tyrrhenian Sea in April and the Ligurian Sea in October. From August to September 1988 the capture of 37 cetaceans by driftnets was recorded in the Ligurian sea, of which 29 died and 8 were released (Podesta and Magnaghi, 1989). In another study carried out between 1986 and 1988 in Italy, the capture of 150 cetaceans was recorded: 24 sperm whales (Physeter macrocephalus), 2 goose-beaked whales (Ziphius cavirostris), 10 pilot whales (Globicephala melas), 5 Risso's dolphins (Grampus griseus), 13 bottlenose dolphins (Tursiops truncatus), 68 striped dolphins (Stenella coeruleoalba) and 28 others were unidentified (Notarbartolo de Sciara, 1989). As Di Natale (1989) reports, in 1988 12 individuals were also disentangled from driftnets: 7 sperm

whales, 4 pilot whales and one fin whale (Balaenoptera physalus).
Notarbartolo di Sciara's study, carried out over a three year period, is based on figures for stranded animals on Italian shores. This report records the number of stranded animals entangled in nets or with signs of injury caused by these nets. It must, however, be noted that most captured animals do not reach the shores (Di Natale, 1990) and are lost at sea, or sunk by fishermen who weigh the animals down with heavy objects such as rocks and batteries in an effort to reduce the number of stranded animals. It is estimated that thousands of cetaceans fall victim to these nets each year (Di Natale, 1990). In the case of some populations, such as the sperm whale and striped dolhin, it is believed that the use of these nets could drive them to extinction in the Mediterranean Sea (Notarbartolo Di Sciara, 1989). In 1985 a study was carried out on 67 recorded cases of strandings and captures of sperm whales in Italian waters, in an attempt to determine their cause. Conclusions were reached for 46 cases, and driftnets were established as the cause in 30 of them (Di Natale and Mangano, 1985). Three sperm whales were also found entangled in driftnets around the French coast in September 1988 (Maigret, 1989).

Cetaceans have also been found entangled in driftnets off North Africa. Ktari-Chakroun (1980) points out the sighting at sea of a group of 10 minke whales (Balaenoptera acutorostrata), of which 4 were trapped in driftnets targeting swordfish. Despite efforts made by the Italian government to reduce the length of these nets, between April and June 1990 the capture of 3 sperm whales, 1 fin whale, 1 goose-beaked whale and about 20 small cetaceans in the Southern Tyrrhenian Sea was recorded. A decree was laid down in Italy in late July 1990, banning the use and possession of driftnets for the capture of swordfish. This ban lasted only one year. In May 1991, the new Minister of Merchant Marine allowed the resumption of the driftnet fishery. Furthermore, the lack of any effective control mechanisms means that even measures enacted to reduce the net lengths connot be verified. Moreover, according to a report by Lilly Venizelos, coordinator of the Meddaset Project in Greece, 50 Italian driftnetters have been seen fishing in the Aegean and Ionic Seas in 1990, causing the death of dolphins and sea turtles.

The Spanish fleet has some 40 vessels fishing in the area around the Straits of Gibraltar. All these vessels hold Moroccan fishing licenses, obtained through a fisheries agreement between the EEC and Morocco signed in 1988. Most of these vessels fish in the Atlantic area, close to Cape Espartel, although an unknown number occasionally also fishes in Mediterranean waters (south of Cape Gata).

The Straits of Gibraltar are the sole route of access for cetaceans and other marine animals entering the Mediterranean Sea from the Atlantic Ocean. Recent studies in this area reveal the importance of this geographical area for certain cetacean populations, like the common dolphin (Delphinus delphis) and, to a lesser extent, the striped dolphin, believed to use the area as feeding grounds (Adloff, 1990). Resident populations of other cetaceans, such as the bottlenose dolphin, are also thought to exist here.

In addition to the Spanish fleet, there are also over 40 Moroccan vessels using driftnets. Cost-benefit ratios are better for driftnets than for surface long-liners (no bait is required, captures per unit effort are larger, etc.) For this reason, the risks posed by the increased use in this type of fishing net in the Mediterranean has to be taken into account, as recent figures indicate that the fleet is increasing.

This increase was discussed at the GFCM/ICCAT (1990) meeting on estimates of pelagic fish stocks in the Mediterranean, held in Bari (Italy) last June. Representatives of several countries expressed their concern about the increase. According to figures presented at this meeting, the vessels using this type of net are: Italy, 900; Spain, 43; France, 1; Morocco, 40; Greece, 13; Turkey, 13 and Algeria 1.

2.3 Other Fishing Gear

The lack of information regarding incidental cetacean captures by artisanal fishing fleets and the high diversity of local fishing methods make it impossible to determine which species are the worst affected.

In any case, it should be noted that most fishing methods and tackles create their own particular impact on cetacean populations, to varying degrees depending on the type of fishing method used and the ecology and behavior of these marine mammals. Several published papers describe incidental captures by trammel nets, trawling nets, longlines and purse seine nets (Duguy et al, 1983; Di Natale, 1989), and the impact which fishing activities in general can have on cetacean populations in certain geographical regions (M'Hamed el Bouali, 1987).

Interactions between cetaceans and fishing methods

	tramell nets	purse-seine nets	longlines	trawler nets
S. coeruleoalba	yes	yes	yes	yes
D. delphis	yes	yes	yes	yes
T. truncatus	yes			yes
G. griseus	yes			yes
G. melas	yes			
P. macrocephalus			yes	yes
P. crassidens			yes	
B. physalus				
B. acutorostrata				

Although the most common instances of interactions known are those between the species and fishing methods indicated above, other cases of interactions between tuna traps (Di Natale, 1983; Ktari-Chakroun, 1980) and other less common fishing methods in the Mediterranean, and killer whales (Orcinus orca), bottlenose dolphins (Tursiops truncatus) and even one minke whale (Balaenoptera acutorostrata) have occurred (Ktari- chakroun, 1980).

Based on studies carried out by the FAO General Fisheries Council for the Mediterranean, the Review of the States of World Fish Resources (FAO, 1981) states that demersal stocks of the northern and western shores of the Mediterranean, as well as some pelagic stocks, are already overexploited. It seems reasonable to consider the depletion of stocks of captured species as having a direct impact upon some marine mammal populations (Northridge, 1984). In addition, lack of food could lead to increased interactions between cetaceans and fishing activities, with the resulting risk to these marine mammals, considered by certain fishermen as "competitors" for a relatively scarce resource of high commercial value. Overfishing of prey species could also lead to malnutrition and associated problems in cetaceans.

3. OTHER THREATS

3.1 Plastic floating debris

The Mediterranean Sea is heavily polluted by floating plastic debris discharged more or less directly into the waters. When in the seas, the floating materials are concentrated in "convergence lines" created from contacts of masses of waters with different concentration of salts or different temperature. These lines are very important because the high concentration of phyto and zooplankton and represent feeding zones for fishes and cetaceans. Unfortunately the mix of food and plastic could have a deleterious effect on cetaceans as demonstrated by the recovering of dead samples affected by the obstruction of the esophagus by plastic debris. In Italy, from 1986-1988, 177 dead cetaceans were analyzed and it was established that the 3.4% of the deaths were due to ingestion of plastic debris (Cagnolaro L., Notarbartolo Di Sciara G., in press).

3.1 Noise

Cetaceans depend on sound for locating and identifying their prey and for communication. Increased boat traffic, industrial activity and oil drilling have brought noise to the aquatic environment, especially in waters near the coast. The effect of noise on cetaceans has been poorly studied, although it is generally accepted that the levels of noise usually associated with common human activities at sea are capable of interfering with signals produced by cetaceans in nearby waters or even causing damage to their sound receptors. Also, sustained exposure to even non-intense sound is known to produce stress-related effects which may lower resistance to disease and produce endocrine imbalances (Geraci and St.Aubin, 1980; Stirling and Calvert, 1983).

4. STATUS AND POPULATIONS

4.1 Tursiops truncatus

Common name: Bottlenose dolphin
Habitat: Typically coastal. No pelagic populations are known in the Mediterranean.
Range: Throughout the Mediterranean .
Conservation: Due to its coastal lifestyle, this species has been strongly impacted by human activities. Populations are currently fragmented into small units, surviving with difficulty in the areas where human impact is slightest. Interacts intensely with the fisheries industry, feeding on a large number of commercially important fish species and often destroying trammel nets, trawler nets and driftnets when taking fish. Mortality rates of this species are high, as it often gets trapped in nets. The IWC/UNEP Workshop on Mortality of Cetaceans in Passive Fishing Nets and Traps (La Jolla, October 1990) concluded that the current incidental take of the species "may not be sustainable".Fishermen react aggressively to the presence of bottlenose dolphins, shooting them with harpoons. Contaminant levels in the dolphins' tissues are very high, although lower than those found in common and striped dolphins.
Remarks: This species is included in the recommendations for research on the Black Sea populations, under section 22 of the "Action Plan for the Conservation of the Diversity of Dolphins, Porpoises and Whales, (1988-1992)".

4.2 Delphinus delphis

Common name: Common dolphin
Habitat: Typically neritic, can be pelagic in some areas.
Range: Throughout the Mediterranean .
Conservation: Frequent instances of accidental captures by purse seiners off the coasts of southern Spain, southern Italy and northern Africa. They are also impacted by driftnets in every region where driftnets are used. Tissue contaminant levels are often very high. This species is very

coastal in the Mediterranean, so is probably seriously impacted by the commercial overexploitation of the organisms it preys upon. In the northern section of the western basin (north of 39 degrees N) the species has apparently experienced a great decline and now its presence in the area is considered to be exceptional. Remarks: Determining the state of the common dolphin population in the Western Mediterranean is considered to be a priority by the "Action Plan for the Conservation of Biological Diversity of Dolphins, Porpoises and Whales. 1988-1992".

4.3 Ziphius cavirostris

Common name: Cuvier's beaked whale
Habitat: Typically pelagic
Range: Throughout the Mediterranean
Conservation: A shy species, avoids all contact with humans. Does not interact with the fisheries industry, except for a few isolated cases of accidental captures by driftnets. Contaminant levels in their tissues so far reported are comparatively low.

4.4 Pseudorca crassidens

Common name: False killer whale
Habitat:
Distribution: Throughout the Western Mediterranean
Conservation problems: This species is rare in the Mediterranean and does not seem to pose any important conservation problems. Interactions with the fisheries fleets are minimal in the Mediterranean, due to the small population present in that sea. Contaminant levels in their tissues are unknown.

4.5 Balaenoptera physalus

Common name: fin whale
Habitat: Typically pelagic
Range: Throughout the Central and Western Mediterranean
Conservation: Although the individuals from this species aren't at the end of the food chain, organochlorine compounds were found both in stranded and alive samples, being the total amounts higher then those found in Atlantic specimens. The impact of the fishing gears in this species seems to be moderate.

4.6 Orcinus orca

Common name: Killer whale
Habitat: Neritic and pelagic.
Range: Most common in the western Mediterranean, but has been sighted occasionally in the southeast as well.
Conservation: This species is not abundant in the Mediterranean, but is frequently sighted in the southern part of the Mediterranean and around the islands. Limited interaction with the tunids fishery, particularly tuna traps and purse seiners. There is no information available on the levels of chemical contaminants in their tissues, although they are assumed to be high as this species is a top predator and may even feed on other marine mammals.

4.7 Globicephala melas

Common name: Long-finned pilot whale
Habitat: Pelagic
Range: Western Mediterranean, rarely in the east.
Conservation : There are some isolated instances of accidental captures in different fishing gear with potential for impacting the population, and some individuals have been known to be affected by hydrocarbon spills. Contaminant levels in their tissues are relatively moderate.

4.8 Balaenoptera acutorostrata

Common name: Minke whale
Habitat: Pelagic but also neritic
Range: Southern and Western Mediterranean
Conservation: The information about this species in Mediterranean are scarce because this specie is quite rare in the Mediterranean. Some cases of bycatch of samples from this species in driftnets traps have been reported. Contaminants levels unknown.

4.9 Grampus griseus

Common name: Risso's dolphin
Habitat: Pelagic.
Range: Western Mediterranean.
Conservation: There are apparently some isolated instances of accidental captures in different fishing gear, and some individuals have been known to be affected by hydrocarbon spills. Contaminant levels in their tissues are moderate.

4.10 Steno bredanensis

Common name: Rough-toothed dolphin
Habitat: Pelagic.
Range: Western Mediterranean. Very rarely seen in the east.
Conservation : This species is rare in the Mediterranean Sea, and is thought to infrequently occur in every ocean. Fisheries interactions unknown. Contaminant levels in tissues unknown.

4.11 Physeter macrocephalus

Common name: Sperm whale
Habitat: Typically pelagic
Range: Throughout the Western Mediterranean
Conservation: During the last years the increasing use of driftnets in the Mediterranean has caused a large number of sperm whales by-catches. Serious concerns about the health status of the Mediterranean stock of sperm whales were expressed at the IWC/UNEP Workshop on the Mortality of Cetaceans in Passive Fishing Nets and Traps (La Jolla, October 1990).

4.12 Stenella coeruleoalba

Common name: Striped dolphin
Habitat: Mostly pelagic, but also neritic in some areas close to the coast.
Range: Throughout the Mediterranean.
Conservation: This cetacean species is at present undoubtedly the most abundant in the Mediterranean. It has been suggested that it may have stepped into the ecological niche left by the common dolphin. Often falls prey to purse seine nets in southern Spain, southern Italy and northern Africa, and to driftnets in every area. The IWC/UNEP Workshop on the Mortality of Cetaceans in SRtPassive Fishing Nets and Traps (La Jolla, October 1990) concluded that the population was "unable to sustain current levels" of incidental takes and that "menagement measures should be adopted to ensure the enforcement of existing laws to restrict harmful fishing operations, and reduction of pollutant shedding into Mediterranean waters". Tissue contaminant levels, particularly PCBs, are extremely high, often in excess of 1,000 ppm. Diet is based on many fish and cephalopod species of economic importance, so fishing activities may seriously limit the growth of populations. In addition, this species has recently been struck by an epidemic of unknown origin, probably causing the death of several thousand individuals in the Western Mediterranean.

Remarks: This species is included in section 23 of the "Action Plan for the Conservation of the Diversity of Dolphins, Porpoises and Whales. 1988-1992."

Cetacean species in the Mediterranean

	S.c.	D.d.	S.b.	T.t.	G.g.	G.m.	Z.c.	O.o.	P.c.	P.m.	B.p.	B.a.
ALBANIA		*										
ALGERIA	*	*		*	*	*	*	*		*	*	
CYPRUS	*											
EGYPT	*	*		*			*		*			
FRANCE	*	*	*	*	*	*	*	*	*	*	*	*
GREECE	*	*		*			*					
ISRAEL		*	*	*		*	*	*				
ITALY	*	*	*	*	*	*	*	*	*	*	*	*
LEBANON				*				*				
LIBYA	*			*								
MOROCCO	*	*		*	*	*	*	*		*	*	*
SPAIN	*	*		*	*	*	*	*	*	*	*	*
SYRIA												
TUNISIA	*	*		*	*	*				*	*	
TURKEY	*	*		*			*					
YUGOSLAVIA		*		*	*	*						

S.c. Stenella coeruleoalba; D.d. Delphinus delphis; S.b. Steno bredanensis; T.t. Tursiops truncatus; G.g. Grampus griseus; G.m. Globicephala melas; Z.c. Ziphius cavirostris; O.o. Orcinus orca; P.c. Pseudorca crassidens; P.m. Physeter macrocephalus; B.p. Balaenoptera physalus; B.a. *Balaenoptera acutorostrata.*

The absence of species in any given country indicates only that data is not available, not that the species does not exist there. The species present in territorial waters around Monaco are not considered different from the ones found in French and Italian waters, given the small area in question.

5. CONCLUSIONS

This report shows that while information collected so far does not suffice to give a complete view of the distribution and status of cetacean populations in the Mediterranean, there is without doubt cause for grave concern.

From the results of analyses carried out on tissue samples, it can be concluded that dolphins in the Mediterranean are amongst the animals most highly contaminated by PCBs in the world. Other toxic compounds such as DDT, and heavy metals like mercury, are also present in their tissues in very high concentrations. It is estimated that each year 120,000 tons of mineral oils, 12,000 tons of phenols (toxic, bioaccumulative organic compounds), 60,000 tons of detergents, 100 tons of mercury, 3,8000 tons of lead and 3,600 tons of phosphates are dumped into the Mediterranean by industrial, agricultural and urban activities (UNEP, 1984). In addition, over 600 tons of mercury, 150 tons of cyanide, 1,200 tons of PCBs, 3,000 tons of acids, 1,000 tons of solvents, 4,000 tons of paint sludge, 5,000 tons of pesticides and an unknown amount of heavy metals have accumulated on land (World Bank, 1990).

The Mediterranean Sea is almost completely closed off, and it takes over a century for its waters to be (renewed). This means that there is a great accumulation of toxic compounds, threatening the Mediterranean ecosystem and its fauna and flora. The build-up of contaminants weakens small cetaceans, making them more vulnerable to disease and reproductive problems. The only solution in the Mediterranean lies in halting all toxic discharges into the sea.

The development of a regional phase-out strategy for toxic compounds is urgently needed to halt the increasing contaminant concentrations in the Mediterranean Sea. Some toxic compounds can persist between 50 and 120 years, during which they continue to act as highly hazardous agents. For example, mercury in water or in an animal metabolism forms methylmercury, highly toxic to all living organisms. Protection laws for cetaceans should be laid down in every Mediterranean coastal country, banning the capture, killing, injury, trade and use as food or bait of cetaceans. The objective of such measures would be to protect Mediterranean biological diversity, and prevent cetaceans being used for food.

Further information is needed to quantify the scope and frequency of cetacean interactions with the fishing industry, and must include research into measures to reduce the instances of accidental captures. Non-selective and destructive fishing gear such as large-scale driftnets should be banned in order to protect the biological diversity of the Mediterranean Sea and help prevent overfishing.

As this report indicates, overexploitation of fish stocks can have a serious impact on cetacean populations, causing malnutrition and making them more vulnerable to viral, bacteriological or parasite infections. Fisheries overexploitation can also limit the recovery of different species due to the lack of food.

Lack of fish can intensify cetacean interactions with fishery activities and any measure taken to prevent overexploitation of fish stocks will benefit fishermen, dolphins and fishing resources alike. Intense maritime traffic in the Mediterranean can also have an important impact on specific cetacean populations. In other seas, the presence of a large number of vessels in calving areas has been known to negatively affect the animals. The intensive use of some coastal areas as anchoring sites has degraded the sea bed, impacting the benthic fauna and therefore impacting the whole ecosystem. It is necessary to establish protected areas where productivity can be enhanced and cetacean populations recover.

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