



MEDITERRANEAN ACTION PLAN
SPECIALLY PROTECTED AREAS

UNITED NATIONS ENVIRONMENT PROGRAMME

GREENPEACE



THE WORLD CONSERVATION UNION

TECHNICAL REPORT ON THE STATE OF CETACEANS IN THE MEDITERRANEAN

Prepared by Greenpeace and revised by IUCN
September 1993

MAP Technical Reports Series No. 82

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This volume is the eighty-second issue of the Mediterranean Action Plan Technical Report Series.

This series will collect and disseminate selected scientific reports obtained through the implementation of the various MAP components: Pollution Monitoring and Research Programme (MED POL), Blue Plan, Priority Actions Programme, Specially Protected Areas, Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea, Environment Remote Sensing and Protection of Historic Sites.

Ce volume constitue le quatre-vingt deuxième numéro de la série des Rapports techniques du Plan d'action pour la Méditerranée.

Cette série permettra de rassembler et de diffuser certains des rapports scientifiques établis dans le cadre de la mise en oeuvre des diverses composantes du PAM: Programme de surveillance continue et de recherche en matière de pollution (MED POL), Plan Bleu, Programme d'actions prioritaires, Aires spécialement protégées, Centre régional méditerranéen pour l'intervention d'urgence contre la pollution marine accidentelle, Centre méditerranéen de télédétection et Protection des sites historiques.

PREFACE

In 1975, the United Nations Environment Programme (UNEP) organized an intergovernmental meeting which adopted the Mediterranean Action Plan. In 1976, UNEP convened in Barcelona a Conference of Plenipotentiaries of the Coastal Mediterranean States on the Protection of the Mediterranean Sea. This Conference adopted the Convention for the Protection of the Mediterranean against Pollution (called the "Barcelona Convention").

In 1982, the Contracting Parties to the Barcelona Convention adopted a Protocol on the Specially Protected Areas; article 3 stipulates that countries should protect in particular:

- the genetic diversity of species
- satisfactory levels of their populations, reproduction areas and habitats; and
- representative type of ecosystems.

In September 1985, the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution convened at Genoa:

- reconfirmed their commitment for the protection of the Mediterranean through the implementation of the Mediterranean Action Plan;
- decided to launch a new phase in their common effort to speed up activities in progress in order to achieve concrete objectives in the second decade of the Mediterranean Action Plan;
- adopted 10 priority objectives to be achieved during the second decades.

The Genoa Declaration, unanimously approved, comprises two objectives concerning the preservation of biodiversity and the conservation of ecosystems [document UNEP/IG.56/5, II, 17 (f) et (h)]:

- (f) "the protection of endangered marine species" and
- (h) "the identification and protection of at least 50 new sites or marine and coastal reserves of Mediterranean interest".

It is in order to help the Mediterranean States to reach these objectives that the Regional Activity Centre for the Specially Protected Areas has set up expert groups to collect existing data, determine the state of the conservation of species, identify management measures adapted to each species and propose the protection of certain sites of Mediterranean interest.

FOREWORD

This report has been prepared by GREENPEACE INTERNATIONAL as a working document for the Meeting of Experts on the protection of Mediterranean cetaceans (Copanello, Italy, 25-26 August 1991).

A first revision of this report was prepared by IUCN on behalf of the Regional Activity Centre for Specially Protected Areas (SPA/RAC), and was diffused as information document at the Meeting of the National Focal Points for Specially Protected Areas (Athens, 26-30 October 1992), which included a joint consultation concerning the conservation of cetaceans in the Mediterranean and Black Sea.

The present document is a further revised version of the report, prepared by IUCN for the RAC/SPA.

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INTRODUCTION

Approximately 20 different cetacean species has been reported to be present in the Mediterranean Sea, of which about half belong to Atlantic populations and enter this sea only sporadically. Only eight small cetacean species and three large whales species have been sighted frequently in the Mediterranean Sea. Of these, the following nine can be regarded as regular species (Notarbartolo di Sciara, 1992; Klinowska, 1991).

- *Balaenoptera physalus* (Fin whale)
- *Delphinus delphis* (Common dolphin)
- *Globicephala melas* (Long-finned pilot whale)
- *Grampus griseus* (Risso's dolphin)
- *Physeter macrocephalus* (Sperm whale)
- *Stenella coeruleoalba* (Striped dolphin)
- *Tursiops truncatus* (Bottlenose dolphin)
- *Ziphius cavirostris* (Cuvier's beaked whale)

The following four species are occasional species, which enter the Mediterranean repeatedly from the Atlantic.

- *Balaenoptera acutorostrata* (Minke whale)
- *Orcinus orca* (Killer whale)
- *Pseudorca crassidens* (False killer whale)
- *Steno bredanensis* (Rough-toothed dolphin)

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 differs greatly between these two areas. The cetacean fauna in the western basin is much richer than in the east for a number of reasons (Notarbartolo di Sciara, 1992).

The western basin is subject to greater influence by the Atlantic, and species and populations from that ocean occasionally enter the Mediterranean Sea through the Straits of Gibraltar, the only natural access route from the Atlantic ocean. This is 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*) found in Spain and physeterids such as the dwarf sperm whale (*Kogia simus*) found in Italy (Centro Studi Cetacei, 1988; Baccetti *et al*, 1991). The harbour porpoise (*Phocoena phocoena*), apparently once abundant in the Mediterranean, (Graells, 1889; Barcelo, 1875; Companyo, 1863), is now considered to have vanished from this sea. The last details concerning their presence here dates to the turn of the century, although there are a few exceptions including individuals found on African coasts in the last few years (Ktari-Chakroun, 1980; Duguy *et al*, 1983a) or in Southern Spain (Rey and Cendrero, 1982).

Wildlife richness in the western basin is not only evident in cetaceans, but also in fish and other marine organisms. The Mediterranean Sea contains highly productive areas owing to the nutrient blooms generated by wind driven upwellings in areas like that between the Ligurian sea and the Gulf of Lyons (Jaques, 1990), or the coasts of north Africa. This characteristic enables the concentration of consumers, including fishes and predators such as cetaceans.

The surface currents, which cross through the Straits of Gibraltar and circulate in the western part of the Mediterranean basin, are also an important causal factor for the presence of cetaceans there. These currents are used by different shoals of fish, including tuna (Scrombidae) and swordfish (*Xiphias gladius*), to aid them on their migration to breeding or spawning areas. The migrations are followed by predators, including killer 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, making 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*) entering the canal and even reaching as far as Port Said in the Mediterranean Sea. These are isolated cases and such 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 serve only to give a general overview of distribution and frequency of species in the different regions. Research has been based mainly on the systematic collection of data on stranded animals, on accidental captures by various types of fishing gear and on information from privately owned vessels concerning sightings on the high seas. There are very few research programmes on cetaceans in the Mediterranean, and they are mostly limited to specific areas and populations. Most data has been obtained for the western basin, and information on the east is particularly 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 passed along the food chain. Although by their very nature marine mammals are difficult to study, evidence that they are being severely, perhaps irreversibly, impacted by these substances is growing. It has been predicted that those impacts already reported will become more widespread.

PCBs can be taken as good examples of persistent, fat-soluble, ubiquitous environmental contaminants and, to a large extent, this review will focus on them. 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). 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.

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. Larger animals are also exposed to chemicals by direct contact. At each step in the food chain the contaminants accumulated become concentrated where the rate of their excretion is less than the rate of uptake. Marine mammal blubber, a fat store, acts as a 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 by marine mammals to their young via the milk. Lactation allows females to shed an important proportion of contaminants which they accumulated prior to giving birth and 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). 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.

Concentrations of organochlorines reached in dolphin tissues are thousands, if not millions, of times higher than those found in the surrounding sea water (see Table 1). PCBs, DDT (and its derivatives) have also been found in the subcutaneous fat of Mediterranean fin whales in total concentrations greater than those found in the fat of NE Atlantic populations (Focardi *et al*, 1991).

Recent research also indicates that marine mammals lack certain enzymes which may help terrestrial mammals to counteract PCB exposure to some extent (Tanabe, 1988; Tanabe *et al*, 1988). Fossi *et al*. (1992) have presented evidence for this in Mediterranean species. This would make them more susceptible to the effects of contaminants and may be linked directly to specific reproductive disorders reported in marine mammal populations.

There are three principal areas of research which have demonstrated the correlation between the presence of contaminants and observable effects in marine mammals. The first concerns 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).

A second 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 immuno-suppressive agents (Safe, 1984), and this may contribute to mortality.

Finally, studies on other small cetaceans have been carried out by Japanese scientists. They found a negative correlation 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.

Evidence for abnormalities in lipid metabolism, such as fatty livers, has been detected in

wild Japanese striped dolphins with high PCB and DDT levels in their tissues (Kawai *et al.*, 1988).

1.2 Heavy Metals and Other Pollutants

While organochlorine compounds are found in highest concentrations, metal pollution is also reflected in cetacean tissues. Metals have been found in kidney, liver, blubber, muscle, skin, lung and brain tissues (Viale, 1978).

Heavy metal concentrations in cetaceans are higher than in other animals. Dolphin tissues examined from the Mediterranean contained iron concentrations eight times higher than the maximum allowed in human diet, and 1,500 times higher in the case of mercury (Viale, 1978). Levels of methylmercury found in dolphins stranded in the Tyrrhenian coast were considered to be of great concern (Carlini and Fabbri, 1990), (See Table 2).

Metals may be bioaccumulated by cetaceans as they are unable to excrete them. For example, various processes in dolphin metabolism bind lead, mercury and selenium in non biodegradable compounds. A high proportion of the total concentration of mercury in contaminated marine animals is found as methylmercury which is its most toxic form (Martoja and Berry, 1980).

1.3 Other pollutants

The impact of other pollutants has been little studied, and their effect on cetacean populations is largely unknown. Information is available concerning isolated instances of oil contamination from 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, particularly the PAHs (Polyaromatic hydrocarbons) which bioaccumulate in fatty tissues, are of considerable concern.

The excessive local use of pesticides releases large quantities of pollutants, including HCH, HCB, dieldrin, and aldrin 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 toxic compounds could also have an effect on the dolphins' prey and on the ecosystem in general, perhaps by reducing its biological diversity or decreasing the biomass, thus indirectly affecting the cetacean fauna.

1.4 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 Johnston, 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 the full death toll may be several thousand (Aguilar and Raga, 1990). The epizootic spread eastward into the Mediterranean and several hundred dead and dying cetaceans were washed up on the beaches of southern Italy and Greece during the summer of 1991.

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 may have contributed to the severity of these events, perhaps by facilitating the spread of infection. This and the additional chronic effects of organochlorines could hinder, or even prevent, recovery of individuals from pathogenic disease. Moreover, the effects of contaminants on reproductive systems could hinder population recovery following mass mortalities.

Table 1

**Levels of organochlorine contaminants in the adipose tissue of cetaceans in the Mediterranean.
(ppm base lipids)**

Spp	Place	No	Year	ppDDE	ppTDE	opDDT	ppDDT	tDDT	PCB	Ref
Stranded Samples										
D.d	France	1	1977	75	27		324	426	700	(1)
D.d	Catalo.	1	1978	650	147	7	31	835	2090	(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.	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.	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)
Biopsied Samples										
D.d	Catalo.	1	1987	23	5	8		36	92	(2)
S.c.	Catalo.	78	1987-88	112	15	17	22	166	326	(2)
T.t.	Catalo.	1	1985	42	28	5	12	87	581	(2)

Catalo. = Catalonia; Castell. = Castellon

Table 2

**Levels of heavy metals in Mediterranean cetaceans
ppm fresh weight**

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	0.30	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 *et al*, 1982
- (7) Focardi *et al*, 1991

Heavy metals

- (1) Viale, 1978
- (2) Thibaud, 1978
- (3) Martoja and 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, cetacean mortality continues to occur in almost all Mediterranean coastal countries as a result of human activity. These deaths arise from interactions with fishing activities, commercialization of cetacean meat and blubber, the use of cetacean meat as fishing bait and deliberate slaughter of individuals.

Fishermen often kill large numbers of cetaceans in countries where interaction with the artisanal fishing fleet is high. This practice is fairly commonplace throughout the Mediterranean and 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 Italy, between 1986 and 1987, 22 cetaceans were found stranded with evidence of bullet or harpoon wounds (Centro Studi Cetacei, 1987). Twelve 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. A small number of vessels reputedly hunt dolphins out of Arbatax harbour, while in Porto S. Stefano (Toscana) it seems that around four vessels capture dolphins as a sideline 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 sale. The killing of dolphins is illegal in both Italy and Spain

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 longline and crustacean fisheries, and its smell and texture make it a favourite in the shrimp fishery. None of these vessels appear to be exclusively directed at capture of cetaceans and 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. Concerns must also be voiced about the occasional shooting of cetaceans from recreational vessels as a sport.

2.2 Driftnets

Although the use of driftnets in the Mediterranean had increased and became more widespread in the late seventies, their use only became common during the last few years. Until recently, some one thousand fishing vessels were known to use driftnets (CFCM/ICCAT, 1990).

Although driftnets are put out to capture specific species, such as swordfish and tunids, their inherent non-selectivity (they can potentially 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 (Di Natale and Notarbartolo di Sciarra, 1990). The largest driftnet fleet in the Mediterranean was Italian, with over 900 vessels using nets between three 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 ground and season. The Italian vessels normally fish the southern Tyrrhenian Sea in April and the Ligurian Sea in October. Between August and September 1988, the capture of 37 cetaceans by driftnets was recorded in the Ligurian sea. Of these, 29 died and eight were released (Podesta and Magnaghi, 1989). Another study carried out between 1986 and 1988 in Italy, recorded the capture of 150 cetaceans, specifically 24 sperm whales (*Physeter macrocephalus*), two Cuvier's beaked whales (*Ziphius cavirostris*), ten pilot whales (*Globicephala melas*), five Risso's dolphins (*Grampus griseus*), 13 bottlenose dolphins (*Tursiops truncatus*), 68 striped dolphins (*Stenella coeruleoalba*) as well as 28 unidentified cetaceans (Notarbartolo de Sciarra, 1990). Di Natale (1989) reports that in 1988, an additional 12 individuals were disentangled from driftnets: seven sperm whales, four pilot whales and one fin whale (*Balaenoptera physalus*).

Notarbartolo di Sciarra's data is based on a survey of stranded animals on Italian shores which recorded the number of cetaceans entangled in nets or with signs of injury caused by nets over a three year period. It must, however, be noted that most captured animals do not reach the shores (Di Natale, 1990) but are lost at sea, or sunk by fishermen who weigh them 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 dolphin, it is believed that the use of these nets could drive them to extinction in the Mediterranean Sea (Notarbartolo Di Sciarra, 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. Causes could be established in 46 cases, and driftnets were implicated in 30 of these (Di Natale and Mangano, 1985). Three sperm whales were also found entangled in driftnets around the French coast in September 1988 (Maigret, 1989).

Ktari-Chakroun (1980) reported that four of ten minke whales (*Balaenoptera acutorostrata*) sighted at sea 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 three sperm whales, one fin whale, one 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 but in May 1991, the new Minister of Merchant Marine allowed the resumption of the driftnet fishery. The lack of any effective control mechanisms means that even measures enacted to reduce the net lengths cannot be verified. Lilly Venizelos, coordinator of the Medasset 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.

Cetaceans have also been found entangled in driftnets off North Africa. 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 fish in Mediterranean waters (south of Cape Gata). In addition to the Spanish fleet, there are also over 40 Moroccan vessels using driftnets.

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.

Cost-benefit ratios are better for driftnets than for surface long-liners since no bait is required and captures per unit effort are larger. The risks posed by the use of this type of fishing net in the Mediterranean need to be seriously considered, since recent figures indicate that the fleet is, in general, increasing.

This increase was discussed at the GFCM/ICCAT (1990) meeting on estimates of pelagic fish stocks in the Mediterranean, held in Bari (Italy). 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. The Italian fleet is now complying with EEC regulations which limit the length of driftnets to 2.5km.

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.

It should be noted that most fishing methods and tackles create their own particular impact on cetacean populations, to varying degrees depending on their ecology and behaviour. A number of papers describe incidental captures by trammel nets, trawling nets, longlines and purse seine nets and tuna traps (Cataldini and Bello, 1987; Di Natale, 1983, 1989; Duguy *et al*, 1983; Ktari-Chakroun, 1980), and the impact which fishing activities in general can have on cetacean populations in certain geographical regions (M'Hamed el Bouali, 1987).

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) stated that demersal stocks of the northern and western shores of the Mediterranean, as well as some pelagic stocks, were already overexploited. Mediterranean fisheries continued to expand over the decade and the total marine catch for the Mediterranean was over two million tonnes in 1987, compared to just 1.1 million tones in 1973 (FAO, 1989). It seems reasonable to suppose that depletion of stocks of captured species would have a direct impact upon some marine mammal populations (Northridge, 1984). Overfishing of prey species could also lead to malnutrition and associated problems in cetaceans. In addition, lack of food could lead to an increase in interactions between cetaceans and fishing activities, with a resultant increase in threat to these marine mammals, which are already considered by some fishermen as "competitors" for a relatively scarce resource of high commercial value.

Table 3

Interactions between cetaceans and fishing methods

	trammel nets	purse-seine nets	longlines	trawler nets	other incl. tuna traps
<i>S. coeruleoalba</i>	yes	yes	yes	yes	
<i>D. delphis</i>	yes	yes	yes	yes	
<i>T. truncatus</i> yes			yes	yes	
<i>G. griseus</i>	yes		yes	yes	
<i>G. melas</i>	yes				
<i>P. macrocephalus</i>			yes	yes	
<i>P. crassidens</i>		yes			
<i>B. physalus</i>				yes	
<i>B. acutorostrata</i>					yes
<i>O. orca</i>					yes

3. OTHER THREATS

3.1 Plastic floating debris

The Mediterranean Sea is heavily polluted by floating plastic debris which is often discharged directly into the waters. The floating materials are concentrated in "convergence lines" at the junctions of masses of waters of differing salinities or temperatures. These lines are very important feeding zones for fishes and cetaceans owing to the high concentration of phyto- and zooplankton. The dangers of ingesting a mixture of food and plastic are evident in dead animals affected by the obstruction of the oesophagus by plastic debris. Between 1986 and 1988, 177 cetacean carcasses in Italy were analyzed and it was established that the 3.4% of the deaths were caused by ingestion of plastic debris (Notarbartolo di Sciara and Cagnolaro, in prep). An additional threat posed by discarded plastics such as ropes or six-pack rings is entanglement which may cause strangulation or severe wounding of animals.

3.2 Noise

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). Although the effect of noise on cetaceans has been poorly studied, it is generally accepted that the levels of noise arising from human activities at sea (such as shipping, exploration for and extraction of minerals, military operations, use of sonar, and scientific experimentation) are capable of interfering with signals produced by cetaceans in nearby waters and may even cause damage to their sound receptors.

4. STATUS AND POPULATIONS OF REGULAR AND OCCASIONAL SPECIES

4.1 *Tursiops truncatus*

Common name: Bottlenose dolphin

Habitat: Typically coastal. No pelagic populations are known in the Mediterranean.

Range: Throughout the Mediterranean.

Conservation: Owing to its coastal lifestyle, this species has been heavily impacted by human activities. Populations are currently fragmented into small units, surviving with difficulty in the areas where human impact is slightest. This species interacts widely 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 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: The Black Sea population is included in the research recommendations 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, but may be pelagic in some areas.

Range: Throughout the Mediterranean.

Conservation: There are frequent instances of accidental capture by purse seiners off the coasts of southern Spain, southern Italy and northern Africa. This species is impacted by driftnets in every region where these are used. The 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 undergone a substantial decline and its presence in the area is now considered to be exceptional. Tissue contaminant levels are often very high.

Remarks: Determination of 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: This is a shy species which avoids any contact with humans. There is virtually no interaction with the fisheries industry, except for a few isolated cases of accidental captures by driftnets. Contaminant levels in their tissues are relatively low.

4.4 *Pseudorca crassidens*

Common name: False killer whale

Habitat: Neritic and pelagic.

Range: Throughout the Western Mediterranean

Conservation: This species is rare in the Mediterranean and does not seem to pose any important conservation problems. Interactions with fisheries are minimal in the

Mediterranean, owing to the low population numbers. The level of contamination of tissues is not known.

4.5 *Balaenoptera physalus*

Common name: fin whale

Habitat: Typically pelagic.

Range: Throughout the Central and Western Mediterranean.

Conservation: Organochlorine compounds have been found in samples from both stranded and living animals at higher concentrations than in Atlantic specimens. The impact of the fisheries on this species appears 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.

Conservation: This species is not abundant in the Mediterranean. It has been sighted in the southern part of the Mediterranean and around the islands, but it is not yet resolved as to whether the species is resident in this sea (Klinowska, 1991). There is limited interaction with the tunid fishery, particularly through tuna traps and purse seiners. There is no information available on the levels of chemical contaminants in their tissues, but these are probably high since this species is a top predator which 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 have been isolated instances of accidental captures in different fishing gears and this could potentially impact the population. Some individuals have been known to be affected by hydrocarbon spills. Contaminant levels in their tissues are moderate.

4.8 *Balaenoptera acutorostrata*

Common name: Minke whale

Habitat: Pelagic and neritic.

Range: Southern and Western Mediterranean.

Conservation: Little is known concerning this species in the Mediterranean where it is quite rare. There have been some cases of accidental capture in driftnets. No information is available concerning contaminant levels in their tissues.

4.9 *Grampus griseus*

Common name: Risso's dolphin

Habitat: Pelagic.

Range: Western Mediterranean.

Conservation: There have been instances of accidental captures in different fishing gears, 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 in the east.

Conservation: This species is rare in the Mediterranean Sea, and occurs only infrequently in other oceans. Fisheries interactions have not been reported. No information is available concerning contaminant levels in their tissues.

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 led to a large number of sperm whale 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), and current levels of catch are probably not sustainable (UNEP, 1991).

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 and it has been suggested that it may have stepped into the ecological niche left by the common dolphin. It is frequently trapped in purse seine nets in southern Spain, southern Italy and northern Africa, and in driftnets in every area. The IWC/UNEP Workshop on the Mortality of Cetaceans in Passive Fishing Nets and Traps (La Jolla, October 1990) concluded that the population was "unable to sustain current levels" of incidental takes and that "management 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. Its diet is largely based on fish and cephalopod species of economic importance, and fishing activities may limit food availability. In addition, this species has recently been struck by an epidemic of unknown origin, which has caused 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 which concerns contamination levels in dolphins.

Table 4 indicates the occurrence of cetacean species in the territorial waters of Mediterranean coastal countries. 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.

Table 4

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			*		*	*	*				*	*

* - reported presence

? - likely presence

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*.

5. CONCLUSIONS

While information available to date does not suffice to give a complete view of the distribution and status of cetacean populations in the Mediterranean, this report demonstrates that there is cause for grave concern.

It can be concluded from the results of analyses carried out on tissue samples that dolphins in the Mediterranean are amongst the animals most highly contaminated by PCBs in the world. Other toxic compounds including DDT, and heavy metals such as 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, 3,800 tons of lead and 3,600 tons of phosphates are released into the Mediterranean by industrial, agricultural and urban activities (UNEP/ECE/UNIDO/FAO/UNESCO/WHO/IAEA, 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 quantity 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 completely renewed through the Straits of Gibraltar. As a consequence contaminants released into the Mediterranean may have a lengthy residence time and there

is a potential 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 to the prevention of cetacean exposure to such compounds in the Mediterranean lies in halting their discharge into the sea.

The development of a regional phase-out strategy for toxic compounds is urgently needed to halt the increase in 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, while others undergo transformation to products which may be equally or more toxic. For example, mercury forms methylmercury in water or in an animal metabolism, a compound highly toxic to all living organisms.

Protection laws for cetaceans are needed 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 research is required 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.

Food shortages may intensify cetacean interactions with fisheries and any measure taken to prevent overexploitation of fish stocks will benefit fishermen, dolphins and fishing resources alike. Overexploitation of fish stocks can have a serious impact on predator populations, causing malnutrition and increasing vulnerability to viral, bacteriological or parasite infections. Lack of food may limit the recovery of different populations already depleted by other causes.

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 subsequently the whole ecosystem. It is necessary to establish protected areas where productivity can be enhanced and cetacean populations recover.

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