Guidelines for technical measures to minimise cetacean-fishery conflicts in the Mediterranean and Black Seas

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Administrative introduction

These Guidelines have been developed in response to requests made by member states to the ACCOBAMS Secretariat for advice on how to minimise conflicts between small cetaceans and fisheries in the Mediterranean and Black Seas. Implicit in the Agreement between member states is the assertion that culling is an inappropriate and usually ineffective means of addressing such conflicts with unacceptable consequences for the conservation of small cetaceans.

There is still much uncertainty over many aspects of the mitigation tools that have been used in attempts to minimise cetacean fishery conflicts. In some cases the efficacy of the methods used is still questionable. These Guidelines have been compiled with the knowledge that there are no certain solutions to any of these problems, and that much scientific work remains to be done to understand how they can be resolved in the long term. Governments are urged to support research efforts in this area.

Terminology:

Conflicts between fisheries and cetaceans generally take one or both of two forms. These are: the accidental capture of cetaceans in fishing operations (**bycatch**) and the **depredation** of fishing gear by cetaceans, leading to loss of catch and damage to fishing gear. In many cases these two problems occur in the same fisheries, and resolving the latter problem may help to resolve the former.

The 2001 ICRAM workshop (Reeves *et al* 2001) recognised a variety of potential mitigation methods to deal with cetacean bycatch and depredation of fish catches in static net fisheries in the Mediterranean. Perhaps the most widely-used methods involve acoustic devices of one form or another. The ICRAM workshop recognised two major categories of acoustic mitigation devices: Acoustic Harassment Devices (AHDs) and Acoustic Deterrent Devices (ADD), including pingers.

Pingers are relatively low-intensity (generally <150dB re 1µP at 1m) battery-powered sound generators that operate in the mid to high sound frequencies (between about 10kHz to around 100 kHz). Pingers are usually designed to prevent small cetaceans from becoming entangled in gillnets, however a new generation of such devices has been designed to mitigate the depredation. At the other extreme, AHDs are designed to work by causing pain, discomfort or irritation to potential predators, and have been developed primarily with the aim of discouraging seals from approaching caged fish. Pingers are usually small (hand-sized) devices that run for weeks, months or years on small batteries. AHDs, in contrast, have relatively high sound source levels (typically >185dB re 1µP at 1m) and operate primarily in the low to mid frequency range (c. 5-30kHz). They are typically bulky pieces of equipment powered from mains electricity or large lead-acid vehicle batteries. As they have primarily been designed with seals in mind, AHDs produce sound within pinniped hearing sensitivities, which are typically lower than those of small odontocetes. Not all acoustic devices necessarily fall into one category or another and the difference between the two types of device, especially in terms of their acoustic output, is qualitative.

How do acoustic devices work?

It remains unclear how most of these devices work and a range of possible mechanisms has been postulated. These include: in the case of AHDs discomfort; scaring; deterring; masking of the animals' acoustic detection senses; or simple confusion. However, in most cases the exact behavioural mechanism by which AHDs work is unclear.

In some cases, it appears that ADDs function in an aversive manner. For example, several studies have shown that harbour porpoises (*Phocoena phocoena*) and, to a lesser extent, bottlenose dolphins (*Tursiops truncatus*) avoid pingers (Koschinski & Culik 1997, Kastelein *et al.* 2000, Culik *et al.* 2001, Laake *et al.* 1998, Cox *et al.* 2003, Goodson *et al.* 1994, Anonymous 2003b). Further details of this research are available on the ACCOBAMS website. Nevertheless, the scope of this research is limited i. The response of small cetaceans to any acoustic stimulus is likely to be context-dependent and our understanding of their reaction to any such sound is limited at best.

Do they work?

Both practical experience and several experimental studies have shown that pingers are able to significantly reduce the bycatch of harbour porpoises in gillnets (Kraus *et al.* 1997, Gearin *et al.* 2000, SMRU *et al.* 2000, Larsen *et al.* 2000). Several other studies have shown a similar effect with other small cetacean species including the striped dolphin (*Stenella coeruleoalba*), common dolphin (*Delphinus delphis*) and franciscana (*Pontoporia blainvillei*) (Barlow and Cameron 1999, Imbert *et al.* 2001, Imbert *et al.* 2002, Bordino *et al.* 2002, Bordino *et al.* 2004). The exact reduction in by-catch depends on many factors including the behavioural response of the species in question and the degree to which devices are properly used and maintained.

Early types of AHD were shown to be ineffective in the medium to long term in several experimental studies in North America. Pinnipeds habituated to these devices and sometimes came to regard them as a dinner bell, resulting in *increased* depredation at salmon capture sites (Mate and Harvey 1980). Since these early studies, a new generation of AHDs has been designed for the salmon aquaculture industry. Unfortunately, there have been very few experimental studies to show whether or not these new generation AHDs are effective in reducing depredation. One study in Sweden, in which one model of 'seal scarer' AHD was used close to a salmon netting station was shown to be effective over a short period of several weeks (Westerberg *et al.* 1999).

Several studies in the Mediterranean have tested the effectiveness of acoustic deterrents in reducing damage to gear and depredation caused by bottlenose dolphins. The results of these studies, while promising in some cases, do not present a clear and straightforward answer to the question. Studies to date are summarised in Box 1 below.

Concerns about the use of acoustic devices –

Several concerns have been raised about the use of acoustic devices. Louder devices, such as AHDs designed to keep pinnipeds away from fish farm sites, have been shown to exclude cetaceans from large areas (Olesiuk *et al.* 2002, Morton and Symonds 2002, Johnston 2002). Concerns have, therefore, been raised that the widespread use of such devices may significantly reduce the habitat available for cetaceans in an area. This concern has also been expressed with respect to the large-scale use of pingers, although the spatial scale of such exclusion is likely to be much smaller for each individual device. Small-scale exclusion has been reported for harbour porpoises around active pingers (Culik *et al.* 2001, Berggren *et al.* 2002), but intensive use of such devices over a large area may be a cause for concern if small cetaceans are likewise excluded from significant parts of their habitat. The potential exclusion effect of pingers may be ameliorated to some extent by the finding that continued exposure to such devices may lead to a diminution (though not a disappearance) of the behavioural response and, thus, the area of exclusion (Cox *et al.* 2001).

The possibility has also been raised that some of the AHDs in use around aquaculture sites may cause physical damage to animals nearby. It might be assumed that animals would choose to remain at a comfortable distance from a very loud sound source, but in situations in which aversive signals are only emitted sporadically it is possible that a cetacean or seal might get close enough to a sound source to suffer auditory damage if the device was activated. Theoretical studies suggest that auditory damage would be possible for cetaceans within 10m of a sound source. Pinnipeds, with less sensitive hearing, are less likely to be damaged unless they were even closer (Gordon and Northridge, 2002; Taylor *et al.* 1997).

In the Mediterranean, where small populations of the highly endangered Mediterranean monk seal still survive, there are important concerns about the possibility of both habitat exclusion and hearing damage to seals as a result of the use of AHDs (Reeves *et al.* 2001).

Depredation – approaches to minimising the problem

There are numerous accounts of dolphins depredating fisheries in the Mediterranean, and more details of these can be found on the ACCOBAMS website (http://www.accobams.org/index_science.htm). Fisheries involved include hook and line fisheries, purse seine or *lampara* fisheries and gillnet fisheries. While not the only species involved, bottlenose dolphins appear to be the most frequently implicated.

Member States in the ACCOBAMS area have committed themselves to protecting cetaceans, and thus have a duty to assist fishermen in finding appropriate means of minimising these conflicts. Experience in many areas shows that if fishermen are not given appropriate assistance and guidance that they may resort to inappropriate measures to deal with the problem. Appropriate mitigation measures should therefore be sought and encouraged by Member States.

At present there does not appear to be any one simple panacea that will solve the problem of depredation. It is likely that solutions will be case-specific, and the national authorities of member states will need to determine which are the most likely routes to resolve the problem. These guidelines are intended to summarise information at present and assist national or regional authorities to find the most promising avenues. It should be stressed that at present there has been no demonstration of long term effectiveness of any solution.

Acoustic mitigation measures represent a potential avenue that may lead to a solution, but many other appropriate ideas should also be explored, including changes in fishing practices and behavioural conditioning of animals (Reeves *et al.* 2001). Member states should be encouraged to explore such ideas.

Several acoustic deterrents are currently being marketed for use in the ACCOBAMS region to minimise dolphin depredation. It is important to note that no study of such devices has yet shown anything more than a short-term effect. Further trials are urgently required, particularly as there are concerns that animals may habituate to acoustic deterrent signals over time and resume depredation. A summary of the trials conducted so far is given in Box 1. **At the present time, no acoustic device has been shown effective at reducing depredation over the medium to long-term**.

The acoustic devices marketed to reduce depredation are all relatively quiet, none approaching the sound source levels achieved in the AHDs used at aquaculture sites. This is largely because AHDs are very expensive and require significant power inputs, whereas most of the lower power devices are less expensive and run on standard alkaline or lithium cells. Box 2 lists some of the available devices.

Not all trials done so far have involved battery-powered sound sources, and some have relied on physical sound production using bells, tubes or clangers (see Box 1). Although these sounds may reduce depredation over the very short term, their effects are not long-lasting.

As some of these devices may effectively limit cetacean habitat availability, member states should be aware of where and how they are being used, and should consider ways to monitor their use. If certain devices are shown to be effective at reducing depredation over the long-term, it may be advisable to certify them for use as mitigation tools. Member States should determine the number of users, the number and type of devices, their output levels, the exposure schedule, the gear type on which they are being used, the area and season of use and the number of ‘target’ and ‘non target’ species present (notably monk seals). ACCOBAMS can provide a central registry to maintain these data. Further details of the number of units that have been sold to certain areas could usefully be obtained from manufacturers.

The main species involved in depredation is the bottlenose dolphin *Tursiops truncatus*. This species, like other cetaceans, may show an obvious **startle** reaction to novel stimuli that could lead to excessively optimistic expectations by the fishermen. In fact, this species learns rapidly, is extremely adaptable and likely to habituate in the long run to almost any noise. Therefore, alternative mitigation strategies or "combined approaches" - such as changes in fishing practices or behavioural conditioning should be favoured.

Overall, acoustic tools to minimise dolphin predation should be used only in an experimental manner. Government agencies should continue to learn how and if they work, and in what circumstances, and also the nature and extent of any ill-effects that they might have, including habituation to the signal. With adequate co-operation and transfer of experience, much may be learned with little expenditure.

Member states should also be aware that other approaches, such as changes in fishing practice or behavioural conditioning, may also prove useful avenues for further research.

Bycatch –unintentional capture in fishing operations

There are numerous records of bycatch of cetaceans in the ACCOBAMS area. Almost all species of cetaceans that are present in any number in the ACCOBAMS area have been recorded taken in some fishing operation or other. In the Black Sea the largest number of animals taken is harbour porpoises. In the Mediterranean and Contiguous Atlantic areas common and striped dolphins are the species most often recorded. A summary of information on bycatches is presented in Box 3.

European Council regulation 812/2004 will require the use of pingers in many northern European gill and entangling net fisheries from 2005 – 2006. The intention of this regulation is primarily to minimise bycatch of harbour porpoises in EU waters. As noted above, pingers have been shown to be effective in reducing porpoise bycatch in a number of fisheries in Europe and North America, and there is no evidence yet that their effectiveness is diminished through time. It should be noted that there have been at least two studies in which bycatch of delphinid species in driftnets has been demonstrably reduced through the use of pingers. Box 2 summarises the types of pinger that are currently available to reduce bycatch, and the tests that have been carried out to show that they work.

It must also be recognised that bycatch of cetaceans cannot ever be completely eliminated by the use of acoustic devices. Pingers have been shown to reduce porpoise bycatch by 90% or more in carefully controlled field experiments. Similar studies have shown a reduction of dolphin bycatch by 80% or more.

Where pinger use has been mandated in other areas, including northern Europe, accompanying observer/monitoring programmes have been mandated to ensure that the efficacy of these devices is maintained. This is even more important where delphinids are concerned, as they may be less easily deterred from entanglement than porpoises.

Any intention to deploy pingers should be preceded by a practicability trial in which selected vessels are equipped with the devices so that deployment issues can be addressed. Experience elsewhere shows that while one pinger may work in one fishery, unexpected problems may arise in another fishery. Issues of concern include how the devices are attached to the net, how they effect fishing efficiency and whether they lead to net fouling. Specific expertise to address these issues can be made available through the ACCOBAMS secretariat.

Other issues, including spacing, costs, battery replacement, and enforcement (where this is needed) need to be considered in advance of any deployment programme. Again, expertise in these areas is available and can be contacted through the ACCOBAMS secretariat.

As with measures to reduce depredation, acoustic approaches are not the only possible solution. Other approaches may include, on a case by case basis, time or area closures for fisheries, or switching to other gear types.

Final remarks:

> The possible adverse impacts of acoustic devices on cetaceans, at both individual and population level, remain poorly known. Furthermore, their effectiveness in reducing depredation is still in the process of being assessed. There is scientific evidence that pingers may reduce the by-catch of harbour porpoises and other small cetaceans in some fisheries. It is still too early to say whether acoustic devices will be effective in reducing depredation over the long term. More focused, long-term research on these topics is urgently needed.

Further information can also be accessed at the following websites:

ACCOBAMS:
http://accobams.org

Cetacean Bycatch Resource Center:
http://www.cetaceanbycatch.org/

International Dolphin Conservation Programme:
http://europa.eu.int/scadplus/printversion/en/lvb/l28083.htm

Summary of current legislation for the conservation of cetaceans:
http://europa.eu.int/comm/fisheries/doc_et_publ/liste_publi/studies/bycatch/07_10legislation.htm

National Marine Fisheries Service:
http://www.nmfs.noaa.gov/bycatch.htm

Other information:
http://europa.eu.int/comm/fisheries/doc_et_publ/liste_publi/studies/bycatch/contents.htm

BOX 1: Studies examining effectiveness of acoustic deterrents:

Species	**Type of interaction**	**Fishery**	**Author**	**Country**	**Device/Manufacturer**
Harbour porpoise (*Phocoena phocoena*)	Bycatch	Bottom set nets	Larsen 1999, Larsen *et al*. 2002	Denmark	Pinger/AQUAtec Sub Sea Ltd.
Harbour porpoise	Bycatch	Bottom set nets	Kraus *et al.* 1997, Trippel *et al*. 1999, Gearin *et al.* 2000	Canada, and USA	Pinger/Dukane Corporation
Common dolphin (*Delphinus delphis*)	Bycatch	Drift nets	Barlow and Cameron 2003	USA	Pinger/Dukane Corporation
Striped dolphins (*Stenella coeruleoalba*)	Bycatch	Drift nets	Imbert *et al* 2002	France	Pinger/AQUAtec Sub Sea Ltd.
Bottlenose dolphins (*Tursiops truncatus*)	Depredation	Set nets	Goodson *et al.* 2001	Italy	Pinger/AQUAtec Sub Sea Ltd.
Bottlenose dolphins	Depredation	Set nets	Gazo *et al.* 2002 also as IWC paper in Shimonoseki	Spain	Pinger/AQUAtec Sub Sea Ltd.
Bottlenose dolphins	Depredation	Set nets	Northridge *et al*. 2003, Vernicos *et al.* 2003	Greece	Pinger/SaveWave BV
Bottlenose dolphins	Depredation	Set nets	Anonymous 2003a	Italy	Pinger/STM Dolphin Deterrent Device
Bottlenose dolphins	Depredation	Set nets, Purse seine	Ben Naceur 1994, Zahri *et al*. 2004	Morocco, Tunisia	Dolphin scaring tube/ handmade
Franciscana (*Pontoporia blainvillei*)	Bycatch	Set nets	Bordino 2003 and Bordino *et al.* 2004	Argentina	Pinger/AIRMAR

BOX 2: Available deterrent devices:

Produced by	**Dukane (dismissed)**	**Aquatec**				**Savewave**		**Airmar**	**Fumunda**	**STM**
Model	Netmark 1000	Aquamark 100 Porpoise deterrent	Aquamark 200 Acoustic Cetacean Deterrent	Aquamark 210 Acoustic Cetacean Deterrent	Aquamark 300 Pinger	Endurance Yellow Saver	High Impact White Saver & Black Saver	Gillnet pinger	FMDP2000	DDD Dolphin Dissuasive Device
Gear	Gillnets and drifnets	Gillnets	Gill, drift and trammel nets	Trammel nets, gillnets, tanglenets and drifnets	Gillnets	Gill and trammel nets	Gill, trammel and trawling nets	Gillnets	Driftnet	Trammel nets
Mitigation use	bycatch	bycatch	Depredation and bycatch	Severe depredation and bycatch	bycatch	depredation	depredation	bycatch	bycatch	depredation
Frequency (kHz)	10	20-160	5-160	5-160	10 (tonal)	50-90	5-90 & 30-160	10	10	1-500
Source level (dB re 1µPa at 1m)	130	145	145	150	132	140	155	132	130-134	NA
High-frequency harmonics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Pulse duration (ms)	300	200-300	200-300	50-300	300	200-400	200-900	300	300	NA
Inter-pulse period (s)	4	4-30	4-30	4-30	4	4-30	4-16	4	4	NA
Wet switch	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Battery	4 Alkaline AA cells	1 D-Cell Alkaline	1 D-Cell Alkaline	1 D-Cell Alkaline	1 D-Cell Alkaline	Sealed 9 v unit	NA	1 D-Cell Alkaline	1 lithium	1,3 Ah NiMH rechargeable
Life	800 hours	1.5-2 years	1.5-2 years	1-2 years	1.5-4 years	8000 hours	2000 hours	At least 1 year	15 months	1000-1500 hours
Battery change	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No
# of emitters	1	1	1	1	1	1	1	1		NA
Maximum depth	200	200	200	200	200	200	200	275	200	200
Distance between pingers	100	200	200	100-200	200	200	200	NA	100	200
Dimensions	168 x 55mm (∅)	164mm x 58mm (∅)	164mm x 58mm (∅)	164mm x 58mm (∅)	164mm x 58mm (∅)	202mm x 67mm x 42mm	202mm x 67mm x 42mm	156mm x 53mm (∅)	152mm x 46mm (∅)	185mm x 61mm (∅)
Weight (g)	400	410	410	410	410	400	Trawls: 6 units per net	408	230	740
Price (Euro)	Discontinued	100	100	100	100	55-70	55-70	44.72	71.14	223
Web site	NA	www.netPinger.net				www.savewave.net		www.airmar.com	www.fumunda.com	www.stm-products.com

Box 3: Bycatch summary of information for the ACCOBAMS area

Gear Type	**Nation**	**Season**	**Location**	**Target species**	**Bycatch species**	**Known or suspected**	**Monitored/ Estimated**
Drift nets (“spadara” and other types) (mesh size 18 to 42 cm)	Morocco, Turkey, France, Italy, a few vessels are also present in Albania, Algeria, Greece, Monaco	April-August	Mediterranean	*Xiphias gladius, T. alalunga*	*S. coeruleoalba, Ziphius cavirostris* (*Globicephala spp., D. delphis, Grampus griseus, Physeter macrocephalus, Balaenoptera physalus, B. acutorostrata*	Known	Monitored and extrapolated*:* Di Natale *et al*., 1999; Di Natale *et al*., 1992; Silvani *et al*. 1999; Di Natale *et al*. 1993
Drift nets (“Thonaille”) (mesh size 18 to 24 cm)	France, Monaco	May-September	Mediterranean	*T. thynnus*	*S. coeruleoalba*	Known	Monitored and extrapolated: Imbert *et al*. 2001, 2002
Drift nets (mesh size 8 to 16 cm)	Italy	Spring-Autumn	Mediterranean	*Sarda sarda, Auxis rochei,* other small tuna species.	*T. truncatus, Grampus griseus*	Known	Estimated total: Di Natale & Notarbartolo di Sciara, 1994
Drift nets (mesh size 4 to 7 cm)	Many coastal areas	Spring	Mediterranean	*Scomber* spp., *Boops boops,* and other small pelagic species	*S. coeruleoalba, Tursiops truncatus*	Suspected: many interactions with fishing gear	
Bottom set gillnets (including coastal trammels)	Many coastal areas	All	Mediterranean	*Mullus* spp., *Sepia* spp. Sparidae, *Scorpaena* spp. other demersal species	*Ziphius cavirostris*, *D. delphis S. coeruleoalba*, *Grampus griseus,T. truncatus, Physeter macrocephalus*	Known: also high level of gear interaction	Di Natale, 1989; Di Natale & Notarbartolo, 1994; Bradai, 2000; Centro Studi Cetacei, 1987-2000; Lauriano *et al*., 2001.
Bottom set gillnets	Many deep coastal areas	All	Mediterranean	*Palinurus elephas, Merluccius merluccius*	*T. truncatus*	Gear interactions known	CORISA, 1992
Bottom set gillnets for turbot and dogfish	All range countries	April-June	Black Sea	*P. maeotica, Sualus acanthias*	*Phocoena phocoena, T. truncatus*	Known: high impact	Birkun 2002
Bottom set gillnets for sturgeon	All range countries	April-June	Black Sea	*Acipenser spp., Huso huso*	*Phocoena phocoena, T. truncatus, D. delphis*	Known: low impact	Birkun 2002
Bottom set gillnets for turbot	Turkey	April-June	Black Sea	*P. maeotica, Sualus acanthias*	*Phocoena phocoena*	Known: high impact	Birkun 2002
Bottom set gillnets for turbot	Turkey	April-June	Black Sea	*P. maeotica, Sualus acanthias*	*T. truncatus*	Known: very low impact	Birkun 2002
Middle-water set gillnets	Many coastal areas	All	Mediterranean	*Boops boops, Oblada melanura, Trachurus* sp., *Spicara* spp.	*T.truncatus*	Known	Di Natale pers comm.
Set gillnets for sprat	Romania	March-May	Black Sea	*S.s. phalaericus, E .e.*	*Phocoena phocoena*	Known	Birkun 2002

and anchovy				*ponticus*			
Set gillnets for scad	Romania	July-September	Black Sea	*Trachurus spp.*	*D. delphis*	Known	Birkun 2002
Trap nets	Bulgaria, Georgia, Ukraine	May-June	Black Sea		*T. truncatus*	Very low impact	Birkun 2002
Purse seine	All	All	Mediterranean	*Sardina pilchardus, Engraulis enchrasiculus,* other small pelagic species	*T. truncatus*	Known: occasional plus many gear interatciuons	Bradai, 2001
Purse seine (mullet and anchovy)	Kerch Strait, Crimea	November-December	Black Sea	*M. soiuy, E .e. ponticus*	*T. truncatus*	Low impact	Birkun 2002
Tuna purse seine	Spain, France, Italy, Greece, Tunisia, Turkey, Croatia, Algeria, Morocco	March-October	Mediterranean	*Thunnus thynnus*	*S. coeruleoalba*.	Known: rare	Magnaghi & Podesta, 1987; Podestà & Magnaghi, 1989
Tuna traps	Spain, Italy, Tunisia, Libya, Morocco, Croatia	April-July	Mediterranean	*Thunnus thynnus*	*T. truncatus B. acutorostrata*, *Orcinus orca*	Known: Interactions are sporadic	Di Natale, 1992; Bradai, 2001; Di Natale & Mangano, 1983
Bottom trawl	All areas	All	Mediterranean	A large range of demersal species	*T. truncatus*. A very high number of interactions is reported	Known.	Silvani et al., 1992
Harpoons	Italy, Turkey	April-August	Mediterranean	*Xiphias gladius, Thunnus thynnus, Tetrapturus belone*	*S. coeruleoalba, Grampus griseus, Physeter macrocephalus, Ziphius cavirostris, D. delphis*.	Known: reports of deliberate harpooning in the 1980s, no recent cases recorded;	Di Natale, 1992
Drifting long lines	Spain, Italy, Greece, Albania, Turkey, Cyprus, Lebanon, Egypt, Libya, Tunisia, Algeria, Morocco, Malta	March-December	Mediterranean	*Xiphias gladius, Thunnus thynnus*	*Stenella coeruleoalba*, *Grampus griseus*, *T. truncatus*, *Pseudorca crassidens*, *Globicephala melas*, *Ziphius cavirostris*, *Physeter macrocephalus*, *Balaenoptera physalus*	Known: probably low level	Duguy *et al*. 1983; Di Natale & Mangano, 1983; Di Natale, 1992 Di Natale *et al*., 1993
Drifting long lines	Spain, Italy, Greece, Albania	Spring-Autumn	Mediterranean	*Thunnus alalunga* and other small tunas	*S. coeruleoalba, T. truncatus..*	Frequent interactions are already reported	Di Natale *et al*., 1992
Pelagic pair trawl	Italy	All	Mediterranean	Pelagic schooling species	*T. truncatus*	Known	Vallini, pers.com
Pelagic trawl	France, Italy	All	Mediterranean	Demersal species	Delphinids	Suspected, by analogy	No
Pelagic trawl	Georgia, Ukraine	November-	Black Sea	*E .e. ponticus*	*D. delphis*	Known	Birkun 2002

		December					
Encircling gillnets	Spain, Italy, Greece	Spring-Summer	Mediterranean	*Boops boops, Oblada melanura, Belone belone, Spicara spp.* other small and medium size pelagic species	*Tursiops truncatus*	Suspected	Goodson *et al*., 2001
Bottom long lines	Spain, Italy, Greece, Albania,	All	Mediterranean	*Merluccius merluccius,* Sparidae spp., *Lepidopus caudatus*		Suspected: fishermen report sporadic interactions	
Rod and reel	Spain, France, Italy	Spring-Summer	Mediterranean	*Thunnus thynnus*		Suspected: fishermen report sporadic interactions	
Hand-line	Spain, Italy, Greece	Sping-Summer-Autumn	Mediterranean	*Thunnus thynnus*		Suspected: fishermen have reported a few interactions	
Jigging line	Spain, Italy, Greece	May-September	Mediterranean	*Todarodes sagittatus, Illex* sp.		Suspected: Very frequent interactions are reported by fishermen	

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