Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area, concluded under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS)

Accord sur la Conservation des Cétacés de la Mer Noire, de la Méditerranée et de la zone Atlantique adjacente, conclu sous l'égide de la Convention sur la Conservation des Espèces Migratrices appartenant à la Faune Sauvage (CMS)

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REVIEW OF BYCATCH RATES OF CETACEANS IN THE MEDITERRANEAN AND THE BLACK SEA

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Note of the Secretariat:

This document is aimed at reviewing available data and information on cetacean bycatch in the ACCOBAMS Area and at providing baseline information.

It has been prepared in 2017/2018 within the framework of the ACCOBAMS/GFCM Project on mitigating the interactions between endangered marine species and fishing activities supported by the MAVA Foundation.

The document has been reviewed by the ACCOBAMS Support Group to the Task Manager on Interactions with fisheries and presented to the Twelfth Meeting of the ACCOBAMS Scientific Committee (Monaco, 5-8 November 2018).

REVIEW OF BYCATCH RATES OF CETACEANS IN THE MEDITERRANEAN AND THE BLACK SEA

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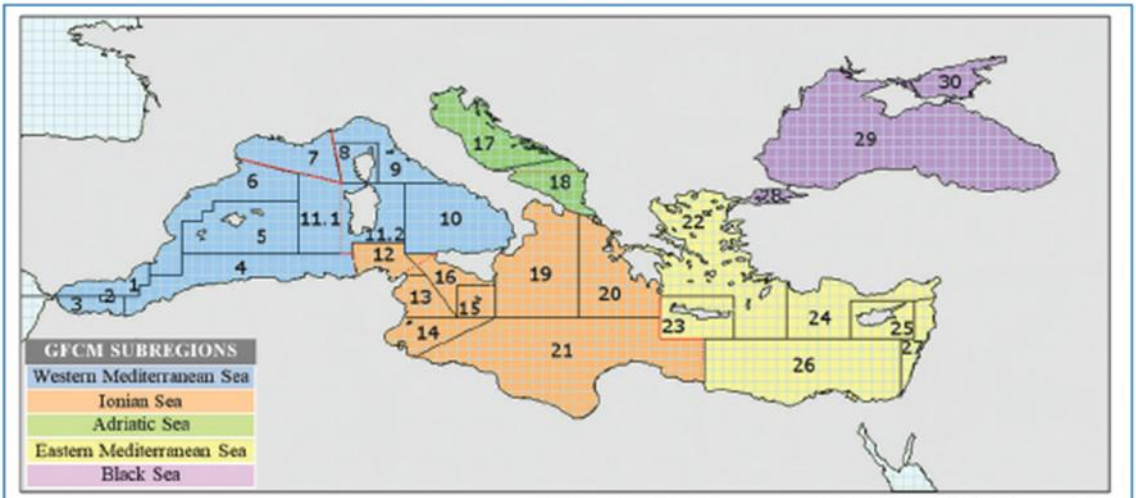
INTRODUCTION

The aim of this document is to present, by GFCM geographical sub-area (GSA), the most significant results of studies published on cetacean bycatch in Mediterranean and Black Sea fisheries. The catch per unit effort (CPUE), the mortality rate and the estimated number caught annually are the main parameters used to evaluate and compare the impact of different fishing techniques on the protected species.

This information, when documented by the authors, is presented in tables that include the GSA, species affected, fishing gear used, fishing effort and number caught during the study period. If available, the method used is also indicated: at sea observation (O), survey by questionnaire (S), logbook monitoring (L) or noted as simple anecdotal information (A).



GFCM GSAs

01 - Northern Alboran Sea	07 - Gulf of Lion	13 - Gulf of Hammamet	19 - Western Ionian Sea	25 - Cyprus
02 - Alboran Island	08 - Corsica	14 - Gulf of Gabes	20 - Eastern Ionian Sea	26 - South Levant Sea
03 - Southern Alboran Sea	09 - Ligurian Sea and Northern Tyrrhenian Sea	15 - Malta	21 - Southern Ionian Sea	27 - Eastern Levant Sea
04 - Algeria	10 - South and Central Tyrrhenian Sea	16 - Southern Sicily	22 - Aegean Sea	28 - Marmara Sea
05 - Balearic Islands	11.1 - Sardinia (west) 11.2 - Sardinia (east)	17 - Northern Adriatic Sea	23 - Crete	29 - Black Sea
06 - Northern Spain	12 - Northern Tunisia	18 - Southern Adriatic Sea	24 - North Levant Sea	30 - Azov Sea

THE SPECIES

All species found in the Mediterranean and Black Sea can be impacted by fishing:

- **the striped dolphin (*Stenella coeruleoalba*)** considered to be the most abundant cetacean species in the Mediterranean (Aguilar, 2000).
- **the common bottlenose dolphin (*Tursiops truncatus*)** and its Black Sea sub-species ***Tursiops truncatus ponticus*** widely found in areas dominated by neritic waters.
- **the short-beaked common dolphin (*Delphinus delphis*), *Delphinus delphis ponticus*** in the Black Sea, the abundance of which is in strong decline.
- the **sub-species of porpoise *Phocoena phocoena relicta*** confined to the coastal waters of the Black Sea as well as the northern-central part of the Aegean Sea.
- the **Long-finned pilot whale** (***Globicephala melas)*** which is regularly present in Mediterranean Sea.
- the **Cuvier's beaked whale (*Ziphius cavirostris*), Risso's dolphin (*Grampus griseus*), the fin whale (*Balaenoptera physalus*), the sperm whale** (***Physeter macrocephalus***) found in deep pelagic areas and in the canyons of the continental slope.

In addition to these endemic species, ***Phocoena phocoena*** which can occasionally penetrate in Mediterranean Sea up to Tunisian coast (Duguy *et al.*, 1983), as ***also Megaptera novaeangliae*** (Bradai et Ghorbel, 1998), **killer whales** (***Orca orca***) and **false killer whales** (***Pseudorca crassidens***) are occasionally found in the Mediterranean.

FISHING TECHNIQUES

1. DRIFTNETS (GND)

A significant cause of mortality for small cetaceans, the use of driftnets targeting large pelagic fishes such as bluefin tuna (BFT), swordfish (SWO) and albacore (ALB) has been banned in GFCM member countries. However, applying this ban in the Mediterranean has been difficult despite the programmes to assist with gear change put in place in some countries (Pace *et al*., 2007; Fortuna *et al.,* 2007).

GSA 1 & GSA 3 Morocco, the Alboran Sea

In 2000, an analysis of the Moroccan swordfish fishery by the ONP (the National Fisheries Bureau) of Tangiers showed only limited bycatch, mostly of sharks (Srour and Abid, 2004). However, Hispano-Moroccan gillnetters targeting large pelagics in the Strait of Gibraltar caught, between 2000 and 2004, an annual average of some 13 358 short-beaked common dolphins and striped dolphins in the Strait and in the neighbouring Atlantic waters as well as 3 647 dolphins (50% of *D. delphis* and 50% of *S. coeruleoalba*) in the Alboran Sea (Tudela *et al.*, 2005). Incidental catches and strandings of large cetaceans (*Balaenoptera physalus, Balaenoptera acurostrata*) and long-finned pilot whales (*Globicephala melas*) with net marks were also observed suggesting that this activity persisted beyond the deadline (Cornax *et al.,* 2006). Until 2004 Morocco acknowledged that around 370 vessels were drift-netting for swordfish. In 2006, the United States and the EU offered financial assistance to eliminate this technique which was to become effective on the 1st of January 2009.

GSA	Species	Period	Gear	Effort (km)	No (Obs.)	CPUE	No/annum	Mortality	Method	Reference
1 Al Hoceima-Nador Alboran Sea	*S. coeruleoalba/ D.delphis*	2002-2003	GND SWO	4 140.5	237	0.06	3 647		S	Tudela *et al.*, 2005
1 Strait of Gibraltar	*Delphinus delphis*	1993-1994	GND SWO	304	20	0.0064	160	99	O	Silvani *et al.,* 1999
1 Strait of Gibraltar	*Stenella coeruleoalba*	1993-1994	GND SWO	304	21	0.0067	167	100	O	Silvani *et al.,* 1999
1 Strait of Gibraltar	*S. coeruleoalba/ D.delphis*	1993-1994	GND SWO	304	41	013	327		O	Silvani *et al.,* 1999
3 Alboran Sea	No data	2000	GND SWO						S	Srour and Abid, 2004

GSA 4 Algeria

There is no available data on estimation of cetacean by-catch by driftnetting although several anecdotal information provided by newspapers seem to confirm the use of swordfish driftnets in Algeria, as it is reported in an article of 15 March 2018 from the Algerian electronic newspaper observalgerie.com with the mortality of 30 dolphins killed after being caught by fishermen using driftnets at Skikda, Jijel and Beni Saf (https://www.observalgerie.com/actualite-algerie/video-kabylie-des-dauphins-massacres-par-des-pecheurs/).

GSA 7 and 8 France

The “thonaille”, a small pelagic driftnet used to catch tuna and swordfish by small-scale French fishers, has been banned since 2007. It is estimated that some 155 striped dolphins were caught annually by these nets (David *et al*., 2010) together with occasional catches of other cetacean species such as the sperm whale, the fin whale or Risso’s dolphin.

However, as in the Alboran Sea, stranded Stenella with net marks indicated that this illegal activity persisted along the French coast until 2009 (Sacchi and David, 2008).

The activity of French gillnetters targeting Bluefin tuna along the French Mediterranean coast (NW Mediterranean) was monitored from 2000 to 2003 to determine their incidental catch of protected species such as certain cetaceans (striped dolphins and long-finned pilot whales) (Banaru *et al.,* 2010).

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference
7 Gulf of Lions and Gulf of Genoa	*S.coeruleoalba*	(2000-2003)	GND BFT ("thonaille")	14 500	93	0.006			L O	Bănaru *et al.*, 2010
7 Gulf of Lions and Gulf of Genoa	*S.coeruleoalba*		GND BFT ("thonaille")		155				O	David *et al.*, 2010
7 Gulf of Lions and Gulf of Genoa	*G. melas*		GND BFT ("thonaille")		1	0.000			O	David *et al.*, 2010

GSA 12, 14 Tunisia

In several southern Mediterranean areas, despite being banned, this technique has persisted illegally and can results in the incidental catch of large marine mammals as reported in 1995 by Bradai and Ghorbel (Bradai and Ghorbel, 1998). Unfortunately, there is no report on cetacean by-catch by driftnetting excepted only one Minke whale of 4,74m length caught by a fisherman from la Skahira (Gulf of Gabès).

GSA	Species	Period	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
12-14	*B. acutorostrata*	Oct 1995	GND SWO		1				A	Bradai and Ghorbel (1998)

GSA 22 Turkey

Several studies have been undertaken to evaluate the incidental catch of the Turkish pelagic driftnet fishery, which dates from the early 1990s. In May and June 1999 and in 2000, 5 vessels of 9 to 14m long, were monitored in the Aegean Sea, which showed that *S. coeruleoalba, T. truncatus and G. griseus* are the species most affected by this technique (Öztürk *et al.*, 2001).

The development of this metier was immediately associated with several issues of incidental catches as, fishermen in the Fethiye region had reported the catch of 23 dolphins, of which 18 died, entangled during the 2002 season (Akyol *et al.*, 2005); during the same period and in the same area a female sperm whale (*Physeter macrocephalus*) of 12 m length was found entangled in a driftnet for large pelagic fishes the 21 June 2002 and released in life after 3 hours (Öztürk, A.A., 2013).

If a survey carried between May and July 2006 on 18 vessels targeting Albacore in the Gulf of Antalya showed no incidental catch of protected species other than for a few sea turtles, (Karakulak *et al.*, 2007) an another one monitoring 18 gillnetters from the ports of Alanya, Kas, Fethiye and Sığacık over the period May to July 2010 and 2011 with on-board observers and logbooks recorded the by-catch of 7 striped dolphins (Akyol and Ceylan, 2012).

The traditional swordfish and albacore fishery using driftnets ended in July 2011.

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference
22 Aegean Sea	*S. coeruleoalba*	May and June 1999 and 2000	GND SWO	5 VESSELS	13				O,L	Öztürk *et al* (2001)
22	*T. truncatus*	May and June 1999 and 2000	GND SWO		4				O,L	Öztürk *et al* (2001)
22	*G. griseus*	May and June1999 and 2000	GND SWO		2				O,L	Öztürk *et al* (2001)
22 Gulf of Antalya		May and July 2006	GND ALB	18 VESSELS	0				O,L	Karakulak *et al.*, 2007

22 Gulf of Antalya	*S.coeruleo alba*	May and July 2010 and -2011	GND ALB	125 sets 446km	7	0.015		O,L	Akyol and Ceyhan, 2012.

GSA 29 Black Sea

Until its complete ban in 1983, commercial hunting was the main human threat to cetacean populations in the Black Sea (Birkun, 2002).

Cetacean bycatch occurs in the Black Sea waters of the six coastal countries. Fixed gillnets are the most widely-used gear in all countries whilst lines are heavily used in Bulgaria as are pots and traps (FPO) in Ukraine.

The use of driftnets to catch small pelagics as the Black Sea sprat, Black Sea anchovy, shad, horse mackerel and bonito has also become widespread in the Black Sea, especially in Bulgaria, in Romania and in Turkey (Birkun, 2002; Birkun *et al.*, 2014).

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference
29 Turkey	*D.delphis*		GND - Large pelagics	120	0	0			S, O	Birkun *et al.*, 2014
29 Turkey	*P. phocoena*		GND - Large pelagics	2	0	0.0			S, O	Birkun *et al.*, 2014
29 Turkey	*D.delphis*		GND – Small pelagics	60	0	0			S, O	Birkun *et al.*, 2014

2. BOTTOM-SET GILLNET AND TRAMMEL NET (GNS)

These nets are the main gear used in small-scale fishing which represents over 70% of the Mediterranean fleet; their widespread use is one of the main causes of bycatch in coastal areas (Reeves *et al.*, 2013). Given the relatively long duration of the sets, animals that are caught drown. Entanglement in abandoned nets is an additional risk (Sacchi, 2008).

GSA 5 Balearic Islands

In order to evaluate the impact of interactions between bottlenose dolphins and artisanal coastal fishing in the Balearic Islands, Brotons *et al.,* (2008) monitored 1 040 fishing trips between January 2001 and April 2003 with on-board observers on nine different vessels. Whilst depredation by dolphins was reported, no dolphin incidental catch was recorded.

GSA 7 and 8 France

Over the period 2008-2013, bycatch observations were made on board gillnetters in the North Sea, the Atlantic and principally in Corsica for the Mediterranean coast. No incidental catches of cetaceans or sea turtles were recorded during the 164 days of observation between March and September 2011; the absence of the porpoise species probably made the use of this particular gear less problematic in the Mediterranean than in the North East Atlantic (Morizur, 2012; Morizur *et al*., 2014).

GSA 11 Sardinia

The common bottlenose dolphin (*Tursiops truncatus*) is found throughout the year along the northern coast of Sardinia; the increasing presence of bottom-set nets (mainly trammel nets) in the coastal areas (4 to 63 m) has led to the development of depredation and bycatch.

Two studies were undertaken to evaluate the level of interaction between dolphins and bottom-set-net fisheries and their economic impact. One in the Gulf of Ansirana to the north-west of Sardinia, in 2002 used on-board observers (Lauriano *et al.,* 2004); the other along the north-east coast of Sardinia (Italy) between October 1999 and December 2004 combined a survey (S) of fishers with direct observations (O) (Diaz Lopez, 2006). Only the latter study reported the incidental catch of 3 common bottlenose dolphins.

GSA	Species	Area	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
11 NW Sardinia Jan-Apr	*Tursiops truncatus*	2002	GNS 32-72mm White bream, cuttlefish		0				O	Lauriano *et al.*, 2004
11 NW Sardinia	*Tursiops truncatus*	Sep-Dec 2002 2002	GNS 27mm red mullet		0				O	Lauriano *et al.*, 2004
11 W E NE Sardinia	*Tursiops truncatus*	1999- 2004	TR	3 720 days	3	0.29	1.47	66	S, O	Dıaz Lopez, 2006

GSA 12, 14 Tunisia

Excepted one Striped dolphin caught in a trammel net (Bradai, 1991) there is no published data on cetacean by-catch based on fishery survey; however, from 1937 to 2009, 132 strandings of cetaceans on the Tunisian coasts where recorded where bottlenose dolphins (*Tursiops truncatus)* and fin whales (*Balaenoptera physalus)* were the main species concerned. Even though these strandings cannot be directly linked to bycatch, the observations of net marks or pieces of net on the body, tails attached with ropes, show that entanglement in gillnets appear to be the main cause of stranding of 25 *Tursiops truncatus* (Karaa *et al.,* 2012). In this publication, the authors do not give more precision on date of occurrence and on strandings causes for other cetaceans. The authors also stress the problems caused by bottlenose dolphin depredation on the coastal gillnets and trammel nets and the risk that some of them will find themselves trapped as Bradai raise in a previous study (Bradai, 1991).

GSA	Species	Period	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
12,14	*S. coeruleoalba*	June 1991	GTR		1				S	Bradai, 1991
12,14	*T. truncatus*	1937-2009	GNS		25			100%	S	Karaa *et al*., 2012

GSA 17 Italy

Anecdotic information exists on interaction between bottlenose dolphins and sole trammel fishery in the Gulf of Venice (North Adriatic) dealing particularly with depredation (Casale, 2001; 2002).

Black Sea

In the Black Sea (Birkun *et al.,* 2014), the impact of fishing on cetacean populations was studied in 4 countries: Bulgaria, Turkey, Romania and Ukraine. The study combined the results of previous work with the results of surveys undertaken jointly in the 4 participating countries and covering all the metiers known to involve incidental catches.

The estimates were made once fishing effort had been adjusted for the 1 075 different boat/metier combinations for the four countries.

The most commonly-used gillnets are those for turbot, together with turbot trammel nets (GNS and GTR SCO), and for dogfish.

GSA 29 Bulgaria

A study using on-board observers, undertaken from April to July 2010 and 2011, showed that, over the course of 24 sets, 982 turbot gillnets (88.4 km) caught 21 cetaceans, comprising 19 porpoises and 2 bottlenose dolphins (Mihaylov K., 2011).

Moreover, a survey of 812 gillnet turbot fishers enabled an estimate to be made that 945 662 km of rigged nets resulted in annual catches of 3 016 porpoises and 1 895 bottlenose dolphins, giving respective CPUEs of 0.22 and 0.02 (Birkun *et al.*, 2014).

GSA	Species	Period	Gear	Effort	No	CPUE (/km)	No/annum	Mortality	Method	Reference
29 Central Bulgaria	*P. phocoena*	April-July 2010-2011	GNS SCO	88.4km	19	0.22/km			O	Mihaylov K., 2011

29 Central Bulgaria	*T. truncatus*	April-July 2010-2011	GNS SCO	88.4km	2	0.02/km			O	Mihaylov K., 2011
29 Bulgaria	*P. phocoena*		GNS SCO	945 662 km		0.02	3 016		S	Birkun *et al.*, 2014
29 Bulgaria	*D. delphis*		GNS SCO	945 662 km		0.002	1 895		S	Birkun *et al.*, 2014

GSA 29 Ukraine

Bottom-set gillnets targeting turbot (*Psetta maxima maeotica*) and spiny dogfish (*S. acanthias*) account for 98% of cetacean bycatch in the waters of Crimea and the Russian Caucasus.

Between 2006 and 2009, in Ukraine, the annual monitoring by on-board observers of 4 769 bottom-set gillnets (354.1 km) targeting turbot or dogfish recorded an incidental catch of 515 harbour porpoises and five bottlenose dolphins (Birkun Jr. and Krivokhizhin S., 2011).

Furthermore, a survey of 543 vessels enabled an estimate to be made that 760 865 km of nets, covering all target species, resulted in a reported annual bycatch of 1 539 harbour porpoises and 1 211 dolphins.

GSA	Species	Period	Gear	Effort (km)	No	CPUE	No/annum	Mortality	Method	Reference
29 Ukraine	*P. phocoena*	2006-2009	GTR SCO	250	355	1.42			O	Birkun and Krivokhizhin, 2011
29 Ukraine	*T. truncatus*	2006-2009	GTR SCO	250	5	0.02			O	Birkun and Krivokhizhin, 2011
29 Ukraine	*P. phocoena*	2006-2009	GNS dogfish	104	159	1.51			O	Birkun and Krivokhizhin, 2011
29 Ukraine	*T. truncatus*	2006-2009	GNS dogfish	104	0	0			O	Birkun and Krivokhizhin, 2011
29 Ukraine	*P. phocoena*		GNS SCO	760 865		0.002	1 539		S	Birkun *et al.*, 2014
29 Ukraine	*D.delphis*		GNS SCO	760 865		0.0015	1 211		S	Birkun *et al.*, 2014
29 Ukraine	*T. truncatus*	2006-2009	GNS SCO & dogfish	84 sets	5	0.06				ICES 2010
29 Ukraine	*D.delphis*	2006-2009	GNS	23	2	0.09				Birkun *et al.*, 2014
29 Ukraine	*D.delphis*	2006-2009	GNS	31	29.5	0.95				Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006-2009	GNS	18	0	0.0				Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006-2009	GNS	2	2	1.0				Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006-2009	GNS SCO	24	68	2.8				Birkun *et al.*, 2014
29 Ukraine	*D.delphis*	2006-2009	GNS SCO	34	81.5	2.4				Birkun *et al.*, 2014

GSA 29 Romania

Due to the number of nets and their distribution area, turbot (*Psetta maxima maeotica*) gillnet is responsible of important by-catch of dolphins. According Anton *et al.* (2012) every year, during the turbot fishing a large number of stranded *Phocoena phocoena relicta* is recorded attributed to accidental capture with gillnets especially when the mesh size and construction materials provided by the legislation in force are not respected. Furthermore, although turbot fishing is prohibited between 15 April to 15 June, illegal practices are reported, including poaching by Turkish boats entering in the Romanian exclusive economic zone (Radu et Anton, 2014). 9 cases of IUU fishing were reported in Romania between 2007 and 2011 (Ozturk B., 2013).

From 2002, surveys on cetaceans by-catch and stranding were carried on the Romanian littoral by the National Institute for Marine Research and Development (NIMRD) and several other partners. One survey was carried out from April 2006 to March 2007, in collaboration with Mare Nostrum NGO (Radu *et al.*, 2008); an another one was carried out in 2010 with support from ACCOBAMS (Radu *et al.*, 2012). In 2011, data were provided both by Border Police County Inspectorate and records done by NIMRD Constanta during the survey fishing carried-out with the bottom/mid-water trawl or turbot gillnet (Radu et Anton, 2014).

Moreover, poaching and illegal fishing practices result in the abandon of gillnets at sea by the offenders leading to ghost fishing. Radu *et al.* (2006) thus noted that 20 porpoises (*Ph. Phocoena*) had been caught in abandoned illegal turbot nets around 40 km long roughly estimated as 50 cetaceans per 100 km of net (0.5 indiv./km).
To reduce the risk of "ghost fishing", surveys with the research vessel Steaua de Mare 1, were conducted in the months May-June, in 2010 and 2011, to recover nets abandoned by the gillnetters. When abandoned gillnets lifted on board control vessels, by-caught dolphins are often found, usually decayed.
From 2002 to 2011, 483 stranded cetaceans were recorded of which 259 porpoises, 20 common dolphins, 44 bottlenose and 160 unidentified dolphins; from these field dolphins stranded investigations the presence of nets marks and scars on the body revealed that more than 95% of the dolphins stranded on the Romanian Black Sea coast had been accidentally caught in gillnets (for turbot, dogfish etc.). Thus, from 2002 to 2011, 129 porpoises and 2 bottlenose dolphins were recorded as consequence as by-catch in the fishing gears (gillnets, pound nets, pelagic trawl) used in the Romanian fisheries (Radu et Anton, 2014).
The study to determine the existing state of knowledge of Black Sea cetaceans and their interactions with fisheries historically and currently (Birkun *et al.*, 2014) considered only 5 observed trips made by fishery enforcement vessels or research vessels to inspect nets at sea and interview surveys to estimate by-catch rate; 5 hauls were observed in 2002 (1 trip), 2010 (3 trips) and 2011 (1 trip). Concerning the interview surveys, the number of questionnaire responses is given with the number of boats the answers refer to – as some responses were recorded on behalf of two or more vessels. 56 responses from 165 boats give an estimation of a by-catch of 208 porpoises per year but none of the 84 records from 249 boats gives by-catch of other dolphin's species.
The authors estimate a potential by-catch of turbot net of 2.71 porpoise/boat/year as long as one assumes that responses are not biased (Birkun *et al.*, 2014).

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference
29 Romania	*P.phocoena*	1984-1990	GNS SCO		541		77		S	Vasiliu and Dima, 1990
29 Romania	*D. delphis*	1984-1990	GNS SCO		22		3		S	Vasiliu and Dima, 1990
29 Romania	*T.truncatus*	1984-1990	GNS SCO		3		0.42		S	Vasiliu and Dima, 1990
29 Romania	*P.phocoena*	2002-2006	GNS SCO		46				S	Radu *et al.*, 2006
29 Romania	*D.delphis*	2002-2006	GNS SCO		3				S	Radu *et al.*, 2006
29 Romania	*T.tursiops*	2002-2006	GNS SCO		2				S	Radu *et al.*, 2006
29 Romania	*P.phocoena*	2005	GNS SCO	40km	20	0.5/km			S	Radu *et al.*, 2006
29 Romania	*P;phocoena*		GNS SCO	56 hauls	208	3.71	208		S	Radu et Anton, 2014
29 Romania	*P.phocoena*	2002. 2010, 2011	GNS SCO	5 hauls	52	10.40			S	Radu et Anton, 2014
29 Romania	*T.truncatus*	2002. 2010, 2011	GNS SCO	5 hauls	0	0			S	Radu et Anton, 2014
29 Romania	*P.phocoena*	2013 ?	GNS SCO	56 records			208		S	Radu et Anton, 2014
29 Romania	*delphinidae*	2013 ?	GNS SCO	84 records	0	0	0		S	Radu et Anton, 2014
29 Romania	*P.phocoena*	2002 & 2010	GNS SCO	5 5 sets	52	10.4			O	Birkun *et al.*, 2014
29 Romania	*T.truncatus*	2002 & 2010	GNS SCO	5 5 sets	0	0.000			O	Birkun *et al.*, 2014

GSA 29 Turkey

In the western part of the Turkish Black Sea, 40 porpoises and one bottlenose dolphin were bycaught in 875 nets that totalled 94.5 km in length (Tonay A.M., Öztürk B. 2003).
In 2006, ten cruises were undertaken from the port of Sinop (on the central coast of the Black Sea) using four turbot set-gillnets per trip, 2 with pingers and 2 without. The control nets (without pingers) produced a bycatch sample of 92 porpoises for 20 sets of 1.1 km of turbot gillnet (Gönener and Bilgin, 2009).

The study over two seasons (from April to the end of July in 2007 and to the middle of September in 2008) of the fishing trips of a vessel using trammel nets to target turbot showed a total bycatch of 24 harbour porpoises and one common bottlenose dolphin (Tonay A.M., 2011).
According to Tonay, annual porpoise catches in the Western Turkey turbot fishery are estimated as between 1 269 and 3 100 individuals, including illegal fishing (Tonay A.M. 2016).
Based on interviews with 1 119 fishers, it may be estimated that 306 158 km of turbot trammel net resulted in an annual bycatch of 6 477 porpoises and 4 500 dolphins.

GSA	Species	Period	Gear	Effort (km)	No	CPUE	No/annum	Mortality	Method	Reference
29 W Turkey Black Sea	P. phocoena		GTR SCO	94.5km long	40	0.42			O	Tonay & Öztürk, 2003
29 W Turkey Black Sea	T.truncatus		GTR SCO	94.5km long	1	0.01			O	Tonay & Öztürk, 2003
29 W Turkey Black Sea	D. delphis		GTR SCO	94.5km long	1	0.01			O	Tonay & Öztürk, 2003
29 Central Turkey Sinop peninsula	P. phocoena	March April 2006	GTR SCO	22km	92	4.6/set 4.14/km			O	Gönener & Bilgin, 2009
29 Central Turkey Sinop peninsula	P. phocoena	March April 2006	GTR SCO	22km	2	0.01			O	Gönener & Bilgin, 2009
29 W Turkey Black Sea	P. phocoena	2007-2008	GTR SCO	~130 km	24	0.18	2 039		O	Tonay, 2011, 2016
29 W Turkey Black Sea	T. truncatus	2007-2008	GTR SCO	~130 km	1	0.01			O	Tonay, 2011, 2016
29 Turkey	P. phocoena	2006	GTR SCO	306 158		0.02	6 477		S	Birkun *et al.*, 2014
29 Turkey	D. delphis	2006	GTR SCO	306 158		0.014	4 500		S	Birkun *et al.*, 2014

Other gillnet metiers

Bottom-set gillnets targeting turbot from April to June appear to be the most dangerous for dolphins in the Black Sea and especially for porpoises. However, porpoises and bottlenose dolphins can also be caught in sole (*Solea spp*.) trammel nets and sturgeon nets.

GSA	Species	Period	Gear	Effort (km)	No	CPUE	No/annum	Mortality	Method	Reference
29 Turkey	*D.delphis*	2006	GNS	17	33	1.94			S	Birkun *et al.*, 2014
29 Turkey	*D.delphis*	2006	GNS	85	134	1.58			S	Birkun *et al.*, 2014
29 Turkey	*P. phocoena*	2006	GNS	9	24	2.7			S	Birkun *et al.*, 2014
29 Turkey	*P. phocoena*	2006	GNS	53	169	3.2			S	Birkun *et al.*, 2014

3. DRIFTING LONGLINES (LLD)

Drifting and surface longlines are mainly used in the Mediterranean to target tuna, albacore, swordfish and some other fishes (Di Natale, 1990). Little is known of their interactions with marine mammals as the latter are often released at sea alive. Because they are offshore techniques, the risks of incidental catch by drifting longlines are mainly the result of depredation attempts on the bait or on the catch and therefore concern mainly striped dolphins (*Stenella coeruleoalba*), false killer whales (*Pseudorca crassidens*) and Risso's dolphins (*Grampus griseus)*.

GSA 4, 5, 6 Spain

An on-board observer programme was implemented by the Spanish Institute of Oceanography to study the incidental catches caused by different types of longline used by the Spanish fleet in large pelagic fisheries: i.e. the traditional longline (LLHB), the American longline (LLAM), the Japanese longline (LLJAP), the albacore longline (LLALB) and the semi-pelagic longline (LLSP) whose main line floats in mid-water (Macías López *et al.,* 2012).
These longlines differ mainly in the immersion depth of the hooks with the albacore longline being the shallowest whilst hooks of Japanese longlines (LLJAP) and semi-pelagic longlines (LLSP) can reach depths of 50 to 100 m.
They were also compared to the longline generally used to catch hake and blue-spotted seabream, the piedra y bola longline (LLPB).
In all, 2 877 sets were observed between 2000 and 2009. Only 52 of these fishing operations were found to have interacted with marine mammals, with Risso's dolphin being the species most frequently affected by this fishing technique. Most bycatch was recorded beyond the continental shelf, in the pelagic waters to the south west of the Balearic Islands and in the Alboran Sea.

The differences found between fishing gears might be related in part to the depth at which they are used as well as to the type of bait: cephalopods are used with LLJAP whilst sardines and mackerels are mainly used for other types of gear.
Moreover, the deepest longlines may result in higher mortality rates as they prevent marine mammals from regaining the water surface to breathe.

GSA	Species	Period	Gear	Effort (No of hours)	No (Obs.)	CPUE	No/annum	Mortality	Method	Reference
6 Western Mediterranean	*D.delphis*	2000-2009	LLALB	498 854	1	0.002			O	Macías López *et al.,* 2012
6 Western Mediterranean	*D.delphis*	2000-2009	LLHB	3 224 335	5	0.0015			O	Macías López *et al.,* 2012
6 Western Mediterranean	*S. coeruleoalba*	2000-2009	LLALB	498 854	2	0.0040			O	Macías López *et al.,* 2012
6 Western Mediterranean	*S. coeruleoalba*	2000-2009	LLHB	3 224 335	5	0.0016			O	Macías López *et al.,* 2012
6 Western Mediterranean	*S. coeruleoalba*	2000-2009	LLAM	332 890	1	0.0030			O	Macías López *et al.,* 2012
6 Western Mediterranean	*G. melas*	2000-2009	LLJAP	528 555	2	0.0038			O	Macías López *et al.,* 2012
6 Western Mediterranean	*G. melas*	2000-2009	LLHB	3 224 335	2	0.0006			O	Macías López *et al.,* 2012
6 Western Mediterranean	*G. griseus*	2000-2009	LLJAP	528 555	13	0.0246			O	Macías López *et al.,* 2012
6 Western Mediterranean	*G. griseus*	2000-2009	LLHB	3 224 335	9	0.0028			O	Macías López *et al.,* 2012
6 Western Mediterranean	*G. griseus*	2000-2009	LLSP	461 830	4	0.0087			O	Macías López *et al.,* 2012
6 Western Mediterranean	*G. griseus*	2000-2009	LLAM	332 890	4	0.0120			O	Macías López *et al.,* 2012

4. DEMERSAL LONGLINES (LLS)

Except for a few semi-pelagic techniques used on the steep continental slopes, most bottom-set longlines are found in coastal areas, are not very long and are set for relatively short periods of time, thus rarely resulting in cetacean bycatch**.**

Long liners operating in the Black Sea (from Romania and Ukraine) are mostly small vessels (from 6 to 12 metres) targeting mixed demersal species such as the goby and the spiny dogfish. These vessels can use other types of gear during mixed fishing operations.

5. HANDLINES (LHP)

A survey of 4 fishers in Bulgaria did not reveal any cetacean bycatch using this fishing technique given its short soak time (Birkun *et al*., 2014).

6. TRAWLS (OTB and OTM)

Amongst the various types of trawling, only pair trawls or large-opening trawls targeting small pelagics (OTM), and even demersal species in mid water, may result in bycatch of small cetacean and, occasionally, fin whale or killer whale bycatch (Sacchi, 2008). Bottom trawling (OTB) presents fewer risks for cetaceans. The impact of these metiers in the Mediterranean remains relatively low compared to Atlantic fisheries, given the reduced duration of the hauls, the small number of fishing areas where these techniques are used. At the opposite, mid-water trawling (OTM) represent a more important risk with the large size of the net opening and because the small pelagic fishes which is the main target species in Mediterranean Sea represent typical components of dolphins' diet.
Bycatch in trawling nets appears often as consequence of depredation behaviour particularly with the common bottlenose dolphin which can be attracted by discards or by the concentrated food into in the trawl (Northridge, 1984; Consiglio *et al.*, 1992; Silvani *et al.*, 1992; Goffman *et al.*, 1995; Bearzi, 2002).

GSA 5 Balearic Islands
No bycatch was recorded by on-board observers or reported in interviews with over 50 fishers (Gonzalvo *et al.,* 2008). Massuti (unpublished data) monitored 460 commercial trawling trips off Majorca between 2001 and 2004 and did not report bycatch of dolphins despite the presence of several specimens (*Tursiops truncatus* mainly) around the trawler during the observations.

GSA	Species	Period	Gear	Effort (km)	No (Obs.)	CPUE	No/annum	Mortality	Method	Reference
5		May 2004 and May 2005	OTB	79 tows	0				O,S	Gonzalvo *et al.,* 2008 2008
5		From 2001 to 2004	OTB	460 tows	0				O,S	Massuti (unpublished data)

GSA 7 and 8 France
The information available for the French EEZ in the Mediterranean Sea comes mainly from the Obsmam and Obsmer programmes developed within the framework of the European regulation 812/2004 which initially targeted only small pelagic trawlers but since 2010 has also included large vertical-opening hake trawls. Hence it was observed in 2010 that four striped dolphins (*Stenella coeruleoalba*) were bycaught by Gulf of Lions trawlers using such gear (Morizur *et al.*, 2011). In 2011, one Bottlenose dolphin has been caught by a trawler in the Gulf of Lions after 200 days of fishing and 700 trawl operations. One Striped dolphin was also bycaught for 50 days of fishing activity and 150 trawling operations also within the Gulf of Lions, (Morizur *et al.*, 2012).

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference
7 Gulf of Lions 2004	*S.coeruleoalba*	2004	OTM (large opening trawl)	88	4	0.001-0.004			O	Morizur *et al.*, 2011
7 Gulf of Lions 2004	*S.coeruleoalba*	2004	OTM Hake	?	4				O	Morizur *et al.,* 2011
8 Corsica		From March to	OTB/OTM	164 days	0	0			O	Morizur, 2012

		September 2011								

GSA 12, 14 Tunisia

2 by-catches of dolphins by bottom-trawls have been reported; a stripped dolphin of 1,75 m long in October 1988 near the cap Zebib -North Tunisia (Bradaï, 2000) and a bottlenose dolphin in August 2004 in the Gulf of Gabes (Bradaï *et al.*, 2010).

GSA	Species	Period	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
12 Cape Zebib (North)	*S. coeruleoalba*	Oct 1988	OTB	1 boat	1				A	Bradai, 2000
14 Gulf of Gabes (GG)	*T. truncatus*	August 2004	OTB	1 boat	1				A	Bradai *et al.*, 2010

GSA 17 Italy

There is little quantitative data concerning past or current rates of cetacean bycatch in the Adriatic Sea.

The only quantitative data that exists concerns bottlenose dolphins bycaught by pelagic trawlers targeting anchovy (OTM).

Annual bycatch monitoring programmes of the Italian trawler fleet operating in the Northern Adriatic were established between 2006 and 2008. Observations were made for 27 vessels and 3 141 tows. A total of 609 bottlenose dolphin pods were spotted near the net in more than 30% of the trips, often interacting with fishing operations but only 2 Tursiops were bycaught. The whole fleet recorded a total of 22 animals per annum (Fortuna *et al.*, 2010).

GSA	Species	Period	Metier	Number of tows	No	CPUE	No/annum	Mortality	Method	Reference
17 N Adriatic	*T. truncatus*	2006-2008	OTM	3 141	2	0.001	22	0.0006	O	Fortuna *et al.*, 2010

GSA 27 Israël

Although cetaceans by-catch is a relatively uncommon occurrence in Mediterranean trawling, the danger for dolphins to be caught in a bottom trawl rig seems more acute in Israel, as a third of the reported annual mortality would be trawling bycatch (Kent *et al.*, 2005). As for example, 67 common bottlenose dolphins were found dead stranded or adrift on Israeli coasts of which 26 (39%) were identified incidentally caught in trawls (Goffman *et al*. 1995 in Bearzi, 2002).

GSA	Species	Period	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
27 Israël	*T. truncatus*	Oct 1988	OTB		26			100	A	Goffman *et al.* 1995

GSA 29 Black Sea

There are two main trawling activities in the western part of the Black Sea: mid-water trawlers targeting small pelagics (Black Sea sprat, Black Sea anchovy, shad, horse mackerel, skipjack and bonito) and bottom trawlers targeting demersal fish (turbot, whiting, spiny dogfish and whelk).

The trawl fishery in the Black Sea is seasonal owing to the limited period when target fish species are present in the area covered by the Romanian coastal trawlers (Anton, 2001 in Radu & Anton, 2014).

To a lesser extent, beam trawlers are used in Bulgaria, and Eastern Turkey but no cetacean by-catch has been declared.

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference
29 Bulgaria	*D.delphis*	2006	OTM	36	0	0			S	Birkun *et al.*, 2014

29 Bulgaria	*P. phocoena*	2006	OTM	18	0	0.0		S	Birkun *et al.*, 2014
29 Ukraine	*D.delphis*	2006	OTM	10	18	1.8		S	Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006	OTM	4	2	0.5		S	Birkun *et al.*, 2014

7. PURSE SEINE (PS)

The information available for the Mediterranean seems to confirm that dolphins are not being massively caught in purse seine operations at least for tuna fishing; a technique generally used during the day. The purse seine fleets targeting small pelagic fish which is widespread all around the Mediterranean Sea could be sometimes responsible of bycatches of short-beaked common dolphins and stripped dolphins as it was described for purse seining off the coasts of southern Spain, southern Italy and northern Africa (Aguilar *et al.*, 1991; Tudela, 2004; Zahri *et al.*, 2007).

GSA 7 and 8 France

Unlike tropical tuna-like species in the Western Pacific, the bluefin tuna is not associated with delphinids present in the Mediterranean Sea. As the bluefin tuna purse seine fishery mainly targets free schools, cetacean bycatch is rare; within the framework of the ICCAT Regional Bluefin Tuna Observation Programme, it was reported that 3 *Stenella coeruleoalba* were bycaught in the Gulf of Lions during the 190 fishing day trips on one tuna seiner (Fromentin and Farrugio, 2005).

GSA	Species	Period	Gear	Effort (km)	No	CPUE	No/annum	Mortality	Method	Reference
7 Gulf of Lions 2004	*S.coeruleoalba*	2004	PS Bluefin tuna	1 vessel	3				O	Fromentin & Farrugio , 2005

GSA 12, 14 Tunisia

Bradaï (1991) notes the catch of a bottlenose dolphin of 2.58 m length in a small seine in October 1991. In September 1992, the same author (Bradai and Ghorbel, 1998) reports the catch of a Balaenopteridae of 8.5 m length identified as an Humpback whale (*Megaloptera novaeangliae*) by a purse seiner from La Skhira (Gulf of Gabès).

GSA	Species	Period	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
12-14	*T. truncatus*	Oct 1991	Small seine	1					A	Bradai (1991)
	M.novaeangliae	Sep 1992	PS	1					A	(Bradai and Bouain, 1994; Bradai etGhorbel, 1998)

Black Sea

Purse-seining and shooting were the two principal methods used to catch cetaceans in the Black Sea cetacean fisheries until 1983. Non-selective purse-seining, which enabled catches of 1 000 specimens or more, was the most widespread technique used in the former USSR. Fishing with firearms was banned in this country in 1936 because of the large number of wounded individuals and of dolphins that sank and were wasted. However, shooting remained the most widely-used method from the 1940s and became the predominant technique in the 1960s-1980s. Shooting could result in 40 to 50% catch losses (Birkun *et al.,* 2014).

Nowadays, purse seine fisheries in the Black Sea are dominated by small pelagics, mainly Black Sea anchovies (72% of landings) and Black Sea sprats (20% of landings) with some pilchards, bonitos and other small fish. Seiners represent a large part of small pelagic landings in the Black Sea with the largest fleet coming from Turkey. For example, Turkish vessels are responsible for over 97% of the total anchovy catch in the Black Sea.

GSA	Species	Period	Gear	Effort	No	CPUE	No/annum	Mortality	Method	Reference

29 Ukraine	*D.delphis*	2006	PS	2	2	1		S	Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006	PS	2	0	0.0		S	Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006	PS	4	3	0.8		S	Birkun *et al.*, 2014
29 Turkey	*D.delphis*	2006	PS	91	63.5	0.7		S	Birkun *et al.*, 2014
29 Turkey	*D.delphis*	2006	PS	64	0	0		S	Birkun *et al.*, 2014
29 Turkey	*P. phocoena*	2006	PS	2	0	0.0		S	Birkun *et al.*, 2014
29 Turkey	*P. phocoena*	2006	PS	37	45	1.2		S	Birkun *et al.*, 2014

8. TRAP NET (FPN & FYK)

There are passive and coastal fishing techniques which can trap cetaceans accidentally. In this category, tuna "madragues" can accidentally catch cetaceans. Pound nets can also catch cetaceans as it was recorded by Vasiliu and Dima (1990) for 8 dolphins *Delphinus delphis* caught in the pound nets installed by the Romanian Marine Research Institute in July 1988. Dolphin specimens can enter these installations in search for food and can become captive, especially in pound nets installed on stakes, in which the aerial wall can be rather high above the water and thus constitute a real barrier for dolphins that enter the catching enclosure (Radu et Anton, 2014).

GSA	Species	Period	Metier	Effort	No	CPUE	No/annum	Mortality	Method	Reference
12 Tunisia Sidi Daoud	*B. acutorostrata*	1976	"Madrague" FPN		1				A	Ktari-Chakroun 1980
29 Romania	*D. delphis*	July 1988	Pound net FYKt						A	Vasiliu and Dima (1990)
29 Bulgaria	*D.delphis*	2006	FYKs	16		0	0		S	Birkun *et al.*, 2014
29 Bulgaria	*P. phocoena*	2006	FYKs	16		0	0.0		S	Birkun *et al.*, 2014
29 Turkey	*D.delphis*	2006	FYKs	3		5	1.67		S	Birkun *et al.*, 2014
29 Ukraine	*P. phocoena*	2006	FYKs	14		0	0.0		S	Birkun *et al.*, 2014

DISCUSSION

The review of sixty publications on interactions between Cetaceans and fishing provides various information on by-catch in ACCOBAMS and GFCM areas countries. According to these data, bottom-set nets in coastal areas and in particular turbot bottom-set nets in the Black Sea appear to have the most significant impact on porpoises and bottlenose dolphins. Given the significant lengths that are set and their long soak times (around 245 hours), these bycatch result in high mortality rates. Most net entanglement cases occur near the shore in shallow waters which are the traditional gillnet fishing areas and are also frequented by coastal cetaceans such as bottlenose dolphins and porpoises, with the latter being the most affected species.

Other subject of concern is illegal fishing practise as the use of driftnet which are banned in GFCM area and are poorly reported.

Most of these studies are focused on limited areas or on particular fisheries; furthermore, several GSA could not be documented due to the lack of available published works (see Annex) and the data are unfortunately of uneven quality and present gaps for many of them, as mortality rates and fishing effort.

As Birkun *et al.* (2014) points it out, estimating cetacean bycatch depend on the accuracy of the information collected on effective effort (illegal fishing included), the correct identification of the species and the seasonal and geographical variability of the process and consequently of methodology. The data given in these publications are coming either from anecdotal information, or from structured programs based on log-books consultation, on board observers or questionnaire surveys.

Logbooks are not really relevant for small units and need the fishers goodwill. One of the advantages of observers on board is that they can detect incidental captures in only a few boat trips when the catch per unit of effort is high but when these are weak or irregular, questionnaire surveys are the most practical method for assessing the magnitude of the problem (Godley, 1998) specially when the vessel is small. Nevertheless, biases may arise if people wish to exaggerate the rate at which cetaceans are caught or because interviewees perceive by-catch of cetaceans as a negative aspect of their fishing activities or because such events are not well recorded or remembered well by the interviewee, as individuals can fall out of the fishing gear before it is brought onboard the vessel (Bravington & Bisack, 1996; Kindt-Larsen *et al.*, 2012).

Each of these methods of monitoring and recording bycatch vary dramatically in their effectiveness, and so we can expect the results of the studies to be minimum estimates, and in some cases (log book monitoring) huge underestimates.

Remote electronic Monitoring (REM) could theoretically overcome this constraint; based on cameras and GPS logger fixed on board this technique allows to reduce catch records missing, need of on-board observers and for more space and time monitoring. The fact that no important regulations were ever properly enforced justify the interest for this type of control devices in fishery management for monitoring by-catches and discards (Course G. P., 2015; Mc Lachlan, 2017; Read *et al.*, 2017). All authors demonstrate that REM is a cost-effective method compared to traditional monitoring and control catch and sorting process, as well for small-scale fisheries (Bartholomew *et al.*, 2018) or monitoring small cetaceans by-catch in gillnetting (Kindt-Larsen *et al.*, 2012)

Nevertheless, REM is still expensive and perfectible, in particular for the Mediterranean fisheries of which 80% of fleets are less than 12 m and most of them having no shelter deck and electronic devices.

RECOMMENDATIONS

More perhaps than by-catch rates themselves, the evidence of entanglement in nets collected in cetaceans stranding in the past few years shows the strong impact of fisheries on Mediterranean and Black Sea cetaceans' populations. Particularly, estimated cetacean bycatch in the Black Sea appears to be outside the accepted data on the biological capacities of the species affected (Birkun *et al.*, 2014).

- To improve the assessment of the impact of fisheries on cetacean populations, it is important to have a complete overview of bycatch throughout the Mediterranean and Black Sea. For this, it is necessary to fill the data gaps in the geographical subregions where they are missing, firstly on the basis of standardized methodologies already in use (questionnaire, observers on board, etc.) and progressively by the implementation of REM or any other methods requiring a voluntary participation of fishers.

Concerning the by -catch reduction of non-targeted species, including cetaceans, international organization have adopted some recommendations followed sometimes by legal measures but not always implemented. It is particularly the case for illegal driftnet fishing which was prohibited by GFCM in 1997 under a binding resolution and for all illegal, unreported and unregulated (IUU) fisheries.

- To fight against IUU fisheries, Öztürk B., (2015) and Anton & Radu (2014), suggest to develop common instruments at regional level including control by inspections team from riparian countries, spotting of IUU activities and penalties with forbidding the right to operate. These instruments should be built from specific studies comprising both institutional, legal, research, technical and socio-economic and education aspects.

Bad fishing practices and technical conception of the fishing gears are obviously responsible of by-catches.

- To avoid interactions between cetaceans and fishing gear or to reduce the mortality of captured individuals, studies should also be conducted on the improvement of fishing gear selectivity and other technical measures; moreover, a particular attention should be paid to the implementation of good practices reducing ghost fishing by abandoned gears.

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ANNEX - Availability of Cetacean by-catch data by GSAs

GSA	GND	GNS	DLL	BLL	HL	OTB	OTM	PS	PS BFT	FPN/FYK
1 -Northern Alboran Sea										
2 -Alboran Island										
3 -Southern Alboran Sea										
4- Algeria										
5 -Balearic Islands										
6 -Northern Spain										
7- Gulf of Lions										
8 -Corsica										
9-Ligurian Sea & Northern Tyrrhenian Sea										
10 - South & Central Tyrrhenian Sea										
11- Sardinia										
12- Northern Tunisia										
13- Gulf of Hammamet										
14 -Gulf of Gabes										
15 -Malta										
16- Southern Sicily										
17-Northern Adriatic Sea										
18- Southern Adriatic Sea										
19 -Western Ionian Sea										
20 -Eastern Ionian Sea										
21 -Southern Ionian Sea										
22-Aegean Sea										
23-Crete										
24-Northern Levant Sea										
25-Cyprus										
26-South Levant Sea										
27- Eastern Levant Sea										
28 - Marmara Sea										
29-Black Sea										
30 - Azov Sea										

	at sea observation & questionnaire survey		questionnaire survey
	at sea observation		anedoctal information