Annual report on the implementation of Council Regulation (EC) No 812/2004 during 2016

Member State: United Kingdom

Reference Period: 2016

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Summary

During 2016, official fishing effort and landings statistics indicated that there were 23 UK registered vessels of 12 m or more that fished with specified gear types and in specific areas where acoustic deterrent devices are required under Council Regulation 812/2004 to minimise cetacean bycatch. All relevant skippers are aware of the requirements of the 812/2004 regulation, and inspections at sea by UK authorities indicate a high level of compliance. Static net vessels over 12 m account for only 2% of the UK static net fleet in terms of vessel numbers but are responsible for 45% of the total landings by the netting sector.

Ten trips covering 117 sea days and 320 monitored net fleet hauls were observed on board over 12 m vessels in 2016. Observed porpoise bycatch rates were consistent with previously observed rates in nets properly equipped with pingers, with no evidence of habituation thus far. Limited sample sizes restrict our ability to say with any confidence whether pingers influence seal or dolphin bycatch rates.

UK based vessels appear to be mainly using the DDD-03L acoustic deterrent device which is authorised for use by the UK government under derogation. A key requirement for the permitted use of these devices is that they should be positioned along each net fleet so that no part of the fleet is more than 2000m from the nearest device.

Overall in 2016 315 dedicated bycatch monitoring days were conducted during 177 trips on board static net vessels, 36 dedicated bycatch monitoring days during 4 trips on longline vessels and 23 dedicated bycatch monitoring days during 17 trips on pelagic trawlers.

A further 79 days of non-dedicated sampling in static net fisheries was also conducted under other English, Welsh and Northern Irish fishery monitoring programmes, and 591 days of non-dedicated sampling was also conducted under those programmes, mostly in a variety of demersal trawl fisheries.

Total observations of cetacean bycatch from dedicated sampling included ten harbour porpoises, two common dolphins and 2 long-finned pilot whales, all taken in static net gears (mainly large meshed tangle and trammel net fisheries) in Subarea 7. A single common dolphin was also observed bycaught during non-dedicated fish discard sampling in a static net fishery targeting anglerfish in Division 7e.

Other protected species recorded during dedicated sampling included 7 (grey) seals, 69 seabirds (30 guillemots, 26 fulmars, 6 gannets, 5 cormorants and 2 unidentified gulls). Rarer and/or protected fish species recorded included small-eyed ray (97), six-gilled shark (58), common skate (56), blue shark (48), undulate ray (39), tope (31) and porbeagle shark (22). 25 shads were also recorded.

The current best estimate of porpoise bycatch in all UK gillnet fisheries ranges from 771 and 2994 animals (best estimate 1482; CV=0.09) in the absence of pingers, and from 606 and 3114 animals (best estimate 1250 CV=0.11) if all over 12 m boats used pingers in relevant areas. These estimates include several assumptions that are discussed in Appendix 2. Bycatch estimates for common dolphins and seals in 2016, with similar caveats, are 285 (range 137-922) and 610 (range 449-1262) respectively.

ACOUSTIC DETERRENT DEVICES

1. General Information

European Council Regulation 812/2004 ("the Regulation") requires certain EU fisheries to use acoustic deterrent devices to limit the bycatch of harbour porpoises and other small cetaceans. Only vessels of 12 m or over are required to use these devices, commonly known as pingers. Fisheries affected include those using (1) any bottom-set gillnet or entangling net in ICES Divisions 7 d,e,f,g,h and j, (2) any bottom-set gillnet or entangling net with mesh sizes 220 mm or more operating in Subarea 4 or Division 3a, or (3) any bottom set gillnet or entangling net the total length of which does not exceed 400 m during the months of August, September or October in Subarea 4 or Division 3a. (A map of ICES areas is provided in Annex 3).

UK vessels that are required to use pingers in the above fisheries have all been made aware of the requirements of the Regulation, and for several years have been using appropriate devices and have been subject to at-sea inspections by regulatory agencies. Enforcement Officers have been provided with appropriate training in assessing pinger attachment and functioning. The Marine Management Organisation (MMO) has provided full guidance on the implementation of the Regulation and the use of pingers which is available at:
http://www.marinemanagement.org.uk/fisheries/monitoring/regulations_cetaceans.htm

Many of the UK vessels affected are using a device that was not in the original list of specified devices in Annex II of the Regulation, but which was tested for efficacy with EMFF funding in 2010-2011 (Kingston and Northridge, 2011). This device (DDD-03L - manufactured by STM products in Italy) has been authorised for use by the UK Government's Department for the Environment and Rural Affairs (Defra) under the derogation contained in Article 3(2) of the Regulation.

1.1 Description of the fleet

Official logbook and landings records indicate that 1153 UK vessels reported landings of fish or shellfish caught using static nets (gillnets, trammel, tangle and driftnets – generically termed "gillnets"). However, during 2016 only 512 of these vessels fished with gillnets for more than ten days, and only 133 fished for more than 50 days, meaning that netting activity appears to be a fairly sporadic for approximately half of the vessels in the UK "netting" fleet.

Of the 1153 vessels reported to use static nets, only 25 (2%) were over 12 m in length (down from 28 in 2015 and 32 in 2014). Nevertheless, these 25 vessels accounted for 20% of the total days at sea, and landed 45% of all fish and shellfish caught by UK vessels using gillnets by weight, and 58% by value, so they clearly represent a far more significant part of the total netting fleet effort (more days at sea per boat and longer net fleet lengths) than their numbers alone would suggest.

Of the 25 vessels over 12 m in length that were reported to have used gillnets in 2016, 20 fished in Divisions 7defghj and were therefore required to use pingers. 6 vessels fished in Subarea 4 and are conservatively all assumed to have been required to use pingers (5 reported using meshes >220mm).

Three vessels fished in both areas where pingers are required and 2 vessels did not fish in either of the regulated areas.

Overall we conclude that 23 UK registered vessels may have been fishing in such a way as to require the use of pingers during 2016. As far as we are aware, the masters and owners of all relevant vessels have been notified of their obligations under the Regulation and all such vessels are subject to routine inspection at sea and while in port.

Table 1.1 Description of the UK fleet required to use pingers under Annex I of the Regulation (Note that total net length and total soak time are not available for the UK fleet)

Metier	Fishing Area	No of Vessels >12m	Expected % using pingers	No of Trips	Days at Sea	Months of Operation
	Southwest					
GNS-Crustaceans	7e	3	100%	5	5	4-12
GNS-Demersal fish	7e	13	100%	167	502	1-12
GNS-Demersal fish	7f	11	100%	85	292	1-12
GNS-Demersal fish	7g	11	100%	216	1133	1-12
GNS-Demersal fish	7h	12	100%	108	555	1-12
GNS-Demersal fish	7j	12	100%	66	564	1-12
TOTALS	**7defghj**	**20**	100%	**509**	**3051**	**1-12**
	North Sea					
GNS-Demersal fish	4a	5	100%	10	408	2-6
GNS-Demersal fish	4b	1	100%	29	188	1-12
TOTALS	**4abc**	**6**	100%	**39**	**596**	**1-12**

2. Acoustic Deterrent Devices (Article 2 and 3)

2.1 Mitigation measures

Based on our observations, UK registered over 12 m vessels operating from ports in the Southwest of England appear to be using DDD-03 pingers routinely. Observer data and anecdotal accounts indicate that other pinger models (meeting the type 1 or type 2 specifications of Regulation 812) may also be in use by some of the larger UK registered vessels that land into Spain or overland their catch to the continent from the UK.

The UK pair trawl fishery for bass in the English Channel, which had in previous years used pingers on a voluntary basis to minimise the risk of dolphin bycatch, remained closed during 2016 to protect spawning aggregations of bass under current bass management measures.

Table 2.1: Mitigation measures being used in the UK fleet

Metier	Fishing Area	Pinger Characteristics	Other mitigation measures
GNS-Crustaceans	7e	DDD-03L and possibly others	None known
GNS-Demersal fish	7e	DDD-03L and possibly others	None known
GNS-Demersal fish	7f	DDD-03L and possibly others	None known
GNS-Demersal fish	7g	DDD-03L and possibly others	None known
GNS-Demersal fish	7h	DDD-03L and possibly others	None known
GNS-Demersal fish	7j	DDD-03L and possibly others	None known
GNS-Demersal fish	4a	DDD-03L and possibly others	None known
GNS-Demersal fish	4b	Unknown	None known

We note that the number of UK vessels using static nets continues to decline.

3. Monitoring and assessment

3.1 Monitoring and assessment of the effects of pinger use (Article 2.4)

During 2016 we monitored ten trips by vessels of more than 12 m fishing wholly or partly in areas where pingers are required by the Regulation, amounting to 320 observed hauls. Once again, we found no evidence to suggest any reduction of pinger effectiveness in minimising porpoise bycatch rates, as long as they are used in the recommended manner (see Table 6.1). The guidelines on pinger use which were produced in 2012 and agreed with industry, state that DDD pingers should be placed no more than 4 km apart, either to the buoy ropes at each end of a net fleet, or if net fleets more than 4 km are used, pingers should be attached to the floatline and/or buoy ropes so that no part of the net fleet is more than 2 km from an active pinger.

3.2. Report on measures to control specifications when pingers are in use by fishermen (Article 2.4)

Royal Navy and relevant national marine enforcement officers have been checking for compliance with Regulation 812/2004 whilst carrying out at-sea inspections; this is a task which is included as a regular inspection requirement in the relevant fishing areas. Inspections of over 12 metre gill netting vessels are carried out according to a risk based enforcement approach.

In English and Welsh waters, 13 inspections of over 12 metre gill net vessels were carried out at sea and in port during 2016. Inspections took place in ICES Subarea 7. Two infringements were detected. One on a Spanish vessel which had no working pingers on board, and pingers attached to only one fleet of nets. The other was a UK vessel which had pingers on board but none of them were

functional. Verbal re-briefs were issued for both vessels to remind them of the requirements of the legislation.

The MMO in England has taken steps to employ the use of the ETEC detector (http://www.etec.dk/). Pinger testing kits including the ETEC detector have been issued to all the royal Navy fishery patrol squadron, as well as the MMO coastal offices in the South West and a training video has been created demonstrating its use. At sea inspections (in line with the risk based enforcement model) are the primary monitoring tool for the regulation, but vessels are also inspected in port for pinger presence by MMO coastal officers.

In Scottish waters, Marine Scotland's Marine Protection Vessels (MPVs) completed 4 at sea inspections on 4 different gill netters in ICES Division 4a (Northern North Sea) during 2016.

One infringement (of retaining Anglerfish using a mesh size less 220mm was detected) on a Norwegian vessel. Pingers were noted to be in use during some of the inspections but details of the devices used were not recorded. Marine Scotland received no intelligence regarding lack of pinger use during 2016. There were no reports of any cetaceans being caught during any of the inspections, which included periods aboard fishing vessels while nets were being hauled.

The main concentration of gill net effort in Scottish waters continues to be along the continental shelf edge west of Shetland Islands, with increasing gillnet activity taking place on the continental shelf and up to the 6 mile limit west of Shetland

Compliance operational priorities during 2016 did not focus on this sector and Marine Scotland will continue to base the majority of their at sea inspection activities on a risk assessed basis.

3.3. Derogation

In 2012 the UK authorised the use of DDD pingers if used in accordance with agreed operating procedures, under Article 3 (2) of Regulation 812, and notified the European Commission accordingly. In June 2014 and again in 2016, the Commission was notified that the authorisation was to be extended for a further two years, in accordance with Article 3(2) of the Regulation. The latter re-authorisation covers the period 1 July 2016 to 30 June 2018.

3.4 Overall assessment

Pingers appear to be widely used and accepted by those UK registered vessels that are required to use them under Regulation 812. UK enforcement authorities are routinely checking vessels in relation to the implementation of the Regulation. Data collected by observers indicates that harbour porpoise bycatch rates continue to be significantly reduced as a result of pinger use.

OBSERVER SCHEMES

4. General information on implementation of Articles 4 and 5

Observer Scheme procedures for the UK in 2016 are in line with those from previous years. A dedicated protected species bycatch monitoring programme is managed and coordinated by the Sea Mammal Research Unit (SMRU) at the University of St Andrews, in collaboration with the Centre for Environment, Fisheries and Aquaculture Science at Lowestoft (Cefas) and the Agri-Food and

Biosciences Institute of Northern Ireland (AFBINI). Data provided by Cefas and AFBINI include discard sampling conducted under the Data Collection Framework (DCF), data collected under other specific research efforts, and a limited number of dedicated sea days where protected species bycatch monitoring is the main focus for their observers.

The bycatch monitoring programme fulfils UK monitoring obligations under Council Regulation 812/2004, as well as meeting the surveillance requirements of Article 12 of the Habitats Directive and international agreements including ASCOBANS, the International Convention on the Regulation of Whaling (ICRW) and OSPAR.

Data collected under the programme are also increasingly being used to assess bycatch of other non-cetacean but protected or potentially vulnerable taxonomic groups or species, through the ICES Working Group on Protected Species Bycatch (WGBYC). The UK participates fully in the work of WGBYC. The EU Action Plan for reducing incidental catches of seabirds in fishing gears also calls on member states to undertake monitoring of seabird bycatch and "to report biennially to the Commission on the level of seabird bycatch observed by fishery and gear type". The current report also fulfils this obligation.

5. Monitoring

Tables 5.1 and 5.2 list the fishing fleet effort by métier and ICES Division for mid-water or pelagic trawls and for gillnets and tangle nets respectively. Sampling in pelagic trawl fisheries in 2016 was limited to 23 days, in herring and sprat fisheries. This was in part due to known low bycatch rates in most pelagic trawl fisheries which has led to a gradual reduction in monitoring targets for this gear type (under agreement with the UK government) and increases in targets for other gear types with known protected species interactions such as longlines, and in part due to a lack of UK effort in 2016 in the boarfish fishery which normally occurs in late autumn each year.

UK logbook data do not include sufficient detail to enable us to make reliable estimates of the number of hauls, tow durations, net lengths or soak times by the UK fleet, but these are reported for the observed trips.

Table 5.1 Description of fishing effort and observer effort in towed gear: rows in bold are metiers with cetacean bycatch (see Table 6.1)

"Type of Monitoring" codes: SS= Scientific Studies; PP = Pilot project; HDM= Habitats Directive Monitoring; PMS = Pilot Monitoring Scheme.

Metier	Fishing Area	Fleet Fishing Activity						Observer Effort Achieved						
		No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Time	No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Type of Monitoring	Coverage
>15-PTM-Sprat	27.6a	2	30	30	Apr-Nov									
>15-PTM-Sprat	27.6a	2	15	18	Dec-Mar									
>15-PTM-Sardine	27.7d	1	2	7	Apr-Nov									
>15-PTM-Sardine	27.7e	1	3	19	Apr-Nov									
>15-PTM-Sardine	27.7d	1	1	1	Dec-Mar									
>15-PTM-Sardine	27.7e	1	1	8	Dec-Mar									
>15-PTM-Mackerel	27.8	1	1	1	Apr-Nov									
>15-PTM-Mackerel	27.4a	2	5	13	Apr-Nov									
>15-PTM-Mackerel	27.7d	1	1	8	Apr-Nov									
>15-PTM-Mackerel	27.7e	1	1	6	Apr-Nov									
>15-PTM-Mackerel	27.7j	1	1	10	Apr-Nov									
>15-PTM-Mackerel	27.6a	1	3	13	Dec-Mar									
>15-PTM-Mackerel	27.7d	1	1	14	Dec-Mar									
>15-PTM-Mackerel	27.7e	1	1	2	Dec-Mar									
>15-PTM-Mackerel	27.7j	1	1	10	Dec-Mar									
>15-PTM-Horse mackerel	27.7d	1	2	20	Apr-Nov									
>15-PTM-Horse mackerel	27.4c	1	2	8	Dec-Mar									
>15-PTM-Horse mackerel	27.7d	1	1	14	Dec-Mar									

Metier	Fishing Area	Fleet Fishing Activity						Observer Effort Achieved						
		No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Time	No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Type of Monitoring	Coverage
>15-PTM-Horse mackerel	27.7e	1	1	0	Dec-Mar									
>15-PTM-Herring	27.4a	1	5	44	Apr-Nov									
>15-PTM-Herring	27.4b	1	5	11	Apr-Nov									
>15-PTM-Herring	27.6a	1	1	8	Apr-Nov									
>15-PTM-Herring	27.7a	1	13	38	Apr-Nov			2	9	13	Apr-Nov	17	PMS	35%
>15-PTM-Herring	27.7g	1	2	9	Apr-Nov									
>15-PTM-Herring	27.7d	1	1	7	Dec-Mar									
>15-PTM-Herring	27.7e	1	1	0	Dec-Mar									
>15-PTM-Demersal fish	27.6a	1	2	8	Apr-Nov									
>15-PTM-Demersal fish	27.6a	1	2	6	Dec-Mar									
>15-PTM-Bass	27.7e	1	1	5	Apr-Nov									
>15-OTM-Mackerel	27.2a	1	1	20	Apr-Nov									
>15-OTM-Mackerel	27.4a	20	89	244	Apr-Nov									
>15-OTM-Mackerel	27.4a	1	1	3	Dec-Mar									
>15-OTM-Mackerel	27.6a	21	95	408	Dec-Mar									
>15-OTM-Mackerel	27.7b	1	1	2	Dec-Mar									
>15-OTM-Mackerel	27.7e	1	1	1	Dec-Mar									
>15-OTM-Mackerel	27.7j	1	1	18	Dec-Mar									
>15-OTM-Horse mackerel	27.4c	1	1	2	Dec-Mar									
>15-OTM-Horse mackerel	27.6a	2	4	22	Dec-Mar									
>15-OTM-Horse mackerel	27.7d	1	2	16	Dec-Mar									
>15-OTM-Herring	27.2a	1	1	6	Apr-Nov									

Metier	Fishing Area	Fleet Fishing Activity						Observer Effort Achieved						
		No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Time	No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Type of Monitoring	Coverage
>15-OTM-Herring	27.4a	19	113	325	Apr-Nov			1	1	3	Apr-Nov	3	PMS	1%
>15-OTM-Herring	27.4b	2	3	27	Apr-Nov									
>15-OTM-Herring	27.6a	3	7	15	Apr-Nov									
>15-OTM-Herring	27.2a	3	5	29	Dec-Mar									
>15-OTM-Herring	27.7d	1	1	15	Dec-Mar									
>15-OTM-Demersal fish	27.6a	1	1	2	Apr-Nov									
>15-OTM-Demersal fish	27.7a	5	69	260	Apr-Nov									
>15-OTM-Demersal fish	27.7g	1	1	2	Apr-Nov									
>15-OTM-Demersal fish	27.4b	1	9	55	Dec-Mar									
>15-OTM-Demersal fish	27.6a	2	2	4	Dec-Mar									
>15-OTM-Demersal fish	27.7a	5	23	76	Dec-Mar									
>15-OTM-Blue Whiting	27.6a	3	4	24	Apr-Nov									
>15-OTM-Blue Whiting	27.6a	6	8	45	Dec-Mar									
>15-OTM-Blue Whiting	27.7b	2	2	4	Dec-Mar									
>15-OTM-Blue Whiting	27.7c	8	18	74	Dec-Mar									
>15-OTM-Bass	27.7e	1	1	3	Apr-Nov									
<15-PTM-Sprat	27.7e	1	37	37	Apr-Nov									
<15-PTM-Sprat	27.4c	1	10	10	Dec-Mar									
<15-PTM-Sprat	27.7e	1	8	8	Dec-Mar									
<15-PTM-Sardine	27.7e	1	1	1	Apr-Nov									
<15-PTM-Sardine	27.7e	1	1	1	Dec-Mar									
<15-PTM-Herring	27.4c	1	14	14	Dec-Mar									

Metier	Fishing Area	Fleet Fishing Activity						Observer Effort Achieved						
		No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Time	No of vessels	No of Trips	Days at Sea	Fishing Season	Hauls	Type of Monitoring	Coverage
<15-PTM-Herring	27.7e	1	4	4	Dec-Mar									
<15-PTM-Demersal fish	27.7e	1	1	1	Dec-Mar									
<15-PTM-Anchovy	27.7e	1	2	2	Apr-Nov									
<15-PTM-Anchovy	27.7e	1	1	1	Dec-Mar									
<15-OTM-Sprat	27.7e	2	109	109	Apr-Nov			1	7	7	Apr-Nov	9	PMS	6%
<15-OTM-Sprat	27.4c	1	8	8	Dec-Mar									
<15-OTM-Sprat	27.7e	2	44	44	Dec-Mar									
<15-OTM-Sardine	27.7e	1	1	1	Apr-Nov									
<15-OTM-Sardine	27.7e	2	8	8	Dec-Mar									
<15-OTM-Mackerel	27.7e	1	1	1	Apr-Nov									
<15-OTM-Mackerel	27.7e	1	1	1	Dec-Mar									
<15-OTM-Herring	27.4c	1	8	11	Dec-Mar									
<15-OTM-Herring	27.7e	1	19	19	Dec-Mar									
<15-OTM-Demersal fish	27.4a	1	1	1	Apr-Nov									
<15-OTM-Demersal fish	27.7e	1	1	3	Dec-Mar									
<15-OTM-Bass	27.7e	1	1	2	Apr-Nov									
<15-OTM-Anchovy	27.4a	1	1	1	Apr-Nov									
<15-OTM-Anchovy	27.7e	2	4	4	Apr-Nov									
<15-OTM-Anchovy	27.7e	2	4	4	Dec-Mar									

Table 5.2 Description of fishing effort and observer effort in static gear: rows in bold are metiers with cetacean bycatch (see table 6.1)

"Type of Monitoring" codes: SS= Scientific Studies; PP = Pilot project; HDM= Habitats Directive Monitoring; PMS = Pilot Monitoring Scheme.

Metier	Fishing Area	Fleet Fishing Activity				Observer Effort Achieved								
		Vessels	Trips	Days at sea	Months fishing	No. of Vessels	No. of trips	Days at Sea	No. of Hauls	Season	Length of nets	Total Soak Time (Km.Hr)	Type of monitoring	Coverage
>15-Gill Hake-Demersal fish	27.7a	1	1	2	7-7									
>15-Gill Hake-Demersal fish	27.7e	2	3	23	2-7									
>15-Gill Hake-Demersal fish	27.7f	6	43	144	1-12									
>15-Gill Hake-Demersal fish	27.7g	6	141	711	1-12	1	4	20	47	Sep-Dec	204	3652	SS	2.8%
>15-Gill Hake-Demersal fish	27.7h	4	10	41	3-10									
>15-Gill Hake-Demersal fish	27.7j	6	39	204	1-7	1	1	6	12	Mar	55	1086	SS	2.9%
>15-Gill light flatfish-Demersal fish	27.4b	1	13	78	1-4									
>15-Gill light-Demersal fish	27.7g	2	2	13	1-8									
>15-Gill-Demersal fish	27.8	4	9	37	3-12									
>15-Gill-Demersal fish	27.4b	1	14	98	4-12									
>15-Gill-Demersal fish	27.7e	7	44	158	1-12	1	1	1	2	Aug	1	9	SS	0.6%
>15-Gill-Demersal fish	27.7f	6	10	27	1-12									
>15-Gill-Demersal fish	27.7g	7	17	71	1-12									
>15-Gill-Demersal fish	27.7h	7	53	262	1-12	1	1	7	53	Aug	16	231	SS	2.7%
>15-Gill-Demersal fish	27.7j	3	10	66	6-12									
>15-TangTram-Demersal fish	27.8	1	10	88	1-12	1	1	18	31	Dec	245	15807	HDM	20.4%
>15-TangTram-Demersal fish	27.2a	1	1	50	2-2									
>15-TangTram-Demersal fish	27.4a	5	10	408	2-6									

Metier	Fishing Area	Fleet Fishing Activity				Observer Effort Achieved								
		Vessels	Trips	Days at sea	Months fishing	No. of Vessels	No. of trips	Days at Sea	No. of Hauls	Season	Length of nets	Total Soak Time (Km.Hr)	Type of monitoring	Coverage
>15-TangTram-Demersal fish	27.4b	1	2	12	5-5									
>15-TangTram-Demersal fish	27.6b	4	10	371	3-11									
>15-TangTram-Demersal fish	27.7c	2	3	107	8-12									
>15-TangTram-Demersal fish	27.7e	5	28	154	1-9									
>15-TangTram-Demersal fish	27.7f	6	25	99	1-10									
>15-TangTram-Demersal fish	27.7g	8	46	276	1-12	1	1	9	20	Apr-May	72	6826	SS	3.3%
>15-TangTram-Demersal fish	27.7h	9	36	212	1-12	1	1	2	3	Dec	27	1836	SS	0.9%
>15-TangTram-Demersal fish	**27.7j**	**7**	**17**	**294**	**1-12**	**3**	**3**	**47**	**121**	**Jan-May**	**1182**	**83860**	**SS**	**16.0%**
>15-TangTram-Demersal fish	27.7k	5	42	503	1-12									
<15-Drift Oth-Cephalopods	27.7d	1	1	1	10-10									
<15-Drift Oth-Cephalopods	27.7e	1	1	1	3-3									
<15-Drift Oth-Cephalopods	27.7f	1	1	1	9-9									
<15-Drift Oth-Crustaceans	27.4c	6	15	15	6-9									
<15-Drift Oth-Crustaceans	27.7d	2	3	3	4-8									
<15-Drift Oth-Demersal fish	27.4c	39	361	361	1-12									
<15-Drift Oth-Demersal fish	27.7a	1	2	2	7-8									
<15-Drift Oth-Demersal fish	27.7d	42	486	506	1-12									
<15-Drift Oth-Demersal fish	27.7e	33	74	74	1-12									
<15-Drift Oth-Demersal fish	27.7f	4	19	19	1-12									
<15-Drift Oth-Molluscs	27.4c	1	1	1	10-10									
<15-Drift Pel-Anadromous	27.4b	3	41	41	6-8									
<15-Drift Pel-Small pelagic fish	27.4c	39	177	181	1-12									
<15-Drift Pel-Small pelagic fish	27.7a	1	1	1	10-10									

Metier	Fishing Area	Fleet Fishing Activity				Observer Effort Achieved								
		Vessels	Trips	Days at sea	Months fishing	No. of Vessels	No. of trips	Days at Sea	No. of Hauls	Season	Length of nets	Total Soak Time (Km.Hr)	Type of monitoring	Coverage
<15-Drift Pel-Small pelagic fish	27.7d	12	78	78	3-12									
<15-Drift Pel-Small pelagic fish	27.7e	52	441	441	1-12									
<15-Drift Pel-Small pelagic fish	27.7f	22	93	93	1-12									
<15-Gill Hake-Demersal fish	27.7f	2	4	17	4-12									
<15-Gill light flatfish-Demersal fish	27.4b	7	18	18	4-11									
<15-Gill light flatfish-Demersal fish	27.4c	94	1103	1100	1-12	1	1	1	3	Jul	1	2	HDM	0.1%
<15-Gill light flatfish-Demersal fish	27.7a	17	91	90	1-12	1	2	2	2	Apr-Dec	2	9	HDM	2.2%
<15-Gill light flatfish-Demersal fish	27.7d	269	7927	7954	1-12	10	16	16	99	Feb-Oct	44	1101	HDM	0.2%
<15-Gill light flatfish-Demersal fish	27.7e	185	1143	1149	1-12	2	16	16	42	Feb-Nov	34	719	HDM	1.4%
<15-Gill light flatfish-Demersal fish	27.7f	42	227	227	1-12									
<15-Gill light-Anadromous	27.4b	1	11	11	6-7									
<15-Gill light-Anadromous	27.7e	1	1	1	6-6									
<15-Gill light-Cephalopods	27.4c	2	4	4	4-12									
<15-Gill light-Cephalopods	27.7a	1	2	2	5-6									
<15-Gill light-Cephalopods	27.7d	92	602	602	3-11									
<15-Gill light-Cephalopods	27.7e	30	67	67	3-11									
<15-Gill light-Cephalopods	27.7f	5	32	32	4-6									
<15-Gill light-Demersal fish	27.4b	6	7	7	1-12									
<15-Gill light-Demersal fish	27.4c	109	702	705	1-12									
<15-Gill light-Demersal fish	27.7a	48	528	648	1-12	1	2	2	5	Jun-Sep	2	9	HDM	0.3%
<15-Gill light-Demersal fish	27.7d	249	2152	2151	1-12	1	1	1	1	Oct	0	9	HDM	0.0%
<15-Gill light-Demersal fish	27.7e	240	1463	1468	1-12	2	6	6	23	Sep-Oct	11	216	HDM	0.4%
<15-Gill light-Demersal fish	**27.7f**	**159**	**917**	**917**	**1-12**	**4**	**13**	**13**	**49**	**Jan-Dec**	**26**	**96**	**HDM**	**1.4%**

Metier	Fishing Area	Fleet Fishing Activity				Observer Effort Achieved								
		Vessels	Trips	Days at sea	Months fishing	No. of Vessels	No. of trips	Days at Sea	No. of Hauls	Season	Length of nets	Total Soak Time (Km.Hr)	Type of monitoring	Coverage
<15-Gill light-Demersal fish	27.7g	13	85	85	1-12									
<15-Gill light-Small pelagic fish	27.4a	3	3	4	6-8									
<15-Gill light-Small pelagic fish	27.4b	4	11	11	6-10									
<15-Gill light-Small pelagic fish	27.4c	12	25	25	1-12									
<15-Gill light-Small pelagic fish	27.7a	8	15	15	7-10									
<15-Gill light-Small pelagic fish	27.7d	29	89	89	1-12									
<15-Gill light-Small pelagic fish	27.7e	74	237	244	1-12									
<15-Gill light-Small pelagic fish	27.7f	23	223	261	1-12	1	1	1	1	Jan	0	1	HDM	0.4%
<15-Gill light-Small pelagic fish	27.7g	2	3	3	5-8									
<15-Gill-Demersal fish	27.4a	9	28	33	1-7									
<15-Gill-Demersal fish	27.4b	22	118	118	1-12									
<15-Gill-Demersal fish	27.4c	71	423	418	1-12									
<15-Gill-Demersal fish	27.6a	1	1	1	6-6									
<15-Gill-Demersal fish	27.7a	11	23	23	1-11									
<15-Gill-Demersal fish	27.7d	168	929	919	1-12	1	1	1	2	Jul	1	14	HDM	0.1%
<15-Gill-Demersal fish	27.7e	221	1430	1525	1-12	4	18	18	126	Jan-Dec	31	729	HDM	1.2%
<15-Gill-Demersal fish	**27.7f**	**126**	**927**	**944**	**1-12**	**3**	**16**	**14**	**58**	**Jan-Dec**	**31**	**222**	**HDM**	**1.5%**
<15-Gill-Demersal fish	27.7g	4	11	31	1-12									
<15-Gill-Demersal fish	27.7h	3	9	29	1-9	1	1	1	2	Jun	1	9	HDM	3.4%
<15-Gill-Large Pelagic Fish	27.7d	1	1	1	12-12									
<15-Gill-Large Pelagic Fish	27.7e	1	1	1	9-9									
<15-TangTram-Cephalopods	27.4a	1	1	1	6-6									
<15-TangTram-Cephalopods	27.7d	3	4	4	1-10									

Metier	Fishing Area	Fleet Fishing Activity				Observer Effort Achieved								
		Vessels	Trips	Days at sea	Months fishing	No. of Vessels	No. of trips	Days at Sea	No. of Hauls	Season	Length of nets	Total Soak Time (Km.Hr)	Type of monitoring	Coverage
<15-TangTram-Cephalopods	27.7e	23	66	65	1-12									
<15-TangTram-Cephalopods	27.7f	3	5	5	9-11									
<15-TangTram-Crustaceans	27.4a	1	8	8	8-10									
<15-TangTram-Crustaceans	27.4b	16	110	109	1-12									
<15-TangTram-Crustaceans	27.4c	34	63	62	5-12									
<15-TangTram-Crustaceans	27.7a	9	45	45	4-12	1	1	1	1	Sep	1	72	HDM	2.2%
<15-TangTram-Crustaceans	27.7d	59	141	139	1-12									
<15-TangTram-Crustaceans	27.7e	103	559	621	1-12	3	9	7	28	Apr-Jul	27	2103	HDM	1.1%
<15-TangTram-Crustaceans	27.7f	83	615	621	2-12	1	10	7	35	Apr-Sep	25	2988	HDM	1.1%
<15-TangTram-Crustaceans	27.7g	1	2	2	8-8									
<15-TangTram-Demersal fish	27.4a	3	5	5	4-8									
<15-TangTram-Demersal fish	27.4b	4	7	7	6-9									
<15-TangTram-Demersal fish	27.4c	91	360	362	1-12									
<15-TangTram-Demersal fish	27.7a	11	45	45	3-12	1	1	1	3	Apr-Dec	3	144	HDM	2.2%
<15-TangTram-Demersal fish	27.7d	170	870	863	1-12	4	4	4	22	Jan-Oct	9	410	HDM	0.5%
<15-TangTram-Demersal fish	**27.7e**	**156**	**1272**	**1320**	**1-12**	**7**	**69**	**74**	**236**	**Jan-Dec**	**311**	**22394**	**HDM**	**5.6%**
<15-TangTram-Demersal fish	**27.7f**	**101**	**1089**	**1149**	**1-12**	**3**	**10**	**9**	**38**	**Jan-Sep**	**33**	**1656**	**HDM**	**0.8%**
<15-TangTram-Demersal fish	27.7g	4	16	62	1-9									
<15-TangTram-Demersal fish	27.7h	1	3	17	4-6	1	1	10	29	Jun	87	6125	HDM	58.8%

6. Estimation of incidental catches

Observations of cetacean bycatch in 2016 included 10 harbour porpoises, 2 common dolphins and 2 long-finned pilot whales all in static net fisheries and mostly in large meshed nets (see Table 6.1).

Table 6.1 Incidental catch rates by fleet segment and target species

Metier	Area	Main Target Species	Cetacean Species Bycaught	No of incidents	Individuals		Rate	
					with pingers	without	with pingers	without
<15-GNS-Demersal	7e	Anglerfish	Harbour porpoise	1	0	1	0	0.0058
<15-GNS-Demersal	7e	Mixed (Anglerfish/Turbot)	Harbour porpoise	1	0	1	0	0.0769
<15-GNS-Demersal	7f	Anglerfish	Harbour porpoise	2	0	2	0	0.0833
<15-GNS-Demersal	7f	Mixed (Anglerfish/Ray)	Harbour porpoise	2	0	2	0	0.1818
<15-GNS-Demersal	7f	Haddock	Harbour porpoise	1	0	1	0	0.0233
<15-GNS-Demersal	7f	Pollack	Harbour porpoise	1	0	1	0	0.0233
>15-GNS-Demersal	7j	Anglerfish	Harbour porpoise	2	2	0	0.0179	0.0000
Totals and Mean rates				**10**	**2**	**8**	**0.0179**	**0.0259**
<15-GNS-Demersal	7f	Haddock	Common dolphin	1	0	1	0	0.0233
<15-GNS-Demersal	7e	Mixed (Anglerfish/Turbot)	Common dolphin	1	0	1	0	0.0769
Totals and Mean rates				**2**	**0**	**2**	**0**	**0.0357**
>15-GNS-Demersal	7j	Anglerfish	Long-finned pilot whale	2	2	0	0.0179	0.0000
Totals and Mean rates				**1**	**0**	**1**	**0**	**0.0833**

As in previous years' reports, total mortality estimates have not been generated by metier in Table 6.1, because these metiers are too narrowly defined to provide useful estimates, and because care is needed in interpreting the bycatch rates in pingered vs. unpingered nets and how these are extrapolated to the total fleet in the absence of information on how pingers were being used during fishing operations that were not observed.

Instead synoptic bycatch mortality estimates for harbour porpoises, dolphins and seals are presented in Annex 2 of the report, based on a larger sample size of observations made over several years and in a wider range of metiers.

Common dolphin bycatch observations continue to occur at a low level, and we have yet to be able to explore the significance of pinger use in influencing dolphin bycatch rates.

6.2 Recording of incidental catches

As in previous years, all bycatches were recorded according to standard data collection procedures by experienced on-board fishery observers. Not all hauls are observed on all trips, especially when hauling is more or less continuous. Wherever feasible, bycaught specimens were sampled at sea (measurements including length, girth and blubber thickness were recorded, sex is determined and teeth and skin samples were also collected and are held in storage until funds are available for age determination and genetic analysis). Several other whole marine mammal and seabird specimens were returned to shore for more detailed analysis under a complementary and fully licensed sub-project.

During 2016, dedicated sampling effort again slightly exceeded our overall target levels. In 2016 we achieved 23 days on pelagic trawlers, 315 dedicated sampling days on static netters, and 36 dedicated days on longliners (total 374 days against an annual target of 373 dedicated days). These are augmented by 79 selected but non-dedicated days at sea on netters observed by Cefas under the discard programme, meaning that a total of 453 days (against an overall target of 425) days were sampled in relevant fisheries (static nets, longlines and pelagic trawls) during 2016.

Additionally, we have reviewed and tabulated data from a further 591 discard sampling days conducted by AFBINI and Cefas on a variety of other vessel types (See Annex 1). Although we rely solely on the dedicated protected species trips to estimate bycatch rates and produce bycatch estimates for protected species, the additional discard sampling days are useful to screen other fisheries and areas for potential protected species bycatches that may warrant further focus in future.

7. Discussion

Monitoring

Monitoring focused heavily on static net fisheries (315 dedicated days at sea). In 2016 the majority of sampling (205 days, 65%) in static net fisheries was on inshore vessels (less than 15m), with 110 days at sea (35%) monitored on static net vessels over 15m in length. Most observer effort was focused in ICES Divisions 7efghj (268 days), with 23 days in the Eastern Channel (7d) and Southern North Sea (4c), 6 days in the Irish Sea (7a) and 18 in Subarea 8 (Biscay). While sampling levels have increased in recent years in the Eastern Channel, sampling levels in the southern North Sea have reduced (22 to 1 days in 2015 to 2016 respectively).

Monitoring of pelagic trawlers was limited in 2016 to 23 days in herring and sprat fisheries, mostly in 7a and 7e. A total of 36 days at sea during 5 longline trips was achieved, with longline fishing effort monitored in Divisions 4a (Northern North Sea), 6a (West of Scotland) and 7c (West of Ireland) (See Annex 2, Table A2.1).

Cetacean bycatch

Observed cetacean bycatch consisted of 10 harbour porpoises, two common dolphins and two long-finned pilot whales (the latter two caught on the same trip) (see Table 6.1). All the cetaceans were observed caught in static net fisheries in Subarea 7. Although two pilot whales have previously been reported caught in a pelagic trawl fishery, these are the first records of this species from a UK gillnet fishery, and brings the total number of small cetacean species recorded as bycatch in UK static net fisheries to eight.

Bycatch estimates have been produced for common dolphins and harbour porpoises (the only two cetacean species where more than 2 individuals have been recorded) and these are provided in Annex 2. Direct fisheries mortality is expected to be relatively low for the other species whose observed bycatch rates are all less than 1% of that reported for porpoises.

Bycatch of other taxa

In addition to cetaceans, the UK protected species bycatch monitoring programme also collects data and regularly reports on the bycatch of all protected species including seals, seabirds and rarer fish species. A summary of the observed bycatches of these taxa recorded in 2016 is provided below.

Seals

A total of 7 bycaught seals was recorded in 2016, all of which were identified (or assumed from location) to be grey seals in Divisions 7f (5), 7e (1) and 7j (1); all were taken in static nets, for pollack (1), monkfish (2), spider crabs (3) and turbot (1). Total mortality estimates for seals for 2016 are provided in Annex 2.

Seabirds

Reported seabird bycatches in 2016 amounted to 69 individuals of at least 5 species (see Table 7.1). As in 2015, the most frequently reported species were guillemots (30), fulmars (26), gannets (6) and cormorants (5). Two gulls of indeterminate species were also recorded. Fulmars and gulls were reported exclusively from longlines, while cormorants and guillemots were taken exclusively in static nets; gannets were reported from both gear types. We continue to compile data on bird bycatches with the eventual aim of assessing the levels of bycatch in different fisheries, though at present records appear too patchy (leading to concerns over the representativeness of the data) to be used for this purpose reliably.

Rarer Elasmobranchs and Other Fish

At least ten species of rarer elasmobranchs were reported caught, totalling 368 individuals (see Table 7.2), all in static net fisheries. Among the elasmobranchs, small-eyed rays (97) were taken in gillnets, trammel and tangle nets. Common skates (56) were reported mostly from trammel nets, six-gilled sharks (58) mainly from tangle nets and blue sharks (48) mainly from gillnets. Also observed were 25 shads, taken mostly in gillnets.

Table 7.1 – Species of possible conservation concern identified during 2016 bycatch observations-individuals by ICES Division (numbers of individuals observed).

Species of potential conservation concern	4a	6a	7d	7e	7f	7g	7h	7j	8a	Total
Seabirds										
Cormorant				2	3					**5**
Fulmar	22	4								**26**
Gannet	3					1		2		**6**
Guillemot				14	15	1				**30**
Gull (spp. ind.)	2									**2**
Sharks										
Blue Shark						33	15			**48**
Porbeagle shark				1		13	4	4		**22**
Six-gilled shark								57	1	**58**
Spurdog					14					**14**
Tope			1	3	9	6	1	11		**31**
Skates										
Black skate								2		2
Common skate complex			1			29	1	25		**56**
Undulate ray			37	2						**39**
Marbled electric ray			1							**1**
Small eyed ray			66	24	7					**97**
Fish										
Allis shad					1	13				**14**
Twaite shad					1					**1**
Shad (spp. Ind.)			2		1	7				**10**
Total	**27**	**4**	**108**	**46**	**51**	**103**	**21**	**101**	**1**	**462**

Table 7.2 Species of possible conservation concern identified during 2016 bycatch observations- individuals by gear type (numbers of individuals observed).

Species of potential conservation concern	Gillnet	Longline	Tangle net	Trammel net	Wreck net	Total
Seabirds						
Cormorant	3		2			**5**
Fulmar		26				**26**
Gannet		3	2	1		**6**
Guillemot	29		1			**30**
Gull (spp ind)		2				**2**
Sharks						
Blue Shark	33			1	14	**48**
Porbeagle shark	12		5	1	4	**22**
Six-gilled shark	1		57			**58**
Spurdog	14					**14**
Tope	19		7	4	1	**31**
Skates						
Black skate			2			**2**
Common skate complex	4		1	51		**56**
Undulate ray	1		1	37		**39**
Marbled electric ray			1			**1**
Small eyed ray	25		25	47		**97**
Fish						
Allis shad	14					**14**
Twaite shad			1			**1**
Shad (spp ind)	7		1	2		**10**
Total	**162**	**31**	**106**	**144**	**19**	**462**

8. Conclusions

Sampling was focused on those fisheries where the greatest levels of protected species bycatch are expected, especially the various static net fisheries in Subarea 7. In the light of observed seabird bycatch in longline fisheries, observations on longline vessels in 2016 were increased. Sampling in the Eastern Channel, previously at low levels, was also increased during 2016, though at the expense of sampling in the southern North Sea. Sampling in more distant waters (7j, 8) was increased, but fell slightly in 7h compared with 2015. Sampling in pelagic trawl fisheries remains low, and was again lower in 2016 than in previous years, in part reflecting the continued absence of the bass pelagic pair trawl fishery, and in part due to the very low incidence of protected species bycatch observed in most pelagic trawl fisheries meaning annual monitoring targets have been deliberately reduced in recent years.

An analysis of marine mammal bycatch observations is presented in Annex 2, where we have used statistical modelling to look for patterns in observed bycatch rates. We have extrapolated total mortality estimates, using observed bycatch rates (numbers per haul) calculated from an extended multi-annual time period, and applied those to fishing effort data for 2016. Estimates are provided for harbour porpoises, common dolphins and seals (two species), but as in previous years, it is very important that these estimates are considered in the light of the caveats discussed in Annex 2.

Reference

Kingston, A & Northridge, S. 2011. Extension trial of an acoustic deterrent system to minimise dolphin and porpoise bycatch in gill and tangle net fisheries. Fisheries Challenge Fund report.

Annex 1: Other dedicated and non-dedicated sampling.

Other dedicated sampling of gear types not required under 812/2004 or 92/43/EEC

Table A1.1: Dedicated monitoring effort not required under 812/2004 or 92/43/EEC.

Category	Nantes Type	Metier Group	Target Group	ICES DIVISION	Vessels	Trips	Days at Sea	Hauls	Season	Mammal Bycatch	Seabird Bycatch
>15m	LLS	Longlines	Demersal fish	4a	1	1	4	6	Oct	0	27
				6a	1	2	15	11	Oct	0	4
				7c	1	2	17	10	Sep-Oct	0	0
TOTAL							**36**	**27**		**0**	**31**

Five longline trips, totalling 36 sea days in Subareas 4, 6 and 7 were achieved in 2016, resulting in 31 observed seabird bycatches (fulmars, gulls and gannets – see Table 7.2).

Non-dedicated sampling.

We have also collated data from CEFAS and AFBINI from discard sampling work undertaken by those two organisations. 670 'non-dedicated' monitoring days were conducted during 2016, of which 588 were on a variety of demersal trawl or dredge gears under the English (Cefas) and Northern Irish (AFBINI) discard sampling programmes to meet requirements of the Data Collection Framework (DCF). These data are not incorporated into our annual marine mammal bycatch estimates because we cannot be sure that all bycatches would have been seen or recorded by discard officers as they have different work patterns and commitments while on deck compared with 'dedicated' protected species bycatch observers. Nevertheless, the data are summarised as in previous reports, and included below (Table A1.2) because they may provide an initial insight into the potential for cetacean bycatch to occur in gear types not routinely covered by dedicated monitoring under Regulation 812/2004 and the Habitats Directive. No cetacean or seal bycatch was reported in any of these 588 sampled demersal trawl days.

In addition, CEFAS conducted 79 non-dedicated days on static net vessels and 3 on handline vessels in 2016. A single common dolphin was reported bycaught in an anglerfish tangle net in 7e.

Table A1.2: A summary of 'non-dedicated' sampling conducted under the English/Welsh and Northern Irish discard programmes.

Gear Group	Gear Type	Area	Target	Days	Hauls	Dolphins	Porpoise	Contractor
Demersal Trawl	Beam	4c	Brown shrimp	6	16	0	0	Cefas
Demersal Trawl	Beam	7d	Plaice	4	14	0	0	Cefas
Demersal Trawl	Beam	7e	Anglerfish	19	71	0	0	Cefas
Demersal Trawl	Beam	7e	Cuttlefish	38	147	0	0	Cefas
Demersal Trawl	Beam	7e	Dover sole	13	65	0	0	Cefas
Demersal Trawl	Beam	7e	Lemon sole	8	32	0	0	Cefas
Demersal Trawl	Beam	7e	Megrim	23	85	0	0	Cefas
Demersal Trawl	Beam	7f	Anglerfish	12	54	0	0	Cefas
Demersal Trawl	Beam	7f	Dover sole	10	50	0	0	Cefas
Demersal Trawl	Beam	7h	Anglerfish	38	140	0	0	Cefas
Demersal Trawl	Beam	7h	Lemon sole	16	60	0	0	Cefas
Demersal Trawl	Beam	7h	Megrim	30	104	0	0	Cefas
Demersal Trawl	Dredge	4b	Scallop	6	35	0	0	Cefas
Demersal Trawl	Dredge	7a	Scallop	16	134	0	0	AFBI
Demersal Trawl	Dredge	7e	Anglerfish	2	16	0	0	Cefas
Demersal Trawl	Dredge	7e	Scallop	5	34	0	0	Cefas
Demersal Trawl	Dredge	7f	Scallop	2	5	0	0	Cefas
Demersal Trawl	Midwater Demersal	7a	Whitefish	78	154	0	0	AFBI
Demersal Trawl	Midwater Demersal	7e	Sprat	1	2	0	0	Cefas
Demersal Trawl	Otter	4b	Dover sole	1	3	0	0	Cefas
Demersal Trawl	Otter	4b	Whiting	4	5	0	0	Cefas
Demersal Trawl	Otter	4c	Dover sole	1	3	0	0	Cefas
Demersal Trawl	Otter	6a	Nephrops	2	5	0	0	AFBI
Demersal Trawl	Otter	7a	Cod	1	2	0	0	Cefas

Demersal Trawl	Otter	7a	Nephrops	64	180	0	0	AFBI
Demersal Trawl	Otter	7a	Plaice	1	2	0	0	Cefas
Demersal Trawl	Otter	7a	Skates and Rays	1	2	0	0	Cefas
Demersal Trawl	Otter	7a	Whitefish	11	28	0	0	AFBI
Demersal Trawl	Otter	7d	Lemon sole	4	10	0	0	Cefas
Demersal Trawl	Otter	7e	Anglerfish	4	11	0	0	Cefas
Demersal Trawl	Otter	7e	Cuttlefish	2	4	0	0	Cefas
Demersal Trawl	Otter	7e	Haddock	7	13	0	0	Cefas
Demersal Trawl	Otter	7e	John dory	1	3	0	0	Cefas
Demersal Trawl	Otter	7e	Lemon sole	8	19	0	0	Cefas
Demersal Trawl	Otter	7e	Squid	1	4	0	0	Cefas
Demersal Trawl	Otter	7f	Anglerfish	1	3	0	0	Cefas
Demersal Trawl	Otter	7f	Bass	2	3	0	0	Cefas
Demersal Trawl	Otter	7f	Dover sole	2	4	0	0	Cefas
Demersal Trawl	Quadruple Otter	7a	Nephrops	27	77	0	0	AFBI
Demersal Trawl	Single Nephrops	4b	Nephrops	5	8	0	0	Cefas
Demersal Trawl	Single Nephrops	7a	Nephrops	5	5	0	0	Cefas
Demersal Trawl	Triple Otter	4c	Dover sole	1	2	0	0	Cefas
Demersal Trawl	Twin Nephrops	4b	Anglerfish	1	2	0	0	Cefas
Demersal Trawl	Twin Nephrops	4b	Nephrops	3	4	0	0	Cefas
Demersal Trawl	Twin Otter	4c	Dover sole	6	33	0	0	Cefas
Demersal Trawl	Twin Otter	6a	Nephrops	32	81	0	0	AFBI
Demersal Trawl	Twin Otter	7a	Nephrops	55	159	0	0	AFBI
Demersal Trawl	Twin Otter	7e	Anglerfish	2	6	0	0	Cefas
Demersal Trawl	Twin Otter	7e	Cuttlefish	4	11	0	0	Cefas

Demersal Trawl	Twin Otter	7e	Lemon sole	1	2	0	0	Cefas
Drift Net	Drift	7a	Bass	1	3	0	0	Cefas
Lines	Handline	7e	Bass	2	13	0	0	Cefas
Lines	Handline	7e	Whiting	1	1	0	0	Cefas
Midwater Trawl	Midwater Trawl	7e	Sprat	1	1	0	0	Cefas
Static Net	Gill	7e	Anglerfish	1	7	0	0	Cefas
Static Net	Gill	7e	Dover sole	2	5	0	0	Cefas
Static Net	Gill	7e	Hake	6	12	0	0	Cefas
Static Net	Gill	7e	Pollack	2	12	0	0	Cefas
Static Net	Gill	7f	Brill	1	4	0	0	Cefas
Static Net	Gill	7f	Haddock	1	4	0	0	Cefas
Static Net	Gill	7f	Hake	5	13	0	0	Cefas
Static Net	Gill	7f	Pollack	1	4	0	0	Cefas
Static Net	Gill	7g	Hake	27	69	0	0	Cefas
Static Net	Gill	7j	Hake	4	5	0	0	Cefas
Static Net	Tangle / Trammel	7a	Cod	1	1	0	0	Cefas
Static Net	Tangle / Trammel	7a	Skates and Rays	1	3	0	0	Cefas
Static Net	Tangle / Trammel	7d	Dover sole	2	10	0	0	Cefas
Static Net	Tangle / Trammel	7e	Anglerfish	5	23	1	0	Cefas
Static Net	Tangle / Trammel	7e	Brill	1	4	0	0	Cefas
Static Net	Tangle / Trammel	7e	Hake	6	12	0	0	Cefas
Static Net	Tangle / Trammel	7e	Lobster	1	4	0	0	Cefas
Static Net	Tangle / Trammel	7e	Skates and Rays	1	4	0	0	Cefas
Static Net	Tangle / Trammel	7f	Brill	1	4	0	0	Cefas
Static Net	Tangle / Trammel	7f	Skates and Rays	2	7	0	0	Cefas
Static Net	Tangle / Trammel	7g	Hake	7	18	0	0	Cefas
TOTAL				**670**	**2155**	**1**	**0**	

Annex 2

Statistical analyses and estimates of marine mammal bycatch in UK gillnet fisheries.

Observations of marine mammal, seabird and vulnerable fish species bycatch made during 2016 were added to an annual data series that was initiated in 2000. These incremental observations help to refine our understanding of the bycatch process by improving sampling coverage from the various different fisheries, seasons and areas fished by UK vessels. The precision of bycatch estimates is thereby improved, while trends and changes in bycatch rates over time can be examined. We use these pooled observations made over several years to provide a best estimate of the bycatch rate (number of animals observed per haul) by fishery stratum. We then use official logbook and landings data from the most recent year (2016) to estimate fishing effort for the same strata, and finally we apply the calculated bycatch rate by strata to the effort estimate to generate bycatch estimates for the most recent year. We have so far confined our estimation of total annual bycatch to three species/groups of animal (harbour porpoise, common dolphin and seals), pending a more in-depth analysis for other species.

Preliminary exploration

Analysis was based on observations of 12,739 static net hauls observed since 2000, of which around 1800 were observed with pingers being used. Observations of 'pingered' hauls (mostly using the pinger model DDD-03L) began in 2008, but it is important to note that not all pingered hauls observed since then were equipped in accordance with current operating guidelines, whereby any part of a net should be no more than 2 km from a DDD-03 pinger.

We used generalised additive models (GAMs) to explore porpoise bycatch rate (porpoises per haul) in relation to net fleet length, vessel size category, month, year, area (ICES Division or Divisions pooled into 6 regions), presence or absence of pingers and metier (a combination of mesh size and target species – all observed hauls were assigned to one of seven notional metiers). When single factors were modelled, net fleet length explained the most variation in bycatch rate, but when interactions between factors were included in the modelling, a model with year and net fleet length interacting, and with different surfaces for "pinger on" or "pinger off" provided the best fit to the data. The modelling results concur with last year's analysis that net length, year and pinger presence were most important. The modelling results suggested that there may have been higher bycatch rates, over a wider range of net fleet lengths, prior to 2010 than after that. Consequently, the assumption of a constant bycatch rate over the entire time series may not be tenable, so we have generally only used the more recent year's data to estimate bycatch totals for all metiers. A longer time series was used for hake netting, where recent data with nets without pingers are quite limited and the full dataset provides a more robust estimated rate. The apparently lower bycatch rates over most net fleet lengths since 2010 is not easy to explain, and would need further exploratory analysis for confirmation, but could be due to a change in animal density over this time period.

Ideally, we would use net fleet length as an explanatory variable in predicting the overall bycatch per year by metier, but unfortunately this effort parameter is not (reliably) available in the logbook and

landings data, and we therefore need to use metier, based on net type and landed species, along with area (Division) as the primary strata for bycatch estimation.

In order to estimate total bycatch we also need to extrapolate the number of animals observed per haul (fishing operation) to the entire fleet, but the landings and logbook data do not record the number of hauls by trip, only the number of days at sea. We therefore need to use the observations that we have made to estimate the mean number of hauls per day for unobserved vessel trips. This has been done by trip length category and metier as there are significant differences in the operational characteristics and numbers of fishing operations per day in different metiers. The mean number of operations per day by metier and by trip category is shown below in Table A2.1, where smaller vessels making day trips have been separated from larger vessels making multi-day trips. Multi-day trips result in fewer hauls per day because time is spent steaming to fishing grounds, but also because net fleet lengths are generally longer in most metiers.

Table A2.1: Estimated number of hauls per day by vessel category from observer data

Metier	Single Day Trips	Multiday Trips
Drift Other	3.59	1.00
Drift Pelagic	3.59	1.00
Gill	5.81	4.07
Gill Hake	11.00	2.20
Gill Light	4.95	2.47
Gill Light Flatfish	4.94	3.96
Tangle/Trammel	4.63	2.57

Further modelling by vessel and landing characteristics will be required to incorporate net fleet length into our bycatch estimation. In the meantime we are effectively assuming net fleet lengths are the same within a metier regardless of vessel size. *A strong caveat here is that subsequent bycatch estimates will likely underestimate bycatch from larger offshore vessels and overestimate it for smaller inshore vessels.*

Bycatch estimation of porpoises

Porpoise bycatch has been estimated using the observed bycatch-per-haul rates by metier, by pinger presence, and by vessel size category (over 12 m and under 12 m). Bootstrapped ratio estimates are used to generate confidence limits. Porpoise bycatch was estimated under two scenarios, first on the assumption that no boats were using pingers in 2016 (the baseline scenario) by using only observations made on nets without pingers, and secondly, assuming all vessels over 12 m in length were using pingers (regardless of mesh size or net length). The second scenario is the 'best case' assumption that all vessels have been fully complying with the regulation, and is based on

observations of nets on vessels over 12 m in length where pingers were used correctly and where net fleet length did not exceed 4 km for the observed haul.

Table A2.2 Observed bycatch rates for porpoises in 6 gillnet metiers – All UK vessels observed.

Estimated bycatch rates of porpoises per haul, for hauls *without* pingers from observations between 2010 and 2016 (hake 2005-2016); binomial distribution assumed.

Metier	Number of hauls observed	Observed porpoises caught	Mean bycatch rate: animals per haul	Standard Error of bycatch rate estimate	Two-sided Lower 95% Confidence Limit	Two-sided Upper 95% Confidence Limit	One-sided Upper 90% Confidence Limit
Drift	154	2	0.0130	0.0092	0.0016	0.0461	0.0403
Gill	995	8	0.0080	0.0028	0.0035	0.0158	0.0145
Gill Hake	290	14	0.0483	0.0135	0.0266	0.0797	0.0744
Gill Light	405	4	0.0099	0.0060	0.0027	0.0251	0.0225
Gill Light Flatfish	777	1	0.0013	0.0013	0.0000	0.0071	0.0061
Tangle/Trammel	2962	65	0.0219	0.0031	0.0170	0.0279	0.0269

The porpoise bycatch rate estimates are shown in Table A2.2. Note that while for most metiers we use only observations between 2010 and 2016, for the hake fishery more recent sampling of nets without pingers has been limited so a longer time frame has been used (2005-2016). The standard error (a measure of the precision of the estimate, where smaller is better) as well as the upper and lower 95% 2-sided confidence limits for the estimated rates are also shown. We also provide the one-sided upper 90% confidence limit (this is useful if or when we ask the question how likely is the rate to be above some pre-specified level).

These bycatch rate estimates are then applied to the estimates of the number of hauls per day by metier (disregarding any uncertainty in those estimates while recognising that this should eventually be considered), to provide estimated total porpoise bycatch by metier and by area, assuming no pingers are in use. The estimates by metier are shown in Tables A2.3.

Table A2.3 Estimated number of porpoises taken incidentally in UK gillnet fisheries in 2016 by metier, assuming no pinger use

Metier	Estimated total annual bycatch (rounded numbers)	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift demersal	44	5	158	138
Drift pelagic	39	4	137	120
Gill	208	91	407	373
Gill hake	118	65	195	182
Gill light	354	97	898	803
Gill flatfish	67	2	373	318
Tangle/Trammel	651	506	826	797

Overall we estimate that, with no pinger use, 1482 porpoises (point estimate, CV=0.09; 95% confidence limits of 771-2994) would have been caught in UK gillnet fisheries in 2016.

Bycatch estimates by ICES Division have also been produced in Table A2.4, but these are based on stratified observations by metier and vessel size alone, and not by area-specific observed bycatch rates, as there are too few observations by metier in several areas for estimates to be generated.

Another important caveat is therefore that these estimates make assumptions about bycatch rates across areas that are likely to be inaccurate (biased). For example, if bycatch rates in 7d, where sampling has been limited, are higher or lower than in other parts of Subarea 7, this will not be reflected in the extrapolated totals below. In the absence of precise estimates of bycatch in several areas, we have estimated bycatch totals based on the best *available* data, while recognising that there are likely to be biases in these estimates.

Table A2.4 Estimated number of porpoises taken incidentally in UK gillnet fisheries 2016 by area, assuming no pinger use

ICES Division	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	26	20	34	33
4b	25	14	46	43
4c	131	54	314	282
6b	21	16	27	26
7a	40	16	92	83
7d	360	140	939	837
7e	396	217	750	689
7f	311	191	521	485
7g	100	58	163	153
7h	26	16	41	38
7j	39	25	59	55
8abcd	6	4	9	8

Bycatch rates have clearly been reduced by the implementation of EC regulation 812/2004. Observed bycatch rates in the over 12 m vessel sector are now considerably lower than they were before pingers were in widespread use. Observed bycatch rates in the over 12 m sector (with standard errors and confidence limits) are shown in Table A2.5, but only for net fleet lengths of up to 4km in length, because during the monitoring period some longer nets with an insufficient number of pingers were also observed. Two porpoises have been observed in nets properly equipped with pingers, whereas 12 animals would have been expected in the same number of hauls without pingers.

Table A2.5 Estimated bycatch rates of porpoises for hauls *with* pingers from observations between 2010 and 2016 with nets <=4km

Metier	Number of hauls observed	Observed porpoises caught	Mean bycatch rate	Standard Error of bycatch rate	Two-sided Lower 95% Confidence Limit	Two-sided Upper 95% Confidence Limit	One-sided Upper 90% Confidence Limit
Drift	0	0	0.0000	0.0000	0.0000	1.0000	NA
Gill	371	0	0.0000	0.0000	0.0000	0.0099	0.0080
Gill Hake	68	0	0.0000	0.0000	0.0000	0.0528	0.0431
Gill Light	5	1	0.2000	0.2000	0.0051	0.7164	0.6574
Gill Light Flatfish	5	0	0.0000	0.0000	0.0000	0.5218	0.4507
Tangle/ Trammel	237	1	0.0042	0.0042	0.0001	0.0233	0.0199

From these data we can estimate the expected porpoise bycatch totals if all vessels of 12m or more used pingers in all areas, while no vessels under 12m used pingers. These estimates are shown in Tables A2.6 (by metier) and A2.7 (by area).

Table A2.6 Estimated number of porpoises taken incidentally in UK gillnet fisheries 2016 by metier, assuming all vessels of 12 m or more used pingers in all areas

Metier	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Other	44	5	158	138
Drift Pelagic	39	5	141	120
Gill	183	78	393	357
Gill Hake	14	1	154	129
Gill Light	353	97	943	843
Gill Light Flatfish	67	2	541	463
Tangle / Trammel	550	418	785	745

Table A2.7 Estimated number of porpoises taken incidentally in UK gillnet fisheries 2016 by area assuming all vessels of 12m or more used pingers

ICES Division	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	5	2	26	22
4b	21	12	203	178
4c	131	54	314	282
6b	2	0	19	16
7a	40	16	96	83
7d	360	140	939	837
7e	373	201	778	709
7f	291	177	513	475
7g	17	3	146	123
7h	3	0	30	25
7j	6	2	45	38
8abcd	1	0	6	5

Overall we estimate that if all over 12 m vessels used pingers (in all areas), then 1250 porpoises might have been expected to have been caught (CV=0.11, 95% confidence limits 606-3114).

This estimate is a liberal one, as it includes areas (6b, 7a and 8) where pingers are not required and might not be used, but these numbers suggest that close to 200 porpoises per year are being saved by the use of pingers, though the caveats mentioned previously, that our bycatch estimates may over-estimate bycatch by smaller vessels and under estimate larger vessel bycatch, could mean that the numbers 'saved' are in fact higher than this.

Bycatch estimation of common dolphin

Eight species of small cetacean have been recorded in UK set net fisheries under the protected species bycatch programme, but none, other than common dolphin and harbour porpoise, has been recorded more than twice. Common dolphin bycatch estimates are based on observations from 2005-2016, and we have been unable to detect any changes in bycatch rate over that period, as numbers are relatively low (45 animals in total). We used only nets without pingers to estimate the bycatch rate, as we do not yet know whether or not pinger use has an effect on common dolphin bycatch. If pingers are effective in reducing common dolphin bycatch then our estimate is likely to be high.

Our estimate that 285 common dolphins were caught in 2016 (CV 0.108, 95% confidence limits 137-922) is not very different from that in previous years. Annual estimates (with confidence limits) were 323 (172-1189), 276 (146-1138) and 239 (134-905) in 2013, 2014 and 2015 respectively. Confidence intervals remain large and there is no clear evidence of a trend in bycatch rate.

Estimates by metier and by area are presented below in Tables A2.8 and A2.9. We have not taken account of differences in the density of common dolphins in these areas: there is no spatially explicit modelling of bycatch rates. Estimates are based on observed bycatch rates, mainly in areas 7fgh and assumed to apply to all other areas. Estimates for Divisions 4abc where common dolphins are less frequently found are therefore likely overestimated, whereas the estimate for Divisions 8abcd (Biscay) where common dolphins are more abundant, may be underestimated.

Table A2.8: Estimates of common dolphin bycatch 2016 by metier

Metier	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Demersal	0	0	57	46
Drift Pelagic	0	0	50	40
Gill	44	12	111	100
Gill Hake	39	19	73	68
Gill Light	47	1	260	221
Gill Light Flatfish	0	0	150	122
Tangle/Trammel	155	106	220	210

Table A2.9: Estimates of common dolphin bycatch 2016 by ICES Division

ICES Division	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	6	4	9	9
4b	5	3	14	12
4c	19	8	100	85
6b	5	3	7	7
7a	6	2	27	23
7d	52	20	306	260
7e	76	38	220	194
7f	66	35	148	133
7g	31	15	58	53
7h	6	3	12	11
7j	11	6	19	17
8abcd	1	1	2	2

Seal bycatch estimates

Seal bycatch estimates are made for both species of seal (grey and common/harbour) combined. Most seals caught are young (yearlings typically) and the two species commonly found in the UK can be hard to distinguish at that life stage. In recent years we have been fairly confident that all seals observed were grey seals, and were taken in the southwest where common seals are rarely seen, though last year two common seals were also recorded bycaught in Division 4a. The numbers are too low to generate a useful bycatch estimate for common seals separately, so for expedience we have generated a seal bycatch total, with the assumption that while most of these are grey seals, in the North Sea at least, some proportion of these will be common or harbour seals. Estimates of seal bycatch for 2016 are presented by metier in Table A2.10 and by area in Table A2.11.

Table A2.10: Seal bycatch estimates by metier 2016

Metier	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Demersal	0	0	57	46
Drift Pelagic	0	0	50	40
Gill	33	7	95	84
Gill Hake	0	0	16	13
Gill Light	0	0	172	140
Gill Light Flatfish	41	1	227	193
Tangle / Trammel	536	442	646	628

Table A2.11 Seal bycatch estimates by ICES Division 2016

ICES Division	Estimated total bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	24	20	29	28
4b	12	9	21	19
4c	42	29	125	110
6b	17	14	21	20
7a	8	6	26	23
7d	120	70	391	341
7e	181	138	330	304
7f	163	130	248	233
7g	16	13	32	29
7h	11	8	17	16
7j	12	9	18	17
8abcd	4	3	5	5

The total seal bycatch estimate for 2016 is 610 animals (CV = 0.07; 95% confidence limits 449-1262) which is higher than the previous year (580), and which in turn was slightly higher than the preceding year (417). Confidence intervals are large and it would be unwise to infer any trend as yet from three data points. Estimates of seal bycatch have fluctuated somewhat over the past few years, but are generally in the region of 400-600 seals per year. These are shown in Table A2.12 with their respective confidence limits for 2013-2015. We do not know which breeding colonies the young animals involved originate from.

Table A2.12: recent estimates of annual seal bycatch in UK gillnet fisheries with 95% confidence limits

Year	Estimated number	95% confidence interval
2013	469	285-1369
2014	417	255-1312
2015	580	423-1297
2016	610	449-1262

Annex 3

Map of relevant ICES areas

(Note: recent changes mean statistical areas are now labelled by ICES in Arabic numerals rather than Roman numerals, but an updated map was not available at time of report publication).