



University of
St Andrews



UK Bycatch Monitoring Programme



Report for 2022



UK Centre for
Ecology & Hydrology



Scottish Government
Riaghaltas na h-Alba

Marine Directorate

Authorship

Al Kingston^{1*}, Len Thomas², Faye Moyes¹, Alex Coram¹, Carol Sparling¹, Alice Mackay¹, Joanna Murray³, Jon Elson³, Francis Daunt⁴, Kate Searle⁴, Mike Cohen⁵, Mike Roach⁵, Liz Clarke⁶, Elena Balestri⁷, Gerry McAllister⁷, Simon Northridge^{1**}.

* Corresponding author.

** Author deceased.

Author affiliations

¹ Sea Mammal Research Unit / Scottish Oceans Institute, University of St Andrews.

² Centre for Research into Ecological and Environmental Modelling, University of St Andrews.

³ Centre for Environment, Fisheries and Aquaculture Science.

⁴ United Kingdom Centre for Ecology and Hydrology.

⁵ National Federation of Fishermen's Organisations.

⁶ Marine Directorate, Scottish Government.

⁷ Scottish Fishermen's Federation.

Recommended format for the purpose of citation:

UK Bycatch Monitoring Programme Report for 2022. (2026). Annual report to DEFRA and Scottish Government. 46pp.

The UK Bycatch Monitoring Programme is funded by the UK Department for Environment, Food and Rural Affairs and Scottish Government.

Executive Summary

This report describes work carried out under the UK Bycatch Monitoring Programme (BMP) during 2022.

In mid-2022 the programme underwent a structural change and is now a consortium based programme consisting of four scientific institutions (the University of St Andrews, the Centre for Environment, Fisheries and Aquaculture Science, the Centre for Ecology and Hydrology, and the Scottish Marine Directorate's Science, Evidence, Data and Digital Portfolio) and two fishing industry representative bodies (the National Federation of Fishermen's Organisations and the Scottish Fishermen's Federation). The purpose of this consortium is to bring together organisations with an unparalleled concentration of expertise in relevant taxa biology and ecology, fisheries monitoring, statistical analysis/modelling, bycatch assessment and mitigation, data collection technologies, fishing gear technology and broad knowledge of fisheries and environmental policy and management systems.

Over one thousand days at sea were monitored for protected species bycatch across a range of demersal and midwater trawl, net, line and demersal and pelagic seine fisheries during 2022.

Approximately 12,000 specimens of species of bycatch relevance were recorded, including eleven marine mammals (three species), 206 seabirds (two species), 4935 fish (18 species) and 6877 elasmobranchs (19 species).

Official UK fishing effort statistics for 2022 show that two broad gear groups, pots and demersal trawl/seines continue to make up the majority of total UK fishing effort in terms of days at sea. Dredge, line and net fisheries make up about a quarter of UK effort, and a small percentage of total UK effort is accounted for by a mix of hand gathering, pelagic trawls, purse seines/ring nets and miscellaneous gears. Most gear types have shown a gradual decline in overall effort since 2018.

A time-series of monitoring data was used, along with fishing effort data from 2022, to produce bycatch mortality estimates for harbour porpoise, common dolphin and seals (grey and harbour combined), in static net fisheries using a multi-annual modelled ratio-based approach.

The point estimate for harbour porpoise bycatch in 2022, assuming full compliance by the relevant over 12m netting fleet with Acoustic Deterrent Device (ADD) requirements was 816 animals (95% CL range 477-1676), and the point estimate, assuming no ADD use, was 1173 animals (95% CL range 651-2094). The point estimate for common dolphin bycatch in 2022 was 325 (95% CL range 187-724). The point estimate for seal (grey and harbour combined) bycatch in 2022 was 452 (95% CL range 351-820).

The Bycatch Monitoring Programme also contributed to international scale risk and mortality assessments carried out by the International Council for the Exploration of the Sea (ICES).

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List of acronyms used in the report.

ADD	Acoustic Deterrent Device
ASCOBANS	Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas
BEAM	Bycatch Evaluation and Assessment Matrix
BMP	Bycatch Monitoring Programme
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEH	Centre for Ecology and Hydrology
CL	Confidence Limit
DaS	Days at Sea
DEFRA	Department for Environment, Food and Rural Affairs
DCF	Data Collection Framework
EC	European Commission
EU	European Union
ETP	Endangered, Threatened and Protected
ICES	International Council for the Exploration of the Sea
ICRW	International Convention on the Regulation of Whaling
iFish	Integrated Fisheries System Holding
LCL	Lower Confidence Limit
MD	Marine Directorate
MMO	Marine Management Organisation
MMPA	Marine Mammal Protection Act
MPV	Marine Protection Vessel
NFFO	National Federation of Fishermen's Organisations
OSPAR	Oslo and Paris Conventions
PSG	Project Steering Group
SEDD	Scottish Government Science, Evidence, Data and Digital Portfolio
SFF	Scottish Fishermen's Federation
SMRU	Sea Mammal Research Unit
SOI	Scottish Oceans Institute
ToR	Term of Reference
UCL	Upper Confidence Limit
UK	United Kingdom
USTAN	University of St Andrews
VMS	Vessel Monitoring Systems
WG	Working Group
WGBYC	Working Group on Bycatch of Protected Species
WGFTFB	Working Group on Fishing Technology and Fish Behaviour

1 Introduction.

The UK Bycatch Monitoring Programme (BMP) has been running since the mid 1990's and is a long-term, broadscale, at-sea, fishery dependent data collection programme focussed on the bycatch of Endangered, Threatened and Protected (ETP) marine species, including marine mammals, seabirds and fish. The programme is funded by the Department of Environment, Food and Rural Affairs (DEFRA) and the Scottish Government's Marine Directorate. The programme is designed to meet national and international bycatch monitoring obligations and to improve knowledge of the patterns and scale of ETP bycatch in UK commercial fisheries, to support Government aspirations for clean, healthy, biologically diverse seas and resilient ecosystem, and the sustainable use of its resources.

Work carried out under the BMP during 2022 addressed UK and other international monitoring obligations relevant to ETP species bycatch including the UK Fisheries Act 2020, the UK Conservation of Offshore Marine Habitats and Species Regulations 2017, the Conservation (Natural Habitats, &c.) Regulations 1994 (Scotland), the UK Marine Strategy, the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS), the International Convention on the Regulation of Whaling (ICRW), the Oslo and Paris Conventions (OSPAR) and the United States Marine Mammal Protection Act (MMPA) import provisions.

Until mid-2022 the BMP was managed by staff from the Sea Mammal Research Unit (SMRU) and Scottish Oceans Institute (SOI) at the University of St Andrews. Following a project contract renewal in 2022 the programme underwent a significant structural change and became a multi-organisation consortium-based programme, comprising of four scientific institutions and two fishing industry representative organisations. The purpose of this consortium approach was to bring together a significant concentration of UK scientific expertise in bycatch science, fisheries monitoring, relevant taxa biology and ecology, and industry knowledge to help shape the future form and direction of the BMP. This annual report provides an update on work undertaken within the BMP during the full 2022 calendar year and so contains information collected under both programme structures.

In the report there are sections describing the consortium partners, bycatch data collection activities, bycatch observations, UK fishing effort, marine mammal bycatch estimates, Acoustic Deterrent Device (ADD) efficacy and compliance activities, and relevant scientific work undertaken by the International Council for the Exploration of the Sea (ICES) during 2022, to which the BMP consortium made significant contributions.

Details of the bycatch estimation procedure used in Section 4 of the report are provided in Annex 1, a map showing the ICES Ecoregions and Divisions is provided in Annex 2 and recently developed ICES ecoregion species lists for the Greater North Sea and Celtic Seas ecoregions are provided in Annex 3.

1.1 Annual report format.

From 2010 to 2018 all BMP annual reports followed a standardised format which was developed by the European Commission (EC) under European Union (EU) Regulation 812/2004. That format was designed to ensure that bycatch monitoring data from all relevant EU member states were collated and published in a consistent and comparable way to facilitate analyses at spatial scales relevant to affected cetacean populations. The standardised reporting format is no longer necessary (see Kingston *et al*, 2021 for details). Consequently, a new reporting format was developed for the 2019 UK annual report, and the same general format has been used for this report, but with some presentational adjustments to account for the expanding scope of the programme.

2 The BMP Consortium.

The BMP consortium consists of four scientific institutions: the Sea Mammal Research Unit / Scottish Oceans Institute at the University of St Andrews (USTAN); the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), the UK Centre for Ecology and Hydrology (UKCEH) and the Marine Directorate of the Scottish Government Science, Evidence, Data and Digital (SEDD) Portfolio that provide impartial scientific oversight and insight, and two fishing industry representative bodies: the National Federation of Fishermen’s Organisations (NFFO) and the Scottish Fishermen’s Federation (SFF) that provide industry oversight and insight and direct links to grassroots industry.

Collectively, these organisations provide a unique concentration of expertise in the biology and ecology of relevant taxa (marine mammals, seabirds, elasmobranchs and fish), fisheries sampling design and implementation, data management, statistical analysis and modelling, bycatch assessment, bycatch mitigation, acoustics, Remote Electronic Monitoring (REM), gear technology and broader knowledge of fisheries and environmental management systems.

A summary of the main roles and expertise for each of the consortium partners is provided in Table 1.

Table 1: Roles and relevant expertise of the BMP consortium partner organisations.

Organisation	Main roles/expertise.
USTAN	<ul style="list-style-type: none">• Overall project management and coordination.• Sampling design and implementation.• Data analysis, interpretation and reporting.• Risk and mortality assessments.• Marine mammal biology & ecology.• Bycatch mitigation, acoustics, REM.

CEFAS	<ul style="list-style-type: none"> • Sampling design and implementation. • Data analysis, interpretation and reporting. • Fish/elasmobranch biology & ecology. • Bycatch mitigation, REM.
UKCEH	<ul style="list-style-type: none"> • Seabird biology/ecology/distribution. • Anthropogenic effects on seabird populations. • Interpretation and reporting.
SEDD	<ul style="list-style-type: none"> • Sampling design and implementation. • Data analysis, interpretation and reporting. • Fish/elasmobranch biology & ecology. • REM, gear technology.
NFFO	<ul style="list-style-type: none"> • Industry knowledge and oversight. • Links to grassroots industry. • Fisheries management systems. • Interpretation and dissemination.
SFF	<ul style="list-style-type: none"> • Industry knowledge and oversight. • Links to grassroots industry. • Fisheries management systems. • Sampling implementation. • Interpretation and dissemination.

In addition to ongoing at-sea data collection, several additional tasks are planned to improve understanding of the scale and patterns of ETP species bycatch in UK fisheries, by evaluating current sampling designs and protocols (including fishing effort analyses and monitoring gap analyses), assessing the suitability of REM for broadscale, multi-taxa, multi-gear bycatch monitoring, investigating ways to improve current mortality and risk assessment procedures and by undertaking bycatch trend analyses. This work will be reported on through standalone reports or scientific papers or through the BMP annual reports as appropriate.

3 BMP Data.

2.1 Sampling designs and data collection protocols.

Historical sampling designs (i.e., which fisheries are sampled and at what level) within the USTAN element of the BMP has evolved over time in response to changing legislative and policy needs. Initially the programme focussed mainly on small cetacean bycatch (but bycatch of other taxa was also recorded) so most data collection activities were directed at specific fisheries considered high-risk at that time, such as static net fisheries in the North Sea (ICES Subarea 4) and various midwater trawl fisheries in Subareas 4, 6 & 7 (North Sea, West of Scotland, Celtic Sea/English Channel).

In 2005, phocids, seabirds, marine reptiles and fish species of conservation interest were formally included in the programme's remit, and routine sampling efforts gradually expanded from static net and pelagic trawl gears to also include longline and ring net/purse seine fisheries. Sampling designs were based on existing legislative drivers, and design alterations were agreed with the BMP Project Steering Group (PSG) before being implemented.

Following the formation of the BMP consortium in 2022, the programme is now accessing and compiling more detailed bycatch data from the English (managed by CEFAS) and Scottish (managed by SEDD and implemented by SFF) at-sea catch sampling programmes. The primary aim of these programmes is to collect data on commercial species discard rates for inclusion in fish stock assessments and consequently, the focus is largely on demersal trawl fisheries, although some sampling of static net and line fisheries is undertaken within the English programme. Although sampling designs and data collection protocols in these programmes have not historically been specifically optimised for recording ETP bycatch, work has been ongoing within the UK and through ICES to improve the quality of bycatch data collection in national catch sampling programmes. This is the first year that these data have been fully incorporated into BMP reporting.

This means that with the exception of pot/creel fisheries, all major gear groups used by the UK fishing industry are subject to at-sea catch/bycatch monitoring. Further work on data collection protocols will continue to improve the reliability of bycatch data collected under the catch sampling programmes, and the intention is for those data (and data from various REM initiatives that include ETP bycatch recording within their remit) to be incorporated into more comprehensive (i.e., a wider range of species and gears) bycatch assessments going forward.

2.2 Sampling during 2022.

At-sea data collection activities during 2022 remained partially impacted by the effects of the COVID-19 pandemic, but access to vessels for data collection was improving. Although the stringent COVID-19 related measures seen in 2020 and 2021 had significantly relaxed, there remained a nervousness in some fishery sectors about external non-crew members joining trips and this was particularly evident for larger vessels that undertake multi-day trips where there was no realistic possibility of observers and crew remaining a safe distance apart for the duration of the trip. A similar pattern was observed in at-sea data collection programmes in several other European countries (ICES 2024).

Table 2 provides a breakdown of sampling conducted by USTAN, CEFAS and SEDD/SFF during 2022 by gear type, vessel size and ICES Division.

Table 2: Sampling during 2022.

Metier level 4	Vessel size	ICES Division	No of vessels	No of trips	Days at sea	No of hauls
Nets	</> 15m	4c	2	2	2	2
	>15m	6b	1	1	40	76
	>15m	7c	1	1	1	1
	<15m	7d	7	14	14	81
	<15m	7e	2	4	5	10
	<15m	7f	2	26	27	97
	</> 15m	7e	11	11	15	73
	</> 15m	7f	5	5	12	25
	</> 15m	7g	2	2	9	16
	</> 15m	7h	3	3	16	23
	</> 15m	7j	2	2	12	8
Handlines	</> 15m	7d	1	1	1	9
	</> 15m	7e	8	8	8	45
Longlines	>15m	4a	2	3	22	38
	>15m	6a	2	3	28	26
Beam trawl	> 15m	4c	5	5	6	23
	< 15m	7e	1	1	1	5
	> 15m	7e	27	27	157	376
	> 15m	7f	7	7	43	54
	> 15m	7g	4	4	23	27
	> 15m	7h	2	2	12	20
Bottom otter trawl	<15m	4a	1	9	10	24
	>15m	4a	32	57	251	691
	<15m	4b	1	1	1	1
	>15m	4b	9	19	40	71
	</> 15m	4b	45	47	47	87
	<15m	6a	3	12	12	20
	>15m	6a	11	18	55	163
	>15m	6b	1	2	11	43
	</> 15m	7a	9	9	19	33
	</> 15m	7d	7	10	10	26
</> 15m	7e	43	45	46	121	
Dredge	</> 15m	7e	2	2	2	16
Midwater trawl	>15m	4a	2	4	15	15
Ring nets/purse seine	>15m	4a	2	2	4	3
	<15m	7f	7	7	8	3
Fly shooting seine	>15	4a	2	4	15	74
	>15	6a	1	2	8	50
Total			275	382	1008	2476

Over one thousand days at sea of monitoring were undertaken in 2022 across a wide range of passive and mobile gears. Most data collection was carried out on demersal trawls (75%) including bottom otter trawl, beam trawl and dredge, followed by a mix of inshore and offshore net fisheries (15%), longlines (5%), demersal and pelagic seines (3.5%) and midwater trawls (1.5%).

2.3 Observed bycatch.

Table 3 details recorded bycatches during 2022 by ICES Division and broad gear type. Previously, the species reported in this section of the report were based on a list of “species of interest” that was developed within the BMP and agreed with the BMP Steering Group in 2013. ICES have recently developed ecoregion specific lists for marine mammals, seabirds, turtles and fish of bycatch relevance. The fish list contains a mix of data limited commercial species and ETP species that are protected under national and/or international hard (e.g., legislation) and soft (e.g., international agreements) law. The ICES lists are now used as the standard reference for bycatch data recording and reporting purposes throughout the Northeast Atlantic to provide consistency in national data collection programmes, and to facilitate more comprehensive bycatch assessments across the ICES area. The species lists for the Greater North Sea and Celtic Seas ecoregions (where the majority of UK fishing effort occurs) are used as the basis for populating Table 3. The species lists are provided in Annex 3a and 3b or can be accessed through the [ICES Roadmap for bycatch advice on protected, endangered and threatened species \(2020\)](#).

In total, 12,029 specimens of species from the ICES reference lists for the Celtic Seas and Greater North Seas ecoregions were recorded: 11 marine mammals (three species); 206 seabirds (two species), 4935 fish (18 species) and 6877 elasmobranchs (19 species).

Within the USTAN element of the BMP, estimated total weights and counts of the number of individuals by species are generally recorded directly by observers. In some cases, when high numbers of fish or elasmobranchs were caught in a particular fishing operation, only an estimated total weight for that species was recorded. In those instances, the number of individuals is estimated using the mean weight for that species from haul records where both numbers and estimated weights were available.

Within the catch sampling programmes, sample level data was provided for fish and elasmobranchs, meaning the presented numbers have not been extrapolated beyond sample level.

Seven common dolphins were recorded bycaught in bottom trawl and static net fisheries in the Southwest UK. Small cetacean bycatch in most bottom trawl fisheries is generally a relatively rare occurrence, and it is not clear if those records were of animals that died in that

particular fishing operation, or if they had died previously and were then “bycaught” by the trawl. Efforts to improve this element of data collection are being discussed.

Seabird bycatch was recorded in longline and static net fisheries. In total, 164 northern fulmars and four northern gannets were bycaught in the offshore longline fishery that mainly targets hake to the north and west of Scotland. A further 38 northern fulmars were bycaught in the deepwater net fishery for anglerfish that operates mostly on the upper continental slope. Northern fulmars cannot dive to the depths this fishery operates at, so current understanding is that individuals are sometimes caught while foraging on fish/offal scraps in the nets as the gear is being shot.

Fish and elasmobranch bycatch was recorded from a wide range of gears and areas. Most of the fish records are of data limited commercial species but there are several records of the diadromous species’ allis and twaite shad in trawl and net fisheries. Both species are afforded protection under the Bern Convention (1979) and UK domestic legislation (Wildlife and Countryside Act (1981), The Conservation (Natural Habitats, &c.) Regulations 1994, and the Conservation of Offshore Marine Habitats and Species Regulations (2017)).

Similarly, many of the recorded elasmobranch bycatches are of data limited commercial species. For species more typically classed as ETP species, there are several records of flapper and blue skate from bottom trawl and static net gears, porbeagle sharks in static net and seine fisheries, stingrays and electric rays in bottom trawl and static net fisheries and the deepwater species’ blackmouth catshark and sixgill shark in static net fisheries. There are also bycatch records of rabbitfish (Chimaera), a Holocephalid species that has features of elasmobranch and bony fish, from trawl and longline fisheries.

Table 3: Recorded bycatches by species, gear type and ICES Division in 2022. Note: some of the species presented below are classed as data limited commercial species and are included here to align with the ICES Bycatch Roadmap species lists.

Taxon	Common name	Gear	4a	4b	4c	6a	6b	7a	7c	7d	7e	7f	7g	7h	7j	Total	
Elasmobranch	Blackmouth catshark	Gillnet											5			5	
	Blonde ray	Beam trawl									466	96	9				571
		Bottom Trawl			3				2		17	356					378
		Driftnet									1	9					10
		Gillnet										5	170		1		176
		Multi-rig otter trawl									4	14					18
	Blue shark	Trammel													1	1	
	Blue skate	Beam trawl										19	3	19	56		97
		Bottom Trawl		1								1					2
		Driftnet									3				23		26
		Gillnet												1	60		61
		Seine					5										5
	Bluntnose six-gill shark	Trammel														1	1
			Driftnet													6	6
	Common stingray	Beam trawl										1					1
		Bottom Trawl										5					5
		Gillnet										2					2
		Multi-rig otter trawl									1	1					2
	Common torpedo	Beam trawl									1						1
	Cuckoo ray	Beam trawl										109	106	149	236		600
		Bottom Trawl			41				1			232					274
		Driftnet										4			4		8
		Gillnet										28	1		21		50
Multi-rig otter trawl				1							2					3	
Flapper skate	Bottom Trawl	111														111	

Taxon	Common name	Gear	4a	4b	4c	6a	6b	7a	7c	7d	7e	7f	7g	7h	7j	Total
		Gillnet										2				2
	Marbled electric ray	Beam trawl									5					5
	Nursehound (bull huss)	Beam trawl									42	1	4			47
		Bottom Trawl						7		3	29					39
		Gillnet									4	14	11			29
		Multi-rig otter trawl									1					1
	Porbeagle shark	Gillnet					1									1
		Seine	1													1
	Shagreen ray	Beam trawl									3			31		34
		Bottom Trawl									1					1
		Driftnet												18	71	89
		Gillnet												35	1	36
		Trammel									4				1	5
	Skates	Trammel								3						3
	Small eyed ray	Beam trawl									79	6	1			86
		Bottom Trawl								11	351					362
		Driftnet								15	1					16
		Gillnet								1	10	80				91
		Multi-rig otter trawl								1	11					12
	Thornback ray	Beam trawl									245	27	13	1		286
		Bottom Trawl	5	39		38	3	284		154	329					852
		Dredge									1					1
		Driftnet								195	49					244
		Gillnet			30					23	34				1	88
		Multi-rig otter trawl	3	5		69				37	36					150
		Seine				7										7
	Thorny skate	Bottom pair trawl	262													262
		Bottom Trawl	1215	39												1254

Taxon	Common name	Gear	4a	4b	4c	6a	6b	7a	7c	7d	7e	7f	7g	7h	7j	Total	
		Multi-rig otter trawl	95	28		14										137	
		Seine	16														16
	Tope	Bottom Trawl	1														1
		Seine				1											1
	Undulate ray	Beam trawl										146					146
		Bottom Trawl									25	52					77
		Driftnet									7	4					11
		Gillnet					22					11	2				35
		Multi-rig otter trawl									5	23					28
		Trammel									7						7
	Fish	Allis shad	Bottom Trawl									6					6
Atlantic Halibut		Bottom Trawl		4												4	
Ballan wrasse		Beam trawl										5					5
		Bottom Trawl									1	3					4
		Driftnet									68						68
		Gillnet											233				233
		Trammel									65						65
Blackbelly rosefish		Beam trawl												1			1
		Bottom Trawl		1					1								2
		Longline				186											186
Brill		Beam trawl			1							838	89	49	7		984
		Bottom Trawl		37					268		4	88					397
		Driftnet									13	3					16
		Gillnet									4	12			3		19
		Multi-rig otter trawl										11					11
	Trammel									13						13	
Common Goby	Bottom Trawl						2								2		
European conger	Beam trawl									213	12	12	30		267		

Taxon	Common name	Gear	4a	4b	4c	6a	6b	7a	7c	7d	7e	7f	7g	7h	7j	Total	
		Bottom Trawl						2		6	156					164	
		Gillnet									1	1				2	
		Multi-rig otter trawl										35					35
	Gilthead seabream	Bottom Trawl										1					1
		Multi-rig otter trawl									147						147
	John Dory	Beam trawl										310	139	29	24		502
		Bottom Trawl									23	687					713
		Dredge										1					1
		Gillnet										6	34	32			72
		Multi-rig otter trawl										110					110
	Lumpfish	Beam trawl															2
		Bottom trawl				2											2
	Norway Redfish	Bottom trawl															8
	Rabbit fish (<i>Chimaera</i>)	Longline		41													41
		Multi-rig otter trawl										1					1
	Sand Goby	Bottom trawl								4							4
	Shad	Trammel										3					3
	Tub gurnard	Trammel										4					4
	Turbot (Celtic Seas Ecoregion only)	Beam trawl										398	47	20	1		466
		Bottom trawl								65	4	50					119
		Driftnet									13	25			41		79
Gillnet							60			4	11	1		60		136	
Multi-rig otter trawl											8					8	
Trammel										11	8			10		29	
Twaite shad	Driftnet									2						2	
Wreckfish	Gillnet														1	1	
Mammal	Common dolphin	Bottom Trawl									4					4	
		Gillnet											2				2

Taxon	Common name	Gear	4a	4b	4c	6a	6b	7a	7c	7d	7e	7f	7g	7h	7j	Total
		Trammel									1					1
	Grey Seal	Gillnet										3				3
	Harbour porpoise	Trammel												1		1
Seabird	Northern Fulmar	Gillnet					37		1							38
		Longline	77			87										164
	Northern Gannet	Longline	4													4
Total			1832	211	33	407	123	636	1	898	5717	1069	355	667	79	12029

3 Fishing Effort Data.

3.1 Fishing effort data collection.

In the UK, fishing effort data describing the scale and geographic distribution of fishing activity are collected by three main methods: 1 - Vessel Monitoring Systems (VMS) for vessels over 12m, 2 - official logbooks / e-logs for vessels over 10m, and 3 - sales notes and the Catch App for vessels under 10m.

Logbook and sales note records are held together in the UK Integrated Fisheries System Holding (iFish) database. iFish currently provides the most complete and useful fishing effort dataset for assessing patterns and trends in fishing activity and for compiling fishing effort data for use in the production of broadscale bycatch estimates.

3.2 Summary of UK fishing effort.

Figure 1 shows the annual UK fishing effort by broad gear type for 2018 to 2022 in terms of recorded Days at Sea (DaS). According to the official statistics, total UK fishing effort in 2022 was 329,903 DaS. This is a 5% decrease compared to 2021 and a 12% decrease since 2018.

The majority of UK fishing effort is carried out by demersal trawls/seines and pot fisheries. These two gear groups account for about 75% of total UK effort (33% and 42% respectively). Dredges (8%), lines (handlines and longlines - 8%) and nets (static and drift – 7%) make up a further 23% of total effort. The remaining 2% of effort is accounted for by a mix of hand gathering (1%), pelagic trawls (0.6%), purse seine/ring nets (0.3%) and miscellaneous gears (0.3%).

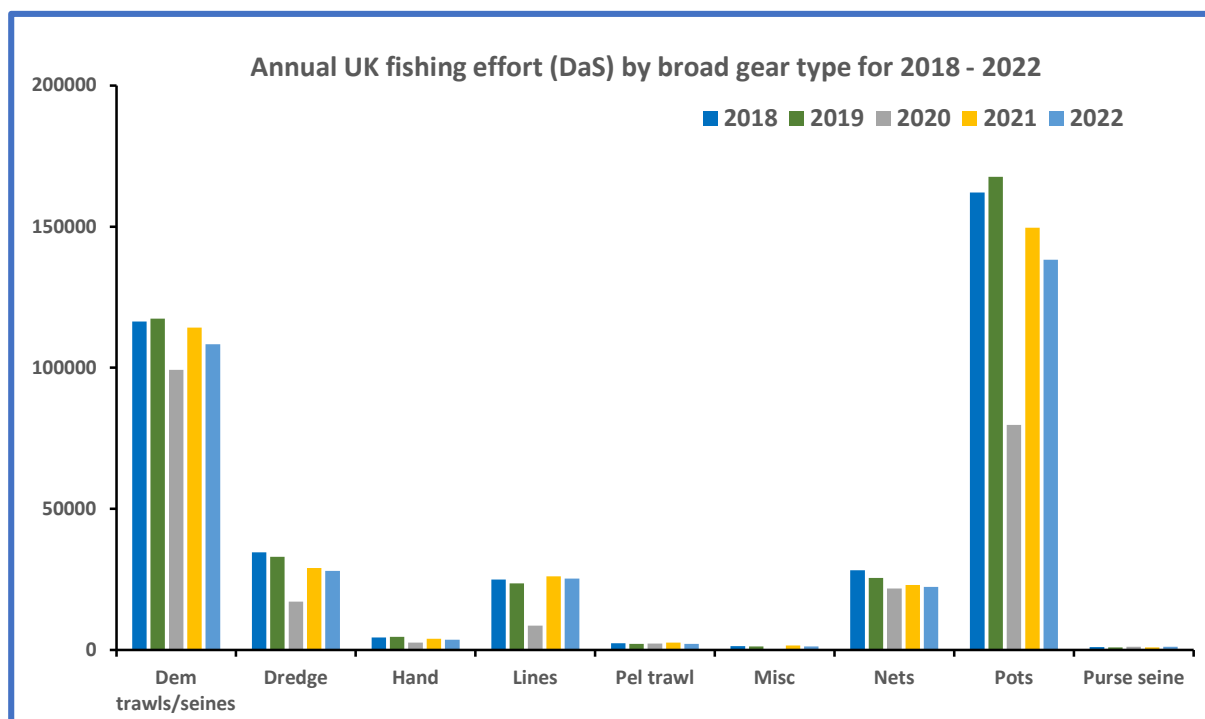


Figure 1: UK fishing effort for 2018 - 2022 by broad gear type.

Figure 2 provides a breakdown of 2022 UK fishing effort by ICES Division for the main gear types sampled under the BMP.

Demersal trawl/seine fisheries are widespread and accounted for over 108,000 DaS in 2022. The highest concentrations of effort are found in the Northern (4a) and Central (4b) North Sea, West of Scotland (6a), Irish Sea (7a) and Western English Channel (7e). Lower effort levels occur in most other ICES Divisions around the UK.

Static net fisheries accounted for just over 22,000 DaS in 2022 and are concentrated largely in ICES Subarea 7. According to the official data the highest netting effort occurs in Divisions 7de (Eastern and Western English Channel). However, the fleet operating in 7d is known to be highly polyvalent (i.e., vessels use a mix of gear types) and discussions with industry members in the area and unusual entries in the official effort and landings statistics, suggest that there may be some overestimation error contained in the netting statistics for that area. This has been highlighted in previous BMP annual reports. According to the statistics significant amounts of netting effort also occurred in 7f (Bristol Channel) and 4c (Southern North Sea), with lower levels in the Northern and Central North Sea (4ab), Rockall (6b), Irish Sea (7a) and Southwest Approaches (7g-k).

Pelagic trawl effort occurs mainly in the Northern North Sea (4a), West of Scotland (6a) and Irish Sea (7a) with lower levels in other parts of Subarea 7.

Longline effort is concentrated in the Northern North Sea (4a) and West of Scotland (6a). This offshore fishery targets hake and sometimes ling on the offshore shelf, shelf break and upper continental slope. Smaller amounts of offshore longline effort also occur on the Great Sole Bank (Gran Sol) region in Divisions 7jk. Low level longlining by smaller inshore vessels occurs in the Southern North Sea (4c) and Eastern English Channel (7d).

Ring net effort is largely confined to the Southwest UK, and this fishery mostly targets pilchard off the south coast of Cornwall in Divisions 7ef. A short purse seine fishery is also undertaken in Scottish waters (4a,6a) targeting mackerel during autumn.

More detailed analysis of trends and patterns of UK fishing effort are planned and will be reported on in future annual reports.

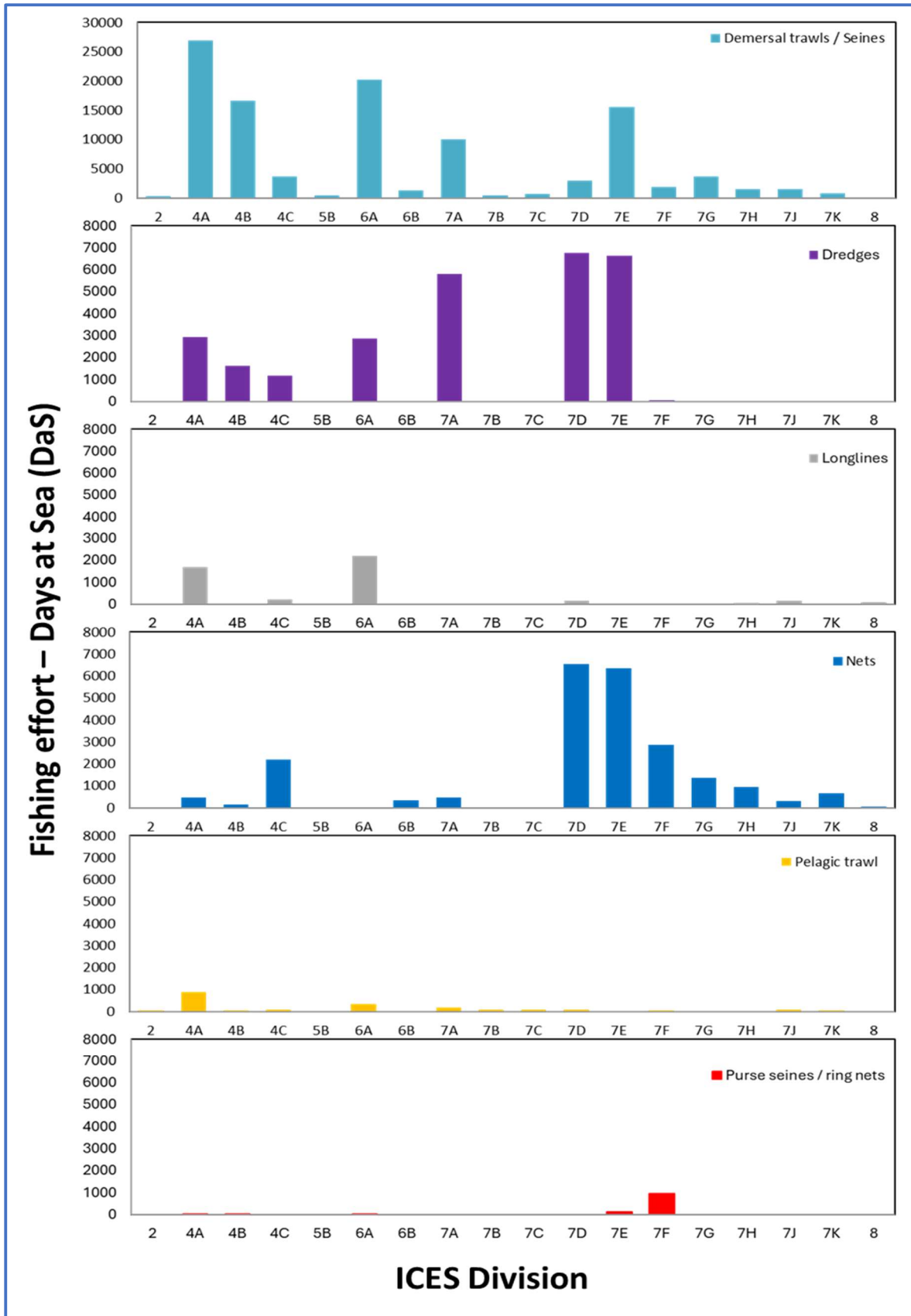


Figure 2: 2022 fishing effort by ICES Division for the main gears sampled within the BMP. Note: the y-axis scale for Demersal trawls/seines (max 30,000 DaS) is different to the scale for all other gears (max 8,000 DaS).

4 Marine Mammal Bycatch Estimates in Static Net Fisheries.

4.1 Estimation methodology.

Broadscale bycatch mortality estimates in UK net fisheries for harbour porpoise and common dolphin (the two most frequently bycaught cetacean species in UK fisheries) have been produced annually since 2007 using data collected under the BMP. In 2011, bycatch estimates for seals (grey and harbour seal species combined but most bycatch observations are of grey seal) were also calculated and have also been produced annually since. Occasional marine mammal bycatch is recorded from other gear types and for other species, but because of the limited number of records the data are insufficient to calculate reliable bycatch rates, so mortality estimates are not currently produced for those metier/species combinations.

For other taxa (seabirds, fish) bycatch estimates are not yet produced routinely on an annual basis, but preliminary seabird bycatch mortality estimates for a variety of gears/species were produced using BMP data in 2019 (Northridge *et al*, 2020) and specifically for the UK offshore longline fishery in 2023 (Kingston *et al*, 2023).

Currently, bycatch estimates are produced using a modelled ratio-based approach. A brief description of the methodology is provided in this section, along with bycatch estimates for harbour porpoise, common dolphin and seals in 2022. A more detailed description of the estimation procedure is provided in Annex 1.

The estimation approach involves the calculation of bycatch rates (number of individuals bycaught per unit of fishing effort) and associated confidence intervals from sampling data. Bycatch rates are then extrapolated to the total fishing effort by metier (ICES Division/gear type combination) to produce metier specific bycatch mortality estimates and upper and lower confidence intervals. Metier specific estimates are then summed to provide a total mortality estimate. We also present the one-sided upper 90% confidence limit. This is useful if we are interested in how likely the estimate is to be above some pre-specified level, such as a mortality threshold or reference point.

The calculation of bycatch rates uses a multi-annual approach, whereby sampling efforts over multiple years are combined to calculate underlying rates. This approach has been developed to help produce more robust mortality estimates across metiers even when overall sampling levels might be considered low. The method is also used in other countries (e.g., Iceland, USA) and by ICES. The method has the important benefit that bycatch rates can be calculated for metiers that may not have been sampled, or were sampled but no bycatch was recorded, in a particular calendar year. Consequently, more complete mortality estimates can be produced than would be the case if just a single year's sampling data was used in the calculation of annual estimates. The multi-annual approach is particularly appropriate for species such as marine mammals and seabirds that do not normally exhibit large fluctuations in population abundance or bycatch rates over the short to medium term.

The stratification system used to produce bycatch estimates involves seven different net metiers. This system has been specifically developed within the BMP for the UK netting situation where a wide variety of different net types are used to target many different species. The system is more detailed than the metier level 4 or 5 that are often used in ICES bycatch assessments and better reflects the heterogeneity of UK net fisheries.

The seven basic metiers used in the analysis are:

Drift Oth - bottom drift nets for demersal species.

Drift Pel - surface or midwater drift nets for small pelagic species.

Gill - heavy twine gillnets typically used for larger gadoids (cod, pollack etc).

Gill Hake - heavy twine gillnets designed specifically to target hake.

Gill Light - light twine gillnets typically used for smaller species (red mullet, bass, whiting etc).

Gill Light Flatfish - light twine nets designed to target small flatfish (sole, plaice etc).

TangTram - large mesh, heavy twine tangle and trammel nets designed to target large fish (anglerfish, turbot etc) and shellfish (spider crab, crayfish etc).

The time periods used in the calculation of bycatch rates vary by species and metier and the reasons for this are explained fully in Annex 1. Harbour porpoise rates are calculated using data from 2010 onwards, except for Gill Hake where data from 2005 onwards are used. Rates are also calculated separately for hauls where ADDs were used optimally and for hauls where ADD use was suboptimal or they were not used. This allows estimation of the likely bycatch reduction associated with ADD use in the over 12m netting fleet. For common dolphin and seals (for all metiers) data from 2005 onwards are used in the calculation of bycatch rates because of low bycatch records for both species in several metiers. No distinction is currently made between hauls with or without ADDs when calculating common dolphin and seal bycatch rates, but recent work (Moyes *et al*, 2025) indicated increased seal bycatch rates associated with the use of ADDs. This finding suggests that methodological alterations may be required in future assessments to account for an ADD effect on seal mortality estimates.

4.2 Harbour porpoise bycatch estimates.

Table 4: Estimated number of harbour porpoises bycaught in UK net fisheries in 2022 by metier, assuming no ADD use. Estimates rounded to nearest integer.

Metier	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Oth	10	1	37	27
Drift Pel	8	1	28	20
Gill	88	41	165	138
Gill Hake	280	154	462	398
Gill Light	375	152	770	630
Gill Light Flatfish	25	1	141	99
TangTram	387	301	491	455
Total	1173*	651	2094	1767

* Minor differences between metier and division total estimates are due to rounding effects.

Table 5: Estimated number of harbour porpoises bycaught in UK net fisheries 2022 by ICES Division, assuming no ADD use. Estimates rounded to nearest integer.

ICES Division	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	77	60	98	91
4b	4	2	6	5
4c	93	63	142	127
6a*	0	0	0	0
6b	12	10	16	15
7a	20	10	39	33
7c	3	2	4	3
7d	157	97	270	234
7e	333	229	505	448
7f	218	155	317	284
7g	166	98	265	230
7h	76	47	117	103
7j	14	9	21	18
8a	1	1	1	1
Total	1174**	783	1801	1592

* There was no record of netting activity in 6a in 2022, therefore the best estimate is zero.

** Minor differences between metier and division total estimates are due to rounding effects.

Table 6: Estimated number of harbour porpoises bycaught in UK net fisheries in 2022 by metier, assuming full ADD compliance. Estimates rounded to nearest integer.

Metier	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Oth	10	1	37	27
Drift Pel	8	2	22	17
Gill	79	45	139	118
Gill Hake	38	7	248	160
Gill Light	376	195	662	565
Gill Light Flatfish	25	2	112	81
TangTram	280	225	456	402
Total	816*	477	1676	1370

* Minor differences between metier and division total estimates are due to rounding effects.

Table 7: Estimated number of harbour porpoises bycaught in UK net fisheries 2022 by ICES Division, assuming full ADD compliance. Estimates rounded to nearest integer.

ICES Division	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	9	1	111	78
4b	4	2	6	5
4c	93	63	141	127
6a*	0	0	0	0
6b	1	0	18	12
7a	20	10	39	33
7c	0	0	3	2
7d	157	97	270	234
7e	309	210	477	422
7f	184	125	281	249
7g	26	7	143	96
7h	10	2	61	41
7j	1	0	9	6
8a	0	0	2	1
Total	814**	517	1561	1306

* There was no record of netting activity in 6a in 2022, therefore the best estimate is zero.

** Minor differences between metier and division total estimates are due to rounding effects.

Four metiers (Drift Oth, Drift Pel, Gill Light, Gill Light Flatfish) are not typically used by over 12m vessels. ADD use is not mandated for vessels under 12m so there is little data showing how ADD use affects bycatch rates in these metiers. This means the normal estimation procedure produces very wide confidence intervals for the very limited occasions ADDs are used in those metiers. This is a statistical artifact associated with few observed hauls with ADDs in these metiers and creates a false impression of high uncertainty. Instead, a more conservative but plausible approach is used where it is assumed that bycatch rates in hauls with and without ADDs in those four metiers are the same. This has the effect of significantly reducing the uncertainty associated with the overall estimate, but the estimate is likely to be biased slightly high because it is known that ADD use reduces harbour porpoise bycatch in other metiers.

The total metier-based point estimate for harbour porpoise bycatch in 2022, assuming full compliance by the over 12m fleet with the ADD requirements under retained Regulation 2019/1241, was 816 (95% CL range 477-1676 (Table 6)), and the metier-based point estimate assuming no ADD use was 1173 (95% CL range 651-2094). This suggests that full ADD compliance in 2022 would have reduced total mortality in UK net fisheries by in the region of 357 harbour porpoises or 30% of the total estimated mortality (for all metiers/vessel sizes) if no ADDs were used.

The largest estimated metier specific reduction (280 to 38 porpoises or 86% reduction) associated with ADD use was in the Gill Hake metier which mainly involves vessels over 12m operating in areas where ADDs are required.

Approximately 96% of harbour porpoise bycatch was estimated to occur in four metiers: TangTram; Gill Hake (assuming no ADD use); Gill and Gill Light. The three other metiers (Drift Oth; Drift Pel and Gill Light Flatfish) had relatively low bycatch estimates and account for the remaining 4% of total estimated mortality.

Spatially, about 95% of harbour porpoise bycatch was estimated to occur in ICES Divisions 7defgh (English Channel & Celtic Sea), 4a (Northern North Sea) and 4c (Southern North Sea).

4.3 Common dolphin bycatch estimates.

Table 8: Estimated number of common dolphins bycaught in UK net fisheries in 2022 by metier. Estimates rounded to nearest integer.

Metier	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Oth	0	0	14	9
Drift Pel	0	0	10	6
Gill	20	5	51	40
Gill Hake	101	55	169	145
Gill Light	34	1	190	133
Gill Light Flatfish	0	0	66	41
TangTram	170	126	224	205
Total	325*	187	724	579

* Minor differences between metier and division total estimates are due to rounding effects.

Table 9: Estimated number of common dolphins bycaught in UK net fisheries 2022 by ICES Division. Estimates rounded to nearest integer.

ICES Division	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	33	25	44	40
4b	1	0	2	1
4c	20	14	42	36
6a*	0	0	0	0
6b	5	4	7	6
7a	2	1	10	7
7c	1	1	2	1
7d	31	19	85	68
7e	80	54	150	127
7f	58	41	98	85
7g	59	35	96	83
7h	27	17	43	37
7j	5	3	7	7
8a	0	0	1	1
Total	322**	214	587	499

* There was no record of netting activity in 6a in 2022, therefore the best estimate is zero.

** Minor differences between metier and division total estimates are due to rounding effects.

The total metier-based point estimate for common dolphin bycatch in 2022 was 325 (95% CL range 187-724). Most estimated bycatch (83%) occurred in two metiers (TangTram & Gill Hake) with the remaining 17% in the Gill and Gill Light metiers.

Spatially, bycatch was mainly concentrated in ICES Divisions 7e-g (Western English Channel and Celtic Sea). The estimated bycatch of 20 individuals in 4c (southern North Sea) is likely overestimated (due to an analytical artefact), as this species is rarely found in that area. The same may apply to 7d but likely to a lesser extent.

The 2022 estimates do not incorporate possible effects of ADDs on common dolphin bycatch rates because these have not been fully quantified yet but work by Moyes *et al* (2025) indicates that there might be some reduction in estimated rates associated with ADD use.

4.4 Seal bycatch estimates.

Table 10: Estimated number of seals bycaught in UK net fisheries in 2022 by metier. Estimates rounded to nearest integer.

Metier	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
Drift Oth	0	0	14	9
Drift Pel	0	0	10	6
Gill	15	3	44	33
Gill Hake	0	0	27	17
Gill Light	0	0	126	79
Gill Light Flatfish	18	0	100	70
TangTram	419	348	499	471
Total	452*	351	820	685

* Minor differences between metier and division total estimates are due to rounding effects.

Table 11: Estimated number of seals bycaught in UK net fisheries in 2022 by ICES Division. Estimates rounded to nearest integer.

ICES Division	Estimated annual bycatch	Two-Sided 95% LCL	Two-Sided 95% UCL	One-sided 90% UCL
4a	83	69	99	93
4b	1	0	1	1
4c	42	34	62	57
6a*	0	0	0	0
6b	13	11	16	15

7a	2	2	8	6
7c	2	2	3	3
7d	66	48	127	108
7e	137	112	198	179
7f	81	67	115	104
7g	11	9	26	20
7h	11	9	17	15
7j	1	1	2	2
8a	1	1	1	1
Total	451**	365	675	604

* There was no record of netting activity in 6a in 2022, therefore the best estimate is zero.

** Minor differences between metier and division total estimates are due to rounding effects.

The metier-based point estimate for seal bycatch in 2022 was 452 (95% CL range 351-820). The latest estimates indicate that over 90% of seal bycatch occurs in the TangTram metier. Spatially, bycatch is mainly concentrated in ICES Divisions 7d-f (English Channel and Bristol Channel) with relatively high levels also estimated in the northern and southern North Sea (4ac). The same pattern was evident in previous assessments.

The 2022 estimates do not consider possible effects of ADDs on seal bycatch rates but Moyes *et al* (2025) using data from the BMP indicates that seal bycatch rates may be higher when ADDs are used. Further analysis to verify and fully explain this finding is ongoing.

4.5 Trends in bycatch estimates.

The estimates presented in Tables 4-11 are based on data collected by bycatch observers from over 15,000 monitored hauls since 2005 (common dolphin, seals, harbour porpoise “Gill Hake” metier) and from over 9,000 monitored hauls since 2010 (harbour porpoise all other metiers). This large dataset, combined with the analytical approach used, provides the most complete broadscale bycatch mortality estimates available for these species for UK net fisheries.

The multi-annual approach used means that inter-annual differences in recorded bycatch rates are essentially smoothed out over a longer period. This means that trends in mortality estimates over time are driven mainly by reported fishing effort levels rather than sudden changes in observed bycatch rates, though both elements will influence the annual estimates to some degree because the data used to estimate bycatch rates incrementally grows as more data is collected.

In Figures 3-5, the bycatch estimates and confidence intervals from 2012 to 2022 are plotted to provide an indication of the likely trajectory of total bycatch mortality for each species over that period. The reducing uncertainty through the time series is due partly to the cumulative increase in the number of monitored hauls used in the bycatch rate estimation process, and from 2018 onwards, also from the use of a new method (see Annex 1 for details) for calculating confidence intervals.

The annual mortality estimates for harbour porpoise (assuming full ADD compliance) have decreased by approximately 50% since 2012 (Figure 3). This is likely, at least partly, to reflect the general pattern of gradually decreasing netting effort over the period. However, it is possible that the underlying bycatch rates are also falling, which could indicate reduced abundance, regional distribution shifts, animal behavioural changes and/or fishing gear/operational factors including use of ADDs in some fleet sectors and/or changes in the relative proportions of effort by métiers with different bycatch rates.

Recent work using the BMP dataset (Moyes *et al*, 2025) indicated that porpoise bycatch rates have been declining since about 2015. This finding suggests that methodological alterations could improve the current bycatch estimation procedure and work is currently ongoing within the BMP to evaluate the possible effect of different analytical approaches on resulting bycatch estimates. Methodological modifications may be incorporated into future estimation procedures pending the results of that work.

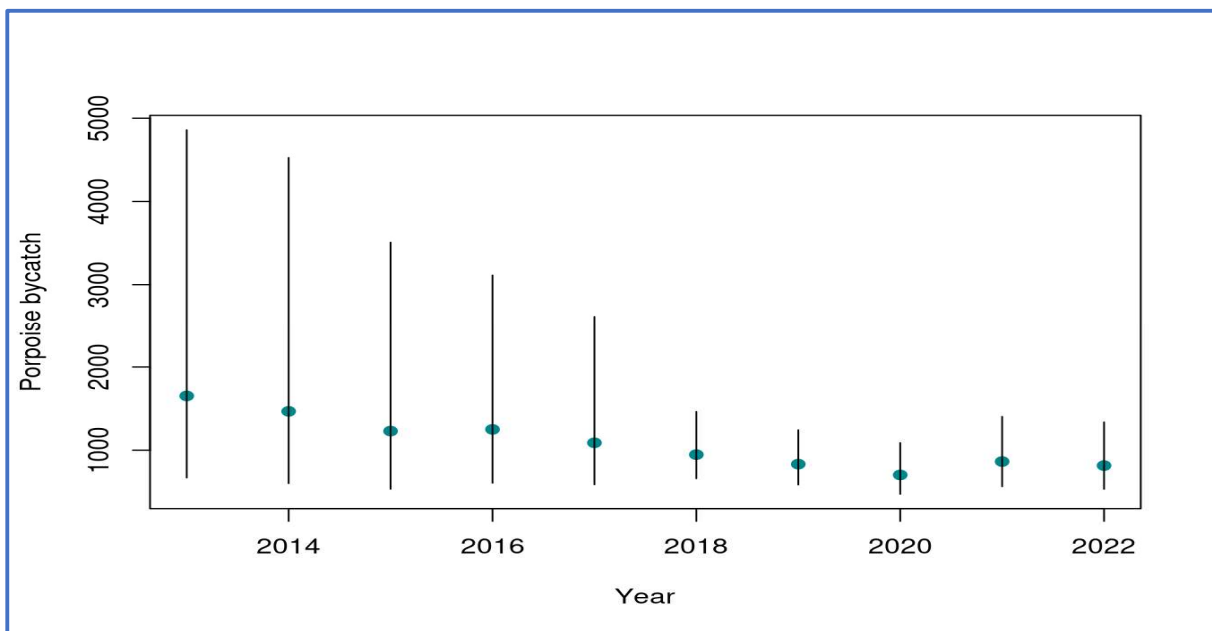


Figure 3: Harbour porpoise bycatch estimates from 2012 – 2022 (note: the reduced uncertainty evident since 2018 is related to a new method (see Annex 1) for calculating the confidence intervals).

Annual bycatch mortality estimates for common dolphin since 2012 (Figure 4) show no clear trend. When considered against the decreasing pattern in UK netting effort this may represent an increasing trend in underlying bycatch rates for this species. This interpretation is supported by the work of Moyes *et al* (2025).

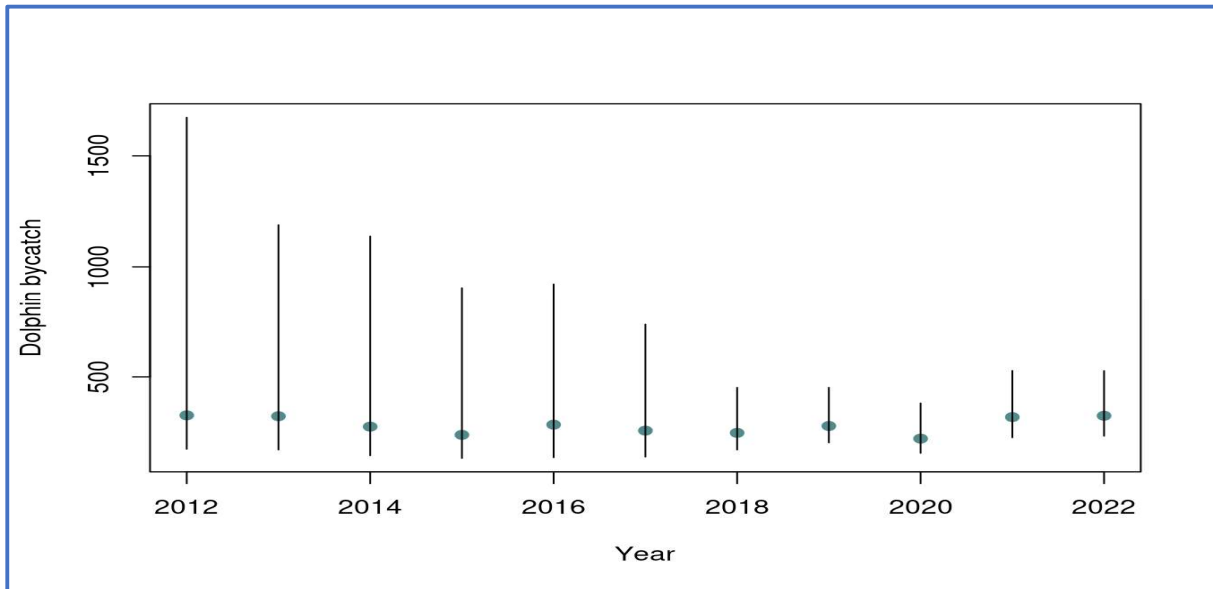


Figure 4: Common dolphin bycatch estimates from 2012 – 2022 (note: the reduced uncertainty evident since 2018 is related to a new method (see Annex 1) for calculating the confidence intervals).

Annual seal bycatch estimates since 2012 are quite variable (Figure 5), though there is a slight indication of increasing mortality up to 2016 and decreasing mortality since then.

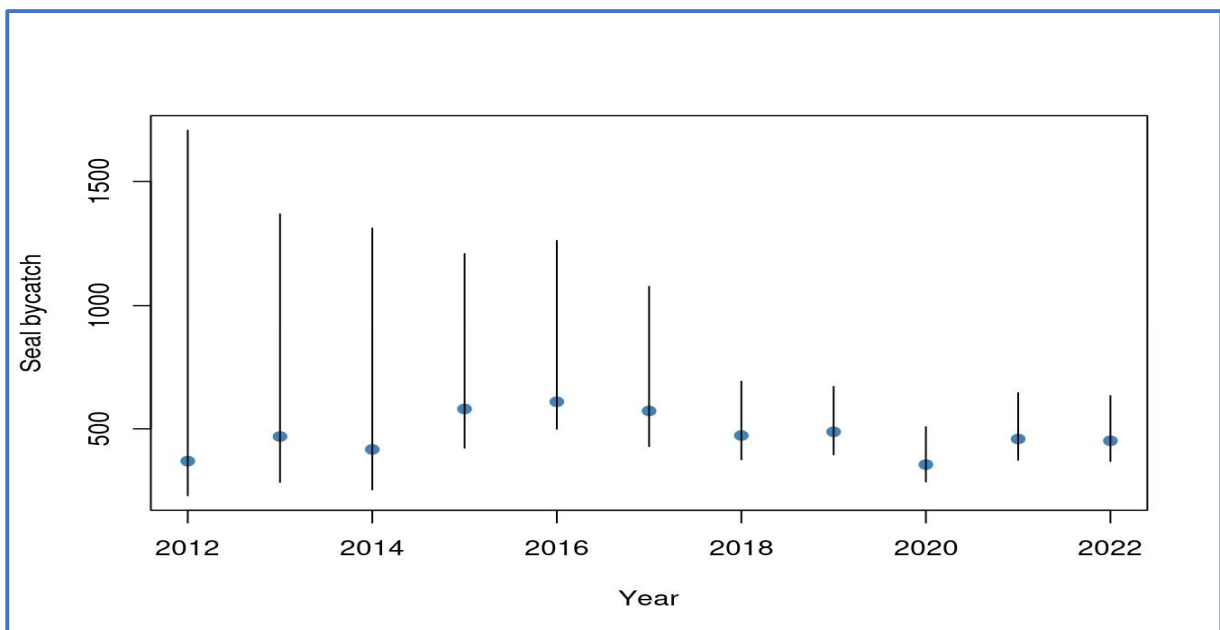


Figure 5: Seal bycatch estimates from 2012 – 2022 (note: the reduced uncertainty evident since 2018 is related to a new method (see Annex 1) for calculating the confidence intervals).

5 Acoustic Deterrent Devices.

5.1 Acoustic deterrent device legislation.

The use of ADDs in some specific net fisheries was mandated under EC Regulation 812/2004 from 2004 until July 2019 when Regulation 812/2004 was repealed. The ADD requirements were then moved into the new Technical Conservation Measures Regulation (2019/1241) which was transposed into UK law prior to the UK withdrawing from the EU on 31st January 2020. The areas and fisheries covered by the relevant regulations remained the same throughout these changes and are shown in Table 12 and only apply to vessels over 12m.

Table 12: Fisheries in which use of ADDs is mandatory under 2019/1241 (Annex XIII).

Area	Gear
Baltic Sea Area delimited by a line running from the Swedish coast at the point at longitude 13° E, thence due south to latitude 55° N, thence due east to longitude 14° E, thence due north to the coast of Sweden; and, Area delimited by a line running from the eastern coast of Sweden at the point at latitude 55°30' N, thence due east to longitude 15° E, thence due north to latitude 56° N, thence due east to longitude 16° E thence due north to the coast of Sweden	Any bottom-set gill net or entangling net
Baltic Sea sub-division 24 (except for the area covered above)	Any bottom-set gill net or entangling net
ICES subarea 4 and ICES division 3a (only from 1 August to 31 October)	Any bottom-set gill net or entangling net, or combination of these nets, the total length of which does not exceed 400 m Any bottom-set gillnet or entangling net ≥ 220 mm
ICES divisions 7e, 7f, 7g, 7h and 7j	Any bottom-set gill net or entangling net
ICES division 7d	Any bottom-set gill net or entangling net

5.2 Vessels required to use ADDs.

Based on official logbook records for 2022, 20 UK registered vessels over 12m worked in areas and seasons where the use of ADDs is required. Of these, 16 vessels worked in relevant ICES Divisions within Subarea 7 and six vessels worked in Subarea 4 with relevant net mesh sizes. Two vessels worked in Subareas 4 and 7.

5.3 Monitoring ADD efficacy.

During 2022 ongoing monitoring of ADD effectiveness in bycatch reduction terms was required under transposed EU Regulation 2019/1241 (Annex XIII, Part A, (1.3)). This monitoring is carried out under the BMP where a proportion of overall netting targets are directed at fisheries where ADD use is mandatory. In addition to standard bycatch monitoring an additional element of this sampling is to collect data to support periodic assessments to check if ADDs are maintaining previously observed (Northridge *et al*, 2011) bycatch reduction rates for harbour porpoise and to assess effects on other species as data permits. Additional data fields are recorded in relevant fisheries on a haul-by-haul basis, including the ADD type/model, functionality, and attachment position. The exact position (latitude/longitude) and estimated distance from bycatch events to the nearest ADD is also recorded.

Due to the delayed publication of this report, summary information on an analysis published by Moyes *et al* (2025) that considered ADD efficacy using a long-term dataset, consisting of almost 20,000 monitored static net fishing operations, collected under the BMP was included. The primary purpose of the analysis was to investigate which environmental and operational factors might be associated with marine mammal bycatch in UK net fisheries. A subset of the data (containing over 4,000) monitored operations in fisheries and periods when ADD were being trialled or required mandatorily was used to evaluate the effect of ADD use on the bycatch rates of harbour porpoise, common dolphins and seals.

The analysis revealed that the presence of ADDs reduced bycatch rates of harbour porpoise by about 75%, an indication of a small (statistically insignificant) reduction in the bycatch rates of common dolphin, and a statistically significant increase (more than doubling) in seal bycatch rates in relevant fisheries. Follow on work will focus on understanding if the seal result is driven by localised patterns or is widespread, and what this finding may mean in terms of additional seal mortality related to ADD use.

5.4 ADD compliance activities.

Fishing vessel compliance with the ADD requirements of Regulation 2019/1241 are carried out by the Marine Management Organisation (MMO) in English and Welsh waters and by the Marine Directorate (MD) in Scottish waters. ADDs are not required in Northern Irish waters.

Although not a formal part of the BMP contract, short summaries received from the MMO and MD on ADD compliance activities carried out during 2022 are provided.

The MMO carried out six shore-side inspections of over 12m netting vessels. All vessels were UK registered. Compliance issues were noted in two inspections, however not related to ADDs, and no mention of ADDs was provided in any of the port inspection reports. Five at-sea inspections were carried on over 12m netting vessels involving two UK registered vessels and three French vessels. Four of the five inspections involved assessment of ADD compliance.

One British vessel received verbal advice, and one French vessel received an advisory letter, both for ADDs having no charge when tested. The other British vessel received an Official Written Warning for ADDs missing from the net. One of the other French vessels had compliant ADDs and the remaining French vessel had no mention of ADDs in the inspection report.

In Scottish waters, Marine Directorate's Marine Protection Vessels (MPVs) completed eight at-sea inspections on gill netters, five in ICES Division 4a (Northern North Sea), one in Division 4b (Central North Sea), one in Division 6a (West of Scotland) and one in Division 6b (Rockall). One infringement was detected during these boardings but did not relate to ADD use. ADDs were noted to be in use during three of the inspections. Note – ADDs are not required in Subarea 6. The Marine Directorate received no intelligence regarding lack of ADD use in relevant areas during 2022.

There were no reports of any cetaceans being bycaught during the inspections, which included periods aboard the fishing vessel while nets were being hauled.

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

Compliance operational priorities during 2022 did not focus on the netting sector and the Marine Directorate will continue to base the majority of at sea inspection activities on a risk assessed basis.

6 Other related work using BMP data and input.

6.1 ICES Working Group on Bycatch of Protected Species (WGBYC).

WGBYC was established in 2007 and collates and analyses data from the Northeast Atlantic, Baltic, Mediterranean and Black Sea on fishing effort, bycatch monitoring and mitigation efforts, and undertakes regular bycatch mortality and risk assessments for protected and sensitive species including marine mammals, seabirds, turtles and rare fish. The BMP has contributed data to WGBYC annually since 2007 and BMP staff have been active members and/or working group chairs throughout WGBYC's existence.

Since 2017 ICES/WGBYC has issued an annual data call requesting data on fishing effort, bycatch monitoring and recorded bycatch from all ICES Member States and EU Mediterranean/Black Sea countries.

In 2022, the BMP, the UK national at-sea Data Collection Framework (DCF) programmes for England and Scotland (managed by CEFAS & the Scottish Government Marine Directorate) and the MMO provided data relating to fishing effort, sampling effort and bycatch events during 2021 in response to the 2022 WGBYC data call. The UK data call submission is

coordinated by BMP staff and consisted of over 9,000 metier-based fishing effort records for multiple gears (totalling over 315,000 DaS), 170 metier-based monitoring records (totalling about 800 monitored DaS) and 278 metier-based bycatch records (totalling over 2,400 marine mammal, seabird and fish specimens).

The international scale of the data acquired by WGBYC means that bycatch issues can be considered at geographic scales that are demographically appropriate, because many ETP species populations are highly mobile and/or have wide distributions.

WGBYC meets annually for approximately one week and works inter-sessionally to carry out various tasks related to its Terms of Reference (ToRs). In 2022, the Working Group (WG) met in La Rochelle, France and by correspondence/online. The meeting was attended by 34 scientists from multiple ICES member countries and chair-invited experts from non-ICES countries. In 2022 the WG addressed seven ToRs:

- a) Review and summarize information submitted through the annual data call and other means, and data assembled by other ICES WGs to describe and evaluate the quality of current monitoring efforts for the collection of protected species bycatch;
- b) Collate and review information from WGFTFB national reports, other ICES WGs and recent published documents relating to implementation of protected species bycatch mitigation measures and summarize recent and ongoing bycatch mitigation trials;
- c) Collate and use available data on protected species bycatch rates to direct and underpin assessments on the range of (minimum/maximum) impacts of bycatch on affected populations, and where possible, to identify likely conservation level threats;
- d) Review ongoing monitoring of different taxonomic groups in relation to spatial bycatch risk and fishing effort, to inform coordinated sampling plans;
- e) Coordinate with other ICES WGs to ensure complete compilation of data on protected species bycatch from multiple sources and to develop and improve on methods for bycatch monitoring, research and assessment;
- f) Continue, in cooperation with the ICES Data Centre to develop, improve, populate and maintain the WGBYC database on bycatch monitoring and fishing effort in ICES and Mediterranean waters through a formal data call (Intersessional).
- g) Produce first drafts of the advice for the i) recurrent advice request, and ii) relevant Fisheries Overviews, based on templates provided by ACOM.

6.1.1 Summary of work within relevant WGBYC ToRs:

Of most relevance to this annual report was the work carried out by WGBYC under ToR C (Points 1-4 below) and ToR D (point 5 below). Several analyses were undertaken. A short summary is provided below (full details are presented in ICES 2024):

1. The group began developing a new assessment approach called the 'Bycatch Evaluation and Assessment Matrix' (BEAM) to provide a systematic methodology to evaluate the reliability and utility of bycatch assessments for different area, gear and species combination. BEAM compiles information on the various components required to evaluate potential population risks including bycatch rate reliability, fishing effort data availability, population abundance estimates, sustainability reference points/thresholds. The components are presented using a traffic light approach that indicates those elements that are currently considered sufficient (green), partially sufficient (yellow) or insufficient (red) to produce a full population impact assessment.
2. The BEAM approach was tested on various marine mammal, seabird, turtle and fish species and highlighted issues related to the reliability of bycatch rate estimation and a general lack of sustainability reference points/thresholds that limit current attempts at assessing population impacts for most species.
3. The group also provided background information on rare species that are unlikely to be candidates for assessment using the quantitative BEAM approach due to low abundance or low bycatch susceptibility and as such are unlikely to be regularly recorded in fisheries monitoring programmes.
4. The group estimated bycatch rates and confidence intervals for approximately 630 species/gear (metier level 4)/area (ICES Ecoregion) combinations.
5. The group further developed a risk-based approach for highlighting metiers which might be considered under-sampled with respect to ETP bycatch. The methodology uses fishing effort, monitoring effort and species functional group risk scores to indicate those gear types and areas which are perceived to be high risk across a range of taxa, but which currently experience low or no monitoring effort. This is a broadscale approach which provides useful insights into where the risk of "not knowing" is likely to be greatest and which is being used to inform the development of coordinated regional sampling plans in the EU.

7 References

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8 Annexes

Annex 1: Bycatch estimation procedure

Observations of marine mammal, seabird and sensitive fish species bycatch made during 2022 were added to an annual data series that began in 2000. These incremental annual observations help to refine our understanding of the bycatch process by improving sampling coverage in the various net 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. The pooled observations made over several years are used to provide a best estimate of the bycatch rate (number of animals bycaught per haul) and associated confidence intervals by fishery stratum (metiers). We then use official logbook and landings data from the most recent year (2022) to estimate fishing effort for the same metiers. Finally, we apply the calculated multi-annual bycatch rate by metier to the fishing effort estimate for that metier to generate mortality estimates for the most recent year. The production of regular estimates of total annual bycatch has so far been confined to three species/groups of mammals (harbour porpoise, common dolphin and seals), pending a more in-depth analysis of data quantity and the statistical distribution of bycatch events for other species/taxa.

Preliminary data exploration and preparation

As in previous years, an initial analysis was conducted on observations from over 15,000 sampled static net hauls since 2000, over 2000 of which had one or more ADDs in place. Observations of 'pingered' hauls (mostly using the ADD 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.

Analyses have suggested that there may have been higher porpoise bycatch rates, over a range of net fleet lengths, prior to 2010 so we have only used the more recent years' data (from 2010) to calculate porpoise bycatch estimates for all metiers, except for hake netting where recent data with net fleets without pingers are limited, and the full dataset (from 2005) therefore provides a more robust estimate of bycatch rates in fleets without ADDs.

Ideally, we would use net fleet length as an explanatory variable in predicting the overall bycatch per metier per year, as this variable has previously been shown to have a significant effect on bycatch rates. However, net fleet length is not a mandatory field in the official logbook and landings data collection process, and we therefore use a metier approach (based on general net type and most landed species), along with ICES Division as the two primary strata for bycatch estimation.

To estimate total bycatch, we need to extrapolate the number of animals bycaught per haul from our observations to the entire fleet, so we use the observer data to estimate the mean number of hauls per day for unobserved vessel trips. This is done by trip length category and

metier as there are significant differences in the operational characteristics between metiers, and because a statistical analysis of the number of hauls per day by metier suggests that there is also significant difference in the number of hauls per day between single day trips and multiday trips. Multi-day trips tend to result in fewer hauls per day because more time is generally spent steaming to and from fishing grounds and because net fleet lengths are generally substantially longer in most offshore metiers than in inshore fisheries where single day trips are typical.

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

Calculation of rates and estimates

Bycatch rates are calculated for all species using the observed bycatch per haul rates by metier, by ADD presence (for harbour porpoise only), and by vessel size category (over 12 m and under 12 m). Binomial confidence limits were calculated using the F-distribution (exact or Clopper-Pearson) method in R. This method is known to be conservative (i.e., it produces intervals that may be wider than necessary), but other less conservative methods produce confidence intervals with zero width when no bycaught animals are observed.

Harbour porpoise rates are estimated under two scenarios, first on the assumption that no boats were using ADDs in 2022 (the baseline scenario) by using only observations made on observed hauls without ADDs, and secondly, assuming all vessels over 12 m in length were using ADDs (regardless of mesh size or net length). The second scenario is the 'best case' assumption that all vessels have fully complied with ADD use requirements and the calculated rate is based on observations on vessels over 12 m in length where ADDs were used correctly. For four metiers (Drift Oth, Drift Pel, Gill Light and Gill Light Flatfish) the no ADD rate is used for both elements because the number of observed hauls with ADDs in these metiers is very low because they are mostly prosecuted by under 12m vessels, and this leads to very wide confidence intervals for these metiers when assuming ADD presence.

The standard error (a measure of the precision of the estimate) and the upper and lower 95% 2-sided confidence limits for the rates are calculated. We also calculate and present the one-sided upper 90% confidence limit which is useful if we ask the question how likely the rate is to be above some pre-specified level.

The bycatch rates for each metier are then applied to the fleet estimates of the number of hauls per day to estimate the total bycatch by metier and area, assuming no ADDs are in use. This is done separately for each ICES division, and the area values are then summed across divisions to obtain an estimate of overall bycatch by metier. Confidence intervals are derived by multiplying the confidence limits around the bycatch rates by the estimated number of

hauls that were not observed in each metier and adding on any observed bycatch. This approach does not account for uncertainty in estimating the number of hauls per metier.

To produce the total bycatch estimate, the estimates for each metier are simply summed. Two measures of uncertainty are calculated. Firstly, the coefficient of variation (CV) which is the standard error divided by the estimate. The standard error is derived by summing the squared metier specific standard errors and taking the square root of the sum. Secondly, the 95% confidence interval is obtained from the metier-specific confidence intervals using the PropImp method of Newcombe (2011). This method for calculating confidence intervals has been used since 2018 and leads to less uncertainty. We have not recalculated the uncertainty around the 2012 – 2017 estimates using the new method.

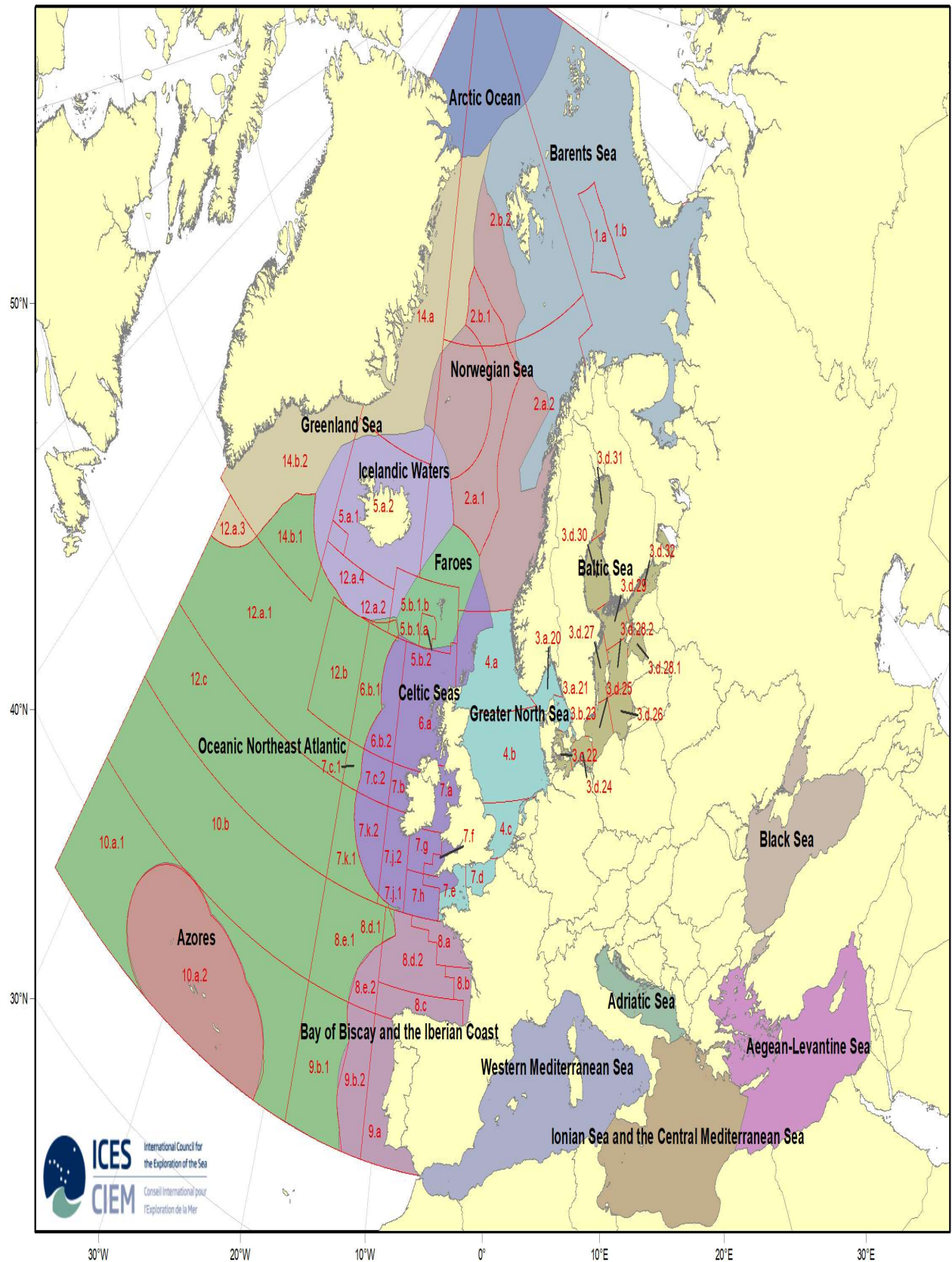
Bycatch estimates by ICES Division are also calculated and presented but these are based on stratified observations by metier and vessel size alone, and not by incorporating division level bycatch rates, because in several area/metier combinations there are too few observations to calculate robust rates.

Another important caveat is therefore that these estimates make assumptions about bycatch rates across areas that may be biased. For example, if bycatch rates in 7d, where sampling has been limited, are systematically higher or lower than in other parts of Subarea 7, this will not be reflected in the extrapolated totals. 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 associated with these estimates.

Work on a new methodology to address some of the assumptions in the current estimation procedure is currently ongoing.

Annex 2 – Map of ICES Ecoregions and ICES Divisions in the Northeast Atlantic.

ICES Ecoregions including ICES Statistical Areas, ices.dk, Dec 2017



Annex 3. ICES species reference lists for the Greater North Sea and Celtic Seas eoregions.

3a: Greater North Sea.

Scientific name	Common name
<i>Aythya ferina</i>	Common pochard
<i>Aythya fuligula</i>	Tufted duck
<i>Aythya marila</i>	Greater scaup
<i>Somateria spectabilis</i>	King eider
<i>Somateria mollissima</i>	Common eider
<i>Melanitta fusca</i>	Velvet scoter
<i>Melanitta nigra</i>	Common scoter
<i>Clangula hyemalis</i>	Long-tailed duck
<i>Bucephala clangula</i>	Common goldeneye
<i>Mergellus albellus</i>	Smew
<i>Mergus merganser</i>	Goosander
<i>Mergus serrator</i>	Red-breasted merganser
<i>Gavia stellata</i>	Red-throated diver
<i>Gavia arctica</i>	Black-throated diver
<i>Gavia immer</i>	Great northern diver
<i>Fulmarus glacialis</i>	Northern fulmar
<i>Puffinus griseus</i>	Sooty shearwater
<i>Puffinus gravis</i>	Great shearwater
<i>Puffinus puffinus</i>	Manx shearwater
<i>Podiceps grisegena</i>	Red-necked grebe
<i>Podiceps cristatus</i>	Great crested grebe
<i>Podiceps auritus</i>	Horned grebe
<i>Podiceps nigricollis</i>	Black-necked grebe
<i>Morus bassanus</i>	Northern gannet
<i>Phalacrocorax aristotelis</i>	European shag
<i>Phalacrocorax carbo</i>	Great cormorant
<i>Fulica atra</i>	Eurasian coot
<i>Rissa tridactyla</i>	Black-legged kittiwake
<i>Larus ridibundus</i>	Black-headed gull
<i>Hydrocoloeus minutus</i>	Little gull
<i>Ichthyaetus melanocephalus</i>	Mediterranean gull
<i>Larus canus</i>	Common gull
<i>Larus marinus</i>	Great black-backed gull
<i>Larus hyperboreus</i>	Glaucous gull
<i>Larus glaucoides</i>	Iceland gull
<i>Larus argentatus</i>	Herring gull
<i>Larus fuscus</i>	Lesser black-backed gull
<i>Stercorarius skua</i>	Great skua
<i>Stercorarius parasiticus</i>	Arctic skua
<i>Alle alle</i>	Little auk

<i>Uria lomvia</i>	Brünnich's guillemot
<i>Uria aalge</i>	Common guillemot
<i>Alca torda</i>	Razorbill
<i>Cephus grylle</i>	Black guillemot
<i>Fratercula arctica</i>	Atlantic puffin
<i>Phocoena phocoena</i>	Harbour porpoise
<i>Tursiops truncatus</i>	Common bottlenose dolphin
<i>Stenella coeruleoalba</i>	Striped dolphin
<i>Delphinus delphis</i>	Common dolphin
<i>Lagenorhynchus albirostris</i>	White-beaked dolphin
<i>Leucopleurus acutus</i>	Atlantic white-sided dolphin
<i>Grampus griseus</i>	Risso's dolphin
<i>Orcinus orca</i>	Killer whale
<i>Globicephala melas</i>	Long-finned pilot whale
<i>Hyperoodon ampullatus</i>	Northern bottlenose whale
<i>Mesoplodon bidens</i>	Sowerby's beaked whale
<i>Physeter macrocephalus</i>	Sperm whale
<i>Megaptera novaeangliae</i>	Humpback whale
<i>Balaenoptera acutorostrata</i>	Common minke whale
<i>Balaenoptera borealis</i>	Sei whale
<i>Balaenoptera physalus</i>	Fin whale
<i>Halichoerus grypus</i>	Grey seal
<i>Phoca vitulina</i>	Harbour seal
<i>Lampetra fluviatilis</i>	River lamprey
<i>Petromyzon marinus</i>	Sea lamprey
<i>Hexanchus griseus</i>	Bluntnose sixgill shark
<i>Galeus melastomus</i>	Blackmouth catshark
<i>Scyliorhinus stellaris</i>	Greater-spotted dogfish
<i>Centroscyllium fabricii</i>	Black dogfish
<i>Etmopterus princeps</i>	Great lanternshark
<i>Etmopterus spinax</i>	Velvet belly lanternshark
<i>Scymnodon ringens</i>	Knifetooth dogfish
<i>Somniosus microcephalus</i>	Greenland shark
<i>Oxynotus paradoxus</i>	Sailfin roughshark
<i>Deania calcea</i>	Birdbeak dogfish
<i>Tetronarce nobiliana</i>	Atlantic torpedo ray
<i>Torpedo marmorata</i>	Marbled electric ray
<i>Dipturus intermedius</i>	Flapper skate
<i>Dipturus nidarosiensis</i>	Norwegian skate
<i>Dipturus oxyrinchus</i>	Long-nosed skate
<i>Leucoraja circularis</i>	Sandy ray
<i>Leucoraja fullonica</i>	Shagreen ray
<i>Raja microocellata</i>	Small-eyed ray
<i>Raja undulata</i>	Undulate ray
<i>Rajella fyllae</i>	Round skate

<i>Rajella lintea</i>	Sailray
<i>Dasyatis pastinaca</i>	Common stingray
<i>Myliobatis aquila</i>	Common eagle ray
<i>Chimaera monstrosa</i>	Rabbitfish
<i>Acipenser sturio</i>	Atlantic sturgeon
<i>Conger conger</i>	Conger eel
<i>Alosa alosa</i>	Allis shad
<i>Alosa fallax</i>	Twaite shad
<i>Coregonus spp. (incl. C. maraena and C. oxyrinchus)</i>	Whitefish
<i>Salmo trutta</i>	Sea trout
<i>Brama brama</i>	Atlantic pomfret
<i>Hippocampus guttulatus</i>	Long-snouted seahorse
<i>Hippocampus hippocampus</i>	Short-snouted seahorse
<i>Pomatoschistus microps</i>	Common goby
<i>Pomatoschistus minutus</i>	Sand goby
<i>Hippoglossus hippoglossus</i>	Atlantic halibut
<i>Mola mola</i>	Ocean sunfish
<i>Sparus aurata</i>	Gilthead seabream
<i>Sciaena umbra</i>	Brown meagre
<i>Umbrina cirrosa</i>	Shi drum
<i>Labrus bergylta</i>	Ballan wrasse
<i>Lycodes esmarkii</i>	Esmark's eelpout
<i>Zoarces viviparus</i>	Eelpout
<i>Anarhichas lupus</i>	Atlantic wolffish
<i>Anarhichas minor</i>	Spotted wolffish
<i>Helicolenus dactylopterus</i>	Blackbelly rosefish
<i>Sebastes mentella</i>	Beaked redfish
<i>Sebastes norvegicus</i>	Golden redfish
<i>Sebastes viviparus</i>	Norway redfish
<i>Chelidonichthys lucerna</i>	Tub gurnard
<i>Cyclopterus lumpus</i>	Lumpfish
<i>Zeus faber</i>	John Dory
<i>Cetorhinus maximus</i>	Basking shark
<i>Squatina squatina</i>	Angel shark
<i>Dermochelys coriacea</i>	Leatherback turtle
<i>Caretta caretta</i>	Loggerhead turtle
<i>Lepidochelys olivacea</i>	Olive ridley turtle
<i>Lepidochelys kempii</i>	Kemp's ridley turtle
<i>Chelonia mydas</i>	Green sea turtle
<i>Eretmochelys imbricata</i>	Hawksbill turtle

3b: Celtic Seas

Scientific name	Common name
<i>Aythya ferina</i>	Common pochard
<i>Aythya fuligula</i>	Tufted duck
<i>Aythya marila</i>	Greater scaup
<i>Somateria mollissima</i>	Common eider
<i>Melanitta fusca</i>	Velvet scoter
<i>Melanitta nigra</i>	Common scoter
<i>Clangula hyemalis</i>	Long-tailed duck
<i>Bucephala clangula</i>	Common goldeneye
<i>Mergus serrator</i>	Red-breasted merganser
<i>Gavia stellata</i>	Red-throated diver
<i>Gavia arctica</i>	Black-throated diver
<i>Gavia immer</i>	Great northern diver
<i>Fulmarus glacialis</i>	Northern fulmar
<i>Calonectris borealis</i>	Cory's shearwater
<i>Puffinus griseus</i>	Sooty shearwater
<i>Puffinus gravis</i>	Great shearwater
<i>Puffinus puffinus</i>	Manx shearwater
<i>Puffinus mauretanicus</i>	Balearic shearwater
<i>Podiceps grisegena</i>	Red-necked grebe
<i>Podiceps cristatus</i>	Great crested grebe
<i>Podiceps auritus</i>	Horned grebe
<i>Podiceps nigricollis</i>	Black-necked grebe
<i>Morus bassanus</i>	Northern gannet
<i>Phalacrocorax aristotelis</i>	European shag
<i>Phalacrocorax carbo</i>	Great cormorant
<i>Fulica atra</i>	Eurasian coot
<i>Rissa tridactyla</i>	Black-legged kittiwake
<i>Xema sabini</i>	Sabine's gull
<i>Larus ridibundus</i>	Black-headed gull
<i>Hydrocoloeus minutus</i>	Little gull
<i>Ichthyaetus melanocephalus</i>	Mediterranean gull
<i>Larus canus</i>	Common gull
<i>Larus marinus</i>	Great black-backed gull
<i>Larus hyperboreus</i>	Glaucous gull
<i>Larus glaucoides</i>	Iceland gull
<i>Larus argentatus</i>	Herring gull
<i>Larus michahellis</i>	Yellow-legged gull
<i>Larus fuscus</i>	Lesser black-backed gull
<i>Stercorarius skua</i>	Great skua
<i>Stercorarius pomarinus</i>	Pomarine skua
<i>Stercorarius parasiticus</i>	Arctic skua
<i>Stercorarius longicaudus</i>	Long-tailed skua

<i>Alle alle</i>	Little auk
<i>Uria aalge</i>	Common guillemot
<i>Alca torda</i>	Razorbill
<i>Cephus grylle</i>	Black guillemot
<i>Fratercula arctica</i>	Atlantic puffin
<i>Phocoena phocoena</i>	Harbour porpoise
<i>Tursiops truncatus</i>	Common bottlenose dolphin
<i>Stenella coeruleoalba</i>	Striped dolphin
<i>Delphinus delphis</i>	Common dolphin
<i>Lagenorhynchus albirostris</i>	White-beaked dolphin
<i>Leucopleurus acutus</i>	Atlantic white-sided dolphin
<i>Grampus griseus</i>	Risso's dolphin
<i>Orcinus orca</i>	Killer whale
<i>Globicephala melas</i>	Long-finned pilot whale
<i>Ziphius cavirostris</i>	Cuvier's beaked whale
<i>Hyperoodon ampullatus</i>	Northern bottlenose whale
<i>Mesoplodon bidens</i>	Sowerby's beaked whale
<i>Physeter macrocephalus</i>	Sperm whale
<i>Megaptera novaeangliae</i>	Humpback whale
<i>Balaenoptera acutorostrata</i>	Common minke whale
<i>Balaenoptera borealis</i>	Sei whale
<i>Balaenoptera physalus</i>	Fin whale
<i>Balaenoptera musculus</i>	Blue whale
<i>Halichoerus grypus</i>	Grey seal
<i>Phoca vitulina</i>	Harbour seal
<i>Lampetra fluviatilis</i>	River lamprey
<i>Petromyzon marinus</i>	Sea lamprey
<i>Hexanchus griseus</i>	Bluntnose sixgill shark
<i>Chlamydoselachus anguineus</i>	Frilled shark
<i>Galeus murinus</i>	Mouse catshark
<i>Apristurus laurussonii</i>	Iceland catshark
<i>Apristurus spp.</i>	Deep-water catshark
<i>Sphyrna zygaena</i>	Smooth hammerhead
<i>Sphyrnidae</i>	Hammerhead sharks
<i>Centroscyllium fabricii</i>	Black dogfish
<i>Etmopterus princeps</i>	Great lanternshark
<i>Etmopterus spinax</i>	Velvet belly lanternshark
<i>Centroscymnus crepidater</i>	Longnose velvet dogfish
<i>Scymnodon ringens</i>	Knifetooth dogfish
<i>Somniosus microcephalus</i>	Greenland shark
<i>Oxynotus paradoxus</i>	Sailfin roughshark
<i>Deania calcea</i>	Birdbeak dogfish
<i>Tetronarce nobiliana</i>	Atlantic torpedo ray
<i>Torpedo marmorata</i>	Marbled electric ray
<i>Amblyraja radiata</i>	Starry ray

<i>Dipturus intermedius</i>	Flapper skate
<i>Dipturus nidarosiensis</i>	Norwegian skate
<i>Dipturus oxyrinchus</i>	Long-nosed skate
<i>Rajella bathyphila</i>	Deep-water ray
<i>Rajella fyllae</i>	Round skate
<i>Rajella lintea</i>	Sailray
<i>Dasyatis pastinaca</i>	Common stingray
<i>Myliobatis aquila</i>	Common eagle ray
<i>Chimaera monstrosa</i>	Rabbitfish
<i>Hydrolagus mirabilis</i>	Large-eyed rabbitfish
<i>Rhinochimaera atlantica</i>	Atlantic longnose chimaera
<i>Acipenser sturio</i>	Atlantic sturgeon
<i>Synaphobranchus kaupii</i>	Kaup's arrowtooth eel
<i>Conger conger</i>	Conger eel
<i>Alosa alosa</i>	Allis shad
<i>Alosa fallax</i>	Twaite shad
<i>Coregonus spp. (excluding C. oxyrinchus)</i>	Whitefish
<i>Salmo trutta</i>	Sea trout
<i>Mora moro</i>	Common mora
<i>Molva macrophthalma</i>	Spanish ling
<i>Brama brama</i>	Atlantic pomfret
<i>Hippocampus guttulatus</i>	Long-snouted seahorse
<i>Hippocampus hippocampus</i>	Short-snouted seahorse
<i>Gobius cobitis</i>	Giant goby
<i>Gobius couchi</i>	Couch's goby
<i>Pomatoschistus microps</i>	Common goby
<i>Pomatoschistus minutus</i>	Sand goby
<i>Scophthalmus maximus</i>	Turbot
<i>Scophthalmus rhombus</i>	Brill
<i>Hippoglossus hippoglossus</i>	Atlantic halibut
<i>Mola mola</i>	Ocean sunfish
<i>Polyprion americanus</i>	Wreckfish
<i>Epigonus telescopus</i>	Black cardinal fish
<i>Dicentrarchus punctatus</i>	Spotted seabass
<i>Sparus aurata</i>	Gilt-head seabream
<i>Sciaena umbra</i>	Brown meagre
<i>Labrus bergylta</i>	Ballan wrasse
<i>Zoarces viviparus</i>	Eelpout
<i>Anarhichas lupus</i>	Atlantic wolffish
<i>Anarhichas minor</i>	Spotted wolffish
<i>Helicolenus dactylopterus</i>	Blackbelly rosefish
<i>Sebastes mentella</i>	Beaked redfish
<i>Sebastes viviparus</i>	Norway redfish
<i>Scorpaena scrofa</i>	Red scorpionfish
<i>Chelidonichthys lucerna</i>	Tub gurnard

<i>Cyclopterus lumpus</i>	Lumpfish
<i>Alepocephalus bairdii</i>	Baird's slickhead
<i>Zeus faber</i>	John Dory
<i>Cetorhinus maximus</i>	Basking shark
<i>Squatina squatina</i>	Angel shark
<i>Dermochelys coriacea</i>	Leatherback turtle
<i>Caretta caretta</i>	Loggerhead turtle
<i>Lepidochelys olivacea</i>	Olive ridley turtle
<i>Lepidochelys kempii</i>	Kemp's ridley turtle
<i>Chelonia mydas</i>	Green sea turtle
<i>Eretmochelys imbricata</i>	Hawksbill turtle