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Updated abundance estimates for cetacean Management Units in UK waters (Revised 2022)

IAMMWG

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Summary

In 2015, the Inter-Agency Marine Mammal Working Group (IAMMWG) defined Management Units (MUs) for the seven most common cetacean species found in UK waters (IAMMWG, 2015): harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), white-beaked dolphin (*Lagenorhynchus albirostris*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*), and minke whale (*Balaenoptera acutorostrata*). Abundance estimates were calculated for each species within their respective MUs using the most recent data available at the time, notably estimates from the Small Cetacean Abundance in the European Atlantic and North Sea project (SCANS-II; Hammond *et al.* 2013). This report details updated abundance estimates for these species and their MUs using the most up to date data available as of February 2021, notably SCANS-III (Hammond *et al.* 2021) and the ObSERVE Programme (Rogan *et al.* 2018). These updated estimates supersede those in the previous report (2015) and should be used in preference. MUs are used to inform Statutory Nature Conservation Body advice in several ways, including the assessment of environmental impacts in marine casework (e.g. through HRA, EIA).

Contents

Glossary

Species is a specifically named taxonomic group of living organisms (e.g. animals and plants) of the same kind which are capable of producing fertile offspring but are predominantly reproductively isolated from other organisms.

Population is a collection of individuals all of the same species with a tendency to be found in the same area. Populations contain *genetic variation* within the population itself, and between other populations. Populations can exist in isolation or can co-exist at least during a part of the year with other conspecific populations (i.e. other populations of the same species) in the same area.

Management Unit (MU) typically refers to a geographical area in which the animals of a particular species are found to which management of human activities is applied. An MU may be smaller than what is believed to be a 'population' to reflect spatial differences in human activities and their management. If MUs are defined at a smaller spatial scale than the population, it is important that management takes into account the rates of interchange of individuals between MUs; that is, the MUs should not be treated as if they were demographically independent.

1   Introduction

The Inter-Agency Marine Mammal Working Group (IAMMWG), comprising representatives of the UK Statutory Nature Conservation Bodies (SNCB) from, Natural England (NE); NatureScot (previously known as Scottish Natural Heritage), Natural Resources Wales (NRW) and Joint Nature Conservation Committee (JNCC); defined Management Units (MUs) for the seven most common cetacean species found in UK waters (IAMMWG 2015): harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), white-beaked dolphin (*Lagenorhynchus albirostris*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*), and minke whale (*Balaenoptera acutorostrata*). Management Unit (MU) boundaries are based on our best understanding of the structure of biological populations and ecological differentiation within such populations, also taking into account political boundaries and the management of human activities (see IAMMWG 2015 for details). The MUs therefore provide an indication of the spatial scales at which impacts of plans and projects alone, cumulatively and in-combination need to be assessed for the key cetacean species in UK waters, aiding consistency across the UK. Abundance estimates in IAMMWG (2015) were calculated for each species within their respected MUs using the most recent data available at the time. It was agreed that the MU boundaries and supporting evidence on population structure were to be reviewed every five years, and that abundance estimates are revised and updated using data from the most recent dedicated surveys. This report details the updated abundance estimates for the species included in the 2015 report, calculated using the most recent data available as of February 2021. A review of evidence on population structure to establish whether MU boundaries need to be revised is ongoing.

Almost all species of cetacean found in UK waters are part of larger biological populations with ranges that extend into international waters and/or the High Seas. Equally, the number of individuals present at any one time may be only a small proportion of those that make use of UK waters throughout the year. The cetacean MUs defined in this report are geographical areas in which animals of a particular species are found and management of human activities is applied (IAMMWG 2015). For this reason, delineation of cetacean MUs are, as far as is practical, aligned with the ICES Subarea and/or Divisions (Figure 1) that are used for implementation of fisheries management measures as recommended by the ICES Working Group of Marine Mammal Ecology (WGMME) (see IAMMWG 2015 for details). MUs are used to inform SNCB advice in several ways, including the relevant spatial scale for assessment of environmental impacts in marine casework (e.g. through HRA, EIA).
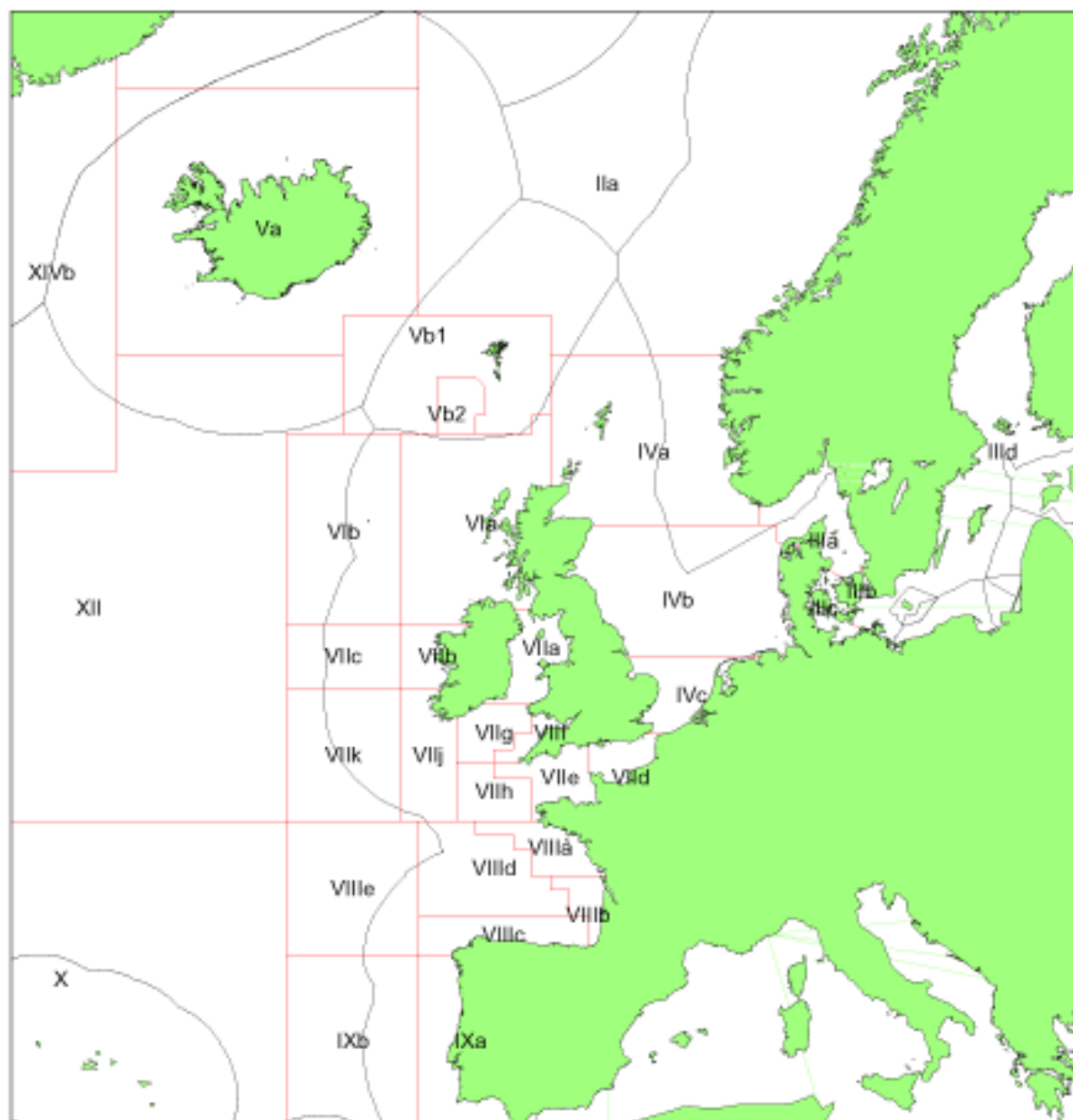
Figure 1. ICES Subareas and Divisions in the European North Atlantic.

2   Method

MU cetacean abundance estimates are derived from the most recent data available at the time. The abundance estimates published in IAMMWG (2015) were derived from animal density estimates within the survey blocks of SCANS-II (Hammond *et al.* 2013), Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA; Macleod *et al.* 2009), and regional dedicated surveys for coastal areas (Evans *et al.* 2012; Cheney *et al.* 2013; Brereton *et al.* 2014).

More recent estimates of cetacean abundance have been derived from two subsequent large-scale survey projects in European-Atlantic waters: SCANS-III (Hammond *et al.* 2021) and ObSERVE (Rogan *et al.* 2018). Additionally, SCANS-II (Hammond *et al.* 2013) estimates were reanalysed using a more robust modelling approach used to calculate SCANS-III abundance estimates (see Hammond *et al.* 2021 for details); these revised SCANS-II estimates are presented in this report's appendix, for harbour porpoise, white-beaked dolphin, common dolphin, and minke whale.

As there is no spatial overlap between the survey blocks of SCANS nor ObSERVE, it was possible to calculate the abundance for each MU area based on area of the management unit multiplied by the estimated densities from the corresponding SCANS survey block.

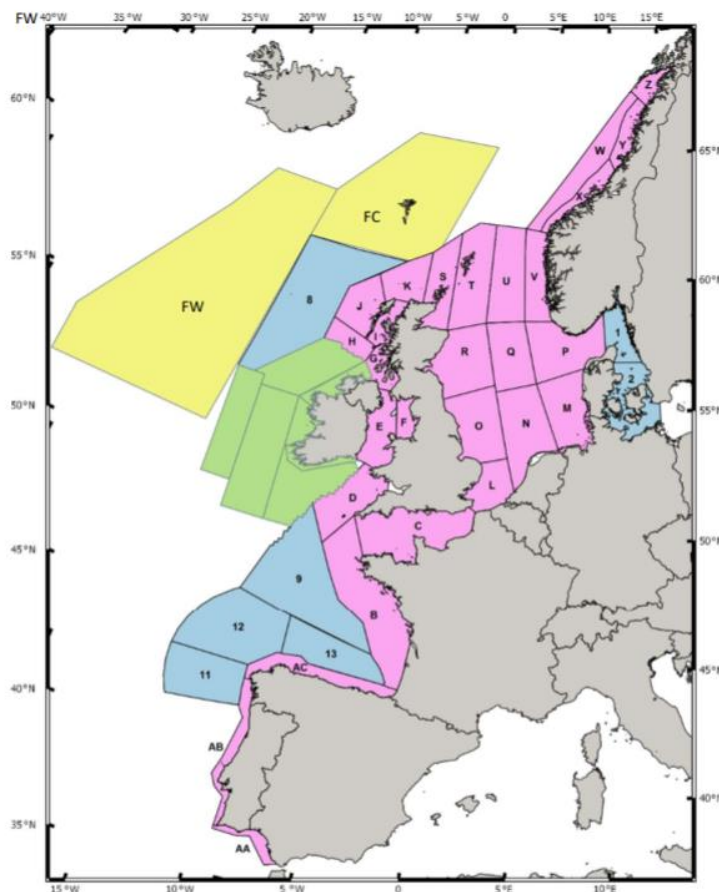**Figure 2:** From Hammond *et al.* 2021. Area covered by SCANS-III and adjacent surveys. SCANS-III: pink lettered blocks were surveyed by air; blue numbered blocks were surveyed by ship. Blocks coloured green to the south, west and north of Ireland were surveyed by the Irish ObSERVE project. Blocks FC and FW coloured yellow were surveyed by the Faroe Islands as part of the North Atlantic Sightings Survey in 2015.

Updated abundance estimates detailed in this paper were calculated by combining and pro-rating survey block density estimates by area from SCANS-III and ObSERVE for each of the various cetacean MUs outlined in IAWWMG (2015), details of the data sources used for each assessment can be found in Appendix 1. For each species, abundance estimates and associated coefficients of variation (CV) and 95% confidence intervals (CIs) are given for the whole MU, and the portion of the MU within the UK EEZ (referred to as UK portion of MU) (Tables 1 – 3). MU abundance estimates from IAMMWG (2015) were also recalculated using the revised estimates from SCANS-II (Hammond *et al.* 2021). Original MU abundance estimates using SCANS-II (IAWMMG 2015), MU abundance estimates using the revised SCANS-II abundance, and updated MU abundance estimates using SCANS-III are summarised in Appendix 1.

3   Species Management Units

3.1   Harbour porpoise (*Phocoena phocoena*)

Three MUs (Figure 2) were identified for harbour porpoise (IAMMWG 2015). The MUs are defined as:

1.   North Sea (NS) (comprising ICES[1] subareas 4, 7d and part of Division 3a [Skagerrak and northern Kattegat]).

     The northern and western boundary is arbitrary (i.e. does not align with ICES divisions) and there will be an interchange of animals here with the 'West Scotland' MU. The eastern boundary has been defined by the ASCOBANS North Sea Conservation Plan for the species. The northern peak of the UK's EEZ is to be treated as part of the NS MU and has been included in abundance estimates (see below).

2.   West Scotland (WS) (comprising ICES divisions 6a and b).

     The boundary with the North Sea MU is arbitrary and there will be an interchange of animals here and in the south of the MU with the Celtic and Irish Seas MUs. It should be noted that harbour porpoise are generally rare in waters >200 m depth.

3.   Celtic and Irish Seas (CIS) (comprising ICES subareas 6 and 7, except 7d).
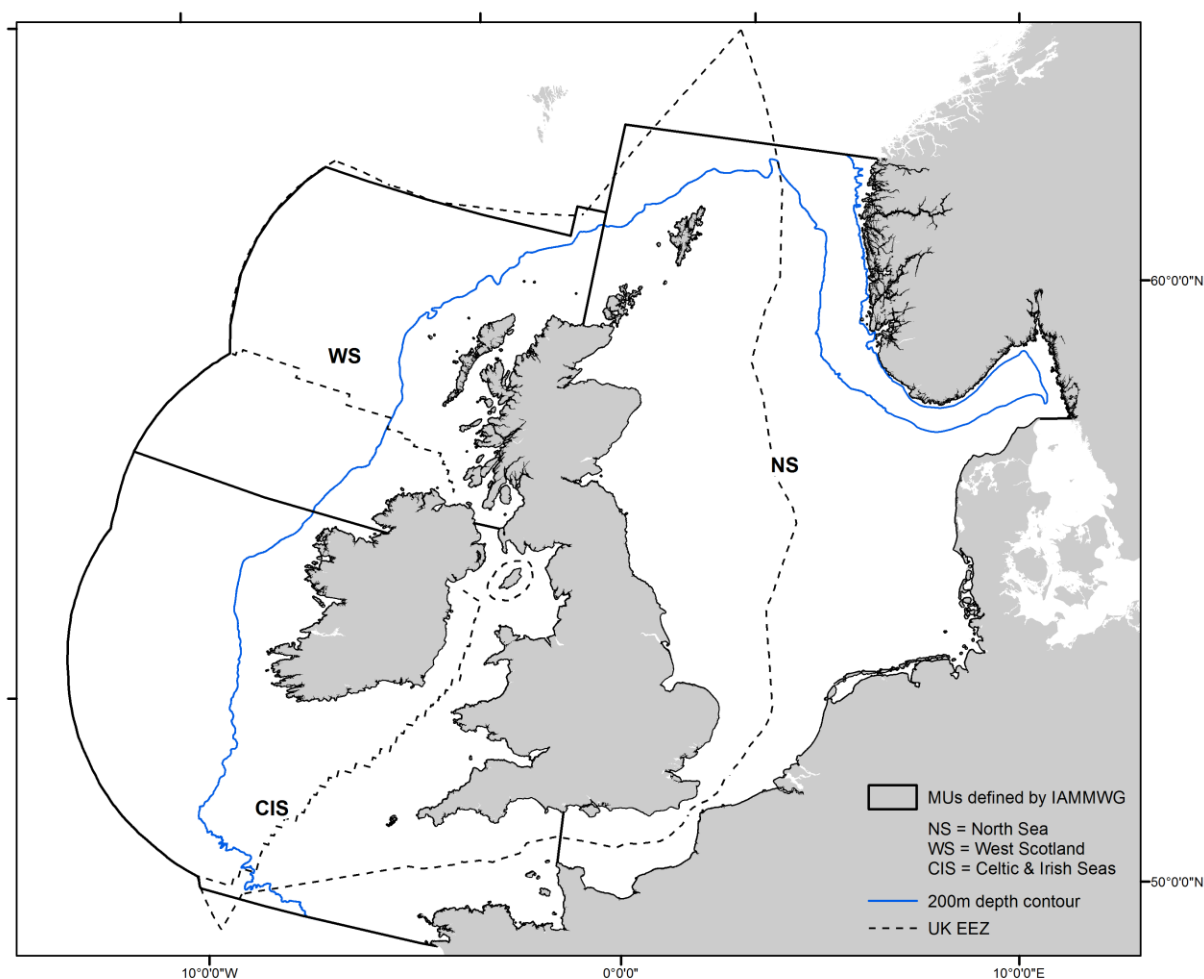
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[1] https://www.ices.dk/data/maps/Pages/default.aspx

Figure 2. Harbour porpoise Management Units (MUs), noting that this species is largely confined to the continental shelf (i.e. waters < 200 m depth). The UK portion of the MUs is delimited by the UK EEZ.

Table 1 shows the most recent estimates of harbour porpoise abundance for the three UK MUs.

Table 1. Abundance estimates of harbour porpoise by Management Unit (MU) and the UK portion of the MU (defined by the EEZ).

MU	Abundance of animals in MU (CV)	95% Confidence interval for MU	Abundance of animals in the UK portion of MU (CV)	95% Confidence interval for UK portion of MU	Source
NS	346,601 (0.09)	289,498 – 419,967	159,632 (0.12)	127,442 - 199,954	Hammond *et al.* 2021; Rogan *et al.* 2018
WS	28,936 (0.16)	21,140 – 39,608	24,305 (0.18)	17,121 – 34,505	Hammond *et al.* 2021; Rogan *et al.* 2018
CIS	62,517 (0.13)	48,324 – 80,877	16,777 (0.2)	11,216 – 25, 096	Hammond *et al.* 2021; Rogan *et al.* 2018

3.2   Bottlenose dolphin (*Tursiops truncatus)*

Two distinct ecotypes of bottlenose dolphin are recognised in UK waters – a wide-ranging offshore type, and a more philopatric inshore type (Louis *et al.* 2014). A number of inshore groups (considered inshore populations) have been identified in UK and Irish waters and there is limited interchange between them (Robinson *et al.* 2012; Cheney *et al.* 2013; ICES 2014; IAMMWG 2015; Lohrengel *et al.* 2018). Seven MUs in UK waters are currently recognised for bottlenose dolphin (Figure 3):

1. Coastal West Scotland and the Hebrides (CWSH, to 12 nm);

2. Coastal East Scotland (CES, to 12 nm);

3. Greater North Sea (GNS) (represented by ICES Area 4 excluding coastal east Scotland; and ICES Division 3a)

4. The Offshore Channel and SW England (OCSW) (ICES Divisions 7d to h);

5. Coastal West Channel (CWC, to 12 nm);

6. Irish Sea (IS) (ICES Division 7a);

7. Oceanic waters (OW) (ICES Divisions 6a-b, 7b, c, k and j, excluding coastal west Scotland).

Two MUs in the Republic of Ireland are included in Figure 2 - the Shannon Estuary (SHE) and West Coast of Ireland (WCI) MU – as they represent two distinct inshore populations of bottlenose dolphins in western Irish waters of the British Isles.

GNS = Greater North Sea
CES = Coastal East Scotland
CWSH = Coastal West Scotland & Hebrides
IS = Irish Sea
CWC = Coastal West Channel

OCSW = Offshore Channel, Celtic Sea & South West England
WCI = West Coast of Ireland
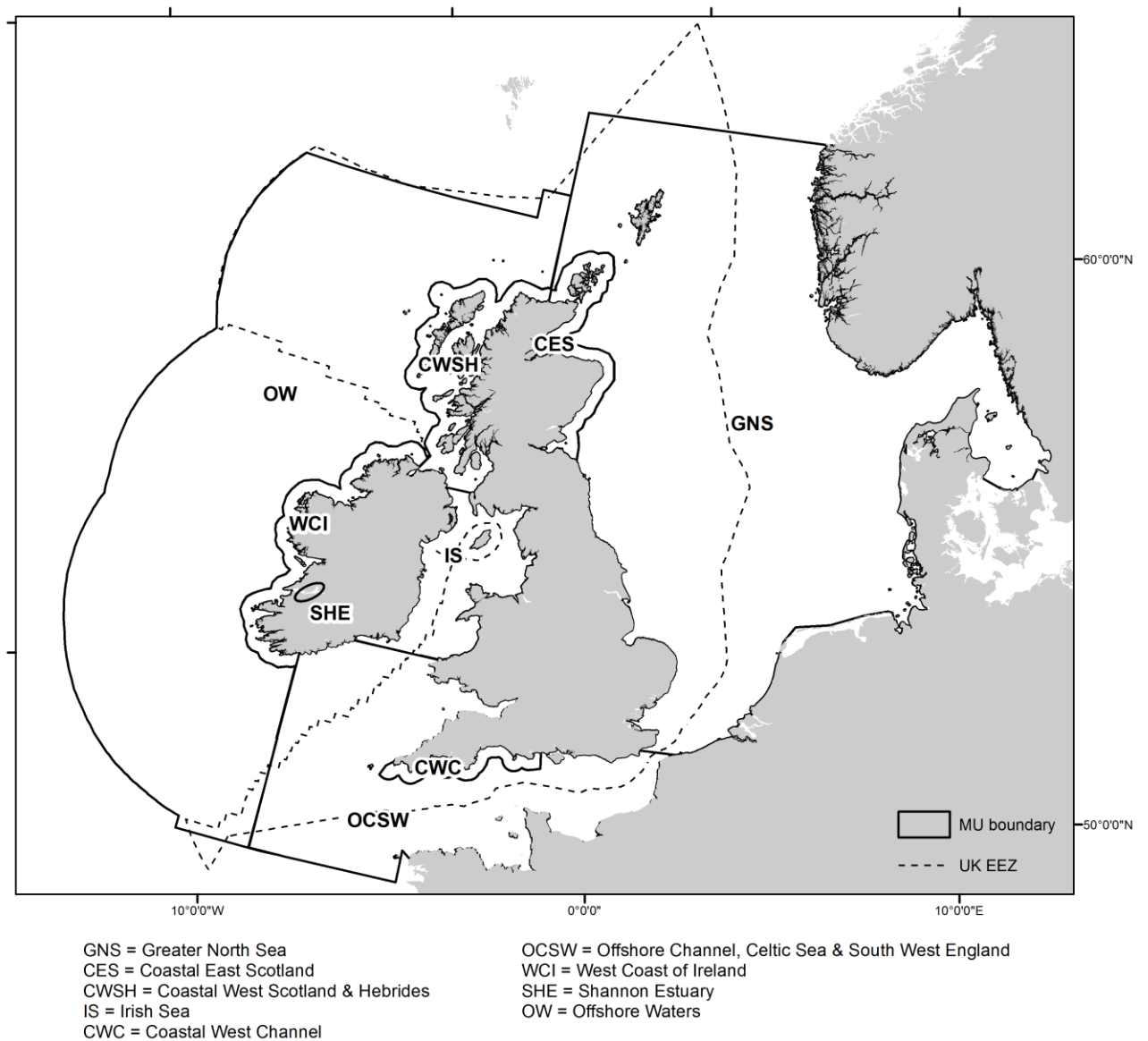SHE = Shannon Estuary
OW = Offshore Waters

Figure 3. Bottlenose dolphin Management Units (MU).

Table 2 shows the most recent estimates of bottlenose dolphin abundance for the seven UK MUs.

Table 2. Abundance estimates of bottlenose dolphins by Management Units. Estimates of inshore populations from regional line-transect [a] and photo-id studies [b]. IS*; please see additional information in main text.

MU	Abundance of animals in MU (CV)	95% Confidence Interval for MU	Abundance of animals in UK portion of MU (CV)	95% Confidence Interval for UK portion of MU	Source
CWSH	-	-	45 [b]	33-66	Cheney *et al.* 2013
CES	-	-	224 (0.02) [b]	214-234	Arso Civil *et al.* 2021[2]
GNS	2,022 (0.75)	548 – 7,453	1,885 (0.8) [a]	476-7,461	Hammond *et al.* 2021; Rogan *et al.* 2018
OCSW	10,947 (0.25)	6,727 – 17,814	3,866 (0.35) [a]	1,974 – 7,572	Hammond *et al.* 2021; Rogan *et al.* 2018
CWC	-	-	40 (0.18) [b]	30-59	Corr 2020
IS*	293 (0.54)	108 - 793	186 (0.52) [a & b]	70 - 492	Hammond *et al.* 2021; Rogan *et al.* 2018
OW	70,249 (0.17)	49,720– 99,255	1,299 (0.41) [a]	597 – 2826	Hammond *et al.* 2021; Rogan *et al.* 2018

For inshore bottlenose dolphin populations monitoring estimates are also available from regional line transect and photo-ID surveys. The inshore bottlenose dolphin population estimate for the Coastal East Scotland (CES) MU is of the Scottish east coast bottlenose dolphin population based on capture-mark-recapture (CMR) photo-ID and calculated using a weighted mean of annual estimates for 2015-2019 from Arso Civil *et al.* (2021). Other estimates of the inshore bottlenose dolphin population within the Irish Sea (IS) MU are also available: wider Cardigan Bay and Cardigan Bay Special Area of Conservation (SAC) estimates obtained using a closed population capture-mark-recapture (CMR) model and those obtained using distance sampling (line transect survey) (see Lohrengel *et al.* 2018).

It should also be noted that there are two inshore groups of bottlenose dolphins in Irish waters, with separate MUs identified for the Shannon Estuary (SHE) and West Coast of Ireland (WCI) in the coastal region. It has been suggested that there may be an all-Irish coastal population that is highly mobile but has little interchange of animals with Welsh waters of the Irish Sea (O'Brien *et al.* 2009).

A new population estimate has also been provided for the Coastal West Channel population (CWC), following a recent photo-ID study (Corr 2020) which used social structure analysis and Bayesian model with 95% High Posterior Density Interval (HPDI) to highlight the geographically distinct nature of this coastal bottlenose dolphin community.

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[2] The weighted mean was calculated using inverse-CV^2 as weights, which are more appropriate than inverse variance weights for mark-recapture estimates of population size because in these estimates the variance is not independent of the estimate. The abundance will be updated annually once input estimates are available from monitoring.

3.3 Other species

A single MU (Figure 4), the Celtic and Greater North Seas (CGNS), has been defined for common dolphin (CD), white-beaked dolphin (WBD), Atlantic white-sided dolphin (WSD), Risso's dolphin (RD) and minke whale (MW) (IAMMWG 2015).
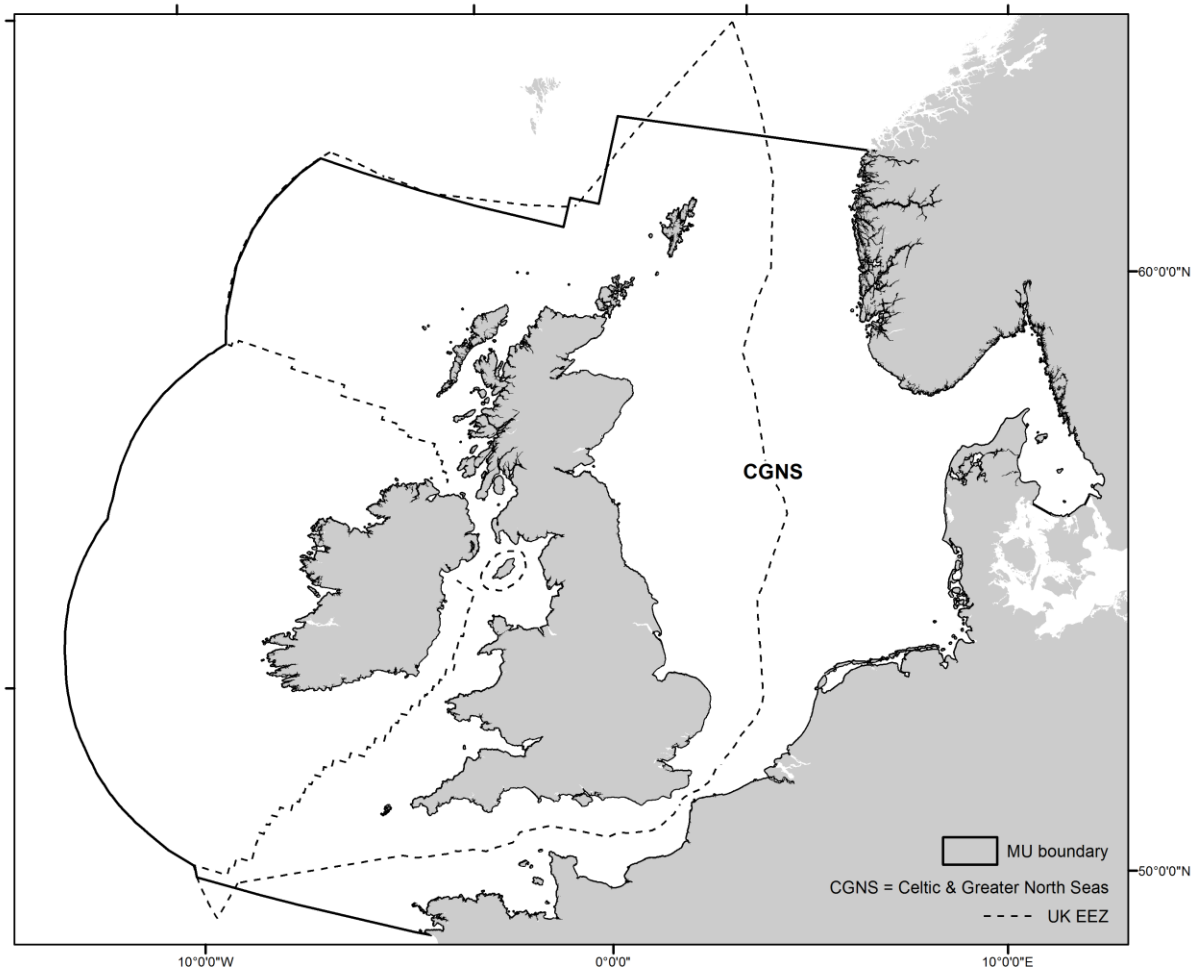

Figure 4. MU for common dolphin, white-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin, and minke whale.

The MU abundance estimates published for these species in the IAMMWG (2015) report were calculated from SCANS-II data (Hammond *et al.* 2013). Revised reference populations calculated using the SCANS-III and ObSERVE data are presented in Table 3.

Table 3. Abundance estimates of common dolphin (CD), white-beaked dolphin (WBD), white-sided dolphin (WSD), Risso's dolphin (RD), and minke whale (MW) of the Celtic and Greater North Seas (CGNS) MU.

Species	Abundance of animals in MU (CV)	95% Confidence Interval for MU	Abundance of animals in UK portion of MU (CV)	95% Confidence Interval for UK portion of MU	Source
CD	102,656 (0.29)	58,932 – 178,822	57,417 (0.32)	30,850 – 106,863	Hammond *et al.* 2021; Rogan *et al.* 2018
WBD	43,951 (0.22)	28,439 – 67,924	34,025 (0.28)	20,026 – 57,807	Hammond *et al.* 2021; Rogan *et al.* 2018
WSD	18,128 (0.61)	6,049 – 54,323	12,293 (0.64)	3,891 – 38,841	Hammond *et al.* 2021; Rogan *et al.* 2018
RD[3]	12,262 (0.46)	5,227 – 28,764	8,687 (0.63)	2,810 – 26,852	Hammond *et al.* 2021; Rogan *et al.* 2018
MW	20,118 (0.18)	14,061 – 28,786	10,288 (0.26)	6,210 – 17,042	Hammond *et al.* 2021; Rogan *et al.* 2018

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[3] There was no abundance estimate available for Risso's dolphin in SCANS II (Hammond *et al.* 2013) and therefore the IAMMWG (2015) report. This is the first estimate of RD abundance in the CGNS MU.

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Appendix 1: Collation of estimates from 2015 to 2021

Tables A1-A3 detail a collation of abundances estimates for the cetacean Management Units as defined by IAMMWG (2015). Different versions of abundance estimates are reported with the accompanying sources used to derive the estimate. Where management unit areas overlapped multiple SCANS survey blocks, and/or ObSERVE survey blocks, the abundance was recalculated for each survey block area within the management unit (hereafter referred to as a block overlap area). When partial survey blocks overlapped with an MU, the areas within the MUs were calculated using ArcGIS 10.3 by digitising areas in an Equal Area Lambert projection where an entire block is covered by the MU then the block areas are taken from the published report (Hammond *et al.* 2021). The cetacean abundance within each proportion of the block overlap areas was recalculated by multiplying the density estimate for the whole survey block by the area of overlap. These abundances were then summed for the total estimated abundance for the whole management unit.

The versions are as follows:

- IAMMWG (2015) – as previously published.
- IAMMWG (2015) revised – Abundance estimates from IAMMWG (2015) revised using SCANS-II estimates detailed in Hammond *et al.* 2021 (only for species where revised estimates were calculated in Hammond *et al.* 2021).
- IAMMWG (2021) – Updated estimates detailed in this report, derived using the most recent evidence available (SCANS-III and ObSERVE) as of February 2021.

Table A1. Harbour porpoise MU abundance estimates comparison table. Original MU estimates from IAMMWG (2015) are included alongside recalculated estimates using SCANS-II revised data (following Hammond *et al.* 2021) and updated estimates from SCANS III and ObSERVE.

MU	Version	Abundance of animals in MU (CV)	95% Confidence interval for MU	Abundance of animals in the UK portion of MU (CV)	95% Confidence interval for UK portion of MU	Source of estimate
North Sea (NS)	IAMMWG (2015)	227,298 (0.13)	176,360 - 292,948	110,433 (0.16)	80,866 - 150,811	Hammond *et al.* 2013
	IAMMWG (2015) revised	369,560 (0.22)	241,338 – 565,906	171,445 (0.20)	109,514 – 268,396	Hammond *et al.* 2021
	IAMMWG (2021)	346,601 (0.09)	289,498 – 419,967	159,632 (0.12)	127,442 - 199,954	Hammond *et al.* 2021; Rogan *et al.* 2018
West Scotland (WS)	IAMMWG (2015)	21,462 (0.42)	9,740 - 47,289	19,291 (0.49)	7,771 - 47,888	Hammond *et al.* 2013; Macleod *et al.* 2009
	IAMMWG (2015) revised	24,435 (0.5)	9,681 – 61,675	35,150 (0.60)	12,488 – 98,932	Hammond *et al.* 2021
	IAMMWG (2021)	28,936 (0.16)	21,140 – 39,608	24,305 (0.18)	17,121 – 34,505	Hammond *et al.* 2021; Rogan *et al.* 2018
Celtic and Irish Seas (CIS)	IAMMWG (2015)	104,695 (0.32)	56,774 - 193,065	47,229 (0.32)	25,611 - 87,094	Hammond *et al.* 2013; Macleod *et al.* 2009
	IAMMWG (2015) revised	98,807 (0.30)	57,315 – 170,336	44,565 (0.3)	25,060 – 79,252	Hammond *et al.* 2021
	IAMMWG (2021)	62,517 (0.13)	48,324 – 80,877	16,777 (0.2)	11,216 – 25, 096	Hammond *et al.* 2021; Rogan *et al.* 2018

Table A2. Bottlenose dolphin MU abundance estimates comparison table. Original MU estimates from IAMMWG (2015) are included alongside updated estimates from SCANS III and ObSERVE. Italics indicates numbers are derived from a local survey. Where estimates are reported only for the UK portion of MU it is because the whole MU is within the UK EEZ.

MU	Year	Abundance of animals in MU (CV)	95% Confidence Interval for MU	Abundance of animals in UK portion of MU (CV)	95% Confidence Interval for UK portion of MU	Source
Coastal West Scotland and the Hebrides (CWSH)	IAMMWG (2015)	-	-	45	33 - 66	Cheney *et al.* 2013
	IAMMWG (2021)	-	-	45	33 - 66	Cheney *et al.* 2013
Coastal East Scotland (CES)	IAMMWG (2015)	-	-	195	162 - 253	Cheney *et al.* 2013
	IAMMWG (2021)	-	-	189	155 - 216	Cheney *et al.* 2018
	IAMMWG (2021)	-	-	224 (0.023)	214-234	Arso Civil *et al.* 2021
Greater North Sea (GNS)	IAMMWG (2015)	0	0	0	0	N/A
	IAMMWG (2021)	2,022 (0.75)	548 – 7,453	1,885 (0.8)	476-7,461	Hammond *et al.* 2021; Rogan *et al.* 2018
The Offshore Channel and SW England (OCSW)	IAMMWG (2015)	4,856 (0.60)	1,638 - 14,398	3,014 (0.6)	1,017 - 8,936	Hammond *et al.* 2013
	IAMMWG (2021)	10,947 (0.25)	6,727 – 17,814	3,866 (0.35)	1,974 – 7,572	Hammond *et al.* 2021; Rogan *et al.* 2018
Coastal West Channel (CWC)	IAMMWG (2015)	-	-	100	-	*Brereton et al.* 2014
	IAMMWG (2021)	-	-	40	30-59	Corr 2020
Irish Sea (IS)	IAMMWG (2015)	379 (0.23)[4]	362 - 414	-	-	Evans 2012

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[4] This estimate was incorrectly reported in IAMMWG, 2015 as 397.

	IAMMWG (2021)	293 (0.54)	108 - 793	186 (0.52)	70 - 492	Hammond *et al.* 2021; Rogan et al. 2018
Oceanic Waters (OW)	IAMMWG (2015)	11,923 (0.21)	7,935 - 17,915	3,202 (0.28)	1,869 - 5,486	Hammond *et al.* 2013; Macleod *et al.* 2009
	IAMMWG (2021)	70,249 (0.17)	49,720– 99,255	1,299 (0.41)	597 – 2826	Hammond *et al.* 2021; Rogan *et al.* 2018

Updated abundance estimates for cetacean Management Units in UK waters

Table A3. Common dolphin, white beaked dolphin, white sided dolphin, Risso's dolphin, minke whale MU abundance estimates comparison table. Original MU estimates from IAMMWG (2015) are included alongside recalculated estimates using SCANS-II revised data (following Hammond *et al.* 2021) and updated estimates from SCANS III and ObSERVE.

Species	Year	Abundance of animals in MU (CV)	95% Confidence Interval for MU	Abundance of animals in UK portion of MU (CV)	95% Confidence Interval for UK portion of MU	Source
Common Dolphin	IAMMWG (2015)	56,556 (0.28)	33,014 – 96,920	13,607(0.23)	8,720 – 21,234	Hammond *et al.* 2013; Macleod *et al.* 2009
	IAMMWG (2015) revised	181,880 (0.38)	88,447 – 374,015	35,314 (0.28)	20,470 – 60,920	Hammond *et al.* 2021
	IAMMWG (2021)	102,656 (0.29)	58,932 – 178,822	57,417 (0.32)	30,850 – 106,863	Hammond *et al.* 2021; Rogan *et al.* 2018
White Beaked Dolphin	IAMMWG (2015)	15,895 (0.29)	9,107-27,743	11,694 (0.30)	6,578 – 20,790	Hammond *et al.* 2013
	IAMMWG (2015) revised	37,309 (0.29)	21,464 – 64,852	24,597 (0.29)	14,213 – 42,565	Hammond *et al.* 2021
	IAMMWG (2021)	43,951 (0.22)	28,439 – 67,924	34,025 (0.28)	20,026 – 57,807	Hammond et al. 2021; Rogan *et al.* 2018
White Sided Dolphin	IAMMWG (2015)	69,293 (0.37)	34,339 – 139,828	46,249 (0.28)	26,993 – 79,243	Hammond *et al.* 2013; Macleod *et al.* 2009
	IAMMWG (2021)	18,128 (0.61)	6,049 – 54,323	12,293 (0.64)	3,891 – 38,841	Hammond *et al.* 2021; Rogan *et al.* 2018
Risso's Dolphin	IAMMWG (2015)	N/A	N/A	N/A	N/A	
	IAMMWG (2021)	12,262 (0.46)	5,227 – 28,764	8,687 (0.63)	2,810 – 26,852	Hammond *et al.* 2021; Rogan *et al.* 2018
Minke Whale	IAMMWG (2015)	23,528 (0.27)	13,989 – 39,572	12,295 (0.28)	7,176 – 21,066	Hammond *et al.* 2013; Macleod *et al.* 2009
	IAMMWG (2015) revised	20,136 (0.29)	11,498 – 35,264	10,780 (0.30)	6,026 – 19,282	Hammond *et al.* 2021
	IAMMWG (2021)	20,118 (0.18)	14,061 – 28,786	10,288 (0.26)	6,210 – 17,042	Hammond *et al.* 2021; Rogan *et al.* 2018