Reporting under the Habitat Regulations (as amended)[1]

2019-2024

Conservation status assessment for the species:

S2618 - Minke whale

(*Balaenoptera acutorostrata*)

United Kingdom

JNCC

NATURAL ENGLAND

NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

Cyfoeth Naturiol Cymru
Natural Resources Wales

Scottish Government
Riaghaltas na h-Alba
gov.scot

Department of Agriculture, Environment and Rural Affairs
An Roinn Talmhaíochta, Comhshaoil agus Gnóthaí Tuaithe
Depairtment o' Fairmin, Environment an' Kintra Matthers
www.daera-ni.gov.uk

NIEA
Northern Ireland Environment Agency
Gníomhaireacht Comhshaoil Thuaisceart Éireann
Norlin Airlan Environment Agency

[1] **Habitat Regulations (as amended):**

- The Conservation of Habitats and Species Regulations 2017 (as amended), Regulation 9A
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended), Regulation 6A
- Report under The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), regulation 3ZA
- The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended), regulation 3ZA

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Important note - Please read

- The information in this document represents the United Kingdom Reporting under the Habitat Regulations (as amended)[1], for the period 2019-2024.
- It is based on supporting information provided by Joint Nature Conservation Committee and UK Country Nature Consevation Bodies (CNCBs), which is documented separately.
- The Habitats Regulations reporting 2019-2024 Approach Document provides details on how this supporting information contributed to the UK Report and the fields that were completed for each parameter.
- Map showing the distribution and range of the species is included.
- Explanatory notes (where provided) are included at the end. These provide additional audit trail information to that included within the assessments. Further underpinning explanatory notes are available in the related country reports.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; and/or (iii) the field was not relevant to this species (section 12 National Site Network coverage for Annex II species).

Further details on the approach to the Habitats Regulations Reporting 2019-2024 are available on the JNCC website.

Assessment Summary: Minke whale

Distribution and Range Map

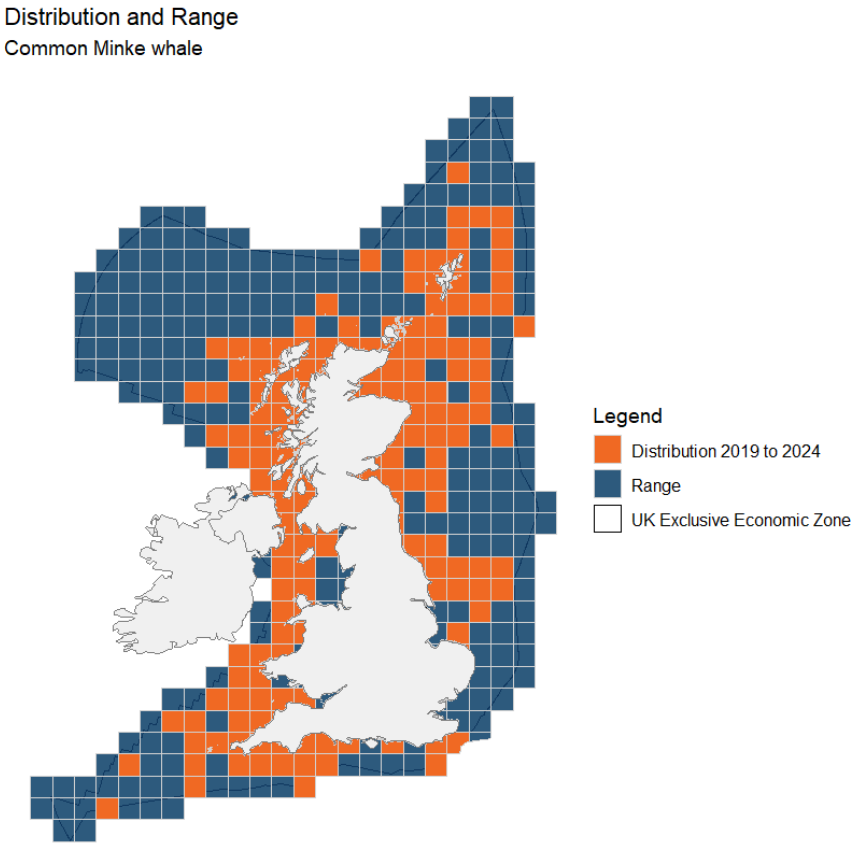

Figure 1: United Kingdom distribution and range map for S2618 - Minke whale (*Balaenoptera acutorostrata*). The 50km grid square distribution map is based on available species records within the current reporting period.

Table 1: Table summarising the conservation status for S2618 - Minke whale (*Balaenoptera acutorostrata*). Overall conservation status for species is based on assessments of range, population, habitat for the species, and future prospects.

Overall Conservation Status (see section 11)

Unfavourable-inadequate (U1)

Breakdown of Overall Conservation Status

Range (see section 5)	**Favourable (FV)**
Population (see section 6)	**Unfavourable-inadequate (U1)**
Habitat for the species (see section 7)	**Unknown (XX)**
Future prospects (see section 10)	**Unknown (XX)**

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National Level

1. General information

1.1 Country	United Kingdom
1.2 Species code	S2618
1.3 Species scientific name	*Balaenoptera acutorostrata*
1.4 Alternative species scientific name	
1.5 Common name	Minke whale
Annex(es)	IV

2. Maps

2.1 Sensitive species	No
2.2 Year or period	2019-2022
2.3 Distribution map	Yes
2.4 Distribution map; Method used	Complete survey or a statistically robust estimate

2.5 Additional information

The distribution map is based on verified sightings data of minke whale between 2019 and 2024. The sightings were collated from SCANS IV, Pelagis French surveys, NBN Atlas, European Seabirds at Sea, the Joint Cetacean Data Programme, POSEIDON project, University of Aberdeen, The Crown Estate Marine Data Exchange, Whale and Dolphin Conservation, Hebridean Whale and Dolphin Trust, ORCA, Sea Watch Foundation, Marine Discovery Penzance, Sussex Dolphin Project, Cornwall Seal Group Research Trust, Cardigan Bay Marine Wildlife Centre, Natural England, Sea Trust and The Royal Society for the Protection of Birds (RSPB).

3. Information related to Annex V Species

3.1 Is the species taken in the wild / exploited?

3.2 What measures have been taken?

a) Regulations regarding access to property

b) Temporary or local prohibition on the taking of specimens in the wild and exploitation

c) Regulation of the periods and/or methods of taking specimens

d) Application of hunting and fishing rules which take account of the conservation of such populations

e) Establishment of a system of licences for taking specimens or of quotas

f) Regulation of the purchase, sale, offering for sale, keeping for sale, or transport for sale of specimens

g) Breeding in captivity of animal species as well as artificial propagation of plant species

Other measures

Other measures description

3.3: Hunting bag or quantity taken in the wild for Mammals and Acipenseridae (Fish)

a) Unit

Table 2: Quantity taken from the wild during the reporting period (see 3.3a for units). For species with defined hunting seasons, Season 1 refers to 2018/2019 (autumn 2018 to spring 2019), and Season 6 to 2023/2024. For species without hunting seasons, data are reported by calendar year: Year 1 is 2019, and Year 6 is 2024.

	Season/ year 1	Season/ year 2	Season/ year 3	Season/ year 4	Season/ year 5	Season/ year 6
b) Minimum	-	-	-	-	-	-
c) Maximum	-	-	-	-	-	-
d) Unknown	-	-	-	-	-	-

3.4: Hunting bag or quantity taken in the wild; Method used	

3.5: Additional information

No additional information

Biogeographical Level

4. Biogeographical and marine regions

4.1 Biogeographical or marine region where the species occurs	MATL

4.2 Sources of information

See section 14 References

5. Range

5.1 Surface area (km²)	895,498
5.2 Short-term trend; Period	2013-2024
5.3 Short-term trend; Direction	Stable
5.4 Short-term trend; Magnitude	
a) Estimated minimum	
b) Estimated maximum	
c) Pre-defined range	
d) Unknown	
e) Type of estimate	
f) Rate of decrease	
5.5 Short-term trend; Method used	Complete survey or a statistically robust estimate
5.6 Long-term trend; Period	1994-2024
5.7 Long-term trend; Direction	Stable

5.8 Long-term trend; Magnitude	
a) Minimum	
b) Maximum	
c) Rate of decrease	
5.9 Long-term trend; Method used	Complete survey or a statistically robust estimate

5.10 Favourable Reference Range (FRR)

a) Area (km²)	895,498
b) Pre-defined increment	
c) Unknown	No
d) Method used	Model-based approach
e) Quality of information	high

5.11 Change and reason for change in surface area of range

a) Change	No
b) Genuine change	
c) Improved knowledge or more accurate data	
d) Different method	
e) No information	
f) Other reason	
g) Main reason	

5.12 Additional information

The distribution is based on verified sightings data of minke whale between 2019 and 2024. The sightings were collated from SCANS IV, Pelagis French surveys, NBN Atlas, European Seabirds at Sea, the Joint Cetacean Data Programme, POSEIDON project, University of Aberdeen, The Crown Estate Marine Data Exchange, Whale and Dolphin Conservation, Hebridean Whale and Dolphin Trust, ORCA, Sea Watch Foundation, Marine Discovery Penzance, Sussex Dolphin Project, Cornwall Seal Group Research

Trust, Cardigan Bay Marine Wildlife Centre, Natural England, Sea Trust and The Royal Society for the Protection of Birds (RSPB).

The FRR was based on an analysis of effort related survey data spanning 1994-2010 compiled for the Joint Cetacean Protocol (JCP) undertaken by Paxton et al. (2016). The estimated range was based on a modelled prediction of minke whale distribution during August 2010 and adapted based on additional sightings data and expert knowledge (see Paxton et al., 2016 for further detail).

Minke whales are found throughout the UK EEZ as they migrate from spring to autumn. Though the overall range for the species has not changed, there is inter-annual variation in their distribution driven by prey availability.

Since the 2019 Habitats Directive Article 17 assessments, the FRR has changed due to the removal of the EEZ extension into offshore waters west of Scotland. This area has been removed due to lack of data for all species, and subsequent impact on confidence in assessments. This does not represent genuine change in FRR.

6. Population

6.1 Year or period	2022

6.2 Population size (in reporting unit)

a) Unit	number of individuals
b) Minimum	6,051
c) Maximum	15,590
d) Best single value	9,712
6.3 Type of estimate	95% confidence interval
6.4 Quality of extrapolation to reporting unit	moderate

6.5 Additional population size (using population unit other than reporting unit)

a) Unit	
b) Minimum	
c) Maximum	
d) Best single value	
e) Type of estimate	

6.6 Population size; Method used	Complete survey or a statistically robust estimate
6.7 Short-term trend; Period	2016-2022
6.8 Short-term trend; Direction	Uncertain
6.9 Short-term trend; Magnitude	
a) Estimated minimum	
b) Estimated maximum	
c) Pre-defined range	
d) Unknown	Yes
e) Type of estimate	
f) Rate of decrease	
6.10 Short-term trend; Method used	Complete survey or a statistically robust estimate
6.11 Long-term trend; Period	2005-2022
6.12 Long-term trend; Direction	Uncertain
6.13 Long-term trend; Magnitude	
a) Minimum	
b) Maximum	
c) Confidence interval	
d) Rate of decrease	
6.14 Long-term trend; Method used	Complete survey or a statistically robust estimate

6.15 Favourable Reference Population (FRP)

ai) Population size	9,674
aii) Unit	number of individuals
b) Pre-defined increment	

c) Unknown	No
d) Method used	Model-based approach
e) Quality of information	high

6.16 Change and reason for change in population size

a) Change	Yes
b) Genuine change	
c) Improved knowledge or more accurate data	
d) Different method	
e) No information	
f) Other reason	Yes
g) Main reason	

6.17 Additional information

The population estimate for 2022 is based primarily on density estimates from the SCANS IV survey. However, there is a gap in the 2022 SCANS survey effort in offshore waters west of Scotland, a high-density region for this species which accounted for 11% of the UK population during SCANS III (Gilles et al., 2013; Hammond et al., 2021). The population estimate provided here has therefore been corrected using the % of the UK population sighted in the missing block during SCANS III. While necessary, such extrapolation introduces uncertainty and decreases confidence in the population estimate produced.

In terms of the wider context for minke whale population in the NE Atlantic; ObSERVE programme in Irish waters found a decrease in abundance between 2015 and 2022, believed to changes in distribution in response to prey availability and seasonal movements (Giralt Paradell, et al. 2024). Findings from NASS 2024 survey in the NAMMCO region will provide more context for the northern areas of their range, once published.

The FRV (9538 CV: .297 CI: 5399-16852) for population was calculated based on estimates from SCANS II in 2005 (Hammond, et al., 2021) and CODA in 2007 (Hammond, et al., 2009), supplemented with density estimates from neighbouring regions to fill data gaps within the UK EEZ and limit extrapolation where possible; ObSERVE in Irish waters (Rogan, e al., 2018), NASS and T-NASS (Pike, et al., 2019a;

Pike, et al., 2019b) and NILS (Leonard and Øien, 2020a; Leonard and Øien, 2020b) surveys in the NAMMCO region.

Since the 2019 Habitats Directive Article 17 assessments, the FRV has changed due to the removal of the EEZ extension into offshore waters west of Scotland. This area has been removed due to lack of data for all species, and subsequent impact on confidence in assessments. This does not represent genuine change in FRV.

6.18 Age structure, mortality and reproduction deviation	Unknown

7. Habitat for the species

7.1 Sufficiency of area and quality of occupied habitat (for long-term survival)

a) Is area of occupied habitat sufficient?	Unknown
b) Is quality of occupied habitat sufficient?	Unknown
c) If No or Unknown, is there a sufficiently large area of unoccupied habitat of suitable quality?	Unknown

7.2 Sufficiency of area and quality of occupied habitat; Method used

a) Sufficiency of area of occupied habitat; Method used	Based mainly on expert opinion with very limited data
b) Sufficiency of quality of occupied habitat; Method used	Based mainly on expert opinion with very limited data

7.3 Short-term trend; Period

7.4 Short-term trend; Direction	Unknown
7.5 Short-term trend; Method used	Based mainly on expert opinion with very limited data

7.6 Long-term trend; Period

7.7 Long-term trend; Direction	Unknown

7.8 Long-term trend; Method used	Based mainly on expert opinion with very limited data

7.9 Additional information

Direct evidence of cetacean habitat quality is limited as presently, a comprehensive understanding of the key elements important to the species is undetermined. In some cases, conclusions for species range and population could be indicative of habitat quality by proxy, however confidence in assessment outputs would be low.

While the range has remained stable, the population of minke whale using the UK EEZ waters is has been remained stable in the long term, there is some uncertainty in the short term due to a gap in the SCANS IV survey effort in offshore waters West of Scotland.

8. Main pressures

8.1 Characterisation of pressures

Table 3: Pressures affecting the species, including timing and importance/impact ranking. Pressures are defined as factors acting currently and/or during the reporting period (2019–2024). Rankings are: High (direct/immediate influence and/or large spatial extent) and Medium (moderate direct/immediate influence, mainly indirect and/or regional extent).

Pressure	Timing	Ranking
Shipping lanes and ferry lanes transport operations	Ongoing and likely to be in the future	Medium (M)
Residential, commercial and industrial activities and structures generating noise, light, heat or other forms of pollution	Ongoing and likely to be in the future	Medium (M)
Marine fish and shellfish harvesting causing reduction of species/prey populations and disturbance of species (professional)	Ongoing and likely to be in the future	Medium (M)
Bycatch and incidental killing (due to fishing and hunting activities)	Ongoing and likely to be in the future	Medium (M)
Geotechnical surveying	Ongoing and likely to be in the future	Medium (M)
Decline or extinction of related species (e.g. food source / prey, predator / parasite, symbiote, etc.) due to climate change	Ongoing and likely to be in the future	Medium (M)

Threats and pressures from outside the Member State	Ongoing and likely to be in the future	Medium (M)

8.2 Sources of information

See section 14 References

8.3 Additional information

PC07: Regional pressure in the North Sea and the Irish Sea.

PX02: Relating to continued whaling of this species outside of UK waters which may be having an impact on populations.

9. Conservation measures

9.1: Status of measures

a) Are measures needed?	Yes
b) Indicate the status of measures	Measures identified and taken
9.2 Main purpose of the measures taken	Maintain the current range, population and/or habitat for the species
9.3 Location of the measures taken	Both inside and outside National Site Network
9.4 Response to measures	Medium-term results (within the next two reporting periods, 2025–2036)

9.5 List of main conservation measures

Table 4: Key conservation measures addressing current pressures and/or anticipated threats during the next two reporting periods (2025–2036). Measures are ranked by importance/impact: High (direct/immediate influence and/or large spatial extent) and Medium (moderate direct/immediate influence, mainly indirect and/or regional extent).

Conservation measure	Ranking
Adapt/manage exploitation of energy resources	High (H)
Control/eradication of illegal killing, fishing and harvesting of wild plants, fungi and anmals	High (H)
Reduce bycatch and incidental killing of non-target species	High (H)
Reduce impact of military installations and activities	High (H)

Reduce impact of mixed source pollution	High (H)
Adapt/manage renewable energy installation, facilities and operation (excl. hydropower and abstraction activities)	High (H)
Management of professional/commercial fishing, shellfish and seaweed harvesting (incl. restoration of habitats)	High (H)

9.6 Additional information

This species is not an Annex II species and therefore the designation of SACs is not required, as stipulated in the Habitats Regulations. However, as a European Protected Species, protection is provided throughout UK waters and it is an offence to kill, injure or disturb. The UK remains committed to the conservation of marine mammals in UK waters and the implementation of measures to mitigate the impact of pressures and conservation measures have been undertaken in the UK and adjacent waters as part of the requirements of the Habitats Regulations. Such measures include monitoring bycatch, monitoring strandings data to monitor current and identify emerging pressures, application of appropriate management measures, and noise monitoring and mitigation with regards to offshore industry. This is reflected in the list of conservation measures under field 9.5. The UK also supports a range of international agreements and conventions on the conservation of marine mammals and the marine environment. For example: The Convention on Migratory Species; the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). Two Marine Protected Areas (MPAs) have been designated with minke whale as a qualifying feature (grade A-C): (555703754) Sea of the Hebrides MPA and (555703756) Southern Trench MPA. A UK Cetacean Conservation Strategy is currently in development, due for publication shortly. The strategy is intended to support decision making and identify actions necessary to maintain or improve the conservation status of cetaceans in UK waters. Defra and devolved administrations fund national strandings schemes for cetaceans which aim to: collate, analyse and report data for all cetacean strandings around the coast of the UK; determine the causes of death (both natural and anthropogenic) in stranded cetaceans, including bycatch and physical trauma and; undertake surveillance on the incidence of disease in stranded cetaceans in order to identify any substantial new threats to their conservation status.

10. Future prospects

10.1a Future trends of parameters

ai) Range Overall stable

bi) Population	Overall stable
ci) Habitat for the species	Unknown

10.1b Future prospects of parameters

aii) Range	Good
bii) Population	Good
cii) Habitat for the species	Unknown

10.2 Additional information

No additional information

11. Conclusions

11.1 Range	Favourable (FV)
11.2 Population	Unfavourable-inadequate (U1)
11.3 Habitat for the species	Unknown (XX)
11.4 Future prospects	Unknown (XX)
11.5 Overall assessment of Conservation Status	Unfavourable-inadequate (U1)
11.6 Overall trend in Conservation Status	Unknown

11.7 Change and reason for change in conservation status

a) Change	Yes
b) Genuine change	No
c) Improved knowledge or more accurate data	No
d) Different method	No
e) No information	No
f) Other reason	Yes
g) Main reason	Other reasons

11.7 Change and reason for change in conservation status trend

a) Change	No
b) Genuine change	
c) Improved knowledge or more accurate data	
d) Different method	
e) No information	
f) Other reason	
g) Main reason	

11.8 Additional information

The change in status for minke whale is likely to be an underestimation UK population due to the SCANS IV survey not reaching the offshore region west of Scotland.

Conclusion on Range reached because: (i) the short-term trend direction in Range surface area is stable and (ii) the current Range surface area is equivalent to the Favourable Reference Range.

Conclusion on Population reached because: (i) the short-term trend direction in Population size is unknown; and (ii) the best estimate for population size is less than the Favourable Reference Population but not more than 25% less. The 2022 population estimate for minke whale is likely to be an underestimate of the true abundance at the time. Offshore waters west of Scotland is considered to be a high-density region for this species, accounting for of the total population abundance estimate for the SCANS survey area in 2015 (Hammond et al 2021) and 11% of the UK proportion. As this offshore region west of Scotland was unable to be surveyed as part of the 2022 SCANS IV effort, it has not been possible to calculate the total population abundance estimate for this species across the entire UK EEZ using SCANS IV survey data. Taking this into account, the minke whale population between 2005 and 2022 has remained largely stable, with variations between survey iterations within the confidence intervals.

Conclusion on Habitat for the species reached because: (i) it is unknown whether the area of habitat is sufficiently large; (ii) it is unknown if habitat quality is sufficient for the long-term survival of the species; and (iii) the short-term trend in area and quality of habitat is unknown.

Conclusion on Future prospects reached because: (i) the Future prospects for Range are Good; (ii) the Future prospects for Population are Good; and (iii) the Future prospects for Habitat for the species are Unknown.

Overall assessment of Conservation Status is Unfavourable-inadequate because one or more conclusions are Unfavourable-inadequate.

Overall trend in Conservation Status is based on the combination of the short-term trends for Range - stable, Population - unknown, and Habitat for the species - unknown.

12. UK National Site Network (pSCIs, SCIs, SACs) coverage for Annex II species

12.1 Population size inside the pSCIs, SCIs and SACs network

a) Unit	
b) Minimum	
c) Maximum	
d) Best single value	
12.2 Type of estimate	
12.3 Population size inside the network; Method used	
12.4 Short-term trend of population size within the network; Direction	
12.5 Short-term trend of population size within the network; Method used	
12.6 Short-term trend of habitat for the species inside the pSCIs, SCIs and SACs network; Direction	
12.7 Short-term trend of habitat for the species inside the pSCIs, SCIs and SACs network; Method used	

12.8 Additional information

No additional information

13. Complementary information

13.1 Justification of percentage thresholds for trends

No justification information

13.2 Trans-boundary assessment

No trans-boundary assessment information

13.2 Other relevant information

No other relevant information

14. References

Biogeographical and marine regions

4.2 Sources of information

Hammond, PS, Lacey, C, Gilles, A, Viquerat, S, Börjesson, P, Herr, H, Macleod, K, Ridoux, V, Santos, MB, Scheidat, M, Teilmann, J, Vingada, J & Øien, N (2021). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. SCANS-III project report 1, 39 pp. https://scans3.wp.st-andrews.ac.uk/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf

Gilles, A, Authier, M, Ramirez-Martinez, NC, Araújo, H, Blanchard, A, Carlström, J, Eira, C, Dorémus, G, Fernández-Maldonado, C, Geelhoed, SCV, Kyhn, L, Laran, S, Nachtsheim, D, Panigada, S, Pigeault, R, Sequeira, M, Sveegaard, S,Taylor, NL, Owen, K, Saavedra, C, Vázquez-Bonales, JA, Unger, B, Hammond, PS (2023). Estimates of cetaceanabundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. Final report published 29 September 2023. 64 pp. https://www.tiho-hannover.de/itaw/scans-iv-survey

Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. & Jessopp, M. (2018). Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017. Department of Communications, Climate Action & Environment and National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland. 297pp. https://www.gov.ie/en/publication/12374-observe-programme

Leonard, D. M. & Øien, N. I. (2020a). Estimated Abundances of Cetacean Species in the Northeast Atlantic from Norwegian Shipboard Surveys Conducted in 2014–2018. NAMMCO Scientific Publications 11. https://doi.org/ 10.7557/3.4694

Leonard, D. M. & Øien, N. I. (2020b). Estimated Abundances of Cetaceans Species in the Northeast Atlantic from Two Multiyear Surveys Conducted by Norwegian Vessels between 2002–2013. NAMMCO Scientific Publications 11. https://doi.org/10.7557/3.4695

Pike, D.G., Gunnlaugsson, T., Mikkelsen, B., Halldórsson, S.D. & Víkingsson, G.A. (2019a). Estimates of the Abundance of Cetaceans in the Central North Atlantic Based on the NASS Icelandic and Faroese Shipboard Surveys Conducted in 2015. NAMMCO Scientific Publications 11. https://doi.org/10.7557/3.4941

Pike, D.G., Gunnlaugsson, T., Mikkelsen, B., Halldórsson, S.D., Víkingsson, G.A., Acquarone, M. & Desportes, G. (2020b). Estimates of the Abundance of Cetaceans in the Central North Atlantic From the T-NASS Icelandic and Faroese Ship Surveys Conducted in 2007. NAMMCO Scientific Publications 11. https://doi.org/10.7557/3.5269

Hammond, P., Macleod, K., Gillespie, D., Swift, R., Winship, A., Burt, M., Cañadas, A., Vázquez, J., Ridoux, V., Certain, G., Canneyt, O.V., Lens, S., Santos, B., Rogan, E., Uriarte, A., Hernandez, C., Castro, R., 2009. Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA) (Project report). St Andrews University. https://archive.st-andrews.ac.uk/biology/coda/

Hammond, P. s., Macleod, K., Berggren, P., Borchers, D.L., Burt, L., Cañadas, A., Desportes, G., Donovan, G.P., Gilles, A., Gillespie, D., Gordon, J., Hiby, L., Kuklik, I., Leaper, R., Lehnert, K., Leopold, M., Lovell, P., Øien, N., Paxton, C.G.M., Ridoux, V., Rogan, E., Samarra, F., Scheidat, M., Sequeira, M., Siebert, U., Skov, H., Swift, R., Tasker, M.L., Teilmann, J., Van Canneyt, O., Vázquez, J.A., 2013. Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. Biological Conservation 164, 107–122. https://doi.org/10.1016/j.biocon.2013.04.010

Giralt Paradell, O., Cañadas, A., Bennison, A., Todd, N., Jessopp, M., Rogan, E. (2024). Aerial

surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in

2021-2023. Department of the Environment, Climate & Communications and Department of

Housing, Local Government & Heritage, Ireland. 260pp https://www.gov.ie/pdf/?file=https://assets.gov.ie/308027/e03a534c-0fa5-4a22-8bad-5f002ae94857.pdf

Anderwald, P., Brandecker, A., Coleman, M., Collins, C., Denniston, H., Haberlin, M.D., Donovan, M.O., Pinfield, R., Visser, F. and Walshe, L., 2013. Displacement responses of a mysticete, an odontocete, and a phocid seal to construction-related vessel traffic. Endangered Species Research, 21(3), pp.231-240.

Boisseau, O., McGarry, T., Stephenson, S., Compton, R., Cucknell, A.C., Ryan, C., McLanaghan, R. and Moscrop, A., 2021. Minke whales Balaenoptera acutorostrata avoid a 15 kHz acoustic deterrent device (ADD). Marine Ecology Progress Series, 667, pp.191-206.

Davison, N. and ten Doeschate, M. 2021. Scottish Marine Animal Stranding Scheme (SMASS) Annual Report 2020. Available at: https://strandings.org/wp-content/uploads/2022/09/SMASS-AR-2020-final.pdf [Accessed 06 Nov 2024]

Davison, N., ten Doeschate, M. and Brownlow, A. 2020. Scottish Marine Animal Stranding Scheme (SMASS) Annual Report 2019. Available at: https://strandings.org/wp-content/uploads/2021/05/SMASS_Annual_Report_2019.pdf [Accessed 06 Nov 2024]

Deaville, R. (compiler). 2011:2024. Annual report for the period 1st January to 31st December. UK Cetacean Strandings Investigation Programme (CSIP).

Götz, T., Hastie, G., Hatch, L.T., Raustein, O., Southall, B.L., Tasker, M., Thomsen, F., Campbell, J. and Fredheim, B., 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR Biodiversity Series, 441, pp.1-134.

Haug, T., Bogstad, B., Chierici, M., Gjøsæter, H., Hallfredsson, E.H., Høines, Å.S., Hoel, A.H., Ingvaldsen, R.B., Jørgensen, L.L., Knutsen, T. and Loeng, H., 2017. Future harvest of living resources in the Arctic Ocean north of the Nordic and Barents Seas: A review of possibilities and constraints. Fisheries Research, 188, pp.38-57.

Helble, T.A., Guazzo, R.A., Martin, C.R., Durbach, I.N., Alongi, G.C., Martin, S.W., Boyle, J.K. and Henderson, E.E., 2020. Lombard effect: Minke whale boing call source levels vary with natural variations in ocean noise. The Journal of the Acoustical Society of America, 147(2), pp.698-712.

Jepson, P.D., Deaville, R., Barber, J.L., Aguilar, À., Borrell, A., Murphy, S., Barry, J., Brownlow, A., Barnett, J., Berrow, S. and Cunningham, A.A., 2016. PCB pollution continues to impact populations of orcas and other dolphins in European waters. Scientific reports, 6(1), pp.1-17.

JNCC. 2010a. The protection of marine European Protected Species from deliberate injury, killing and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Available on request from JNCC.

JNCC. 2010b. Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from Piling noise. 2010. JNCC Peterborough. United Kingdom. Available at: https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf [Accessed 06 Nov 2024]

JNCC. 2010c. JNCC guidelines for minimising the risk of injury to marine mammals from using explosives. August 2010. Available at: https://data.jncc.gov.uk/data/24cc180d-4030-49dd-8977-a04ebe0d7aca/JNCC-Guidelines-Explosives-Guidelines-201008-Web.pdf [Accessed 06 Nov 2024]

JNCC. 2017. JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys. Available at: https://data.jncc.gov.uk/data/e2a46de5-43d4-43f0-b296-c62134397ce4/jncc-guidelines-seismicsurvey-aug2017-web.pdf [Accessed 06 Nov 2024]

JNCC. 2023. JNCC guidance for the use of Passive Acoustic Monitoring in UK waters for minimising the risk of injury to marine mammals from offshore activities. JNCC, Peterborough. Available at: https://hub.jncc.gov.uk/assets/fb7d345b-ec24-4c60-aba2-894e50375e33 [Accessed 06 Nov 2024]

Kvadsheim, P.H., DeRuiter, S., Sivle, L.D., Goldbogen, J., Roland-Hansen, R., Miller, P.J., Lam, F.P.A., Calambokidis, J., Friedlaender, A., Visser, F. and Tyack, P.L., 2017. Avoidance responses of minke whales to 1–4 kHz naval sonar. Marine Pollution Bulletin, 121(1-2), pp.60-68.

Leaper, R., MacLennan, E., Brownlow, A., Calderan, S.V., Dyke, K., Evans, P.G., Hartny-Mills, L., Jarvis, D., McWhinnie, L., Philp, A. and Read, F.L., 2022. Estimates of humpback and minke whale entanglements in the Scottish static pot (creel) fishery. Endangered Species Research, 49, pp.217-232.

MacLennan, E., Hartny-Mills, L., Read, F.L., Dolman, S.J., Philp, A., Dearing, K.E., Jarvis, D. and Brownlow, A.C., 2021. Scottish Entanglement Alliance (SEA): Understanding the scale and impacts of marine animal entanglement in the Scottish creel fishery. NatureScot Research Report 1268. Available at: https://www.nature.scot/doc/naturescot-research-report-1268-scottish-entanglement-alliance-sea-understanding-scale-and-impacts [Accessed 07 Nov 2024]

MacLennan, Ellie & Leaper, Russell & Brownlow, Andrew & Calderan, Susannah & Jarvis, Dan & Hartny-Mills, Lauren & Ryan, Conor & Yamada, Chika. 2020. Estimates of humpback and minke whale entanglements in Scotland. Available at: https://www.researchgate.net/publication/345146035_Estimates_of_humpback_and_minke_whale_entanglements_in_Scotland [Accessed 07 Nov 2024]

Malinauskaite, L., Cook, D., Davíðsdóttir, B., Karami, M.P., Koenigk, T., Kruschke, T., Ögmundardóttir, H. and Rasmussen, M., 2022. Connecting the dots: An interdisciplinary perspective on climate change effects on whales and whale watching in Skjalfandi Bay, Iceland. Ocean & Coastal Management, 226, p.106274.

Marine Scotland. 2014. The protection of Marine European Protected Species from injury and disturbance. Guidance for Scottish Inshore Waters.

Northridge, S., Cargill, A., Coram, A., Mandleberg, L., Calderan, S. and Reid, R., 2010. Entanglement of minke whales in Scottish waters: an investigation into occurrence, causes and mitigation. Contract Report. Final Report to Scottish Government CR/2007/49, 57.

Pierce, G.J., Santos, M.B., Reid, R.J., Patterson, I.A.P. and Ross, H.M., 2004. Diet of minke whales Balaenoptera acutorostrata in Scottish (UK) waters with notes on

strandings of this species in Scotland 1992–2002. Journal of the Marine Biological Association of the United Kingdom, 84(6), pp.1241-1244.

Scottish Marine Animal Stranding Scheme. 2022. Scottish Marine Animal Stranding Scheme (SMASS) Annual Report 2021. Available at: https://strandings.org/wp-content/uploads/2024/06/SMASS-Annual-Report-2021-final.pdf [Accessed 06 Nov 2024]

Scottish Marine Animal Stranding Scheme. 2023. Scottish Marine Animal Stranding Scheme (SMASS) Annual Report 2022. Available: https://strandings.org/wp-content/uploads/2024/06/SMASS-Annual-Report-2022-v1.2.pdf [Accessed 07 Nov 2024]

Simmonds, M., McLellan, F., Entrup, N., & Nunny, L. (2021). Whaling in Europe: An Ongoing Welfare and Conservation Concern In: Under Pressure: The need to protect whales and dolphins in European waters. An OceanCare Report. Available at: https://www.oceancare.org/wp-content/uploads/2022/11/Animal_Species_Protection_Under-Pressure_Whales-and-Dolphins_EU_Report_OceanCare_EN_146p_2021.pdf [Accessed 06 Nov 2024]

Snell, M., Baillie, A., Berrow, S., Deaville, R., Penrose, R., Perkins, M., Williams, R. and Simmonds, M.P., 2023. An investigation into the effects of climate change on baleen whale distribution in the British Isles. Marine Pollution Bulletin, 187, p.114565.

Solway, H., 2023. Assessing changing Baleen whale distributions and incidents relative to vessel activity. MSc Dissertation.

Stone, C., Hall, K., Mendes, S. and Tasker, M. 2017. The effects of seismic operations in UK waters: analysis of Marine Mammal Observer data. J. Cetacean Res. Manage., 16, pp.71-85.

Stone, C.J. 2015. Implementation of and considerations for revisions to the JNCC guidelines for seismic surveys. JNCC Report No. 463b. Avaialble at: https://data.jncc.gov.uk/data/f7990481-7a99-414c-be04-b972da10c1b7/JNCC-Report-463b-FINAL-WEB.pdf [Accessed 06 Nov 2024]

Thomsen, F., Ram, M., Chreptowicz, M., Nocoń, M. and Balicka, I., 2023. Noise modelling and environmental risk assessment of a geophysical survey and its impact on herring and minke whales in Irish coastal waters. Marine Institute.

Víkingsson, G.A., Elvarsson, B.Þ., Ólafsdóttir, D., Sigurjónsson, J., Chosson, V. and Galan, A., 2014. Recent changes in the diet composition of common minke whales (Balaenoptera acutorostrata) in Icelandic waters. A consequence of climate change?. Marine Biology Research, 10(2), pp.138-152.

JNCC. 2025. JNCC guidelines for minimising the risk of injury to marine mammals from unexploded ordnance (UXO) clearance in the marine environment. JNCC, Aberdeen.

JNCC, Natural England and Cefas. 2025. JNCC, Natural England and Cefas position on the use of quieter piling methods and noise abatement systems when installing offshore wind turbine foundations. JNCC, Aberdeen.

Evans, P.G.H. and Waggitt, J.J. 2023. Modelled Distribution and Abundance of Cetaceans and Seabirds in Wales and Surrounding Waters. NRW Evidence Report, Report No: 646,

354 pp. Natural Resources Wales, Bangor.

Main pressures

8.2 Sources of information

No sources of information

15. Explanatory Notes

Field label	Note
8.1: Characterisation of pressures	PG13 Bycatch and incidental killing (due to fishing and hunting activities). In the UK, entanglement is a category largely confined to minke whales, with evidence of entanglement in mooring rope and creel lines, or other discarded gear and marine litter (Pierce et al., 2004; Deaville, 2011; Leaper et al., 2022; MacLennan et al., 2020; 2021). Minke whale deaths due to entanglement in fishing gear, principally in creel lines, represent the single most frequently documented cause of anthropogenic mortality in Scottish and UK waters (Leaper et al., 2022; MacLennan et al., 2020; 2021). Entanglement was the cause of death in 19 minke whales examined by the UK CSIP and SMASS between 2019-2022 (Deaville, 2019:2024; Davison et al., 2020; Davison & ten Doeschate, 2021; Scottish Marine Animal Strandings Scheme, 2022; 2023) however, numbers are likely to be under reported through the strandings schemes, as not all animals that die as consequence of entanglement will wash ashore (Northridge et al., 2010). Modelling suggests that up to 30 minke whales become entangled in creel groundlines each year, and the number of fatal entanglements represent 2.3% of recent abundance estimates (Leaper et al., 2022). Secondary bycatch in fishing gear caught on floating offshore wind may also be a concern for this species. Exposure of the population across its distribution is regional, therefore the pressure ranking is medium.
8.1: Characterisation of pressures	PX02 Threats and pressures from outside the Member State. Minke whales have been historically hunted (with quotas) in neighbouring waters, and the species continues to be hunted annually by Norwegian, Icelandic and Greenland whalers (NAMMCO: https://nammco.no/topics/common-minke-whale/ 1475844711542-eedf1c7b-5dde). Given the migratory

	nature of minke whales, individuals taken in the annual hunt are likely to be from the same population as those occurring in UK waters (Northridge et al., 2010). The latest IWC abundance estimate for the North-east Atlantic is 104,700 (95% CI 75,200 - 145,750; https://iwc.int/estimate table). Norway, Iceland and Greenland take over 700 minke whales per year (https://nammco.no/marine-mammal-catch-database/; Simmonds et al., 2021).
8.1: Characterisation of pressures	PJ12 Decline or extinction of related species (e.g. food source / prey, predator / parasite, symbiot, etc.) due to climate change. The effects of climate change on minke whales is likely to be mediated through variation in prey resource. Initial evidence from stranding records has suggested a northward expansion this species in response to climate change (Snell et al., 2023), which may result in competition for resources with endemic Arctic species (Haug et al., 2017). However, evidence also suggests that minke whales have spatial and temporal variation in diet and are able to switch prey and feeding grounds with ecosystem changes such as sea surface temperature and bottom temperatures, and changes in prey abundance and distribution (Vikingsson et al., 2013; Malinauskaite et al., 2022). This will increase potential for adapting to change in future prey availability.
8.1: Characterisation of pressures	PG01 Marine fish and shellfish harvesting (professional, recreational) causing reduction of species/prey populations and disturbance of species. Prey depletion has a direct and immediate influence on the individual. Evidence for starvation in the species comes CSIP stranding data, with starvation noted as a cause of death in 11% of minke whales examined post-mortem between 2000 and 2017 (CSIP annual reports, http://ukstrandings.org/csip-reports). Although, numbers reported to have died due to starvation is limited between 2019, with 1 animals in 2019 and 1 animal in 2021 (Deaville, 2020; 2022). A study on minke

	whale stomachs in Iceland indicated prey preferences of herring; haddock; sandeel; krill and capelin (Vikingsson et al., 2013). There is potential for competition between whales and fishing activity of commercial species, however evidence also suggests that minke whales are able to adapt to changing availability of prey (Vikingsson et al., 2013). It should be noted that prey depletion can result from both natural and anthropogenic causes, and no direct link has been identified between commercial fishing practices and the cases of cetacean starvation recorded through the UK CSIP. Limited evidence suggests that minke whales may display avoidance behaviours (increased dive duration and horizontal speed) in response to acoustic deterrent devices on aquaculture and risks of temporary thresholds shifts may be experienced within 25m of some devices (Boisseau et al., 2021).
8.1: Characterisation of pressures	PF12 Industrial or commercial activities and structures generating noise, light, heat or other forms of pollution. Minke whales showed strong behavioural responses to a large, active airgun array in UK waters (Stone, 2015). Stereotypical behaviours such as travelling away from the source vessel, increase in fast swimming, and an increase in surfacing or 'milling' during periods of firing (Stone, 2015) was observed in the species. Furthermore, tagged minke whales showed strong avoidance behaviour in response to naval sonar, with one individual displaying a 5-fold increase in horizontal speed away from the source, implying an increase in metabolic rate (Kvadsheim et al., 2017). Limited evidence also exists that minke whales may demonstrate avoidance behaviours (increased dive duration and horizontal swimming speeds) in response to acoustic deterrent devices used in aquaculture and risks of temporary thresholds shifts may be experienced within 25m of some devices (Boisseau et al., 2021). Minke whales have also been recorded increasing call intensity and variance in noisier backgrounds but they seem unable/ unwilling to increase source levels of vocalisations by the same amount as environment noise (Helble et al., 2020).

	Increasing noise and repeated exposure to noise generating activities may therefore have the potential to cause longer term impacts on minke whale populations, through alterations in feeding behaviour, increased energy expenditure, and disruptions to migrations or social behaviour.
8.1: Characterisation of pressures	PE02 Shipping lanes and ferry lanes transport operations. 6.5% of minke whales necropsied or sampled by CSIP and SMASS between 2018 and 2022 had a cause of death of physical trauma due to the ship strike (Deaville, 2019:2024; Davison et al., 2020; Davison & ten Doeschate, 2021; Scottish Marine Animal Strandings Scheme, 2022; 2023). In the northwest Atlantic 15% of fatal incidents between 2004 and 2019 across all baleen species were attributed to ship strikes and 29% of vessel strikes involved minke whales (Solway, 2023). Noise from shipping vessels is thought to affect baleen whales in particular, due to their good hearing at low frequencies (Gotz et al., 2009). Increased vessel traffic from marine construction activities was correlated with a decrease in minke whale presence in the area surveyed off the northwest coast of Ireland, suggesting they were displaced by the high levels of vessels presence (Anderwald et al., 2013).
8.1: Characterisation of pressures	PC07 Geotechnical surveying. JNCC advice on geophysical surveying considers the risk of activities to all marine mammals in UK waters (Stone, 2015; JNCC, 2017, 2010b, 2010c) and minke whales have showed strong behavioural responses to a large, active airgun array in UK waters (Stone, 2015). Stereotypical behaviours such as travelling away from the source vessel, increase in fast swimming, and an increase in surfacing or 'milling' during periods of firing (Stone, 2015) was observed in the species. Impacts of geophysical surveying to minke whales (e.g., temporary threshold shifts) may be experienced up to 20km away from the source (Thomsen et al., 2023). Close proximity to noise created by geotechnical activity also has potential to cause injury, although evidence for the impact

	and level of risk is limited. This is also mitigated through guidance on operations such as soft start and on board marine mammal observers. Impacts are likely to be regionally significant (North Sea and Celtic and Irish Seas) during operations.
9.5: List of main conservation measures	MK01 Reduce impact of mixed source pollution. The impact of chemical pollution on minke whales remains an issue (Jepson et al, 2016), however, establishing measures beyond the historic ban on PCB use, has not been achieved to date. Further information is required to understand where exposure is occurring to be able to identify appropriate measures.
9.5: List of main conservation measures	MC02 Adapt/manage exploitation of energy resources. Guidance for the protection of marine European Protected Species from deliberate injury, killing and disturbance has been drafted (JNCC 2010a; Marine Scotland, 2014). Marine Industries generate a variety of noise through activities such as geophysical surveys (e.g. seismic surveys (JNCC 2017)), construction (e.g. pile driving (JNCC 2010b)) and decommissioning (e.g. use of explosives (2010c)). As part of the licencing procedures, developers and operators are required to utilise JNCC guidelines to minimise the risk of injury to cetaceans when undertaking such activities (JNCC, 2010b, 2010c; 2017; 2023; 2025; JNCC, Natural England & Cefas, 2025). The guidelines advise on conducting marine mammal observations prior to and during the activity and, where suitable, utilising procedures such as soft start (gradual introduction of the sound) to reduce and avoid direct harm to animals. A review of the marine mammal observer data demonstrated the effectiveness of soft start approach (Stone et al., 2017).
9.5: List of main conservation measures	MG05 Reduce bycatch and incidental killing of non-target species: The UK is implementing the EU Technical Conservation Measures Regulation transposed into UK regulations which lays down measures concerning

	incidental catches of vulnerable species in fisheries, and more generally the bycatch obligations within the Habitats Regulations. Since 2004, a dedicated bycatch monitoring programme has been in place, with both dedicated and non-dedicated onboard observers collecting data on bycatch numbers. These data inform implementation and potential effectiveness of measures such as pingers. There is a requirement for all fishing vessels over 12m using gill nets or entanglement nets to use pingers under the criteria laid out in the regulation. Inshore Vessel Monitoring System (iVMS) devices are being implemented for under-12 metre fishing vessels, allowing data on latitude, longitude, course and speed to be recorded and help improve the management and sustainability of the marine environment. Legislation to make iVMS mandatory on under-12 metre vessels is expected to come into effect in 2024 in England. In Scotland, consultation on the introduction mandatory electronic tracking for under-12 metre vessels was carried out in late 2023. Legislation requiring iVMS for under-12 metre vessels operating in Welsh waters has been in place since 2022. Since February 2022 it has been mandatory for under-10 metre fishing vessels in English and Welsh waters to create and submit a catch record for every fishing trip through the Catch Recording Application (Catch App or Record your Catch). Data is collected on vessel, trip, gear, area fished and catch and can be used to inform on fishing activity by gear type and species. Furthermore, the UK Marine Wildlife Bycatch Mitigation Initiative (published August 2022) aims to improve our understanding of bycatch and entanglement of sensitive marine species through monitoring and scientific research, identify 'hotspot" or high-risk areas/gear types/fisheries in which to focus monitoring and mitigation, and develop and implement effective measures to minimise bycatch/entanglement. Currently work is progressing towards development of a bycatch risk framework across all PET species to apply all available evidence and support targeted monitoring.
9.5: List of main conservation measures	MG04 Control/eradication of illegal killing, fishing and harvesting. The Habitats Directive is transposed into UK

	law under the Habitat Regulations (HR) for England and Wales (as amended) and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended), which make it an offence to kill, injure, capture or disturb European marine protected species. Similar legislation exists for Scottish and Northern Irish inshore waters.
9.5: List of main conservation measures	MH01 Reduce impact of military installations and activities. To reduce the risk of noise impact on marine mammals, the UK Ministry of Defence (MOD) has a Statement of Intent with UK Statutory Nature Conservation Bodies concerning conduct in relation to marine disturbance. The MOD has developed a real-time alert procedure for naval training operations. This enables localised information on cetacean sightings to be incorporated into the training schedule and for operations to be relocated if necessary.
9.5: List of main conservation measures	MC03 Adapt/manage renewable energy installation, facilities and operation (excl. hydropower and abstraction activities). Guidance for the protection of marine European Protected Species from deliberate injury, killing and disturbance has been drafted (JNCC 2010a; Marine Scotland, 2014). Marine Industries generate a variety of noise through activities such as geophysical surveys (e.g. seismic surveys (JNCC 2017)), construction (e.g. pile driving (JNCC 2010b)) and decommissioning (e.g. use of explosives (2010c)). As part of the licencing procedures, developers and operators are required to utilise JNCC guidelines to minimise the risk of injury to cetaceans when undertaking such activities (JNCC, 2010b, 2010c; 2017; 2023; 2025; JNCC, Natural England & Cefas, 2025). The guidelines advise on conducting marine mammal observations prior to and during the activity and, where suitable, utilising procedures such as soft start (gradual introduction of the sound) to reduce and avoid direct harm to animals. A review of the marine mammal observer data demonstrated the effectiveness of soft start approach (Stone et al., 2017).

9.5: List of main conservation measures	MG01 Management of professional/commercial fishing, shellfish and seaweed harvesting (incl. restoration of habitats). Fisheries Management Plans (FMPs) are currently being developed across all administrations for fisheries with perceived threats or pressures to the marine environment. FMPs are required under the Fisheries Act 2020 which provides the framework for management fisheries outside the EU Common Fisheries Policy. The Joint Fisheries Statement (agreeing the delivery of the 8 objectives of the Fisheries Act 2020) sets out plans for 43 FMPs. Publication of FMPs started last year and is expected to continue for 2-3 years. Some are being jointly developed, others by a single authority for its own waters. 6 FMPs have now been published.